FLORA EUROPAEA

FLORA EUROPAEA

VOLUME 5

ALISMATACEAE TO ORCHIDACEAE

(MONOCOTYLEDONES)

EDITED BY

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PREFACE

The publication of this final volume of *Flora Europaea* represents a landmark in European floristics. The Editorial Committee has achieved its primary aim of producing a concise and complete Flora of the flowering plants and ferns of Europe in the shortest possible time. In practice, completion of the project has taken longer than the twelve years originally anticipated but very many problems had to be overcome, some of which are mentioned in the outline of the history of the *Flora Europaea* project given below.

This volume, devoted to the Monocotyledons, follows the same pattern as the preceding ones. Taxonomically the treatment of the Monocotyledons differs little from that of the Dicotyledons, although the pattern of variation conventionally accepted has led to the acceptance of a smaller proportion of subspecies than in previous volumes. Genera presenting special problems are few, but they include *Allium* and *Ornithogalum*, some of the orchids, such as *Dactylorhiza* and *Ophrys*, and some of the grasses, with *Festuca* outstanding. We are indebted to the numerous authors involved in the volume for their cooperation and understanding. Their manuscripts have been subject to the detailed editorial procedures established by the Editorial Committee over the years and it has to be reiterated that the Committee accepts full responsibility for the texts as they appear here.

The preparation of this volume has been financed by a final grant from the UK Science Research Council, which very generously agreed, following a year of support from other European Research Councils, to guarantee sufficient funds to enable the project to be completed. The Editorial Committee wishes to express, on behalf of the botanical community, its full appreciation of the Science Research Council's financial support which it has provided since 1959 when, as the Department of Scientific and Industrial Research, it made an initial three-year grant for the project. Support on this scale for a taxonomic biological project in Europe is unprecedented and without it the *Flora Europaea* organization would simply have foundered.

The eighth and final *Flora Europaea* symposium was held in Cambridge in September 1977. Financial support was provided by the British Council, the Cambridge Philosophical Society, Cambridge University Press, the Linnean Society, the Science Research Council and the University Botanic Garden, Cambridge. It was a pleasure to welcome so many friends and colleagues to this highly successful meeting, during which the manuscript of this volume was handed over to the Press.

The preparation of the final volume of *Flora Europaea* has been undertaken with a very much reduced research and secretarial staff. Mr I. B. K. Richardson left to take up an appointment at the Herbarium, Royal Botanic Gardens, Kew in April 1976 and Mr A. O. Chater ceased his formal duties with the organization in February 1977 and joined the staff of the British Museum (Natural History). Both of them have given long and loyal service to the organization, for which the Editorial Committee would like to express its deep appreciation. For the whole period of preparation of volume 5, all the secretarial and clerical duties have been undertaken single-handed by Mrs Rosa Husain. Her skill and accuracy in typing the many hundreds of pages of text in their various stages have been appreciated by all members of the organization and were a source of constant admiration on the part of the Committee. We wish to express our profound gratitude for all her untiring effort over a period of nine years.

A special tribute must be paid to the invaluable assistance given over the years by the late Mr J. E. Dandy, former Keeper of Botany, British Museum (Natural History). He applied his unrivalled skills in nomenclature and bibliography to the checking of the manuscripts and thus added a stamp of authority in these areas which the Flora would not otherwise have possessed. The extent of his labours was known to only a few of us who would regularly see him devoting whole days, even in his retirement, to painstaking routine checking, to detecting trivial errors (themselves often inexcusable in the first place) in the places of publication and page citations, as well as in unravelling the most complex nomenclatural problems with the delicate and sure skill of a surgeon. His untimely death in 1976 robbed us of his guidance for much of Volume 5 and we have been hard pressed to fill this gap. Professor Webb and Mr Chater, with the generous assistance of members of the Kew Herbarium staff, especially Mr R. D. Meikle, and also Dr R. K. Brummitt, have borne much of the burden of this nomenclatural and bibliographical work for the greater part of Volume 5. Professor W. T. Stearn, formerly of the British Museum (Natural History), has always been ready to assist us on matters bibliographical and nomenclatural and indeed was frequently involved with Mr Dandy in sorting out some of the more abstruse problems that arose. We are also indebted to Dr C. E. Hubbard, formerly Keeper of the Herbarium at Kew, for his assistance with the Gramineae. His unrivalled knowledge of the world's grasses has been valuable in many ways, particularly in delimiting and describing the tribes.

In a more general way we have received willing cooperation and assistance from the staff of the Herbarium and Library at both the Royal Botanic Gardens, Kew and the Department of Botany, British Museum (Natural History) during the preparation of this and previous volumes, and we wish to record our appreciation to them and to their respective Directors and Keepers.

The University of Reading has continued to provide accommodation for the Secretariat in the Plant Science Laboratories and has handled the financial accounts of the project without charge. The Universities of Cambridge, Dublin, Leicester, Manchester and Ulster have also supported members of the Editorial Committee in making facilities available to them.

We are grateful for the care and skill with which the staff of the Cambridge University Press have guided our manuscripts through the various stages to publication. Without their informed interest, help and patience the Flora might never have seen the light of day and certainly would not have been so convenient to use or such a tribute to the printer's art.

Flora Europaea has been from the start a cooperative venture and has depended by its very nature on its panels of Advisory Editors and Regional Advisers for advice, comments, corrections and additions to the draft manuscripts. We have been fortunate in being able to count on their support during the past twenty or so years and we are most grateful for their patience and cooperation volume after volume. Their individual contributions to the success of the project have varied widely according to circumstance and it would seem invidious to single out particular advisers; yet special mention should be made of the very great trouble taken by Professor J. do Amaral Franco and Dr J. Holub in checking almost every manuscript. The thoroughness and completeness of their work must have consumed a great deal of their time over the years and it is a pleasure to acknowledge this.

It would be appropriate here to add a few words about the specialized duties of the members of the Editorial Committee, as distinct from family editorships. Professor Webb

has from an early stage been responsible for the thankless task of editing the geographical information and later the ecological data. This has involved a great deal of very expert checking and revision of every single manuscript. Chromosome data have been the responsibility of Dr Walters and then Professor Moore. Mr Chater has undertaken the checking of citations for Volumes 2–5 and has performed the exceedingly intricate task of compiling Appendices I–III, which have attracted almost universal praise. Professor Heywood has had the responsibility since the inception of the project for running the Secretariat and for the general administration of the organization, a task in which Professor Moore has also shared in recent years.

The compilation of the index of each volume has been entrusted to Mr P. D. Sell, who has undertaken it with characteristic thoroughness. Finally we should like to acknowledge all those people and organizations who have assisted us with finance or by their general support and encouragement. *Flora Europaea* stands as a monument to international botanical cooperation and has set its mark on the taxonomic scene. This is a source of great satisfaction to the Editorial Committee and is in no small way a reward for its efforts.

T.G.T. V.H.H.
N.A.B. D.M.M.
D.H.V. S.M.W.

December 1977 D.A.W.

As Secretary to the Editorial Committee and one who has been closely involved with *Flora Europaea* from its earliest beginnings, I should like to add a few words of tribute to our Chairman, Professor Tutin, whose unflagging enthusiasm and determination during the twenty-two years that the planning, writing and editing of the Flora has taken has been an inspiration to us all. Through all the many vicissitudes of this period he has steadily worked away, always retaining his enthusiasm and underlying optimism. That we have now completed our *magnum opus* (an apposite term, for once) has been in no small measure due to him.

V.H.H.

A SHORT HISTORY OF THE FLORA EUROPAEA PROJECT

It has been suggested to the Editorial Committee that this final volume should include a brief historical account of the *Flora Europaea* project. So as not to overload the introduction, the main events are outlined here in chronological order.

1954 July. At the 5e Congrès Internationale de Botanique, Paris (symposium on Progrès des Etudes des Flores Européennes) a *rapport* was given by Professor D. H. Valentine 'Progress of work on the European Flora'. No decision was taken about writing a European Flora. At an informal meeting in a *brasserie* on the banks of the Seine of several interested botanists including Professor T. G. Tutin (Leicester), Professor A. R. Clapham (Sheffield), Mr J. S. L. Gilmour (Cambridge), Professor N. A. Burges (Liverpool), Professor D. H. Valentine (Durham) and Dr V. H. Heywood (Madrid) a decision was taken that a Flora of Europe could and should be written.

1955 Informal discussions took place in Britain about the feasibility of writing a European Flora. It was decided in December to hold a meeting of the working group to consider the organization of a Flora project.

1956 4 January. A meeting to consider the organization of a European Flora was held at the University of Leicester. Present: Professor N. A. Burges (Liverpool), Dr V. H. Heywood (Liverpool), Professor T. G. Tutin (Leicester), Professor D. H. Valentine (Durham) and Professor D. A. Webb (Dublin). The general aim was conceived as the compilation of a Flora of Europe for the use of Universities, professional botanists, biologists, etc. – an educational work rather than a book for amateurs. The total number of species was estimated at about 12,000. An organization consisting of an Editorial Board (later Editorial Committee) with Professor Tutin as Chairman and Dr Heywood as Secretary, a panel of Advisory Editors, and a team of Regional Advisers for most countries or areas of Europe, was to be set up.

1956 21–22 March. Second meeting of the Committee, at the University of Liverpool. Dr S. M. Walters was invited to join the Committee. Several sample accounts were prepared and approved.

1957 An agreement was reached with the Linnean Society of London for them to act as sponsors of the *Flora Europaea* project. Sample pages and a manifesto were sent to all Botany Departments in the United Kingdom, all Regional Advisers and Advisory Editors and all council members of the International Association for Plant Taxonomy. After extensive consultation a decision was taken to write the Flora in English.

A grant was obtained from the Botanical Research Fund to assist with secretarial expenditure and financial help received from private individuals to keep the project going.

An article was published in *Taxon* setting out the nature of the project and the methods of preparation being adopted.

A grant of £750 was obtained from The Royal Society. A Leverhulme Research Fellow (Mr P. W. Ball) was appointed at the University of Liverpool to work on the Flora and it was decided to follow Engler's *Syllabus*, latest edition, for the sequence and circumscription of families. An agreement was reached with Professor W. Rothmaler to publish in *Feddes Repertorium* special taxonomic and nomenclatural notes arising out of the preparation of the Flora.

An offer by Cambridge University Press to publish *Flora Europaea* was accepted.

The Presentation of Taxonomic Information. A short Guide for Contributors to Flora Europaea compiled by V. H. Heywood, and later known as the Green Book, was published by Leicester University Press.

1959 A grant of £14,000 for a three-year period was awarded by the UK Department of Scientific and Industrial Research. A grant for secretarial expenses was received from the Instituto de Alta Cultura, Lisbon. Dr P. W. Ball was appointed as a Research Fellow and Miss A. B. Mowat as a Research Assistant.

1–7 April. The first *Flora Europaea* symposium was held in Vienna at the Naturhistorisches Museum under the local chairmanship of Dr K. H. Rechinger.

1960 Publication of *Problems of Taxonomy and Distribution in the European Flora.* Proceedings of the Flora Europaea Round Table Conference held in Vienna, 1–7 April, 1959. Edited by V. H. Heywood and published in *Feddes Repertorium* **63**, Heft 2 (1961).

A further grant was received from the Instituto de Alta Cultura, Lisbon.

Miss A. B. Mowat resigned. Mr A. O. Chater was appointed as a Research Assistant.

A supplement to the 'Green Book' was published in Portugal and circulated.

1961 The second *Flora Europaea* symposium was held in Genoa and Florence under the local chairmanship of Professor R. E. G. Pichi Sermolli.

Flora Europaea, Notulae Systematicae ad Floram Europaeam pertinentes, No. 1, was published in *Feddes Repertorium.*

1962 The grant from the Department of Scientific and Industrial Research was extended to 1965 and increased to £33,808 for the period 1959–65.

1963 On 16 January, the manuscript of Volume 1 of *Flora Europaea* was delivered by the Chairman, the Secretary and Mr A. O. Chater to Cambridge University Press.

The third *Flora Europaea* symposium was held in Bucharest and Cluj under the local chairmanship of Academician E. Pop and Professor A. Borza.

1964 Volume 1 of *Flora Europaea* was published.

1965 The fourth *Flora Europaea* symposium was held in Copenhagen and Århus under the local chairmanship of Professor T. W. Böcher and Professor K. Larsen.

A grant of £34,000 was received from the UK Science Research Council for the period 1965–68.

Dr D. M. Moore was appointed a member of the Editorial Committee.

1966 The first 'Index to European Taxonomic Literature', compiled by Dr R. K. Brummitt, was published under the auspices of the *Flora Europaea* Organization by the International Bureau for Plant Taxonomy and Nomenclature.

Dr I. K. Ferguson was appointed as Research Assistant.

1967 The manuscript of Volume 2 was completed and delivered to the Press.

The fifth *Flora Europaea* symposium was held in Seville and Madrid under the local chairmanship of Professor E. Fernández-Galiano, Professor S. Rivas Goday and Professor F. Bellot Rodríguez.

1968 Volume 2 of *Flora Europaea* was published. The Secretariat moved to the University of Reading. Dr I. K. Ferguson resigned to take up an appointment at Kew. Mr I. B. K. Richardson was appointed as a Research Assistant.

A grant of £45,236 for the period 1968–72 was received from the UK Science Research Council.

1969 Dr P. W. Ball resigned to take up a post in Canada. Dr R. A. DeFilipps was appointed as a Research Assistant.

1970 The sixth *Flora Europaea* symposium was held in Geneva and Nice under the local chairmanship of Professor J. Miège, Professor M. Guinochet and Professor J.-P. Barry.

1971 The manuscript of Volume 3 was completed and delivered to the Press.

Flora Europaea Notulae No. 8 was published in the *Botanical Journal of the Linnean Society*, the previous issues having been published in *Feddes Repertorium*.

1972 Volume 3 of *Flora Europaea* was published.

The seventh *Flora Europaea* symposium was held in Coimbra under the local chairmanship of Professor A. Fernandes.

A grant of £14,176 for the period 1972–73 was received from the UK Science Research Council.

1974 The manuscript of Volume 4 was completed and delivered to the Press.

Grants from several European Science Research Councils were obtained to finance the Flora for one year.

1975 Dr R. A. DeFilipps resigned on appointment to a post at the Smithsonian Institution, Washington, USA.

The UK Science Research Council agreed to provide a final grant of £21,810 to see the Flora completed.

1976 Volume 4 of *Flora Europaea* was published.

Mr I. B. K. Richardson resigned on appointment to a post at the Royal Botanic Gardens, Kew.

1977 Mr A. O. Chater's appointment ended and he went to a post at the British Museum (Natural History).

31 August–4 September. The final *Flora Europaea* symposium was held in Cambridge.

The manuscript of Volume 5 was completed and delivered to the Press.

1978 *Flora Europaea* Notulae Systematicae No. 20 was published in the *Botanical Journal of the Linnean Society.*

1980 *Flora Europaea* Volume 5 is published.

NUMBERS OF TAXA IN FLORA EUROPAEA

During the initial stages of planning *Flora Europaea*, estimates of the number of species likely to be included ranged from 12,000–17,000. Now that the Flora is complete we felt it would be of interest to give a summary of the numbers of families, genera and species in each volume and the totals in the whole Flora. Only numbered families, genera and species are included.

	families	*genera*	*species*
Volume 1	79	396	2758
Volume 2	50	332	2602
Volume 3	32	248	1899
Volume 4	8	229	2302
Volume 5	34	336	1996
Totals	203	1541	11,557

INTRODUCTION

The aim of the Flora is in general diagnostic, and the descriptions, while brief, are as far as possible comparable for related species. The Floras listed on pp. xxv–xxvii, and the monographs or revisions given when appropriate after the descriptions of families and genera, may assist the reader in obtaining more detailed information. Other references to published work are occasionally given in cases of special taxonomic difficulty.

All available evidence, morphological, geographical, ecological and cytogenetical, has been taken into consideration in delimiting species and subspecies, but they are in all cases definable in morphological terms. (Taxa below the rank of subspecies are not normally included.) The delimitation of genera is often controversial and the solution adopted in the Flora may be a somewhat arbitrary choice between conflicting opinions. We have endeavoured to weigh as fairly as possible the various opinions available, but there has been no consistent policy of 'lumping' or 'splitting' genera (or, for that matter, species). The order and circumscription of the families is, with few small exceptions, that of Melchior in Engler, *Syllabus der Pflanzenfamilien* ed. 12 (1964).

All descriptions of taxa refer only to their representatives in Europe. In practice, we have relaxed this rule slightly for families and genera to avoid giving taxonomically misleading information, particularly in those cases where a large family or genus has only one or few, somewhat atypical, members in Europe. In such cases we have occasionally added 'in European members' or a similar phrase to emphasize the atypical representation. It should, however, never be assumed that the description is valid for all non-European taxa.

For the purpose of this Flora, we have tried as far as possible to interpret Europe in its traditional sense. The area covered is shown on the maps at the end of the volume.

Place-names used in the summaries of geographical distribution have been given in their English form when they refer to independent states (including the constituent republics of the U.S.S.R.) or to such geographical features of Europe as transcend national boundaries. All other place-names are given in the language of the country concerned. Thus we write *Sweden*, *Ukraine*, *Danube*, *Alps*, *Mediterranean* but *Corse*, *Kriti*, *Slovenija*, *Rodopi Planina*, *Ahvenanmaa*.

In *transliteration* from Cyrillic characters we have followed the ISO system recommended in the UNESCO *Bulletin for Libraries* **10**: 136–137 (1956) for place-names and titles of journals. With personal names, however, we have followed the list of transliterations given in the index-volume (1962) to *Not. Syst.* (*Leningrad*), and have transliterated personal names which do not occur in this list according to the conventions used there.

In transliterating place-names from Greek characters, we have, except for omitting the accents, followed *The Times Atlas of the World*, Mid-Century Edition, vol. 4 (London, 1956).

On pp. xxv–xxvii, we give a list of *Basic and Standard Floras*. Basic Floras have been chosen as widely known Floras covering large or important parts of Europe. Standard Floras are considered to represent those Floras in current use and likely to be familiar to a large number of people in the particular country concerned; the list has been revised since the publication of Volume 4. There are, of course, a number of other useful Floras which do not, for one reason or another, appear in our list; the list, however, attempts to include

those which are widely consulted and which have, therefore, been used as the main source of synonyms cited in *Flora Europaea*.

Synonyms, whether full or partial, are given in parentheses in the text only when they are used in one of the Basic Floras or when they are necessary to prevent confusion. (For primarily Iberian and Mediterranean species, synonyms used in the *Prodromus* of Willkomm & Lange, and the *Supplementum* by Willkomm (p. xxvii) are also included.) Synonyms (or the basionym) are also usually given in the text when the combination has not previously been used in a Flora or monograph, or when the nomenclature is otherwise unfamiliar or in need of explanation. Otherwise, synonyms are given in the Index only; but it is important to note that no attempt has been made to give a complete synonymy. Even at the binomial level, the number of names for European plants is four or five times the number of accepted species, and to include all these would be impracticable. Thus, in addition to the binomials in the text, the Index contains all synonyms at specific rank which are used in the Basic and Standard Floras, or in cited monographs, with an indication of the species in the text under which they have been relegated to synonymy. Some subspecific names also appear in the Index. In this way, we hope that users of any Basic or Standard Flora will be able to relate the names used in their own Floras to those in *Flora Europaea*. In cases where the name of a familiar species has been changed, an explanation of this is usually published as a Notula (see p. xxiv).

Citations have been abbreviated, and the abbreviations used for authors and places of publication have been standardized; lists of these abbreviations are given in Appendices I, II and III. These lists apply only to the abbreviations used in Volume 5.

Species descriptions attempt to give, within the limits of length set by the Flora, both the diagnostic characters of the plant and a general idea of its appearance. Where dimensions are given, a measurement without qualification refers to length. Two measurements connected by × indicate length followed by width. Further measurements in parentheses indicate exceptional sizes outside the normal ranges. In order to save space and facilitate identification, descriptions may sometimes take the form of a comparison with another description. The conventional way of setting this out is, to give an example (p. 77):

6. Leucojum valentinum Pau....Like **5** but....

This implies that the description with which it is being compared (in this example **5. Leucojum nicaeense** Ardoino) applies to this taxon but for the differences noted. It does not necessarily mean that the two taxa are similar in general appearance. Additional descriptive information is sometimes also given, but in separate sentences.

The *diploid chromosome number* ($2n =$) is given where it has been possible to verify that the count was made on material of known wild European origin. For naturalized and cultivated species, the count is from material which is naturalized or is cultivated in the way which justifies its inclusion in the Flora. It is hoped to publish separately a list of references to the data on which the published numbers are based.

Ecological information is given sparingly, and only where the ecological characteristics of a species are clearly and concisely definable for its total European range. Sometimes a general statement, applicable to a whole genus or to a group of species, is made. There is an inevitable irregularity of treatment, as in a great many cases reliable ecological information is not available.

The description of each species is followed by an indication of its *distribution within Europe*. This falls into two parts: (1) a summary in a short phrase; (2) a list of abbrevia-

tions of 'territories' in which the species occurs. The summary phrase makes use of everyday geographical phrases and concepts such as 'W. Europe', 'the Mediterranean region', 'the Balkan peninsula', etc. Maps IV and V and the legends accompanying them indicate the interpretation which is to be put on these phrases. We would emphasize that they are to be interpreted in a simple geographical sense, and do not attempt in any way to divide Europe phytogeographically.

Species believed to be endemic to Europe are distinguished by a symbol (●) before the summary of geographical distribution.

A more precise indication of distribution is given by the enumeration of the 'territories' (indicated by two-letter abbreviations) in which the plant occurs. The limits of these territories follow, with very few exceptions, existing political boundaries (see Map I). The territories, of course, vary greatly in size, and Ga, Hs or Ju gives very much less information than does Fa, Rs(K) or Tu. In all cases, however, the lists provide a guide to which national Floras should be searched for further detailed information, whether on taxonomy or on distribution. Occasionally, the list of territories is followed by a brief indication, in parentheses, of extra-European distribution. This is done only for plants of which the European range is but a small fraction of the total and for species not native in Europe.

We have been greatly assisted in our preparation of the accounts of the Gramineae, Cyperaceae, and a few smaller families by the publication, before this volume went to press, of the first two parts of the *Flora Partis Europaeae URSS*, under the editorship of An. A. Fedorov, and we hope that at least for these families the accuracy of our information on the taxonomy and distribution of Russian plants has been improved. It is necessary, however to draw attention to the fact that the geographical subdivisions of the USSR used by Fedorov, although modelled on those used in *Flora Europaea*, do not exactly correspond. This is because Fedorov has (very sensibly) defined his areas mainly in terms of administrative boundaries, whereas we have been compelled, in order to maintain consistency with our earlier volumes, to adhere to the rather imprecisely drawn ecological boundaries put forward by Komarov in 1934. The three most important areas of divergence are in N.W. Ukraine, S. Ural, and the region north-east of Leningrad. These are included by Fedorov in his western (Zapad), eastern (Vostok) and northern (Sever) divisions respectively, whereas for us they are all included in Rs(C). Our divergences, therefore, from Fedorov's distributional data, though they sometimes arise from a difference of opinion on the status of a species (native, introduced or casual), are more often due simply to the use of slightly different geographical units.

In general the only infraspecific taxa described and keyed in the Flora are subspecies. Any formal treatment of variation below the level of subspecies would have been impossible in a Flora of this kind; the known variation of taxa is, however, covered in the descriptions. No 'experimental' categories, such as ecotypes, are used in the Flora in a formal systematic sense, though they are sometimes mentioned in notes.

Where it is difficult to distinguish between a number of closely similar species in a genus, an *ad hoc* 'group' has been made, and these groups, not the individual species, are keyed out in the main species key. They will serve for at least a partial identification. Following the description of a group in the text, a key to the component species is given, and they are then numbered and described, so that a more detailed study, or the availability of more adequate material, may enable the user to take the identification further. For example, in *Carex* there is the *C. flava* group, which comprises the species *C. flava* L.,

C. lepidocarpa Tausch, *C. jemtlandica* (Palmgren) Palmgren, *C. nevadensis* Boiss. & Reuter, *C. bergrothii* Palmgren, *C. demissa* Hornem. and *C. serotina* Mérat. Such groups have no nomenclatural status.

Only those few *hybrids* which are frequent over a reasonably large area (e.g. *Narcissus* × *medioluteus* Miller) are described and keyed as for species. Other fairly common hybrids may be mentioned individually in notes (e.g. in *Alisma*) or collectively for the whole genus (e.g. in *Dactylorhiza*).

We have attempted to include the following categories of *alien species*:

(i) Aliens which are effectively naturalized. These include garden plants which have escaped to situations not immediately adjacent to those in which they are cultivated, as well as weeds and other plants which have been accidentally introduced; provided, in both cases, that the plant has been established in a single station for at least 25 years, or is reported as naturalized in a number of widely separated localities.

(ii) Trees or crop-plants which are planted or cultivated in continuous stands on a fairly extensive scale.

Casual aliens, i.e. those which do not persist without repeated re-introduction, are not included unless they have often been mistaken for a native or established species, or are for any other reason of special interest. In assessing the status of a species in any part of Europe we have, however, been dependent very largely on the information contained in the national Floras, and it is clear that the criteria used by different authors vary widely. All data on native, naturalized or casual status relating to synanthropic plants must, therefore, be regarded as only approximate; in particular, we have found it very difficult to distinguish casual from naturalized status in the numerous tropical and subtropical grasses which have been introduced to the Mediterranean region.

It is the policy of the Committee not to publish new names in the Flora itself. To deal with the publication of much of this material, an arrangement has been made with our sponsor the Linnean Society of London, by which taxonomic and nomenclatural notes are being published as part of a series entitled *Notulae Systematicae ad Floram Europaeam spectantes* in the *Botanical Journal of the Linnean Society*. The *Notulae* corresponding to Volumes 1 and 2 were published in *Feddes Repertorium*.

LISTS OF BASIC AND STANDARD FLORAS

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SYNOPSIS OF FAMILIES

MONOCOTYLEDONES

Helobiae

CLXX Alismataceae
CLXXI Butomaceae
CLXXII Hydrocharitaceae
CLXXIII Scheuchzeriaceae
CLXXIV Aponogetonaceae
CLXXV Juncaginaceae
CLXXVI Lilaeaceae
CLXXVII Potamogetonaceae
CLXXVIII Ruppiaceae
CLXXIX Posidoniaceae
CLXXX Zosteraceae
CLXXXI Zannichelliaceae
CLXXXII Najadaceae

Liliiflorae

CLXXXIII Liliaceae
CLXXXIV Agavaceae
CLXXXV Amaryllidaceae
CLXXXVI Dioscoreaceae
CLXXXVII Pontederiaceae
CLXXXVIII Iridaceae

Juncales

CLXXXIX Juncaceae

Bromeliales

CXC Bromeliaceae

Commelinales

CXCI Commelinaceae
CXCII Eriocaulaceae

Graminales

CXCIII Gramineae

Principes

CXCIV Palmae

Spathiflorae

CXCV Araceae
CXCVI Lemnaceae

Pandanales

CXCVII Sparganiaceae
CXCVIII Typhaceae

Cyperales

CXCIX Cyperaceae

Scitamineae

CC Musaceae
CCI Zingiberaceae
CCII Cannaceae

Microspermae

CCIII Orchidaceae

KEY TO FAMILIES OF ANGIOSPERMAE

This key covers all the families of Angiospermae in vols. 1–5.

1 Plant free-floating on or below the surface of the water, not rooted in mud
2 Plant without obvious differentiation into stems and leaves **CXCVI. Lemnaceae**
2 Plant with obvious stems and leaves
3 Leaves divided into numerous filiform segments
4 Plant with small bladders on leaves or on apparently leafless stems **CLXI. Lentibulariaceae**
4 Plant without small bladders
5 Leaves dichotomously divided, the segments often again divided **LX. Ceratophyllaceae**
5 Leaves pinnately divided, the segments simple **CXXIV. Haloragaceae**
3 Leaves not divided into numerous filiform segments
6 Leaves with a cuneate basal part, 4–6 lateral setaceous segments and a terminal orbicular lobe **LXXI. Droseraceae**
6 Leaves not as above
7 Perianth entirely petaloid; basal part of petioles inflated **CLXXXVII. Pontederiaceae**
7 Perianth with a distinct calyx and corolla; petioles not inflated
8 Sepals, petals and stamens 4 **CXX. Trapaceae**
8 Sepals and petals 3; stamens 9–12 **CLXXII. Hydrocharitaceae**

1 Land plant or aquatic rooted in mud
9 2- to 4-fid coloured staminodes present; leaves often fasciculate **LIII. Molluginaceae**
9 Not as above
10 Perianth absent or of a single whorl or of 2 or more whorls, all similar in shape, size, colour and texture
11 Perianth petaloid
12 Plant without chlorophyll
13 Flowers mostly unisexual; stamen 1 **XLVI. Balanophoraceae**
13 Flowers hermaphrodite; stamens 6–16
14 Filaments free **CXXXI. Pyrolaceae**
14 Filaments connate into a column **XLV. Rafflesiaceae**
12 Plant with chlorophyll
15 Perianth-segment 1, bract-like **CLXXIV. Aponogetonaceae**
15 Perianth-segments more than 1, or perianth tubular
16 Stems succulent, leafless but with groups of spines **CXVIII. Cactaceae**
16 Not as above
17 Stamens more than 12
18 Leaves pinnate **LXI. Ranunculaceae**
18 Leaves not pinnate
19 Herb **LXI. Ranunculaceae**
19 Tree **LXIV. Magnoliaceae**
17 Stamens not more than 12
20 Flowers in ovoid capitula; involucre absent **LXXX. Rosaceae**
20 Flowers not in capitula, or in capitula surrounded by an involucre of bracts
21 Ovary superior
22 Perianth-segments 4
23 Flowers zygomorphic **XLI. Proteaceae**
23 Flowers actinomorphic
24 Perianth with a long tube **CVII. Thymelaeaceae**
24 Perianth-segments free
25 Herb **CLXXXIII. Liliaceae**
25 Shrub **XLVII. Polygonaceae**
22 Perianth-segments more than 4
26 Carpels more than 1, free or nearly so
27 Leaves triquetrous, all basal **CLXXI. Butomaceae**
27 Leaves flat, cauline **LI. Phytolaccaceae**
26 Carpel 1 or carpels obviously united
28 Perianth-segments 6
29 Stem stout, woody; leaves crowded, rigid, very fibrous **CLXXXIV. Agavaceae**
29 Not as above
30 Flowers actinomorphic **CLXXXIII. Liliaceae**
30 Flowers zygomorphic **CLXXXVII. Pontederiaceae**
28 Perianth-segments 5
31 Stigmas 2–3; stipules sheathing, scarious **XLVII. Polygonaceae**
31 Stigma 1; stipules absent
32 Ovules numerous; perianth divided almost to base **CXXXV. Primulaceae**
32 Ovule 1; perianth with a long tube **L. Nyctaginaceae**
21 Ovary inferior, or flowers male
33 Leaves at least partly in whorls of 4 or more **CXLIV. Rubiaceae**
33 Leaves not in whorls of 4 or more
34 Flowers sessile in capitula surrounded by an involucre of bracts
35 Anthers cohering in a tube round the style, or flowers unisexual **CLXIX. Compositae**
35 Anthers free; flowers hermaphrodite **CLXVII. Dipsacaceae**
34 Flowers pedicellate, though pedicels sometimes short and flowers in compact umbels or cymes
36 Ovules 1 or 2
37 Leaves opposite **CLXVI. Valerianaceae**
37 Leaves alternate
38 Flowers in simple cymes or solitary **XLII. Santalaceae**
38 Flowers in umbels or superposed whorls **CXXIX. Umbelliferae**
36 Ovules numerous
39 Perianth-segments 3 or perianth tubular with an entire, unilateral limb **XLIV. Aristolochiaceae**
39 Perianth-segments 6 or 8
40 Perianth-segments in 2 whorls of 4 **CXXIII. Onagraceae**
40 Perianth-segments in 2 whorls of 3
41 Stamens 3 **CLXXXVIII. Iridaceae**
41 Stamens 6
42 Scapose plant with a bulb **CLXXXV. Amaryllidaceae**
42 Stem leafy; rhizomatous **CLXXXIV. Agavaceae**
11 Perianth dry and scarious (though sometimes brightly coloured) or sepaloid or absent
43 Tree or shrub, sometimes small
44 Parasitic on branches of other trees or shrubs **XLIII. Loranthaceae**
44 Not parasitic
45 Stems creeping or climbing with adventitious roots; evergreen **CXXVIII. Araliaceae**
45 Not as above
46 Most leaves opposite or subopposite
47 Young stems and leaves fleshy **XLVIII. Chenopodiaceae**
47 Neither stems nor leaves fleshy
48 Style 1

49 Leaves pinnate **CXXXIX. Oleaceae**
49 Leaves simple
50 Flowers in catkins **XXXI. Salicaceae**
50 Flowers not in catkins **CIII. Rhamnaceae**
48 Styles 2 or more
51 Stamens 5; flowers hermaphrodite **CIII. Rhamnaceae**
51 Stamens 4 or 8; flowers often unisexual
52 Stamens 4; evergreen **CII. Buxaceae**
52 Stamens 8; usually deciduous **XCV. Aceraceae**
46 Most leaves alternate
53 Leaves pinnate
54 Male flowers in catkins; styles 2; pith septate **XXXIII. Juglandaceae**
54 Flowers not in catkins; styles 3 or 1; pith not septate
55 Style 1; fruit a compressed legume with several seeds **LXXXI. Leguminosae**
55 Styles 3; fruit a dry 1-seeded drupe **XCIV. Anacardiaceae**
53 Leaves simple
56 Leaves not more than 2 mm wide, linear or oblong
57 Stigma 1 **CVII. Thymelaeaceae**
57 Stigmas 2–9
58 Stamens 3 **CXXXIII. Empetraceae**
58 Stamens 5 **XLVIII. Chenopodiaceae**
56 Leaves more than 2 mm wide
59 Petiole-base enclosing the bud **LXXIX. Platanaceae**
59 Petiole-base not enclosing the bud
60 Anthers opening by transverse valves **LXV. Lauraceae**
60 Anthers opening by longitudinal slits
61 Flowers not in catkins or dense heads
62 Inflorescence of several male flowers, each of 1 stamen, and a female flower, appearing as a stalked ovary, all surrounded by 4–5(–8) conspicuous glands; latex present **LXXXVII. Euphorbiaceae**
62 Inflorescence not as above; latex absent
63 Flowers unisexual
64 Peltate, scale-like silvery or ferrugineous hairs present beneath the leaves and often elsewhere; ovary 1-locular; fruit fleshy **CVIII. Elaeagnaceae**
64 Peltate hairs absent; ovary 3-locular; fruit dry **LXXXVII. Euphorbiaceae**
63 Flowers hermaphrodite
65 Tree; perianth-tube short, with stamens inserted near its base **XXXVII. Ulmaceae**
65 Shrub; perianth-tube long, with stamens inserted near its apex **CVII. Thymelaeaceae**
61 At least the male flowers in catkins or dense heads
66 Latex present; fruit or false fruit fleshy **XXXVIII. Moraceae**
66 Latex absent; fruit dry
67 Usually dioecious; perianth absent
68 Bracts (catkin-scales) fimbriate or lobed at apex; flowers with a cup-like disc **XXXI. Salicaceae**
68 Bracts (catkin-scales) entire; disc absent
69 Leaves with pellucid glands; stamens with short filaments; ovule 1 **XXXII. Myricaceae**
69 Leaves without pellucid glands; stamens with long filaments; ovules numerous **XXXI. Salicaceae**
67 Monoecious; perianth present in male or female flowers or in both
70 Styles 3 or more; perianth present in flowers of both sexes **XXXVI. Fagaceae**
70 Styles 2; perianth present in flowers of 1 sex only
71 Male flowers 3 to each bract, with perianth **XXXIV. Betulaceae**
71 Male flowers 1 to each bract, without perianth **XXXV. Corylaceae**
43 Herb
72 Perianth absent or represented by scales or bristles, minute at anthesis; flowers in the axils of bracts, one or more forming a spikelet; leaves usually linear, grass-like, sheathing below
73 Flowers usually with a bract above and below; sheaths usually open; stems usually with hollow internodes, not triquetrous **CXCIII. Gramineae**
73 Flowers with a bract below only; sheaths usually closed; stems usually with solid internodes, often triquetrous **CXCIX. Cyperaceae**
72 Perianth present, or perianth absent and flowers not arranged in spikelets
74 Aquatic plant with submerged or floating leaves; inflorescence sometimes emergent
75 Leaves divided into numerous filiform segments
76 Leaves pinnately divided; flowers in a terminal spike **CXXIV. Haloragaceae**
76 Leaves dichotomously divided; flowers solitary, axillary **LX. Ceratophyllaceae**
75 Leaves entire or minutely toothed
77 Fruitlets with stalks several times their own length **CLXXVIII. Ruppiaceae**
77 Fruitlets sessile
78 Flowers in spikes
79 Rhizome densely covered with rigid fibres; inflorescence subtended by several leaf-like bracts (marine) **CLXXIX. Posidoniaceae**
79 Rhizome without rigid fibres; inflorescence not subtended by several leaf-like bracts
80 Flowers on one side of a flat rhachis (marine) **CLXXX. Zosteraceae**
80 Flowers all round or on 2 sides of a terete rhachis (fresh, rarely brackish water) **CLXXVII. Potamogetonaceae**
78 Flowers not in spikes
81 Flowers in heads or in branched inflorescences
82 Flowers hermaphrodite **CLXXXIX. Juncaceae**
82 Flowers unisexual
83 Leaves all basal; heads solitary, on long scapes **CXCII. Eriocaulaceae**
83 At least some leaves cauline; inflorescence with female heads below and male heads above **CXCVII. Sparganiaceae**
81 Flowers solitary or few, sessile or shortly pedicellate, usually in leaf-axils
84 Leaves in whorls of 8 or more **CXXVI. Hippuridaceae**
84 Leaves not in whorls of 8 or more
85 Carpels 2 or more, free **CLXXXI. Zannichelliaceae**
85 Carpels connate or solitary
86 Perianth-segments 4 or 6; stamens 4 or more; leaves ovate to obovate
87 Perianth-segments 4; ovary inferior **CXXIII. Onagraceae**
87 Perianth-segments 6; ovary superior **CXIX. Lythraceae**
86 Perianth-segments fewer than 4, or perianth absent; stamens 1–3; leaves linear to lanceolate
88 Perianth-segments 3; ovary inferior; stamens 2–3 **CLXXII. Hydrocharitaceae**
88 Perianth 2-lipped, cupular, or absent; ovary superior; stamens 1(–2)
89 Leaves without a sheathing base; ovary compressed, deeply 4-lobed **CL. Callitrichaceae**
89 Leaves with a sheathing base; ovary terete, not lobed
90 Leaves entire **CLXXXI. Zannichelliaceae**
90 Leaves dentate or denticulate **CLXXXII. Najadaceae**

74 Land plant or aquatic with emergent stems or leaves
91 Climbing plant with unisexual flowers
92 Leaves opposite; perianth-segments 5 **XXXIX. Cannabaceae**
92 Leaves alternate; perianth-segments 6 **CLXXXVI. Dioscoreaceae**
91 Not climbing, or rarely climber with hermaphrodite flowers
93 Leaves linear
94 Flowers unisexual
95 Female flowers solitary; male flowers solitary or in short cymes **XLVIII. Chenopodiaceae**
95 Male and female flowers numerous, in dense heads or spikes
96 Male and female (and some hermaphrodite) flowers mixed together in the same spike; stamen 1 **CLXXVI. Lilaeaceae**
96 Male and female flowers separate in the inflorescence; stamens 2 or more
97 Male and female flowers in separate globose heads **CXCVII. Sparganiaceae**
97 Flowers in a dense cylindrical spike, male above, female below, sometimes with a gap between them **CXCVIII. Typhaceae**
94 Flowers hermaphrodite
98 Plant densely pubescent **XLVIII. Chenopodiaceae**
98 Plant glabrous to sparsely pubescent
99 Flowers in a dense spike which is apparently lateral on a flattened leaf-like stem **CXCV. Araceae**
99 Not as above
100 Carpel 1
101 Leaves not subverticillate; stipules absent **XLVIII. Chenopodiaceae**
101 Leaves subverticillate; small stipules present **LVII. Caryophyllaceae**
100 Carpels more than 1
102 Carpels free (except at base); leaves with a conspicuous pore at apex **CLXXIII. Scheuchzeriaceae**
102 Carpels ± completely united; leaves without a conspicuous pore at apex
103 Perianth-segments 5
104 Leaves opposite, not glaucous **LVII. Carophyllaceae**
104 Leaves in whorls, glaucous **LIII. Molluginaceae**
103 Perianth-segments 6
105 Flowers in unbranched racemes; styles short or absent **CLXXV. Juncaginaceae**
105 Flowers in cymes, usually in a branched inflorescence; styles 3, distinct **CLXXIX. Juncaceae**
93 Leaves lanceolate or wider, or small and scale-like but not linear
106 Leaves compound
107 Flowers in compound umbels **CXXIX. Umbelliferae**
107 Flowers not in compound umbels
108 Flowers in capitula
109 Leaves pinnate; styles 1 or 2 **LXXX. Rosaceae**
109 Leaves ternate; styles 3–5 **CLXV. Adoxaceae**
108 Flowers not in capitula
110 Ovary inferior; styles 3, 2-fid **CXVI. Datiscaceae**
110 Ovary superior; styles 1, 4 or 5
111 Stamens numerous **LXI. Ranunculaceae**
111 Stamens 4–5(–10)
112 Epicalyx present **LXXX. Rosaceae**
112 Epicalyx absent **LXXXIII. Geraniaceae**
106 Leaves simple or apparently absent
113 Flowers small, usually numerous, arranged on an axis (spadix) subtended and often ± enclosed by a conspicuous bract (spathe) **CXCV. Araceae**
113 Not as above
114 Inflorescence of several male flowers, each of 1 stamen, and a female flower, appearing as a stalked ovary, all surrounded by 4 or 5(8) conspicuous glands; latex present **LXXXVII. Euphorbiaceae**
114 Not as above
115 Leaves apparently absent; stem green and succulent **XLVIII. Chenopodiaceae**
115 Leaves obvious; stem not succulent
116 Lower leaves opposite, upper alternate; monoecious; male flowers with 2-partite perianth, the female with tubular perianth **CXXV. Theligonaceae**
116 Not as above
117 Plant densely clothed with stellate or peltate hairs; ovary 3-locular with 1 ovule in each loculus **LXXXVII. Euphorbiaceae**
117 Not as above
118 Plant densely papillose
119 Leaves oblong-lanceolate, not hastate; fruit dehiscing by 5 valves **LII. Aizoaceae**
119 Leaves ovate-rhombic, often hastate; fruit indehiscent **LIV. Tetragoniaceae**
118 Plant not densely papillose
120 Leaves in whorls
121 Stigma 1; stems hollow **CXXVI. Hippuridaceae**
121 Stigmas 3; stems solid **LIII. Molluginaceae**
120 Leaves not in whorls
122 Leaves opposite (rarely a few of the upper apparently alternate)
123 Leaves toothed or lobed
124 Flowers hermaphrodite
125 Ovary inferior or semi-inferior; stigmas 2 **LXXIII. Saxifragaceae**
125 Ovary superior; stigmas 5 **LXXXIII. Geraniaceae**
124 Flowers unisexual
126 Perianth-segments 4 or 2; style 1 **XL. Urticaceae**
126 Perianth-segments 3; styles 2 **LXXXVII. Euphorbiaceae**
123 Leaves entire
127 Perianth absent; ovary strongly compressed, deeply 4-lobed **CL. Callitrichaceae**
127 Perianth present; ovary not compressed and 4-lobed
128 Perianth-segments 3 **XLVII. Polygonaceae**
128 Perianth-segments 4 or more
129 Ovary inferior **CXXIII. Onagraceae**
129 Ovary superior
130 Perianth-segments 6 or 12; style and stigma 1 **CXIX. Lythraceae**
130 Perianth-segments 4 or 5; styles and stigmas 2 or more
131 Leaves with a long spinose apex; perianth-segments transversely winged in fruit **XLVIII. Chenopodiaceae**
131 Leaves without a long spinose apex; perianth-segments not winged in fruit **LVII. Caryophyllaceae**
122 Leaves alternate or all basal (rarely the lower opposite)
132 Stamens numerous; carpels free, except sometimes at the base **LXI. Ranunculaceae**
132 Stamens 12 or fewer; carpels usually solitary or united

133 Carpels attached to a central axis, otherwise free **LI. Phytolaccaceae**
133 Carpel 1 or carpels obviously united
134 Stamens 12 **XLIV. Aristolochiaceae**
134 Stamens 10 or fewer
135 Stipules united into a sheath **XLVII. Polygonaceae**
135 Stipules free or absent
136 Leaves very large, palmately lobed, all basal; inflorescence of dense, many-flowered spikes much shorter than the leaves **CXXIV. Haloragaceae**
136 Not as above
137 Epicalyx present; stipules leaf-like **LXXX. Rosaceae**
137 Epicalyx absent; stipules small or absent
138 Ovary inferior
139 Leaves reniform, cordate **LXXIII. Saxifragaceae**
139 Leaves subulate to linear-lanceolate **XLII. Santalaceae**
138 Ovary superior
140 Perianth tubular below
141 Stamens 1–5; ovule basal **XLVIII. Chenopodiaceae**
141 Stamens 8; ovule pendent **CVII. Thymelaeaceae**
140 Perianth-segments free or nearly so
142 Perianth-segments 4
143 Flowers in ebracteate racemes **LXVIII. Cruciferae**
143 Flowers in axillary clusters **XL. Urticaceae**
142 Perianth-segments 5, at least in male flowers
144 Perianth herbaceous, or absent in female flowers **XLVIII. Chenopodiaceae**
144 Perianth scarious **XLIX. Amaranthaceae**

10 Perianth of 2 (rarely more) whorls differing markedly from each other in shape, size, colour or texture
145 Petals all united at base into a longer or shorter tube
146 Ovary inferior
147 Stamens 8–10, or 4–5 with filaments divided to base
148 Herb; anthers opening by longitudinal slits; leaves ternate **CLXV. Adoxaceae**
148 Woody; anthers opening by apical pores; leaves simple **CXXXII. Ericaceae**
147 Stamens 5 or fewer; filaments not divided
149 Leaves in whorls of 4 or more **CXLIV. Rubiaceae**
149 Leaves not in whorls
150 Stamens opposite the corolla-lobes **CXXXV. Primulaceae**
150 Stamens alternating with the corolla-lobes
151 Stipules interpetiolar **CXLIV. Rubiaceae**
151 Stipules absent or not interpetiolar
152 Flowers in capitula surrounded by an involucre of more than 2 bracts
153 Anthers coherent in a ring round the style
154 Ovule 1; calyx represented by hairs, scales, a corona or auricle **CLXIX. Compositae**
154 Ovules numerous; calyx-lobes conspicuous, usually green **CLXVIII. Campanulaceae**
153 Anthers free
155 Ovule 1; corolla-lobes usually much shorter than tube **CLXVII. Dipsacaceae**
155 Ovules numerous; corolla-lobes longer than tube **CLXVIII. Campanulaceae**
152 Flowers not in capitula or with an involucre of 2 bracts
156 Anthers coherent in a tube round the style **CLXVIII. Campanulaceae**
156 Anthers free
157 Anthers sessile; pollen-grains coherent in pollinia **CCIII. Orchidaceae**
157 Anthers with filaments; pollen-grains not in pollinia
158 Leaves more than 100 cm **CC. Musaceae**
158 Leaves not more than *c.* 50 cm
159 Stamens 1–3(–4)
160 Corolla 4- to 5-merous **CLXVI. Valerianaceae**
160 Corolla 3-merous
161 Sepals connate into a tube **CCI. Zingiberaceae**
161 Sepals free **CCII. Cannaceae**
159 Stamens 4–8
162 Shrub (sometimes small and creeping) or woody climber **CLXIV. Caprifoliaceae**
162 Herb
163 Tendrils present **CXVII. Cucurbitaceae**
163 Tendrils absent
164 Leaves pinnate **CLXIV. Caprifoliaceae**
164 Leaves not pinnate
165 Flowers hermaphrodite; fruit a capsule **CLXVIII. Campanulaceae**
165 Flowers unisexual; fruit fleshy **CXVII. Cucurbitaceae**
146 Ovary superior
166 Flowers papilionaceous
167 Sepals free; stamens 8 **XCII. Polygalaceae**
167 Sepals connate; stamens 10 **LXXXI. Leguminosae**
166 Flowers not papilionaceous
168 Stamens at least twice as many as corolla-lobes
169 Herb with succulent leaves **LXXII. Crassulaceae**
169 Shrub or tree
170 Flowers unisexual **CXXXVII. Ebenaceae**
170 Flowers hermaphrodite
171 Anthers opening by apical pores; hairs simple or scale-like **CXXXII. Ericaceae**
171 Anthers opening by longitudinal slits; hairs stellate **CXXXVIII. Styracaceae**
168 Stamens not more than corolla-lobes
172 Plant without chlorophyll; leaves scale-like
173 Flowers actinomorphic; stem slender, twining **CXLVI. Convolvulaceae**
173 Flowers ± zygomorphic; stem stout, erect
174 Leaves fleshy at anthesis; corolla with cylindrical tube and 2-lipped limb; upper lip entire, the lower entire or shortly 3-lobed **CLIV. Scrophulariaceae**
174 Leaves not fleshy at anthesis; corolla 5-lobed, 2-lipped or almost regular **CLX. Orobanchaceae**
172 Green plant
175 Ovary deeply (2-)4-lobed with 1 ovule in each lobe; fruit separating into nutlets when mature
176 Leaves alternate **CXLVIII. Boraginaceae**
176 Leaves opposite
177 Style gynobasic **CLI. Labiatae**
177 Style apical **CXLIX. Verbenaceae**
175 Ovary not deeply (2-)4-lobed
178 Flowers distinctly zygomorphic
179 Anthers opening by apical pores **CXXXII. Ericaceae**
179 Anthers opening by longitudinal slits
180 Calyx with patent spines and erect, membranous, usually dark-spotted lobes **CXXXV. Primulaceae**
180 Calyx not as above
181 Flowers small, crowded in capitula **CLV. Globulariaceae**
181 Flowers not in capitula
182 Ovary 1-locular; carnivorous plants **CLXI. Lentibulariaceae**
182 Ovary 2-locular; not carnivorous plants
183 Ovules 4

184 Bracts and bracteoles shorter than calyx **CXLIX. Verbenaceae**
184 Bracts or bracteoles longer than calyx **CLVI. Acanthaceae**
183 Ovules numerous
185 Leaves all basal **CLIX. Gesneriaceae**
185 Cauline leaves present
186 Capsule not more than twice as long as wide **CLIV. Scrophulariaceae**
186 Capsule many times as long as wide
187 Capsule with a short beak **CLVII. Pedaliaceae**
187 Capsule with a horn 8–20 cm **CLVIII. Martyniaceae**
178 Flowers actinomorphic or nearly so
188 Sepals 2
189 Petals 2; leaves all basal **CXCII. Eriocaulaceae**
189 Petals 5; leaves not all basal **LV. Portulacaceae**
188 Sepals more than 2
190 Carpels free
191 Carpels 4 or more; latex absent **LXXII. Crassulaceae**
191 Carpels 2; latex present
192 Corolla with a corona; styles 2, free but united by the stigma **CXLIII. Asclepiadaceae**
192 Corolla without a corona; styles 2, united except at the very base **CXLII. Apocynaceae**
190 Carpels united
193 Stamens fewer than corolla-lobes
194 Herb **CLIV. Scrophulariaceae**
194 Shrub or tree
195 Leaves opposite **CXXXIX. Oleaceae**
195 Leaves alternate
196 Leaves with numerous pellucid glands **CLXII. Myoporaceae**
196 Leaves without pellucid glands
197 Corolla yellow **CXXXIX. Oleaceae**
197 Corolla not yellow **CLIV. Scrophulariaceae**
193 Stamens as many as corolla-lobes
198 Stamens opposite corolla-lobes
199 Styles or stigmas more than 1; ovule 1 **CXXXVI. Plumbaginaceae**
199 Style and stigma 1; ovules numerous
200 Herb **CXXXV. Primulaceae**
200 Shrub **CXXXIV. Myrsinaceae**
198 Stamens alternating with corolla-lobes
201 Leaves opposite or verticillate
202 Corolla entirely scarious **CLXIII. Plantaginaceae**
202 Corolla not scarious
203 Herb
204 Aquatic plant; leaves petiolate **CXLI. Menyanthaceae**
204 Land plant; leaves sessile **CXL. Gentianaceae**
203 Shrub
205 Plant small, procumbent; leaves evergreen, coriaceous **CXXXII. Ericaceae**
205 Plant large, erect; leaves deciduous, herbaceous
206 Leaves digitate **CXLIX. Verbenaceae**
206 Leaves simple
207 Flowers in long panicles; fruit a capsule **CLIII. Buddlejaceae**
207 Flowers in corymbs; fruit a drupe **CXLIX. Verbenaceae**
201 Leaves alternate or all basal
208 Corolla-lobes and stamens 4
209 Corolla scarious **CLXIII. Plantaginaceae**
209 Corolla not scarious **CLIX. Gesneriaceae**
208 Corolla-lobes and stamens 5
210 Ovary 3-locular; stigmas 3, or 1 but distinctly 3-lobed
211 Leaves herbaceous; corolla not white **CXLV. Polemoniaceae**
211 Leaves coriaceous; corolla white **CXXX. Diapensiaceae**
210 Ovary 2-locular; stigmas 2 or 1
212 Ovules 4 or fewer
213 Flowers numerous in scorpioid cymes **CXLVIII. Boraginaceae**
213 Flowers usually solitary or few, rarely in congested racemes **CXLVI. Convolvulaceae**
212 Ovules numerous
214 Aquatic or bog-plant; corolla-lobes fimbriate **CXLI. Menyanthaceae**
214 Land plant; corolla-lobes not fimbriate
215 Leaves all basal **CLIX. Gesneriaceae**
215 Some leaves cauline
216 Style deeply divided **CXLVII. Hydrophyllaceae**
216 Style undivided
217 Corolla-lobes imbricate in bud; internal phloem absent **CLIV. Scrophulariaceae**
217 Corolla-lobes plicate or valvate in bud; internal phloem present **CLII. Solanaceae**
145 Petals not all united into a tube at base, very rarely cohering at apex
218 Ovary inferior or partly so
219 Petals numerous
220 Aquatic plant; leaves not succulent **LVIII. Nymphaeaceae**
220 Land plant; leaves succulent **LV. Portulacaceae**
219 Petals 5 or fewer
221 Petals and sepals 3
222 Flowers zygomorphic
223 Style and filaments obvious **CLXXXVIII. Iridaceae**
223 Stigma and anthers sessile **CCIII. Orchidaceae**
222 Flowers actinomorphic
224 Leaves and bracts spinose-dentate **CXC. Bromeliaceae**
224 Leaves and bracts not spinose-dentate
225 Outer perianth-whorl sepaloid **CLXXII. Hydrocharitaceae**
225 Both perianth-whorls petaloid
226 Stamens 6 **CLXXXV. Amaryllidaceae**
226 Stamens 3 **CLXXXVIII. Iridaceae**
221 Petals and sepals 2, 4 or 5
227 Stamens numerous
228 Leaves opposite, with pellucid glands **CXXI. Myrtaceae**
228 Leaves alternate, without pellucid glands
229 Leaves entire; seeds covered with pulp **CXXII. Punicaceae**
229 Leaves serrulate; seeds dry
230 Styles free; fruit fleshy **LXXX. Rosaceae**
230 Styles connate, except at apex; fruit dry **LXXV. Hydrangeaceae**
227 Stamens 10 or fewer
231 Aquatic; leaves pinnate, with filiform segments; flowers in spikes **CXXIV. Haloragaceae**
231 Not as above
232 Herb
233 Petals 5
234 Stamens 5 **CXXIX. Umbelliferae**
234 Stamens 10 **LXXIII. Saxifragaceae**
233 Petals 4 or 2
235 Flowers in umbels surrounded by 4 conspicuous white bracts **CXXVII. Cornaceae**
235 Flowers not in umbels; no conspicuous white bracts **CXXIII. Onagraceae**
232 Shrub or woody climber
236 Flowers in umbels
237 Climber **CXXVIII. Araliaceae**

237 Erect shrub
238 Evergreen; umbels flat **CXXIX. Umbelliferae**
238 Deciduous; umbels globose **CXXVII. Cornaceae**
236 Flowers not in umbels
239 Leaves palmately lobed **LXXVII. Grossulariaceae**
239 Leaves not lobed
240 Both perianth-whorls petaloid **CXXIII. Onagraceae**
240 Outer perianth-whorl sepaloid
241 Calyx-teeth very small; ovules 1 in each carpel; fruit a drupe **CXXVII. Cornaceae**
241 Calyx-teeth large; ovules numerous; fruit a capsule
242 Stamens 10 **LXXV. Hydrangeaceae**
242 Stamens 5 **LXXVI. Escalloniaceae**
218 Ovary superior
243 Carpels 2 or more, free or united at the base only
244 Sepals and petals 3
245 Carpels more than 3
246 Leaves lobed **LXI. Ranunculaceae**
246 Leaves entire **CLXX. Alismataceae**
245 Carpels 3
247 Leaves palmately or pinnately divided; petioles spiny **CXCIV. Palmae**
247 Leaves simple, sessile **LXXII. Crassulaceae**
244 Sepals or petals more than 3
248 Flowers zygomorphic
249 Petals deeply divided **LXIX. Resedaceae**
249 Petals entire **LXI. Ranunculaceae**
248 Flowers actinomorphic
250 Stamens more than twice as many as petals
251 Shrub or herb with stipulate leaves; flowers perigynous **LXXX. Rosaceae**
251 Herb; stipules absent, though leaf-bases sometimes sheathing; flowers hypogynous
252 Fruit a head of achenes; sepals deciduous **LXI. Ranunculaceae**
252 Fruit of 2–5 follicles; sepals persistent **LXII. Paeoniaceae**
250 Stamens not more than twice as many as petals
253 Leaves 3-foliolate **LXXX. Rosaceae**
253 Leaves simple
254 Tree with palmately lobed leaves; flowers in globose capitula **LXXIX. Platanaceae**
254 Herb or shrub; leaves not palmately lobed; flowers not in globose capitula
255 Carpels spirally arranged on an elongated receptacle **LXI. Ranunculaceae**
255 Carpels in 1 whorl
256 Herb or dwarf shrub; leaves ±succulent **LXXII. Crassulaceae**
256 Shrub with angular stems; leaves not succulent **XCIII. Coriariaceae**
243 Carpels obviously united for at least ½ their length, or carpel solitary
257 Flowers zygomorphic
258 One or more perianth-segments saccate or spurred at base
259 Sepals 2, small **LXVI. Papaveraceae**
259 Sepals 3 or 5
260 Sepals 3, very unequal, 1 spurred; petals 3, not spurred **XCVIII. Balsaminaceae**
260 Sepals and petals 5
261 Leaves peltate **LXXXIV. Tropaeolaceae**
261 Leaves not peltate
262 Leaves opposite **LXXXIII. Geraniaceae**
262 Leaves alternate
263 Outer whorl of perianth-segments sepaloid **CX. Violaceae**
263 Both whorls of perianth-segments petaloid **LXI. Ranunculaceae**
258 Perianth not saccate or spurred at base
264 All, or all but one of the stamens with their filaments connate into a tube **LXXXI. Leguminosae**
264 All stamens free
265 Tree or shrub
266 Leaves compound
267 Leaves 3-foliolate or pinnate **LXXXI. Leguminosae**
267 Leaves digitate, with more than 3 leaflets **XCVII. Hippocastanaceae**
266 Leaves simple
268 Ovary on a long gynophore **LXVII. Capparaceae**
268 Ovary sessile or subsessile
269 Petals 4 **LXVIII. Cruciferae**
269 Petals 5 **LXXXI. Leguminosae**
265 Herb
270 Ovary and fruit deeply 5-lobed
271 Flowers in umbellate cymes; fruit with a long beak **LXXXIII. Geraniaceae**
271 Flowers in racemes; fruit not beaked **LXXXVIII. Rutaceae**
270 Ovary and fruit not deeply 5-lobed
272 Petals fimbriate or lobed **LXIX. Resedaceae**
272 Petals entire or emarginate
273 Stamens 10 **LXXXI. Leguminosae**
273 Stamens not more than 6
274 Sepals inserted on a cup-like hypanthium **LVII. Caryophyllaceae**
274 Sepals not inserted on a cup-like hypanthium
275 Ovary 2-locular; gynophore short or absent **LXVIII. Cruciferae**
275 Ovary 1-locular; gynophore long **LXVII. Capparaceae**
257 Flowers actinomorphic
276 Inner whorl of perianth-segments spurred **LXI. Ranunculaceae**
276 Both whorls of perianth-segments without spurs
277 Corona of long filaments present inside the petals **CXI. Passifloraceae**
277 Flowers without a corona
278 Petals more than 10
279 Aquatic herb with petiolate leaves
280 Leaves floating, usually with a deep basal sinus **LVIII. Nymphaeaceae**
280 Leaves not floating, peltate **LIX. Nelumbonaceae**
279 Terrestrial herb or shrub with sessile or subsessile leaves
281 Stamens 4–6 **LXIII. Berberidaceae**
281 Stamens numerous **LII. Aizoaceae**
278 Petals fewer than 10
282 Stamens more than twice as many as petals
283 Stamens with their filaments connate into a tube **CVI. Malvaceae**
283 Stamens free or connate in separate bundles
284 Perianth-segments persistent in fruit, 2 large and 2 small **XLVII. Polygonaceae**
284 Perianth-segments not as above
285 Ovary on a long gynophore **LXVII. Capparaceae**
285 Ovary sessile or subsessile
286 Ovary surrounded by a cup-shaped hypanthium; ovule 1 **LXXX. Rosaceae**
286 Flowers without a cup-shaped hypanthium; ovules 2 or more
287 Flowers small, in dense spikes or globose clusters, arranged in racemes or panicles **LXXXI. Leguminosae**
287 Flowers not as above
288 Carpel 1; leaves 2-ternate, the lower leaflets stalked **LXI. Ranunculaceae**
288 Carpels 2 or more; leaves not as above
289 Large tree; inflorescence with a conspicuous bract partly adnate to peduncle **CV. Tiliaceae**
289 Not as above
290 Styles more than 1, free

291 Most leaves alternate; outer perianth-segments petaloid **LXI. Ranunculaceae**
291 Leaves opposite or verticillate; outer perianth-segments sepaloid **CIX. Guttiferae**
290 Style 1 or absent
292 Petals 4 **LXVI. Papaveraceae**
292 Petals 5
293 Ovary 1-locular or septate at base only; stamens numerous **CXII. Cistaceae**
293 Ovary 3-locular; stamens 15 **LXXXV. Zygophyllaceae**
282 Stamens not more than twice as many as petals
294 Tree, shrub or woody climber
295 Flowers on tough, leaf-life cladodes; leaves scale-like, brownish **CLXXXIII. Liliaceae**
295 Not as above
296 Leaves small, scale-like or ericoid
297 Perianth-segments in 2 whorls of 3; stamens 3 **CXXXIII. Empetraceae**
297 Perianth-segments and stamens more than 3 in a whorl
298 Leaves opposite **CXIV. Frankeniaceae**
298 Leaves alternate **CXIII. Tamaricaceae**
296 Leaves not scale-like or ericoid
299 Peduncles adnate to petioles; ovary on a short gynophore **LXXXIX. Cneoraceae**
299 Not as above
300 All leaves opposite
301 Leaves pinnate
302 Shrub; fruit a capsule **CI. Staphyleaceae**
302 Tree; fruit of 2 single-seeded samaras **XCV. Aceraceae**
301 Leaves entire or palmately lobed
303 Fruit of 2 single-seeded samaras; leaves usually palmately lobed **XCV. Aceraceae**
303 Fruit a fleshy capsule; leaves entire **C. Celastraceae**
300 At least some leaves alternate
304 Stamens 8 **XCVI. Sapindaceae**
304 Stamens 4, 5, 6, 10 or 12
305 Stamens 10 or 12
306 Leaves entire **CXXXII. Ericaceae**
306 Leaves pinnate
307 Spiny tree **LXXXI. Leguminosae**
307 Unarmed shrub or tree
308 Stamens with connate filaments **XCI. Meliaceae**
308 Stamens free
309 Shrub or small tree; carpel 1; fruit a small drupe **XCIV. Anacardiaceae**
309 Large tree; carpels 5–6, ± free; fruit a group of samaras **XC. Simaroubaceae**
305 Stamens not more than 6
310 Stamens 6 **LXVIII. Cruciferae**
310 Stamens 4 or 5
311 Stamens opposite petals
312 Shrub or small tree; petals shorter than sepals **CIII. Rhamnaceae**
312 Woody climber; petals longer than sepals **CIV. Vitaceae**
311 Stamens alternating with petals
313 Very spiny shrub **C. Celastraceae**
313 Unarmed shrub or small tree
314 Bark resinous; ovule 1 **XCIV. Anacardiaceae**
314 Bark not resinous; ovules several
315 Leaf-margin usually spiny; fruit a bright red drupe **XCIX. Aquifoliaceae**
315 Leaf-margin not spiny; fruit a capsule **LXXVIII. Pittosporaceae**

294 Herb, sometimes ± woody at base
316 Sepals 2; petals 5
317 Stems erect or procumbent, not twining **LV. Portulacaceae**
317 Stems twining **LVI. Basellaceae**
316 Sepals as many as petals
318 Flowers 3-merous **CXCI. Commelinaceae**
318 Flowers 4- or more-merous
319 Leaves forming long pitchers; stigma very large, peltate **LXX. Sarraceniaceae**
319 Not as above
320 Flowers strongly perigynous, with a tubular or campanulate hypanthium **CIX. Lythraceae**
320 Flowers hypogynous, or perigynous with a flat or weakly concave hypanthium
321 Cauline leaves opposite or verticillate
322 Leaves divided or serrate
323 Petals 4 **LXVIII. Cruciferae**
323 Petals 5
324 Stamens without scales on the inner side of the filaments **LXXXIII. Geraniaceae**
324 Stamens with scales on the inner side of the filaments **LXXXV. Zygophyllaceae**
322 Leaves undivided and entire
325 Leaves in 1 whorl; flower solitary, terminal **CLXXXIII. Liliaceae**
325 Not as above
326 Stipules present
327 Stipules scarious; land-plant **LVII. Caryophyllaceae**
327 Stipules not scarious; usually submerged aquatic **CXV. Elatinaceae**
326 Stipules absent
328 Sepals connate for more than ½ their length
329 Styles connate; placentation parietal **CXIV. Frankeniaceae**
329 Styles free; placentation free-central **LVII. Caryophyllaceae**
328 Sepals free or connate at the base only
330 Ovary 1-locular; placentation free-central **LVII. Caryophyllaceae**
330 Ovary 4- to 5-locular; placentation axile **LXXXVI. Linaceae**
321 Leaves alternate or all basal, rarely absent
331 Herbaceous climber; tendrils present **XCVI. Sapindaceae**
331 Not climbing; tendrils absent
332 Leaves 3- to 4-foliolate **LXXXII. Oxalidaceae**
332 Leaves not 3- to 4-foliolate
333 Sepals and petals 2–3 **XLVII. Polygonaceae**
333 Sepals and petals 4–5
334 Sepals and petals 4; stamens 4 or 6
335 Stipules absent; stamens usually 6 **LXVIII. Cruciferae**
335 Stipules present; stamens 4 **LVII. Caryophyllaceae**
334 Sepals and petals 5; stamens 5 or 10
336 Leaves with conspicuous, red, viscid glandular hairs **LXXI. Droseraceae**
336 Not as above
337 Leaves with numerous pellucid glands, smelling strongly when crushed **LXXXVIII. Rutaceae**
337 Leaves without pellucid glands
338 Style 1; stigma entire or shallowly lobed; anthers opening by apical pores **CXXXI. Pyrolaceae**

338 Styles or stigmas more than 1; anthers opening by longitudinal slits
339 Stigmas 5
340 Leaves lobed or pinnate **LXXXIII. Geraniaceae**
340 Leaves entire or absent
341 Sepals connate; leaves basal or absent **CXXXVI. Plumbaginaceae**
341 Sepals free; leaves cauline **LXXXVI. Linaceae**
339 Stigmas 2–4
342 Flowers with conspicuous glandular-fimbriate staminodes **LXXIV. Parnassiaceae**
342 Glandular-fimbriate staminodes absent
343 Stamens 5 **LVII. Caryophyllaceae**
343 Stamens 10 **LXXIII. Saxifragaceae**

Non-flowering specimens of marine angiosperms ('sea-grasses') may be identified by the following key:

1 Rhizome with abundant rigid fibres **CLXXIX. Posidoniaceae**
1 Rhizome with few or no fibres
2 Leaves with a distinct petiole **CLXXII. Hydrocharitaceae** (*Halophila*)
2 Leaves without a petiole
3 Rhizome filiform **CLXXXI. Zannichelliaceae** (*Althenia*)
3 Rhizome at least 0·5 mm in diameter
4 Rhizome with 2 or more unbranched roots at a node **CLXXX. Zosteraceae**
4 Rhizome with 1 branched root at a node **CLXXXI. Zannichelliaceae** (*Cymodocea*)

Ruppia, *Zannichellia* and *Potamogeton pectinatus* can also occur in brackish water or in sheltered bays, though not in the open sea; flowers or fruits are almost always present in these plants.

EXPLANATORY NOTES ON THE TEXT

Signs and abbreviations

c.	*circa*, approximately
C.	central
cm	centimetre(s)
E.	eastern, east
excl.	excluding
f.	forma
incl.	including
loc. cit.	*loco citato*, on the same page in the work cited above
m	metre(s)
mm	millimetre(s)
N.	northern, north
2*n*	the somatic chromosome number
op. cit.	*opere citato*, in the work cited above
S.	southern, south
Sect.	Sectio
sp. / spp.	species
Subfam.	Subfamilia
Subgen.	Subgenus
Subsect.	Subsectio
subsp. / subspp.	subspecies
var.	varietas
W.	western, west
±	more or less
0	absent
●	endemic to Europe
[ ]	naturalized, or cultivated on a field scale; not native
*	status doubtful; possibly native, possibly naturalized
?	(before a two-letter geographical abbreviation) occurrence doubtful
†	extinct

Abbreviations of geographical territories

(*For precise definitions of these territories, see map* I)

Al	Albania
Au	Austria
Az	Açores (Azores)
Be	Belgium and Luxembourg
Bl	Islas Baleares (Balearic Islands)
Br	Britain
Bu	Bulgaria
Co	Corse (Corsica)
Cr	Kriti (Crete)
Cz	Czechoslovakia
Da	Denmark
Fa	Færöer (Faeroes)
Fe	Finland
Ga	France
Ge	Germany
Gr	Greece
Hb	Ireland
He	Switzerland
Ho	Netherlands
Hs	Spain
Hu	Hungary
Is	Iceland
It	Italy
Ju	Jugoslavia
Lu	Portugal
No	Norway
Po	Poland
Rm	Romania
Rs	U.S.S.R. (European part), subdivided thus: (N) Northern region (B) Baltic region (C) Central region (W) South-western region (K) Krym (Crimea) (E) South-eastern region
Sa	Sardegna (Sardinia)
Sb	Svalbard (Spitsbergen)
Si	Sicilia (Sicily)
Su	Sweden
Tu	Turkey (European part)

General notes

The sequence of families is that of Melchior in Engler, *Syllabus der Pflanzenfamilien* ed. 12 (1964).

Descriptions of taxa refer only to the European populations of the taxon in question. If extra-European representatives differ substantially, an explanatory note is sometimes added.

Groups of species have been used in some genera where the species are very difficult to separate. These groups have no formal nomenclatural status and are simply a device to enable a partial identification to be made.

Taxa below the rank of subspecies are neither keyed nor described, and varieties are mentioned only when there are special reasons.

Aliens are included only when they appear to be effectively naturalized or when planted in continuous stands on a fairly large scale.

Hybrids are mentioned only when they occur frequently.

A measurement given without qualification refers to length. Two measurements connected by × indicate length followed by width. Further measurements in parentheses indicate exceptional cases outside the normal range.

Synonyms given in the text are principally those names under which the species or subspecies is described in the Basic Floras listed on p. xix. The index contains (in addition to these) names which occur in any of the Standard Floras (p. xix) or in well-known monographs.

Chromosome numbers are given only when the editors are satisfied that the count has been made on correctly identified material known to be of wild European origin. For naturalized and cultivated species the count is from material which is naturalized or is cultivated in the way which justifies its inclusion in the Flora.

Ecological information is provided only when the habitat-preference of a species is sufficiently uniform over its European range to permit it to be summed up in a short phrase.

Geographical terms such as 'W. Europe', 'Mediterranean region', etc., are to be interpreted as shown on maps IV and V. The statement that a plant occurs in one or more of these regions does not necessarily imply that it occurs throughout the region.

Extra-European distribution is indicated only for those plants whose European range is small and whose range outside Europe is considerably greater, or for species which are not native in Europe.

HELOBIAE

CLXX. ALISMATACEAE[1]

Aquatic or marsh herbs, usually perennial. Leaves alternate or basal, sheathing at the base. Flowers hermaphrodite or unisexual, usually bracteate and verticillate in pedunculate umbels, racemes or panicles, occasionally long-pedunculate in leaf-axils. Sepals 3. Petals 3, usually larger than the sepals, often fugacious or deciduous. Stamens 3–numerous, with elongated filaments; anthers opening by longitudinal slits. Carpels 3–numerous, spirally arranged or whorled, free or connate at the base; ovules 1–many; styles apical or subventral. Fruit a group of achenes, drupelets or follicles; seeds without endosperm; embryo horse-shoe-shaped.

All European species of this family grow in marshes or in shallow water at the edges of lakes, ponds, canals or slow rivers. Most of them, when growing in water, can produce linear, phyllodal submerged leaves which may or may not persist; these leaves are not mentioned in the keys and descriptions unless they are characteristic of mature flowering plants. When growing in relatively dry habitats the plants are usually dwarfed and may be misleadingly different from plants growing in wetter conditions.

1 Flowers unisexual; stamens 7–numerous **1. Sagittaria**
1 Flowers hermaphrodite; stamens 6
2 Carpels connate at the base in a single whorl, 2- to many-ovulate, follicular and stellately radiating in fruit, ±long-beaked **6. Damasonium**
2 Carpels free, 1-ovulate, achenial or drupaceous in fruit, short-beaked
3 Carpels numerous, spirally arranged in a globose head; flowers in simple inflorescences of 1–3 whorls, or long-pedunculate in leaf-axils **2. Baldellia**
3 Carpels few or numerous in a single, sometimes irregular whorl
4 Stems elongated, rising in the water and bearing floating leaves or creeping and rooting at the nodes; flowers pedunculate in leaf-axils; carpels 6–15 in an irregular whorl, with apical styles; fruitlets many-ribbed **3. Luronium**
4 Stems short, the leaves all basal; flowers in panicles, racemes or umbels; carpels in a regular whorl, with subventral styles; fruitlets 3- to 5-ribbed or unribbed
5 Carpels 5–10; fruitlets drupaceous, swollen, with woody endocarp and spongy exocarp; leaves deeply cordate to subcordate **5. Caldesia**
5 Carpels 11–28; fruitlets achenial, laterally compressed; leaves not deeply cordate **4. Alisma**

1. Sagittaria L.[2]

Stock often stoloniferous and tuberiferous. Leaves aerial, floating or submerged. Flowers unisexual or polygamous, in umbels, racemes or panicles with female or hermaphrodite flowers at the base and male flowers above, or occasionally with the flowers all male or all female. Stamens usually numerous. Carpels numerous, spirally arranged, free, each with 1 ovule; styles apical or subventral. Fruitlets achenial, laterally compressed, obliquely obovate, the margins winged, with an apical or ventral beak.

Several species from North America are cultivated for ornament, and two of these have recently become established in Europe. **S. subulata** (L.) Buchenau, *Abh. Naturw. Ver. Bremen* **2**: 490 (1871), naturalized in a single locality in S. England, has glabrous dilated filaments, and leaves which are linear and submerged or may terminate in an elliptical to ovate-oblong floating blade. **S. platyphylla** (Engelm.) G.E. Sm., *Ann. Rep. Missouri Bot. Gard.* **6**: 55 (1895), naturalized in a single locality in N. Italy (Varese prov.), has pubescent, dilated filaments, lanceolate aerial leaves and the pedicels deflexed in fruit.

Literature: K. Rataj, *Annot. Zool. Bot.* (*Bratislava*) **76**: 1–31 (1972); **78**: 1–61 (1972).

1 Filaments of male flowers dilated, pubescent; bracts all ±connate **4. rigida**
1 Filaments of male flowers linear, not dilated, glabrous; at least the lower bracts free
2 Leaves mostly floating, linear to oblong or ovate-oblong, cuneate to rounded at the base or cordate with 2 short obtuse lobes; anthers yellow **2. natans**
2 Leaves mostly aerial and sagittate with 2 long acute basal lobes
3 Fruitlets with a short, erect, apical beak; petals white, usually with a purple patch at the base; anthers usually purple **1. sagittifolia**
3 Fruitlets with a ±elongated, horizontal, ventral beak; petals white, without a purple patch; anthers yellow **3. latifolia**

1. S. sagittifolia L., *Sp. Pl.* 993 (1753). Monoecious. Aerial leaves broadly to narrowly sagittate with 2 long acute basal lobes; floating leaves (if present) lanceolate to ovate. Flowers in racemes or panicles; at least the lower bracts free. Petals 10–15 mm, white, usually with a purple patch at the base. Filaments of stamens linear, glabrous; anthers usually purple, Fruitlets 4–6 mm, with a short, erect, apical beak. $2n=22$. *Most of Europe, but rare in the extreme north and extreme south.* Au Be Br Bu Cz Da Fe Ga Ge Gr Hb He Ho Hs Hu It Ju Lu No Po Rm Rs (N, B, C, W, E) Sa Su Tu.

S. trifolia L., *Sp. Pl.* 993 (1753), widespread in Asia, has recently been reported from S.E. Russia (where it is believed to be native in the Volga delta) and S. Ukraine (where it is naturalized). It is like **1** but with the basal lobes of the aerial leaves longer in proportion to the rest of the lamina, and with entirely white petals and yellow anthers.

2. S. natans Pallas, *Reise* **3**: 757 (1776). Monoecious. Floating (or sometimes aerial) leaves linear to oblong or ovate-oblong, cuneate to rounded at the base or cordate with 2 short obtuse lobes. Flowers in racemes of 2–3 whorls or sometimes umbellate; at least the lower bracts free. Petals 8–10 mm, white. Filaments of stamens linear, glabrous; anthers yellow. Fruitlets 2–3 mm, with a short subventral beak. $2n=22$. *N.E. Europe, extending southwards to 55° N. in S. Ural.* Fe Rs (N, C) Su.

3. S. latifolia Willd., *Sp. Pl.* **4**: 409 (1805) (*S. obtusa* Muhl. ex Willd.). Monoecious or dioecious. Aerial leaves broadly to narrowly sagittate with 2 long, acute basal lobes, or some of them ovate to linear without basal lobes. Flowers in racemes or panicles; at least the lower bracts free. Petals 10–20 mm, white.

[1] Edit. V. H. Heywood. [2] By J. E. Dandy.

Filaments of stamens linear, glabrous; anthers yellow. Fruitlets 2·5–4 mm, with a more or less elongated, horizontal ventral beak. *Naturalized in various parts of Europe.* [Cz Ga Ge He It Rm Rs (C).] (*North America.*)

4. S. rigida Pursh, *Fl. Amer. Sept.* **2**: 397 (1814). Monoecious. Aerial leaves linear to elliptical or ovate, sometimes with 2 short basal lobes. Flowers in racemes; bracts connate towards the base; female flowers subsessile or shortly pedicellate; fruiting peduncle usually bent below the infructescence. Petals 8–14 mm, white. Filaments of male flowers dilated, pubescent. Fruitlets 3–4 mm, with a long, oblique subventral beak. *Naturalized in S.W. England.* [Br.] (*North America.*)

2. Baldellia Parl.[1]

Leaves aerial, elliptical to lanceolate or linear-lanceolate. Flowers hermaphrodite, in 1–3 whorls in umbels or racemes, or long-pedunculate in leaf-axils. Stamens 6. Carpels numerous, spirally arranged in a globose head, free, each with 1 ovule; styles apical. Fruitlets achenial, longitudinally 5-ribbed (3 dorsal ribs and 2 closely approximated ventral ribs), with a short, apical beak.

Leaves lanceolate or linear-lanceolate, tapered to the apex and base, gradually decurrent into the petiole **1. ranunculoides**
Leaves elliptical, rounded at the apex, ±abruptly contracted at the base into the petiole **2. alpestris**

1. B. ranunculoides (L.) Parl., *Nuovi Gen. Sp. Monocot.* 58 (1854) (*Echinodorus ranunculoides* (L.) Engelm., *Alisma ranunculoides* L.). Stem short or with elongated, decumbent branches rooting at the nodes and bearing rosettes of leaves with axillary flowers. Leaves up to 10 × 1·5 cm or sometimes larger, lanceolate or linear-lanceolate, tapered to the base and apex, gradually decurrent into the petiole. Petals 7–10 mm, white or pale pink. Fruitlets 2–3·5 mm, obliquely and narrowly obovoid, sometimes pubescent. $2n = 16, 30$. *S., W. & C. Europe, northwards to S. Norway and eastwards to Lithuania and W. Greece.* Az Be Br Co Da Ga Ge Gr Hb He Ho Hs It Ju Lu No Po Rs (B) Su.

2. B. alpestris (Cosson) Vasc., *Bol. Soc. Brot.* ser. 2, **44**: 82 (1970). Like small variants of **1** but leaves not more than 3·5 × 1 cm, elliptical, rounded at the apex, cuneate to rounded and more or less abruptly contracted at the base into the petiole; petals 3–4 mm. ● *Mountains of N.W. Spain and N. & C. Portugal.* Hs Lu.

3. Luronium Rafin.[1] (*Elisma* Buchenau)

Stems elongated, rising in the water or creeping and rooting at the nodes. Submerged leaves (if present) basal, linear; floating or aerial leaves elliptical to ovate. Flowers hermaphrodite, long-pedunculate in the axils of the floating or aerial leaves. Stamens 6. Carpels 6–15 in an irregular whorl, free, each with 1 ovule; styles apical. Fruitlets achenial, longitudinally many-ribbed, with a short apical beak.

1. L. natans (L.) Rafin., *Autikon Bot.* 63 (1840) (*Elisma natans* (L.) Buchenau, *Alisma natans* L.). Floating or aerial leaves up to 4 × 1·5 cm, rounded to cuneate at the base, rounded at the apex. Petals 7–10 mm, white, with a yellow spot at the base. Fruitlets 2·5 mm, ellipsoid-oblong, with 12–15 close ribs. $2n = 42$. ● *W. & C. Europe, northwards to S. Norway and extending south-eastwards to Moldavia and Bulgaria.* Be Br Bu †Cz Da Ga Ge Ho Hs It Ju No Po †Rm Rs (?B, W) Su.

[1] By J. E. Dandy.

4. Alisma L.[1]

Leaves aerial, floating or submerged. Flowers hermaphrodite, in panicles or occasionally (in small plants) in racemes or umbels. Stamens 6. Carpels numerous (11-28) in a single whorl, free, each with 1 ovule; styles subventral. Fruitlets achenial, laterally compressed, obovate to elliptical, with a short ventral beak.

Literature: I. Bjorkqvist, *Op. Bot.* (*Lund*) **17**: 1–128 (1967); **19**: 1–138 (1968).

1 Styles equalling or longer than the ovaries, ±erect; anthers elliptical; at least some leaves aerial or floating, petiolate, ±acuminate
2 Leaves ovate or elliptic-ovate to lanceolate, usually subcordate or truncate at the base but sometimes cuneate; styles stigmatose in the upper ⅛–⅕; fruitlets with thickish opaque lateral pericarp **1. plantago-aquatica**
2 Leaves lanceolate to elliptical, cuneate at the base; styles stigmatose in the upper ½–⅔; fruitlets with thin translucent lateral pericarp **2. lanceolatum**
1 Styles shorter than the ovaries, recurved; anthers suborbicular; leaves all submerged or aerial, elliptical to narrowly oblong-elliptical, not acuminate
3 Inflorescence overtopping the leaves; fruitlets with thickish opaque lateral pericarp **3. gramineum**
3 Inflorescence not overtopping the leaves; fruitlets with thin lateral pericarp **4. wahlenbergii**

1. A. plantago-aquatica L., *Sp. Pl.* 342 (1753). Leaves up to 30 × 12 cm but usually smaller, usually aerial, ovate or elliptic-ovate to lanceolate, mostly subcordate or truncate at the base but sometimes cuneate, more or less rounded but ultimately acuminate at the apex. Petals 3·5–6·5 mm, white or purplish-white. Anthers elliptical. Styles equalling or longer than the ovaries, filiform, more or less erect, stigmatose in the upper ⅛–⅕ of their length. Fruitlets 2–3 mm; lateral pericarp thickish, opaque. $2n = 14$. *Most of Europe.* All except Az Bl Fa Is Sb.

The hybrid **1** × **2** ($2n = 21$) is reported from Sweden.

2. A. lanceolatum With., *Arr. Brit. Pl.* ed. 3, **2**: 362 (1796). Leaves up to 27 × 7·5 cm but usually much smaller, aerial, lanceolate to elliptical, cuneate at the base, more or less rounded but ultimately acuminate at the apex. Petals 4·5–6·5 mm, purplish-pink. Anthers elliptical. Styles equalling or longer than the ovaries, filiform, more or less erect, stigmatose in the upper ½–⅔ of their length. Fruitlets 2–3 mm; lateral pericarp thin, translucent. $2n = 26$ (27, 28). *Most of Europe, but rare in much of the north.* All except Fa Is No Rs (N) Sb.

3. A. gramineum Lej., *Fl. Spa* **1**: 175 (1811) (*A. loeselii* Gorski, *A. plantago-aquatica* subsp. *graminifolium* (Ehrh. ex Steudel) Hegi). Leaves submerged or aerial, linear or with an expanded blade; blade up to 4·5 cm wide, elliptical to narrowly oblong-elliptical, gradually attenuated at the base into the petiole; submerged leaves 0·2–1·3 cm wide. Inflorescence overtopping the leaves. Petals 2·5–3·5 mm, white or purplish-white. Anthers suborbicular. Styles shorter than the ovaries, recurved, stigmatose in the upper ¼–½ of their length. Fruitlets 2–2·75 mm; lateral pericarp thickish, opaque. $2n = 14$. *C. & E. Europe, northwards to the Leningrad region, and extending to France, England and Denmark.* Au Be Br Bu Cz Da Ga Ge Gr He Ho Hu It Ju Po Rm Rs (B, C, W, E) †Su Tu.

4. A. wahlenbergii (Holmberg) Juz. in Komarov, *Fl. URSS* **1**: 283 (1933) (*A. gramineum* subsp. *wahlenbergii* Holmberg). Leaves usually submerged, 0·1–0·3 cm wide, narrowly linear, or sometimes with a narrowly elliptic-oblong blade gradually attenuated at the base into the petiole. Inflorescence not overtopping the leaves. Petals 1·5–3 mm, slightly longer than the sepals, white. Anthers suborbicular. Styles shorter than the ovaries, recurved. Fruitlets 2–2·5 mm; lateral pericarp thin, translucent. $2n=14$. ● *Baltic region, southwards to Latvia, and extending eastwards to c.* 33° *E. in W.C. Russia.* Fe Rs (B, C) Su.

5. Caldesia Parl.[1]

Leaves all basal, floating or aerial, ovate to elliptical, cordate or subcordate. Flowers hermaphrodite, in racemes or panicles. Stamens 6(–11). Carpels few or numerous in a single whorl, free, each with 1 ovule; styles subventral. Fruitlets drupaceous, with woody endocarp and spongy exocarp, swollen, with a short subventral beak, smooth or with tubercles or spines.

1. C. parnassifolia (L.) Parl., *Fl. Ital.* 3: 599 (1860) (*Alisma parnassifolium* L.). Leaves up to 6 × 4 cm, obtuse. Petals 5–7 mm, white. Stamens 6. Carpels 5–10. Fruitlets 3–4 mm, obliquely obovoid, smooth, with 3–5 longitudinal ribs on the dorsal side. *From N.C. France to N.E. Ukraine, northwards to Lithuania and southwards to C. Italy.* †Au †Bu Ga Ge †He Hu It Ju Po Rm Rs (B, C, W).

6. Damasonium Miller[1]

Aquatic perennial herbs. Leaves all basal, floating, or aerial in subterrestrial plants. Flowers hermaphrodite, in 1–many whorls, in umbels, racemes or panicles. Stamens 6. Carpels 6–9, in 1 whorl, connate at the base, each with 2–many ventral ovules; styles terminal. Fruit a whorl of follicles; follicles laterally compressed, stellately radiating, with a more or less elongated apical beak.

1. D. alisma Miller, *Gard. Dict.* ed. 8, no. 1 (1768) (*D. stellatum* Thuill.; incl. *D. polyspermum* Cosson, *D. constrictum* Juz.). Floating leaves up to 8 × 3 cm, oblong or ovate-oblong, subcordate or truncate at the base, obtuse or rounded at the apex; aerial leaves in subterrestrial plants often lanceolate or linear-lanceolate, cuneate at the base. Petals *c.* 3 mm, white, with a yellow spot at the base. Carpels usually 6. Follicles 5–12 mm, gradually or more or less abruptly contracted into the beak. $2n=28$. *W., S. & S.E. Europe, northwards to S. England.* Bl Br Ga Gr Hs It Lu Rs (W, E) Sa Si.

Very variable in size and robustness according to the depth of the water; dwarf plants with aerial leaves occur growing subterrestrially on mud. The number of ovules is unstable: usually there are 2 in each carpel, but carpels with 4–many ovules occur here and there over the range of the species, especially in small plants. Multiovulate plants from S.W. Europe and Sicilia have been described as **D. polyspermum** Cosson, *Not. Pl. Crit.* 47 (1849), but are not worth taxonomic recognition. The shape of the follicles depends on the number of seeds: the beak (empty upper part) of the carpel is elongated in 2-seeded plants, whereas in many-seeded plants the seeds occupy more of the follicle and the beak is relatively shorter and less well defined.

CLXXI. BUTOMACEAE[2]

Perennial aquatic herbs, with creeping rhizome. Leaves basal, alternate, linear, sheathing at the base. Flowers hermaphrodite, in long-pedunculate umbels subtended by an involucre of bracts. Sepals 3, petaloid. Petals 3, slightly larger than the sepals. Stamens 9, with elongated filaments; anthers opening by longitudinal slits. Carpels 6, connate at the base, each with numerous parietal ovules. Fruit a whorl of follicles; seeds without endosperm; embryo straight.

1. Butomus L.[1]

Rhizome thick. Leaves usually emersed, triquetrous below Umbels many-flowered; bracts free, acuminate. Flowers long-pedicellate. Styles short.

1. B. umbellatus L., *Sp. Pl.* 372 (1753). Leaves up to 150 cm × 10 mm, twisted. Peduncles usually overtopping the leaves. Sepals and petals 1–1·5 cm, pinkish-white, with darker pink veins, the sepals greenish outside along the midrib. $2n=26, 39$. *Still or slowly-moving water. Most of Europe except for some of the islands.* All except Az Bl Co Cr Fa Is Sb Si.

CLXXII. HYDROCHARITACEAE[3]

Submerged or floating aquatic herbs, sometimes marine. Leaves alternate, opposite or verticillate, sheathing at the base or with nodal scales. Flowers hermaphrodite or unisexual, 1 or more together in spathes composed of 1 or 2 free or connate bracts. Sepals 3. Petals 3 or 0. Stamens 2–15, free or connate at the base, occasionally some staminodal; filaments elongated or absent; anthers 2-thecous, opening by longitudinal slits. Ovary syncarpous, inferior, often attenuated into a filiform beak; ovules on parietal, sometimes intruded placentas; styles 3–15. Fruit dehiscing irregularly or splitting stellately into valves; seeds without endosperm; embryo straight.

1 Plant marine, submerged **10. Halophila**
1 Plant of fresh water, submerged or floating
2 Stems short, with or without stolons; leaves all basal; spathes (at least the male ones) pedunculate

[1] By J. E. Dandy. [2] Edit. V. H. Heywood. [3] Edit. S. M. Walters.

3 Leaves linear, ribbon-like; dioecious; flowers small, with minute, vestigial petals; stamens 2–3; styles 3 **9. Vallisneria**
3 Leaves linear-lanceolate to orbicular-reniform; flowers hermaphrodite or unisexual, with conspicuous petals; stamens 6–12; styles 6–9
4 Plant rooted, without stolons; flowers hermaphrodite; spathes tubular **3. Ottelia**
4 Plant floating at anthesis, stoloniferous; flowers unisexual; spathes of 1 or 2 free bracts
5 Leaves floating, petiolate, orbicular-reniform, entire; female flowers pedicellate, the ovary exserted from the spathe **1. Hydrocharis**
5 Leaves raised above the water at anthesis, sessile, linear-lanceolate, spinose-serrate; female flowers sessile, included in the spathe **2. Stratiotes**
2 Stems elongated, leafy; leaves sessile, linear; spathes sessile in the leaf-axils
6 Leaves spirally arranged
7 Leaves patent-recurved, densely crowded towards the ends of the branches; dioecious **7. Lagarosiphon**
7 Leaves not recurved; flowers hermaphrodite **8. Blyxa**
6 Leaves verticillate or the lowest opposite
8 Male spathes 2- to 4-flowered; petals much longer and wider than the sepals **4. Egeria**
8 Male spathes 1-flowered; petals subequalling or narrower than the sepals
9 Leaves in whorls of 3–8, with fringed nodal scales; stamens 3; styles simple **6. Hydrilla**
9 Leaves in whorls of 3(–4), with inconspicuous, unfringed nodal scales; stamens 9; styles 2-lobed **5. Elodea**

1. Hydrocharis L.[1]

Stems short, stoloniferous. Leaves basal, petiolate. Flowers unisexual, insect-pollinated above the water-surface. Spathes 1- or 2-valved; male spathes pedunculate, 1- to 4-flowered; female spathes sessile, 1-flowered. Petals much longer and wider than the sepals. Stamens 9–12, the outer ones usually staminodal. Ovary long-pedicellate, exserted from the spathe; styles 6, 2-fid, free.

1. H. morsus-ranae L., *Sp. Pl.* 1036 (1753). Plant floating (or rarely on mud). Leaves orbicular-reniform, cordate at the base, entire. Petals *c.* 10 mm, broadly obovate, white, with a yellow spot at the base. $2n=28$. *Slow-flowing rivers, ditches and pools. Most of Europe, but rare in the Mediterranean region.* Au Be Br Bu Cz Da Fe Ga Ge Gr Hb He Ho Hs Hu It Ju No Po Rm Rs (N, B, C, W, E) Su Tu.

2. Stratiotes L.[1]

Dioecious; stems short, stoloniferous. Leaves basal, sessile, linear-lanceolate, tapered to the apex, spinose-serrate, brittle. Flowers insect-pollinated above the water-surface. Spathes 2-valved, shortly pedunculate, the male with several bracteolate flowers, the female 1-flowered. Petals much longer and wider than the sepals. Stamens 12, surrounded by staminodes. Ovary sessile within the spathe; styles 6, 2-fid, free.

1. S. aloides L., *Sp. Pl.* 535 (1753). Plant submerged but rising to float on the water-surface at anthesis. Leaves up to 50×2 cm. Petals 15–25 mm, obovate-orbicular, white. $2n=24$. *Much of Europe, but rare in most of the south and west.* Au Be Br Bu Cz Da Fe Ge Ho Hs Hu It Ju Po Rm Rs (N, B, C, W, E) Su Tu [Ga Hb He].

[1] By J. E. Dandy.

3. Ottelia Pers.[1]

Stems short. Leaves basal, petiolate. Flowers usually hermaphrodite, insect-pollinated above the water-surface. Spathes tubular, pedunculate, usually 1-flowered. Petals much longer and wider than the sepals. Stamens 6–20. Ovary sessile within the spathe; styles 3–15, 2-fid, free.

1. O. alismoides (L.) Pers., *Syn. Pl.* **1**: 400 (1805). Leaves varying greatly in size, up to 20 cm wide, submerged or partly emersed, broadly ovate to lanceolate, subcordate to cuneate at the base, 7- to 11-veined. Spathes with 5–10 longitudinal wings. Petals 20–30 mm, obovate, white, with a yellow spot at the base. Stamens 6–9. Styles 6–9. $2n=22$. *Naturalized in rice-fields in N. Italy.* [It.] (*S.E. Asia, N.E. Africa, Australasia.*)

4. Egeria Planchon[1]

Dioecious; stems elongated. Leaves submerged, verticillate, sessile, linear. Flowers insect-pollinated above the water-surface. Spathes tubular, axillary, sessile, the male 2- to 4-flowered, the female 1-flowered. Petals much longer and wider than the sepals. Male flowers long-pedicellate; stamens 9(–10). Ovary sessile within the spathe, attenuated into a long filiform beak; styles 3, 2(–3)-fid, free.

Literature: H. St John, *Darwiniana* **12**: 293–307 (1961).

1. E. densa Planchon, *Ann. Sci. Nat.* ser. 3, **11**: 80 (1849). Leaves up to 40×5 mm, in whorls of 3–5, more or less densely crowded, minutely denticulate. Sepals 3–4 mm. Petals 8–11 mm, obovate to suborbicular, white. *Cultivated in aquaria, and locally naturalized in N.W. & C. Europe.* [?Au Br Ga Ge He Ho It.] (*South America.*)

5. Elodea Michx[1]

Dioecious or with hermaphrodite flowers; stems elongated. Leaves submerged, verticillate or sometimes opposite, sessile, usually linear, with 2 minute, entire nodal scales. Flowers pollinated at the water-surface. Spathes tubular, axillary, sessile, 1-flowered. Petals subequalling the sepals. Stamens usually 9. Ovary sessile within the spathe, attenuated into a long, filiform beak; styles 3, usually 2-lobed, free.

Literature: H. St John, *Darwiniana* **12**: 639–652 (1963); *Rhodora* **67**: 1–35, 155–180 (1965).

1 Sepals of female flowers 1–1·8 mm; male flowers breaking free and rising to the water-surface; leaves less than 2 mm wide **3. nuttallii**
1 Sepals of female flowers 2–3·5 mm; male flowers not breaking free; leaves usually at least 2 mm wide
2 Leaves usually *c.* 10×2 mm, oblong-linear, rounded at the apex; sepals of female flowers 2–2·7 mm **1. canadensis**
2 Leaves up to $25\times2{\cdot}5$ mm, gradually tapered to the acute apex; sepals of female flowers 3–3·5 mm **2. ernstiae**

Sect. ELODEA. Dioecious. Male flowers remaining attached, raised to the water-surface on long, filiform pedicels.

1. E. canadensis Michx, *Fl. Bor. Amer.* **1**: 20 (1803). Leaves up to 17×4 mm but usually *c.* 10×2 mm, in whorls of 3 or the lowest opposite, usually oblong-linear, rounded at the apex, minutely denticulate, more or less crowded. Sepals of female flowers 2–2·7 mm; petals white or pale purple. $2n=24$, 48.

Lakes, rivers and canals; mainly in base-rich waters. Naturalized almost throughout Europe, except for the Arctic and most of the islands. [Au Be Br Bu Cz Da Fe Ga Ge Hb He Ho Hs Hu It Ju Lu No Po Rm Rs (N, B, C, W, E) Su.] (*North America.*)

First naturalized in Ireland in 1834, and on the continent in 1859. In most parts of Europe male plants are rare or absent.

2. E. ernstiae St John, *Darwiniana* **12**: 644 (1963). Leaves up to 25 × 2·5 mm, in whorls of 3 or the lower opposite, gradually tapered to the acute apex, minutely denticulate. Sepals of female flowers 3–3·5 mm; petals white. *Still or slow-moving water. Cultivated in aquaria, and locally naturalized in W. Europe.* [Br Ga.] (*South America.*)

Sect. NATATOR St John. Dioecious. Male flowers breaking free and rising to the water-surface.

3. E. nuttallii (Planchon) St John, *Rhodora* **22**: 29 (1920). Leaves up to 15 × 1·8 mm, in whorls of 3(–4) or the lowest opposite, gradually tapered to the acute apex, minutely denticulate. Sepals of female flowers 1–1·8 mm; petals white. *Still or slow-moving water. Cultivated in aquaria, and naturalized in N.W. & C. Europe.* [Be Br Ge He Ho.] (*North America.*)

Spreading rapidly, and in some places tending to displace **1.**

6. Hydrilla L. C. M. Richard[1]

Dioecious; stems elongated. Leaves submerged, verticillate or the lowest opposite, sessile, linear (to ovate), with 2 small, fringed nodal scales. Flowers pollinated at the water-surface. Spathes tubular, axillary, sessile, 1-flowered. Petals subequalling the sepals. Male flowers breaking free and rising to the surface; stamens 3. Ovary sessile within the spathe, attenuated into a filiform beak; styles 3(–5), simple, free.

Literature: M. J. P. Scannell & D. A. Webb, *Irish Nat. Jour.* **18**: 327–331 (1976).

1. H. verticillata (L. fil.) Royle, *Ill. Bot. Himal. Mount.* 376 (1839). Leaves in whorls of (2–)3–8, up to 20(–40) × 2(–5) mm, conspicuously or minutely denticulate; nodal scales fringed with orange-brown hairs. Sepals of female flowers 1·5–3 mm. Petals narrower than the sepals, transparent, with a few red streaks. $2n=16$. *From N.E. Germany to N. White Russia; isolated stations in W. Ireland and N.W. England; very local and often impermanent.* Br Ge Hb Rs (B, C). (*S. & E. Asia, E. Africa, Australia.*)

7. Lagarosiphon Harvey[1]

Dioecious; stems elongated. Leaves submerged, sessile, linear, with 2 minute nodal scales. Flowers pollinated at the water-surface. Spathes tubular, axillary, sessile, the male many-flowered, the female 1(–3)-flowered. Sepals and petals subequal. Male flowers breaking free and rising to the surface; stamens 3; staminodes 3. Ovary sessile within the spathe, attenuated into a long, filiform beak; styles 3, 2-fid, free.

Literature: A. A. Obermeyer, *Bothalia* **8**: 139–146 (1964).

1. L. major (Ridley) Moss, *Trans. Roy. Soc. S. Afr.* **16**: 193 (1928). Leaves up to 30 × 3 mm, alternate, densely crowded towards the ends of the branches, patent-recurved, minutely denticulate. Sepals and petals pinkish. *Cultivated in aquaria and naturalized in a few ponds, lakes and rivers in W. & C. Europe.* [Br Ga He It.] (*S. Africa.*)

[1] By J. E. Dandy.

8. Blyxa Noronha ex Thouars[1]

Stems short or elongated. Leaves submerged, alternate, sessile, linear. Flowers usually hermaphrodite. Spathes tubular, axillary, sessile, 1-flowered. Petals linear, longer than the sepals. Stamens 3. Ovary sessile within the spathe, attenuated into a long, filiform beak, styles 3, simple, linear, connate at the base.

1. B. japonica (Miq.) Maxim. in Engler & Prantl, *Natürl. Pflanzenfam.* **2(1)**: 253 (1889). Stems elongated. Leaves up to 70 × 3·5 mm, minutely denticulate. Spathes sessile. Sepals 3–4 mm. Petals 6–10 mm, white. *Naturalized in rice-fields in N. Italy and S.W. Portugal.* [It Lu.] (*S.E. Asia.*)

9. Vallisneria L.[1]

Dioecious; stems short, stoloniferous. Leaves submerged, alternate, sessile, linear. Flowers pollinated at the water-surface. Spathes tubular; male spathes pedunculate or subsessile, many-flowered; female spathes long-pedunculate, 1-flowered. Petals vestigial. Male flowers very small, breaking free and rising to the surface; stamens 2–3. Ovary sessile within the spathe, cylindrical; styles 3, 2-lobed, free.

1. V. spiralis L., *Sp. Pl.* 1015 (1753). Leaves up to 10 mm wide, basal, ribbon-like, obtuse or rounded at the apex, denticulate towards the apex, with reddish dots or short streaks. Male spathes ovoid, shortly pedunculate. Peduncles of female spathes filiform, becoming spirally coiled after anthesis; sepals of female flowers 1·75–4 mm, pinkish-white. $2n=20$. *S. Europe, extending northwards to N.C. France and C. Ukraine; locally naturalized elsewhere.* Bu Ga Gr He Hs It Ju Lu Rm Rs (W, E) Tu [Be Br Ge Ho Hu].

10. Halophila Thouars[1]

Submerged marine plants; rhizomes slender, creeping, with 2 scales at each node. Leaves opposite, petiolate or sessile, in 1 or more pairs on short or elongated shoots. Flowers unisexual. Spathes 2-valved, sessile, usually 1-flowered. Petals absent. Male flowers pedicellate; stamens 3; anthers sessile; pollen moniliform. Ovary sessile or subsessile within the spathe, attenuated into a slender apical beak; styles 3–5, simple, filiform, free. Fruit beaked, with membranous pericarp.

Literature: C. den Hartog, *The Sea-grasses of the World* 238–268. Amsterdam & London. 1970.

1. H. stipulacea (Forskål) Ascherson, *Sitz.-Ber. Ges. Naturf. Freunde Berlin* **1867**: 3 (1867). Leaves up to 60 × 8 mm, in single pairs on short shoots, shortly petiolate, linear to oblong, obtuse, serrulate, 3-veined, with numerous ascending secondary veins, glabrous or more or less papillose or puberulent. Ovary with 3 styles. Fruit 5 mm, ellipsoid, with a beak 4–6 mm; seeds 30–40. *Submerged sand or mud. Mediterranean sea, westwards to Malta.* [Cr Gr Si.] (*Red Sea, W. Indian Ocean.*)

This species entered the Mediterranean Sea *via* the Suez Canal, soon after the latter was opened in 1869, and appears to be still spreading westwards.

CLXXIII. SCHEUCHZERIACEAE[1]

Perennial herbs with creeping rhizomes. Leaves alternate, linear, sheathing at the base. Flowers hermaphrodite, bracteate, in few-flowered racemes. Perianth of 6 segments, sepaloid. Stamens 6, with elongated filaments; anthers opening by longitudinal slits. Carpels 3(6), shortly connate at the base; ovules 2 or few in each carpel. Fruiting carpels follicular, inflated; seeds without endosperm; embryo straight.

1. Scheuchzeria L.[2]

Stems leafy. Leaves semi-terete, entire, with a pore on the upper side at the apex; sheaths auriculate. Racemes lax, 3- to 10-flowered; bracts leaf-like, with reduced blades. Perianth-segments narrowly lanceolate. Stigmas sessile.

1. S. palustris L., *Sp. Pl.* 338 (1753). Rhizome clothed with persistent leaf-bases. Leaves up to 40 cm, equalling or exceeding the stem. Perianth-segments 2–3 mm, yellowish-green. $2n=22$. *Wet bogs. Europe southwards to the Pyrenees, Alps and S. Carpathians.* Au Be Br Cz Da Fe Ga Ge †Hb He Ho It Ju No Po Rm Rs (N, B, C, W, E) Su.

CLXXIV. APONOGETONACEAE[3]

Aquatic perennial herbs. Leaves basal, alternate, sheathing at the base. Flowers hermaphrodite or unisexual, ebracteate, in pedunculate spikes. Perianth of 1–3 segments. Stamens 6–18, with elongated filaments; anthers opening by longitudinal slits. Carpels 3–8, free; ovules 2–8 in each carpel. Fruit a whorl of follicles; seeds without endosperm; embryo straight.

1. Aponogeton L. fil.[2]

Stock tuberous. Leaves submerged or floating, petiolate or rarely sessile. Spikes simple or 2- (or more-) furcate, at first enclosed in a deciduous spathe. Perianth-segments petaloid. Styles short or somewhat elongated.

1. A. distachyos L. fil., *Suppl.* 215 (1781). Leaves up to 25 × 7 cm, floating, long-petiolate, elliptic-oblong, rounded or obtuse at the base and apex. Flowers hermaphrodite, distichous in 2-furcate dorsiventral spikes. Perianth-segments 1–2, 10–20 mm, elliptical, white. Carpels 3. *Cultivated for ornament; naturalized in England and France.* [Br Ga.] (*S. Africa.*)

CLXXV. JUNCAGINACEAE[1]

Aquatic or marsh herbs; stems stout. Leaves basal, alternate, linear, sheathing at the base. Flowers hermaphrodite or unisexual, ebracteate, in pedunculate racemes or spikes. Perianth of 2–6 sepaloid segments. Stamens 3 or 6, often adnate at the base to the perianth-segments; anthers sessile, 2-thecous, opening by longitudinal slits. Carpels 3 or 6, free or connate, each with 1 ovule; styles short or stigmas sessile. Fruit apocarpous or syncarpous, the fruitlets separating when ripe; seeds with or without endosperm; embryo straight.

1. Triglochin L.[2]

Perennial or annual marsh plants. Flowers hermaphrodite, in racemes. Perianth-segments 6. Stamens 6, or 3 by abortion. Carpels 6, connate, all or only 3 fertile. Fruit syncarpous, the fruitlets separating when ripe; seeds without endosperm.

1 All 6 carpels fertile; rhizomes thick, not stoloniferous **1. maritima**

1 Only 3 carpels fertile
- 2 Stock a fibrous-coated bulb, not stoloniferous **4. bulbosa**
- 2 Stock a slender, stoloniferous rhizome
  - 3 Fruit 7–10 mm, clavate, attenuate and substipitate at the base **2. palustris**
  - 3 Fruit 1·5–2 mm, globose, rounded at the base **3. striata**

Sect. HEXAGLOCHIN Dumort. All 6 carpels fertile.

1. T. maritima L., *Sp. Pl.* 339 (1753). Perennial up to 60 cm; rhizome short, thick, clothed with sheaths of old leaves. Leaves up to 4 mm wide, semi-terete. Flowers 3–4 mm. Stamens 6. Fruit 3–4 mm, oblong-ovoid, rounded at the base, ascending. $2n=24$, 30, 36, 48. *Saline marshes. Europe, southwards to C. Portugal, N.C. Italy and Bulgaria.* Au Be Bl Br Bu Cz Da Fa Fe Ga Ge Hb Ho Hs Hu Is It Ju Lu No Po Rm Rs (N, B, C, W, K, E) Su.

Sect. TRIGLOCHIN. Only 3 carpels fertile.

2. T. palustris L., *Sp. Pl.* 338 (1753). Perennial up to 70 cm; rhizome slender, stoloniferous. Leaves up to 2 mm wide, semi-terete. Flowers 2–3 mm. Stamens 6. Fruit 7–10 mm, clavate, attenuate and substipitate at the base, ascending. $2n=24$. *Marshes and wet meadows. Much of Europe, but absent from most of the Mediterranean region.* Al Au Be Br Bu Cz Da Fa Fe Ga Ge Hb He Ho Hs Hu Is It Ju Lu No Po Rm Rs (N, B, C, W, K, E) Su.

[1] Edit. S. M. Walters. [2] By J. E. Dandy. [3] Edit. V. H. Heywood.

3. T. striata Ruiz & Pavón, *Fl. Peruv.* **3**: 72 (1802). Perennial up to 60 cm; rhizome slender, stoloniferous. Leaves up to 5 mm wide, semi-terete. Flowers 1·5–2 mm. Stamens 6, or often 3 by abortion. Fruit 1·5–2 mm, globose, rounded at the base, shortly 3-apiculate, obliquely patent; fruitlets dorsally 3-ribbed. *Salt-marshes. Naturalized in W. Portugal.* [Lu.] (*S. Africa, America, Australasia.*)

4. T. bulbosa L., *Mantissa Alt.* 226 (1771). Perennial up to 20 cm or more; stock a fibrous-coated bulb. Leaves up to 4 mm wide, semi-terete. Flowers 1·5–2·5 mm. Stamens 6. Fruit 6–12 mm, ellipsoid-cylindrical, 3-apiculate, ascending or patent. *Damp, saline habitats. Mediterranean region and W. Europe, northwards to N.W. France.* Al Bl Co Cr Ga Gr Hs It Ju Lu Sa Si.

(a) Subsp. **barrelieri** (Loisel.) Rouy, *Fl. Fr.* **13**: 271 (1912) (*T. barrelieri* Loisel.): Flowering in March–May. Pedicels more or less erecto-patent in fruit. $2n=30$, 32. *Throughout the range of the species.*

(b) Subsp. **laxiflora** (Guss.) Rouy, *op. cit.* 272 (1912) (*T. laxiflora* Guss.); Flowering in September–November. Pedicels ascending in fruit, more or less appressed to the rhachis. $2n=18$. *Throughout much of the range of the species.*

Subsp. **bulbosa** is confined to southern Africa.

CLXXVI. LILAEACEAE[1]

Aquatic or marsh herbs; stems short. Leaves basal, alternate, linear, sheathing at the base. Flowers hermaphrodite or unisexual, ebracteate, mostly in long-pedunculate spikes but others solitary and axillary at the base of the plant. Stamen 1; anther subsessile, opening by longitudinal slits. Carpel 1, with 1 ovule. Fruit achenial; seed without endosperm; embryo straight.

1. Lilaea Humb. & Bonpl.[2]

Annual. Leaves subterete. Spicate flowers polygamous, the lowest ones female, the upper ones hermaphrodite and male; solitary basal flowers female. Perianth of 1 segment in the hermaphrodite and male flowers, absent in the female flowers. Style short or more or less elongated in the spicate flowers, very much elongated and filiform in the solitary basal flowers.

1. L. scilloides (Poiret) Hauman, *Fac. Fil. Letras Buenos Aires Publ. Inst. Invest. Geogr.* **10**: 26 (1925). Leaves up to 60 cm × 4 mm, obtuse. Spikes many-flowered, dense. Fruit in spicate flowers longitudinally 2-winged and ribbed, in solitary basal flowers unwinged. *Marshes and mud-flats. Naturalized in W. Portugal (near Aveiro).* [Lu.] (*North and South America.*)

CLXXVII. POTAMOGETONACEAE[3]

Aquatic herbs, submerged or with floating leaves, occasionally subterrestrial. Stems elongated. Leaves alternate or opposite (rarely in whorls of 3), sheathing at the base. Flowers hermaphrodite, ebracteate, in pedunculate spikes. Perianth of 4 unguiculate, sepaloid segments. Stamens 4, adnate at the base to the perianth-segments; anthers sessile, opening by longitudinal slits. Carpels (1–)4, free or shortly connate at the base, 1-ovulate; styles usually short. Fruitlets drupaceous or achenial. Seeds without endosperm; embryo unciform or spiral (coiled more than 1 complete turn).

1 Leaves all opposite or rarely in whorls of 3; fruitlets achenial **2. Groenlandia**

1 Leaves alternate, or the involucral ones subopposite; fruitlets drupaceous **1. Potamogeton**

1. Potamogeton L.[2]

Leaves alternate, or the involucral ones subopposite; sheaths adnate to the leaf-base, ligulate, or free from the leaf-base and stipuliform. Carpels (1–)4, free or shortly connate at the base. Fruitlets drupaceous, with bony endocarp and softer exocarp; embryo unciform or spiral.

Hybridization is frequent within each of the two subgenera, but does not occur between them, their methods of pollination being different. With the exception of *P.* × *zizii* (**5** × **6**), which often bears well-formed fruitlets, all the hybrids are sterile, entirely without fruit or with occasional malformed fruitlets. The hybrids frequently form vigorous, persistent clonal populations, and, especially in rivers and canals, may become dispersed over long distances by means of vegetative winter-buds or detached fragments. As the hybrids show varying degrees of intermediacy between the parent species it is not practicable to include them in the key, but some of the more frequent are mentioned in the text and others are included in the index; the distinguishing features of most of them are given by J. E. Dandy in C. A. Stace, *Hybridization and the Flora of the British Isles* 444–459. London. 1975.

The floating leaves which occur in some of the species and hybrids are always petiolate, with an expanded lamina which is usually opaque but occasionally translucent. Some of the floating-leaved species and hybrids can grow subterrestrially in dried-up situations or in *Sphagnum*-bogs, in which case the floating leaves become aerial.

Potamogeton species are found in a wide variety of fresh-water habitats – in deep or shallow water, stagnant to fast-flowing; a few species, especially those of Subgen. *Coleogeton*, can flourish also in brackish water. Some of the species are more or less restricted to base-rich water, but the majority are tolerant of a considerable range of water conditions. The broad-leaved species (Sect. *Potamogeton*) vary greatly in the size and shape of the

[1] Edit. S. M. Walters. [2] By J. E. Dandy.
[3] Edit. D. H. Valentine.

leaves according to the type of water, and leaf-dimensions are of little diagnostic value in this group.

1 Leaf-sheaths adnate to the leaf-base, ligulate; leaves all submerged, narrowly linear to filiform, entire
2 Leaves acute to apiculate or mucronate at the apex; sheaths open and convolute, usually white-margined; fruitlets 3–5 mm, with a short subventral beak **22. pectinatus**
2 Leaves obtuse or rounded at the apex, not mucronate; sheaths not white-margined; fruitlets 2–3 mm, with a very short, verruciform, subapical beak
3 Leaf-sheaths open and convolute, the lower ones inflated; spikes shortly interrupted; fruitlets 2·5–3 mm **21. vaginatus**
3 Leaf-sheaths closed, tubular towards the base at least when young, the lower ones not inflated; spikes widely interrupted especially in fruit; fruitlets 2–2·75 mm **20. filiformis**
1 Leaf-sheaths free or almost free from the leaf-base, forming an intrafoliar stipule
4 Floating leaves present, at least in mature flowering plants
5 Floating leaves with a discoloured, flexible joint at the top of the petiole immediately below the lamina; submerged leaves (if present) all reduced to narrowly linear, opaque, phyllodes **1. natans**
5 Floating leaves without a discoloured joint at the top of the petiole; submerged leaves (if present) with a translucent lamina, only occasional ones reduced to phyllodes
6 Submerged leaves present, all or most sessile
7 Stems compressed; submerged leaves up to 8 mm wide, parallel-sided, narrowly linear, with a broad band of lacunae bordering the midrib **10. epihydrus**
7 Stems terete; submerged leaves often more than 8 mm wide, convex-sided, without a broad band of lacunae bordering the midrib
8 Submerged leaves acute or acuminate, usually narrowly elliptic-oblong, with minutely denticulate margin and regularly ascending secondary veins; petiole of floating leaves often longer than the lamina **6. gramineus**
8 Submerged leaves rounded or obtuse, elliptical to lanceolate, with entire margin and mostly horizontal secondary veins; petiole of floating leaves shorter than the lamina **7. alpinus**
6 Submerged leaves (if present) all petiolate
9 Fruitlets 3–4 mm; floating leaves elliptical or ovate-elliptical, cuneate or obtuse at the base; submerged leaves lanceolate to elliptic-lanceolate, at first very minutely denticulate, often disappearing early **4. nodosus**
9 Fruitlets 1·5–2·5 mm; floating leaves ovate to lanceolate, cuneate to subcordate at the base; submerged leaves entire
10 Floating leaves opaque, the petiole shorter or longer than the lamina; submerged leaves lanceolate, clearly differentiated from the floating leaves, often disappearing early; fruitlets 2–2·5 mm, red or reddish-brown **2. polygonifolius**
10 Floating leaves translucent, the petiole not longer than the lamina; submerged leaves similar to the floating leaves but narrower; fruitlets 1·5–1·75 mm, greenish **3. coloratus**
4 Floating leaves absent
11 Carpels 4, shortly connate at the base, the beak in fruit as long as or longer than the body of the carpel; leaves often undulate **19. crispus**
11 Carpels 4(–1), free, the beak in fruit much shorter than the body of the carpel
12 Leaves convex-sided, narrowly elliptic-oblong to elliptical or ovate; stems terete; rhizome creeping
13 Leaves acute or ±cuspidate (occasionally reduced to phyllodes), the secondary veins regularly ascending; peduncles ±thickened upwards
14 Leaves petiolate, elliptical or obovate-elliptical to narrowly elliptic-oblong, ±distinctly serrulate; fruitlets 3·5–4 mm **5. lucens**
14 Leaves (at least the lower ones) sessile, narrowly elliptic-oblong to narrowly elliptical or oblanceolate-oblong, minutely denticulate; fruitlets 2–3 mm **6. gramineus**
13 Leaves obtuse or rounded and often ±cucullate, sessile, the secondary veins mostly horizontal; peduncles not thickened upwards
15 Leaves cuneate at the base, not or only slightly amplexicaul, linear-lanceolate to elliptic-oblong, entire; plant often tinged with red **7. alpinus**
15 Leaves (at least the lower) rounded to cordate and ±amplexicaul at the base
16 Stipules large, conspicuous, ±fibrous-persistent; leaves (at least the lower) rounded and semiamplexicaul at the base, lanceolate to ovate-oblong, entire; fruitlets 4–5 mm **8. praelongus**
16 Stipules small, membranous, evanescent; leaves cordate and amplexicaul at the base, ovate to lanceolate, minutely denticulate; fruitlets 3–3·5 mm **9. perfoliatus**
12 Leaves parallel-sided, linear, not more than 5 mm wide, sessile, entire; stems compressed or very slender; rhizome absent
17 Leaves appearing many-veined (3 or 5 vascular veins interspersed with numerous fine, vein-like sclerenchymatous strands)
18 Leaves with 5 vascular veins and very numerous sclerenchymatous strands, the midrib closely bordered by lacunae especially towards the base; spikes cylindrical, usually shorter than the peduncle **17. compressus**
18 Leaves with 3 vascular veins and fairly numerous sclerenchymatous strands, the midrib widely bordered by lacunae especially towards the base; spike usually few-flowered, subcapitate, shorter than or almost equalling the peduncle **18. acutifolius**
17 Leaves 3- to 5(–7)-veined, without sclerenchymatous strands
19 Stipules closed, tubular in the lower part at least when young; fruitlets 1·5–2 mm
20 Leaves usually more than 2 mm wide, mostly 5-veined and with conspicuous nodal glands; stipules usually becoming 2-fid; winter-buds compressed and strongly ribbed at the base **11. friesii**
20 Leaves usually less than 2 mm wide, mostly 3-veined, the nodal glands usually inconspicuous or absent; stipules not becoming 2-fid
21 Leaves rigid, gradually narrowed to a fine, almost bristle-like point; lateral veins conspicuous; stipules firm, strongly veined, fibrous-persistent; winter-buds strongly ribbed at the base **12. rutilus**
21 Leaves not rigid, mucronate; lateral veins inconspicuous; stipules delicately veined, not fibrous-persistent; winter-buds not or finely ribbed **13. pusillus**
19 Stipules open, convolute
22 Carpels 1–3; leaves not more than 1·5 mm wide, 3-veined, the midrib prominent and thick especially towards the base **16. trichoides**
22 Carpels 4; leaves 3- to 5-veined, with ±conspicuous nodal glands
23 Fruitlets 3–4 mm, with a sharp dorsal keel; leaves mostly more than 2 mm wide, 3- to 5-veined, the lateral veins faint, the midrib with or without a narrow border of lacunae **14. obtusifolius**
23 Fruitlets 2–2·5 mm, with a rounded dorsal keel; leaves mostly less than 2 mm wide, usually 3-veined, the lateral veins fine but distinct, the midrib with a border of lacunae, at least towards the base **15. berchtoldii**

Subgen. **Potamogeton.** Rhizome creeping or absent. Leaves submerged or floating, sessile or petiolate; sheaths free or almost

free from the leaf-base, forming an intrafoliar stipule. Flowers wind-pollinated above the water surface. Carpels 1–4, free or shortly connate at the base.

Sect. POTAMOGETON. Rhizome creeping, often producing winter-buds; stems terete. Leaves submerged or floating, mostly convex-sided or some reduced to narrowly linear phyllodes; stipules open. Spikes many-flowered, cylindrical, dense. Carpels 4, free. Fruitlets short-beaked; embryo unciform.

1. P. natans L., *Sp. Pl.* 126 (1753). Floating leaves up to 12·5 × 7 cm, ovate to elliptical or lanceolate, cuneate to subcordate at the base, opaque; petiole often longer than the lamina, with a discoloured flexible joint immediately below the lamina. Submerged leaves less than 3 mm wide, reduced to narrowly linear, obtuse, opaque phyllodes, often disappearing early. Stipules large, closely veined, often fibrous-persistent. Fruitlets 3–4 mm. $2n=52$. *Almost throughout Europe.* All except Az Bl ?Cr Sb ?Tu.

P. × fluitans Roth, *Tent. Fl. Germ.* **1**: 72 (1788) (*P. sterilis* Hagström) (**1 × 5**) and **P. × sparganifolius** Laest. ex Fries, *Nov. Fl. Suec. Mantissa* **1**: 9 (1832) (**1 × 6**) are the most frequent hybrids of **1**, from which they differ in their laminate (not phyllodal) submerged leaves.

2. P. polygonifolius Pourret, *Mém. Acad. Sci. Toulouse* **3**: 325 (1788). Floating leaves up to 9 × 4 cm, ovate to lanceolate, cuneate to subcordate at the base, opaque; petiole shorter or longer than the lamina. Submerged leaves up to 20 × 3 cm, petiolate, lanceolate, obtuse at the apex, entire, often disappearing early. Stipules membranous, with well-separated, slender veins. Fruitlets 2–2·5 mm, red or reddish-brown. $2n=26$. *Usually in acid waters; often subterrestrial in* Sphagnum-*bogs. W. & C. Europe, extending eastwards to S.W. Finland and Bulgaria.* ?Au Az Be Br Bu Co Cz Da Fa Fe Ga Ge ?Gr Hb He Ho Hs It Ju Lu No Po ?Si Su.

3. P. coloratus Hornem., *Fl. Dan.* **9(25)**: 4 (1813). Floating leaves up to 10 × 5 cm, ovate to lanceolate, cuneate to subcordate at the base, translucent; petiole not longer than the lamina. Submerged leaves up to 18 cm, petiolate, similar to the floating leaves but narrower, obtuse, entire. Stipules membranous, with well-separated, slender veins. Fruitlets 1·5–1·75 mm, greenish. $2n=26$. *Usually in calcareous waters. W. & C. Europe, extending to S. Sweden.* Au Be Bl Br Co Cz Da Ga Ge ?Gr Hb He Ho Hs Hu It Ju ?Lu Po Rm Sa Si Su.

4. P. nodosus Poiret in Lam., *Encycl. Méth. Bot., Suppl.* **4**: 535 (1816) (*P. fluitans* Roth pro parte). Floating leaves up to 15 × 6 cm, elliptical or ovate-elliptical, cuneate or obtuse at the base, opaque; petiole shorter or longer than the lamina. Submerged leaves up to 20 × 4 cm, petiolate, lanceolate or elliptic-lanceolate, obtuse, at first very minutely and fugaciously denticulate, often disappearing early. Stipules large and conspicuous. Fruitlets 3–4 mm. *Europe, northwards to the Netherlands and Estonia.* Al Au Az Br Bu Cr Cz Ga Ge Gr He Ho Hs Hu It Ju Lu Po Rm Rs (B, C, W, K, E) Si Tu.

5. P. lucens L., *Sp. Pl.* 126 (1753). Leaves all submerged, up to 20 × 6 cm, short- or long-petiolate, elliptical or obovate-elliptical to narrowly elliptic-oblong, cuneate at the base, acute or acuminate or cuspidate, more or less distinctly serrulate, with regularly ascending secondary veins (occasional leaves reduced to phyllodes). Stipules large and conspicuous, herbaceous. Peduncles thickened upwards. Fruitlets 3·5–4 mm. $2n=52$. *Base-rich water. Most of Europe.* All except Co Fa Is Sb Tu.

P. × zizii Koch ex Roth, *Enum.* 531 (1827) (**5 × 6**) and **P. × salicifolius** Wolfg. in Schultes & Schultes fil., *Mantissa* **3**: 355 (1827) (*P. decipiens* Nolte ex Koch) (**5 × 9**) are two of the most frequent *Potamogeton* hybrids and *P. × zizii* is the only one known to produce well-formed fruits. Both these hybrids in some of their forms can be confused with **5**.

6. P. gramineus L., *Sp. Pl.* 127 (1753). Floating leaves (if present) up to 7 × 3 cm, elliptical or ovate-elliptical, cuneate or rounded at the base, opaque; petiole often longer than the lamina. Submerged leaves (at least the lower) up to 8 × 3 cm, sessile, narrowly elliptic-oblong to narrowly elliptical or oblanceolate-oblong, cuneate at the base, acute or acuminate, minutely denticulate at least when young, with regularly ascending secondary veins (occasional leaves more or less reduced to phyllodes). Stipules conspicuous, herbaceous. Peduncles thickened upwards. Fruitlets 2–3 mm. $2n=52$. *Much of Europe, but rare in the Mediterranean region.* Au Be Br Bu ?Co Cz Da Fa Fe Ga Ge Hb He Ho Hs Hu Is It Ju Lu No Po Rm Rs (N, B, C, W, E) Su Tu.

P. × nitens Weber, *Suppl. Fl. Holsat.* 5 (1787) (**6 × 9**) is a frequent and widespread hybrid which often closely resembles **6**.

7. P. alpinus Balbis, *Mém. Acad. Sci. (Turin)* **10–11** (*Phys. Math.* **1**): 329 (1804). Plant often tinged with red. Floating leaves (if present) up to 8 × 2 cm, elliptical to oblanceolate, cuneate at the base, opaque; petiole shorter than the lamina. Submerged leaves up to 15 × 2 cm, sessile, lanceolate or linear-lanceolate to elliptic-oblong, cuneate to rounded at the base and sometimes slightly amplexicaul, rounded or obtuse at the apex, entire; secondary veins mostly horizontal. Stipules large and conspicuous. Fruitlets 2·5–3 mm, with a sharp dorsal keel. $2n=26, 52$. *Much of Europe, but rare in the south.* Au Be Br ?Bu ?Co Cz Da Fa Fe Ga Ge Gr Hb He Ho Hs Is It Ju No Po Rm Rs (N, B, C, W, E) Su.

8. P. praelongus Wulfen, *Arch. Bot. (Roemer)* **3**: 331 (1805). Leaves up to 20 × 4·5 cm, all submerged, sessile, lanceolate to ovate-oblong, rounded to cuneate at the base (at least the lower semi-amplexicaul), rounded or obtuse at the apex and markedly cucullate, entire. Stipules large and conspicuous, more or less fibrous-persistent. Fruitlets 4–5 mm, with a sharp dorsal keel. $2n=52$. *N. & C. Europe, extending southwards to S. France, C. Bulgaria and C. Ukraine.* Au Be Br Bu Cz Da Fa Fe Ga Ge Hb He Ho Is ?It Ju No Po Rs (N, B, C, W) Su.

P. × undulatus Wolfg. in Schultes & Schultes fil., *Mantissa* **3**: 360 (1827) (**8 × 19**) is known from several countries and can be confused with **8**.

9. P. perfoliatus L., *Sp. Pl.* 126 (1753). Leaves up to 10 × 6 cm, all submerged, sessile, ovate or orbicular-ovate to lanceolate, cordate and amplexicaul at the base, obtuse or rounded at the apex and often somewhat cucullate, minutely denticulate at least when young. Stipules small, membranous, evanescent. Fruitlets 3–3·5 mm. $2n=52$. *Throughout Europe except for some of the islands.* All except Az Bl Co Cr Sa Sb Si.

P. × cooperi (Fryer) Fryer, *Rep. Bot. Exch. Club Brit. Is.* **1895**: 497 (1897) (*P. cymatodes* Ascherson & Graebner) (**9 × 19**) is a fairly frequent hybrid which can be confused with **9**.

Sect. GRAMINIFOLII Fries. Rhizome creeping or more usually absent, with perennation by cauline winter-buds; stems compressed or very slender. Leaves submerged or the upper some-

times floating; submerged leaves sessile, parallel-sided, linear, entire; stipules open or closed. Spikes many- or few-flowered, sometimes interrupted. Carpels 1–4, free. Fruitlets short-beaked; embryo unciform or spiral.

10. P. epihydrus Rafin., *Med. Reposit.* (*New York*) Hexade 2, **5**: 354 (1808). Rhizome creeping; stems compressed. Upper leaves up to 7 × 2·5 cm, floating, oblong to elliptical, cuneate at the base, opaque. Submerged leaves up to 8 mm wide, ribbon-like, rounded to subacute, 5- to 7-veined, the midrib with a broad border of lacunae extending sideways towards the inner lateral veins or sometimes beyond them. Stipules open. Carpels 4. Fruitlets 2·5–3·5 mm; embryo subspiral. *N.W. Scotland, N.W. England.* Br. (*North America.*)

11. P. friesii Rupr., *Beitr. Pfl. Russ. Reich.* **4**: 43 (1845) (*P. mucronatus* Schrader ex Sonder). Rhizome absent; stems strongly compressed; winter-buds terminating short, lateral branches, compressed and strongly ribbed at the base. Leaves all submerged, up to 3·5 mm wide (usually more than 2 mm), mucronate, (3–)5(–7)-veined, usually with conspicuous nodal glands. Stipules closed, tubular towards the base at least when young, usually becoming 2-fid. Carpels 4. Fruitlets 2–2·5 mm. $2n=26$. *Europe, southwards to Corse and Bulgaria.* Au Be Br Bu Co Cz Da Fe Ga Ge Hb He Ho It Ju No Po ?Rm Rs (N, B, C, W, E) Su.

12. P. rutilus Wolfg. in Schultes & Schultes fil., *Mantissa* **3**: 362 (1827). Rhizome absent; winter-buds terminating lateral branches, strongly ribbed at the base, with fibrous sheaths. Leaves all submerged, up to 1·5 mm wide but usually less than 1 mm, rigid, gradually narrowed at the apex to a fine, almost bristle-like point (involucral leaves occasionally slightly dilated at the apex), 3(–5)-veined, the lateral veins conspicuous; nodal glands small, inconspicuous. Stipules closed, tubular towards the base at least when young, firm, strongly veined, fibrous-persistent. Carpels 4. Fruitlets 1·5–2 mm. *N., C. & E. Europe, from N. Scotland and N.W. France eastwards to C. Ukraine and S.C. Russia; very local.* Br Da Fe Ga Ge Po ?Rm Rs (N, B, C, W) Su.

13. P. pusillus L., *Sp. Pl.* 127 (1753) (*P. panormitanus* Biv.). Rhizome absent; winter-buds axillary, usually slender-fusiform, not strongly ribbed. Leaves all submerged, up to 3 mm wide but usually less than 2 mm, mucronate (involucral leaves sometimes slightly dilated at the apex), 3(–5)-veined, the lateral veins inconspicuous; nodal glands usually absent or only feebly developed. Stipules closed, tubular towards the base at least when young, not fibrous-persistent. Carpels 4. Fruitlets 2 mm. $2n=26$. *Usually in base-rich, sometimes brackish water. Most of Europe.* All except Al Co Cr Fa Rs (N, K) Sa Sb.

14. P. obtusifolius Mert. & Koch in Röhling, *Deutschl. Fl.* ed. 3, **1**: 855 (1823). Rhizome absent; winter-buds terminating lateral branches, leafy. Leaves all submerged, up to 4 mm wide (usually more than 2 mm), rounded to mucronate, 3(–5)-veined, the lateral veins faint, the midrib with or without a narrow border of lacunae; nodal glands large, conspicuous. Stipules open, convolute, membranous. Carpels 4. Fruitlets 3–4 mm, with a sharp dorsal keel. $2n=26$. *Europe, southwards to S.W. France, C. Jugoslavia and S. Ukraine.* Au Be Br Cz Da Fe Ga Ge ?Gr Hb He Ho Hu It Ju No Po Rm Rs (N, B, C, W, E) Su.

15. P. berchtoldii Fieber in Berchtold & Opiz, *Ökon.-Techn. Fl. Böhm.* **2(1)**: 277 (1838) (*P. pusillus* auct., non L.). Rhizome absent; winter-buds terminating long or short lateral branches. Leaves all submerged, up to 2·5 mm wide but usually less than 2 mm, mucronate (involucral leaves occasionally slightly dilated at the apex), 3(–5)-veined, the lateral veins conspicuous, the midrib with a narrow or sometimes wide border of lacunae at least towards the base; nodal glands usually conspicuous. Stipules open, convolute, membranous or somewhat herbaceous. Carpels 4. Fruitlets 2–2·5 mm. $2n=26$. *Most of Europe, but absent from much of the south-west.* All except Az Bl Cr Hs Lu Sb Si.

16. P. trichoides Cham. & Schlecht., *Linnaea* **2**: 175 (1827). Rhizome absent; stems very slender, subterete; winter-buds terminating lateral branches. Leaves all submerged, up to 1·5 mm wide but usually less than 1 mm, gradually acute, 3-veined, the lateral veins very faint, the midrib prominent and usually much thickened especially towards the base; nodal glands small. Stipules open, convolute, herbaceous, shining-green. Carpels 1–3. Fruitlets 3 mm, the dorsal keel usually muriculate. $2n=26$. *Most of Europe, northwards to Scotland, S. Sweden and C. Russia.* Au Be Br Bu Cr Cz Da Ga Ge Gr He Ho Hs Hu It Ju *Lu Po Rm Rs (B, C, W, E) Si Su.

17. P. compressus L., *Sp. Pl.* 127 (1753) (*P. zosterifolius* Schumacher). Rhizome absent; stems strongly compressed. Leaves all submerged, 2–4 mm wide, mucronate, appearing many-veined (5 vascular veins interspersed with very numerous, fine, vein-like sclerenchymatous strands), the midrib closely bordered by lacunae especially towards the base. Stipules open. Spikes many-flowered, cylindrical, usually shorter than the peduncle. Carpels usually 2. Fruitlets 3–4·5 mm. $2n=26$. *N., C. & E. Europe, southwards to S.C. France and S. Ukraine; isolated records from Crna Gora and N.W. Greece.* Au Be Br Cz Da Fe Ga Ge Gr He Ho ?Hs Ju No Po Rm Rs (N, B, C, W, E) Su.

18. P. acutifolius Link in Roemer & Schultes, *Syst. Veg.* **3**: 513 (1818). Rhizome absent; stems strongly compressed. Leaves all submerged, 2–4 mm wide, finely acute to mucronate, appearing many-veined (3 vascular veins interspersed with numerous fine, vein-like sclerenchymatous strands), the midrib more or less widely bordered by lacunae especially towards the base. Stipules open. Spikes usually few-flowered, subcapitate, with only 2–4 groups of flowers, equalling or shorter than the peduncle. Carpel usually 1. Fruitlets 3–4 mm, with a small ventral tooth towards the base. $2n=26$. *Mainly in calcareous water. From England, S. Sweden and N.W. Russia southwards to C. Italy and C. Greece.* Au Be Br Bu Cz Da Ga Ge Gr He Ho Hu It Ju Po Rm Rs (B, C, W, E) Su.

Sect. BATRACHOSERIS Irmisch. Rhizome creeping; winter-buds cauline; stems compressed, 2-canaliculate. Leaves submerged, sessile, linear to linear-oblong, serrulate; stipules open, often very shortly adnate to the leaf-base. Spikes shortly cylindrical, becoming interrupted. Carpels 4, shortly connate at the base. Fruitlets long-beaked; embryo unciform.

19. P. crispus L., *Sp. Pl.* 126 (1753). Leaves 3–15 mm wide, obtuse to acute, 3- to 5-veined, usually undulate or crispate when mature; young leaves flat, sometimes obscurely serrulate. Stipules small, membranous, evanescent. Fruitlets 4–5 mm, the beak equalling or longer than the body of the carpel. $2n=52$. *Europe, northwards to c. 61° 30′ N. in Finland.* All except Az Cr Fa Is Rs (N) Sb.

Subgen. **Coleogeton** Reichenb. Rhizome creeping. Leaves submerged, sessile, narrowly linear, entire; sheaths adnate to the leaf-base. Flowers pollinated below the water-surface. Carpels 4, free. Fruitlets short-beaked; embryo unciform.

20. P. filiformis Pers., *Syn. Pl.* **1**: 152 (1805). Leaves up to 1·5 mm wide but usually less than 1 mm, obtuse or rounded; sheaths closed, tubular towards the base at least when young. Spikes widely interrupted, especially in fruit. Fruitlets 2–2·75 mm, with a very short, verruciform, subapical beak. $2n=78$. *Chiefly near the sea and often in brackish water. N. Europe and the Alps, extending very locally southwards to N.E. Spain, S. Italy and Crna Gora.* Au Br Da Fa Fe Ga Ge Hb He Hs Hu Is It Ju No Po Rs (N, B, C) Su.

P. × suecicus K. Richter, *Pl. Eur.* **1**: 15 (1890) (**20 × 22**) is a fairly frequent hybrid which can be confused with either **20** or **22**.

21. P. vaginatus Turcz., *Bull. Soc. Nat. Moscou* **27(2)**: 66 (1854). Leaves up to 2·5 mm wide but mostly less than 1 mm, obtuse or rounded; sheaths open, convolute, the lower ones loose and inflated with a more or less reduced lamina. Spikes shortly interrupted. Fruitlets 2·5–3 mm, with a very short, verruciform, subapical beak. $2n=c.\ 88$. *Usually in brackish water. E. Sweden and W. Finland.* Fe Su. (*N. Asia, North America.*)

22. P. pectinatus L., *Sp. Pl.* 127 (1753). Leaves usually less than 2 mm wide (sometimes wider on young non-flowering branches), gradually acute to apiculate or mucronate; sheaths open, convolute, usually white-margined. Spikes at first cylindrical, later becoming more or less interrupted. Fruitlets 3–5 mm, with a short, subventral beak. $2n=78$. *Base-rich or brackish water. Almost throughout Europe.* All except Az Fa Is Sb.

2. Groenlandia Gay[1]

Leaves opposite or rarely in whorls of 3; sheaths adnate to the leaf-base, with auricles in the involucral leaves, without auricles in the other leaves. Spikes few-flowered, shortly pedunculate. Carpels 4, free. Fruitlets achene-like, with thin pericarp; embryo spiral.

1. G. densa (L.) Fourr., *Ann. Soc. Linn. Lyon* nov. ser., **17**: 169 (1869) (*Potamogeton densus* L.). Rhizome creeping. Leaves up to 4 × 1·5 cm, submerged, ovate to lanceolate, obtuse, minutely denticulate, 3- to 5-veined. Peduncles 0·5–1·5 cm, recurved in fruit. Fruitlets 3 mm, shortly beaked. $2n=30$. *Fresh-water streams, ditches and ponds. Europe, northwards to Scotland and Denmark, and eastwards to Lithuania and Turkey.* Au Be Br Bu Cz Da Ga Ge Gr Hb He Ho Hs Hu It Ju Lu †No Po Rm Rs (B) Si †Su Tu.

CLXXVIII. RUPPIACEAE[2]

Submerged, perennial herbs of saline water. Leaves narrowly linear, sheathing at the base. Flowers hermaphrodite, small, ebracteate, in 2-flowered, pedunculate spikes; peduncles slender, often accrescent in fruit. Perianth absent. Stamens 2; anthers sessile, opening by longitudinal slits. Carpels 4(–10), free, with 1 ovule, sessile in flower but usually becoming slender-stipitate in fruit. Fruitlets indehiscent; seeds without endosperm.

1. Ruppia L.[1]

Leaves alternate, or the involucral subopposite, minutely denticulate at the apex, otherwise entire; sheaths shortly auriculate. Spikes subtended by 2 subopposite involucral leaves with more or less inflated sheaths; flowers arranged one above the other on opposite sides of the rhachis. Stamens with a small dorsal appendage at the base. Carpels with a sessile, peltate stigma.

Literature: G. Reese, *Zeitschr. Bot.* (*Stuttgart*) **50**: 237–264 (1962). J. C. Gamarro, *Darwiniana* **14**: 575–608 (1968).

Peduncles more than 8 cm, much elongated after anthesis, spirally coiled in fruit; anthers *c.* 1·7 mm, reniform; leaves usually rounded or obtuse **2. cirrhosa**

Peduncles usually less than 6 cm, shortly accrescent after anthesis, not spirally coiled in fruit; anthers 0·6–0·7 mm, elliptical; leaves usually acute **1. maritima**

1. R. maritima L., *Sp. Pl.* 127 (1753) (*R. rostellata* Koch). Leaves less than 1 mm wide, usually acute at least in flowering plants; sheaths of involucral leaves only slightly inflated. Peduncles up to 6 cm, shortly accrescent after anthesis, often recurved or somewhat flexuous in fruit but not spirally coiled. Anthers 0·6–0·7 mm, elliptical. Fruitlets 2–3 mm (excluding the stipe), long- or short-stipitate, very obliquely ovoid, often curved. $2n=20$. *Saline water, usually near the sea. Most of Europe.* All except Al Au ?Cz He Hu Sb.

2. R. cirrhosa (Petagna) Grande, *Bull Orto Bot. Napoli* **5**: 58 (1918) (*R. spiralis* L. ex Dumort., *R. maritima* subsp. *spiralis* (L. ex Dumort.) Ascherson & Graebner, *R. maritima* auct., non L.). Leaves up to 1 mm wide, usually rounded or obtuse; sheaths of involucral leaves usually conspicuously inflated. Peduncles more than 8 cm, much elongated after anthesis, spirally coiled in fruit. Anthers *c.* 1·7 mm, reniform. Fruitlets 2·5–3 mm (excluding the stipe), long-stipitate, somewhat obliquely ovoid. $2n=40$. *Saline waters near the sea. Coasts of most of Europe except N. Russia.* Al Be Bl Br Bu Co Cr Da Fe Ga Ge Gr Hb Ho Hs It Ju Lu No Po Rs (B, W, K, E) Sa Si Su.

CLXXIX. POSIDONIACEAE[2]

Submerged, marine perennial herbs with creeping rhizomes. Leaves basal, alternate, linear, sheathing at the base. Inflorescence of 1 or more aggregated spikes borne on an elongated peduncle and subtended by leaf-like bracts. Flowers hermaphrodite or the uppermost with a reduced gynoecium, ebracteate. Perianth absent. Stamens 3; anthers sessile, opening by longitudinal slits. Carpel 1, ovule 1. Fruit a berry; seeds without endosperm; embryo straight.

[1] By J. E. Dandy. [2] Edit. D. H. Valentine.

1. Posidonia C. Konig[1]

Leaves entire. Leaf-like bracts similar to the leaves but smaller, with a more or less reduced blade; spikes 3- to 6-flowered. Anthers extrorse, with a broad connective produced above the thecae into an appendage; pollen-grains filiform. Stigma sessile, irregularly lobed.

Literature: C. den Hartog, *The Sea-grasses of the World.* 121–144. Amsterdam & London. 1970.

1. P. oceanica (L.) Delile, *Descr. Égypte, Hist. Nat.* **2**: 78 (1813) (*P. caulini* C. Konig). Rhizomes stout, with a sheath-like scale at each node; base of plant densely clothed with the fibrous remains of old scales and sheaths. Leaves up to 55 cm × 9 mm, obtuse to emarginate, 13- to 17-veined. Peduncles up to 25 cm; leaf-like bracts with blades at least as long as their sheaths; spikes 3- to 5-flowered. Connective of anthers obovate-obcordate, with a narrow appendage. Fruit *c.* 10 mm, ovoid. *Coasts of the Mediterranean region and locally on the Atlantic coast of S.W. Europe.* Al Bl Co Cr Ga Gr Hs It Ju ?Lu Sa Si ?Tu.

CLXXX. ZOSTERACEAE[2]

Perennial, submerged marine herbs. Rhizome creeping, with long internodes, bearing at each node 2 or more unbranched roots and a leaf with a short shoot in its axil. Short shoots with several distichous, linear leaves with compressed, sheathing bases. Flowering stems lateral or terminal. Inflorescence enclosed in the sheathing base of a spathe. Flowers with 1 dorsifixed, sessile stamen and 1 unilocular ovary with a style and 2 long, filiform stigmas, arranged alternately on the margin of the flattened axis; perianth absent. Pollen-grains filiform. Ovule 1.

1. Zostera L.[3]

Rhizome monopodial, with 2 vascular bundles in the cortex. Small axillary scales present. Leaves with 3–9(–11) parallel veins; margin entire or rarely minutely denticulate. Spathes leaf-like, with a caducous lamina. Connective of anthers sometimes with an appendage (*retinaculum*).

Literature: C. Den Hartog, *The Sea-grasses of the World.* Amsterdam & London. 1970. F. Markgraf, *Ber. Deutsch. Bot. Ges.* **54**: 191–229 (1936).

1 Flowering-stems lateral, simple or sparingly branched; leaf-sheaths open; retinacula present **3. noltii**
1 Flowering-stems terminal, much-branched; leaf-sheaths closed, splitting when old; retinacula absent
2 Leaves on non-flowering shoots usually 5–10 mm wide; stigma twice as long as style; fruit 3–3·5 mm **1. marina**
2 Leaves on non-flowering shoots usually 1–2 mm wide; stigma about as long as style; fruit 2·5–3 mm **2. angustifolia**

Subgen. **Zostera**. Sheaths closed. Retinacula absent.

1. Z. marina L., *Sp. Pl.* 968 (1753). Leaves on non-flowering shoots 20–50(–120) cm × (2–)5–12 mm, dark green, with rounded, often mucronate apex, those on flowering stems usually narrower; sheaths closed, splitting irregularly when old. Flowering stems up to 80(–150) cm, terminal, much-branched. Retinacula absent, except rarely in the lowest flower. Stigma twice as long as style. Fruit 3–3·5 mm, ellipsoid. $2n=12$. *On fine gravel, sand or mud, from low water neap tides down to c. 10 m. Coasts of most of Europe.* Be Bl Br Bu Co Cr Da Fa Fe Ga Ge Gr Hb Ho Hs Is It Ju Lu No Po Rm Rs (N, B, C, W, K, ?E) Sa Si Su Tu.

2. Z. angustifolia (Hornem.) Reichenb., *Icon. Fl. Germ.* **7**: 3 (1845). Like **1** but leaves on non-flowering shoots usually 15–30 cm × 1–2 mm, often becoming emarginate at apex; flowering stems 10–30 cm; stigma about as long as style; fruit 2·5–3 mm. $2n=12$. *On mud in sheltered habitats, from half-tide down to low-tide mark, rarely lower. Probably throughout most of the range of* **1** *but distribution imperfectly known owing to confusion with* **3** *and narrow-leaved variants of* **1**. Br Da Hb Su.

Subgen. **Zosterella** (Ascherson) Ostenf. Sheaths open. Retinacula present.

3. Z. noltii Hornem., *Fl. Dan.* **12(35)**: 1 (1832) (*Z. minor* Nolte ex Reichenb., *Z. nana* Roth pro parte). Leaves on non-flowering shoots 4–12(–20) cm × 0·5–1·5 mm, with emarginate apex; sheaths open. Flowering stems usually *c.* 10 cm, lateral, simple or sparingly branched. Retinacula present. Fruit 1·5–2 mm. $2n=12$. *On mud in sheltered habitats, from half-tide mark down to low-tide mark, and in shallow water in non-tidal saline habitats. Coasts of Europe northwards to* 60° 30′ *in Norway.* ?Al Be Bl Br Bu Co Da Ga Ge Gr Hb Ho Hs It Ju Lu No Po Rm Rs (W, K, E) Sa Si Su Tu.

CLXXXI. ZANNICHELLIACEAE[4]

Submerged, perennial aquatic herbs, with creeping rhizomes. Leaves alternate or subopposite, linear, sheathing at the base. Flowers unisexual, small, solitary or in falcate cymes. Male flowers pedunculate; perianth absent or cupular; stamens 1–3; anthers connate, sessile, opening by longitudinal slits. Female flowers sessile or shortly pedunculate; perianth absent or cupular or of 3 segments; carpels 1–9, free, with 1 ovule; styles simple or divided into 2 filiform stigmas. Fruitlets achene- or nut-like; seeds without endosperm.

1 Dioecious, marine; leaves 2–4 mm wide, spinulose-dentate towards the apex; styles divided into 2 filiform stigmas **3. Cymodocea**
1 Monoecious, in fresh or brackish water; leaves up to 2 mm wide, entire; styles simple
2 Leaves alternate; sheaths adnate to the leaf-base, long-auriculate; male flowers with a 3-dentate, cupular perianth; female flowers with a perianth of 3 segments **1. Althenia**

[1] By J. E. Dandy.
[2] Edit. T. G. Tutin.
[3] By T. G. Tutin.
[4] Edit. D. H. Valentine.

2 Leaves subopposite (or alternate on non-flowering branches); sheaths free from the leaf-base, stipuliform; male flowers without a perianth; female flowers with a cupular perianth **2. Zannichellia**

1. Althenia Petit[1]

Monoecious or dioecious. Stems elongated, slender. Leaves alternate; sheaths auriculate. Flowers axillary, solitary. Male flowers with a 3-dentate, shallowly cupular perianth; stamens 1–3; anthers 1- or 2-thecous. Female flowers with a perianth of 3 segments; carpels 3; styles simple.

1. A. filiformis Petit, *Ann. Sci. Obs.* **1**: 452 (1829) (incl. *A. barrandonii* Duval-Jouve). Monoecious. Leaves less than 0·5 mm wide, setaceous, acute, entire; sheaths long-auriculate. Stamen 1; anther 1-thecous. Styles elongated, filiform; stigma infundibular. Fruitlets 2–3 mm (excluding the beak), stipitate, ellipsoid or oblong-ellipsoid, smooth, beaked. *Brackish water near the sea. S. & W. Europe, from W. France to N.W. Jugoslavia.* ?Co Ga Hs It Ju ?Lu Sa Si.

A record from S.E. Russia requires confirmation.

2. Zannichellia L.[1]

Monoecious. Stems elongated, slender. Sheaths free from or adnate to the leaf-base. Flowers axillary, solitary. Male flowers without a perianth, the peduncle simulating a filament; stamens 1–2; anthers 2-thecous. Female flowers with a cupular perianth; carpels 1–9; styles simple.

Literature: G. Reese, *Biol. Zentr.* **86** (*Suppl.*): 277–306 (1967).

1. Z. palustris L., *Sp. Pl.* 969 (1753) (incl. *Z. major* (Hartman) Boenn. ex Reichenb., *Z. pedunculata* Reichenb., *Z. pedicellata* (Wahlenb. & Rosén) Fries). Leaves up to 2 mm wide but usually narrower, subopposite (or alternate on non-flowering branches), acute, entire, sheaths free from the leaf-base, stipuliform, tubular when young, membranous, evanescent. Stamens 1–2. Carpels 2–9 (usually 4); stigmas peltate, with an irregularly crenate margin. Fruitlets 3–6 mm, stipitate or subsessile, laterally compressed, often curved, crenate-dentate, beaked. $2n = 12, 24, 28, 32, 34, 36$. *Still, fresh or brackish water. Almost throughout Europe.* All except Al Az Fa Sb.

Very variable in some flower- and fruit-characters, but not vegetatively. The male flowers may consist of one (2-thecous) anther or of two united anthers simulating a single 4-thecous anther. In the female flowers there is variation in the number of carpels and the shape of the stigmas, also in the degree of stipitation, the beak-length and the dentition of the fruitlets. Because of this many supposed taxa have been described at specific and infraspecific levels, and have been arranged in various conflicting ways, none of which appears satisfactory. The plants are here regarded as forming a single variable species.

3. Cymodocea C. Konig[1]

Dioecious, marine. Leaves 2–7 together on short shoots; sheaths auriculate. Flowers solitary. Perianth absent. Male peduncle simulating a filament; stamens 2; anthers 2-thecous. Female flowers sessile; carpels 2; styles divided into 2 filiform stigmas. Fruitlets with bony pericarp.

Literature: C. den Hartog, *The Sea-grasses of the World* 160–176. Amsterdam & London. 1970.

1. C. nodosa (Ucria) Ascherson, *Sitz.-Ber. Ges. Naturf. Freunde Berlin* **1869**: 4 (1869) (*C. aequorea* C. Konig). Stems with annular scars at the nodes left by fallen leaves. Leaves up to 40 cm × 4 mm, rounded-obtuse, 7- to 9-veined, spinulose-dentate towards the apex. Peduncles of male flowers 7–10 cm; anthers 11–15 mm. Fruitlets 8 mm (excluding the short beak), laterally compressed, semicircular. *Coasts of the Mediterranean region, extending to S. Portugal.* Al Bl Co Cr Ga Gr Hs It Ju Lu Sa Si Tu.

CLXXXII. NAJADACEAE[2]

Submerged, aquatic, annual herbs; stems elongated. Leaves opposite (sometimes apparently in whorls of 3), linear, sheathing at the base. Flowers unisexual, small, axillary. Male flowers with a 2-lipped perianth closely applied to the anther; stamen 1; anther subsessile, 1- to 4-thecous, opening at the apex. Female flowers without a perianth; ovary 1-locular, with 1 basal ovule. Fruit indehiscent; seeds without endosperm; testa areolate; embryo straight.

1. Najas L.[1]

Monoecious or dioecious. Leaves conspicuously or minutely dentate at the margins; sheath with or without auricles. Flowers solitary or few together, ebracteate or with a spathe-like bract, pedunculate or subsessile. Style 2- to 4-branched.

1 Dioecious; leaves 1–6 mm wide including the teeth, conspicuously spinose-dentate; stems spinose-dentate or smooth **1. marina**

1 Monoecious; leaves less than 1 mm wide including the teeth, minutely spinose-dentate; stems smooth
2 Leaf-sheaths with long, narrow or conspicuous, rounded to truncate auricles
3 Auricles long, narrowly triangular; fruit 1·75–2·25 mm **6. graminea**
3 Auricles conspicuous, rounded to truncate; fruit 2·5–3·5 mm **5. gracillima**
2 Leaf-sheaths with short auricles or none
4 Leaf-sheaths with sloping shoulders, not auriculate; leaves with 20–36 minute teeth on each margin **2. flexilis**
4 Leaf-sheaths with short, rounded-truncate auricles; leaves with 5–17 teeth on each margin
5 Areoles of seeds wider than long; leaves up to 3 cm **3. minor**
5 Areoles of seeds longer than wide; leaves not more than 1·2 cm **4. tenuissima**

Sect. NAJAS. Dioecious. Stems spinose-dentate or smooth.

1. N. marina L., *Sp. Pl.* 1015 (1753) (*N. major* All.). Leaves up to 4·5 cm, 1–6 mm wide including the teeth, conspicuously

[1] By J. E. Dandy. [2] Edit. D. H. Valentine.

spinose-dentate on the margins and often also on the back of the midrib; sheaths not or only very shortly auriculate. Male flowers with a spathe; anther 4-thecous. Female flowers without a spathe. Fruit 3–8 mm. $2n=12$. *Fresh or brackish water. Most of Europe, northwards to S.E. England and to c. 63°N. in Finland.* Au Be Bl Br Bu Co Cz Da Fe Ga Ge Gr He Ho Hs Hu It Ju Lu No Po Rm Rs (B, C, W, E) Si Su.

Sect. HYAS Dumort. Monoecious. Stems smooth.

2. N. flexilis (Willd.) Rostk. & W. L. E. Schmidt, *Fl. Sedin.* 382 (1824). Leaves up to 2·5 cm, less than 1 mm wide including the teeth, with 20–36 minute ascending teeth on each margin; sheaths with sloping shoulders, not auriculate. Male flowers with a spathe; anther 1-thecous. Female flowers without a spathe. Fruit 2–3 mm. $2n=24$. *N. & C. Europe, southwards to Switzerland; very local.* Br Da Fe Ge Hb He No Po Rs (N, B, C) Su. (*North America.*)

3. N. minor All., *Auct. Syn. Stirp. Horti Taur.* 3 (1773). Leaves up to 3 cm, less than 1 mm wide including the teeth, minutely spinose-dentate on the margins and sometimes also on the back of the midrib, with 5–17 teeth on each margin; sheaths with short, rounded-truncate auricles. Male flowers with a spathe; anther 1-thecous. Female flowers without a spathe. Fruit 2–3 mm; seed with transverse areoles (wider than long). $2n=24$. *Europe, northwards to Belgium & C. Russia, but absent from the islands.* Au Be Bu Cz Ga Ge He †Ho Hu It Ju Lu Po Rm Rs (C, W, E) Tu.

4. N. tenuissima (A. Braun) Magnus, *Beitr. Kenntn. Gatt. Najas* 24, 45 (1870). Like **3** but leaves not more than 1·2 cm, with *c.* 6 teeth on each margin; areoles of seed longitudinal (longer than wide). ● *S. Finland and N.W. Russia.* Fe Rs (C).

5. N. gracillima (A. Braun ex Engelm.) Magnus, *op. cit.* 23 (1870). Leaves 1·5–3·5 cm, up to 0·3 mm wide, linear-setaceous, straight, somewhat divergent from the scarious sheathing base, with 6–20 remote, usually 3-celled spinules above the entire lower third; sheaths with conspicuous, rounded to truncate 4- to 7-toothed auricles. Male flowers with a spathe; anthers 1-thecous. Female flowers without a spathe. Fruit 2·5–3·5 mm. *Extensively naturalized in rice-fields in N. Italy.* [It.] (*E. North America.*)

6. N. graminea Delile, *Descr. Égypte, Hist. Nat.* **2**: 282 (1813). Leaves up to 4 cm, less than 1 mm wide including the teeth, with 30 or more very minute, ascending teeth on each margin; sheaths with long, narrowly triangular auricles. Male flowers without a spathe; anthers 4-(2-)thecous. Female flowers without a spathe. Fruit 1·75–2·25 mm. *Naturalized in rice-fields and ditches in N. Italy, Romania and Bulgaria.* [Bu It Rm.] (*S. Asia, N. & E. Africa, Australasia.*)

LILIIFLORAE

CLXXXIII. LILIACEAE[1]

Perennial herbs, often with bulbs, corms, rhizomes or tuberous roots; sometimes climbers, rarely annuals or small shrubs. Flowers usually in racemes or panicles, more rarely solitary or in cymes or umbels, regular or slightly zygomorphic, usually hermaphrodite. Perianth of two whorls, each of (2–)3(–5) usually petaloid segments, free or variously connate. Stamens usually as many as perianth-segments, free or connate. Ovary 3-locular, superior (very rarely 1-locular or semi-inferior); styles 1 or 3(–5). Fruit a loculicidal or septicidal capsule or a berry.

1 Flowers axillary, or in lateral inflorescences arising from aerial stems
2 Leaves reduced to small, scarious scales; cladodes present
3 Flowers arising from the surface of ovate or elliptical cladoles; filaments united to form a tube **49. Ruscus**
3 Flowers arising from the stem or from lateral inflorescences; cladodes usually linear; filaments free **48. Asparagus**
2 Leaves green, not scale-like; cladodes absent
4 Stems spiny, climbing or creeping **50. Smilax**
4 Stems unarmed, not climbing, usually erect
5 Flowers red or yellow; leaf-margins with ±spinose teeth **14. Aloe**
5 Flowers white or greenish; leaves entire
6 Leaves amplexicaul; perianth-segments connate only at the base **45. Streptopus**
6 Leaves not amplexicaul; perianth-segments connate for most of their length **46. Polygonatum**
1 Flower or inflorescence terminal on an aerial stem, or arising directly from an underground rootstock
7 Flowers arising from a corm; scape very short; ovary underground at anthesis
8 Style 1, 3-fid near apex **17. Bulbocodium**
8 Styles 3, free from the base
9 Perianth-segments connate below, forming a long, slender tube **16. Colchicum**
9 Perianth-segments free to the base, their claws approximated to form a tube, but not connate
10 Leaves arising from top of stem, immediately below the flowers; ovaries at or only slightly below ground-level; anthers versatile **15. Androcymbium**
10 Leaves basal, arising from top of corm; ovaries at anthesis several centimetres below ground-level; anthers basifixed **18. Merendera**
7 Flowers with evident scape, or arising from leafy, aerial stems; ovary above ground at anthesis
11 Flowers in umbels, enclosed in bud by one or more spathe-like bracts
12 Perianth 40–45 mm; stamens and style declinate; seeds winged **37. Agapanthus**
12 Perianth not more than 20 mm; stamens and style straight; seeds not winged
13 Ovary semi-inferior; perianth-segments 3- to 7-veined, the inner with distinct claw **39. Nectaroscordum**
13 Ovary superior; perianth-segments usually 1-veined, usually all alike and without claw
14 Plant usually with onion-like smell when bruised; perianth-segments free; style gynobasic **38. Allium**
14 Plant without onion-like smell; perianth-segments connate at base; style terminal **40. Nothoscordum**
11 Flowers solitary, or in racemes, panicles or cymes, or, if in umbel-like inflorescences, not enclosed by spathe-like bracts in bud
15 Larger leaves at least 100 cm, erect, equitant, very fibrous **13. Phormium**
15 Leaves without this combination of characters
16 Leaves coriaceous and somewhat succulent, the margins with ±spinose teeth; anthers extrorse, basifixed **14. Aloe**

[1] Edit. V. H. Heywood and A. O. Chater.

16 Leaves not coriaceous and seldom succulent, the margins without spinose teeth; anthers usually introrse or versatile
17 Perianth-segments connate at the base for at least ⅛ of their length
18 Perianth-tube longer than the lobes or teeth
19 Fruit a berry; rootstock a rhizome **42. Convallaria**
19 Fruit a capsule; rootstock a bulb
20 Bracts as long as pedicels **31. Brimeura**
20 Bracts minute or absent
21 Perianth somewhat constricted at mouth of tube, which is at least 4 times as long as the lobes **36. Muscari**
21 Perianth not constricted at mouth of tube, which is less than 4 times as long as the lobes
22 Capsule triquetrous **33. Bellevalia**
22 Capsule globose
23 Perianth 4–5 mm **34. Hyacinthella**
23 Perianth 10–25 mm **30. Hyacinthus**
18 Perianth-tube equalling the lobes or shorter
24 Perianth-tube more than 10 mm
25 Flowers solitary, blue or white; perianth infundibuliform to rotate **41. Ipheion**
25 Flowers in forked cymes, yellow or orange; perianth campanulate **12. Hemerocallis**
24 Perianth-tube less than 10 mm
26 Anthers basifixed, extrorse; styles 3; capsule septicidal (E. Russia) **3. Zigadenus**
26 Anthers dorsifixed, introrse or versatile; style 1; capsule loculicidal
27 Pedicels all shorter than the flowers
28 Flowers dull orange to yellowish-brown; filaments not winged or toothed **35. Dipcadi**
28 Flowers purplish-blue; filaments winged, and toothed at apex **32. Strangweia**
27 At least the lower pedicels longer than the flowers
29 Bracts absent; capsule globose **29. Chionodoxa**
29 Bracts present; capsule triquetrous **31. Brimeura**
17 Perianth-segments free, or connate at the base for less than ⅛ of their length
30 Styles 3–4(–5), free throughout their length
31 Leaves verticillate **47. Paris**
31 Leaves alternate or basal
32 Leaves broadly ovate to elliptical, mainly cauline; stem 50–175 cm **4. Veratrum**
32 Leaves ensiform, mainly basal; stem not more than 35 cm **1. Tofieldia**
30 Style, if present, single, sometimes 3-fid at apex
33 Filaments densely hairy
34 Inflorescence a panicle; anthers versatile, dorsifixed; seeds 3, subglobose **10. Simethis**
34 Inflorescence a raceme; anthers extrorse, basifixed; seeds numerous, filiform **2. Narthecium**
33 Filaments glabrous or subglabrous
35 Stems junciform; leaves reduced to scarious scales **11. Aphyllanthes**
35 Green leaves present
36 Leaves all basal (sometimes 1 or 2 sheathing the stem and appearing cauline)
37 Rootstock a bulb
38 Seeds flat, winged; perianth-segments with a usually red or purple mid-vein **26. Urginea**
38 Seeds not winged and seldom flat; perianth-segments concolorous, or with a median green stripe
39 Perianth white, variously tinged with yellow or green **25. Ornithogalum**
39 Perianth blue, lilac or pink (rarely pure white)
40 Bracts single **27. Scilla**
40 Bracts 2 to each flower **28. Hyacinthoides**
37 Rootstock undifferentiated, or a cluster of tuberous roots
41 Perianth campanulate; style and stamens declinate **8. Paradisea**
41 Perianth rotate or cup shaped; style and stamens not declinate
42 Anthers dorsifixed; filaments expanded at base so as to invest the ovary **5. Asphodelus**
42 Anthers basifixed; filaments not conspicuously expanded at base
43 Perianth cup-shaped, its segments shorter than the stamens **9. Eremurus**
43 Perianth rotate, its segments as long as the stamens or longer **7. Anthericum**
36 Some cauline leaves or large, leaf-like bracts present
44 Leaves amplexicaul **44. Smilacina**
44 Leaves not amplexicaul
45 Styles 3 **15. Androcymbium**
45 Style 1
46 Rootstock a rhizome; leaves cordate; stamens and perianth-segments 4; fruit a berry **43. Maianthemum**
46 Rootstock a bulb; leaves not cordate; stamens and perianth-segments 6; fruit a capsule
47 Anthers dorsifixed, ± versatile
48 Leaves with a wide, scarious, sheathing base; perianth ± rotate **6. Asphodeline**
48 Leaves not sheathing; perianth campanulate or with revolute segments **24. Lilium**
47 Anthers basifixed, introrse
49 Cauline leaves 2, opposite, spotted; perianth-segments sharply deflexed **21. Erythronium**
49 Cauline leaves not spotted; perianth-segments not deflexed
50 Stigma sessile **22. Tulipa**
50 Style well-developed
51 Flowers nodding, variously coloured, but usually tinged, tessellated or striped with purple, brown or green **23. Fritillaria**
51 Flowers erect or horizontal, yellow or white
52 Perianth-segments yellow (rarely white), without a nectary **20. Gagea**
52 Perianth-segments white, with a small, pit-like nectary at the base **19. Lloydia**

1. Tofieldia Hudson[1]

Rhizomatous perennial herbs. Leaves distichous, ensiform. Flowers small, in terminal racemes or heads, shortly pedicellate or subsessile. Perianth persistent; segments free, ascending or patent. Stamens with glabrous filaments and broadly ovate, basifixed, introrse anthers. Ovary ovoid, the 3 carpels free above, gradually narrowed into 3 short, persistent styles. Fruit a septicidal capsule, subglobose or broadly ellipsoid. Seeds numerous, very small, ellipsoid or narrowly oblong.

Literature: W. T. Stearn, *Jour. Linn. Soc. London (Bot.)* **53**: 194–204 (1947). H. Kunz, *Phyton (Austria)* **9**: 135–139 (1961). B. Křísa & J. Chrtek, *Novit. Bot. Horti Bot. Univ. Carol. Prag.* **1963**: 36–38 (1963).

Bract at base of pedicel 3-lobed; pedicel without bracteole **1. pusilla**
Bract at base of pedicel entire; pedicel with a 3-lobed bracteole immediately below the flower **2. calyculata**

1. T. pusilla (Michx) Pers., *Syn. Pl.* **1**: 399 (1805) (*T. palustris* Hudson pro parte). Leaves 1–8 cm, 3- to 7-veined, densely caespitose. Stem 1·5–12(–25) cm, leafless. Inflorescence a 5- to 10-flowered head 3–20 mm. Flowers white or greenish, with a 3-lobed bract at base of pedicel; bracteole absent. Perianth-

[1] By W. T. Stearn.

segments 1·5–2·5 mm. Capsule 2·5–3 mm. *Wet places. N. Europe, southwards to N. England and C. Ural; Alps, W. Carpathians.* Au Br Cz Fa Fe Ga Ge He Is It ?Ju No Po Rs (N, C) Sb Su.

(a) Subsp. **pusilla**: Leaves mostly 2–5 cm, 3- to 4-veined. $2n=30$. *Throughout the range of the species.*

(b) Subsp. **austriaca** H. Kunz, *Phyton (Austria)* **9**: 138 (1961): Leaves mostly 4–8 cm, 5- to 7-veined. 1800–2200 *m.* ● *E. Alps.*

2. T. calyculata (L.) Wahlenb., *Fl. Lapp.* 90 (1812). Leaves 1·5–15 cm, 4- to 10-veined, densely caespitose. Stem (5–)14–35 cm, usually with 1–3 leaves. Inflorescence usually a cylindrical raceme 20–60 mm with up to 30 flowers, rarely a head *c.* 5 mm and with 3 flowers. Flowers yellowish, rarely reddish, with an entire bract at base of pedicel and 3-lobed bracteole immediately below flower. Perianth-segments 2–3·5 mm. Capsule 3·5 mm. $2n=30$. *Wet places; calcicole.* ● *From Gotland and Estonia southwards to the Pyrenees, Crna Gora and N.C. Ukraine.* Au Cz Ga Ge He Hs It Ju Po Rm Rs (B, C, W) Su.

Variants from high altitudes resembling **1** in habit, with 4- to 5-veined leaves but with a 3-lobed bracteole below the flower, have been distinguished as **T. glacialis** Gaudin, *Fl. Helv.* **2**: 596 (1828).

Putative hybrids of **1** & **2**, **T. × hybrida** A. Kerner ex Ascherson & Graebner, *Syn. Mitteleur. Fl.* **3**: 7 (1905), have been recorded from Tirol, but some of the plants may in fact belong to **1(b)**.

2. Narthecium Hudson[1]

Small, rhizomatous perennial herbs. Leaves distichous, ensiform. Flowers small, in terminal racemes. Perianth persistent, stellate at anthesis, erect in fruit; segments free. Stamens with linear, basifixed, extrorse anthers; filaments lanate. Ovary attenuate into a short style with a small, slightly 3-lobed stigma. Capsule loculicidal, narrowly ellipsoid or narrowly ovoid. Seeds numerous, almost filiform.

Descriptions of leaves, unless otherwise stated, refer to those on non-flowering shoots.

Literature: A. Schumacher, *Arch. Hydrobiol.* **41**: 112–195 (1945).

1 Cauline leaves unlike the other leaves, the lower smaller than the upper **1. ossifragum**

1 Cauline leaves like the other leaves, the lower larger than the upper

2 Raceme lax; pedicels 7–12 mm; perianth-segments 6–8 mm **2. reverchonii**

2 Raceme dense; pedicels 4–7 mm; perianth-segments 4–5 mm **3. scardicum**

1. N. ossifragum (L.) Hudson, *Fl. Angl.* 128 (1762). Leaves 3–20(–50) cm, (3–)6(–8)-veined. Stem 5–45 cm, with small, clasping leaves at base and larger leaves above, unlike the other leaves; raceme with 6–20 flowers. Perianth-segments 6–9 mm, yellow inside, greenish outside. Capsule *c.* 12 mm, orange. $2n=26$. *Bogs and wet, acid heaths.* ● *W. & N. Europe, eastwards to S.E. Sweden and southwards to N. Portugal.* Be Br †Cz Da Fa Ga Ge Hb Ho Hs Lu No Su.

In Faeröer a dwarf variant occurs with stems usually *c.* 10 cm.

2. N. reverchonii Čelak., *Österr. Bot. Zeitschr.* **37**: 154 (1887). Leaves up to 20 cm, 6- to 12-veined. Stem 10–40 cm; cauline leaves like the other leaves, the upper smaller than the lower. Raceme with 10–24 flowers, lax; pedicels 7–12 mm. Perianth-segments 6–8 mm, yellow. Capsule 10–13 mm. $2n=26$. *Damp places by mountain streams.* ● *Corse.* Co.

3. N. scardicum Košanin, *op. cit.* **63**: 141 (1913). Leaves up to 10 cm, 4- to 10-veined. Stem 9–27 cm; cauline leaves like the other leaves, the upper smaller than the lower. Raceme with 5–13 flowers, dense; pedicels 4–7 mm. Perianth-segments 4–5 mm, yellow. Capsule 8–10 mm. *Damp places*, 1600–2300 *m.* ● *Mountains of S.W. Jugoslavia, N.E. Albania and N.W. Greece.* Al Gr Ju.

3. Zigadenus L. C. M. Richard[2]

Bulbous, scapose perennial herbs. Leaves few, mainly basal, linear, acuminate. Inflorescence a lax, few-flowered raceme. Perianth tubular-campanulate, deeply 6-lobed, persistent; segments patent, the outer ovate-lanceolate, the inner lanceolate. Stamens 6, shorter than the perianth. Fruit a capsule. Seeds numerous.

1. Z. sibiricus (L.) A. Gray, *Ann. Lyc. New York* **4**: 112 (1837). Bulb oblong-ovoid, covered with brownish-black leaf-remains. Scape up to 80 cm, about as long as leaves, erect, simple. Pedicels as long as or longer than the perianth. Bracts elliptical, dark violet. Perianth-segments 5–8(–10) × 2–3 mm, whitish inside, greenish outside, bearing nectariferous glands on the lower third. Anthers purple. Capsule oblong-ovoid, obtusely trigonous. *S. Ural and adjacent lowlands.* Rs (C, E). (*Temperate Asia.*)

4. Veratrum L.[2]

Robust, rhizomatous perennial herbs. Rhizomes stout, vertical, clothed above with remains of leaf-sheaths. Stems simple, fistular, leafy. Leaves alternate, broadly ovate to elliptical, many-veined, suberect and overlapping, narrowed into a long sheathing base. Flowers numerous, in a terminal panicle or raceme, hermaphrodite or occasionally male. Perianth-segments widely patent, white, greenish, reddish-brown or -black, elliptical to lanceolate, free to the base, persistent in fruit. Stamens 6, inserted at the base of the perianth-segments. Fruit a 3-locular capsule. Seeds numerous.

Leaves glabrous, the upper linear-lanceolate; pedicels about equalling or slightly longer than the bracts; perianth-segments 3·5–7 mm, reddish-brown to -black **1. nigrum**

Leaves shortly pubescent beneath, the upper broadly lanceolate; pedicels much shorter than the bracts; perianth-segments 7–15 mm, white to green or yellow **2. album**

1. V. nigrum L., *Sp. Pl.* 1044 (1753). Stems 50–100(–130) cm. Cauline leaves glabrous, the lower 10–25(–35) × 4–10(–20) cm, broadly elliptical, becoming smaller and narrower above. Inflorescence a panicle, branched below, or a simple raceme. Pedicels 3–7 mm. Flowers 9–15 mm in diameter. Perianth-segments 3·5–7 × 2·5–4 mm, elliptical to oblong-elliptical, reddish-brown to -black. Capsule glabrous. $2n=16$. *Scrub, wood-margins and mountain meadows. C., S. & S.E. Europe, from C. Russia southwards to S.C. Italy and Bulgaria.* Al Au Bu Cz Ga ?Gr He Hu It Ju Po Rm Rs (C, W).

2. V. album L., *Sp. Pl.* 1044 (1753). Stems 50–175 cm. Cauline leaves glabrous or subglabrous above, shortly pubescent beneath especially on the veins, the lower 10–25 × 6–15 cm, elliptical to broadly elliptical, becoming shorter and narrower above. Inflorescence a much-branched panicle. Pedicels 2–3 mm. Flowers 15–25 mm in diameter. Perianth-segments 7–15 × 3–6 mm, elliptical to lanceolate, white outside and greenish inside to greenish-white or yellowish on both surfaces. Capsule sparsely pubescent. $2n=16$. *Damp grassland, mainly in the mountains.*

[1] By W. T. Stearn. [2] By V. H. Heywood.

Much of Europe, but absent from the islands, the north-west and most of Fennoscandia. Al Au Bu Cz Fe Ga Ge Gr He Hs Hu It Ju No Po Rm Rs (N, B, C, W, E).

A highly variable species which recent authors regard as being restricted in the narrow sense to the mountains of C. and S.E. Europe, whereas **V. lobelianum** Bernh. in Schrader, *Neues Jour. Bot.* **2(2)**: 356 (1808), described from Switzerland, is recorded from most parts of the range given above for **2**, and is sometimes sympatric with it. It differs from **2** in having the perianth-segments greenish on both surfaces and longer bracts, but other reputed differences in pedicel-length, flower-size and in hairiness do not seem to apply unambiguously to it and it must be regarded as of doubtful status. It has $2n=32$.

V. misae (Širj.) Loesener fil., *Feddes Repert.* **24**: 65 (1927), which occurs in Arctic Russia, is like **2** but has stems not more than 40 cm, leaves glabrous on both surfaces, and narrower (2–3 mm wide), subacute, yellowish-green perianth-segments. Intermediates, however, are reported between this and *V. lobelianum*.

Plants from N. Portugal and perhaps W.C. Spain differ from **2** in having glabrous leaves and greenish-white perianth-segments 8–10 mm. They may constitute a further species or subspecies.

5. Asphodelus L.[1]

Annuals or rhizomatous perennials. Leaves linear, all basal. Flowers white or pale pink, numerous, in a dense raceme or panicle; bracts persistent, scarious. Pedicels articulated. Perianth-segments 6, free or united only at the base, patent. Stamens 6, free; filaments expanded at base; anthers dorsifixed, introrse. Fruit a loculicidal capsule; seeds 6.

1 Slender annual or short-lived perennial with hollow, subterete leaves and slender roots; capsule 4–5 mm in diameter **1. fistulosus**
1 Robust perennial with flat leaves and napiform to fusiform roots on a short rhizome; capsule (5–)6–18 mm in diameter
2 Bracts dark brown; inflorescence usually simple **2. albus**
2 Bracts whitish, sometimes becoming brown on drying; inflorescence usually branched
3 Capsule 8–20 mm
4 Capsule 8–14 mm, ovoid; inflorescence much-branched, the terminal branch scarcely exceeding the laterals **3. ramosus**
4 Capsule 16–20 mm, globose; inflorescence unbranched or with few, short lateral branches **2. albus**
3 Capsule 5–7 mm
5 Capsule obovoid **4. aestivus**
5 Capsule mitriform, ±3-lobed at apex **5. bento-rainhae**

1. A. fistulosus L., *Sp. Pl.* 309 (1753) (*A. tenuifolius* Cav.). Annual or short-lived perennial with numerous slender roots. Leaves 3–35 × *c.* 0·4 cm, hollow, subterete. Scape 15–70 cm, hollow, simple or branched. Bracts scarious. Perianth-segments 5–12 mm, oblong, obtuse. Capsule 5–7 × 4–5 mm. $2n=28, 56$. *Roadsides, cultivated ground and dry, sandy or rocky places. Mediterranean region and S.W. Europe.* Az Bl Co Cr Ga Gr Hs It Ju Lu Sa Si Tu.

2. A. albus Miller, *Gard. Dict.* ed. 8, no. 3 (1768) (incl. *A. arrondeaui* Lloyd, *A. subalpinus* Gren. & Godron). Perennial with swollen roots. Leaves 15–60 × (0·5–)1–2(–3) cm, flat. Scape 30–100(–150) cm, solid, usually simple, or with a few, short branches at base of inflorescence. Perianth-segments 15–20(–30) mm, narrowly elliptical. *Meadows, heaths, open woods and mountain pastures. S. Europe, extending northwards to N.W. France, Switzerland and Hungary.* Al Bu Ga Gr He Hs Hu It Ju Lu ?Si.

(a) Subsp. **albus**: Bracts dark brown. Capsule 8–15 × 6–13 mm. $2n=28, 56$. *Throughout the range of the species.*

(b) Subsp. **villarsii** (Verlot ex Billot) I. B. K. Richardson & Smythies, *Bot. Jour. Linn. Soc.* **76**: 368 (1978) (*A. cerasiferus* auct., non Gay, *A. villarsii* Verlot ex Billot): Bracts whitish-scarious. Capsule 16–20 × 18–25 mm. $2n=78$. *S.W. Europe.*

3. A. ramosus L., *Sp. Pl.* 310 (1753) (*A. cerasiferus* Gay; incl. *A. lusitanicus* Coutinho, *A. messeniacus* Heldr.). Perennial with napiform roots. Leaves 15–40 × 1–3(–4) cm, flat, somewhat keeled. Scape 40–150 cm, solid, usually much-branched, the lateral branches almost as long as the terminal. Bracts scarious to pale green. Perianth-segments 15–20 mm, lanceolate or linear-oblong, obtuse. Capsule 8–14 × 5–11 mm, ovoid. $2n=28, 56, 84$. *S.W. Europe, extending locally eastwards to S.W. Greece.* Co Ga Gr Hs It Ju Lu Sa Si.

Plants said to be of hybrid origin involving **3** and **4** have been called **A. chambeironii** Jordan, *Bull. Soc. Bot. Fr.* **7**: 736 (1860) (*A. morisianus* Parl.). They are intermediate between the parents in flower- and fruit-characters and occur in S.W. Europe where the ranges overlap. It has been suggested that **3** is itself of hybrid origin, possibly involving **2(a)** and **4**, but further study is required.

4. A. aestivus Brot., *Fl. Lusit.* **1**: 525 (1804) (*A. microcarpus* Viv.). Like **3** but roots fusiform; leaves 25–45 × (0·5–)1–2(–4) cm; scape 100–200 cm, with somewhat shorter lateral branches; perianth-segments 10–14 mm; capsule 5–7 × 4–5 mm, obovoid. $2n=28, 56, 84$. *Dry grassland and rocky or sandy ground. Mediterranean region, Portugal.* Al Bl Co Cr Ga Gr Hs It Ju Lu Sa Si.

5. A. bento-rainhae P. Silva, *Agron. Lusit.* **18**: 20 (1956). Like **3** but with sessile swollen roots; leaves 25–45 × 0·3–1·2 cm; scape 90–130 cm, sparingly branched or simple; perianth-segments 10–14 mm; capsule 6·5–7 × 6–8 mm, mitriform, 3-lobed at apex. *Pastures and cultivated fields.* ● *C. Portugal (Serra da Gardunha).* Lu.

6. Asphodeline Reichenb.[2]

Glabrous perennial herbs with short, non-bulbous stock and fleshy roots. Leaves linear, alternate, with wide, scarious, sheathing base. Flowers numerous, yellow or white, in a dense terminal raceme; bracts persistent, scarious, each subtending 1–3(–5) flowers. Pedicels articulated. Perianth with a very short tube and narrow, patent, 3-veined segments. Stamens and style curved downwards, the stamens unequal; filaments glabrous, dilated at the base; anthers dorsifixed, introrse. Fruit a loculicidal capsule; seeds 6.

1 Flowers white **3. taurica**
1 Flowers yellow
2 Stem leafy throughout; bracts *c.* 25 × 10 mm **1. lutea**
2 Stem leafy only in lower part; bracts not more than 15 × 3 mm **2. liburnica**

1. A. lutea (L.) Reichenb., *Fl. Germ. Excurs.* 116 (1830). Stem 40–80 cm, stout, erect, entirely covered by sheathing leaf-bases. Lower leaves up to 35 cm × 1·5–3(–5) mm, narrowly linear, recurved, the upper shorter and suberect. Raceme 10–20 cm. Bracts 20–30 × 8–12 mm, ovate, cuspidate. Pedicels *c.* 20 mm, articulated near the middle. Perianth-lobes 20–25 × 4–7 mm, greenish-yellow. Capsule 10 mm, globose; seeds 4–5 mm, trigonous, black. $2n=28$. *Stony ground and dry grassland. Balkan peninsula and Aegean region, extending to Istra and S.E. Romania; C. & S. Italy, Sicilia.* Al Bu Cr Gr It Ju Rm Si Tu.

[1] By I. B. K. Richardson and B. E. Smythies. [2] By D. A. Webb.

2. A. liburnica (Scop.) Reichenb., *loc. cit.* (1830). Like **1** but stem 25–60 cm, rather slender, leafy only in lower half; leaves not more than 25 cm × 2·5 mm; bracts not more than 15 × 3 mm, deltate-orbicular, with long arista; pedicels articulated near the base. $2n=14$, 28. *Rocky and bushy places. Balkan peninsula, extending to Istra; Kriti; S. Italy.* Al Bu Cr Gr It Ju Tu.

3. A. taurica (Pallas ex Bieb.) Kunth, *Enum. Pl.* **4**: 561 (1843). Stem 30–65 cm, stout, erect, the lower part concealed by sheathing leaf-bases, the upper part (where the leaves grade into bracts) usually exposed. Lower leaves 20–30 cm × 1·5–2 mm, narrowly linear, more or less erect, the upper much shorter. Raceme 15–25 cm. Bracts up to 35 × 10 mm, ovate-lanceolate, acuminate. Pedicels *c.* 15 mm, articulated above the middle. Perianth-lobes 15–20 × 4–6 mm, white, with a greenish midrib. Capsule 8 mm, globose; seeds 5 mm, triquetrous, black. $2n=28$. *Mountain rocks and screes; calcicole. C. part of Balkan peninsula; Krym.* Al Bu Gr ?Ju Rs (K).

A. parviflora Baker, *Jour. Linn. Soc. London (Bot.)* **15**: 276 (1876), is known only from the type-specimen, which was grown from seed collected near Istanbul (but possibly in Asia). It is probably a variant of **3**.

7. Anthericum L.[1]

Glabrous, scapose perennial herbs with short, non-bulbous stock and somewhat fleshy roots. Leaves linear, tapered to an acute apex, with scarious, sheathing base. Flowers rotate, in a lax raceme or panicle. Bracts mostly small and scarious (the lowest sometimes leaf-like). Pedicels usually articulated. Perianth-segments patent during anthesis, free or very shortly connate at extreme base, 3-veined, without distinct claw, white. Stamens equal, shorter than or equalling perianth-segments; filaments straight, glabrous, not dilated; anthers basifixed, introrse. Fruit a loculicidal capsule; seeds 2–8 in each loculus.

1 Perianth-segments 16–22 mm, exceeding the stamens by 6–10 mm **1. liliago**
1 Perianth-segments 10–14 mm, exceeding the stamens by not more than 2 mm
2 Leaves 1·5–2(–5) mm wide; inflorescence a simple raceme; capsule ovoid-ellipsoid, subacute **2. baeticum**
2 Leaves (1·5–)4–7 mm wide; inflorescence usually a panicle; capsule depressed-globose, obtuse **3. ramosum**

1. A. liliago L., *Sp. Pl.* 310 (1753). Stem 20–70 cm. Leaves 12–40 cm × (1·5–)3–7 mm, flat or somewhat canaliculate. Inflorescence a raceme usually of 6–10 flowers, rarely with a few short branches at the base. Pedicels 9–12 mm at anthesis, exceeding bracts. Perianth-segments 16–22 mm, narrowly oblong-elliptical; stamens 9–13 mm. Style curved, ascending in distal part. Capsule 8–10 mm, ovoid; seeds 3 mm, trigonous, dull black. $2n=32$, 48, 64. *Open woods, dry grassland and stony slopes. From Belgium and S. Sweden southwards to N. Portugal, S. Italy and Greece.* Al Au Be Bu ?Co Cz Da Ga Ge Gr He †Ho Hs Hu It Ju Lu Po Rm Su [Rs (W)].

2. A. baeticum (Boiss.) Boiss., *Voy. Bot. Midi Esp.* **2**: 619 (1842). Like **1** but less robust; leaves 8–16 cm × 1·5–2(–3) mm; raceme always simple; pedicels not more than 6 mm at anthesis, not exceeding bracts; perianth-segments 10–14 mm; style less conspicuously curved; capsule *c.* 5 mm. $2n=30$. *Wet meadows.* ● *Mountains of S. Spain.* Hs.

In this species the articulation of the pedicel is very near the base, and often so low as to be scarcely recognizable.

[1] By D. A. Webb.

3. A. ramosum L., *Sp. Pl.* 310 (1753). Like **1** but inflorescence usually a pyramidal panicle (rarely reduced to a simple raceme); perianth-segments 10–14 mm; style straight; capsule 5 × 6 mm, depressed-globose, obtuse. $2n=30$, 32. *Dry, sunny places and open scrub. From N. France, S. Sweden and Latvia southwards to the Pyrenees, C. Italy, Turkey and Krym.* Al Au ?Be Bu Cz Da Ga Ge He Hs Hu It Ju Po Rm Rs (B, C, W, K, E) Su Tu.

8. Paradisea Mazzuc.[1]

Like *Anthericum* but inflorescence always a raceme; flowers campanulate; perianth-segments suberect below, patent towards apex, with fairly distinct claw; pedicels articulated or not; style and stamens curved upwards in distal half; anthers dorsifixed, versatile.

Raceme secund; perianth 30–50 mm; pedicels not articulated **1. liliastrum**
Raceme not secund; perianth 20–25 mm; pedicels articulated **2. lusitanica**

1. P. liliastrum (L.) Bertol., *Fl. Ital.* **4**: 133 (1840). Stem 30–50 cm × 2–3 mm. Leaves 12–25 cm × 3–5 mm, flat. Raceme lax, secund, with 4–10(–20) flowers. Bracts 12–40 mm, subulate, exceeding the pedicels. Pedicels not articulated. Perianth-segments 30–50 mm, with oblong-elliptical limb. Stamens shorter than perianth; style slightly longer. Capsule 13–15 mm, ellipsoid-trigonous. Seeds 3 mm, trigonous, black. $2n=16$. *Mountain meadows.* ● *Pyrenees, Alps, Jura, N. & C. Appennini.* Au Ga He Hs It Ju.

2. P. lusitanica (Coutinho) Samp., *Lista Esp. Herb. Port.* 28 (1913). Like **1** but more robust, with stem 80–120 cm and leaves 30–40 cm × 7–20 mm; raceme denser, with 20–25 flowers, not secund; pedicels articulated near the base, about equalling the bracts; perianth-segments 15–20 mm. $2n=32$, 64. *Woods, meadows and marshes.* ● *Mountains of N. Portugal and W.C. Spain.* Hs Lu.

9. Eremurus Bieb.[1]

Like *Anthericum* but more robust and with fusiform, tuberous roots; inflorescence a long, dense raceme with very numerous flowers; perianth cup-shaped, white or yellow, with segments shorter than the stamens.

Flowers yellow; capsule globose; seeds brownish, concolorous or with slightly darker streaks **1. caucasicus**
Flowers white; capsule broadly conical; seeds grey, with black spots and brownish streaks **2. tauricus**

1. E. caucasicus Steven, *Bull. Soc. Nat. Moscou* **4**: 251 (1832) (*E. spectabilis* Bieb. pro parte). Stem 100–200 cm. Leaves 15–40 cm × 15–70 mm, suberect and somewhat canaliculate, glaucous. Raceme 25–70 × 5–8 cm; pedicels longer than the linear bracts, deflexed in fruit. Perianth-segments 8–10 mm, pale yellow. Stamens 15–18 mm; anthers reddish-orange. Style arcuate-deflexed. Capsule *c.* 12 mm, globose. Seeds acutely triquetrous, transversely rugulose, brown, concolorous or with slightly darker streaks. *Stony slopes and steppes. S. Ukraine.* Rs (K, E). (*S.W. & S.C. Asia.*)

The European populations have been separated as **E. thiodanthus** Juz., *Not. Syst. (Leningrad)* **14**: 5 (1951), and **E. jungei** Juz., *op. cit.* 7 (1951); but the rather inadequate descriptions suggest, especially in view of the considerable variability among Asiatic populations of *E. caucasicus*, that they are only varietally distinct.

2. E. tauricus Steven, *Bull. Soc. Nat. Moscou* **4**: 253 (1832). Like **1** but perianth-segments white, with green veins; capsule broadly conical, subacute; seeds grey, with black spots and brownish streaks. *Rocks and screes.* ● *Mountains of Krym.* Rs (K).

10. Simethis Kunth[1]

Glabrous, more or less scapose perennial herbs with short, non-bulbous stock and fleshy roots. Leaves linear, with sheathing, scarious, fibrous base, usually all basal but sometimes 1–2 on lower part of stem. Flowers in a terminal panicle. Pedicels not articulated. Perianth-segments free, patent, 5- to 7-veined, white above, purplish beneath. Stamens and style straight; filaments villous, not dilated at the base; anthers dorsifixed, introrse. Fruit a loculicidal capsule; seeds 3–6.

1. S. planifolia (L.) Gren. in Gren. & Godron, *Fl. Fr.* **3**: 222 (1855) (*S. bicolor* (Desf.) Kunth, *Anthericum planifolium* L.). Stem 12–40 cm, erect, slender, flexuous. Leaves 15–60 cm × 2·5–7 mm, exceeding the stem. Inflorescence lax, with several erecto-patent branches, each with 3–7 flowers. Perianth-segments 9–11 mm, narrowly elliptical. Capsule *c.* 5 mm, depressed-globose. Seeds 4 mm, ovoid, black, with whitish strophiole. $2n = 48$. *Heaths, rocky ground and open* Pinus-*woods. S.W. Europe, extending northwards to S.W. Ireland and eastwards to W. Italy.* Co Ga Hb Hs It Lu Sa [†Br].

11. Aphyllanthes L.[1]

Glabrous, scapose perennial herbs with short, non-bulbous stock and fibrous roots. Leaves reduced to scarious sheaths. Flowers blue (rarely white), solitary or in compact clusters of 2–3, subtended by subterminal bracts and appearing terminal. Perianth-segments free, 1-veined, the lower part erect, the upper more or less patent. Filaments glabrous, not dilated at base; anthers dorsifixed, introrse. Fruit a loculicidal capsule; seeds 3.

1. A. monspeliensis L., *Sp. Pl.* 294 (1753). Stems 20–50 cm, numerous, densely caespitose, slender, tough, somewhat glaucous. Leaf-sheaths 3–8 cm, reddish-brown. Involucre 8–10 mm, scarious, reddish-brown, consisting of 1–3 free, cuspidate bracts, and around each flower 5 obtuse bracteoles, connate at the base. Perianth-segments 15–20 mm, oblanceolate, the basal half concealed by the involucre. Seeds ovoid, black, rugulose. $2n = 32$. *Dry places. S.W. Europe.* Bl Ga Hs It Lu Sa.

12. Hemerocallis L.[1]

Glabrous, rhizomatous, more or less scapose perennial herbs with tuberous roots. Leaves mainly basal, distichous, linear. Stem erect, sometimes with a few small leaves. Inflorescence terminal, consisting of 2 subequal, cymose branches. Flowers yellow or reddish. Perianth infundibuliform, the tube shorter than the recurved lobes; veins numerous. Stamens and style curved upwards; filaments inserted on perianth-tube; anthers dorsifixed, introrse. Fruit a loculicidal capsule; seeds rather few.

Literature: L. H. Bailey, *Gentes Herb.* **2**: 143–156 (1930).

Flowers bright yellow, fragrant; margins of perianth-lobes plane **1. lilioasphodelus**

Flowers dull orange, not fragrant; margins of inner perianth-lobes undulate **2. fulva**

[1] By D. A. Webb.

1. H. lilioasphodelus L., *Sp. Pl.* 324 (1753) (*H. flava* L.). Stem 50–100 cm, leafless. Leaves 40–80 cm × 6–17 mm, acute, keeled. Inflorescence with 6–12 fragrant flowers. Perianth 60–100 mm, bright yellow, the tube 15–25 mm, the outer segments *c.* 15 mm wide, the inner *c.* 25 mm wide, all with plane margins and parallel veins without anastomoses. Capsule 3–4 × 2 cm, ellipsoid. Seeds 6 mm, ovoid, shining black. *Rocky mountain woods and river-sides.* ● *Foothills of S.E. Alps and adjoining lowlands; long cultivated for ornament and widely naturalized elsewhere by rivers and in wet meadows.* It Ju [Au Cz Ga Ge Hu Rm].

The only native European representative of a genus otherwise confined to E. Asia. Despite its frequent naturalization elsewhere its native status in N.E. Italy and Slovenija seems fairly certain. As the species is self-sterile and spreads extensively by clonal growth capsules are rarely found.

2. H. fulva (L.) L., *Sp. Pl.* ed. 2, 462 (1762). Like **1** but more robust; leaves up to 30 mm wide; flowers not fragrant; perianth with yellow tube and dull orange lobes, the outer *c.* 20 mm wide, the inner *c.* 30 mm wide with undulate margins; veins, especially of inner lobes, with numerous anastomoses; capsule never formed. *Cultivated for ornament* (*sometimes as a variant* flore pleno) *and widely naturalized, mainly in C. Europe, in damp meadows, on river-banks, and in open, rocky habitats.* [Au Cz Ga Ge He Hu It ?Ju Rm Rs (C, W).] (*China.*)

It seems probable that all plants naturalized in Europe are sterile triploids with $2n = 33$.

13. Phormium J. R. & G. Forster[1]

Glabrous, rhizomatous perennial herbs. Leaves large, mostly basal, ensiform, distichous, equitant, very coriaceous and fibrous. Stem erect, with a few small cauline leaves, grading into bracts. Flowers brownish-red and yellow, in a large, terminal panicle, the primary branches racemose in arrangement, but the flowers on each branch cymose. Perianth with a short tube and erect lobes; veins numerous, inconspicuous. Anthers dorsifixed, introrse. Fruit a loculicidal capsule; seeds numerous.

1. P. tenax J. R. & G. Forster, *Char. Gen. Pl.* 24 (1775). Rhizome stout, short. Leaves up to 250 × 12 cm, suberect, the basal part keeled on outer and canaliculate on inner surface; midrib, margins and base often reddish. Stem, including panicle, up to 400 cm. Flowers erect; pedicels 1–4 cm. Perianth 3–5 cm; outer lobes dark brownish-red, the inner yellow, somewhat recurved at apex. Stamens exceeding perianth; filaments red. Ovary acuminate. Capsule 7–9 × 2 cm, fusiform, trigonous, often curved, dark brown. Seeds 9 × 4 mm, compressed, elliptical, black. *Planted for ornament and shelter in Atlantic coastal districts, and locally naturalized.* [Az Br Hb.] (*New Zealand, Norfolk Island.*)

P. colensoi Hooker fil., *Rev. Hort.* (*Paris*) ser. 3, **2**: 6 (1848), is also locally naturalized on maritime rocks in S.W. England (Isles of Scilly). It is like **1**, but with leaves not more than 150 × 7 cm, stem not more than 225 cm, outer perianth-segments yellow, and capsule 10–17 cm, twisted. It is native to New Zealand.

14. Aloe L.[1]

Shrubs, or scapose perennial herbs. Leaves ovate to linear-acuminate, coriaceous, more or less succulent, spinose-dentate, usually aggregated into dense rosettes. Inflorescence of 1 or more axillary (often subterminal), bracteate racemes or panicles; flowers red, orange or yellow, pendent or deflexed at full anthesis.

Perianth cylindrical; outer 3 segments free or variously connate; inner 3 free from each other but sometimes adnate to the outer. Stamens exserted or equalling perianth; anthers extrorse, basifixed. Fruit a loculicidal capsule; seeds numerous.

A large genus, almost exclusively African, of which many species and hybrids are cultivated for ornament in the Mediterranean region. In habit it shows strong affinities with the Agavaceae, but lacks the distinctive anatomical and cytological characters of that family.

Measurements of the inflorescence include the peduncle.

In addition to the species described below a few others are reported as escapes and perhaps naturalized in single localities near the coast of S.E. France or N.E. Spain. These include:

A. spectabilis Reynolds, *Jour. S. Afr. Bot.* **3**: 129 (1937). Like **9** but with yellow flowers and shorter racemes and bracts.

A. maculata All., *Auct. Syn. Stirp. Horti Taur.* 13 (1773) (*A. umbellata* DC.). Stem short, erect; leaves 25–30 × 8–12 cm, with white spots on upper surface; flowers in subcapitate racemes arranged in a dichotomous panicle; perianth *c.* 40 mm, orange to pink; stamens scarcely exserted.

A. × principis (Haw.) Stearn, *Cactus Jour.* **7**: 42 (1938) (*A. salm-dyckiana* Schultes & Schultes fil.; **8** × **9**). Like **8** but usually with some spines on lower surface of leaf near apex, and with stamens exceeding perianth by 7–12 mm.

A plant of this genus naturalized in S. Greece has been ascribed to **A. obscura** Miller, *Gard. Dict.* ed. 8, no. 6 (1768), but this name cannot with certainty be attached to any wild species or known hybrid.

Literature: G. W. Reynolds. *The Aloes of South Africa.* Johannesburg. 1950. *The Aloes of tropical Africa and Madagascar.* Mbabane. 1966.

1 Stamens exceeding perianth by 20–25 mm at full anthesis **9. ferox**
1 Stamens equalling perianth, or exceeding it by not more than 5 mm
2 Leaves 35–60 cm
3 Flowers yellow **4. vera**
3 Flowers red
4 Stem not more than 1 m, often absent; bracts and marginal spines of leaves dark purple **7. succotrina**
4 Stem 1·5–3·5 m; bracts and marginal spines of leaves greenish **8. arborescens**
2 Leaves 6–20 cm
5 Stem well-developed, ± decumbent; leaves not all crowded in terminal rosettes
6 Leaves linear-lanceolate, with ciliate auricles; pedicels *c.* 5 mm **5. ciliaris**
6 Leaves ovate-lanceolate, without ciliate auricles; pedicels *c.* 40 mm **6. perfoliata**
5 Stem absent, or short and erect; leaves all crowded in dense, terminal rosettes
7 Leaves 2½–4 times as long as wide; all perianth-segments free **3. brevifolia**
7 Leaves 5–8 times as long as wide; perianth-segments variously united
8 Leaves with a flexuous apical arista 10–15 mm; bracts much shorter than pedicels **1. aristata**
8 Leaves with a stout apical spine 2–4 mm; bracts almost as long as pedicels **2. humilis**

1. A. aristata Haw., *Philos. Mag.* **66**: 280 (1825). Herb; leaves in a dense, subglobose, sessile rosette 8–10 × 1–1·5 cm, narrowly triangular-lanceolate, erect or incurved, with subspinose, white tubercles on the lower and usually on the upper surface, and with a soft, whitish terminal arista 10–15 mm. Inflorescence 30–40 cm, simple or branched; lower part of peduncle without bracts. Racemes 15–20 × 12–15 cm, lax; pedicels up to 35 mm; bracts *c.* 12 mm. Perianth 30–40 mm, orange-red, variably tinged with brownish-green; outer segments connate except at apex; inner segments adnate to outer. Stamens scarcely exceeding perianth. *Naturalized from gardens near the coast of S.E. France.* [Ga.] (*South Africa.*)

2. A. humilis (L.) Miller, *Gard. Dict.* ed. 8, no. 10 in corrig. (1768) (*A. verrucosospinosa* All.). Like **1** but leaves terminating in a stout spine 2–4 mm; bracts almost as long as pedicels and abundant on lower part of peduncle. *Naturalized from gardens in S.E. France.* [Ga.] (*South Africa.*)

3. A. brevifolia Miller, *op. cit.* no. 8 in corrig. (1768). Stoloniferous herb with numerous leaf-rosettes, basal or rarely terminating stems up to 10 cm; leaves 6–15 × 2–4 cm, ovate-lanceolate, glaucous, usually with a few subspinose tubercles on lower surface near the apex. Inflorescence *c.* 40 cm, simple. Raceme 15 × 7 cm; bracts and pedicels *c.* 15 mm; bracts present on lower part of peduncle. Perianth 25–40 mm, orange-red; segments closely contiguous but free. Stamens exceeding perianth by 3–4 mm. *Naturalized from gardens near the coast of S.E. France.* [Ga.] (*South Africa.*)

4. A. vera (L.) Burm. fil., *Fl. Ind.* 83 (1768) (*A. vulgaris* Lam.). Stoloniferous herb with numerous leaf-rosettes, basal or rarely terminating stems up to 10 cm; leaves 35–60 × 5–8 cm, narrowly triangular-lanceolate, glaucous, sometimes tinged with red, smooth on both surfaces. Inflorescence simple or with 1–2 branches. Racemes 30–50 × 5–6 cm; bracts 10 mm; pedicels 5 mm; flowers sharply deflexed. Perianth 25–30 mm, yellow; outer segments connate for ⅓ to ½ their length; inner segments adnate to outer in lower ⅓. Stamens exceeding perianth by 3–4 mm. *Maritime sands and rocks. Mediterranean region, S. Portugal.* [Cr Gr Hs It Lu Si.] (*?Arabia, N.E. Africa.*)

5. A. ciliaris Haw., *Philos. Mag.* **66**: 281 (1825). Freely branched shrub with decumbent stems up to 3(–5) m, 1–1·5 cm in diameter; leaves distributed over apical part of branch with internodes 5–15 mm, not crowded in a terminal rosette. Leaves 10–15 × 1·5–2·5 cm, linear-lanceolate, with sheathing base and conspicuous, ciliate auricles; marginal teeth small, scarcely spinose. Inflorescence 20–30 cm, simple. Racemes 8–20 cm; bracts 3 mm, whitish; pedicels 5 mm. Perianth *c.* 30 mm, scarlet; outer segments connate in basal ⅘; inner free. Stamens exceeding perianth by 2–4 mm. *Naturalized from gardens near the coast of S.E. France.* [Ga.] (*South Africa.*)

6. A. perfoliata L., *Sp. Pl.* 319 (1753) (*A. mitriformis* Miller). Shrub; stem 1–2 m, 4–6 cm in diameter, simple or sparingly branched near the base, procumbent to decumbent; internodes as in **5**. Leaves 12–20 × 5–10(–15) cm, ovate to ovate-lanceolate, somewhat glaucous; marginal spines 4–6 mm, white at first, later yellow or black. Inflorescence 40–60 cm, with 2–5 branches. Racemes *c.* 10 × 12 cm, subcapitate; bracts *c.* 10 mm; pedicels 40–45 mm at base of raceme, shorter above. Perianth 40–50 mm, dull scarlet; segments closely contiguous but free. Stamens scarcely exceeding perianth. *Naturalized from gardens near the coast of S.E. France.* [Ga.] (*South Africa.*)

7. A. succotrina All., *Auct. Syn. Stirp. Horti Taur.* 13 (1773) (*A. vera* Miller, non (L.) Burm. fil., *A. purpurascens* (Aiton) Haw.). Shrub of very variable habit; stem up to 2 m but often very short, simple or branched, erect to decumbent, 10–15 cm in diameter. Leaves 30–50 × 7–10 cm, triangular-lanceolate, dull greyish-green, sometimes with paler spots; marginal teeth dark purple.

Inflorescence up to 100 cm, usually simple. Raceme 25–35 cm; bracts 20 mm, purple; pedicels 25–30 mm. Perianth 30–40 mm, pinkish-red; segments free. Stamens exceeding perianth by 3–5 mm. *Naturalized from gardens in S.E. Spain and S.E. France.* [Ga Hs.] (*South Africa.*)

8. A. arborescens Miller, *Gard. Dict.* ed. 8, no. 3 (1768). Freely-branched shrub with erect to spreading stems 1·5–3·5 m, up to 30 cm in diameter. Leaves 50–60 × 5–7 cm, dull greyish-green, patent or somewhat deflexed, crowded in terminal rosettes, the dead leaves persistent for *c.* 50 cm below the rosette; surface smooth, without spots; marginal teeth scarcely spinose, forwardly curved, greenish. Inflorescence *c.* 80 cm, simple or with one short branch. Raceme 20–30 × 10–12 cm; bracts 15–20 mm, greenish; pedicels 35–40 mm. Perianth 35–40 mm, scarlet; segments free. Stamens exceeding perianth by 3–5 mm. *Naturalized from gardens on rocks, mostly near the sea, in S.W. Europe.* [Ga Hs Lu.] (*Southern Africa, northwards to Malawi.*)

9. A. ferox Miller, *op. cit.* no. 22 (1768). Shrub; stem 2–3(–5) m, erect, simple, 10–15 cm in diameter, densely clothed with dead leaves. Leaves 50–100 × 5–15 cm, dull green, sometimes tinged with red, usually with numerous spines on both surfaces, especially near the apex; marginal spines up to 6 mm, stout, reddish-brown. Inflorescence *c.* 100 cm, with 5–8 branches; racemes 50–75 cm, stiffly erect; bracts 8–10 mm, brownish; pedicels 4–5 mm. Perianth 30–35 mm, scarlet or orange; outer segments connate in basal ⅓; inner free, but adnate to outer at base. Stamens exceeding perianth by 20–25 mm. *Naturalized from gardens near the coast of S.E. France.* [Ga.] (*South Africa.*)

15. Androcymbium Willd.[1]

Perennial herbs. Corms with a dark brown, coriaceous tunic. Stem short, largely subterranean, with a cylindrical, membranous spathe sometimes partly enveloping the leaves and flowers. Leaves few, borne in a rosette at the apex of the stem and forming a conspicuous involucre to the umbellate inflorescence, sheathing at the base. Flowers 1–6, white or pink, sometimes with purplish veins or spots. Perianth-segments free, with a long, narrow claw and an elliptical to lanceolate limb. Stamens inserted towards the base of the limb. Styles free. Fruit a capsule.

Perianth-segments acuminate, the limb nearly twice as long as the claw; fruit subglobose, fracturing at the base **1. europaeum**
Perianth-segments acute, the limb often scarcely longer than the claw; fruit obpyriform, remaining intact **2. rechingeri**

1. A. europaeum (Lange) K. Richter, *Pl. Eur.* **1**: 188 (1890) (*Erythrostictus europaeus* Lange). Corms single or 2–3 one above the other. Stem 2–7 cm. Leaves 20–150 × 4–15 mm, linear to lanceolate, flat or slightly plicate, glabrous, patent, sometimes deflexed. Flowers 1–4, shortly pedicellate; perianth-segments (including claw) 20–25 × 2–5 mm, the limb nearly twice as long as the claw, acuminate. Filaments 3–5 mm; anthers 1–1·5 mm. Fruit 6–8 mm, subglobose, glandular-punctate, fracturing at the base. $2n=18$. *Dry, rocky places; calcicole.* ● *S.E. Spain, between Almería and Cabo de Gata.* Hs.

Frequently confused with *A. gramineum* (Cav.) Macbride, from North Africa, which has fruits 15–20 mm.

2. A. rechingeri W. Greuter, *Candollea* **22**: 248 (1967). Like **1** but flowers often more numerous; perianth-segments acute at the apex; capsule obpyriform, not glandular-punctate except occasionally at the apex, remaining intact. *Between rocks on maritime sands. W. Kriti (island of Elaphonisos).* Cr.

[1] By V. H. Heywood.

16. Colchicum L.[2]

Perennial herbs; stock a corm, occasionally stoloniferous, enclosed by tunics which are frequently extended into a neck above the corm. Flowers solitary or in fascicles, each subtended by a small bract and very shortly pedicellate, purple, pink or white, sometimes with alternating squares of dark and light colour (*tessellated*). Perianth of two rows of equal or subequal segments united below into a long, narrow tube. Stamens inserted near the base of the perianth-segments, usually in two rows; anthers versatile; filaments slender, frequently thickened at the base. Styles 3, free. Ovary subterranean. Fruit a septicidal capsule, maturing at or just above ground-level. Seeds numerous.

A taxonomically difficult genus, particularly in respect of those species which flower in autumn and do not produce their leaves until late winter or spring. Many herbarium specimens of such species are of flowering material only and are difficult to determine.

Several of the characters traditionally used to distinguish species may prove unreliable when used alone, particularly the presence or absence of cilia or hairs on the leaves and the colour of the anthers; both of these can vary within a single population of certain species but are diagnostic in others.

Literature: B. Stefanov, *Sborn. Bălg. Akad. Nauk.* **22**: 1–99 (1926).

1 Leaves at least partly developed at anthesis
 2 Corm with underground stolons **6. psaridis**
 2 Corm not stoloniferous
  3 Tunic membranous, evanescent; leaves with scabrid or glabrous margins **1. triphyllum**
  3 Tunic coriaceous to membranous, persistent; leaves with ciliate or glabrous margins
   4 Leaves 3–18, 1–4(–5) mm wide, narrowly linear **5. pusillum**
   4 Leaves 2 or 3, linear-lanceolate, at least 7 mm wide on well-developed plants
    5 Leaves usually 2, glabrous, rarely sparsely ciliate at base; flowering September–December **4. cupanii**
    5 Leaves 2 or 3, ciliate, often hairy on dorsal surface; flowering December–April
     6 Leaves usually 3; filaments hairy at least below; tunic coriaceous, ribbed **2. burttii**
     6 Leaves usually 2; filaments glabrous; tunics papery, smooth **3. hungaricum**
1 Leaves undeveloped at anthesis (rarely beginning to appear as the flowers fade)
 7 Stigmas punctiform
  8 Corm with underground stolons **7. boissieri**
  8 Corm not stoloniferous
   9 Tunic coriaceous; leaves (4–)6–8(–10), not more than 4 mm wide, linear to narrowly linear **8. parlatoris**
   9 Tunic membranous to subcoriaceous; leaves 2–5, up to 17 mm wide, linear-lanceolate or ligulate
    10 Leaves 3–5; 8–20 cm; flowers 1–4; perianth-segments 25–40 × 3–10 mm **9. arenarium**
    10 Leaves 2(–3), 8–12(–15) cm; flowers 1(–3); perianth-segments 17–30 × 4–6(–10) mm **10. alpinum**
 7 Stigmas decurrent
  11 Flowers not tessellated
   12 Flowers deep crimson-purple, occasionally paler; leaves glaucous, ciliate **19. turcicum**
   12 Flowers pink to purplish or white; leaves neither glaucous nor ciliate
    13 Anthers black **20. callicymbium**

[2] By C. D. Brickell.

13 Anthers yellow
14 Stigma decurrent for not more than 0·5 mm
15 Tunic ±coriaceous; flowers (1–)2–6; leaves ligulate **13. umbrosum**
15 Tunic membranous; flowers 1–2(3); leaves linear-lanceolate to lanceolate, tapering towards the apex **11. corsicum**
14 Stigma decurrent for at least 1 mm
16 Leaves 2(–3); perianth-segments 10–20(–30) mm **12. micranthum**
16 Leaves 3 or more; perianth-segments usually at least 30 mm **(14–18). autumnale** group
11 Flowers ±tessellated
17 Pollen green; leaves up to 35 cm × 140 mm, strongly plicate, ovate to elliptic-ovate **21. macrophyllum**
17 Pollen yellow; leaves usually not more than 30 cm × 60 mm, not plicate
18 Perianth infundibuliform; segments tapering gradually to apex and often twisted **22. variegatum**
18 Perianth narrowly campanulate to broadly campanulate; segments shortly acute to rounded at apex, not or slightly twisted
19 Leaves glaucous, ciliate; flowers obscurely tessellated; deep crimson-purple, occasionally paler **19. turcicum**
19 Leaves neither glaucous nor ciliate; flowers obscurely or strongly tessellated; pink to purplish or white
20 Flowers ±strongly tessellated **23. bivonae**
20 Flowers narrowly campanulate, lightly tessellated **(14–18). autumnale** group

1. C. triphyllum G. Kunze, *Flora* (*Regensb.*) **29**: 755 (1846) (incl. *C. catacuzenium* Heldr., *C. clementei* Graells, *C. bieberstеinii* Rouy, *C. bulbocodioides* Bieb., non Brot.). Corm *c.* 2 × 1–1·5 cm, oblong; tunic reddish-brown, membranous, evanescent, with a short neck. Leaves 3(–4), 3–4(–7) cm at anthesis, 12–15 cm × 4–8(–10) mm at maturity, lanceolate, obtuse to subacute; margins scabrid or glabrous. Flowers 1–3(–6); perianth-segments 15–30 × 6–12 mm, purplish-pink, elliptical, obtuse, occasionally with filiform auricles at the base. Filaments 5–7 mm, glabrous; anthers 2·5 mm, purplish-black or purplish-green; pollen yellow. Styles straight; stigmas punctiform. Capsule up to 30 mm, oblong. Flowering (December-)February to March (–May) $2n = 20, 21$. *Open, stony habitats. S.E. Europe, from S.E. Greece to Krym; C. & S. Spain.* Bu Gr Hs Rm Rs (W, K) Tu.

C. szovitsii Fischer & C. A. Meyer, *Ind. Sem. Horti Petrop.* **1835**: 24 (1835), from S.W. Asia, is known from one locality in European Turkey. It is like **1** but with a coriaceous tunic and 2 (rarely 3) leaves per corm.

C. davidovii Stefanov, *Bull. Soc. Bot. Bulg.* **1**: 69 (1926) (*Merendera caucasica* Davidov), described from E. Bulgaria, is poorly known; it is said to be like *C. szovitsii* but has narrower perianth-segments with filiform auricles at the base. **C. diampolis** Delip. & Češchm. ex Kuzmanov & Kožuharov in Jordanov, *Fl. Rep. Pop. Bulg.* **2**: 402 (1964), also from E. Bulgaria, has auricles at the base of the perianth-segments, and further differs from *C. szovitsii* in its robust habit and more numerous, wider leaves; it has $2n = 18$.

2. C. burttii Meikle, *Bot. Mag.* **81**: t.735 (1976). Like **1** but corms with thick, coriaceous, persistent tunics; leaves ciliate; filaments hairy. *Turkey-in-Europe* (*W. end of Gelibolu peninsula*). Tu. (*N.W. Anatolia.*)

3. C. hungaricum Janka, *Term. Füz.* **10**: 75 (1886) (incl. *C. doerfleri* Halácsy). Corm 2–3 × 1–2 cm, oblong; tunic dark brown, papery to subcoriaceous, with a short neck. Leaves 2(–3), 3–6(–10) cm at anthesis, up to 20 cm × 10–20 mm at maturity, linear-lanceolate, acute; margins retrorsely ciliate; dorsal surface sometimes entirely or partially covered with short hairs. Flowers (1–)3–6(–8); perianth-segments up to 30 × 6–7 mm, purplish-pink, pink or white, elliptic-lanceolate or narrowly elliptical, acute. Filaments up to 10 mm; anthers 2–3·5 mm, purplish-black; pollen yellow or orange. Styles straight or slightly curved at apex; stigmas punctiform. Capsule *c.* 10 mm, subglobose. Flowering December to April. $2n = 54$ *Stony places and dry hillsides. From Hungary to Macedonia.* Al Bu Gr Hu Ju.

4. C. cupanii Guss., *Fl. Sic. Prodr.* **1**: 452–3 (1827). Corm 1–2 × 1–1·5 cm, ovoid; tunic dark brown, coriaceous, with a short neck. Leaves 2(–3), up to 8(–10) cm at anthesis, up to 15 cm × 10–18 mm (rarely only 7 cm × 2–3 mm) at maturity, linear to linear-lanceolate, obtuse to acute, glabrous, rarely ciliate at base. Flowers 1–5(–12); perianth-segments up to 25 × 3–5 mm, purplish-pink, narrowly elliptical, obtuse to acute. Filaments up to 12 mm; anthers 2–3 mm, purplish-black; pollen yellow. Styles straight; stigmas punctiform. Capsule *c.* 15 mm, oblong. Flowering September to December. $2n = 54$. *Rocky ground. Mediterranean region, westwards to S.E. France; local.* ?Al ?Cr Ga Gr It Sa Si.

C. cousturieri W. Greuter, *Candollea* **22**: 247 (1967), described from two islands off the S. coast of Kriti, is doubtfully distinct, apparently differing only in the longitudinally purple-striped perianth-segments.

5. C. pusillum Sieber, *Flora* (*Regensb.*) **5**: 248 (1822). Corm up to 2 × 2 cm, subglobose to ovoid; tunic dark brown, membranous to subcoriaceous, with long neck. Leaves 3–6(–8), up to 1–3(–4) cm at anthesis, up to 14 cm × 1–2(–5) mm at maturity, filiform to narrowly linear, obtuse to acute, glabrous, sometimes ciliate. Flowers 1–4(5); perianth-segments 10–20 × 1·5–2(–3) mm, pinkish-lilac to white, linear-elliptical, obtuse. Filaments up to 8 mm, glabrous or sometimes hairy at the base; anthers 1·5–3(–4·5) mm, purplish-black to grey or pale brown, less often yellow; pollen yellow. Styles straight; stigmas punctiform. Capsule *c.* 3 mm. Flowering October to November. *Rocky ground. C. & S. Greece and S. Aegean region.* Cr Gr.

Anther-colour varies considerably in different populations, those from Kriti being grey (occasionally yellow), those from the Peloponnisos purplish-black, and those from the Kikladhes pale brown. Plants from the mountains of Kriti, with slightly larger anthers and with the leaves frequently developing after anthesis, have been distinguished as **C. cretense** W. Greuter, *Candollea* **22**: 246 (1967). The extent to which the leaves are developed at anthesis varies considerably in **5**, and plants from high altitudes can change in respect of this character in cultivation in the lowlands. **C. peloponnesiacum** Rech. fil. & P. H. Davis, *Österr. Bot. Zeitschr.* **95**: 427 (1949), described from S. Greece (Peloponnisos), has affinities with **5** and is characterized by the yellow anthers and bright purplish-pink, lanceolate perianth-segments up to 30 × 9 mm. It is also closely related to **C. stevenii** Kunth, *Enum. Pl.* **4**: 144 (1843), from S.W. Asia. The relationships of this group of plants are uncertain and in need of critical study.

6. C. psaridis Heldr. ex Halacsy, *Consp. Fl. Graec.* **3**: 274 (1904). Corm with underground stolons; tunic reddish-brown, membranous or papery. Leaves 2(–3), up to 9 cm at anthesis, 7–15 cm × 3–15 mm at maturity, linear-lanceolate to linear, obtuse to acute, sometimes ciliate. Flowers 1–6; perianth-segments 12–27 × 3–6 mm, pink-purple, linear to oblong-elliptical, obtuse to acute. Filaments up to 8 mm; anthers 2 mm, purplish-black; pollen yellow. Styles straight; stigmas punctiform. Capsule up to 15 mm, conic-oblong. Flowering September to December. *Stony hillsides and olive-groves.* ● *S. Greece* (*Peloponnisos*). Gr.

7. C. boissieri Orph., *Atti Congr. Int. Bot. Firenze* **1874**: 31 (1876). Corm with underground stolons; tunic reddish-brown, papery. Leaves 2(–3), 6–22 cm × 2–12 mm at maturity, developing after anthesis, linear, obtuse, the dorsal surface occasionally pubescent at the base; margin sometimes ciliate. Flowers 1(–3); perianth-segments 20–35(–45) × 5–11 mm, bright lilac-pink, oblong-elliptical to linear-elliptical, obtuse to acute. Filaments up to 18 mm; anthers 4–8 mm, yellow; pollen yellow. Styles straight or slightly curved; stigmas punctiform. Capsule 15–20 mm, oblong. Flowering September to December. *Stony ground and scrub.* ● *S. Greece.* Gr.

C. pinatziorum Rech. fil., *Bot. Jahrb.* **80**: 433 (1961), described from S.C. Greece (Evvoia), is doubtfully distinct from **7** and is said to differ only in its smaller, more slender flowers and slightly shorter anthers.

8. C. parlatoris Orph., *Atti Congr. Int. Bot. Firenze* **1874**: 32 (1876). Corm 2–4 × 1·5–2 cm, ovoid; tunic dark brown, coriaceous, with a long neck. Leaves (4–)6–8(–10), 7–10 cm × 1–4 mm, developing after anthesis, linear to narrowly linear, acute, glabrous. Flowers 1(–2); perianth-segments 8–25(–50) × 4–8(–12) mm, pinkish-purple to pale lilac, narrowly elliptical, obtuse. Filaments 10–25 mm; anthers 4–6 mm, yellow; pollen yellow. Styles straight; stigmas punctiform. Capsule 8–10 mm, ovoid-oblong. Flowering August to November. ● *S. Greece* (*Peloponnisos*). Gr.

9. C. arenarium Waldst. & Kit., *Pl. Rar. Hung.* **2**: 195 (1805). Corm 2–2·5 × 1–1·5 cm, ovoid; tunic reddish- to dark brown, membranous or subcoriaceous, with a long neck. Leaves 3–5, 8–20 cm × 4–17 mm, developing after anthesis, ligulate to linear-lanceolate, obtuse, glabrous. Flowers 1–4; perianth-segments 25–40 × 3–10 mm, purplish-pink, oblong to narrowly elliptical, obtuse to acute. Filaments 4–10(–16) mm; anthers 4–6 mm, yellow; pollen yellow. Styles straight; stigmas punctiform. Capsule 15–20(–30) mm, oblong-ovoid. Flowering September to October. $2n = 36$, 54. *Sandy fields.* ● *E.C. Europe.* Cz Hu Ju.

10. C. alpinum DC. in Lam. & DC., *Fl. Fr.* ed. 3, **3**: 195 (1805). Corm 1–2·5 × 1–1·5 cm, subglobose; tunic membranous or subcoriaceous, reddish-brown, with a long neck. Leaves 2(–3), 8–12(–15) cm × 2–10(–14) mm, developing after anthesis, ligulate to linear-lanceolate, obtuse to subacute, glabrous. Flowers 1(–3); perianth-segments 17–30 × 4–6(–10) mm, purplish-pink (rarely white), oblong to narrowly elliptical, obtuse. Filaments 2–6(–9) mm; anthers 2–3 mm, yellow; pollen yellow. Styles straight; stigmas punctiform. Capsule 15–20 mm, oblong-elliptical. Flowering August to September. $2n = 54$, 56. *Mountain meadows. S. Alps, Appennini, mountains of Corse, Sardegna and Sicilia.* Co Ga He It Sa Si.

C. pieperanum Markgraf, *Denkschr. Akad. Wiss. Math.-Nat. Kl.* (*Wien*) 328 (1931), described from N.C. Albania (Deja), is like **10** but has decurrent stigmas and is twice as large in all its parts.

Hybrids between **10** and **14** have been reported from the French Alps with chromosome counts of $2n = 46$, 47. They are said to be intermediate in characters of perianth-segments, anthers and stigmas.

11. C. corsicum Baker, *Jour. Linn. Soc. London* (*Bot.*) **17**: 431 (1879). Corm up to 3 × 2 cm, ovoid to subglobose; tunic brown, membranous, with a long neck. Leaves 3–4, up to 8 cm × 3–9(–18) mm, developing after anthesis, linear-lanceolate, obtuse, glabrous. Flowers 1–2(–3); perianth-segments 20–27 (–40) × 2–5 mm, pink to lilac-pink, linear to oblong-elliptical, obtuse. Filaments 2–4(–8) mm; anthers 2–5 mm, yellow; pollen yellow. Styles straight, shortly curved at the apex; stigma shortly decurrent. Capsule *c.* 30 mm, oblong. Flowering September. ● *S. Corse.* Co ?Sa.

12. C. micranthum Boiss., *Fl. Or.* **5**: 162 (1882). Corm up to 1·5 × 1 cm, ovoid to subglobose; tunic reddish-brown, membranous, with a short neck. Leaves (2)3, 10–15(–20) cm × 3–10 mm, developing after anthesis, linear, obtuse, glabrous. Flowers 1–2 (rarely more); perianth-segments 10–20(–30) × 3–4(–10) mm, pale pink to white, obtuse. Filaments up to 9 mm; anthers 3–4 mm, yellow; pollen yellow. Styles straight, shortly curved at the apex; stigmas decurrent. Capsule *c.* 25 mm, ovoid-oblong. Flowering September to October. *Dry, rocky places. Turkey-in-Europe* (*N. of Istanbul*). Tu.

Two poorly known taxa perhaps belong here: **C. macedonicum** Košanin, *Glas Srpske Kralj. Akad.* **85**: 232 (1911), described from calcareous alpine pastures over 2000 m. in N.W. Macedonia (Jakupica), is said to flower in June; it has $2n = 54$. Material of flowering specimens has sometimes been gathered with the previous season's foliage and fruits, which may account for some authors relating it to *C. davidovii* Stefanov and to *C. szovitsii* Fischer & C. A. Meyer from the Caucasus, which flower with leaves partially developed. *C. macedonicum* clearly lacks foliage at anthesis, and differs from **12** in its punctiform stigma and wider, sometimes oblanceolate leaves. **C. borisii** Stefanov, *Sborn. Bălg. Akad. Nauk.* **22**: 63 (1926), described from calcareous soils in S. Bulgaria (Rodopi Pl.), flowers in August and differs from **12** only in the slightly larger flowers and proportionately wider, more or less glaucous leaves. Further collections are required before their status can be determined.

13. C. umbrosum Steven, *Nouv. Mém. Soc. Nat. Moscou* **1**: 264 (1829). Corm 1·5–2·5 × 1–1·5 cm, ovoid to subglobose; tunic dark brown, subcoriaceous to coriaceous, with a long neck. Leaves 3–5, 8–12 cm × 13–20 mm, developing after anthesis, ligulate, obtuse, glabrous. Flowers (1–)2–6; perianth-segments 16–30 × 2–6 mm, linear-elliptical, obtuse. Filaments up to 6 mm: anthers 2–3 mm, yellow; pollen yellow. Styles straight, shortly curved at apex; stigmas shortly decurrent. Capsule up to 20 mm, elliptic-oblong. Flowering August to September. *Woods and wet meadows. Krym.* Rs (K). (*Caucasus, Anatolia.*)

C. laetum Steven, *op. cit.* 262 (1829), from S.E. Russia, differs from **13** chiefly in its shortly decurrent stigmas, but in the size of its perianth-segments and in its leaf-characters it approaches **14**. **C. fominii** Bordzil., *Feddes Repert.* **40**: 373 (1936), from S.W. Ukraine and S.E. Romania, is said to differ from **13** in its oblong to oblong-ovoid corms and slightly larger flowers. The status of both these taxa requires further investigation.

(14–18). C. autumnale group. Corm 2·5–4(–6) × 2–3(–4) cm, ovoid to subglobose, tunic dark brown, coriaceous or membranous, with a long neck. Leaves developing after anthesis, obtuse to subacute, glabrous. Flowers 1–6(–10); perianth-segments obtuse to acute, pinkish- to lilac-purple, rarely white, sometimes tessellated, narrowly elliptical to oblong-elliptical. Filaments 10–16 mm; anthers 5–8 mm; pollen yellow. Styles curved at apex; stigmas long-decurrent. Capsule (20–)30–60 mm, oblong.

A confusing group, poorly understood and in need of critical study over the whole range.

1 Anthers blackish-purple to pale purplish-pink, rarely yellow; flowers lightly tessellated **16. lusitanum**

1 Anthers yellow; flowers not or very obscurely tessellated

2 Leaves linear-lanceolate to broadly lanceolate, erect or erecto-patent
3 Leaves 3–4, 14–26 cm × 10–30(–40) mm, 6–12 times as long as wide, linear-lanceolate **15. neapolitanum**
3 Leaves (3–)4(–5), up to 35 cm × 20–50(–70) mm, *c.* 5 times as long as wide, broadly lanceolate **14. autumnale**
2 Leaves oblong-elliptical or ligulate, arcuate or patent
4 Leaves not more than 15 cm × 10–20 mm, frequently undulate, appressed to the ground; corm-tunic subcoriaceous **17. lingulatum**
4 Leaves up to 23 cm × 55 mm, not undulate, arcuate; corm-tunic papery **18. parnassicum**

14. C. autumnale L., *Sp. Pl.* 341 (1753) (incl. *C. haynaldii* Heuffel). Leaves (3–)4(–5), 15–35 cm × 20–50(–70) mm, broadly lanceolate. Perianth-segments usually 40–60 × 10–15 mm, rarely smaller. Anthers yellow. Flowering August to October. $2n = 38$. *S., W. & C. Europe, extending eastwards to White Russia and N.W. Ukraine.* Al Au Be Br Bu Cz Ga Ge Gr *Hb He Ho Hs Hu It Ju Lu Po Rm Rs (B, C, W) [Da Su].

C. rhodopaeum Kovatschev, *Nov. Syst. Pl. Vasc.* (*Leningrad*) **1965**: 87 (1965), from S. Bulgaria (C. Rodopi Pl.), appears from the description to be closely related to **14**, although compared by Kovatschev to *C. borisii* Stefanov (vide **12**).

15. C. neapolitanum (Ten.) Ten., *Fl. Neap. Prodr. App. Quinta* 11 (1826) (incl. *C. longifolium* Cast., *C. kochii* Parl.). Leaves (2–)3–4, 14–26 cm × 10–30(–40) mm, linear-lanceolate. Perianth-segments usually 30–45 × 7–12 mm. Anthers yellow. Flowering August to September (–October). $2n = 140$. *Mediterranean region, Portugal.* Co Ga Gr Hs It Ju Lu Sa.

16. C. lusitanum Brot., *Phyt. Lusit.* **2**: 211 (1827). Leaves 4–5, 18–35 cm × 20–40 mm, linear-lanceolate. Perianth-segments 40–60 × 6–14 mm. Anthers blackish-purple to pale purplish-pink or yellow. Flowering September to November. $2n = 106$. *S.W. Europe, extending to C. Italy.* ?Bl Hs It Lu.

17. C. lingulatum Boiss. & Spruner in Boiss., *Diagn. Pl. Or. Nov.* **1(5)**: 66 (1844). Corm 2–5(–6) × 1·5–4 cm, ovoid-oblong; tunic dark brown, coriaceous, with a long neck. Leaves 4–6, up to 15 cm × 10–20 mm, developing after anthesis, oblong-lanceolate to ligulate, undulate, appressed to the ground, obtuse to subacute, glabrous. Flowers (1-)2–5(–10); perianth-segments 20–40 × 3–10(–15) mm, pinkish-lilac, (? sometimes obscurely tessellated), oblong or linear-elliptical, obtuse to subacute. Filaments up to 11 mm; anthers 5–8 mm, yellow (rarely purplish); pollen yellow. Styles straight; stigmas long-decurrent. Capsule up to 25 mm, ovoid-oblong. Flowering September to October (–November). *Cultivated ground and open, stony habitats. From C. Albania to S.E. Greece.* Al Gr.

18. C. parnassicum Sart., Orph. & Heldr. ex Boiss., *op. cit.* **3(4)**: 122 (1859). Like **17** but tunics thinner, membranous; leaves up to 23 cm × 55 mm, not undulate at the margin, arcuate; flowers usually fewer and larger. ● *C. & S. Greece.* Gr.

19. C. turcicum Janka, *Österr. Bot. Zeitschr.* **23**: 242 (1873). Corm up to 3 × 2 cm, ovoid; tunic dark brown, coriaceous, with a long neck. Leaves 5–9, up to 15 cm × 6–25 mm, developing after anthesis, linear-lanceolate, obtuse to subacute, glaucous; margins somewhat undulate, ciliate (sometimes obscurely so). Flowers 3–8; perianth-segments 30–40 × 4–13 mm, deep crimson-purple, occasionally paler, oblong to linear-elliptical, obtuse to subacute. Filaments up to 15 mm; anthers 4–7 mm, yellow (occasionally purplish); pollen yellow. Styles straight, slightly curved at apex; stigmas long-decurrent. Capsule 20–30 mm, oblong. Flowering August to October. *Meadows. E. part of Balkan peninsula.* Bu Gr Ju Tu.

C. drenowskii Degen & Rech. fil. ex Kitanov, *Bull. Inst. Bot.* (*Sofia*) **1**: 378 (1950), is apparently based on flowers and foliage from different species growing together in C. Bulgaria. It is compared with **19** and **14** by Kitanov.

20. C. callicymbium Stearn & Stefanov, *Jour. Bot.* (*London*) **72**: 343 (1934). Corm 3–4 × 3–3·5 cm, subglobose; tunic dark brown, subcoriaceous, with a long neck. Leaves 3–5, 25–40 cm × 10–50 mm, developing after anthesis, linear or narrowly linear. Flowers 2–4; perianth-segments up to 35 × 8–13 mm, purplish-lilac, slightly darker at base, oblanceolate to narrowly elliptical, obtuse. Filaments up to 12 mm; anthers 4·5–6 mm, black; pollen yellow. Styles straight, curved at the apex; stigmas long-decurrent. Capsule 20–30 mm, narrowly ovoid. Flowering September. ● *S.W. Bulgaria.* Bu ?Gr.

Described from garden-grown specimens originating from S.W. Bulgaria and possibly also from E. Greece; it has never been seen in the wild.

21. C. macrophyllum B. L. Burtt, *Kew Bull.* **5**: 433 (1951). Corm 5–6 × 4–5 cm; tunic dark brown, coriaceous, with a long neck. Leaves 3–4, up to 35 cm × 140 mm, developing after anthesis, strongly plicate, ovate to elliptic-ovate, acute to acuminate, glabrous. Flowers 1–4, infundibuliform; perianth-segments up to 45 × 22 mm, tessellated, lilac-purple, often paler or white at the base, oblong-elliptical, acute. Filaments up to 20 mm; anthers 8–10 mm, purple; pollen green. Styles shortly curved at apex; stigmas decurrent. Capsule up to 50 mm, ovoid. Flowering September to October. *Kriti.* Cr. (*Anatolia.*)

22. C. variegatum L., *Sp. Pl.* 342 (1753). Corm 2–2·5 × 2 cm, ovoid; tunic dark brown, coriaceous, with a long neck. Leaves 3–4, 10–15 cm × 7–18 mm, developing after anthesis, patent, linear-lanceolate, obtuse or subacute, glabrous; margin cartilaginous, undulate. Flowers 1–3; perianth-segments 45–70 × 8–15 mm, strongly tessellated, deep red or violet-purple, sometimes paler or white at the base, lanceolate-elliptical, acute. Filaments 20–35 mm; anthers 6–8 mm, purplish-black; pollen yellow. Styles curved at the apex; stigmas decurrent. Capsule *c.* 20 mm, oblong. Flowering September to December. *S. Greece.* Gr. (*Anatolia.*)

C. agrippinum hort. ex Baker, *Jour. Linn. Soc. London* (*Bot.*) **17**: 425 (1879), is possibly a hybrid between **22** and **14** stated to be naturalized in some places in Britain. It resembles **22**, but is distinguished by its upright leaves with only slightly undulate margins, subobtuse narrower-based perianth-segments and less pronounced tessellation.

23. C. bivonae Guss., *Cat. Pl. Boccad.* 72 (1821) (incl. *C. visianii* Parl., *C. latifolium* Sibth. & Sm.). Corm 2·5–5 × 2·5–4 cm, ovoid; tunic dark brown, coriaceous or subcoriaceous, with a long neck. Leaves (4–)5–9, up to 25 cm × 8–13 mm, developing after anthesis, linear-lanceolate to broadly lanceolate, subacute to obtuse, glabrous. Flowers 1–6; perianth-segments (40–)55–65 × 8–20 mm, strongly tessellated, pale to deep pinkish-purple, sometimes white at the base, oblong to broadly elliptical, obtuse to acute. Filaments 10–30 mm; anthers (5–)7–8(–11) mm, purplish-black or -brown; pollen yellow. Styles curved at the apex; stigmas long-decurrent. Capsule *c.* 40 mm, oblong. Flowering August to October (–November). $2n = 36, 54, 90$. *C. Mediterranean region and S. part of Balkan peninsula.* Bu Gr It Ju Sa Si Tu.

A species requiring critical study.

Considerable differences in size and shape of perianth-segments, anther-size and leaf-characters have been attributed to taxa included here under **23** on present evidence. The situation has been confused by the association of foliage of one species with flowers of another in collections from Greece, where **23** and **17** may grow together.

17. Bulbocodium L.[1]

Perennials with a corm. Leaves linear to lanceolate. Perianth petaloid, deeply 6-partite, free from the base but with long, narrow claws forming a tube below, and joined by teeth or auricles at the base of the limb. Stamens inserted at the base of the limb; filaments slender; anthers versatile. Ovary 3-locular, sessile; ovules many. Style undivided at base, 3-fid at apex. Capsule oblong, 3-valved, opening only at the apex. Seeds globose.

Literature: As for *Colchicum*.

Flowers 4–8·5 cm — **1. vernum**
Flowers 2·5–3 cm — **2. versicolor**

1. B. vernum L., *Sp. Pl.* 294 (1753). Corm up to 3 cm in diameter. Plant 5–20 cm. Leaves 3–4, up to 15 × 1·5 cm, with sheathing base and patent limb, linear to linear-lanceolate, obtuse, appearing in spring at the same time as the flowers. Flowers 1(–3), 4–8·5 cm, pink, rarely white. Perianth-segments linear-lanceolate, acute, each with a pair of acute teeth at base of limb. Capsule 1·5–2 cm. *Mountain meadows.* ● *Pyrenees, S.W. & W.C. Alps; one station in S. Austria.* Au Ga He Hs It.

2. B. versicolor (Ker-Gawler) Sprengel, *Syst. Veg.* **2**: 40 (1825) (*B. ruthenicum* Bunge). Like **1** but corm 1–1·5 cm in diameter; leaves 0·5–0·8(–1) cm wide; flowers 2·5–3 cm; perianth-segments with a pair of obtuse auricles at base of limb. *Dry grassland. S. part of U.S.S.R., extending very locally westwards to E. Hungary and C. Italy.* Hu It Ju Rm Rs (C, W, E).

18. Merendera Ramond[2]

Perennial herbs. Corm with thick, black membranous tunic. Leaves all basal. Lower part of leaves and flowers covered by a membranous cylindrical sheath. Flowers solitary or in fascicles, terminal, subsessile, pinkish-purple. Perianth-segments free, with a long, narrow claw and shorter, wider, narrowly elliptical to narrowly obovate limb. Stamens inserted at the base of the limb. Styles free. Capsule oblong, septicidal with 3 apiculate valves.

Literature: As for *Colchicum*.

1 Anthers not more than 5 mm, ¼–½ as long as filaments
 2 Limb of perianth-segments with 2 basal appendages; plant with underground stolons — **3. sobolifera**
 2 Limb of perianth-segments without basal appendages; plant without stolons.
  3 Anthers 1·5–2·5(–3) mm, violet — **1. attica**
  3 Anthers 3–4·5(–5) mm, yellow — **2. androcymbioides**
1 Anthers more than 5 mm, usually longer than filaments
 4 Leaves more than 3 mm wide, usually appearing after the flowers; anthers (5·5–)8–12(–17) mm — **4. pyrenaica**
 4 Leaves not more than 3 mm wide, appearing at about the same time as the flowers; anthers 5·5–8(–10) mm — **5. filifolia**

[1] By D. H. Valentine. [2] By B. Valdés. [3] By V. H. Heywood.

1. M. attica (Spruner ex Tommasini) Boiss. & Spruner in Boiss., *Diagn. Pl. Or. Nov.* **1(5)**: 67 (1844) (*M. rhodopaea* Velen.). Corm 15–20(–30) × 10–15(–25) mm, without stolons. Leaves up to 17 cm × 3–5(–8) mm, appearing with the flowers; margin scabrid. Flowers (1–)2–3(–5). Limb of perianth-segments (12–)15–25(–45) × 2–4 mm, obtuse, expanded at base. Anthers 1·5–3 mm, ¼–½ as long as filaments, violet, dorsifixed, versatile. Capsule 12–20 mm, oblong, shortly pedicellate, with styles and claws of perianth-segments long-persistent. Seeds 2–2·2 × 1·6–1·8 mm, oblong, with a more or less triangular beak. Autumn-flowering. *Dry places. S. Bulgaria, S. Greece.* Bu Gr.

2. M. androcymbioides Valdés, *Lagascalia* **7**: 161 (1978). Like **1** but leaves 6–12 mm wide, with a wide, cartilaginous, scabrid margin; flowers 1–2; limb of perianth-segments 1·5–2 mm wide; anthers 3–4·5(–5) mm, yellow, not versatile. Spring-flowering. *Dry places.* ● *S.W. Spain (Serranía de Ronda).* Hs.

3. M. sobolifera C. A. Meyer in Fischer & C. A. Meyer, *Ind. Sem. Hort. Petrop.* **1**: 34 (1835). Corm 7–15 × 5–10 mm, with underground stolons. Leaves up to 15 cm × 3–6(–8) mm, appearing with the flowers, sulcate; margin smooth. Flowers 1–2. Limb of perianth-segments 20–40 × 2·5–5(–8) mm, obtuse, the base sagittate with 2 descending linear appendages. Anthers 1·5–3·5 mm, ½–½ as long as filaments, violet, dorsifixed, versatile. Capsule 15–20 mm, oblong. Seeds subglobose. Spring-flowering. $2n = 54$. *E. & C. parts of Balkan peninsula; E. Romania.* Bu ?Gr Ju Rm Tu.

4. M. pyrenaica (Pourret) P. Fourn., *Quatre Fl. Fr.* 157 (1935) (*M. montana* Lange, *M. bulbocodium* Ramond). Corm 20–25(–30) × 15–20(–30) mm. Leaves up to 22 cm × (3·5–)4–8(–10) mm, usually appearing after the flowers, plicate. Flowers solitary, rarely 2. Limb of perianth-segments (25–)30–45(–65) × (3–)4–6·5(–11) mm, obtuse, rarely emarginate. Anthers (5·5–)8–12(–17) mm, longer than filaments, yellow, basifixed. Capsule (10–)15–20(–25) mm, oblong. Seeds *c.* 2 × 1·5 mm, globose-pyriform, apiculate. Autumn-flowering. $2n = 60$, 54 + 0–6B. *Dry places.* ● *Iberian peninsula, C. Pyrenees.* Ga Hs Lu.

5. M. filifolia Camb., *Enum. Pl. Balear.* 147 (1827). Corm 15–20 × 10–15(–20) mm. Leaves up to 15 cm × (1–)1·5–2·5(–3) mm, longer than fruiting pedicel, appearing at about the same time as the flowers, flat. Flowers solitary. Perianth-segments (20–)25–40 × (2–)2·5–5(–8) mm, obtuse. Anthers (5·5–)6–8(–10) mm, longer than to somewhat shorter than filaments, yellow, basifixed. Capsule 8–12 mm, oblong. Seeds 1·2–1·5(–1·7) × 1·2–1·5 mm, globose, slightly apiculate. Autumn-flowering. $2n = 54$. *Sandy soils. S.W. Europe.* Bl Ga Hs Lu.

19. Lloydia Salisb. ex Reichenb.[3]

Glabrous, bulbous perennials. Stems leafy. Flowers solitary or paired, rarely 3, terminal. Perianth campanulate-infundibuliform, the segments obovate, with a nectariferous pit delimited by a transverse fold above the base. Stamens 6, inserted at the base of the perianth-segments, included. Style shorter than stamens; stigma entire. Fruit a 3-ribbed capsule, dehiscing apically. Seeds numerous.

1. L. serotina (L.) Reichenb., *Fl. Germ. Excurs.* 102 (1830). Bulb elongate, ovoid, with a persistent membranous tunic, enclosed in remains of old leaves, with filiform stolons. Stem 5–15(–40) cm. Basal leaves usually 2, 7–20(–30) cm, filiform, usually exceeding the stem; cauline leaves 2–4(–5), linear to

linear-lanceolate, the lower 12–25 × 1–2 mm, the upper subtending the pedicels, bract-like, shorter and wider. Pedicels 20–25 mm. Perianth-segments 9–15 mm, white with reddish or purplish veins, obtuse or rounded at the apex. Capsule globose. $2n=24$. *Tundra, stony slopes, rock-ledges and alpine meadows. Alps and Carpathians; N. Ural and arctic Russia; isolated stations in N. Wales and S.W. Bulgaria.* Au Br Bu Cz Ga Ge He It Ju Po Rm Rs (N, ?C, W).

20. Gagea Salisb.[1]

Bulbous perennials. Stems erect, solitary, unbranched, leafy. Flowers solitary or in a few-flowered umbel or raceme. Perianth cylindrical-campanulate to rotate, of 6 free, usually yellow segments. Stamens 6, inserted at the base of the perianth-segments, included; anthers basifixed. Fruit a loculicidal capsule with many seeds.

Basal leaves arise directly from the bulb; cauline leaves are intended to include those subtending the first branch of the inflorescence; leaves above the first branch are considered as bracts. It is important to sample several specimens in assessing the character-state of leaves. The biseriate perianth-segments frequently differ somewhat in size; descriptions refer to all six unless otherwise stated; where no colour is mentioned they are yellow inside and greenish-yellow outside. Bulbils are occasionally present in the leaf-axils of most taxa but are stated as present only for those in which they are a relatively constant feature.

Literature: A. Terracciano, *Revisione monografica delle Specie di* Gagea *della Flora spagnola.* Palermo. 1905. W. Greuter, *Israel Jour. Bot.* **19**: 155–160 (1970).

1 Bulbs (2–)3, one with a tunic **1. pratensis**
1 Bulb 1, or 2 in a common tunic
2 Bulb 1
3 Basal leaves 2 or more
4 Perianth-segments yellow; bulbils present **8. bulbifera**
4 Perianth-segments white, with purple stripes; bulbils absent
5 Anthers obtuse; flowers usually 3–5 **9. graeca**
5 Anthers acute; flowers usually solitary **10. trinervia**
3 Basal leaf solitary
6 Seeds compressed; perianth-segments long-acuminate; bulb usually with a fibrous collar **(5–7). reticulata group**
6 Seeds subglobose; perianth-segments ± obtuse; bulb without a fibrous collar
7 Stem usually 3–7 cm; basal leaf 1·5–3 mm wide, linear; perianth-segments *c.* 13 mm **2. pusilla**
7 Stem usually 10–30 cm; basal leaf 7–15 mm wide, linear-lanceolate; perianth-segments 15–18 mm **3. lutea**
2 Bulbs 2 in a common tunic
8 Basal leaf solitary; perianth-segments acuminate **4. minima**
8 Basal leaves usually 2
9 Cauline leaf 1, distinct from the bracts **11. spathacea**
9 Cauline leaves 2, larger than but similar to the bracts
10 Lower cauline leaves opposite
11 Stems glabrous above **12. fistulosa**
11 Stems ± hairy above **(13–15). arvensis group**
10 Lower cauline leaves alternate, rarely subopposite or solitary
12 Pedicels glabrous **(16–20). foliosa group**
12 Pedicels hairy
13 Bulb usually with numerous recurved fibrous roots; plant usually 8–20 cm **(16–20). foliosa group**
13 Bulb with few or no recurved fibrous roots; plant usually 2–8 cm **(21–23). bohemica group**

1. G. pratensis (Pers.) Dumort., *Fl. Belg.* 140 (1827) (*G. stenopetala* Reichenb.; incl. *G. paczoskii* (Zapał.) Grossh.). Bulbs (2–)3, unequal. Stem glabrous. Basal leaf solitary, broadly linear, flat; cauline 2, opposite, lanceolate, ciliate. Flowers (1–)2–6; pedicels glabrous. Perianth-segments (10–)15–20 mm, oblong-linear, subacute to obtuse. Capsule ovoid; seeds subglobose. $2n=36, 48, 60$. *Grassland and disturbed ground. Europe northwards to c.* 61°*N. in Sweden, but absent from most of the islands and much of the west and south-east.* Au Bu Cz Da Ga Ge Gr He Ho Hs Hu It Ju Po Rm Rs (B, C, W, K) Si Su [Fe].

Plants from Krym with keeled basal leaf and ovate-lanceolate perianth-segments have been called **G. transversalis** Steven, *Bull. Soc. Nat. Moscou* **30(3)**: 81 (1857), and similar plants with $2n=48$ occur in Czechoslovakia; they may merit subspecific status.

2. G. pusilla (F. W. Schmidt) Schultes & Schultes fil., *Syst. Veg.* **7**: 543 (1829). Bulb solitary, rarely 2, without a collar. Stem glabrous. Basal leaf solitary, linear, somewhat canaliculate; cauline 2–3, opposite, lanceolate, usually glabrous. Flowers 1–3(–6); pedicels glabrous. Perianth-segments *c.* 13 mm, lanceolate, subobtuse. Capsule ovoid-globose. Seeds subglobose. $2n=24$. *Dry grassland and stony ground. C. & S.E. Europe.* Al Au Bu Cz Gr Hu ?It Ju Rm Rs (C, W, E) ?Tu.

G. germainae Grossh., *Pl. Or. Exsicc.* **1–8**: 10 (1924), from Caucasus and Iran, has been recorded from Krym. It is like **2**, but with subspathulate, often orange-tinged perianth-segments, and may merit recognition as a species.

3. G. lutea (L.) Ker-Gawler, *Bot. Mag.* **30**: t. 1200 (1809) (*G. silvatica* (Pers.) Loudon; incl. *G. erubescens* Besser). Bulb solitary, without a collar. Stem glabrous. Basal leaf solitary, 7–15 mm wide, linear-lanceolate, flat; cauline 2, opposite, lanceolate, ciliate. Flowers 1–7(–10); pedicels glabrous or hairy. Perianth-segments 15–18 mm, oblong-linear, obtuse. Capsule globose. Seeds subglobose. $2n=72$. *Woods and scrub. Most of Europe.* Au Be Br Bu Co Cz Da Fe Ga Ge Gr He Ho Hs Hu It Ju No Po Rm Rs (N, B, C, W, K, E) Si Su Tu.

4. G. minima (L.) Ker-Gawler, *Jour. Sci. Arts* (*London*) **1**: 180 (1816) (incl. *G. granulosa* Turcz.). Bulbs 2, in a common tunic. Stem glabrous. Basal leaf solitary, 1–2 mm wide, narrowly lanceolate, more or less flat; cauline 1–2, opposite, long-lanceolate, attenuate at apex, usually glabrous. Flowers 1–7; pedicels glabrous or sparsely pubescent. Perianth-segments 10–15 mm, linear-lanceolate, acuminate. Capsule obovoid; seeds subglobose. $2n=24$. *Woods and meadows. Most of Europe except the south-west and the islands.* ?Al Au Bu Cz Da Fe Ge Gr He Hu It Ju No Po Rm Rs (N, B, C, W, K, E) Su.

(5–7). G. reticulata group. Bulb solitary, rarely with stolons bearing terminal bulbils, often with a distinct collar and covered with fibrous roots. Basal leaf solitary; cauline alternate, crowded, narrowly linear. Flowers 1(2–6); pedicels puberulent. Perianth-segments lanceolate, long-acuminate. Capsule obovoid-oblong, obtuse; seeds compressed.

1 Basal leaf flat **6. fibrosa**
1 Basal leaf subterete
2 Bulb with a long collar **5. reticulata**
2 Bulb without or with an indistinct collar **7. taurica**

5. G. reticulata (Pallas) Schultes & Schultes fil., *Syst. Veg.* **7**: 542 (1829). Plants often in clusters. Bulb sometimes covered with recurved fibrous roots, with a collar 1–3 cm. Stem usually 10–15 cm, puberulent. Basal leaf linear, subterete, puberulent. Perianth-segments 14–20 mm. *Dry, grassy slopes. S.E. Europe.* Bu Cr Gr Rm Rs (E).

[1] By I. B. K. Richardson.

6. G. fibrosa (Desf.) Schultes & Schultes fil., *op. cit.* 552 (1829) (incl. *G. rigida* Boiss. & Spruner). Plants solitary. Stem 2–8 cm. Bulb usually covered with recurved fibrous roots and with a collar up to 0·8 cm. Basal leaf flat. Perianth segments 14–20 mm. *Dry, clayey slopes. Aegean region.* Gr. (*S.W. Asia.*)

Perhaps conspecific with **5**; plants intermediate between **5** & **6** occur, and some of the variation may be due to ecological factors. Further study is required. Plants like **6** but with the bulb bearing stolons terminating in bulbils have been called **G. commutata** C. Koch, *Linnaea* **22**: 227 (1849). They occur in Kriti and may represent a distinct species.

7. G. taurica Steven, *Bull. Soc. Nat. Moscou* **30(3)**: 83 (1857). Like **6** but bulb without, or with an indistinct fibrous collar; basal leaf subterete perianth-segments 12–14 mm. *Dry hillsides. Krym.* Rs (K).

G. ucrainica Klokov, *Ukr. Bot. Žur.* **3**: 16 (1926), from S. & E.C. Ukraine, also with short perianth-segments, is otherwise intermediate between **5** and **6**, with a short collar and keeled basal leaf. Its status is obscure.

8. G. bulbifera (Pallas) Schultes & Schultes fil., *Syst. Veg.* **7**: 552 (1829). Bulb solitary. Stems grey-pubescent. Leaves crowded, alternate, the basal not distinct from the cauline, filiform, with bulbils. Flowers 1–3; pedicels glabrous. Perianth-segments 7–12 mm, lanceolate, attenuate at apex, the 3 inner with a claw and undulate margin. Capsule oblong-ovoid, obtuse; seeds compressed. *Steppes and stony slopes. S.E. Europe, from E. Romania to W. Kazakhstan.* Rm Rs (C, W, K, E).

9. G. graeca (L.) A. Terracc., *Mém. Soc. Bot. Fr.* **2**: 25 (1905) (*Lloydia graeca* (L.) Endl. ex Kunth). Glabrous. Bulb solitary. Basal leaves 2–4, linear; cauline alternate, linear-lanceolate. Flowers (1–)3–5(–7). Perianth-segments 10–15 mm, obovate-oblong, white, with usually 3 purple stripes, glabrous. Style 1·8–2·5 mm. Anthers 0·5–1 mm, obtuse; seeds compressed. *Rocky ground. S. Greece and Aegean region.* Cr Gr.

10. G. trinervia (Viv.) W. Greuter, *Israel Jour. Bot.* **19**: 159 (1970) (*Lloydia graeca* auct. ital., non (L.) Endl. ex Kunth). Like **9**, but flowers 1(–3); style usually more than 2·5 mm; anthers 2–3 mm, with an acute apical appendage. *Shady places. Sicilia.* Si. (*N. Africa.*)

11. G. spathacea (Hayne) Salisb., *Ann. Bot.* (*Konig & Sims*) **2**: 556 (1806). Bulbs 2, in a common tunic. Stem glabrous. Basal leaves 2, narrowly linear, fistular; cauline solitary, oblong-lanceolate, cucullate, glabrous. Flowers 2–4; pedicels glabrous. Perianth-segments 10–13 mm, linear-lanceolate, obtuse. Capsule subglobose; seeds subglobose. $2n=106$. *Woods and scrub.* ● *From S. Sweden southwards to N.E. France, N.W. Jugoslavia and E.C. Ukraine; very local in the southern part of its range.* Au Be Cz Da Ga Ge Ho Hu ?It Ju Po ?Rm Rs (B, C, W) Su.

12. G. fistulosa (Ram. ex DC.) Ker-Gawler, *Jour. Sci. Arts* (*London*) **1**: 180 (1816) (*G. liotardii* (Sternb.) Schultes & Schultes fil.; incl. *G. mirabilis* Grossh., *G. samojedorum* Grossh.). Bulbs 2, in a common tunic. Stem glabrous. Basal leaves usually 2, linear, subterete, fistular; cauline 2, opposite, broadly lanceolate, acuminate, glabrous. Flowers (1–)3–5; pedicels more or less hairy. Perianth-segments 13–17(–20) mm, elliptic-lanceolate, obtuse to subacute. Capsule obovoid; seeds subglobose. *Mountains of Europe, from E. Carpathians southwards to the Pyrenees, Sicilia, S. Greece and Krym; at low altitudes in N.E. Russia.* Au Bu Co Ga Gr He Hs It Rm Rs (N, W, K, ?E) Si.

(13–15). G. arvensis group. Bulbs 2, enclosed in a common tunic. Stem puberulent. Basal leaves 2; cauline 2, opposite or almost so, lanceolate, pubescent. Pedicels hairy at least at the base. Capsule obovoid-oblong. Seeds subglobose.

1 Outer perianth-segments glabrous or sparsely pubescent outside, often ± deflexed at apex **13. arvensis**
1 Outer perianth-segments ± densely hairy outside, not deflexed
2 Bulbs not densely surrounded by recurved fibrous roots; perianth-segments puberulent, bearded at apex; bulbils usually absent **14. dubia**
2 Bulbs densely surrounded by recurved fibrous roots; perianth-segments densely white-pubescent; bulbils usually present **15. granatelli**

13. G. arvensis (Pers.) Dumort., *Fl. Belg.* 140 (1827) (*G. villosa* (Bieb.) Duby). Bulb sometimes surrounded by recurved fibrous roots. Basal leaves narrowly linear, canaliculate; bulbils occasionally present. Flowers (1–)5–12. Perianth-segments 13–15 mm, lanceolate, subacute, glabrous or sparsely pubescent outside, often deflexed at apex. $2n=48$. *Dry, open habitats. Europe northwards to the Netherlands, S. Sweden and W.C. Ukraine.* Au †Be ?Bl Bu Cz Da Ga Ge Gr He Ho Hs Hu It Ju Po Rm Rs (W, K, E) Si Su Tu.

14. G. dubia A. Terracc., *Bull. Soc. Palermo* **2**: 34 (1904) (*G. arvensis* subsp. *dubia* (A. Terracc.) Ascherson & Graebner). Bulb not surrounded by fibrous roots. Basal leaves linear, canaliculate; bulbils usually absent. Flowers 3–8(–19). Perianth-segments *c.* 12 mm, oblong-lanceolate, obtuse, not deflexed, puberulent outside and bearded at apex. *Dry, open places. S.E. Europe.* ?Gr Rs (W, K).

15. G. granatellii (Parl.) Parl., *Fl. Palerm.* **1**: 376 (1845) (*G. arvensis* subsp. *granatellii* (Parl.) Ascherson & Graebner). Bulb densely surrounded by recurved fibrous roots. Basal leaves flat; bulbils usually present. Perianth-segments *c.* 12 mm, ovate-lanceolate, obtuse, rarely subacute, not deflexed, the outer densely white-pubescent outside. *Mountain grassland. C. & E. Mediterranean region; Krym.* Co ?Ga Gr Hs It ?Rm Rs (K) Sa Si.

(16–20). G. foliosa group. Bulbs 2, in a common tunic, more or less covered with recurved, fibrous roots. Cauline leaves usually 2, alternate. Seeds subglobose.

1 Basal leaves flat, not differing markedly from the cauline
2 Perianth-segments lanceolate; bulbils often present **19. foliosa**
2 Perianth-segments linear-oblong; bulbils absent **20. polymorpha**
1 Basal leaves filiform to narrowly linear, differing markedly from the wider cauline leaves
3 Perianth-segments elliptical, ± obtuse **18. amblyopetala**
3 Perianth-segments lanceolate to linear-oblong, often acute
4 Stem puberulent; perianth-segments 15–20 mm; capsule obovoid **16. peduncularis**
4 Stem glabrous or with a few long hairs; perianth-segments *c.* 10 mm; capsule oblong **17. nevadensis**

16. G. peduncularis (J. & C. Presl) Pascher, *Sitz.-Ber. Deutsch. Naturw.-Med. Ver. Lotos* nov. ser., **14**: 112 (1904) (*G. polymorpha* Boiss. pro parte). Stems puberulent. Basal leaves 2, filiform to narrowly linear and canaliculate; cauline lanceolate-spathulate, acuminate, glabrous or ciliate; bulbils usually absent. Flowers 1–3; pedicels puberulent. Perianth-segments 15–20 mm, linear-oblong, obtuse to subacute. Capsule obovoid, emarginate. *Dry hills and stony places. Balkan peninsula and Aegean region.* Bu Cr Gr Ju Tu.

17. G. nevadensis Boiss., *Elenchus* 85 (1838) (*G. solierolii* F. W. Schultz). Stem glabrous or with a few long hairs. Basal

leaves (1–)2, filiform; cauline lanceolate; bulbils absent. Flowers 1–3; pedicels usually glabrous. Perianth-segments *c.* 10 mm, lanceolate, usually acute. Capsule oblong. $2n=36$. *Rocky and grassy slopes.* ● *Mountains of S.W. Europe.* Bl Co Ga Hs Lu Sa.

18. G. amblyopetala Boiss. & Heldr. in Boiss., *Diagn. Pl. Or. Nov.***1(7)**: 107 (1846) (incl. *G. heldreichii* A. Terracc.). Stem glabrous. Basal leaves 2, narrowly linear, canaliculate; cauline lanceolate, glabrous or ciliate at base. Flowers 1–7; pedicels glabrous. Perianth-segments *c.* 10 mm, broadly elliptical, more or less obtuse. Capsule obovoid, truncate at apex. *Mountain scrub and open woodland. S.E. Europe, from W.C. Macedonia and S.E. Greece to Krym.* Cr Gr Ju Rs (W, K) Tu.

19. G. foliosa (J. & C. Presl) Schultes & Schultes fil., *Syst. Veg.* 7: 1703 (1829). Stem glabrous. Basal leaves (1–)2, linear-lanceolate, more or less flat; cauline 2–5; bulbils usually present. Flowers 1–5; pedicels pubescent. Perianth-segments *c.* 15 mm, lanceolate, pubescent. *Mountain scrub. Mediterranean region, from S. France to S.E. Italy.* Co Ga It Sa Si.

Plants from Sicilia and S.W. Italy, like **19** but with glabrous pedicels and perianth-segments, have been called **G. chrysantha** Schultes & Schultes fil., *op. cit.* 7: 545 (1829). They may be nearer to **18** but further study is required.

20. G. polymorpha Boiss., *Voy. Bot. Midi Esp.* **2**: 611 (1842). Stem glabrous. Basal leaves (1–)2, linear, flat; bulbils usually absent. Flowers 1–3(–7); pedicels glabrous or hairy. Perianth-segments 15–20 mm, oblong, obtuse. *Rocky places.* ● *Spain and E. Portugal.* Hs Lu.

(21–23). G. bohemica group. Bulbs 2, in a common tunic. Basal leaves 2, filiform; cauline alternate, more or less glabrous. Seeds subglobose.

A group of closely allied taxa which may warrant no more than subspecific status.

1 Stem usually less than 2 cm; perianth-segments 13–17 mm **21. bohemica**

1 Stem up to 10 cm; perianth-segments 12–13 mm
2 Capsule ovoid, truncate **22. saxatilis**
2 Capsule obovoid, emarginate **23. szovitzii**

21. G. bohemica (Zauschner) Schultes & Schultes fil., *Syst. Veg.* 7: 549 (1829) (*G. bohemica* subsp. *zauschneri* (Pohl) Pascher). Stems *c.* 2 cm. Basal leaves often flexuous; cauline lanceolate, acuminate. Flowers 1–3. Perianth-segments 13–17 mm, obovate-oblong, obtuse. Capsule obovoid, emarginate. $2n=60$. *Dry grassland. C. & S. Europe, eastwards from E.C. Germany and Sardegna; W. France; Wales.* Au Br Bu Co Cr Cz Ga Ge Gr Hu It Ju Sa Si.

1 Stem velutinous; basal leaves white-pubescent **(c) subsp. gallica**

1 Stem glabrous; basal leaves glabrous
2 Pedicels and perianth-segments hairy **(a) subsp. bohemica**
2 Pedicels and perianth-segments glabrous **(b) subsp. nebrodensis**

(a) Subsp. **bohemica**: *Throughout the range of the species except France and Sicilia.*

(b) Subsp. **nebrodensis** (Tod. ex Guss.) I. B. K. Richardson, *Bot. Jour. Linn. Soc.* **76**: 356 (1978) (*Ornithogalum nebrodense* Tod. ex Guss.): ● *N. Sicilia (Nebrodi).*

(c) Subsp. **gallica** (Rouy) I. B. K. Richardson, *loc. cit.* (1978) (*G. bohemica* var. *gallica* Rouy): ● *W. France.*

[1] By I. B. K. Richardson. [2] By C. Grey-Wilson and V. A. Matthews.

22. G. saxatilis (Mert. & Koch) Schultes & Schultes fil., *Syst. Veg.* 7: 549 (1829) (*G. bohemica* subsp. *saxatilis* (Mert. & Koch) Pascher). Stem up to 8 cm, glabrous. Basal leaves often circinate; cauline broadly lanceolate, acuminate. Flowers 1–3. Perianth-segments 11–13 mm, oblanceolate-oblong, obtuse to subacute. Capsule ovoid, truncate. *Dry, stony ground. From N.E. Germany to N.E. Portugal, Sicilia and Macedonia; very local in the southern part of its range.* Ga Ge ?Gr He It Ju Lu Si.

Plants from the mountains of W.C. Spain and C. Portugal may key out here. They are robust (up to 15 cm tall), usually sparsely pubescent and have 1(–3) cauline leaves. Their strongest affinity is probably with **17**, but further study is required.

23. G. szovitzii (A. F. Láng) Besser in Schultes & Schultes fil., *op. cit.* 550 (1829) (incl. *G. callieri* Pascher). Stem 3–10 cm. Cauline leaves 2(–4), narrowly lanceolate. Flowers 1–4. Perianth-segments *c.* 12 mm, oblong-lanceolate to subspathulate. Capsule obovoid, emarginate. *Dry, stony slopes.* ● *C. & S. Ukraine, E. Romania.* Rm Rs (W, K).

21. Erythronium L.[1]

Glabrous, bulbous perennials. Stems leafy. Flowers usually solitary, nodding. Perianth of 6 free segments, the inner 3 with a small, transverse, adaxial fold and 2 small patent teeth near the base. Stamens 6, free; anthers basifixed. Style deeply 3-fid. Fruit a capsule with few seeds.

1. E. dens-canis L., *Sp. Pl.* 305 (1753). Bulb ovoid-cylindrical. Stem 10–30 cm. Leaves 5–9 × 1·5–4 cm, usually 2, opposite, ovate-elliptical, reddish-spotted; petiole 2–4 cm, amplexicaul. Perianth-segments 18–30 × 4–10 mm, oblong-lanceolate, subobtuse, strongly deflexed from near the base, bright purplish-pink, sometimes spotted at the base. Filaments fusiform; anthers linear-oblong, bluish. Capsule ovoid-trigonous. $2n=24$. *Woods, scrub and mountain grassland.* ● *S. & S.C. Europe, from C. Czechoslovakia southwards to C. Portugal, C. Italy and Turkey-in-Europe.* Al Au Bu Cz Ga He Hs Hu It Ju Lu Rm Rs (W) Tu.

Plants from S.W. Romania with yellow-spotted leaves and white perianth-segments 40–50 mm have been distinguished as var. *niveum* Baumg. Further information is required, especially to discover whether similar variation occurs elsewhere within the range of the species.

22. Tulipa L.[2]

Bulbous perennials. Bulb-tunics usually lined inside with hairs, occasionally glabrous. Leaves cauline, few, alternate, somewhat fleshy, decreasing in size up the stem. Flowers usually solitary, occasionally up to 4. Perianth-segments 6, free, petaloid, caducous. Nectaries absent. Anthers basifixed, introrse; filaments dilated towards the base. Style short or absent. Fruit a globose or ellipsoid capsule. Seeds flat, numerous.

This genus exhibits the taxonomic difficulties which arise from long-established cultivation, hybridization and selection and subsequent naturalization in various areas. Many populations, especially in S.E. France, W. Switzerland and N. Italy, are certainly naturalized, but their exact origins are obscure. More cytological information is needed to help solve this difficult problem, which also involves numerous nomenclatural difficulties.

Literature: E. Levier, *Bull. Soc. Neuchâtel. Sci. Nat.* **14**: 201–312 (1884). W. R. Dykes, *Notes on Tulip Species*. London. 1930. A. D. Hall, *The Genus* Tulipa. London. 1940.

1 Filaments glabrous; perianth not abruptly narrowed near the base (Sect. *Tulipa*)

2 Tunic sparsely lined inside with straight hairs, or subglabrous
3 Perianth-segments obtuse to shortly acuminate, variously coloured; leaf-margins flat **8. gesnerana**
3 Perianth-segments long-acuminate, scarlet; leaf-margins undulate **9. boeotica**
2 Tunic lined inside with long, undulate hairs, forming a felt
4 Leaves less than 1 cm wide; perianth-segments white, tinged with red on the outside; tunic with a tuft of woolly hairs protruding from the neck **7. clusiana**
4 At least the basal leaves more than 1·5 cm wide; perianth-segments red or orange, tinged with green or grey on the outside; tunic without a tuft of woolly hairs protruding from the neck
5 Perianth-segments *c.* 3 times as long as wide, elliptical to elliptic-oblong, acuminate; leaves green **11. agenensis**
5 Perianth-segments about twice as long as wide, ovate to obovate, subobtuse to shortly apiculate; leaves glaucous **10. praecox**
1 Filaments with a hairy boss near the base; perianth abruptly narrowed near the base (Sect. *Eriostemones*)
6 Tunic densely felted inside with undulate hairs
7 Leaves 5–7; perianth-segments more than 40 mm, dark reddish-orange or orange-brown **3. goulimyi**
7 Leaves 2–3; perianth-segments less than 25 mm, white, with a yellow basal blotch **6. biflora**
6 Tunic glabrous or sparsely lined inside with straight hairs, particularly towards the top
8 Perianth-segments yellow or cream, without a basal blotch inside **1. sylvestris**
8 Perianth-segments white, pink, purple or orange-brown, usually with a basal blotch or zone inside
9 Anthers not more than 3 mm; perianth-segments not more than 30 mm **5. cretica**
9 Anthers at least 5 mm; perianth-segments more than 35 mm
10 Leaves bright, shining green above, ± flat, the lowest one usually more than 2·5 cm wide; perianth-segments lilac-pink or purple, with a yellow basal blotch inside **4. saxatilis**
10 Leaves deep, dull green above, canaliculate, the lowest one less than 2 cm wide; perianth-segments orange-brown or orange-yellow, sometimes with a darker basal blotch or zone **2. orphanidea**

Sect. ERIOSTEMONES Boiss. Filaments with a hairy boss near the base. Perianth-segments usually ciliate at the base. Perianth abruptly narrowed near the base, especially in bud.

1. T. sylvestris L., *Sp. Pl.* 305 (1753). Bulb 18–45 × 8–22 mm, often stoloniferous; tunic tough, with a few straight hairs inside towards the apex, occasionally glabrous. Stem (5–)8–45 cm. Leaves 2–3(–4), up to 30 × 18 cm, linear-lanceolate to linear, canaliculate. Flowers 1(–2), nodding in bud; perianth yellow, rarely cream, the outer segments 20–63 × 4·5–27 mm, narrowly elliptical, acute, sometimes tinged outside with green, pink or crimson; inner segments 21–70 × 6–26 mm, elliptic-oblanceolate, shortly acuminate. Filaments 5–14 mm; anthers 2·5–9 mm. Capsule 17–30 × 14–16 mm, globose to oblong-ellipsoid. *Meadows, grassy and rocky places, occasionally in open woodland. S. & S.E. Europe, extending northwards to N.W. France and to c.* 55°*N. in E.C. Russia; widely naturalized in N. & C. Europe.* Al Bu Ga Gr He Hs It Ju Lu Rm Rs (C, W, K, E) Sa Si [Au Be Br Cz Da Ge Ho No Po Su].

(a) Subsp. **sylvestris** (subsp. *grandiflora* (Hy) Hayek, subsp. *balcanica* (Velen.) Hayek): Stem at least 2·5 mm in diameter (above the uppermost leaf). Lowest leaf at least 1·2 cm wide. Outer perianth-segments (35–)36–63 × 8–18 mm, sometimes tinged with green outside on the back, the inner (35–)37–70 × 16–26 mm. Filaments 9–14 mm; anthers 4–9 mm. $2n=36$. *Italy, Sicilia, Sardegna; naturalized in N. & C. Europe.*

(b) Subsp. **australis** (Link) Pamp., *Bull. Soc. Bot. Ital.* **1914**: 114 (1914) (*T. australis* Link, *T. australis* subsp. *celsiana* (DC.) Hayek; incl. *T. biebersteiniana* Schultes fil.): Stem not more than 2 mm in diameter. Lowest leaf less than 1·2 cm wide. Outer perianth segments 20–35(–37) × 4·5–9 mm, tinged with pink or crimson outside, the inner 21–36(–38) × 6–16 mm. Filaments 5–8 mm; anthers 2·5–4 mm. $2n=24$. *Mountain meadows and stony places. Throughout the native range of the species except for parts of C. Mediterranean region.*

T. patens Agardh ex Schultes fil. in Roemer & Schultes, *Syst. Veg.* **7**: 384 (1829), from S.E. Russia, with white perianth-segments tinged with yellow inside at the base, the outer tinged with violet outside, and **T. grisebachiana** Pant., *Österr. Bot. Zeitschr.* **23**: 265 (1873) (*T. australis* subsp. *grisebachiana* (Pant.) Hayek), described from S. Jugoslavia, a slender plant with erect leaves and plain yellow flowers, are probably best regarded as variants of **1(b)**.

2. T. orphanidea Boiss. ex Heldr., *Gartenfl.* **11**: 309 (1862) (*T. hageri* Heldr., *T. thracica* Davidov, *T. hellespontica* Degen). Bulb 20–47 × 8–22 mm; tunic leathery, lined with a few straight hairs inside towards the apex. Stem 8–27 cm, glabrous or finely pubescent above the uppermost leaf. Leaves (2–)3–7, up to 32 × 1·6 cm, linear-lanceolate to linear, canaliculate, glabrous. Flowers 1(–3); perianth bright orange or orange-red, the segments with a darker, oblong basal blotch inside, the outer 30–49 × 8–16 mm, elliptical, subacute, usually tinged with green outside, the inner 30–47 × 10–19 mm, elliptical-oblanceolate, obtuse or shortly apiculate. Filaments 9–12 mm; anthers 5–10 mm. Ovary glabrous or rarely pubescent. $2n=24$, 36, 48. *Stony ground and cultivated fields. Aegean region and E. part of Balkan peninsula.* Bu Cr Gr Tu.

Variable; a number of taxa have been recognized horticulturally, but it is not possible to maintain these here.

Plants occur in Greece with stems up to 43 cm and it is likely that these are hybrids between **1(b)** and **2**. Their flowers are very variable in colour, from yellowish-orange to orange-red or brownish-red; the outer perianth-segments are 45–65 × 10–16 mm, narrowly elliptical, acute to acuminate, and the inner 45–62 × 12–20 mm, broadly elliptic-oblong, acuminate to apiculate.

3. T. goulimyi Sealy & Turrill, *Kew Bull.* **10**: 59 (1955). Like **2** but bulb-tunics densely woolly inside with long undulate hairs; leaves 5–7, up to 20 × 2 cm, the margin somewhat undulate; perianth bright orange to brownish-red, the outer segments 42–50 × 12–14 mm, elliptic-oblanceolate, subobtuse, the inner 45–52 × 18–22 mm, elliptic-oblanceolate, obtuse; filaments 10–12 mm; anthers 7·5–9 mm. *Sandy fields and stony ground.* ● *S. Greece.* Gr.

4. T. saxatilis Sieber ex Sprengel, *Syst. Veg.* **2**: 63 (1825). Bulb 20–35 × 15–30 mm, markedly stoloniferous; tunics coriaceous, with a few straight hairs inside towards the apex. Leaves 2–3(–4), up to 38 × 4·5 cm, oblong-lanceolate to linear-lanceolate, flattish, glabrous, shiny green above. Flowers 1–2(–4); perianth pink to lilac-purple, the segments with a distinct, white-edged, yellow basal blotch inside; outer segments 38–53 × 9–18 mm, elliptical to elliptic-oblong, acute to subacute, the inner 38–55 × 16–30 mm, oblong-elliptical to oblong-obovate, subacute to obtuse, often shortly apiculate. Filaments 8–17 mm; anthers 4·5–7 mm. Capsule rarely formed. $2n=24$, 36. *Field-margins, hillsides and rocky places.* ● *S. Aegean region.* Cr ?Gr [It].

Normally triploid; diploid plants, which appear to have rather smaller, deeper coloured flowers, are sometimes treated as

a distinct species, **T. bakeri** A. D. Hall, *Jour. Bot.* (*London*) **76**: 316 (1938).

5. T. cretica Boiss. & Heldr. in Boiss., *Diagn. Pl. Or. Nov.* **2(13)**: 19 (1853). Bulb 20–35 × 8–15 mm, usually stoloniferous; tunic thick, with a few straight hairs inside towards the apex. Stem 7–11·5 cm. Leaves 2–3, up to 10 × 1·5 cm, narrowly lanceolate, more or less flat, glabrous, deep shining green above. Flowers 1–2(–3); perianth white, tinged with pink or purple, greenish on the outside, with a dull yellow basal zone inside; outer segments 15–30 × 4–9·5 mm, elliptical, subacute, the inner 16–32 × 6–11 mm, elliptic-oblong, subobtuse. Filaments 5–8 mm; anthers 1·5–3 mm. Capsule 9–15 × 10–15 mm, globose. $2n = 24$. *Rocky and stony places.* ● *Kriti.* Cr.

6. T. biflora Pallas, *Reise* **3**: 727 (1776) (*T. callieri* Halácsy & Levier, *T. koktebelica* Junge). Bulb 10–35 × 8–23 mm; tunics papery, sericeous-lanate inside particularly towards the apex. Stem 5–18(–20) cm. Leaves 2, up to 19 × 2(–2·5) cm, linear-lanceolate to linear, slightly canaliculate, glabrous. Flowers 1–3(–4); perianth white, tinged on the outside with green and pale crimson, and with yellow at the base inside; outer segments 10–20 × 3–5·5 mm, elliptical, acute, the inner 9–20 × 4–8·5 mm, broadly elliptical, subacute. Filaments 6–7 mm; anthers 2–2·5 mm. Capsule 10–16 × 10–15 mm, glabrous. $2n = 24$. *S.E. Russia, W. Kazakhstan; Krym; S. Jugoslavia* (*Makedonija*). Ju Rs (K, E).

The plants from Jugoslavia, described as **T. mariannae** Lindt., *Bull. Soc. Sci. Skoplje* (*Sci. Nat.*) **20**: 137 (1939), appear to be indistinguishable from typical *T. biflora* from S.E. Russia.

Sect. TULIPA (Sect. *Leiostemones* Boiss.). Filaments glabrous. Perianth-segments not ciliate at the base. Perianth not abruptly narrowed near the base.

7. T. clusiana DC. in Redouté, *Liliacées* **1**: t. 37 (1802). Bulb 20–35 × 10–25 mm; tunics usually numerous, coriaceous, lined inside in the upper half with long, undulate or rather setiform hairs forming a felt which protrudes from the neck. Leaves 3–5, up to 28 × 1·7 cm, linear-lanceolate to linear, canaliculate, the uppermost much smaller than the others. Flowers solitary, erect in bud; perianth white, the segments with a small, basal, oblong, purplish blotch inside; outer segments 32–60 × 6–18 mm, lanceolate-elliptical to elliptical, subacute, tinged with pinkish-crimson outside, the inner 25–50 × 8–17 mm, oblong-oblanceolate to obovate, obtuse. Filaments 6–9 mm; anthers 4·5–11 mm. Capsule *c.* 10 × 7 mm. $2n = 48, 56$. *In and around cultivated land. Naturalized in S. Europe.* [Ga Gr Hs It Lu.] (*Iran to N. Pakistan.*)

8. T. gesnerana L., *Sp. Pl.* 306 (1753) (*T. didieri* Jordan, *T. suaveolens* sensu Hayek, non Roth). Bulb-tunics papery or rather coriaceous, subglabrous or with a few straight hairs inside towards the apex. Stems 30–55 cm, glabrous or finely pubescent. Leaves 2–5(–7), up to 30 × 6·5 cm, elliptic-oblong to lanceolate, the uppermost linear-lanceolate or linear. Perianth scarlet, orange, yellow or purplish, sometimes 'broken', the segments with or without a dark basal blotch inside; outer segments 45–75 × 18–32 mm, lanceolate to elliptical, acute or subacute, the inner 38–82 × 21–41 mm, elliptic-oblanceolate to oblanceolate or obovate, obtuse, often shortly apiculate. Filaments 6–14 mm; anthers 8·5–15 mm. *Mainly in and around cultivated land. Locally naturalized, mainly in S.W. Europe.* [Ga ?Gr He Hs It.] (*Origin uncertain; widespread in S.W. & S.C. Asia, but mainly in and around cultivated land.*)

A complex species or group from which the majority of garden tulip cultivars has been derived. There appears to be a great overlap of characters, making the circumscription of taxa difficult. Several variants found in S. France, Switzerland and Italy have in the past been given specific status but are considered here as clones. The popularity of the garden tulip led to a great influx of importations into this area from S.W. & S.C. Asia from the 15th century onwards, and numerous variants were selected and reselected to give a wide range of form and colour. Some of these were subsequently naturalized in the area mentioned, aided by their vigorous capacity for vegetative reproduction, and later became known as the *Neo-tulipae*. No certainly wild counterpart has yet been identified although similar plants occur in S.W. & S.C. Asia. The name *T. gesnerana* L., presumably applied to a plant of similar origin, is used here for this complex.

The following 3 taxa, related to **8**, are apparently native, but they are not clearly separable from each other, nor from **8**, and their status is altogether uncertain.

T. hungarica Borbás, *Földműv. Érdek.* **10**: 561 (1882), a robust plant with large leaves, the lowest up to 30(–37) × 5·7(–7·8) cm, perianth-segments (42–)50–105 × (18–)22–48 mm, yellow, without a basal blotch, and anthers 10–16 mm, grows on limestone rocks in the gorge of the Danube, above the Iron Gates, in S.W. Romania and N.E. Jugoslavia. It has $2n = 24$.

T. urumoffi Hayek, *Verh. Zool.-Bot. Ges. Wien* **61**: (110) (1911) (*T. rhodopea* (Velen.) Velen.), with the stem (15–)20–29 cm, glabrous, leaves up to 16 × 4 cm, perianth-segments 35–60 × 17–26 mm, yellow or red, with or without a basal blotch, and anthers 7–10 mm, grows in S. Bulgaria (E. & C. Rodopi). It has $2n = 24$.

T. schrenkii Regel, *Acta Horti Petrop.* **2**: 452 (1881), a dwarf plant with stem 7–16(–24) cm, finely pubescent or glabrous, leaves up to 11·5 × 2·2 cm, finely pubescent or glabrous, flowers crimson-scarlet, yellow or white, perianth-segments 25–55 × 12–21 mm, usually with a basal blotch, and anthers 5·5–9 mm, grows in steppes and semi-deserts in the S.E. part of U.S.S.R.

9. T. boeotica Boiss. & Heldr. in Boiss., *Diagn. Pl. Or. Nov.* **3(4)**: 99 (1859) (*T. scardica* Bornem.). Bulb-tunics with a few straight hairs inside towards the apex. Stem 17·5–38(–50) cm, finely pubescent, or glabrous. Leaves 3–4, the lower 2 up to 19 × 2·5 cm, lanceolate, with an undulate margin. Perianth scarlet, the segments with a large, basal, yellow-edged, black blotch inside; outer segments 28–69 × 11–21 mm, elliptical, long-acuminate, the inner 30–67 × 12–22 mm, elliptic-oblanceolate to oblanceolate, long-acuminate or apiculate. Filaments 6–13 mm; anthers 7–16 mm. $2n = 24$. *Cultivated fields and rocky places. S. part of Balkan peninsula.* Gr Ju Tu.

A characteristic species of wheat-fields. Perhaps conspecific with **T. undulatifolia** Boiss., *op. cit.* **1(5)**: 57 (1844), from W. Anatolia.

10. T. praecox Ten., *Fl. Nap.* **1**: 170 (1811). Bulb 30–48 × 28–30 mm, stoloniferous; tunics thin and papery, densely lanate inside. Stem 18–65 cm, glabrous or slightly pubescent. Leaves 3–4(–5), up to 37 × 6·7 cm, lanceolate to linear-lanceolate, more or less flat, subobtuse to acute, glaucous, glabrous. Flowers solitary; perianth orange, tinged with green on the outside, each segment with a dark brownish-green basal blotch edged with yellow, extending to ⅓–½ of its length, the inner with a distinct yellowish median stripe; perianth-segments about twice as long as wide, the outer 40–82(–100) × 22–44(–52) mm, broadly ovate-elliptical, acute, the inner 36–68(–76) × 17–34 mm, ovate-oblong to obovate, subobtuse. Filaments 7–16 mm; anthers 11–24 mm. Capsule rarely formed. $2n = 36$. *In and around cultivated land. Locally naturalized in S. Europe.* [?Co Ga Gr It Lu Tu.] (*?S.W. or S.C. Asia.*)

11. T. agenensis DC. in Redouté, *Liliacées* **1**: 60 (1804) (*T. oculus-solis* St-Amans, *T. lortetii* Jordan). Like **10** but leaves green; perianth-segments redder and narrower, more than 3 times as long as wide, the outer 57–85 × 13–30 mm, elliptical to oblong-elliptical, acuminate, the inner 48–75 × 14–23 mm, elliptical to elliptic-ovate, acute. $2n = 24$, 36. *In and around cultivated land. Naturalized in S. France and Italy.* [Ga It.] (*?S.W. Asia.*)

Records from elsewhere in S. Europe refer to casual occurrences in which the plant does not persist for long.

23. Fritillaria L.[1]

Glabrous, bulbous perennials. Bulb usually globose, with few, tightly-packed scales and thin, translucent tunic which disappears with increased bulb-size. Leaves verticillate, opposite or alternate. Flowers solitary, rarely in few-flowered racemes, nodding. Perianth campanulate, or conical-campanulate, the segments often marked with alternating squares of dark and light colour (*tessellations*), and often with a longitudinal stripe of clear green down the middle (*fascia*). Nectaries conspicuous, at the base or at the point of inflection of the perianth-segments. Filaments inserted slightly above base of anther. Style entire or 3-fid, caducous. Fruit a 6-angled, flat-topped, erect capsule, sometimes with 6 longitudinal wings.

In species which normally have opposite or verticillate leaves some individuals, usually the smaller, have all the leaves alternate. Measurements of the style include the branches.

F. persica L., *Sp. Pl.* 304 (1753), with many spirally arranged leaves and a raceme of up to 40 small, purplish or greenish flowers is cultivated for ornament and naturalized in N. & C. Italy.

1 Perianth narrowly or conical-campanulate; nectary at base of perianth-segment
 2 Perianth clear yellow
  3 Stem 7–25 cm; leaves shining green **20. conica**
  3 Stem 3–10 cm; leaves glaucous **21. euboeica**
 2 Perianth blackish, purplish or greenish, usually glaucous outside
  4 Style undivided
   5 Lower leaves alternate, the upper in whorls of 3; capsule winged **22. stribrnyi**
   5 Lower leaves opposite, the upper alternate; capsule not winged **23. ehrhartii**
  4 Style 3-fid
   6 Leaves 4–5(–9); style papillose **19. drenovskii**
   6 Leaves 8–20; style smooth
    7 Style-branches 2–3 mm; flowers usually 1–2 **17. obliqua**
    7 Style-branches 1–1·5 mm; flowers 1–4(–6) **18. tuntasia**
1 Perianth broadly campanulate; nectary at point of inflection of perianth-segment
 8 Perianth yellow, purple or white, tessellated, without fascia; nectary *c.* 10 mm above the base of the perianth-segment
  9 Lowest leaves linear; outer perianth-segments usually acute **1. meleagris**
  9 Lowest leaves lanceolate; all perianth-segments rounded at apex
   10 All leaves alternate; inner perianth-segments entire **2. tubiformis**
   10 Lower leaves subopposite, the upper usually in a whorl of 3; inner perianth-segments toothed **3. macedonica**
 8 Perianth green, brown or blackish, usually with fascia; nectary *c.* 5 mm above base of perianth-segment
  11 Nectary (6–)10–15 mm
   12 Nectary ovate-lanceolate
    13 Stem 15–30 cm; lowest leaves 3–7 mm wide **6. messanensis**
    13 Stem 4–10 cm; lowest leaves 8–15 mm wide **7. epirotica**
   12 Nectary linear to linear-lanceolate
    14 All leaves alternate
     15 Leaves 5–9; perianth-segments greenish- or reddish-brown outside, usually with fascia; style smooth **13. lusitanica**
     15 Leaves 3–6; perianth-segments blackish outside, without fascia; style papillose **16. meleagroides**
    14 Some of the leaves opposite or verticillate
     16 Uppermost leaves with filiform, tendril-like apex; capsule winged **14. ruthenica**
     16 Apex of uppermost leaves often curved or hooked, but not filiform or tendril-like; capsule not winged **15. orientalis**
  11 Nectary 3–6 mm
   17 Perianth not tessellated
    18 Style papillose; capsule not winged **11. rhodocanakis**
    18 Style smooth; capsule winged
     19 Some leaves opposite or verticillate **4. pontica**
     19 All leaves alternate **8. gussichiae**
   17 Perianth tessellated
    20 Nectary lanceolate to linear
     21 Leaves usually glaucous; perianth-segments with fascia **9. graeca**
     21 Leaves usually not glaucous; perianth-segments without fascia **10. davisii**
    20 Nectary triangular to ovate-lanceolate
     22 All leaves alternate **12. pyrenaica**
     22 Some of the leaves opposite or verticillate
      23 Lowest leaves 6–10 mm wide, linear to linear-lanceolate **5. involucrata**
      23 Lowest leaves 11–25 mm wide, ovate to lanceolate **9. graeca**

1. F. meleagris L., *Sp. Pl.* 304 (1753). Stem 12–30 cm. Leaves (3–)4–6(–8), alternate, linear, somewhat glaucous. Perianth very broadly campanulate; segments purple, pink or white, usually tessellated inside and outside with purple, without fascia, the outer 30–45 × 10–15 mm, the inner 13–19 mm wide. Nectaries 7–10 × 1·5 mm, linear, green, 8–12 mm above the base of the perianth-segment. Filaments 10–13 mm, papillose. Style 13–16 mm, 3-fid, the branches 2–5 mm. Capsule not winged. $2n = 24$. ● *From England and C. Russia southwards to the S. Alps and C. Jugoslavia; planted and naturalized in Fennoscandia, the Baltic region and elsewhere.* Au †Be Br Cz Ga Ge He Ho Hu It Ju Po Rm Rs (C, W, ?E) [Da Fe No Su Rs (B)].

(a) Subsp. **meleagris**: Lowest leaves 6–13 cm × 5–12 mm, acute. Perianth-segments often white or pink, the outer acute, the inner usually acute, sometimes obtuse. Filaments papillose. Style papillose. *Open woods and grassy places, usually on flood-plains. Throughout the range of the species except the Alps.*

(b) Subsp. **burnatii** (Planchon) Rix, *Bot. Jour. Linn. Soc.* **76**: 356 (1978) (*F. burnatii* Planchon): Lowest leaves 5–8 cm × 5–10 mm, obtuse. Perianth-segments purple, the outer acute or obtuse, the inner obtuse. Filaments smooth or sparsely and shortly papillose. Style smooth. *Alpine pastures. S. & S.W. Alps.*

2. F. tubiformis Gren. & Godron, *Mém. Soc. Émul. Doubs* **2(6)**: 13 (1855) (*F. delphinensis* Gren. & Godron). Stems 8–24 cm. Leaves 5–6, alternate, glaucous, the lowest 5–9 cm × 8–15 mm. Perianth very broadly campanulate; segments purplish or yellowish, glaucous outside, tessellated and blotched inside with purple or brown, without fascia, the outer 32–48 × 13–22 mm, obtuse, the inner 18–24 mm wide, rounded at the apex. Nectaries greenish, 10 mm above the base of the perianth-segment. Filaments 12–18 mm, papillose. Style smooth. Capsule not winged. *Alpine meadows and pastures*, 1500–2000 *m.* ● *S.W. Alps.* Ga It.

[1] By E. M. Rix.

(a) Subsp. **tubiformis**: Perianth-segments purplish outside, whitish and heavily tessellated with purple inside. Nectaries 3 × 1 mm, triangular. Style 12–13 mm, 3-fid, the branches 1 mm. *Almost throughout the range of the species.*

(b) Subsp. **moggridgei** Boiss. & Reuter ex Rix, *Bot. Jour. Linn. Soc.* **76**: 356 (1978): Perianth-segments yellowish to greenish, lightly tessellated with brown. Nectaries 4–5 × 1 mm, linear. Style 13-17 mm, 3-fid, the branches 1–4 mm. *S.W. Alps, northwards to 45°N.*

3. F. macedonica Bornm., *Feddes Repert.* **19**: 200 (1923). Stem 7–14 cm. Leaves 5–6, the lowest 4–6(–8) cm × 5–10(–16) mm, oblong to lanceolate, obtuse, subopposite, the upper 3 in a whorl. Perianth very broadly campanulate; segments lilac, heavily tessellated with dark purple, without fascia, the outer 30 × 11–14 mm, ovate-lanceolate, the inner 12–16 mm wide, toothed at the margin. Nectaries 3 mm, oblong. Filaments 10 mm, smooth. Style 12 mm, 3-fid, the branches 2–5 mm. Capsule not winged. *Wet mountain grasslands* 1200–2500 *m.* ● *E.C. Albania, just extending into S.W. Jugoslavia.* Al Ju.

4. F. pontica Wahlenb., *Isis* **21**: 984 (1828). Stem 15–45 cm. Leaves usually 8, not glaucous, the lowest 5–8(–10) cm × 5–17 mm, opposite or subopposite, the intermediate opposite or alternate, the upper in a whorl of 3, 5–11 cm × 3–10 mm. Perianth broadly campanulate; segments green, often tinged with reddish-brown but not tessellated, the outer 24–45 × 8–10 mm, usually acute, the inner 10–15 mm wide, obtuse. Nectaries 3–5 mm in diameter, circular, blackish, 5 mm above the base of the perianth-segment. Filaments 12 mm, papillose. Style 12–15 mm, 3-fid, the branches 5–7 mm, slender, smooth. Capsule winged. *Open woods and scrub. Balkan peninsula, from* 40°15′ *to* 43°30′ *N.* Al Bu Gr Ju Tu.

5. F. involucrata All., *Auct. Fl. Pedem.* 34 (1789). Stem 15–25 cm. Leaves 7–10, linear-lanceolate or linear, somewhat glaucous, the lowest 5–11 cm × 6–10 mm, opposite, the intermediate opposite or alternate, the uppermost 4–9 mm, in a whorl of 3. Perianth broadly campanulate; segments green, tessellated with brown or purple, without clear fascia, obtuse, the outer 25–40 × 7–16 mm, the inner somewhat wider. Nectaries 4 mm wide, ovate, blackish, 5–6 mm above the base of the perianth-segment. Filaments 9–14 mm, papillose. Style 8–12 mm, 3-fid, the branches 3–4 mm, smooth, slender. Capsule not winged. *Open woods, scrub and rocky places.* ● *S.E. France, N.W. Italy.* Ga It.

6. F. messanensis Rafin. in Desv., *Jour. Bot. Appl.* **4**: 272 (1814). Stem 15–30 cm. Leaves 7–10, linear, the lowest 4–9 cm × 3–7 mm, usually opposite, the rest alternate, or the upper sometimes in a whorl of 3. Perianth broadly campanulate; segments yellowish or brownish outside, tessellated or marked with brownish-purple, sometimes with greenish fascia, the outer 22–32 × 8–15 mm, ovate-lanceolate, acute or obtuse, the inner 12–17 mm wide, apiculate or rounded. Nectaries 6–10 × 3–4 mm, ovate-lanceolate, green, blackening on drying, 3–5 mm above the base of the perianth-segment. Filaments 10–13 mm, sparsely papillose. Style 10 mm, 3-fid, the branches 5–6 mm, smooth. Capsule not winged. *Open woods, scrub and grassy places. S. & W. parts of Balkan peninsula, Kriti; S. Italy and Sicilia.* Al Cr Gr It Ju Si.

(a) Subsp. **messanensis** (incl. *F. sphaciotica* Gand.): Upper leaves usually in a whorl of three. Perianth expanded at the mouth, usually tessellated; inner segments apiculate. $2n = 24$. *Throughout the range of the species except the north.*

(b) Subsp. **gracilis** (Ebel) Rix, *Bot. Jour. Linn. Soc.* **76**: 356 (1978) (*Lilium gracile* Ebel, *F. gracilis* (Ebel) Ascherson & Graebner *F. neglecta* Parl.): Upper leaves alternate. Perianth not expanded at the mouth, rarely tessellated; inner segments usually rounded at apex. $2n = 24$. ● *W. & S. Jugoslavia, N. Albania.*

7. F. epirotica Turrill ex Rix, *Kew Bull.* **30**: 160 (1975). Stem 4–10 cm. Leaves 6–8, somewhat glaucous, the lowest 3–6 cm × 8–15 mm, sometimes opposite, linear-lanceolate, the rest alternate, linear, the upper sometimes in a whorl of 3. Perianth broadly campanulate, not expanded at the mouth; segments dark brownish-purple outside and without fascia, yellowish and tessellated with reddish-brown inside, the outer 20–25 × 5–7 mm, narrowly oblong, acute, the inner oblanceolate, acute, 8–10 mm wide. Nectaries 10 × 3 mm, ovate-lanceolate, green, 5 mm above the base of the perianth-segment. Filaments 8–9 mm, papillose; style 8 mm, 3-fid, the branches 3 mm, smooth. Capsule not winged. *Serpentine screes,* 2500 *m.* ● *N.W. Greece.* Gr.

8. F. gussichiae (Degen & Dörfler) Rix, *Bot. Jour. Linn. Soc.* **76**: 356 (1978) (*F. graeca* var. *gussichiae* Degen & Dörfler). Stem 20–30 cm. Leaves 5–8, glaucous, alternate, the lowest 6 cm × 15 mm, ovate, amplexicaul, the rest narrower. Flowers 1–3, in an elongated raceme. Perianth broadly campanulate; segments green, often tinged with reddish-brown but not tessellated, obtuse, the outer 30 × 8 mm, the inner *c.* 14 mm wide. Nectary 5 × 3 mm, ovate, green, 6 mm above the base of the perianth-segment. Filaments 10 mm, papillose. Style 9 mm, 3-fid, the branches 4 mm, smooth, slender. Capsule winged. *Woods, shady rocks and subalpine pastures.* ● *Macedonia.* Bu Gr Ju.

F. skorpilii Velen., *Fl. Bulg., Suppl.* 269 (1898), reported from S. Bulgaria (Rila and Rodopi), differs from **8** in its narrower leaves and smaller flowers. It is known only from the original collection and needs further investigation.

9. F. graeca Boiss. & Spruner in Boiss., *Diagn. Pl. Or. Nov.* **1(7)**: 104 (1846). Leaves 5–12, sometimes glaucous, the lowest 3·5–11 cm × 11–25 mm, ovate to lanceolate, often opposite, the rest narrower, opposite or alternate, the uppermost sometimes in a whorl of 3. Flowers 1–2(–3), in a condensed raceme. Perianth broadly campanulate; segments green or purplish, tessellated, often heavily, with purplish-brown, obtuse or acute, the outer 18–35 × 7–10 mm, the inner 12–14 mm wide. Nectaries 4–5·5 mm, 5–6 mm above the base of the perianth-segment. Filaments 7–10 mm, papillose. Style 7–10 mm, 3-fid, the branches 3–6 mm, smooth. Capsule without wings. $2n = 24$. *Open woods and scrub.* ● *S. part of Balkan peninsula and Aegean region.* Al Cr Gr Ju.

(a) Subsp. **graeca** (*F. guicciardii* Heldr. & Sart.): Stem 6–20 (–30) cm. Lowest leaves up to 15 mm wide, often opposite, the rest alternate. Perianth-segments 18–28 mm, dark purple or blackish. Nectaries lanceolate to linear. *S. & E. Greece, Kriti.*

(b) Subsp. **thessala** (Boiss.) Rix, *Bot. Jour. Linn. Soc.* **76**: 356 (1978) (*F. ionica* Halácsy, *F. thessalica* Spruner): Lowest leaves opposite, up to 25 mm wide, the intermediate opposite or subopposite, the upper in a whorl of 3. Perianth-segments 28–38 mm, green, usually lightly tessellated. Nectaries ovate to ovate-lanceolate. *S. Albania, S. Jugoslavia, N.W. Greece.*

10. F. davisii Turrill, *Kew Bull.* **1940**: 265 (1940). Like **9(a)** but stem 10–20(–25) cm; leaves shining green, not glaucous, the lowest up to 32 mm wide; perianth-segments usually without fascia; style 7–9 mm, 3-fid, the branches 3–7 mm. *Scrub, olive-groves and cornfields.* ● *S. Greece.* Gr.

11. F. rhodocanakis Orph. ex Baker, *Jour. Bot.* (*London*) **16**: 323 (1878). Like **9(a)** but perianth-segments dark brownish-

purple, with yellow margins and apex, not tessellated, occasionally yellowish-green throughout; nectaries 3 × 2 mm, ovate; style papillose. $2n=24$. *Vineyards and rocky places.* ● *S. Greece (island of Idhra).* Gr.

12. F. pyrenaica L., *Sp. Pl.* 304 (1753). Stem 15–30 cm. Leaves 7–10, alternate, the lowest 4·5–11 cm × 6–10 mm, obtuse, the rest narrower, usually acute. Perianth broadly campanulate, usually expanded at the mouth; segments dark purplish-brown and usually without fascia outside, greenish-yellow and tessellated with brown inside, the outer 25–35 × 7–10 mm, acute, the inner 10–15 mm wide, obtuse or apiculate. Nectaries 4–6 mm × 2–4 mm at base, triangular to ovate-lanceolate. Filaments 9 mm, papillose. Style 8–9 mm, 3-fid, the branches 2–4 mm, slender, smooth. Capsule not winged. *Mountain meadows.* ◘ *From S.C. France to N.W. Spain.* Ga Hs.

13. F. lusitanica Wikström, *Kungl. Svenska Vet.-Acad. Handl.* **1821**: 352 (1821) (incl. *F. hispanica* Boiss. & Reuter, *F. stenophylla* Boiss. & Reuter, *F. boissieri* Costa, *F. messanensis* sensu Willk., non Rafin.). Stem 10–50 cm. Leaves (5–)6–9(–11), alternate, the lowest 4·8–7·5(–15) cm × 1–9 mm, linear to lanceolate, the rest narrower. Flowers 1(–3). Perianth broadly campanulate, often expanded at the mouth; segments green to brown outside, usually with green fascia, yellowish inside, marked or tessellated with brown, the outer 20–40 × 7–10 mm, the inner 9–15 mm wide, usually acute. Nectaries 10–12 × 2–3 mm, linear-lanceolate to linear, greenish, 3–4 mm above the base of the perianth-segment. Filaments 8–10 mm. Style 8–11 mm, 3-fid, the branches 3–4 mm, slender, smooth. Capsule not winged. $2n=24$. *Rocks, screes and open woods.* ● *E., C. & S. Spain, C. & S. Portugal.* Hs Lu.

Very variable in height, width of leaf and colour and markings of flower. Sometimes divided on these characters into various species or subspecies but the resulting taxa do not seem satisfactory and further study is required to decide whether subdivision is possible.

14. F. ruthenica Wikström, *op. cit.* 353 (1821) (*F. minor* Ledeb.). Stem 20–50 cm. Leaves 6–12, linear, opposite or in whorls of 3, the uppermost often on an extension of the stem above the flowers, the lowest 6–9 cm × 3–5 mm, the uppermost with filiform, tendril-like apex. Flowers 1–5, in a lax raceme. Perianth broadly campanulate; segments acute, blackish outside, greenish-yellow inside, tessellated with purplish-brown, the outer *c.* 25 × 7 mm, the inner *c.* 10 mm wide. Nectaries 10–14 mm, linear, *c.* 4 mm above the base of the perianth-segment. Filaments *c.* 10 mm, papillose. Style *c.* 9 mm, 3-fid, the branches 2 mm, papillose. Capsule winged. *S. & S.E. parts of U.S.S.R.* Rs (C, W, E).

15. F. orientalis Adams in Weber fil. & Mohr, *Beitr. Naturk.* **1**: 50 (1805) (*F. tenella* Bieb., *F. montana* Hoppe). Stem 16–40 cm. Leaves (6–)8–10(–11), the lowest 4–13 cm × 3–6(–10) mm, linear, usually opposite or in a whorl of 3, the intermediate alternate, the uppermost 2·5–5(–11) cm, usually in a whorl of 3, the apex often curved or hooked, but not filiform or tendril-like. Perianth broadly campanulate; segments greenish, heavily tessellated inside and outside with purplish-brown, the outer 20–30(–35) × 6–10 mm, the inner 9–13 mm wide. Nectaries 10–15 × 2 mm, greenish, linear, 5 mm above the base of the perianth-segment. Filaments 8 mm, papillose. Capsule not winged. Style 8–10 mm, 3-fid, the branches 2–7 mm, papillose. $2n=18+0$–9B. *S. & S.E. Europe, westwards to S.E. France.* Al Bu Ga Gr It Ju Rm Rs (W).

16. F. meleagroides Patrin ex Schultes fil. in Schultes & Schultes fil. *Syst. Veg.* **7**: 395 (1829). Stem 25–60 cm. Leaves 3–6(–7), alternate, the lowest 7–16 cm, up to 7 mm wide, the rest shorter and narrower, the uppermost about as long as the pedicel. Flowers solitary. Perianth broadly campanulate; segments blackish outside, greenish inside, tessellated with purplish-brown, without fascia, the outer 20–25 × 7–9 mm, acute, the inner 10 mm wide, obtuse or apiculate. Nectaries 15 × 2 mm, 4 mm above the base of the perianth-segment. Filaments 10 mm, papillose. Style 7 mm, 3-fid, the branches 3–4 mm, papillose. Capsule not winged. *Wet meadows and streamsides. S. part of U.S.S.R., from C. Ukraine eastwards; W.C. Bulgaria.* Bu Rs (C, W, E).

17. F. obliqua Ker-Gawler, *Bot. Mag.* **22**: 857 (1805). Stem 10–20 cm. Leaves 8–11, glaucous, the lowest 4–13 cm × 10–20 mm, lanceolate, opposite or alternate, the rest narrower, alternate. Flowers 1–2(–4). Perianth conical-campanulate, usually somewhat narrowed at the mouth; segments 20–30 × 10–14 mm, blackish, glaucous outside, not tessellated, the inner and outer similar. Nectaries 4 mm, linear, green, at the base of the perianth-segment. Filaments 9 mm, papillose. Style 12 mm, 3-fid, the branches 2–3 mm, smooth. Capsule not winged. $2n=24$. *Scrub.* ● *S. Greece (Attiki).* Gr.

18. F. tuntasia Heldr. ex Halácsy, *Consp. Fl. Graec.* **3**: 222 (1904). Like **17** but usually more robust; stem up to 35 cm; leaves up to 25; flowers 1–4(–6); style 10 mm, the branches 1–1·5 mm. ● *Kikladhes (Kithnos).* Gr.

19. F. drenovskii Degen & Stoj., *Bull. Inst. Roy. Hist. Nat. (Sofia)* **4**: 142 (1931). Stem 17–30 cm. Leaves 4–5(–9), alternate, the lowest 6–7(–14) cm × 4–6 mm, linear-lanceolate, the rest narrower. Flowers 1(–3). Perianth narrowly campanulate; segments dark purplish to reddish-brown, glaucous outside, yellowish-green inside, the outer 16–25 × 4–8 mm, acute, the inner 5–11 mm wide, acute or obtuse. Nectaries 2 × 1 mm, at the base of the perianth-segment, green. Filaments 8–9 mm, papillose. Style 8–10 mm, 3-fid, the branches 1 mm, papillose. Capsule not winged. ● *N.E. Greece, S.W. Bulgaria.* Bu Gr.

20. F. conica Boiss., *Diagn. Pl. Or. Nov.* **1(7)**: 105 (1846). Stems 7–25 cm. Leaves 5–7, shining green, the lowest 2·5–6 cm × 5–16 mm, broadly lanceolate, subopposite, the rest alternate, narrower. Flowers 1–2. Perianth conical-campanulate; segments yellow, not tessellated, narrowly elliptical to rhombic; the outer 12–20 × 5–7 mm, the inner 8 mm wide. Nectaries 1 mm, greenish-yellow, 1 mm above the base of the perianth-segment. Filaments 6–7 mm, sparsely papillose. Style 7–9 mm, 3-fid, the branches 2–4 mm, smooth. Capsule not winged. *Scrub and cultivated ground.* ● *S. Greece (W. Peloponnisos).* Gr.

21. F. euboeica Rix, *Kew Bull.* **30**: 158 (1975) (*F. sibthorpiana* auct. balcan., non (Sibth. & Sm.) Baker). Stem 3–10 cm, glabrous. Leaves 5–9, glaucous, the lowest 3–5 cm × 7–10 mm, lanceolate, subopposite or alternate, the rest alternate, narrower. Flowers 1–2. Perianth narrowly campanulate; segments yellow, not tessellated, narrowly ovate, acute or obtuse, the outer 13–23 × 3–6 mm, the inner 5–10 mm wide. Nectaries 2·5–4 × 1 mm, at the base of the perianth-segments, dark brown, lanceolate. Filaments 5–8 mm, sparsely papillose. Style 7–11 mm, 3-fid, the branches 1–4 mm, smooth or rarely papillose. Capsule not winged. *Rocky limestone slopes.* ● *E. Greece (Evvoia).* Gr.

22. F. stribrnyi Velen., *Sitz.-Ber. Böhm. Ges. Wiss.* **1893(37)**: 61 (1893). Stem 10–30(–80) cm. Leaves 10–14, the lowest 4–10 cm × 5–20 mm, alternate, the middle narrower, alternate, the upper in a whorl of 3. Flowers 1–3. Perianth narrowly campanulate; segments glaucous green with purple markings

outside, especially at the apex, yellowish inside, not tessellated, the outer 20–28 × 4–6 mm, oblong, acute, the inner 7–10 mm wide, obovate-cuneate or obtuse. Nectaries 2 × 1 mm, at the base of the perianth-segment. Filaments 7–9 mm, papillose. Style 10 mm, smooth, undivided. Capsule broadly 6-winged. $2n=24$. *Woods, scrub and grassy places.* ● *S. Bulgaria, Turkey.* Bu ?Ju Tu.

23. F. ehrhartii Boiss. & Orph. in Boiss., *Diagn. Pl. Or. Nov.* **3(4)**: 105 (1859). Stem 6–20 cm. Leaves 6–10, glaucous, the lowest 2·5–7 cm × 10–15 mm, opposite, oblong-lanceolate, the rest narrower, alternate. Perianth narrowly campanulate; segments dark purplish-brown, with a yellow apex outside, greenish-yellow inside, not tessellated, the outer 14–23 × 4–6 mm, narrowly ovate or oblong, acute, the inner 7–11 mm wide, obovate-cuneate, or obtuse. Nectaries 2 × 1 mm, at the base of the perianth-segment. Filaments 4–6 mm, papillose. Style 5–9 mm, smooth, undivided. Capsule not winged. *Rocky and bushy places.* ● *Aegean region (Evvoia, N. Kikladhes).* Gr.

24. Lilium L.[1]

Bulbous perennials. Bulbs of overlapping scales, without a tunic. Leaves numerous, verticillate or scattered, usually decreasing in size up the stem. Flowers solitary or in a raceme, erect or nodding. Perianth-segments 6, free, petaloid, erect to strongly recurved, caducous. Nectary-furrows present. Anthers dorsifixed, versatile; filaments filiform, often slightly flattened. Style long; stigma 3-lobed. Fruit an obovoid capsule, more or less 6-angled. Seeds numerous, flat.

Literature: H. J. Elwes, *A Monograph of the Genus* Lilium. London. 1877–1880. A. Grove & A. D. Cotton, *A Supplement to Elwes' Monograph of the Genus* Lilium. London. 1934–1940. H. B. D. Woodcock & W. T. Stearn, *Lilies of the World.* London. 1950.

1 Flowers with erect or patent, never strongly recurved perianth-segments
2 Flowers orange to bright red **3. bulbiferum**
2 Flowers white **2. candidum**
1 Flowers with ± strongly recurved perianth-segments
3 Flowers pink or purplish, rarely white; leaves usually verticillate **1. martagon**
3 Flowers yellow, orange or scarlet; leaves not verticillate
4 Perianth-segments 8–12 cm
5 Perianth-segments orange; stem-bulbils present **10. lancifolium**
5 Perianth-segments yellow; stem-bulbils absent
6 Perianth-segments unspotted; anthers red **8. rhodopaeum**
6 Perianth-segments spotted; anthers dark yellow **9. monadelphum**
4 Perianth-segments 3–7 cm
7 Leaves changing abruptly in aspect from patent below to appressed above **7. chalcedonicum**
7 Leaves changing gradually in aspect up the stem
8 Flowers bright red or orange
9 Leaves pubescent on the veins beneath **6. carniolicum**
9 Leaves glabrous on the veins beneath
10 Leaves up to 1 cm wide; flowers bright red **5. pomponium**
10 Leaves up to 2 cm wide; flowers orange-red **4. pyrenaicum**
8 Flowers yellow
11 Leaves pubescent on the veins beneath, sometimes intermittently so **6. carniolicum**
11 Leaves glabrous on the veins beneath
12 Perianth-segments *c.* 3 cm, unspotted **6. carniolicum**
12 Perianth-segments 5–6·5 cm, spotted **4. pyrenaicum**

[1] By V. A. Matthews.

1. L. martagon L., *Sp. Pl.* 303 (1753). Stem 90–180 cm. Leaves up to 16 × 6·5 cm, usually in whorls, oblanceolate, 7- to 9-veined, glabrous or pubescent on the veins beneath. Flowers 5–10(–40), ebracteolate; pedicels recurved. Perianth-segments up to 3·5 cm, recurved, pink to dark purplish-red (rarely white), often spotted. Filaments pinkish; anthers orange-yellow or reddish-purple. $2n=24+0$–$2B$. *Woods and scrub. From N.E. France, Estonia and C. Ural southwards to C. Spain and C. Greece.* Al Au Bu Co Cz Ga Ge Gr He Hs Hu It Ju Lu Po Rm Rs (B, C, W, E) Tu [Be *Br Da Fe Ho No Su].

Variable, especially in colour of flowers and hairiness of stem and flowers, but the variants are worth no more than varietal status.

2. L. candidum L., *Sp. Pl.* 302 (1753). Stem 90–120(–180) cm. Leaves up to 19·5 × 2·5 cm, lanceolate, 3- to 5-veined, glabrous beneath. Flowers 5–6(–15), sometimes bracteolate; pedicels erect or patent. Perianth-segments *c.* 8 cm, slightly recurved near apex, white. Filaments white; anthers yellow. $2n=24$. *Rocky slopes and scrub. W. & S. Greece; S. Jugoslavia (S. Makedonija). Cultivated for ornament and naturalized from gardens in the Mediterranean region.* Gr Ju [Al Co Ga It Sa Si]. (*S.W. Asia.*)

3. L. bulbiferum L., *Sp. Pl.* 302 (1753). Stem 40–60(–150) cm; leaf-axils with or without bulbils. Leaves up to 7(–15) × 1·5 cm, lanceolate to ovate-lanceolate, 3- to 7(–9)-veined, more or less glabrous beneath, ciliate. Flowers 1–3, sometimes bracteolate; pedicels erect. Perianth-segments 5·5–8·5 cm, erect, orange or bright red, with black spots and papillose inside. Filaments orange-pink; anthers reddish-brown to orange. $2n=24$. ● *C. Europe, extending southwards to Spain, S. Italy and N.W. Jugoslavia.* Au Co Cz Ga Ge He Hs Hu It Ju Po *Rm [?Fe No Rs (B, W) Su].

Var. *croceum* (Chaix) Pers. (subsp. *croceum* (Chaix) Baker) differs from the typical variety in having orange flowers, and stem-bulbils usually absent.

4. L. pyrenaicum Gouan, *Obs. Bot.* 25 (1773). Stem 30–90 (–135) cm. Leaves up to 13 × 2 cm, ascending to patent, linear-lanceolate, 3(–15)-veined, glabrous beneath, minutely ciliate. Flowers 1–8(–12), bracteolate; pedicels recurved. Perianth-segments 5–6·5 cm, recurved, greenish-yellow or rarely orange-red, with dark purple lines and spots and purplish-black papillae inside. Filaments pale green; anthers reddish-brown. *Woods and mountain meadows.* ● *S. France and N. Spain.* Ga Hs [Br].

A variant with orange-red flowers (forma *rubrum* Stoker) occurs in N. Spain together with the typical plant.

5. L. pomponium L., *Sp. Pl.* 302 (1753). Stem 30–75(–90) cm. Leaves up to 13 × 1 cm, patent below, gradually more appressed above, linear, 1- to 3-veined, glabrous beneath, ciliate. Flowers 1–6(–10), bracteolate; pedicels recurved. Perianth-segments 5–6·5 cm, recurved, bright red, with dark purple lines and spots and purplish papillae inside. Filaments pale green; anthers red. *Rocky hillsides.* ● *Maritime Alps and adjacent hill-country.* Ga ?Hs It.

6. L. carniolicum Bernh. ex Koch, *Syn. Fl. Germ.* 708 (1837). Stem 25–80(–90) cm. Leaves up to 7·5 × 2 cm, lanceolate, 3- to 9-veined, pubescent or not on the veins beneath, ciliate. Flowers 1–6, usually bracteolate; pedicels recurved. Perianth-segments

3–6·5 cm, recurved, red, orange or yellow, often with brownish-purple spots and papillose inside. Filaments yellowish or light green; anthers orange or orange-red. $2n=24$. *Mountain meadows and scrub.* ● *S.E. Alps and Balkan peninsula, southwards to N.W. Greece; W. & C. Romania.* Al Au Bu Gr It Ju Rm.

A very polymorphic species particularly in the Balkan peninsula, where constituent taxa of specific and infraspecific status have been recognized. The best-known segregates are: **L. albanicum** Griseb., *Spicil. Fl. Rumel.* **2**: 385 (1846) (*L. carniolicum* subsp. *albanicum* (Griseb.) Hayek), from Albania, N.W. Greece and S.W. Jugoslavia, a small plant up to 40 cm with yellow perianth-segments *c.* 3 cm, and with the leaves glabrous on the veins beneath; **L. bosniacum** (G. Beck) G. Beck ex Fritsch, *Mitt. Naturw. Ver. Steierm.* **45**: 163 (1909), from C. & S.W. Jugoslavia, with leaves irregularly pubescent beneath and yellow, spotted flowers; and **L. jankae** A. Kerner, *Österr. Bot. Zeitschr.* **27**: 402 (1877) (*L. carniolicum* subsp. *jankae* (A. Kerner) Hayek), from E. Jugoslavia, Bulgaria and Romania, with leaves evenly pubescent on the veins beneath and perianth-segments yellow, spotted sometimes. Typical *L. carniolicum* from the S.E. Alps and N.W. Jugoslavia has the perianth-segments 5–6·5 cm, light red or orange and with brownish-purple spots, and leaves densely pubescent on the veins beneath.

The variation is not fully understood but at present it seems sensible to treat the components of the complex as varieties of *L. carniolicum*.

7. L. chalcedonicum L., *Sp. Pl.* 302 (1753). Stem 45–120 cm. Leaves lanceolate to obovate, 3- to 5-veined, pubescent on the veins beneath, ciliate; lower leaves up to 12×2 cm, patent, markedly distinct from the appressed upper leaves, which are not more than $4·5\times1·5$ cm. Flowers 1–7(–12), sometimes bracteolate; pedicels recurved. Perianth-segments 6·5–7 cm, recurved, orange-red, without spots, with papillae inside on lower half. Filaments pale yellow; anthers red. *Rocky mountain woods.* ● *S. & W. Greece, S. Albania.* Al Gr.

Plants with shorter stems 45–60 cm, usually ebracteolate flowers and with less prominent leaf-cilia have been called **L. heldreichii** Freyn, *Flora* (*Regensb.*) **63**: 28 (1880). It has a more north-westerly range and *L. chalcedonicum* sensu stricto a more south-easterly range, but the area of overlap is large and the differences are not sufficient to warrant subspecific treatment.

8. L. rhodopaeum Delip., *Naučni Trud. Agron. Fak. Plovdiv* **1**: 129 (1952). Stem 80–100 cm. Leaves up to $14\times1·5$ cm, linear to linear-oblong, pubescent on the veins beneath, ciliate. Flowers (1–)3–5, ebracteolate; pedicels recurved. Perianth-segments 8–12 cm, recurved, bright lemon-yellow, without spots. Anthers red. *Mountain meadows and rocky slopes.* ● *C. Rodopi.* Bu Gr.

9. L. monadelphum Bieb., *Fl. Taur.-Cauc.* **1**: 267 (1808). Stem 100–140 cm. Leaves up to $12\times2·5$ cm, broadly lanceolate to oblanceolate, 10- to 12-veined, pubescent on the veins beneath, ciliate. Flowers (1–)5–30, ebracteolate; pedicels recurved. Perianth-segments 8–10 cm, recurved, pale yellow, spotted with purple inside and tinged with purplish-brown at the base outside. Anthers yellow. Stamens free or united into a tube around the ovary. *Open woodland and scrub. Krym* (*hills above Jalta*). Rs (K). (*Caucasus.*)

10. L. lancifolium Thunb., *Trans. Linn. Soc. London* **2**: 333 (1794) (*L. tigrinum* Ker-Gawler). Stem 60–120(–150) cm; leaf-axils with bulbils. Leaves up to $19\times1·7$ cm, patent, linear-lanceolate, 5- to 7-veined, glabrous beneath, ciliate. Flowers 5–12, usually bracteolate; pedicels recurved. Perianth-segments *c.* 10 cm, recurved, bright orange, with purplish-black spots and small purplish papillae inside. Filaments reddish; anthers dark orange-red. *Cultivated for ornament, and naturalized in E. Austria.* [Au.] (*China, Japan.*)

25. Ornithogalum L.[1]

Bulbous perennials. Bulbs usually ovoid, of free or concrescent, concentric scales, renewed each year or progressively over 2–4 years. Leaves basal. Flowers in a corymbiform or elongate raceme. Perianth-segments 6, free or scarcely connate at the base, petaloid. Stamens 6; filaments simple or 3-dentate; anthers dorsifixed, introrse. Fruit a loculicidal capsule; seeds numerous, globose to elongate-prismatic or flattened.

Many characters, especially of the flowers and bulbs, can only be seen properly on live material or on material preserved in fixative; dried material is often unsuitable for determination and cannot be adequately reconstituted by boiling or other techniques.

The classification adopted here relies heavily on features of the bulbs and type of germination and departs, thereby, considerably from more traditional systems.

Literature: J. G. Baker, *Jour. Linn. Soc. London* (*Bot.*) **13**: 257–285 (1873). C. Zahariadi, *Rev. Biol.* (*Bucarest*) **7**: 5–41 (1962); *Rev. Roum. Biol.* (*Bot.*) **10**: 272–291 (1965); *Bot. Žur.* **62**: 1624–1639 (1977); *Ann. Mus. Goulandris* **3**: 51–75 (1977). N. D. Agapova, *Bot. Žur.* **51**: 210–220 (1966); **59**: 406–414 (1974). J. Cullen & J. A. Ratter, *Notes Roy. Bot. Gard. Edinb.* **27**: 293–339 (1967). F. Garbari & N. Tornadore, *Atti Soc. Tosc. Sci. Nat.* ser. B, **77**: 101–111 (1971).

1 Pedicels not more than 10 mm at anthesis and not more than 15 mm in fruit; inflorescence usually narrowly spiciform
 2 Plant 35–100 cm; leaves 4–6; capsule 17–20 mm **9. reverchonii**
 2 Plant 15–40 cm; leaves 1–3; capsule 10–12 mm
  3 Leaf solitary; ovary obovoid-lanceolate, truncate at apex; bulbs 8–12 mm in diameter **33. unifolium**
  3 Leaves 2–3(–4); ovary lanceolate-fusiform, attenuate at apex; bulbs 12–25 mm in diameter **34. concinnum**
1 Pedicels usually more than 10 mm at anthesis, usually more than 15 mm in fruit; inflorescence racemose to corymbose, rarely spiciform
 4 At least the inner filaments tricuspidate
  5 All filaments with the longitudinal crest of the mid-vein not toothed at apex; ovary ovoid to subglobose, shorter than style **30. nutans**
  5 At least the inner filaments with the longitudinal crest of the mid-vein toothed at apex; ovary attenuate-ovoid, longer or shorter than style **31. boucheanum**
 4 Filaments entire
  6 Perianth 50–65 mm in diameter; ovary blackish-violet **32. arabicum**
  6 Perianth 20–45 mm in diameter; ovary glaucous, green or yellowish
   7 Raceme elongate-cylindrical, usually with 20–80 flowers; pedicels subequal, erect in fruit and appressed to axis of inflorescence
    8 Perianth hyaline or greenish-white, yellowish or greenish inside; margins of segments inrolled longitudinally after anthesis
     9 Lower bracts ovate; ovary attenuate, conical at apex **3. visianicum**
     9 Lower bracts lanceolate; ovary truncate or rounded at apex
      10 Perianth hyaline or pale greenish-white **2. sphaerocarpum**

[1] By C. Zahariadi.

10 Perianth yellowish to greenish
11 Ovary usually longer than wide, cylindrical to ovoid-lanceolate; style 2·5–4 mm, equalling or scarcely longer than ovary; flowering May–June **1. pyrenaicum**
11 Ovary globose or subglobose; style (3–)3·5–4·5(–5) mm, usually longer than ovary; flowering July–September **4. creticum**
8 Perianth milky-white inside; margins of segments seldom inrolled after anthesis
12 Perianth-segments with a green stripe outside in the apical part only or without a stripe; flowers with disagreeable odour **10. fischeranum**
12 Perianth-segments with a green stripe almost throughout their length outside; flowers odourless
13 Anthers greenish; ovary attenuate-conical at apex; capsule attenuate-apiculate at apex **8. prasinantherum**
13 Anthers yellow; ovary usually truncate at apex; capsule not apiculate but sometimes mucronate at apex
14 Ovary 2·1–2·5 mm; style usually shorter than ovary, thickened and conical at base; green stripe on outside of outer perianth-segments lanceolate **7. pyramidale**
14 Ovary (2·5–)3·5–5 mm; style usually longer than ovary, filiform throughout; green stripe on outside of outer perianth-segments narrowly ligulate
15 Ovary ovoid-lanceolate; style more than 3·5 mm, distinctly longer than ovary **5. narbonense**
15 Ovary cylindrical; style not more than 3·5 mm, shorter than or scarcely longer than ovary **6. ponticum**
7 Raceme usually short and corymbiform at anthesis (rarely ±cylindrical), usually with 2–15(–25) flowers; lower pedicels longer than upper, not appressed to axis of inflorescence in fruit
16 Leaves without a white stripe on upper surface, the margins often thin, of 2 layers of epidermal cells
17 Capsule at maturity with ±winged angles, pendent; base of pedicels becoming flaccid **11. oligophyllum**
17 Capsule at maturity with obtuse or keeled angles, erect, horizontal or deflexed; base of pedicels not becoming flaccid
18 Leaves pubescent or ciliate (sometimes very shortly so)
19 Leaves with slender, short cilia, glabrous on the surfaces; inflorescence raised above the soil-surface; pedicels patent or ascending at maturity **23. comosum**
19 Leaves pubescent at least on lower surface or only ciliate; inflorescence resting on the soil-surface; pedicels deflexed at maturity **15. fimbriatum**
18 Leaves glabrous, not ciliate but sometimes scabrid on the margin
20 Leaves green or scarcely glaucous, flat; capsule with apical lobes equally spaced **12. montanum**
20 Leaves glaucous, sometimes twisted; capsule ± truncate at apex, with apical lobes contiguous in pairs
21 Leaves (8–)10–22 mm wide, with wide translucent margin; seeds 3–3·5 mm **13. atticum**
21 Leaves (2–)4–8(–10) mm wide, with narrow translucent margin; seeds 2·2–2·7 mm **14. oreoides**
16 Leaves with a white stripe on upper surface (often not visible on dried material), with normal margins
22 Leaves pubescent beneath **26. armeniacum**
22 Leaves glabrous, sometimes ciliate
23 Ovary narrowly cylindrical; young capsule with 3 obtuse angles
24 Anthers without coloured cells at insertion of filament; angles of ovary not thickened on the back, scarcely sulcate **19. amphibolum**
24 Anthers with a group of reddish-brown cells at insertion of filament; angles of ovary slightly thickened on the back, sulcate in the upper ⅓ **17. costatum**
23 Ovary usually elongate-cylindrical to obconical; capsule (before maturity) with 6 ± definite, narrowly winged or obtusely thickened angles
25 Pedicels ascending in flower, arcuate-recurved in fruit (especially the lower ones) so that the capsule rests on the soil **18. woronowii**
25 Pedicels ascending to deflexed but not arcuate-recurved in fruit
26 Ovary and capsule with 3 distinct pairs of wings **20. wiedemannii**
26 Ovary and capsule smooth or keeled but not winged
27 Pedicels deflexed in fruit, sometimes appressed to axis of inflorescence, with a motor pulvinus at base; aerial part of scape short or absent
28 Bulb with concrescent scales, surrounded by numerous bulbils which remain dormant for at least a year **27. refractum**
28 Bulb with free scales, without bulbils, or with a few offsets which grow out in their first year
29 Pedicels after anthesis (but while still green) flaccid and sulcate at apex; ovary ovoid, less than 1½ times as long as wide, equalling or slightly longer than style **21. sibthorpii**
29 Pedicels after anthesis (but while still green) rigid and terete at apex; ovary lanceolate or linear-lanceolate, more than 1½ times as long as wide, as long as or shorter than style **22. exscapum**
27 Pedicels ascending to ±patent in fruit, without a distinct motor pulvinus at the base; aerial part of scape usually long
30 Capsule before dehiscence with 6 strongly thickened angles, separated by deep furrows; testa with linear subepidermal cells; bulbs sprouting in spring **29. exaratum**
30 Capsule before dehiscence with 6 scarcely to strongly thickened, keeled or rounded angles, separated by shallow furrows; testa with ovate to orbicular subepidermal cells; bulbs sprouting in autumn
31 Bulb surrounded by bulbils which remain dormant for at least a year; fruiting pedicels patent or ±deflexed **28. divergens**
31 Bulb without bulbils, or with offsets which grow out in their first year; fruiting pedicels ascending to patent, rarely deflexed
32 Offsets numerous, forming tufts of leaves around the bulb; capsule usually with 6 equally spaced angles **24. umbellatum**
32 Offsets absent or few, not forming tufts of leaves around the bulb; capsule usually with 3 distinct pairs of angles
33 Bulb-scales free **16. collinum**
33 Bulb-scales concrescent **25. orthophyllum**

Subgen. **Beryllis** (Salisb.) Baker. Bulb progressively renewed over 2–3 years, of free scales, the outer sometimes tunicate. Leaves without a white stripe. Inflorescence many-flowered, elongate-cylindrical. Pedicels patent in flower, more or less erect and appressed to axis of inflorescence in fruit. Filaments entire. Ovary and capsule with 3 obtuse angles. Germination epigeal.

1. O. pyrenaicum L., *Sp. Pl.* 306 (1753). Plant 30–80(–100) cm. Leaves (4–)5–8, often withered at anthesis. Bracts shorter than pedicels. Flowers faintly fragrant. Perianth-segments pale yellowish inside, greenish outside and with a darker green stripe on the back, the outer 11–13 × 2·5–3 mm, flat at first, becoming inrolled at the margins. Anthers pale yellow. Ovary 2·4–3 mm, ovoid-lanceolate or shortly cylindrical, truncate at apex. Style

2·5–3·3 mm, slightly longer to slightly shorter than ovary. Flowering May–June. $2n=16, 18$. *Meadows and scrub. S., W. & S.C. Europe, northwards to S. England.* Au Be Br Bu Co Ga ?Gr He Hs It Ju Lu Rm Rs (W, K) Sa.

2. O. sphaerocarpum A. Kerner, *Österr. Bot. Zeitschr.* **28**: 15 (1878). Like **1** but perianth-segments hyaline or pale greenish-white; ovary subglobose to ovoid; style equalling or slightly longer than ovary. $2n=16$. *Meadows and scrub. S. & S.C. Europe.* Al Au ?Bu Co Cz Ga Gr Hu It Ju Rm Sa Tu.

3. O. visianicum Tommasini, *Mem. Ist. Veneto* **20**: 176 (1876). Like **1** but perianth-segments greenish-yellow; ovary ovoid, attenuate-conical at apex. *Maritime rocks.* ● *Adriatic island of Palagruža.* Ju.

4. O. creticum Zahar., *Ann. Mus. Goulandris* **3**: 52 (1977). Like **1** but perianth-segments pale greenish; ovary globose or subglobose; style (3–)3·5–4·5(–5) mm, usually longer than ovary; flowering July–September. *Dry rocky ground.* ● *Kriti.* Cr.

5. O. narbonense L., *Cent. Pl.* **2**: 15 (1756) (*O. pyramidale* subsp. *narbonense* (L.) Ascherson & Graebner; incl. *O. arcuatum* Velen., non Steven). Plant (20–)30–50(–80) cm. Leaves 4–6(–7), 8–16 mm wide, persistent until after anthesis. Bracts shorter or longer than pedicels. Flowers scentless. Perianth-segments 12–16 mm, lanceolate to oblong-lanceolate, patent, remaining flat, milky-white, with a ribbon-shaped green stripe on the back throughout their length. Anthers yellow. Ovary 3·5–5 mm, ovoid, truncate at apex. Style (3·7–)4·2–5·5 mm, as long as or longer than ovary, filiform throughout. Flowering May–July. $2n=54$. *Grassland, roadsides and disturbed ground. S. Europe.* Al Bl Bu Co Cr Ga Gr Hs It Ju Lu ?Rm Sa Si Tu.

6. O. ponticum Zahar., *Rev. Roum. Biol. (Bot.)* **10**: 290 (1965). Like **5** but up to 80(–100) cm; leaves 4–7(–8); perianth often infundibuliform; segments broadly lanceolate to ovate-elliptical; anthers sometimes tinged with reddish-brown; ovary cylindrical; style (1·9–)2–3·5 mm, shorter or scarcely longer than ovary. $2n=16$. *Dry hillsides and cultivated ground. Krym.* Rs (K). (*S.W. Asia.*)

7. O. pyramidale L., *Sp. Pl.* 307 (1753). Plant 30–100(–120) cm. Leaves 4–7, 6–15 mm wide, persistent usually until anthesis. Bracts shorter than pedicels. Perianth-segments 11–15 mm, patent, obovate-lanceolate to narrowly elliptical, milky-white, with a lanceolate green stripe on the back. Anthers yellow. Ovary 2·1–2·5 mm, subglobose to ellipsoid, truncate at apex. Style 1·4–1·7 mm, shorter than ovary, conical at base. Capsule attenuate or truncate, sometimes mucronate at apex. Flowering June–August. $2n=24$. ● *C. Europe, extending to C. Jugoslavia and E. Romania.* Au Cz Ge Hu ?It Ju Rm [Ho].

Records for the Mediterranean region are errors for **5**.

8. O. prasinantherum Zahar., *Ann. Mus. Goulandris* **3**: 57 (1977). Plant 40–90 cm. Leaves (4–)5–6(–8), (3–)4–10 mm wide, persistent usually until anthesis. Bracts shorter than or exceeding pedicels. Perianth-segments 11–16 mm, patent, ovate-lanceolate. Anthers greenish. Ovary 3–5 mm, ovoid-lanceolate, attenuate-conical at apex and passing gradually into the style. Style (3·5)–5–6·5 mm, as long as or longer than ovary, conical at base. Capsule ovoid-lanceolate, attenuate-apiculate at apex. Flowering June. *Dry, stony ground.* ● *S. Greece (Peloponnisos).* Gr.

9. O. reverchonii Lange in Willk., *Ill. Fl. Hisp.* **2**: 117 (1891). Plant 35–100 cm. Leaves 4–6, *c.* 15 mm wide. Pedicels 1–10 mm at anthesis, not more than 15 mm in fruit. Bracts greatly exceeding pedicels. Flowers 30–40 mm in diameter. Perianth campanulate or with patent segments; segments 15–20 mm, oblong-ovate, remaining flat, greenish, becoming white at anthesis, and sometime, with a green stripe on the back throughout their length. Anthers yellowish-white. Ovary *c.* 5 mm, oblong, rounded at apex. Style *c.* 4 mm, shorter than the ovary. Capsule 17–20 mm, attenuate at apex. Flowering April–July. *Limestone rocks. S.W. Spain.* Hs.

The relationships of this seldom-collected species are unclear and some authors consider it to be better placed in Subgen. *Cathissa*.

10. O. fischeranum Krasch. in Komarov, *Fl. URSS* **4**: 392 (1935). Plant 30–70 cm. Leaves 4–6(–7), 2–6(–10) mm wide. Pedicels (15–)23–35 mm. Bracts shorter than or rarely exceeding pedicels. Flowers with a disagreeable odour. Perianth-segments 10·5–15 mm, patent, linear-oblong, remaining flat, with or without a green stripe on the back only in the apical ½–⅓. Ovary 2·2–4·5 mm, ovoid-oblong to subglobose, attenuate at apex. Anthers greenish. Style 3–4·5 mm, as long as or longer than ovary, thickened at base. Capsule 8–10 mm, ovoid to ellipsoid, attenuate at apex. Flowering May–July. $2n=22, 24$. *Steppes. S. part of U.S.S.R.* Rs (W, E).

Subgen. **Leptotesta** Zahar. Bulb completely renewed each year, with 2–3(–4) free scales, the outer tunicate. Leaves 2–4, without a white stripe. Inflorescence a short raceme. Pedicels ascending in flower, deflexed in fruit. Filaments entire. Ovary and capsule with 6 winged angles. Germination hypogeal.

11. O. oligophyllum E. D. Clarke, *Travels* **2(3)**: 555 (1816). Plant 9–24 cm. Leaves 2–3(–4), 5–20 mm wide. Bracts usually exceeding pedicels which become flaccid at base in fruit. Flowers (3–)5–10(–20), odourless, the lower shorter than the pedicels; segments 11–15(–19) mm, oblong to lanceolate, white, with green stripe on the back. Ovary 3·5–5·5 mm, depressed at apex. Style (1·5–)2–2·2 mm. Capsule 10–15 mm, depressed at apex, with wings 1·5–3·5 mm wide. Flowering March–June. $2n=24$. *Rocky hillsides and mountain grassland. Balkan peninsula.* ?Al Bu Gr Ju Tu.

Subgen. **Oreogalum** Zahar. Bulb completely renewed each year, with concrescent scales, the outer sometimes free and tunicate. Leaves without a white stripe. Inflorescence a spreading to narrowly cylindrical raceme. Pedicels ascending in flower, patent or ascending in fruit. Filaments entire. Ovary and capsule with 6 obtuse to almost winged angles. Germination hypogeal.

12. O. montanum Cyr. in Ten., *Fl. Nap.* **1**: 176 (1811). Plant (7–)9–20(–30) cm. Leaves 3–6(–8), (6–)8–20(–30) mm wide, flat, green or slightly glaucous, glabrous, not ciliate. Bracts usually shorter than pedicels. Perianth-segments 10–25 mm, patent, oblong to lanceolate, white, with a green stripe on the back. Ovary (3–)4–6(–7) mm, more or less cylindrical, rounded or depressed at apex; style 2–3(–4) mm, equalling or shorter than ovary. Capsule ovoid, obovoid or cylindrical, with apical lobes equally spaced. Flowering April–May. $2n=12, 14, 18, 20+3B$. *Rocky ground and mountain pastures. Balkan peninsula; C. & S. Italy and Sicilia.* Bu Gr It Ju Si Tu.

Very variable, but no useful division into infraspecific taxa can yet be made in Europe.

Subgen. **Anosmium** Zahar. Like Subgen. *Oreogalum* but bulb-scales all free; leaves very glaucous, twisted when young. Capsule not winged; germination epigeal.

13. O. atticum Boiss. & Heldr. in Orph., *Fl. Graec. Exsicc.* no. 975 (1854). Plant 12–30 cm. Leaves (2–)4–6(–8), (8–)10–20 mm wide, flat or sometimes undulate or twisted, glaucous, glabrous, smooth or scabrid on margin; translucent margin wide. Bracts equalling or exceeding pedicels. Perianth-segments 18–30 mm, patent, oblong-lanceolate, white, with a green stripe on the back. Anthers yellow. Ovary 5–7 mm, elongate- to obovoid-cylindrical. Style (2–)2·2–3·5(–4) mm. Capsule ellipsoid to cylindrical, longer than style, with apical lobes contiguous in pairs. Seeds 3–3·5 mm. Flowering May–June. *Rocky ground.* ● *S. Greece.* Gr.

14. O. oreoides Zahar., *Rev. Biol.* (*Bucarest*) **7**: 20 (1962). Like **13** but leaves (2–)4–8(–10) mm wide, smooth on margin; translucent margin narrow, formed of 3–4 rows of epidermal cells; bracts sometimes shorter than pedicels; perianth-segments 13–20 mm; ovary 3–5 mm; style equalling or shorter than ovary; capsule oblong to ovoid; seeds 2·2–3 mm. Flowering May. $2n=18$. *Dry places.* ● *From N.E. Bulgaria to S.W. Ukraine.* Bu Rm Rs (W).

Subgen. **Hypogaeum** Zahar. Like Subgen. *Oreogalum* but bulb-scales all free; leaves sometimes with a white stripe; pedicels ascending in flower, ascending to deflexed in fruit; ovary and capsule with 3 or 6 angles; germination hypogeal.

15. O. fimbriatum Willd., *Ges. Naturf. Freunde Berlin Neue Schr.* **3**: 420 (1801). Plant 10–20 cm. Leaves 2–6, 2–15 mm wide, flat or concave, without a white stripe on upper surface, more or less pubescent beneath. Inflorescence sessile on the soil; fruiting pedicels deflexed. Perianth-segments 12–19 mm, patent, lanceolate or oblong-lanceolate, white, with green stripe on the back. Anthers yellow. Ovary 3–8 mm, cylindrical, with 6 prominent almost winged angles. Style 2·5–3 mm. Capsule ovoid to ellipsoid, depressed at apex, with 6 narrowly winged angles. Flowering March–May. $2n=12+0$–3B. *Dry places. S.E. Europe.* Bu Gr Rm Rs (W, K) Tu.

Variable, especially in the hairiness of leaves, scape and pedicels.

16. O. collinum Guss., *Ind. Sem. Horto Boccad.* (1825) (*O. gussonei* Ten., *O. tenuifolium* Guss., non F. Delaroche). Plant 7–20(–40) cm. Leaves 4–15, 1·5–8(–15) mm wide, canaliculate, with a white stripe on upper surface, glabrous, sometimes ciliate. Inflorescence sessile on the soil or aerial part of scape up to 4 cm; fruiting pedicels ascending to patent. Perianth-segments 12–17 mm, patent, oblong or lanceolate to linear, white, with green stripe on back, not decurrent. Anthers pale yellowish or reddish at point of attachment. Ovary 3·5–6 mm, elongate-cylindrical, with 6 angles. Style 2–3 mm. Capsule ovoid, with 6 narrowly winged angles. Flowering April–May. *Mediterranean region.* Al ?Co Cr Ga Gr Hs It Ju Sa Si ?Tu.

This species and **25** are often treated as closely related or even conspecific but are distinguished by the structure of the bulb-scales and type of germination. Much further study is required to elucidate their circumscription, relationships and chromosome variation. The chromosome numbers of these taxa are far from clear: different numbers have been reported within and between the two species but the precise identity of the material studied is not always certain.

17. O. costatum Zahar., *Ann. Mus. Goulandris* **3**: 63 (1977). Like **16** but plant 12–30 cm; leaves 6–10(–15), 1–1·5(–3) mm wide; inflorescence always raised above the soil; perianth-segments 12–15(–22) mm; ovary with 3 rounded-obtuse angles; capsule cylindrical, the 3 angles rounded but becoming sulcate in the upper ¼. *Dry places.* ● *S. Greece* (*N.E. Peloponnisos*). Gr.

18. O. woronowii Krasch. in Komarov, *Fl. URSS* **4**: 743 (1935). Plant 10–25 cm. Leaves 4–8, glabrous, 1·5–5(–7) mm wide, with a white stripe. Inflorescence not or only slightly raised above surface of soil; fruiting pedicels arcuate-recurved so that the lower capsules are resting on the soil. Bracts shorter than pedicels. Perianth-segments 12·5–16 mm, patent, oblong or obovate to narrowly lanceolate, white, with pale green stripe on back. Anthers pale yellow. Ovary 2·8–5·5 mm, elongate-cylindrical to broadly ovoid, more or less depressed at apex, with 6 obtuse, not winged angles. Style (1·5–)2–2·6 mm, thickened at base. Capsule 7–13 mm, obovoid, depressed at apex, the 6 angles obtuse. Flowering April. $2n=16$. *Dry grassland and scrub. Krym.* Rs (K). (*Caucasus.*)

Subgen. **Amphibolum** Zahar. Bulb completely renewed each year, of free, fleshy scales, the outer sometimes tunicate. Leaves with a white stripe on upper surface, canaliculate. Inflorescence a more or less elongate raceme. Pedicels ascending in flower and fruit. Filaments entire. Ovary ? and capsule with 3 rounded angles. Germination epigeal.

19. O. amphibolum Zahar., *Rev. Biol.* (*Bucarest*) **7**: 20 (1962). Plant 10–30 cm. Leaves 4–13, 0·6–1·5(–3) mm wide, glabrous. Pedicels without a motor pulvinus at the base. Bracts shorter than pedicels. Perianth-segments 10–19 mm, narrowly lanceolate, white, with green stripe on back. Anthers pale yellow. Ovary 3–6 mm, narrowly cylindrical. Style 4–6 mm, equalling or longer than ovary. Capsule 10–15 mm, narrowly cylindrical, not depressed at apex. Flowering April–May. $2n=18$. *Dry places.* ● *From Bulgaria to S. Moldavia.* Bu Rm Rs (W).

Subgen. **Amphigalum** Zahar. Bulb completely renewed each year, of free scales. Leaves with a white stripe on upper surface, canaliculate. Inflorescence with 3–20(–30) flowers, more or less corymbiform. Pedicels ascending in flower, patent to deflexed in fruit. Filaments entire. Ovary and capsule with 6 wings. Germination epigeal.

20. O. wiedemannii Boiss., *Fl. Or.* **5**: 221 (1882). Plant 12–25 cm. Leaves (4–)5–7, 3–4·5 mm wide, glabrous. Inflorescence usually raised above surface of soil. Pedicels patent or more or less deflexed in fruit, without a motor pulvinus. Bracts longer or shorter than pedicels. Perianth-segments 12–16 mm, patent, ovate-elliptical to lanceolate, white, with green stripe on back. Anthers whitish. Ovary 3–4·5 mm, obovoid-cylindrical, truncate or depressed at apex, with 6 translucent wings. Style 2–2·5 mm, shorter than ovary. Capsule ovoid or obovoid, deeply depressed at apex, with wings 2–3 mm wide. Flowering March–April. *Dry grassland. Turkey-in-Europe, N.E. Greece.* Gr Tu. (*N. Anatolia.*)

21. O. sibthorpii W. Greuter, *Boissiera* **13**: 160 (1967) (*O. nanum* Sibth. & Sm., non Thunb.). Plant 5–15(–20) cm. Leaves (3–)5–9(–11), (1–)1·5–4·5(–7) mm wide, glaucous, glabrous, longer than inflorescence. Inflorescence corymbiform, sessile on surface of soil. Pedicels after anthesis (but while still green) swollen into a motor pulvinus at the base, flaccid and sulcate at the apex, deflexed in fruit. Bracts longer or shorter than pedicels. Flowers (2)4–7(15). Perianth-segments 12·5–26 mm, ovate-elliptical, white, with pale green stripe on back. Anthers yellow or slightly greenish. Ovary 4–6(–7·5) mm, ovoid, with 6 promi-

nent angles, depressed at apex. Style (2·5–)4-5·5 mm. Capsule 9–15 mm, obovoid to cylindrical, the six angles keeled, the septal fissures reaching the base. Flowering February–March. $2n = 14$, 18, 24, 28. *Dry hillsides. Balkan peninsula and Aegean region, S.E. Romania.* Bu Cr Gr Ju Rm Tu.

22. O. exscapum Ten., *Fl. Nap.* **1**: 175 (1811). Like **21** but pedicels after anthesis (but while still green) rigid and terete at apex; bracts longer or shorter than pedicels; perianth-segments not more than 15 mm; style *c.* 5 mm, as long as or longer than ovary; capsule ovoid, the septal fissures not reaching the base; flowering March–April. $2n = 18$. *Pastures. Mediterranean region.* Al Co Gr Hs It Ju Sa Si.

Subgen. **Ornithogalum.** Bulb completely renewed each year by one series of concrescent, fleshy scales. Leaves with or without a white stripe, canaliculate or flat. Inflorescence more or less corymbiform, elongating in fruit. Pedicels ascending in flower, ascending to deflexed in fruit. Perianth-segments patent, appressed to capsule after anthesis. Filaments usually entire. Ovary and capsule with 6 more or less obtuse angles. Germination epigeal.

23. O. comosum L., *Cent. Pl.* **2**: 15 (1756). Plant 15–30(–40) cm. Bulb without bulbils, without or with a few offsets. Leaves (3–)4–6(–9), (1·5–)3·5–6(–9) mm wide, glaucous, flat or concave, without a white stripe, glabrous, ciliate. Scape glabrous. Pedicels ascending in fruit. Bracts lanceolate, shorter or longer than pedicels. Flowers (4–)8–30(–60). Perianth-segments 10–20 mm, white, with narrow green stripe on back. Filaments entire; anthers pale yellow. Ovary cylindrical to obconical, longer or shorter than style, with 6 rounded angles. Capsule cylindrical to obovoid; angles rounded, equal, separated by shallow furrows. Flowering April–June. $2n = 14$, 18. *Dry grassland. S. & S.C. Europe, from Austria and Italy eastwards.* Au Bu †Cz Gr Hu It Ju Rm.

24. O. umbellatum L., *Sp. Pl.* 307 (1753). Plant (15–)20–30 (–40) cm. Bulb surrounded by tufts of leaves arising from offsets, without dormant bulbils. Leaves (4–)6–9, 2–5(–8) mm wide, canaliculate to flat, with a white stripe on upper surface, glabrous, not ciliate. Scape glabrous. Pedicels patent in fruit. Bracts shorter than or equalling pedicels. Flowers (4–)8–20. Perianth-segments 15–22 mm, lanceolate to oblong-lanceolate, white, with wide green stripe on back. Filaments entire; anthers yellow. Ovary ovoid to subcylindrical, longer than style. Capsule oblong-ovoid to obovoid; angles equally spaced, more rarely in pairs, rounded and thickened, separated by shallow furrows. Flowering April–May. $2n = 18$–20, 27, 28, 35, 36, 42, 44, 45, 54, 72, 90, 108. *S. & S.C. Europe; doubtfully native further north, but widely naturalized.* Al Au Be Bl *Br Bu Co *Ga *Ge Gr He Ho Hs Hu It Ju Lu *Po Rm Rs (W, ?C) Sa Si Tu [Cz Da Fe Hb No Rs (B) Su].

Variable, especially in shape of bulb, width of leaves and length of pedicels.

O. × wildtii Podp., *Živa* ser. 2, **23**: 246 (1913) (**31 × 25**), which is recorded from S. Czechoslovakia and W. Hungary, differs in its inner filaments being shortly 3-fid at apex.

25. O. orthophyllum Ten., *Fl. Nap.* **4**, *Syll. App.* **3**: 4 (1830) (*O. kochii* Parl., *O. tenuifolium* auct. eur. medit., non Guss., nec F. Delaroche, *O. gussonei* auct. eur. medit., non Ten.). Like **24** but without or with a few offsets; leaves sometimes up to 15, sometimes only 1 mm wide; pedicels ascending, patent or rarely somewhat deflexed in fruit; bracts shorter or sometimes longer than pedicels; flowers sometimes up to 25; perianth-segments 11–20(–25) mm, ovate, obovate or lanceolate; ovary obconical to cylindrical; capsule obovoid to subcylindrical, the angles contiguous in pairs, rounded and scarcely thickened, sometimes prominent or winged; flowering March–June. $2n = 14 + 0$–3B, 18, 19, 20, 27–29, 36. *S. & C. Europe.* ?Al Au Bu Cz ?Ga *Ge ?Gr He Hs Hu It Ju Lu *Po Rm Rs (W, ?K).

1 Ovary and capsule with the angles neither thickened nor keeled; furrows between angles shallow or absent **(a)** subsp. **psammophilum**
1 Ovary and capsule with thickened and keeled or ±winged angles; furrows between angles conspicuous
2 Ovary and capsule with ±winged angles; gynophore about as long as capsule **(b)** subsp. **orbelicum**
2 Ovary and capsule with keeled angles; gynophore (if present) shorter than capsule
3 Bracts somewhat shorter to longer than pedicels **(c)** subsp. **baeticum**
3 Bracts not more than ½ as long as pedicels
4 Leaves 5–15 mm wide, flat, as long as or slightly longer than the inflorescence **(d)** subsp. **orthophyllum**
4 Leaves (3–)4-8(–11) mm wide, usually canaliculate, longer than the inflorescence
5 Green stripe on back of perianth-segments decurrent on pedicel; spur greenish; leaves spongy **(e)** subsp. **acuminatum**
5 Green stripe on back of perianth-segments not decurrent; spur whitish; leaves firm **(f)** subsp. **kochii**

(a) Subsp. **psammophilum** (Zahar.) Zahar., *Bot. Jour. Linn. Soc.* **76**: 356 (1978) (*O. psammophilum* Zahar.): Leaves linear, canaliculate, longer than inflorescence; bracts usually shorter than the ascending pedicels; green stripe on back of perianth-segments not decurrent; capsule flattened between the 3 angles. *E. Romania.*

(b) Subsp. **orbelicum** (Velen.) Zahar., *loc. cit.* (1978) (*O. orbelicum* Velen.): Leaves linear, canaliculate, as long as or longer than inflorescence; bracts ⅓–½ as long as the patent pedicels; green stripe on back of perianth-segments not decurrent; capsule with winged angles separated by deep furrows. ● *Mountains of Bulgaria.*

(c) Subsp. **baeticum** (Boiss.) Zahar., *loc. cit.* (1978) (*O. baeticum* Boiss., *O. umbellatum* var. *longebracteatum* Willk.): Leaves flat or slightly keeled, longer than inflorescence; bracts shorter or longer than the erect or patent pedicels; green stripe on back of perianth-segments not decurrent; capsule with 6 obtuse angles separated by deep furrows. $2n = 18$, 27. *Portugal and Spain.*

(d) Subsp. **orthophyllum**: Leaves flat, as long as or longer than inflorescence; bracts less than half as long as the erect or patent pedicels; broad green stripe on back of perianth-segments not decurrent; capsule with 6 angles separated by deep furrows. ● *C. & S. Italy.*

(e) Subsp. **acuminatum** (Schur) Zahar., *Bot. Jour. Linn. Soc.* **76**: 357 (1978) (*O. acuminatum* Schur): Leaves usually canaliculate, usually longer than inflorescence; bracts usually shorter than the erect or patent pedicels; green stripe on back of perianth-segments decurrent on pedicel; capsule with 6 angles separated by deep furrows. *S. Carpathians.*

(f) Subsp. **kochii** (Parl.) Zahar., *loc. cit.* (1978) (*O. tenuifolium* var. *kochii* (Parl.) Hayek): Leaves usually canaliculate, longer than inflorescence; bracts shorter than the erect or patent pedicels; green stripe on back of perianth-segments not decurrent; capsule with 6 obtuse angles separated by deep furrows. *Throughout most of the range of the species.*

26. O. armeniacum Baker, *Gard. Chron.* ser. 2, **11**: 748 (1879) (*O. macedonicum* Velen.). Plant 6–12(–15) cm. Bulb without offsets. Leaves 5–12, 1–2 mm wide, flat or canaliculate, pubescent

beneath, ciliate, with a white stripe on lower surface. Scape pubescent. Pedicels patent or slightly deflexed in fruit. Bracts shorter or longer than pedicels. Flowers (3–)6–9(–15). Perianth-segments (15–)20–22 mm, white, with green stripe on back. Filaments entire; anthers yellow. Ovary narrowly oblong to ovoid, longer than style. Capsule obovoid to cylindrical; angles contiguous in pairs, rounded and scarcely thickened. Flowering February–March. *Dry places. Macedonia.* Gr Ju. (*Anatolia.*)

27. O. refractum Kit. ex Schlecht. in Willd., *Enum. Pl. Horti Berol., Suppl.* 18 (1814). Plant 5–8(–12) cm. Bulb surrounded by numerous bulbils which remain dormant for at least a year. Leaves (4–)5–8(–11), (1–)2–4(–8) mm wide, with a white stripe on upper surface, glabrous, not ciliate. Scape glabrous, the aerial part 0·5–1 cm. Pedicels deflexed or refracted in fruit, with a pulvinus at the base. Bracts shorter or longer than pedicels. Flowers 2–18. Perianth-segments 15–24 mm, white, with a narrow green stripe on back. Filaments entire. Ovary oblong, as long as or longer than style. Capsule cylindrical to ovoid; angles contiguous in pairs, obtuse, prominent, separated by shallow furrows. Seeds with ovate to orbicular epidermal cells. Flowering March–April. $2n = 54$, 56, 72. *Stony or cultivated ground. S.E. & S.C. Europe.* Bu Gr Hu It Ju Rm Rs (W, K) ?Si Tu.

28. O. divergens Boreau, *Not. Pl. Fr.* 15 (1887) (*O. umbellatum* var. *divergens* (Boreau) G. Beck). Like **27** but aerial part of scape 5–11 cm; pedicels patent or more or less deflexed in fruit, without a pulvinus; bracts shorter than pedicels; flowers (3–)4–6(–13); perianth-segments with a wide green stripe on back; ovary cylindrical to obovoid. Flowering March–April. $2n = 18$, 42, 54. *Dry pastures and waste places. S. Europe, extending northwards to S.E. Czechoslovakia and to* 49°*N. in France.* Bl Bu Co Cr Cz Ga Gr Hs Hu It Ju Rm Sa Si.

29. O. exaratum Zahar., *Ann. Mus Goulandris* **3**: 67 (1977). Plant 10–25 cm. Bulb without dormant bulbils. Leaves 3–8, 2–5(–7) mm wide, with a white stripe on upper surface, glabrous, not ciliate. Scape glabrous, the aerial part 1–11 cm. Pedicels ascending or patent in fruit, without pulvinus. Bracts shorter or longer than pedicels. Flowers 3–14. Perianth-segments 17–23 mm, patent, white, with a wide green stripe on back. Filaments entire. Ovary broadly obovoid to ellipsoid, longer than style. Capsule cylindrical, with prominent angles separated by deep furrows. Seeds with linear epidermal cells. Flowering March–April. Abies-*woods.* ● *E. Greece* (*C. Evvoia*). Gr.

Subgen. **Myogalum** (Link) Baker. Bulb progressively renewed over 3–4 years, of free scales, the outer tunicate at the base. Leaves with a white stripe on upper surface, flat or concave. Inflorescence a more or less unilateral raceme. Pedicels recurved in fruit. Perianth more or less widely campanulate. At least the inner 3 filaments tricuspidate at apex. Ovary and capsule with 6 equidistant, rounded-obtuse angles. Germination epigeal.

30. O. nutans L., *Sp. Pl.* 308 (1753). Plant (15–)20–60 cm. Bulb with numerous offsets. Leaves 4–6, (6–)10–15 mm wide, glabrous, not ciliate. Scape glabrous. Bracts exceeding pedicels. Flowers 3–12. Perianth-segments 15·5–31 mm, white, with wide green stripe on back. All filaments with crest of mid-vein not toothed at apex. Ovary ovoid to subglobose, shorter than the slender style. Capsule broadly ovoid. Flowering March–May. $2n = 45$. *S.E. part of Balkan peninsula; cultivated elsewhere for ornament and widely naturalized.* Bu Gr Tu [Au Be Br Cz Da Ga Ge He Ho Hs Hu It *Ju No Po Rm Su].

31. O. boucheanum Ascherson, *Österr. Bot. Zeitschr.* **16**: 192 (1866) (*O. nutans* subsp. *boucheanum* (Ascherson) Hayek). Like **30** but leaves 3–4(–6), (3·5–)5–25 mm wide; bracts sometimes shorter than pedicels; flowers 5–20; at least the inner filaments with the longitudinal crest of the mid-vein toothed at apex; ovary narrowly ovoid, often longer than the stout style; capsule narrowly to broadly ovoid. $2n = 28$. *Grassland and roadsides. From Czechoslovakia to Bulgaria and Krym; naturalized elsewhere in C. Europe.* *Au Bu Cz Hu *It Ju Rm Rs (C, W, K) [Ge He Po].

Subgen. **Caruelia** (Parl.) Baker. Bulb progressively renewed over 3–4 years, of 7–8 free scales, the outer tunicate. Leaves without a white stripe, flat or concave. Inflorescence corymbiform. Pedicels ascending in fruit. Perianth shallowly campanulate. Filaments entire. Ovary with angles. Capsule with 3 obtuse angles.

32. O. arabicum L., *Sp. Pl.* 307 (1753). Plant 30–80 cm. Bulb with numerous offsets. Leaves (5–)7–8, 10–30 mm wide, glabrous, not ciliate. Bracts shorter than pedicels. Lower pedicels 80–100 mm, rarely less. Flowers 6–25. Perianth-segments 15–32 mm, white or cream, without green stripe on back. Ovary obovoid to subglobose, blackish-violet. Capsule cylindrical. Flowering March–May. *Rocky ground. Mediterranean region, Portugal.* Bl Co Gr Hs It Ju *Lu Sa Si [Ga].

Subgen. **Cathissa** (Salisb.) Baker. Bulb with free scales, the outer tunicate. Leaves without a white stripe, flat to canaliculate. Inflorescence narrowly spiciform. Pedicels erect in fruit, shorter than capsule. Perianth more or less campanulate. Filaments entire. Ovary and capsule with 3 obtuse angles.

33. O. unifolium (L.) Ker-Gawler, *Bot. Mag.* **24**: t. 935 (1806). Bulb 8–12 mm in diameter. Plant 2–10(–25) cm. Leaf solitary (very rarely 2–3) 5–15 cm × 2–6·5 mm wide, glabrous, narrowed at the apex into a long cylindrical appendage. Pedicels 1·5–3 mm. Bracts 8–10 mm, greatly exceeding pedicels. Flowers 3–5(–8). Perianth-segments 10–16 mm, white, without green stripe on back. Ovary obovoid-lanceolate, obtusely truncate at apex; style longer than ovary. Capsule oblong-ovoid. Flowering February–March. $2n = 34$. *Open woods and pastures. W. half of Iberian peninsula.* Hs Lu.

34. O. concinnum (Salisb.) Coutinho, *Fl. Port.* 134 (1913). Like **33** but plant 12–30(–40) cm; leaves 2–3(–4), 4–10 mm wide; pedicels up to 5(–8) mm; flowers 6–15(–20); ovary narrowly ovoid-fusiform, attenuate at the apex; style shorter than ovary. Flowering March–July. $2n = 36$. ● *Portugal.* ?Hs Lu.

26. Urginea Steinh.[1]

Bulbous perennials. Bulb perennial, ovoid to globose, composed of numerous free scales. Inflorescence a many-flowered raceme; each flower subtended by a bract and often a smaller bracteole. Perianth-segments free, with a dark mid-vein. Filaments slender or dilated at the base, inserted at base of perianth. Capsule triquetrous. Seeds numerous, flattened, winged.

1 Stem 50–150 cm; bulb 5–15 cm in diameter; leaves 30–100 mm wide **3. maritima**
1 Stem 10–50 cm; bulb 2–3·5 cm in diameter; leaves less than 10 mm wide
2 Stem 20–50 cm; leaves 3–10 mm wide, linear, undulate-sinuate; style longer than stamens **1. undulata**
2 Stem 10–35 cm; leaves not more than 2 mm wide, filiform, entire; style about equalling stamens **2. fugax**

[1] By J. McNeill.

1. U. undulata (Desf.) Steinh., *Ann. Sci. Nat.* ser. 2, **1**: 330 (1834). Bulb 2–3·5 cm in diameter. Stem 20–50 cm. Leaves 8–15 cm × 3–10 mm, linear-oblong, undulate-sinuate, appearing after the flowers. Inflorescence a rather lax 8- to 30-flowered raceme; bracts about half as long as the pedicels, with a deflexed appendage at the base; pedicels 10–12 mm. Perianth-segments 10–12 mm, linear to spathulate, dull pink to greyish- or greenish-purple, with a reddish mid-vein. Anthers 1·7–2·5 mm. Style longer than the stamens. $2n=20$, 60. *Rocky ground. E. Spain, Sardegna, S. Corse.* Co Hs Sa. (*N. Africa.*)

2. U. fugax (Moris) Steinh., *op. cit.* 328 (1834). Like **1** but stems 10–35 cm; leaves up to 40 cm × 2 mm, linear-filiform, entire; inflorescence 5- to 10-flowered; bracts *c.* 1 mm, ovate; perianth-segments pale pink, with a red mid-vein; anthers 1·2–1·7 mm; style about equalling the stamens. $2n=20+1B, 4B$. *Dry hillsides. C. Mediterranean region.* Co It Sa. (*N. Africa to Cyprus and Syria.*)

3. U. maritima (L.) Baker, *Jour. Linn. Soc. London (Bot.)* **13**: 221 (1873) (*U. scilla* Steinh., *U. anthericoides* (Poiret) Steinh.). Bulb 5–15 cm in diameter. Stem 50–150 cm. Leaves 30–100 cm × 30–100 mm, long-lanceolate, entire, appearing before the flowers. Inflorescence a long, dense raceme with more than 50 flowers; bracts subulate, often caducous, shorter than the pedicels; pedicels 10–30 mm, more or less erect. Perianth-segments 6–8 mm, oblong, whitish, with a green or purple mid-vein. Anthers *c.* 2·5 mm. Style equalling the stamens. $2n=20$, 30, 40, 60, 64. *Maritime sands and dry, rocky ground. Mediterranean region, Portugal.* Al Bl Co Cr Ga Gr Hs It Ju Lu Sa Si.

27. Scilla L.[1]

Bulbous perennials. Bulb perennial, ovoid to globose, composed of numerous free scales, progressively renewed each year. Flowers solitary or in a raceme or corymb. Bracts 0 or 1 subtending each flower; bracteoles absent. Perianth-segments free, usually blue or purple, rarely white. Filaments free, usually slender, inserted at base of perianth. Capsule subglobose, 3-lobed. Seeds 1–10 in each loculus, globose to ellipsoid, unwinged.

Many species, including several from S.W. Asia, are cultivated for ornament.

Literature: R. D. Meikle, *Lily Year Book* **25**: 122–130 (1961). E. V. Mordak, *Bot. Žur.* **56**: 1444–1456 (1971). F. Speta, *Österr. Bot. Zeitschr.* **119**: 6–18 (1971); *Ann. Mus. Goulandris* **2**: 59–67 (1974); *Linzer Biol. Beitr.* **8**: 293–322 (1976).

1 Bracts more than 4 mm, linear-lanceolate, linear or subulate
2 Bracts 4–7 mm, the lower less than half as long as the pedicels; leaf solitary, linear-lanceolate to lanceolate **9. monophyllos**
2 Bracts more than 7 mm, about as long as or longer than the pedicels; leaves 2–12, linear, linear-oblong or oblanceolate
3 Leaves linear-oblong to oblanceolate, (8–)10–35(–60) mm wide; bulb 25–80 mm in diameter
4 Bracts 50–80 mm; filaments *c.* 2 mm wide, lanceolate-elliptical; inflorescence corymbose, subhemispherical; leaves usually shortly ciliate **13. peruviana**
4 Bracts 10–25 mm; filaments 1–1·3 mm wide, lanceolate; inflorescence racemose, cylindrical to conical; leaves not ciliate
5 Leaves 6–10, 15–30 cm; inflorescence 5- to 15-flowered; perianth-segments 9–11 mm **12. lilio-hyacinthus**
5 Leaves 3–6, 30–40 cm; inflorescence 30- to 40-flowered; perianth-segments 6–7 mm **14. beirana**
3 Leaves linear, 2–15 mm wide; bulb 10–25 mm in diameter
6 Bulb 18–25 mm in diameter; lower pedicels 15–50 mm **7. ramburei**
6 Bulb 10–20 mm in diameter; lower pedicels 5–12 mm
7 Leaves about as long as scape; perianth-segments subacute **6. verna**
7 Leaves usually longer than scape; perianth-segments obtuse **8. odorata**
1 Bracts absent or not more than 2(–3) mm, ovate to triangular
8 Flowers appearing in late summer or autumn, before the leaves; bracts absent
9 Leaves linear, canaliculate or ±filiform, 1–2(–4) mm wide, glabrous, gradually narrowed to the apex **15. autumnalis**
9 Leaves linear-lanceolate, flat, 5–25 mm wide, papillose-hispid at the margin, rounded and sometimes mucronate at the apex **16. obtusifolia**
8 Flowers appearing in the spring or early summer, with or after the leaves; bracts usually present
10 Stems 30–80 cm, with more than 40 flowers; leaves 8–12 **11. hyacinthoides**
10 Stems 5–30 cm, with 1–35 flowers; leaves (1–)2–7
11 Perianth-segments 3–5 mm; leaves not more than 8 mm wide; racemes 15- to 35-flowered **10. litardierei**
11 Perianth-segments 5–15 mm; leaves usually more than 8 mm wide, always so if racemes with more than 12 flowers
12 Perianth-segments 12–15 mm; flowers nodding; pedicels curved, equalling or shorter than the perianth **3. siberica**
12 Perianth-segments 5–12 mm; flowers ±erect; pedicels erect to ascending, at least the lower longer than the perianth
13 Leaves appearing before the flowers, longer than the inflorescence at anthesis; perianth-segments 9–12 mm **4. amoena**
13 Leaves appearing with the flowers, scarcely as long as the inflorescence at anthesis; perianth-segments 5–10 mm
14 Inflorescence 1- to 5(–10)-flowered; leaves 2(–5), sheathing the scape to about halfway; bracts usually absent **1. bifolia**
14 Inflorescence 7- to 15(–20)-flowered; leaves 3–7, not or scarcely sheathing the scape; bracts always present
15 Perianth-segments 6–7 mm; bracts 1 mm, ±truncate at base **2. messeniaca**
15 Perianth-segments 9–10 mm; bracts 2–3 mm, auriculate at base **5. bithynica**

Subgen. **Scilla**. Roots annual, simple. Flowering in spring with or after the leaves. Inflorescence 1- to 15-flowered. Seeds globose, carunculate. Germination epigeal.

1. S. bifolia L., *Sp. Pl.* 309 (1753) (incl. *S. nivalis* Boiss.). Bulb 10–20(–30) mm in diameter, pinkish under the dry outer scales. Stems (2–)5–20 cm, terete. Leaves 2(–5), broadly linear, 3–12 mm wide, appearing with the flowers and sheathing the scape to about halfway. Inflorescence 1- to 5(–10)-flowered, subsecund; bracts usually absent, occasionally minute; lower pedicels 10–30 mm, the upper much shorter. Flowers erect; perianth-segments 5–10 mm, bright blue to pale lilac, occasionally white at the base. Seeds 2–3 mm, with smooth testa. $2n=18$, 36, 54. *Meadows and woods. C. & S. Europe, northwards to Belgium and N. Ukraine.* Al Au Be Bu Cz Ga Ge Gr He Hs Hu It Ju Po Rm Rs (C, W, K) Sa Si Tu [Ho].

Speta (*Linzer Biol. Beitr.* **8**: 293–322 (1976)) distinguishes **S. nivalis** Boiss., *Diagn. Pl. Or. Nov.* **1(5)**: 63 (1844) ($2n=18$), by its narrower, deeply canaliculate leaves and violet flowers and reports it as occurring in Europe only in Greece; he has described a hexaploid variant as **S. pneumonanthe** Speta, *Linzer Biol. Beitr.* **8**: 316 (1976) ($2n=54$). Dwarf mountain plants from other

[1] By J. McNeill.

parts of Europe, often called *S. nivalis*, have been shown to be only phenotypic modifications. Speta (*Naturk. Jahrb. Stadt Linz* **1973**: 9–54 (1974)) calls similar plants from W. Europe **S. bifolia** subsp. **bifolia** and in C. Europe recognizes two other subspecies: subsp. **danubialis** Speta, *op. cit.* 16 (1974), with perianth-segments *c.* 8 mm and $2n=18$, and subsp. **drunensis** Speta, *op. cit.* 17 (1974), with perianth-segments 9–10 mm and $2n=36$. He also distinguishes **S. vindobonensis** Speta, *loc. cit.* (1974), with perianth-segments *c.* 6 mm, darker blue with a white base, smaller lighter-coloured seeds and larger chromosomes; it has $2n=18$. The status of these variants from C. Europe and their relationship to the variation throughout the range of the species is not clear.

2. S. messeniaca Boiss., *Diagn. Pl. Or. Nov.* **1(7)**: 110 (1846). Like **1** but stems angled; leaves 5–7, 12–20 mm wide, scarcely sheathing the scape; inflorescence 7- to 15(–20)-flowered; bracts *c.* 1 mm, oblong, truncate, sometimes 2-fid; pedicels 4–8 mm; perianth-segments 6–7 mm, pale blue. *Rocky grassland.* ● *S. Greece (Peloponnisos).* Gr.

Plants from Albania, said to differ in having elongate bulbs and perianth-segments 5 mm, have been distinguished as **S. albanica** Turrill, *Kew Bull.* **1932**: 197 (1932). Bulb-shape is generally a plastic character in the genus and the status of this variant is uncertain.

3. S. siberica Haw. in Andrews, *Bot. Reposit.* **6**: t. 365 (1804). Bulb 15–20 mm in diameter, ovoid, whitish under the dark purple outer scales. Stems 10–20(–30) cm, angled. Leaves 2–4, broadly linear, 10–20 mm wide, appearing with the flowers, sheathing the scape to about ½. Inflorescence 1- to 2(–5)-flowered; bracts 1–1·5 mm, ovate, truncate or 2-fid; pedicels equalling or shorter than the perianth. Flowers drooping; perianth-segments 12–15 mm, deep blue. Capsule globose. Seeds 2 mm, ovate; caruncle cylindrical, peg-like. *Woods and scrub. U.S.S.R., northwards to c. 55°N. in C. Russia; widely cultivated for ornament and naturalized elsewhere.* Rs (C, W, K, E) [Au Bu Cz Ho Ju Rm].

4. S. amoena L., *Sp. Pl.* 309 (1753). Like **3** but leaves 3–7, appearing before the flowers, fully developed at anthesis, longer than the scape, obtuse; inflorescence (2–)3- to 6-flowered; lower pedicels longer than the perianth; flowers erect; perianth-segments 9–12 mm, bright blue; caruncle raphe-like, scarcely developed. *Widely cultivated for ornament and sometimes naturalized.* [Bu Cz Ga Ju Rm.] (*Origin unknown.*)

5. S. bithynica Boiss., *Diagn. Pl. Or. Nov.* **1(7)**: 111 (1846). Like **3** but bulb sometimes purplish under the dark brown to grey-brown outer scales; leaves narrowly linear, 4–13 mm wide; inflorescence 7- to 10(–15)-flowered; pedicels suberect, the lower longer than the perianth; bracts 2–3 mm, elongate-triangular, cordate-biauriculate at base; perianth-segments 9–10 mm, pale purplish-blue; caruncle raphe-like, scarcely developed. *E. Bulgaria.* Bu ?Rm. (*N.W. Anatolia.*)

Subgen. **Petranthe** (Salisb.) Chouard. Roots perennial, branched. Flowering in summer after the leaves have developed. Inflorescence 1- to *c.* 150-flowered. Seeds not carunculate. Germination hypogeal.

6. S. verna Hudson, *Fl. Angl.* ed. 2, **1**: 142 (1778). Bulb 10–15 mm in diameter, ovoid. Stems 5–15(–25) cm. Leaves 2–7, 3–20 cm × 2–5 mm, narrowly linear, obtuse, shorter than to about as long as the scape. Inflorescence a dense 2- to 12-flowered corymbose cluster; bracts linear-subulate, scarious, longer than the pedicels; lower pedicels 5–12 mm. Flowers scentless. Perianth-segments 5–8 mm, violet-blue, subacute. Filaments lanceolate. Capsule 4–6 mm, subglobose, trigonous. Seeds ovoid, black. $2n=20$. ● *W. Europe, from N. Portugal to the Færöer.* Br Fa Ga Hb Hs Lu No.

Plants from Portugal referred to this species differ in having most leaves longer than the scape, lax and racemose inflorescences and linear filaments.

7. S. ramburei Boiss., *Elenchus* 86 (1838). Like **6** but bulb 18–25 mm in diameter; stems 10–50 cm; leaves 3–10 mm wide, linear-oblong, acute, usually longer than the scape; inflorescence an elongating 6- to 30-flowered raceme; bracts shorter than the pedicels; lower pedicels 15–50 mm; perianth-segments up to 10 mm. $2n=20$. *Sandy places. Portugal, S. Spain.* Hs Lu.

Sometimes regarded as a subspecies or variety of **6**, but its status and that of **8** require further study.

Plants occurring as disjunct populations in S.W. Portugal are taller, with longer leaves and bracts less than half as long as the pedicels.

8. S. odorata Link in Schrader, *Jour. für die Bot.* **1799(2)**: 319 (1800). Like **6** but bulb (10–)15–20 mm in diameter; leaves acute, usually longer than the scape; inflorescence a short, 4- to 10-flowered raceme; lower bracts as long as or longer than pedicels; flowers scented; perianth-segments obtuse. *Sandy places.* ● *S. Spain, S. Portugal.* Hs Lu.

9. S. monophyllos Link, *loc. cit.* (1800). Bulb 10–20 mm in diameter. Stems 5–30 cm. Leaf solitary, 10–30 mm wide, linear-lanceolate to lanceolate, sheathing the scape. Inflorescence a 4- to 12-flowered raceme, becoming rather lax; bracts 4–7 mm, linear-lanceolate, long-acuminate; pedicels ascending, the lower 10–15 mm. Perianth-segments 6–8 mm, deep blue. Capsule 6–8 mm, ovoid. Seeds ovoid, black. $2n=20$, 40. *Heaths, pinewoods and sandy ground. Portugal, W. Spain.* Hs Lu.

10. S. litardierei Breistr., *Bull. Mens. Soc. Linn. Lyon* **23**: 129 (1954) (*S. pratensis* Waldst. & Kit., non Bergeret). Bulb *c.* 15 mm in diameter. Stems 20–30 cm. Leaves 3–6, 4–8 mm wide, linear, about as long as the scape. Inflorescence a dense 15- to 35-flowered raceme: bracts *c.* 10 mm, ovate; pedicels 8–10 mm. Perianth-segments 3–5 mm, blue. $2n=28$. ● *Jugoslavia.* Ju.

11. S. hyacinthoides L., *Syst. Nat.* ed. 12, **2**: 243 (1767). Bulb up to 50 mm in diameter, ovoid; outer scales glabrous, tightly investing the bulb. Stems 30–80 cm, robust. Leaves 8–12, 30–40 cm × 20–30 mm, linear-oblong, gradually narrowed at the base and apex, acute, shortly ciliate. Inflorescence 15–40 cm, racemose, subcylindrical, 40- to 150-flowered; bracts *c.* 1·5 mm, broadly ovate, often toothed; pedicels 15–30 mm, patent to ascending. Perianth-segments 5–7 mm, blue-violet. Filaments *c.* 0·8 mm wide at base, narrowly triangular to subulate. Capsule subglobose, subobtuse. $2n=20$. *Mediterranean region, Portugal.* Co Ga Gr Hs It Ju Lu Sa Si.

12. S. lilio-hyacinthus L., *Sp. Pl.* 308 (1753). Like **11** but bulb scales all loosely imbricate; stems 15–40 cm; leaves 6–10, 15–30 cm × 10–25 mm, rather abruptly narrowed at the apex, the margin glabrous; inflorescence 5–10 cm, 5- to 15-flowered; bracts 10–25 mm, subulate; pedicels ascending; perianth-segments 9–11 mm, bright blue; filaments *c.* 1·2 mm wide, lanceolate. *Woods and damp grassland.* ● *C. & S. France, N. Spain.* Ga Hs.

13. S. peruviana L., *Sp. Pl.* 309 (1753). Like **11** but bulb up to 80 mm in diameter, with outer scales lanate; stems up to 50 cm; leaves 40–60 cm × 10–40(–60) mm; inflorescence 5–20 cm, densely corymbose, subhemispherical, (5–)20- to 100-flowered; bracts 50–80 mm, subulate; perianth-segments 5–14 mm; filaments *c.* 2 mm wide, lanceolate-elliptical; capsule ovoid, acuminate. $2n=16$. *W. Mediterranean region, C. & S. Portugal.* ?Co Hs It Lu Sa Si.

An extremely variable species within which many infraspecific taxa have been recognized both in Europe and North Africa. The Italian populations have also frequently been segregated as four separate species, for which treatment there is some supporting karyological evidence (E. Maugini, *Caryologia* **5**: 167–177 (1953); **8**: 370–378 (1956)): **S. cupanii** Guss., *Fl. Sic. Prodr.* **1**: 416 (1827), a more slender variant from Sicilia with 7- to 15(–20)-flowered corymbs, pedicels only 30–60 mm, much shorter than the bracts, perianth-segments up to 10 mm, and $2n=14$; **S. sicula** Tineo ex Guss., *Fl. Sic. Syn.* **2**: 813 (1845), from Calabria, Sicilia and Malta, with pedicels 40–60 mm, equalling the bracts, sparsely ciliate leaves, and perianth-segments whitish or violet; **S. hughii** Tineo ex Guss., *Fl. Sic. Prodr., Suppl.* 162 (1832), endemic to Marettimo (Isole Egadi), with glabrous leaves 40–60 mm wide, deep violet perianth-segments and $2n=16$; and **S. elongata** Parl., *Nuovi Gen. Sp. Monocot.* 24 (1854), a robust plant from Sicilia, Sardegna and perhaps Corse with densely ciliate leaves, ciliate bracts, pedicels 50–100 mm and perianth-segments 10–14 mm.

14. S. beirana Samp., *Bol. Soc. Brot.* ser. 2, **7**: 125 (1931). Bulb *c.* 25 mm in diameter, ovoid. Stems 30–40 cm. Leaves 3–6, 30–40 cm × 8–15 mm, linear-oblong, gradually narrowed at base and apex, acute, glabrous, the cauline exceeding the stem. Inflorescence 8–15 cm, racemose, 30 to 40-flowered; bracts 15–18 mm, subulate, entire; pedicels 18–25 mm, ascending to semi-patent. Perianth-segments 6–7 mm, bluish-violet. Filaments 1–1·2 mm wide, lanceolate. ● *N.E. Portugal (Beira Alta).* Lu.

Subgen. **Prospero** (Salisb.) Chouard. Roots perennial, branched. Flowering in late summer or autumn before the leaves. Inflorescence 5- to 60-flowered; bracts absent. Germination epigeal.

15. S. autumnalis L., *Sp. Pl.* 309 (1753). Bulb 15–30 mm in diameter, ovoid. Stems 5–20 cm, minutely scabrid towards the base, up to twice as long as the mature leaves. Leaves 5–10 (absent or very short at anthesis), 4–15 cm × 1–2 mm, usually erect (occasionally up to 4 mm wide and more or less procumbent), narrowly linear and canaliculate or subfiliform, glabrous. Inflorescence an elongating 6- to 20-flowered raceme; pedicels 8–15 mm, ascending. Perianth-segments 3–5 mm, pinkish-blue to lilac. Seeds 2 × 1 mm, ellipsoid, black, finely rugulose. $2n=14$, 28, 42. *Dry, grassy, places. S. & W. Europe, northwards to S. England and Hungary.* Al Bl Br Bu Co Cr Ga Gr Hs Hu It Ju Lu Rm Rs (W, K) Sa Si Tu.

16. S. obtusifolia Poiret, *Voy. Barb.* **2**: 149 (1789). Like **15** but stems 10–30 cm, 3–4 times as long as the leaves; leaves 2–5, 3–4 cm × 5–10(–25) mm, patent to recurved, linear-lanceolate, flat, papillose-hispid at the margin. *Dry grassland and scrub. N.E. Spain and islands of W. Mediterranean region.* Bl Co Hs Sa Si.

The European plants belong to the endemic subsp. **intermedia** (Guss.) McNeill, *Bot. Jour. Linn. Soc.* **76**: 357 (1978); subsp. *obtusifolia*, from Morocco and Algeria, is more robust, with leaves 8–20 cm × 10–25 mm and 20- to 60-flowered racemes.

28. Hyacinthoides Medicus[1]
(*Endymion* Dumort.)

Like *Scilla* but bulb-scales coalescent, completely renewed each year; bracts 2. Perianth campanulate or the segments patent.

Literature: P. Chouard. *Types de Développement de l'Appareil végétatif chez les Scillées.* Thèse. Paris. 1930.

1 Perianth-segments 5–7 mm, patent; filaments inserted at base of perianth; leaves 4–8(–14) mm wide **3. italica**
1 Perianth ±campanulate, the segments 14–20 mm; filaments inserted above base or at middle of perianth; leaves 7–35 mm wide
2 Racemes unilateral, nodding towards apex; flowers scented; anthers cream-coloured **1. non-scripta**
2 Racemes not or only slightly unilateral, erect; flowers not scented; anthers blue **2. hispanica**

1. H. non-scripta (L.) Chouard ex Rothm., *Feddes Repert.* **53**: 14 (1944) (*Scilla non-scripta* (L.) Hoffmanns. & Link, *Endymion nutans* Dumort.; incl. *E. cernuus* (L.) Willk.). Leaves 3–6, 20–50 cm × 7–15(–25) mm, linear to linear-lanceolate, as long as or slightly shorter than scape. Raceme 4- to 16-flowered, unilateral, nodding towards apex. Perianth cylindrical-campanulate, the segments 14–20 mm, violet-blue, rarely pink or white, recurved at apex. Stamens unequal, the outer inserted at middle of perianth; anthers cream-coloured. $2n=16$, 24. *Woods, scrub and heaths.* ● *W. Europe, northwards to N. Scotland; locally naturalized from gardens in C. Europe.* Be Br Ga Hb Ho Hs Lu [*Ge It Rm].

2. H. hispanica (Miller) Rothm., *loc. cit.* (1944) (*Scilla hispanica* Miller, *Endymion patulus* Dumort., *E. campanulatus* Willk.). Leaves 4–8, 20–50 cm × 10–35 mm, linear-lanceolate to lanceolate, as long as or slightly shorter than scape. Racemes 4- to 16-flowered, more or less lax, not or only slightly unilateral, erect. Perianth campanulate, the segments semi-patent, blue, not recurved at apex. Stamens all equal, inserted at middle of perianth; anthers blue. $2n=16$, 24. *Shady places and cultivated ground. W. half of Iberian peninsula; naturalized from gardens elsewhere in S. & W. Europe.* Hs Lu [Br Ga Hb It Ju].

Hybrids between **1** and **2** are frequent, not only in those parts of the Iberian peninsula where they are sympatric, but also in England, Holland, and perhaps elsewhere in N.W. Europe, where **2** is only cultivated or naturalized.

3. H. italica (L.) Rothm., *op. cit.* 15 (1944) (*Scilla italica* L.). Leaves 2–6, 10–25 cm × 3–6(–12) mm, linear to linear-lanceolate, shorter to longer than scape. Racemes 6- to 30-flowered, dense. Perianth-segments 5–7 mm, patent, bluish-violet (rarely white). Stamens inserted at base of perianth; anthers blue. *Woods and rocky places.* ● *S.E. France, N.W. Italy; S.W. Portugal.* $2n=16$. Ga ?Hs It Lu.

Plants from S.W. Portugal with smaller stature (not more than 10 cm), few-flowered racemes and yellow anthers, have sometimes been recognized as a separate species, **H. vicentina** (Hoffmanns. & Link) Rothm., *loc. cit.* (1944) (*Scilla vicentina* Hoffmanns. & Link), but are probably not more than varietally distinct.

[1] By V. H. Heywood.

Scilla reverchonii Degen & Hervier, *Magyar Bot. Lapok* **5**: 7 (1906) (*Endymion reverchonii* (Degen & Hervier) Breistr.), from S.E. Spain (Sierra de Cazorla), appears to belong in this genus and is like **3** but with leaves more or less equalling the scape, lax-flowered raceme and deep blue perianth with erect segments. It has seldom been collected and requires further study. It has $2n=16$.

29. Chionodoxa Boiss.[1]

Glabrous, bulbous, scapose perennials. Flowers solitary or few in a raceme, erect. Perianth rotate, the 6 segments shortly connate at the base to form an urceolate tube. Stamens inserted at the base of the tube, the anthers about as long as the filaments, yellow, dorsifixed. Fruit a globose, loculicidal capsule with few seeds.

Several species from W. Anatolia are widely cultivated in gardens, and some are perhaps becoming locally naturalized.

Perianth 9–12 mm, whitish, sometimes lilac at apex; tube 2–3 × 2–3 mm **1. nana**
Perianth (12–)14–19 mm, blue; tube 3·5–5 × *c.* 2 mm **2. cretica**

1. C. nana (Schultes & Schultes fil.) Boiss. & Heldr. in Boiss., *Diagn. Pl. Or. Nov.* **2(13)**: 24 (1853). Bulb ovoid. Stem usually 5–10 cm. Leaves 2, as long as stem, 3–5 mm wide, linear, obtuse. Flowers usually solitary; perianth 9–12 mm, whitish, sometimes lilac at apex; tube 2–3 × 2–3 mm; segments elliptic-oblong, obtuse. Filaments *c.* 2 mm; anthers 3–4 mm. $2n=18$. *Snow-patches*, 1700–2300 *m; calcicole.* ● *Mountains of Kriti.* Cr.

2. C. cretica Boiss. & Heldr., *loc. cit.* (1853). Bulb ovoid. Stem usually 8–18 cm. Leaves 2, as long as stem, 4–10 mm wide, linear-lanceolate, somewhat cucullate at apex. Flowers 1–3(–5); perianth (12–)14–19 mm, blue; tube 3·5–5 × 2–3 mm, segments oblong-spathulate, obtuse or emarginate. Filaments *c.* 3 mm; anthers *c.* 4 mm. *Scrub*, 1300–1700 *m.* ● *Mountains of Kriti.* Cr.

30. Hyacinthus L.[2]

Glabrous, bulbous perennials. Bulb large, with a membranous tunic of free scales. Leaves several, all basal. Inflorescence a raceme with few to many blue, pink, purplish or white, fragrant flowers; bracts minute. Perianth tubular, inflated at the base, not constricted at the mouth, divided to about the middle into 6 patent, lanceolate lobes. Stamens 6, inserted below the perianth-lobes, in 1 row; anthers included. Fruit a globose, loculicidal capsule.

1. H. orientalis L., *Sp. Pl.* 316 (1753). Scape up to 30(–50) cm. Leaves 4–6(–12), 15–35 × 1–2 cm, linear to linear-lanceolate, flat, suberect. Raceme lax or dense, with 5–15 flowers usually nodding at anthesis; pedicels 4–8 mm. Perianth 10–25 mm, the lobes subequal, oblong to ovate, patent or slightly recurved. Anthers dark blue. *Widely cultivated for ornament and naturalized in the Mediterranean region.* [Ga Gr It Ju Sa Si.] (*S.W. Asia.*)

31. Brimeura Salisb.[3]

Glabrous, bulbous perennials. Bulb small; tunics coalescent, the outer evanescent. Leaves all basal, narrowly linear. Flowers 1–12 in a very lax raceme, blue, lilac-pink or white. Bracts narrowly lanceolate, at least as long as the pedicels. Perianth campanulate or tubular-campanulate, the segments united at the base. Stamens 6, inserted in middle of perianth; anthers blue. Fruit a trigonous, loculicidal capsule.

Literature: F. Garbari, *Atti Soc. Tosc. Sci. Nat.* ser. B, **77**: 12–36 (1970).

Flowers 6–12, blue to violet; perianth tubular-campanulate, the segments patent to recurved **1. amethystina**
Flowers 1–6(–8), lilac, lilac-pink or white; perianth-tube campanulate, the segments patent **2. fastigiata**

1. B. amethystina (L.) Chouard, *Compt.-Rend. Acad. Sci. (Paris)* **191**: 1147 (1930) (*Hyacinthus amethystinus* L.). Scapes 10–30 cm. Leaves several, erect, usually exceeding the scapes. Racemes 6- to 12-flowered, unilateral. Perianth 10–11 mm, 6–7 mm in diameter, tubular-campanulate, the segments shorter than the tube, patent to recurved, blue to violet. *Mountain grassland; somewhat calcicole.* ● *Pyrenees and mountains of N.E. Spain; N.W. Jugoslavia.* Ga Hs Ju.

2. B. fastigiata (Viv.) Chouard, *Bull. Mus. Nat. Hist. Nat. (Paris)* ser. 2, **3**: 177 (1931) (*Hyacinthus fastigiatus* (Viv.) Bertol.). Scapes *c.* 5 cm. Leaves several, erect, usually exceeding the scapes. Racemes 1- to 6(–8)-flowered, subcorymbose with the lower pedicels longer than the upper. Perianth 8–9 mm, 10–13 mm in diameter, campanulate, the segments longer than the tube, stellate-patent, lilac, lilac-pink or white. $2n=28$. ● *Islands of W. Mediterranean region; S. Greece (Taïyetos).* Co Bl Gr Sa.

32. Strangweia Bertol.[2]

More or less glabrous, bulbous perennials. Bulbs small, ovoid, with free scales. Leaves all basal, linear-lanceolate. Inflorescence a short, dense, raceme; flowers deep purplish-blue, subsessile; bracts lanceolate, with a deflexed, cylindrical spur. Perianth campanulate, divided to about $\frac{2}{3}$ into 6 erecto-patent, lanceolate segments. Stamens 6, attached at or about the middle of the tube, in 1 row; anthers included; filaments winged for their whole length, with 2 or 3 teeth at the apex. Fruit a globose, loculicidal capsule.

1. S. spicata (Sibth. & Sm.) Boiss., *Fl. Or.* **5**: 309 (1882) (*Hyacinthus spicatus* Sibth. & Sm.). Scape up to 15 cm. Leaves 4–8, slightly ciliate, longer than the scape. Bracts lanceolate, deflexed. Flowers 5–10, erect. Perianth 7–10 mm. Anthers dark blue. $2n=8$. *Rocky hillsides.* ● *S. & W. Greece.* Gr.

33. Bellevalia Lapeyr.[3]

Glabrous, bulbous, scapose perennials. Bulbs with a membranous tunic. Leaves several, all basal. Inflorescence a raceme, with numerous white or blue to violet flowers which become brownish, greenish or yellowish after anthesis. Bracts usually small, membranous. Perianth tubular, campanulate or infundibuliform, deeply divided into 6 more or less patent lobes. Stamens 6, inserted at the base of the perianth-lobes; anthers held next to the perianth-segments, blue. Fruit a triquetrous capsule with 3 prominent ribs.

Literature: N. Feinbrun, *Palest. Jour. Bot. (Jerusalem)* **1**: 336–409 (1940).

1 Racemes conical at anthesis
2 Pedicels nodding at anthesis; racemes 30- to 50-flowered; perianth-lobes greenish **5. ciliata**

[1] By I. B. K. Richardson. [2] By V. H. Heywood and A. Regueiro.
[3] By V. H. Heywood.

2 Pedicels erecto-patent at anthesis; racemes 40- to 80-flowered; perianth-lobes yellowish-white **6. sarmatica**
1 Racemes cylindrical or oblong at anthesis
3 Leaves procumbent; perianth bluish-violet or dark green at anthesis, the lobes whitish, with green veins **2. dubia**
3 Leaves erect or recurved; perianth without this combination of colours
4 Perianth 8–16 mm
5 Racemes oblong; perianth 8–18 mm, turbinate **7. romana**
5 Racemes cylindrical; perianth 9–16 mm, campanulate **1. trifoliata**
4 Perianth 5–7 mm
6 Outer leaves 3–12 mm wide; flowers dark blue or violet, later dingy yellow
7 Outer leaves 3–12 mm wide; leaf-margin smooth; flowers dark blue **4. hackelii**
7 Outer leaves 10–20 mm wide; leaf-margin scabrid; flowers dark violet, later dingy yellow **5. lipskyi**
6 Outer leaves 10–20 mm wide; flowers reddish-grey or white
8 Flowers reddish-grey; pedicels 5–8 mm **3. webbiana**
8 Flowers white; pedicels 1–1·5 mm **9. brevipedicellata**

1. B. trifoliata (Ten.) Kunth, *Enum. Pl.* **4**: 308 (1843). Scape 25–40(–60) cm. Leaves 2–4(–6), erect, about as long as the scape, lanceolate, often finely ciliate. Racemes cylindrical, 10- to 40-flowered; pedicels 4–8 mm. Perianth 8–16 mm, tubular-campanulate, violet at anthesis, later brownish, the lobes ¼–½ as long as tube, ovate to oblong, obtuse, greenish. Fruiting raceme cylindrical; pedicels patent or slightly deflexed. *Grassy places and cultivated ground. C. & E. Mediterranean region.* ?Cr Gr It Tu [Ga].

2. B. dubia (Guss.) Reichenb., *Fl. Germ. Excurs.* 105 (1830). Scape up to 40 cm. Leaves 2–5, procumbent, longer than scape, lingulate. Racemes cylindrical, 10- to 30-flowered; pedicels 5–8 mm. Perianth 5·5–8 mm, campanulate, bluish-violet or dark green at anthesis, later brownish, the lobes whitish, with green veins, *c.* ½ as long as tube, ovate. Fruiting raceme cylindrical; pedicels erecto-patent or horizontal. $2n=8$. *Grassy places and cultivated ground. C. & E. Mediterranean region.* ?Cr Gr It Ju Si.

Plants from the Balkan peninsula, described by Freyn, *Flora* (*Regensb.*) **68**: 95 (1885), as '*B. boissieri* spec. vel subspec. nova', but apparently with no valid name, tend to be smaller than elsewhere in the range with somewhat narrower leaves and smaller flowers. They overlap in all characters with **2** and are sometimes regarded as a subspecies of it. They have $2n=8$.

3. B. webbiana Parl., *Nuovi Gen. Sp. Monocot.* 19 (1854). Scapes 25–60 cm. Leaves 3–4, usually longer than scape, lingulate. Racemes cylindrical, 20- to 50-flowered, the upper flowers sterile; pedicels 5–8 mm. Perianth 5–7 mm, tubular, reddish-grey at anthesis, later darkish, the lobes ½ as long as tube, ovate. Fruiting raceme cylindrical; pedicels horizontal. $2n=16$. *Waste places and wood-margins.* ● *N. & C. Italy.* It.

4. B. hackelii Freyn, *Österr. Bot. Zeitschr.* **27**: 289 (1877) (*Hyacinthus dubius* auct. lusit., non Guss.). Scape up to 35 cm. Leaves 2–5, suberect or recurved, 15–40 cm × 3–6(–8) mm, equalling or slightly exceeding the scape, linear-lingulate in the proximal ⅔ but filiform-caudate in the distal ⅓. Raceme cylindrical, 15- to 30-flowered; pedicels 4–12 mm. Perianth 5–7 mm, campanulate, dark blue at anthesis, the lobes with a whitish margin, *c.* ½ as long as tube, spathulate-obtuse; anthers violet. Fruiting raceme cylindrical; pedicels patent or recurved-nodding. Capsule 6–7 × 8–10 mm, obovoid-globose, truncate. *Dry, open habitats.* ● *S. Portugal.* Lu.

5. B. lipskyi (Miscz.) Wulf, *Fl. Kryma* **1(3)**: 56 (1930). Scapes 15–30 cm. Leaves 2–3(–4), usually longer than scape, lingulate, recurved, scabrous-denticulate at the margins and often on the veins. Raceme cylindrical, *c.* 30-flowered; pedicels 4–6 mm. Perianth 5–7 mm, tubular-campanulate, dark violet at anthesis, later dingy yellow, the lobes ⅓–½ as long as tube, obtuse. Fruiting raceme cylindrical; pedicels horizontal. *Cultivated ground and dry hillsides.* ● *Krym.* Rs (K).

6. B. ciliata (Cyr.) Nees, *Gen. Pl. Fl. Germ.* **4**: t. 8 (1833–1837). Scapes (20–)30–50 cm. Leaves 3–5, shorter than scape, lanceolate, the margins long-ciliate. Racemes conical, 30- to 50-flowered; lower pedicels 30–35 mm, recurved. Perianth (8–)9–11 mm, campanulate, lilac at anthesis, the lobes ½–⅓ as long as tube, greenish, ovate. Fruiting raceme broadly conical; pedicels horizontal, rigid. *Cultivated ground. Aegean region; S.E. Italy.* Gr It Tu [Ga].

7. B. sarmatica (Pallas ex Georgi) Woronow, *Bull. Jard. Bot. URSS* **26**: 619 (1927). Scapes 25–50 cm. Leaves 3–7, shorter than scape, lingulate, the margins thickened and ciliate. Racemes ovate-oblong, 40- to 80-flowered; lower pedicels 30–80 mm, erecto-patent. Perianth 7–9 mm, campanulate, dingy-violet at anthesis, later greyish-brown, the lobes ⅓ as long as tube, yellowish-white, ovate-lanceolate. Fruiting raceme broadly conical; pedicels horizontal. *Dry hillsides and steppes. S. part of U.S.S.R., E. Romania.* ?Bu Rm Rs (C, W, K, E).

8. B. romana (L.) Reichenb., *Fl. Germ. Excurs.* 105 (1830). Scapes 15–30(40) cm. Leaves 3–6, longer than scape, linear. Racemes oblong, 20- to 30-flowered; pedicels 8–20 mm. Perianth 8–10 mm, turbinate, whitish at anthesis, sometimes tinged with blue at the base, later dingy brownish, the lobes equalling or longer than tube, linear-oblong. Fruiting raceme cylindrical; pedicels erecto-patent. $2n=8$. *Meadows and cultivated ground. C. & E. Mediterranean region; S.W. France.* Al Co Ga Gr It Ju Si.

9. B. brevipedicellata Turrill, *Kew Bull.* **1940**: 264 (1940). Scapes 6–17·5 cm. Leaves 2–3, about as long as scape, linear-lanceolate. Racemes cylindrical, 9- to 25-flowered; pedicels 1–1·5 mm. Perianth 7 mm, tubular, white; lobes ⅓–½ as long as tube, pink with green stripe, broadly ovate. Fruiting raceme cylindrical; pedicels erecto-patent. ● *Kriti.* Cr.

34. Hyacinthella Schur[1]

Glabrous, bulbous perennials. Bulb small, with free scales. Leaves (1–)2(–3), all basal, linear-lanceolate, with raised veins. Inflorescence a more or less lax raceme, with 3–20(–30) blue or rarely white flowers; bracts minute. Perianth tubular-campanulate or infundibuliform, with 6 erect or patent lobes, persistent in fruit. Stamens 6, attached below the perianth-lobes, subbiseriate. Fruit a depressed-globose, loculicidal capsule.

Literature: N. Feinbrun, *Bull. Res. Counc. Israel* **10D**: 323–347 (1961).

1 Perianth 8–10 mm, infundibuliform; pedicels erect **3. pallasiana**
1 Perianth 4–5 mm, tubular-campanulate; pedicels patent to erecto-patent
2 Leaves erect, with prominently raised veins; perianth-lobes *c.* ⅓ as long as tube **1. leucophaea**

[1] By V. H. Heywood.

2 Leaves patent or recurved, with only slightly raised veins; perianth-lobes slightly shorter than tube **2. dalmatica**

1. H. leucophaea (C. Koch) Schur, *Österr. Bot. Wochenbl.* **6**: 228 (1856). Scape up to 25 cm. Leaves 2(–3), linear-lanceolate, erect, flat, with prominently raised veins. Raceme 10- to 20 (–30)-flowered, lax; pedicels erecto-patent. Perianth 4–5 mm, tubular-campanulate, pale blue, rarely white, often becoming green after anthesis; lobes ovate-elliptical, obtuse, *c.* ⅓ as long as tube. Filaments inserted in upper part of tube. *Dry grassland and rocky slopes. S.E. Europe, extending to C. Romania, and northwards to* 54°*N. in S.C. Russia.* Bu Gr Ju Po Rm Rs (C, W, K, E).

Variable in leaf-width and flower-size. Plants from Greece with deep blue flowers 4·5–6 mm have been described as **H. atchleyi** (A. K. Jackson & Turrill) Feinbrun, *Bull. Res. Counc. Israel* **10D**: 339 (1961), but further material is needed.

2. H. dalmatica (Baker) Chouard, *Bull. Mus. Nat. Hist. Nat. (Paris)* ser. 2, **3**: 178 (1931). Scape up to 10 cm. Leaves 2–3, linear-lanceolate, patent or recurved, canaliculate, with only slightly raised veins. Racemes 3- to 20-flowered, lax; pedicels patent. Perianth 4–5 mm, tubular-campanulate, pale blue; lobes slightly shorter than tube. Filaments inserted at base of perianth-lobes. *Grassy and rocky places.* ● *W. Jugoslavia.* Ju.

3. H. pallasiana (Steven) Losinsk in Komarov, *Fl. URSS* **4**: 408 (1935). Scape up to 15 cm. Leaves 2, linear, erect, flat, with raised veins. Racemes 3- to 6-flowered, compact; pedicels erect, very short. Perianth 8–10 mm, infundibuliform, blue with darker veins; lobes *c.* ⅓ as long as tube. Filaments inserted at middle of tube. *Steppes. S. Ukraine, just extending into S.E. Russia.* Rs (W, K, E).

35. **Dipcadi** Medicus[1]

Glabrous, bulbous perennials. Bulb ovoid, with a tunic of papery scales. Leaves all basal, linear to lanceolate. Inflorescence an erect, lax raceme; flowers 3–20, brownish-yellow to orange-red or greenish. Bracts lanceolate, acuminate, slightly longer than the pedicels. Perianth tubular-campanulate; segments joined at the base. Stamens 6, shorter than the perianth. Fruit a subglobose, trigonous or 3-lobed, loculicidal capsule.

1. D. serotinum (L.) Medicus, *Acta Acad. Theod.-Palat.* **6**: 431 (1790) (*Uropetalum serotinum* (L.) Ker-Gawler). Scapes 10–40 cm. Leaves few, suberect or spreading, usually shorter than the scapes. Racemes secund. Perianth 12–15 mm; segments linear-oblong, obtuse, the outer recurved from the point of union, the inner erect, connivent. $2n = 8 + 0$–$6B$, 16, 32. *Rocky or sandy places. S.W. Europe.* Bl Ga Hs †It Lu.

D. fulvum (Cav.) Webb & Berth., *Phyt. Canar.* **3**: 340 (1848), from Morocco and Islas Canarias, has been recorded from several localities in Spain. It is a more robust plant up to 1 m, with longer bulbs and wider leaves, flowering in the autumn (not the spring), but its status is very uncertain.

36. **Muscari** Miller[2]

Glabrous, bulbous perennials. Leaves (1–)2–7, all basal. Flowers in terminal racemes or spikes, the apical flowers often sterile and differing in colour from the lower fertile flowers. Perianth globose to oblong-urceolate or -campanulate, usually constricted below the separation of the teeth, blue or brownish or yellow; teeth 6, short, often of different colour from the tube. Anthers (1–)2-seriate, included in the tube. Withered perianth abscissing around the base as the capsule expands. Fruit a capsule with sharply angled valves. Seeds 2 in each loculus, black and shiny, usually minutely reticulate.

The genus is defined here in a broad sense and contains four subgenera which have often been treated as separate genera (cf. Garbari & Greuter). When further work on chromosome-configurations is available, and when all members of Subgen. *Pseudomuscari* (at present a heterogeneous group) are better known, the generic definition used here may be revised. The differences between the subgenera are considered to be of a lower order of importance than those that separate *Muscari* sensu lato from *Bellevalia* and *Hyacinthella.*

Capsule-measurements are taken from pressed material, and may therefore be at variance with the shape given, which is that of fresh material.

Literature: J. G. Baker, *Jour. Linn. Soc. London (Bot.)* **11**: 411–418 (1871). B. Bentzer, *Bot. Not.* **126**: 69–132 (1973). F. Garbari & W. Greuter, *Taxon* **19**: 329–335 (1970). T. von Heldreich, *Bull. Soc. Nat. Moscou* **53(1)**: 56–75 (1878). D. C. Stuart, *Lily Year Book* **29**: 125–138 (1965); *Notes Roy. Bot. Gard. Edinb.* **30**: 189–196 (1970).

1 Tube of mature fertile flowers pale blue to blackish-blue
2 Perianth pale blue, with darker blue stripes on the ± connivent teeth; pedicels ascending; flowering in autumn **13. parviflorum**
2 Perianth bright blue or blackish-blue, without dark blue stripes; pedicels patent or deflexed; flowering in spring
3 Perianth concolorous; tube and teeth blackish-blue **12. commutatum**
3 Perianth discolorous; teeth paler than tube, often white
4 Perianth globose; leaves 2–3(–4), usually linear-oblanceolate; raceme usually becoming lax **9. botryoides**
4 Perianth ovoid or obovoid to oblong-urceolate; leaves (2–)3–7, linear; raceme usually dense
5 Flowers bright blue, sometimes tinged with purple **10. armeniacum**
5 Flowers very dark or blackish-blue **11. neglectum**
1 Tube of mature fertile flowers brownish, yellow, whitish or greenish
6 Fertile flowers with the shoulder expanded into a distinct corona; tube yellow or greenish to whitish; sterile flowers usually absent
7 Perianth-tube yellow, tubular-urceolate **1. macrocarpum**
7 Perianth-tube greenish to whitish, narrowly urceolate **2. moschatum**
6 Fertile flowers with the shoulder not expanded into a corona; tube brownish, yellowish or greenish; sterile flowers usually many, often conspicuous
8 Perianth-teeth blackish; bulb-tunics pale grey **8. tenuiflorum**
8 Perianth-teeth whitish, cream or yellow; bulb-tunics reddish-brown or pink
9 Perianth-teeth cream to pale yellowish-brown; sterile flowers ascending, usually forming a conspicuous corymb **7. comosum**
9 Perianth-teeth yellow; sterile flowers ± patent or sessile
10 Fertile flowers sessile or with pedicels not more than 1·5 mm
11 Sterile flowers pedicellate; leaves more than 4 mm wide **3. cycladicum**
11 Sterile flowers sessile; leaves less than 4 mm wide **4. gussonei**
10 Fertile flowers with pedicels more than 2 mm

[1] By V. H. Heywood. [2] P. H. Davis and D. C. Stuart.

12 Inflorescence conical, with ascending pedicels; fertile flowers dark greenish-brown; sterile flowers few or absent **5. spreitzenhoferi**

12 Inflorescence cylindrical, with ± patent pedicels; fertile flowers brown to yellowish-brown; sterile flowers numerous **6. weissii**

Subgen. **Muscari**. Bulb with thick, swollen, persistent roots. Fertile flowers narrowly or tubular-urceolate, strongly constricted distally, yellow, greenish or white, the shoulder strongly expanded to form a usually brown corona. Sterile flowers minute, sessile, purple, frequently absent. Capsule indehiscent when shed.

For an explanation of the typification of the genus, cf. W. B. Turrill, *Bot. Mag.* **167**: t. 124 (1950).

1. M. macrocarpum Sweet, *Brit. Fl. Gard.* ser. 1, t. 210 (1827). Leaves 10–20 cm × 5–15 mm, linear-lanceolate, pale greyish-green. Scape 10–15 cm, erect to procumbent, shorter than leaves. Raceme up to 6 cm, dense, becoming lax. Pedicel of fertile flowers 1–3 mm. Fertile flowers 8–12 mm, tubular-urceolate, purplish in bud, becoming bright yellow; teeth minute, brownish. Fruiting raceme 1–6 cm, usually dense. Capsule 10–30 × 20–30 mm, suborbicular to broadly obovate, very deeply angled. $2n=18$. *Limestone cliffs. S. Aegean region.* Cr Gr. (*W. Anatolia and adjacent islands.*)

2. M. moschatum Willd., *Enum. Pl. Horti Berol.* 378 (1809) (*M. muscarimi* Medicus, *Muscarimia muscari* (L.) Losinsk.). Like **1** but fertile flowers narrowly urceolate, purplish at first, becoming greenish to whitish at anthesis. *Cultivated for its strong, musk-like scent, and naturalized in W. Italy and Sicilia.* [It Si.] (*S. & W. Anatolia.*)

Subgen. **Leopoldia** (Parl.) Zahar. Bulbs with slender, annual roots. Fertile flowers tubular- or obconic-urceolate, strongly constricted distally, brownish or greenish, often more or less constricted near the middle, the shoulder not forming a corona. Sterile flowers blue or violet, often numerous and arranged in a prominent apical tuft. Capsules usually dehiscent on plant.

3. M. cycladicum P. H. Davis & Stuart, *Lily Year Book* **30**: 123 (1966). Bulb-tunics dark pinkish-brown. Leaves (2–)3–4, 10–20 cm × 8–25 mm, narrowly linear-lanceolate, canaliculate. Scape (5–)8–30 cm, longer or shorter than leaves. Raceme lax, cylindrical. Pedicels of fertile flowers absent, or not more than 1·5 mm. Fertile flowers 5–9(–12) mm, oblong or obconical-oblong, occasionally slightly constricted in middle; shoulders rounded; distal part of tube deep brown; proximal part paler or greenish; teeth bright brownish-yellow. Pedicels of sterile flowers 4–8 mm, patent, pale violet. Sterile flowers 4–8 mm, obovoid. Capsule 8–11 × 8–25 mm, subglobose to broadly ovoid-ellipsoid, often indehiscent when shed. $2n=36$, 54. ● *Kikladhes.* Cr Gr.

Bentzer recognised two subspecies (under *Leopoldia cycladica* (Davis & Stuart) Bentzer), but the differences are in quantitative characters which are normally quite variable in the subgenus and separation at this level does not seem justified.

4. M. gussonei (Parl.) Tod., *Ind. Sem. Horti Panorm.* 58 (1872). Bulb-tunics dark brown. Leaves 2–3, 10–15 cm × 2·5–3 mm, linear. Scape 16–20 cm, erect, exceeding leaves. Raceme lax, cylindrical. Pedicels of fertile flowers not more than 0·5 mm. Fertile flowers 5–5·5 mm, tubular-urceolate, brownish or yellowish, sometimes slightly constricted in middle; shoulders angular; teeth yellow, recurved. Sterile flowers few, sessile, minute, crowded, bluish. Capsule and seeds unknown. $2n=18$. *Maritime sands.* ● *Sicilia, Calabria.* It Si.

This species (like **5**) has frequently been confused with **M. maritimum** Desf., *Fl. Atl.* **1**: 308 (1798), from N. Africa, which has longer-pedicellate fertile flowers and anthers (as in *Bellevalia*) lying beneath the perianth-teeth.

5. M. spreitzenhoferi (Heldr.) Vierh., *Österr. Bot. Zeitschr.* **66**: 166 (1916) (*M. creticum* Vierh.). Bulb-tunics pinkish or brown. Leaves 3–5, 6–20 cm × 8–12 mm, linear, canaliculate, the outermost conspicuously wider. Scape 5–15 cm, usually shorter than leaves. Raceme dense, conical, becoming lax, cylindrical. Pedicels of fertile flowers 4–7 mm, usually ascending at least in fruit. Fertile flowers 4–7 mm, tubular-urceolate, sometimes slightly constricted in middle; shoulders rounded, deep brown; proximal part of tube greenish-brown; teeth deep yellow, patent or recurved. Sterile flowers scarcely developed, forming a minute tuft of threads, rarely few and small. Capsule 6–8 × 6–8 mm, globose, sometimes emarginate or acuminate. $2n=18$, 36. *Kriti.* Cr. (?*Algeria.*)

6. M. weissii Freyn, *Österr. Bot. Zeitschr.* **28**: 87 (1878) (*M. theraeum* (Heldr.) Boiss.). Bulb-tunics dark brown to reddish. Leaves (2–)3–4(–6), 8–30 cm × 8–15 mm, linear-lanceolate, canaliculate. Scape (6–)8–30(–45) cm, longer or shorter than leaves. Raceme lax, cylindrical. Pedicels of fertile flowers 1·5–9 mm, usually shorter than the flowers, patent at anthesis. Fertile flowers 5–9(–11) mm, oblong or obconic-tubular, occasionally slightly constricted in middle; shoulders rounded; distal part of tube dark brown; proximal brownish-yellow or greenish; teeth bright brownish-yellow. Pedicels of sterile flowers 5–9 mm, patent, usually as long as those of fertile flowers. Sterile flowers 4–8 mm, obovoid, violet or purplish, shorter or longer than the fertile. Capsule 10–15 × 9·5–10·5 mm, broadly ellipsoid or obovoid. $2n=18$, 36 (54). *S. Aegean region.* Cr Gr.

Plants occur in which the teeth of the fertile flowers are cream instead of bright yellow. It seems likely that at least some of these are hybrids with **7**.

Plants from Kriti, which are like **6** but taller, with a larger bulb, fertile flowers with cream-coloured teeth, pedicels 10–25 mm, and sterile flowers with suberect pedicels, have been described as **M. dionysicum** Rech. fil., *Denkschr. Akad. Wiss. Math.-Nat. Kl. (Wien)* **105(2, 1)**: 167 (1943). They have $2n=18$, 36, and may represent an extreme variant of **7**.

7. M. comosum (L.) Miller, *Gard. Dict.* ed. 8, no. 2 (1768) (*M. pharmacusanum* (Heldr.) Boiss., *M. tubiflorum* Steven, *M. tenuiflorum* subsp. *charrelii* (Heldr. ex Rouy) Hayek, *Leopoldia comosa* (L.) Parl.). Bulb-tunics pink. Leaves 3–5(–7), 7–40 (–60) cm × 5–17(–30) mm, linear, usually shorter than scape. Scape 15–50(–80) cm, erect. Raceme 40–80 × 3–6 cm, lax, cylindrical. Pedicels of fertile flowers 4–10(–15) mm, patent, not elongating. Fertile flowers 5–9·5 mm, oblong-urceolate, pale brown; shoulders rounded, darker brown; teeth cream to pale yellowish-brown. Pedicels of sterile flowers 6–25(–40) mm, fleshy, ascending, violet. Sterile flowers 2–6(–10) mm, globose to obovoid, bright violet, shorter than fertile flowers, often numerous, in a conspicuous, usually corymbose terminal tuft. Fruiting raceme 8–40 cm, lax, cylindrical. Capsule 10–15 × 6·5–8 mm, obovoid, emarginate. $2n=18$ (27). *Dry grassland and cultivated ground. Europe, northwards to N. France and N.W. Ukraine, but doubtfully native in the northern part of its range.* Al Au Bl Bu Co Cr Cz Ga Ge Gr He Hs Hu It Ju Lu Po Rm Rs (W, K) Sa Si Tu [Be Br Da Ho].

Very polymorphic. Formal taxonomic recognition of infraspecific taxa is premature.

8. M. tenuiflorum Tausch, *Flora* (*Regensb.*) **24**: 234 (1841) (*Leopoldia tenuiflora* (Tausch) Heldr.). Bulb-tunics pale grey. Leaves 3–7, 15–30(–40) cm × 8–20(–30) mm, linear, canaliculate. Scape 20–60 cm, longer than leaves. Raceme 6–30 × 1·5–3 cm, lax, cylindrical. Pedicels of fertile flowers (0·5–)2–7(–20) mm, patent, shorter than flowers, not elongating after anthesis. Fertile flowers 5–9·5 mm, narrowly obconic-urceolate, pale greyish-brown; shoulders sharply angled, pale cream or greenish; teeth blackish, recurved. Pedicels of sterile flowers (2–)3·5–16 mm, bright violet, ascending to patent. Sterile flowers 3·5–14 mm, obovoid to tubular, bright violet. Fruiting raceme lax, cylindrical. Capsule 12–16 × 6·5–7·5 mm, obovoid, emarginate to obcordate. $2n=18$. *Dry places. E.C. & S.E. Europe, extending locally westwards to c.* 10°*E. in S. Germany.* Al Au Bu Cz Ge Gr Hu Ju Rm Rs (W) Tu.

Subgen. **Botryanthus** (Kunth) Zahar. Bulb with slender, annual roots. Fertile flowers globose to oblong-urceolate, not waisted, strongly constricted distally, blue to blackish, never striped. Sterile flowers few or absent, sessile to pedicellate, paler than fertile flowers. Capsules dehiscent on plant.

9. M. botryoides (L.) Miller, *Gard. Dict.* ed. 8, no. 1 (1768) (incl. *M. heldreichii* Boiss.). Bulb not producing offsets; tunics pale or greyish-brown. Leaves 2–3(–4), 5–25 cm × 5–12 mm, erect, linear-oblanceolate or rarely linear, abruptly contracted, hooded or shortly acuminate at apex, the upper surface paler, glaucous, often prominently ribbed. Scape 7–30 cm, almost always exceeding leaves. Raceme dense at first, becoming laxly cylindrical and 1–7 cm long, except in some mountain plants where it does not elongate. Pedicels of fertile flowers (0·5–)2–5 mm, as long as or shorter than flower, patent or deflexed (rarely flowers subsessile). Fertile flowers 2·5–4(–5) mm, globose, strongly constricted, bright blue; teeth white, recurved. Sterile flowers few, smaller and paler, shortly pedicellate. Fruiting raceme lax. Capsule 4–6 × 4–6 mm, globose. $2n=18$, 36. ● *C. & S.E. Europe, extending locally westwards to N.W. France.* Al Au Bu Co Cz Ga Ge Gr He Hu It Ju Po Rm Rs (W) Si Tu [Be Ho].

A somewhat variable species. **M. kerneri** Marchesetti, *Boll. Soc. Adr. Sci. Nat. Trieste* **7**: 266 (1882) and **M. longifolius** Rigo, *Nuovo Gior. Bot. Ital.* nov. ser., **12**: 152 (1905), are variants from N. Italy (the former extending into S.C. Europe) with narrow leaves. **M. lelievrii** Boreau, *Not. Pl. Fr.* **2**: 29 (1846) (*Botryanthus lelievrii* (Boreau) Nyman), is a rare variant from C. France in which the raceme remains dense.

10. M. armeniacum Leichtlin ex Baker, *Gard. Chron.* ser. 2, **9**: 798 (1878) (*M. pyramidatum* Velen.). Bulbs with or without offsets; tunics dark brown. Leaves (2–)3–5(–7), 10–30 cm × 1–10 mm, linear or linear-lanceolate, rarely linear-elliptical, acute, the upper surface sometimes glaucous. Scape 10–40 cm. Raceme 1·5–5 cm, dense to very dense, ovoid to cylindrical. Pedicels of fertile flowers 1–5 mm, patent to deflexed, usually shorter than flowers. Fertile flowers 3·5–5·5 × 2·5–3·5 mm, obovoid to oblong-urceolate, bright blue, sometimes with a purplish tinge; teeth pale or white. Sterile flowers few, smaller, paler or concolorous. Fruiting raceme lax. Capsule 8–12 × 6·5–8 mm, obovoid, emarginate. $2n=18$. *Balkan peninsula.* Bu Gr Ju Tu.

Very variable. Many records of **11** from the Balkan peninsula are really referable to **10**.

11. M. neglectum Guss. ex Ten., *Fl. Neap. Syll. App. Quinta* 13 (1842) (*Hyacinthus racemosus* L., nom. ambig., *M. racemosum* (L.) Lam. & DC., *M. atlanticum* Boiss. & Reuter; incl. *M. mordoanum* Heldr., *M. vandasii* Velen.). Bulbs with or without offsets; tunics dark to reddish-brown. Leaves 3–6, 6–40 cm × 1·5–8 mm, linear to linear-lanceolate, canaliculate to involute, bright green, sometimes reddish at base. Scape 4–30 cm, often as long as leaves. Raceme usually dense. Pedicel of fertile flowers 0·5–5 mm, patent or deflexed, shorter than perianth. Fertile flowers 3·5–7·5 × 1·5–3·5 mm, ovoid to oblong-urceolate, strongly constricted, very dark to blackish-blue; teeth 0·3–1 mm, white, recurved. Sterile flowers up to 20, smaller and paler than fertile flowers. Fruiting raceme lax. Capsule 8–10 × 7–10 mm, ovoid to obovoid, emarginate to apiculate. $2n=18$, 36, 45, 54, 72. *Europe, northwards to N. France and S.C. Russia.* Al Au Bl Bu Co Cr Cz Ga Ge Gr He Hs Hu It Ju Lu Po Rm Rs (C, W K, E) Sa Si Tu [Br].

Very polymorphic. There is also a range of shades of flower colour between the plants with dark blue flowers, commonly known as *M. racemosum* or (in N. Africa) as *M. atlanticum*, and the plants with almost black ones ascribed to *M. neglectum*. As the variation is continuous, formal recognition of constituent taxa is not practicable.

Within Europe, the diploid plants, with $2n=18$, have been recorded only from Greece. They are dwarf (less than 15 cm) and the bulbs have no offsets. They are often referred to **M. pulchellum** Heldr. & Sart. ex Boiss., *Diagn. Pl. Or. Nov.* **3(4)**: 109 (1859) (*Botryanthus pulchellus* (Heldr. & Sart. ex Boiss.) Nyman), and may be found, on further investigation, to deserve formal infraspecific status. Many of the polyploids, however, are less than 15 cm; an octoploid ($2n=72$), from Krym, is a dwarf plant with relatively large flowers, and is unusual in possessing linear-oblanceolate leaves.

12. M. commutatum Guss., *Fl. Sic. Prodr.* **1**: 426 (1827). Bulbs occasionally producing offsets; tunic dark shiny brown. Leaves 2–5, 10–30 cm × 5–15 mm, linear to linear-lanceolate, with a minute scarious margin, canaliculate. Scape 6–30 cm, about as long as leaves. Raceme dense, ovoid. Pedicels of fertile flowers 2–6 mm, patent-deflexed, as long as or shorter than flowers. Fertile flowers 3·5–7 mm, obovoid-urceolate, strongly shouldered and constricted, deep blackish-violet, with recurved concolorous teeth; teeth 0·5–1 mm. Pedicels of sterile flowers 1-3 mm. Sterile flowers 2–4 mm, paler and smaller than the fertile. Fruiting raceme lax. Capsule 7–12 × 5–8 mm, oblong-ovoid or broadly ellipsoid. $2n=18$. *Mediterranean region, westwards to W. Italy.* Cr Gr It Ju Si.

Subgen. **Pseudomuscari** Stuart (*Pseudomuscari* Garbari & W. Greuter). Roots slender, annual. Fertile flowers shortly to oblong-campanulate, slightly constricted distally (in European species), pale blue, with dark markings; pedicels ascending (in European species). Sterile flowers many or few, sessile to pedicellate. Capsules dehiscent on plant.

13. M. parviflorum Desf., *Fl. Atl.* **1**: 309 (1798). Bulbs occasionally producing offsets; tunics light brown. Leaves 3–5, 7–20 cm × 1–3·5 mm, narrowly linear or filiform, rarely narrowly oblanceolate. Scape 15–35 cm, always exceeding leaves. Raceme very lax, cylindrical. Pedicels of fertile flowers 2–4·5 mm, ascending, as long as or shorter than flowers. Fertile flowers 3–5 mm, broadly oblong-obovoid, weakly constricted above, pale blue; teeth paler, with a median darker blue marking, recurved. Sterile flowers few and minute, often absent. Capsule 5–7 × 4–6 mm. Autumn-flowering. $2n=18$. *Mediterranean region.* Bl Cr Gr Hs It Ju Si.

Garbari & Greuter refer this anomalous species to the group of species here included in Subgen. *Botryanthus*, but, despite the constriction of the perianth, its affinities are with species of Sub-

gen. *Pseudomuscari* in Anatolia, with which it shares the dark blue marking on the teeth.

37. Agapanthus L'Hér.[1]

Stock a rhizome. Leaves all basal. Flowers numerous, slightly zygomorphic, in umbels subtended by a deciduous, 2-valved spathe. Bracteoles filiform, persistent. Perianth campanulate, the segments connate in basal half. Stamens inserted on perianth-tube; filaments and style declinate; anthers dorsifixed, introrse. Stigma capitate. Capsule loculicidal; seeds numerous, flat, winged, black.

1. A. praecox Willd., *Enum. Pl. Horti Berol.* 353 (1809). Rhizome short, tuber-like; plant forming dense clumps. Leaves 20–70 cm × 15–55 mm, ligulate, somewhat canaliculate, evergreen. Scape 50–100 cm. Pedicels 4–12 cm. Perianth 40–45 mm, blue or white; lobes patent, somewhat undulate, the outer 6–8 mm wide, the inner 9–11 mm wide. Stamens and style exserted. *Cultivated for ornament, and naturalized on rocky ground in S.W. England* (*Isles of Scilly*). [Br.] (*South Africa.*)

The naturalized plant is referable to subsp. **orientalis** (F. M. Leighton) F. M. Leighton, *Jour. S. Afr. Bot., Suppl.* **4**: 21 (1965). Subsp. *praecox* differs chiefly in its longer perianth (50–70 mm).

38. Allium L.[2]

Perennial, scapose, bulbous herbs, usually with a distinctive smell of onion or garlic. Bulbs solitary or clustered, composed of one to several storage scales, usually tunicate. Leaves filiform to ovate, with sheathing base. Flowers in a terminal umbel at first totally enclosed within a spathe. Pedicels often with bracteoles at base. Perianth-segments persistent, free or slightly connate at base, 1- to 3-veined. Stamens free or connate at base into an annulus, inserted at base of perianth-segments and sometimes adnate to their base; anthers dorsifixed, introrse. Style gynobasic; stigmas entire or shortly 3-lobed. Fruit a membranous capsule; seeds 1–2, rarely more, in each loculus, usually triquetrous or compressed, rarely globose, black.

Literature: E. Regel, *Acta Horti Petrop.* **3**: 1–266 (1875). A. Levan, *Hereditas* **23**: 317–370 (1937). W. T. Stearn, *Herbertia* **11**: 11–34 (1946). J. Helm, *Kulturpfl.* **4**: 130–180 (1956). H. A. Jones & L. K. Mann, *Onions and their Allies*. London & New York. 1963. C. Zahariadi, *Studii Cerc. Biol.* (*Ser. Bot.*) **20**: 539–559 (1968). C. Zahariadi, *Biol. Gallo-Hellen.* **6**: 27–64 (1975). R. von Bothmer, *Bot. Not.* **125**: 62–76 (1972); *Op. Bot.* (*Lund*) **34**: 1–104 (1974); *Mitt. Bot. Staatssamm.* (*München*) **12**: 267–287 (1975). B. E. E. de Wilde-Duyfjes, *Taxon* **22**: 57–91 (1973). B. E. E. de Wilde-Duyfjes, *A Revision of the Genus* Allium *L.* (*Liliaceae*) *in Africa*. Wageningen. 1976. W. T. Stearn, *Ann. Mus. Goulandris* **4**: 83–98 (1978).

Many characters of systematic value in this complex genus, notably the colour of the perianth-segments and stamens and the nature of the leaf, whether solid or hollow, smooth or keeled beneath, are observable on herbarium specimens with difficulty or not at all, often not being recorded; bulbs may also be lacking. Such incomplete and inadequately annotated material may be difficult or impossible to name. In some species the leaves wither before anthesis but their fragile remains can usually be found and should be carefully preserved.

[1] By D. A. Webb. [2] By W. T. Stearn.

Most species flower between May and August; the flowering period has been indicated below for the few species which normally flower earlier or later than this.

Filaments which are *tricuspidate* have a wide, flattened lower part, at the apex of which is a central anther-bearing cusp and two lateral filamentous cusps.

A distinction must be made between *bulbils* (*bulbilli*), formed in the umbel and often replacing flowers, and *bulblets* or increase bulbs (*bulbuli*) formed by the bulb.

1 Leaf narrowed into a distinct petiole
 2 Bulb densely covered with reticulate fibres; leaves sheathing lower ⅓–½ of stem; stamens longer than perianth-segments (Sect. *Anguinum*) **22. victorialis**
 2 Bulb naked, with only a few parallel fibres at base; leaves basal; stamens shorter than perianth-segments (Sect. *Ophioscorodon*) **39. ursinum**
1 Leaf without petiole, usually linear or filiform
 3 Umbel with bulbils only, without flowers
  4 Leaves basal, not sheathing the stem
   5 Leaf solitary, not more than 20 mm wide; stem 3-angled **37. paradoxum**
   5 Leaves several, 15–50 mm wide; stem terete **106. nigrum**
  4 Leaves sheathing lower ½ or more of stem
   6 Spathe with 2 persistent valves much longer than umbel **63. oleraceum**
   6 Spathe shorter than umbel or deciduous
    7 Leaves 5–20 mm wide, solid, flat
     8 Leaves 2–5; main bulb with small exterior bulblets **87. scorodoprasum**
     8 Leaves 6–12; main bulb composed of several large bulblets within a common tunic **75. sativum**
    7 Leaves 0·2–4 mm wide, fistular, semicylindrical or filiform
     9 Spathe 1-valved, deciduous **95. vineale**
     9 Spathe usually 2-valved, persistent
      10 Leaves up to 30 cm, 1–4 mm wide **90. sphaerocephalon**
      10 Leaves up to 18 cm, 0·2–0·8 mm wide **93. pruinatum**
 3 Umbel with flowers, sometimes also with bulbils
  11 Perianth 11–18 mm, lilac or purple (very rarely white), campanulate
   12 Leaves cylindrical, fistular; umbel always erect; perianth-segments not more than 4 mm wide, acute or acuminate **18. schoenoprasum**
   12 Leaves flat, solid; umbel at some time pendent; perianth-segments 3·5–9 mm wide, rounded and apiculate at apex
    13 Bulb with persistent, elongated fibrous tunic; umbel at first pendent, later erect **15. narcissiflorum**
    13 Bulb without fibrous tunic or with only a few basal fibres; umbel always pendent **16. insubricum**
  11 Perianth yellow, greenish, brownish or white or, if purplish, pink or red, then not more than 12 mm
   14 Leaves basal or almost so, all parting from the stem at about the same height
    15 Umbel almost sessile in a rosette of patent leaves (Sect. *Chamaeprason*) **38. chamaemoly**
    15 Umbel on an evident scape (Sect. *Molium* pro parte)
     16 Leaves hairy, or at least ciliate towards base
      17 Stem hairy; leaves spirally coiled (Kriti) **24. circinnatum**
      17 Stem glabrous; leaves straight
       18 Stamens slightly shorter to slightly longer than perianth-segments **32. subvillosum**
       18 Stamens ⅓–⅔ as long as perianth-segments
        19 Perianth-segments 3·5–6 mm wide, with almost truncate-indented apex; filaments triangular **29. longanum**
        19 Perianth-segments not more than 3 mm wide, with acute or obtuse apex; filaments subulate above a short triangular base
         20 Pedicels 3–5 times as long as perianth-segments; anthers usually brown **30. subhirsutum**

20 Pedicels 1½–3 times as long as perianth-segments; anthers yellowish **31. trifoliatum**

16 Leaves glabrous

21 Stigma 3-lobed; stem sharply 3-angled, flaccid after flowering; seeds with elaiosome (Sect. *Briseis*)

22 Leaf solitary; umbels usually with bulbils and few flowers **37. paradoxum**

22 Leaves 2–5; umbel without bulbils

23 Umbel unilateral; flowers always pendent and campanulate **35. triquetrum**

23 Umbel diffuse; flowers patent and stellate, later pendent and campanulate; perianth-segments connivent around the capsule **36. pendulinum**

21 Stigma entire; stem terete or 2- to 3-edged, always erect; seeds without elaiosome

24 Perianth-segments 3–8 mm, not recurved; bulbs elongated, narrowly conical or oblong, attached to a short rhizome

25 Spathe persistent, with one valve 1½–3 times as long as umbel; outer bulb-tunics coriaceous, dark brown or blackish, breaking into firm longitudinal strips

26 Stem 10–70 cm; leaves 3–7; pedicels longer than perianth **4. saxatile**

26 Stem 3–20 cm; leaves 2–4; pedicels equalling perianth **5. horvatii**

25 Spathe persistent or deciduous, shorter than umbel; outer bulb-tunics fibrous or membranous, pale, not breaking into firm longitudinal strips

27 Perianth white or yellowish

28 Outer bulb-tunics somewhat coriaceous, ultimately breaking into fibres; pedicels smooth **8. ericetorum**

28 Outer bulb-tunics thinly membranous, never fibrous

29 Pedicels minutely scabrid **6. albidum**

29 Pedicels smooth **7. stelleranum**

27 Perianth purple, lilac, pink or red

30 Outer tunics fibrous; umbel 1·5–2 cm in diameter; capsule 4·5–5 mm **9. kermesinum**

30 Outer tunics membranous; umbel 2–5 cm in diameter; capsule 3–4 mm

31 Stamens and style shorter than perianth-segments **2. rubens**

31 Stamens and style at least as long as perianth-segments

32 Leaves smooth and rounded beneath; stamens distinctly exserted **3. senescens**

32 Leaves sharply keeled beneath in a living state; stamens only slightly exserted **1. angulosum**

24 Perianth-segments 6–12 mm, rarely 3·5–5 mm and then recurved; bulbs ovoid or subglobose, not on a rhizome

33 Stamens much longer than perianth-segments; umbel 5–20 cm in diameter; style up to 12 mm (S.E. Russia) **110. caspium**

33 Stamens shorter than perianth-segments; umbel not more than 10 cm in diameter; style not more than 5 mm

34 Perianth bright yellow

35 Leaves 15–35 mm wide; ovary not prominently angled or crested **33. moly**

35 Leaves 3–7 mm wide; ovary prominently angled, 6-crested **34. scorzonerifolium**

34 Perianth white, pink, greenish or purple

36 Perianth-segments patent or deflexed after anthesis; leaves arising direct from the bulb or sheathing the stem only up to soil-level; ovules 4–8 in each loculus

37 Perianth-segments and filaments dark purple **105. atropurpureum**

37 Perianth-segments and filaments white, pink or greenish

38 Perianth-segments 3·5–5 mm; leaves 2–10 mm wide (S. part of U.S.S.R.) **108. decipiens**

38 Perianth-segments 6–10 mm; leaves 10–70 mm wide

39 Stem 10–40 cm; leaves about as long as stem or longer, not more than 20 mm wide **109. orientale**

39 Stem 50–90 cm; leaves much shorter than stem, up to 80 mm wide

40 Perianth-segments 1–1·5 mm wide, broadly linear, acuminate, with apex incurved at anthesis; filaments narrowly triangular, 1·5–2·5 mm wide at base, gradually narrowed above **107. cyrilli**

40 Perianth-segments 1·5–3 mm wide, narrowly elliptical, obtuse, patent at anthesis; filaments subulate, 1–1·5 mm wide at base, abruptly narrowed above **106. nigrum**

36 Perianth-segments erect after anthesis, connivent around and covering the capsule; leaves sheathing the base of the stem for a short distance above soil-level; ovules 2 in each loculus

41 Leaves less than 0·5 mm wide, filiform

42 Pedicels subequal; perianth 6–7 mm **40. moschatum**

42 Pedicels very unequal; perianth 4–5 mm **41. inaequale**

41 Leaves at least 1 mm wide

43 Leaves cylindrical, fistular; umbel dense; pedicels usually shorter than perianth **18. schoenoprasum**

43 Leaves linear, flat or canaliculate, solid; umbel lax; pedicels usually much longer than perianth (Sect. *Molium* pro parte)

44 Stem trigonous; leaves up to 40 mm wide **28. neapolitanum**

44 Stem terete or only slightly trigonous; leaves not more than 20 mm wide

45 Spathe dividing into 2 valves; perianth-segments white, with purple keel, acuminate **25. massaessylum**

45 Spathe 1-valved but often becoming 3- to 4-lobed; perianth-segments white or pink, not keeled

46 Outer tunics crustaceous, pitted and perforate; perianth usually pink **23. roseum**

46 Outer tunics membranous, not pitted; perianth white

47 Perianth-segments *c.* 12 mm, acuminate; umbel often with bulbils **26. phthioticum**

47 Perianth-segments 6–10 mm, obtuse or acute; umbel rarely with bulbils

48 Filaments widened in lower ¼; ovary widest above middle **27. breviradium**

48 Filaments slender almost to base; ovary widest at middle **30. subhirsutum**

14 Leaves sheathing at least the lower ¼ or more of the stem and parting from it at different heights

49 Spathe with 2 persistent unequal valves, contracted above, usually into a long, tail-like appendage, from a narrowly ovate or lanceolate base

50 Neither spathe-valve longer than umbel

51 Anthers exserted

52 Leaf-sheaths hairy **66. pilosum**

52 Leaf-sheaths glabrous

53 Perianth yellow; umbel lax **68. flavum**

53 Perianth white, pink or red; umbel dense

54 Outer perianth-segments widest above middle, pink or white; stamens all simple; anthers very slightly exserted **65. staticiforme**

54 Outer perianth-segments widest below middle, usually dark red; inner 3 stamens tricuspidate; anthers long-exserted **90. sphaerocephalon**

51 Anthers included or only partly exserted from perianth
55 Pedicels all much shorter than flowers **18. schoenoprasum**
55 Some or all pedicels as long as or longer than flowers
56 Perianth 7–10 mm; umbel fastigiate; tunic finely reticulate **17. inderiense**
56 Perianth 2·5–7 mm
57 Umbel diffuse, with unequal pedicels 10–45 mm; stem 30–60 cm (Islas Baleares and S. Spain)
58 Leaf-sheaths glabrous; perianth cylindric-campanulate, purplish **48. grosii**
58 Leaf-sheaths hairy; perianth cup-shaped, greenish-yellow **47. chrysonemum**
57 Umbel fastigiate or subglobose, with pedicels rarely more than 15 mm (but up to 30 mm in **41**); stem 5–30 cm
59 Perianth-segments 3–4 mm **51. obtusiflorum**
59 Perianth-segments 4–7·5 mm
60 Inner perianth-segments toothed at apex, the outer entire; inner stamens tricuspidate, the outer simple (Bulgaria) **100. jubatum**
60 All perianth-segments entire; all stamens simple
61 Outer tunic membranous
62 Perianth-segments oblong-elliptical or narrowly obovate, widest at or above middle **46. frigidum**
62 Perianth-segments lanceolate or narrowly lanceolate, widest below middle
63 Outer perianth-segments at least 1·5 mm wide; stamens 3–4 mm **44. meteoricum**
63 Outer perianth-segments 1 mm wide; stamens 4–5 mm **45. delicatulum**
61 Outer tunic fibrous
64 Leaf-margin ciliate **42. bornmuelleri**
64 Leaf-margin minutely scabrid
65 Pedicels almost equal, 1–2 times as long as perianth **40. moschatum**
65 Pedicels very unequal, 3–6 times as long as perianth **41. inaequale**
50 One or both spathe-valves longer than the umbel
66 Stamens long-exserted
67 Umbel rarely more than 3 cm in diameter, dense; pedicels not more than 15 mm, almost equal, all ascending; bulbs narrowly conical
68 Stem 10–70 cm; leaves 3–7; pedicels longer than perianth **4. saxatile**
68 Stem 3–20 cm; leaves 2–4; pedicels equalling perianth **5. horvatii**
67 Umbel 1·5–5 cm in diameter, lax; pedicels up to 30 mm, unequal, some often curved downwards; bulb ovoid or subglobose (Sect. *Codonoprasum*)
69 Leaf-sheaths, especially the lowest, hairy **72. hirtovaginum**
69 Leaf-sheaths glabrous
70 Ovary narrowly obovoid, much longer than wide; perianth purple (very rarely white) **71. carinatum**
70 Ovary subglobose, about as long as wide; perianth usually yellowish
71 Ovary sessile **74. stamineum**
71 Ovary with very short but distinct stalk
72 Perianth *c.* 5 mm; filaments 7 mm; umbel lax; pedicels up to 40 mm, very unequal **68. flavum**
72 Perianth 2·5–4 mm; filaments 5 mm; umbel compact; pedicels not more than 15 mm, almost equal **73. hymettium**
66 Stamens included or with anthers just exserted
73 Perianth 8–10 mm; anthers blackish; umbel with bulbils **69. melanantherum**
73 Perianth 3–8 mm; anthers yellow or reddish; umbel without bulbils
74 Leaves and sheaths hairy
75 Stems not more than 15 cm; perianth-segments obtuse **66. pilosum**
75 Stem up to 70 cm; perianth-segments acute **56. paniculatum**
74 Leaves and sheaths glabrous
76 Umbel lax, with conspicuously unequal pedicels, the longest 15–70 mm
77 Umbel with bulbils, few-flowered **63. oleraceum**
77 Umbel without bulbils, many-flowered
78 Pedicels slightly flattened or winged; perianth clear pink **62. podolicum**
78 Pedicels terete or ribbed; perianth variously coloured
79 Ovary slightly longer than wide, oblong-cylindrical, truncate at apex **61. macedonicum**
79 Ovary about twice as long as wide, ellipsoid, narrowed towards apex
80 Perianth-segments narrowly lanceolate or very narrowly oblong, gradually narrowed to the acute apex; stamens shorter than perianth **58. sipyleum**
80 Perianth-segments mostly narrowly oblong with the apex obtuse or almost truncate, mucronate; stamens about as long as perianth
81 Cells on ribs of leaf-sheaths much longer than wide **56. paniculatum**
81 Cells on ribs of leaf-sheaths about as long as wide **60. favosum**
76 Umbel more compact, the longest pedicels usually less than 20 mm
82 Leaves sheathing *c.* $\frac{7}{8}$ of stem (Kriti) **70. tardans**
82 Leaves sheathing lower $\frac{1}{4}$–$\frac{1}{2}$ of stem
83 Ovary almost as wide as long
84 Umbel very dense, subglobose, many-flowered; perianth white or pink; ovary broadly obovoid **65. staticiforme**
84 Umbel lax, fastigiate, usually few-flowered; perianth yellowish, very rarely pink; ovary subglobose **67. luteolum**
83 Ovary 2–3 times as long as wide
85 Perianth 6·5–8 mm; stamens shorter than perianth-segments **64. parnassicum**
85 Perianth 3–6 mm; stamens about as long as perianth-segments
86 Perianth 3–4 mm **51. obtusiflorum**
86 Perianth 5–6 mm
87 Outer tunic membranous; anthers yellow **57. pallens**
87 Outer tunic often breaking into parallel fibres; anthers violet **59. rupestre**
49 Spathe 1-valved (sometimes 2- or 3-lobed) or deciduous, or both 1-valved and quickly deciduous, or 2-valved with equal valves shorter than or just equalling umbel
88 Stem fistular and inflated, 5–40 mm in diameter; umbel dense, many-flowered; perianth white or yellowish (Sect. *Cepa*)
89 Leaves circular in section; stem widest at about the middle; perianth 7–9 mm; stamens 8–12 mm **21. fistulosum**
89 Leaves semicircular in section; stem widest below the middle; perianth 3–4·5 mm; stamens 4–5 mm **20. cepa**
88 Stem usually solid, not inflated, usually slender
90 Filaments all subulate and simple or the inner 3 with a small tooth on each side at base
91 Umbel fastigiate with erect or ascending pedicels; stem 9–25 cm
92 Leaves sheathing stem almost up to umbel; perianth-segments oblanceolate, truncate (Greece, Kriti) **50. callimischon**
92 Leaves sheathing lower $\frac{1}{2}$–$\frac{2}{3}$ of stem; perianth-segments lanceolate, acute or obtuse
93 Spathe 1-valved, entire; outer tunic fibrous **49. cupani**
93 Spathe with 2 short lobes; outer tunic membranous
94 Perianth pink; ovary at anthesis acute at apex **52. parciflorum**
94 Perianth yellowish; ovary at anthesis rounded at apex **53. rouyi**

91 Umbel subglobose or hemispherical; stem 20–100 cm
95 Perianth blue; bulb subglobose **54. caeruleum**
95 Perianth not blue; bulb narrowly ovoid or cylindrical, rarely subglobose
96 Stamens not exceeding perianth-segments
97 Perianth 7–12 mm; outer bulb tunic crustaceous, pitted **23. roseum**
97 Perianth 5–7 mm; outer bulb tunic membranous, not pitted
98 Stamens *c.* ½ as long as perianth-segments, the inner 3 narrowly triangular **43. rubellum**
98 Stamens about as long as perianth-segments, the inner 3 subulate **19. schmitzii**
96 Stamens exceeding perianth-segments
99 Leaves 5–25 mm wide; stem 60–100 cm; perianth greenish-yellow, smooth; filaments 7–8 mm **14. obliquum**
99 Leaves 1–5 mm wide; stem usually 20–60 cm; filaments 4–6 mm
100 Bulbs narrowly ovoid, without rhizome; perianth papillose **55. sabulosum**
100 Bulbs almost cylindrical, elongated, with a short rhizome; perianth smooth
101 Outer perianth-segments about twice as long as wide, oblong-elliptical, 3-toothed at apex; spathe mostly 1-valved (N.W. Spain) **12. palentinum**
101 Outer perianth-segments about 3 times as long as wide, lanceolate or elliptical, obtuse or subacute (not toothed) at apex; spathe 2-valved
102 Outer bulb-tunics splitting into brown strips; perianth-segments *c.* 5 mm **13. hymenorhizum**
102 Outer bulb-tunics becoming completely fibrous, often reticulate; perianth-segments *c.* 4 mm
103 Inner stamens with a small tooth on each side at base; dehisced anthers *c.* 0·5 mm **11. lineare**
103 Inner stamens without teeth at base; dehisced anthers *c.* 1·5 mm **10. suaveolens**
90 Filaments of inner 3 stamens tricuspidate (Sect. *Allium*)
104 Leaves sheathing stem up to umbel **103. chamaespathum**
104 Leaves sheathing only lower ¼–⅓ of stem
105 Inner perianth-segments laciniate or toothed above, the outer entire (C. Bulgaria) **100. jubatum**
105 All perianth-segments entire
106 Perianth-segments 7–10 mm, acuminate
107 Leaves not more than 4 mm wide, fistular; stamens much shorter than perianth-segments **104. heldreichii**
107 Leaves 5–15 mm wide, flat; stamens about as long as perianth-segments
108 Perianth pink; segments smooth on keel and margin **85. acutiflorum**
108 Perianth white; segments scabrid on keel, minutely denticulate on margin **86. pyrenaicum**
106 Perianth-segments 2·5–7 mm, acute to obtuse
109 Umbel 0·5–2·5 cm in diameter, very compact; pedicels all shorter or scarcely longer than flowers
110 Perianth 5·5–6 mm; outer tunics reticulately fibrous **99. gomphrenoides**
110 Perianth 2·5–4(–5·5) mm; outer tunics coriaceous, sometimes splitting into parallel fibres in upper part
111 Filaments 4–7 mm, long-exserted **90. sphaerocephalon**
111 Filaments 3 mm, included **101. rubrovittatum**
109 Umbel 1–10 cm in diameter, compact to lax; pedicels longer than flowers
112 Stamens included or with anthers slightly exserted
113 Leaves hollow, 0·5–2 mm wide
114 Spathe deciduous
115 Umbel usually with bulbils; central cusp of inner stamens *c.* 1·5 mm **95. vineale**
115 Umbel without bulbils; central cusp of inner stamens *c.* 0·5 mm **94. regelianum**
114 Spathe persistent or with persistent base, 2-lobed
116 Perianth-segments 3–3·5 mm, strongly papillose, blackish-purple; perianth broadly ovoid (Spain) **92. melananthum**
116 Perianth-segments 4–4·5 mm, papillose on keel, pink or purplish
117 Perianth *c.* 3·5–5 mm, cylindrical **93. pruinatum**
117 Perianth *c.* 4 mm, ovoid **102. integerrimum**
113 Leaves flat, often canaliculate above, 3–40 mm wide
118 Umbel with bulbils
119 Flowers usually aborted and withering in bud; spathe with very long beak; basal part of inner stamens shorter than or equalling central cusp, bulb composed of 5–15 bulblets of ± equal size **75. sativum**
119 Flowers normal; spathe with short beak; basal part of inner stamens 2–3 times as long as central cusp, bulb composed of 1–2 large bulbs and varying numbers of smaller bulblets
120 Pedicels not more than 20 mm; outer perianth-segments smooth though slightly papillose; bulblets blackish **87. scorodoprasum**
120 At least some pedicels more than 20 mm; outer perianth-segments scabrid on keel; bulblets yellowish **76. ampeloprasum**
118 Umbel without bulbils
121 Stamens much shorter than perianth
122 Perianth purplish or reddish-purple **87. scorodoprasum**
122 Perianth white **88. albiflorum**
121 Stamens about as long as perianth
123 Margin of upper leaves smooth **77. polyanthum**
123 Margin of upper leaves minutely scabrid
124 Leaves 5–40 mm wide; pedicels 10–60 mm **76. ampeloprasum**
124 Leaves 3–8 mm wide; pedicels 6–15(–20) mm
125 Outer tunics densely fibrous; bulblets yellowish **84. baeticum**
125 Outer tunics membranous; bulblets blackish-purple **89. pervestitum**
112 Stamens exserted, both anthers and lateral cusps usually projecting well beyond the perianth
126 Leaves not more than 4 mm wide, often terete
127 Spathe persistent, 2- to 4-valved
128 Perianth-segments white, with greenish or yellowish mid-vein, smooth or papillose **90. sphaerocephalon**
128 Perianth-segments red or blackish-purple, papillose
129 Perianth cylindrical to narrowly ovoid; anthers long-exserted **90. sphaerocephalon**
129 Perianth subglobose; anthers scarcely exserted **92. melananthum**
127 Spathe deciduous, 1-valved
130 Umbel usually with bulbils; outer perianth-segments narrowly ovate, smooth **95. vineale**

130 Umbel without bulbils; outer perianth-segments narrowly oblong or lanceolate
131 Outer perianth-segments strongly papillose on mid-vein; inner widest below the middle
132 Perianth pink; inner segments slightly narrower than filaments **94. regelianum**
132 Perianth whitish; inner segments slightly wider than filaments **83. talijevii**
131 Outer perianth-segments smooth or papillose on mid-vein; inner widest at or above the middle
133 Inner and outer perianth-segments subequal; basal part of filament less than twice as long as central cusp **97. guttatum**
133 Inner perianth-segments distinctly longer than the outer
134 Perianth-segments white with green stripe, the outer papillose on keel; pedicels 5–15 mm; basal part of filament 2–3 times as long as central cusp **98. dilatatum**
134 Perianth-segments purple, smooth; pedicels 10–25 mm; basal part of filament equalling or shorter than central cusp **96. amethystinum**
126 Leaves more than 4 mm wide
135 Leaves fistular
136 Spathe deciduous, 1-valved; umbel often apparently 2-tiered with the outer pedicels short and deflexed and the inner long and erect; lateral cusps of inner stamens much longer than the central one **96. amethystinum**
136 Spathe persistent, 2-valved; umbel ovoid, hemispherical or subglobose; lateral cusps of inner stamens about as long as the central one
137 Umbel less than 3 cm in diameter, usually ovoid **90. sphaerocephalon**
137 Umbel up to 6·5 cm in diameter, hemispherical **91. proponticum**
135 Leaves flat, usually canaliculate
138 Leaf-margin smooth **77. polyanthum**
138 Leaf-margin minutely scabrid
139 Outer tunics of bulb becoming reticulately fibrous; perianth usually dark purple **79. atroviolaceum**
139 Outer tunics membranous or coriaceous, occasionally with parallel fibres; perianth white, pink, lilac, purple or pale green
140 Outer perianth-segments with some large tooth-like papillae along the keel, the lateral surface smooth or with smaller papillae
141 Basal part of inner stamens 1–1·5 mm wide; top of stem bent or coiled before anthesis **82. pardoi**
141 Basal part of inner stamens 1·5–2·5 mm wide; top of stem erect before anthesis
142 Bulblets usually numerous; outer perianth-segments mostly widest about middle **76. ampeloprasum**
142 Bulblets few; outer perianth-segments mostly widest near base **80. bourgeaui**
140 Outer perianth-segments without large papillae on keel
143 Leaves sheathing lower ¾ of stem; upper leaves much exceeding the stem **83. talijevii**
143 Leaves sheathing the lower ¼–½ of stem; upper leaves not exceeding the stem
144 Perianth-segments almost smooth, with sparse, low, ellipsoid papillae (France) **73. scaberrimum**
144 Perianth-segments covered with dense, uniform, minute papillae circular at base
145 Outer stamens simple; inner perianth-segments narrowly oblong **80. bourgeaui**
145 Outer stamens often tricuspidate; inner perianth-segments narrowly obovate **81. commutatum**

Sect. RHIZIRIDEUM G. Don ex Koch (incl. Sect. *Oreiprason* F. Hermann, Sect. *Petroprason* F. Hermann). Bulbs narrowly conical to cylindrical, usually clustered on a short rhizome. Leaves almost basal to sheathing the lower ½ of the stem, flat, not fistular. Stem angled or terete. Spathe usually shorter than pedicels, which are usually bracteolate at base. Perianth usually cup-shaped or campanulate, rarely stellate or subglobose. Stamens simple, rarely with small teeth at base of inner filaments. Ovary with distinct nectariferous pores; ovules 2 in each loculus; stigmas entire or 3-lobed. Seeds angular.

1. A. angulosum L., *Sp. Pl.* 300 (1753). Bulbs 0·5–1 cm in diameter; cylindrical or narrowly conical, clustered on a horizontal rhizome; tunics membranous, thin. Stem 20–45 cm, angular, 2-edged above. Leaves 4–6, 10–25 cm × 1·5–6 mm, basal, linear, canaliculate above, sharply keeled beneath in a living state. Spathe up to 1 cm, 2- to 5-lobed, persistent. Umbel 2·5–4·5 cm in diameter, hemispherical, many-flowered; pedicels 10–30 mm, almost equal. Perianth cup-shaped; segments 4–6 × 1·5–2·5 mm, pale purple, the outer cymbiform, narrowly ovate, the inner elliptical, longer than the outer, acute or obtuse. Stamens scarcely longer than the segments, with exserted anthers; filaments *c.* 5 mm, almost equal at base; anthers at first yellow, later dark purple. Capsule *c.* 3·5 mm. $2n = 16$. *Damp meadows near rivers. C. & E. Europe, extending to E. France and N. Italy.* Au Bu Cz Ga Ge He Hu It Ju Po Rm Rs (C, W, E) [Rs (N, B)].

Not easily separable from 3 in a dried state, although the stamens are only slightly exserted, but when living distinguishable morphologically by the keel-forming midrib on the lower side of the leaf and ecologically by its preference for damp places subject to seasonal flooding.

2. A. rubens Schrader ex Willd., *Enum. Pl. Horti Berol.* **1**: 360 (1809). Bulbs 0·5–1 cm in diameter, narrowly conical, crowded on a rhizome; outer tunics membranous. Stem 10–25 cm, slightly ribbed. Leaves 5–6, 5–20 cm, 1–2 mm, basal, filiform, semi-terete, canaliculate. Spathe up to 1 cm, shorter than the umbel, 1-valved, sometimes 2-lobed, persistent. Umbel 2–3 cm in diameter, globose or hemispherical, few-flowered, lax; pedicels 8–12 mm, almost equal. Perianth broadly campanulate; segments 4–5 × 2·5 mm, purplish, narrowly ovate, obtuse. Stamens included or with scarcely exserted anthers; filaments *c.* 4 mm, simple; anthers yellow. Style included. *Rocky slopes, screes and steppes. S. Ural and adjacent lowlands.* Rs (C, E). (*N. & C. Asia.*)

3. A. senescens L., *Sp. Pl.* 299 (1753). Bulbs *c.* 1 cm in diameter, oblong or narrowly conical, clustered on a short horizontal rhizome; tunics membranous, thin. Stem 7–45 cm, angular, 2-edged above. Leaves 4–9, 4–30 cm × (1–)1·5–2(–6) mm, basal, linear, almost flat, slightly rounded but not keeled beneath. Spathe 5–8 mm, 2- to 3-lobed, persistent, shorter than pedicel. Umbel 2–5 cm in diameter, hemispherical, many-flowered; pedicels 8–20 mm. Perianth cup-shaped; segments 3·5–8 × 2–2·5 mm, lilac, the outer cymbiform, lanceolate or narrowly ovate, the inner elliptical or narrowly ovate, longer than the outer, acute or obtuse. Stamens exserted; filaments 4–6·5 mm,

the outer 0·5 mm and the inner 1 mm wide at base, simple. Ovary deeply 3-lobed. Capsule 4 mm. $2n=16$, 24, 32+0–4B. *Dry, usually rocky places. C. & S. Europe, extending to C. France, S. Sweden and C. Ukraine.* Au Bu Cz †Da Ga Ge He Hs Hu It Ju ?Lu Po Rm Rs (B, C, W) Si Su [No].

The European plant described above is subsp. **montanum** (Fries) Holub, *Folia Geobot. Phytotax.* (*Praha*) **5**: 341 (1970) (*A. montanum* F. W. Schmidt, non Schrank, *A. lusitanicum* Lam., *A. fallax* Schultes & Schultes fil., nom. illegit.). Other subspecies occur in Siberia and C. Asia.

4. A. saxatile Bieb., *Tabl. Prov. Casp.* 114 (1798) (incl. *A. globosum* Bieb. ex Redouté, *A. marschallianum* Vved.). Bulbs 0·5–1·5 cm in diameter, narrowly conical, attached to a short rhizome; outer tunics coriaceous, splitting lengthwise into strips. Stem 10–70 cm, terete. Leaves 3–7, 5–20 cm × 0·5–1 mm, sheathing the lower ⅓ or less of the stem, filiform, canaliculate. Spathe 2-valved; valves unequal, one long-beaked, up to 3 cm and distinctly longer than the umbel, persistent. Umbel 2–4 cm in diameter, subglobose or hemispherical, many-flowered; pedicels 5–15 mm, almost equal. Perianth cup-shaped; segments 3·5–6 × 1–2 mm, deep pink to white, elliptical, acute. Stamens exserted; filaments 4–5 mm, simple, connate at base. Capsule 3·5–4·5 mm. $2n=16$. *Rocky slopes and steppes. S.E. Europe, extending westwards to N. & C. Italy and northwards to c. 55° 30′ N. in C. Russia.* Bu It Ju Rm Rs (C, W, K, E).

Although few collections are annotated as to the flower-colour in a living state, there would appear to be regional colour-differentiation. Plants with pink perianth and purple anthers (typical *A. saxatile*) occur from the E. Alps eastwards, while plants with yellowish-white perianth and yellow anthers (*A. marschallianum* Vved.) occur in N. Italy, the N. part of the Balkan peninsula and Krym. Further study of these variants is required to ascertain their status.

5. A. horvatii Lovrić, *Österr. Bot. Zeitschr.* **119**: 569 (1972). Bulbs up to 0·6 cm in diameter, very narrowly ovoid, closely clustered; outer tunic membranous, blackish, almost entire. Stem 3–20 cm. Leaves 2–4, up to 12 cm × 0·5–1·5 mm, sheathing only the lower ¼ of the stem and almost basal, filiform. Spathe 2-valved; valves ovate, unequal, acute, the longest equalling the umbel. Umbel 1·5–2 cm in diameter, hemispherical, with 3–25 flowers; pedicels 2–5 mm, ascending. Perianth cup-shaped; segments 4 × 1·5 mm, yellowish-white, with greenish mid-vein, acute, the inner slightly longer than the outer. Stamens long-exserted; filaments simple, connate at base. Capsule 4 mm, 6-ribbed. $2n=16$. *Coastal rocks.* ● *N. Jugoslavia (Kvarner archipelago).* Ju.

6. A. albidum Fischer ex Bieb., *Fl. Taur.-Cauc.* **3**: 260 (1819). Bulbs 0·5–1 cm in diameter, almost cylindrical or very narrowly conical, clustered on a horizontal rhizome; outer tunics membranous. Stem 10–30 cm, slightly ribbed. Leaves 5–9, 4–14 cm × 0·3–2·5 mm, basal, filiform. Spathe 2-valved; valves up to 1 cm, persistent. Umbel 1·5–2·5 cm in diameter, hemispherical or fastigiate, many-flowered; pedicels 8–15 mm, almost equal, ribbed and scabrid with very minute teeth. Perianth cup-shaped or stellate; segments 3–5 × 1–1·5 mm, white or yellowish, narrowly oblong, obtuse. Stamens 3–4 mm, exserted; filaments simple; anthers yellow. Capsule 3 mm. $2n=16$. *Bulgaria, Romania, U.S.S.R. northwards to c. 55° N.* Bu Rm Rs (C, W, K, E).

(a) Subsp. **albidum** (incl. *A. flavescens* Besser, *A. ammophilum* Heuffel): Pedicels 2–3 times as long as flowers. Perianth yellowish-white; segments 3–4 mm. $2n=16$. *Steppes and sandy ground.* ● *Throughout the range of the species except Krym.*

(b) Subsp. **caucasicum** (Regel) Stearn, *Ann. Mus. Goulandris* **4**: 126 (1978) (*A. albidum* Fischer ex Besser, *A. angulosum* var. *caucasicum* Regel): Pedicels 1½–2 times as long as flowers. Perianth whitish, sometimes tinged with pink; segments 4–5 mm. *Rocky places. Krym.* (*Caucasus.*)

7. A. stelleranum Willd., *Sp. Pl.* **2**: 82 (1799). Bulbs 0·5–1 cm in diameter, narrowly conical, clustered on a rhizome; outer tunics membranous. Stem 10–30 cm, slightly ribbed. Leaves 4–6, up to 21 cm × 1·5 mm, all basal, filiform, semi-terete. Spathe shorter than the umbel, persistent. Umbel 2–3 cm in diameter, globose or hemispherical, few-flowered; pedicels 10–15 mm, smooth, almost equal. Perianth cup-shaped; segments 4–5 mm, yellowish-white, elliptical, obtuse. Stamens exserted; filaments up to 10 mm, simple; anthers yellow. Style exserted. *Stony slopes. C. Ural and adjacent lowlands.* Rs (C). (*Siberia, Mongolia.*)

8. A. ericetorum Thore, *Essai Chlor. Land.* 123 (1803) (incl. *A. ochroleucum* Waldst. & Kit.). Bulbs 0·5–1·5 cm in diameter, almost cylindrical or very narrowly conical; outer tunics breaking up into parallel fibres. Stem 10–40 cm, terete. Leaves 3–4, up to 25 cm × 0·5–3 mm, sheathing not more than ¼ of the stem and almost basal, linear, flat. Spathe 2-valved; valves up to 1 cm, unequal, shorter than the umbel. Umbel 1–2·5 cm in diameter; hemispherical; pedicels 4–10 mm, almost equal, smooth. Perianth cup-shaped; segments 3·5–4 × 1·5–2 mm, white or yellowish, sometimes tinged with pink, the outer elliptical, the inner narrowly ovate, obtuse. Stamens long-exserted; filaments 4·5–6·5 mm, simple; anthers brownish. Capsule 3·5–4 mm. $2n=16+0$–1B, 32. *Heaths and rocky hillsides.* ● *S.W. France, N. Spain, N. Portugal, N. & C. Italy, Jugoslavia, Carpathians.* Au Cz Ga Hs It Ju Lu Rm Rs (W).

9. A. kermesinum Reichenb., *Fl. Germ. Exsicc.* cent. 22, no. 2141 (1842). Bulbs 0·5–1 cm in diameter, very narrowly conical or oblong, on a short rhizome; outer tunics with dense, almost parallel fibres. Stem 10–30 cm, slightly 2-edged. Leaves 3–4, 10–25 cm × 1–5 mm, linear, flat. Spathe 2-valved; valves *c.* 0·7 cm, narrowly ovate, acuminate, shorter than the umbel, persistent. Umbel 1·5–2 cm in diameter, hemispherical, with 8–20 flowers; pedicels 5–7 mm, almost equal. Perianth cup-shaped; segments 4 × 1·5–2 mm, red, the outer cymbiform-lanceolate, the inner narrowly ovate, obtuse. Stamens exserted; filaments 5·5 mm, 0·5 mm wide at base, simple. Capsule 3·5–5 mm. $2n=16$. *Calcareous rocks,* 1200–2220 *m.* ● *S.E. Alps (Slovenija).* Ju.

10. A. suaveolens Jacq., *Collect. Bot.* **2**: 305 (1789). Bulbs 1–1·5 cm in diameter, almost cylindrical to very narrowly conical, attached to a short rhizome; outer tunics breaking up into layers of parallel fibres. Stem (20–)30–50(–60) cm, terete. Leaves 2–5, up to 40 cm × 1·5–3 mm, sheathing the lower ¼–⅓ of the stem, linear, flat, keeled beneath. Spathe 2-valved; valves up to 1·5 cm, unequal, about as long as the umbel, persistent. Umbel 2–3·5 cm in diameter, hemispherical; pedicels 8–20 mm. Perianth cup-shaped; segments 4–5 × 1·5–2 mm, pink or white with pink keel, the outer elliptical, the inner narrowly ovate, obtuse. Stamens long-exserted; filaments 6–7 mm, simple; anthers *c.* 1·5 mm when dehisced, brownish. Capsule *c.* 5 mm. $2n=16$. *Damp meadows and moors.* ● *S. & W. parts of C. Europe, N. Italy; Albania.* Al Au Ga Ge He Hu It Ju.

11. A. lineare L., *Sp. Pl.* 295 (1753) (incl. *A. strictum* Schrader). Bulbs cylindrical, solitary or paired, on a short oblique rhizome

5–10 mm thick; outer tunics with brown reticulate fibres. Stem 25–60 cm, slightly ribbed. Leaves 2–4, 18 cm × 3·5 mm, sheathing the lower ¼ of the stem, linear, solid, ribbed beneath, with minutely denticulate margins. Spathe up to 1 cm, 2-valved, about as long as the umbel, persistent. Umbel 1·5–3 cm in diameter, hemispherical, many-flowered, dense; pedicels up to 15 mm, almost equal. Perianth campanulate; segments 4 × 1·5 mm, pink to lilac-purple, lanceolate, obtuse. Stamens slightly to much longer than the segments; filaments 4·5–6 mm, the outer subulate, the inner abruptly widened and up to 0·7 mm wide at base, often with a short basal tooth on one or both sides; anthers *c.* 0·5 mm when dehisced. Capsule 3·5–4 mm. $2n = 16, 48$. *Rocky slopes, mountain grassland and steppes. Locally in the mountains and hill-country of C. Europe, from S.W. Poland to the S.W. Alps and W. Ukraine; S. & E. Russia and E. Ukraine; isolated stations in N.W. Russia.* Au Cz Ga Ge He It Po Rs (C, W, E).

12. A. palentinum Losa & Montserrat, *Anal. Inst. Bot. Cavanilles* **11(2)**: 423 (1953). Bulbs cylindrical, attached to a short rhizome; outer tunics membranous, glossy, brown. Stem 25–40 cm. Leaves 3, narrow, linear, sheathing the lower ⅓ of the stem. Spathe 1- or (less often) 2-valved, shorter than the umbel, persistent. Umbel hemispherical, many-flowered, *c.* 2 cm in diameter. Perianth campanulate; segments *c.* 6 × 3 mm, pink, the outer oblong-elliptical, 3-toothed at the apex, the inner elliptical, obtuse. Stamens long-exserted; filaments *c.* 8 mm, simple, the inner 3 abruptly widened at base with a small obtuse tooth on each side; anthers purple. *Crevices in calcareous rocks*, 1400–2200 *m.* ● *Mountains of N.W. Spain (N.E. part of prov. León).* Hs.

13. A. hymenorhizum Ledeb., *Fl. Altaica* **2**: 12 (1830). Bulbs 1–2 cm in diameter, cylindrical, attached to a short rhizome; outer tunics breaking into coriaceous, glossy, brown longitudinal strips. Stem 40–90 cm, terete. Leaves 4–6, up to 30 cm × 3–6 mm, linear, flat, their bases sheathing most of the lower ½ of the stem. Spathe 2-valved, almost as long as the umbel, persistent or deciduous. Umbel 2–3·5 cm in diameter, subglobose, many-flowered, dense; pedicels 10–15 mm, almost equal. Perianth campanulate; segments 4–6 × 1·5–2 mm, purplish-pink, narrowly oblong or lanceolate, obtuse or subacute. Stamens long-exserted; filaments *c.* 7·7 mm, simple; anthers yellow. Capsule 4–5 mm. *Water-meadows. S. Ural (by the river Tanalyk, S. of Bajmak).* Rs (C). *(W. & C. Asia.)*

14. A. obliquum L., *Sp. Pl.* 296 (1753). Bulbs 2–3 cm in diameter, narrowly ovoid; outer tunic membranous, reddish-brown. Stem 60–100 cm, terete. Leaves 6–10, up to 35 cm × 20 mm, sheathing the lower ½ of the stem, linear, ascending, canaliculate. Spathe 1-valved, persistent, shorter than pedicels. Umbel 3·5–4 cm in diameter, spherical or hemispherical, dense, many-flowered; pedicels 10–20 mm, unequal. Perianth broadly cup-shaped or subglobose; segments 4–5 × 2·5 mm, pale yellowish-green, very concave, the outer broadly ovate-elliptical, the inner ovate, acute. Stamens exserted; filaments 7–8 mm. Capsule 3 mm. $2n = 16$. *Meadows, woods and cliffs. S.E. Russia; one station in C. Romania.* Rm Rs (E). *(Siberia, C. Asia.)*

15. A. narcissiflorum Vill., *Prosp. Pl. Dauph.* 18 (1779). Bulbs 0·5 cm in diameter, oblong, clustered on a short rhizome; outer tunics persisting as layers of parallel fibres 1·5–5·5 cm. Stem 15–35 cm, 2-edged. Leaves 3–5, 9–28 cm × 2–6 mm, sheathing the stem in its lower part all to about the same level, linear, flat. Spathe up to 1·8 cm, 1-valved, often 2- to 3-lobed, persistent. Umbel at first nodding, later erect, fastigiate, with 5–8 flowers; pedicels 8–18 mm. Perianth campanulate; segments 10–15 mm, purple, the outer 3·5–5 mm wide, lanceolate or oblanceolate, acute or obtuse, the inner 4·5–7 mm wide, narrowly obovate, rounded at apex. Stamens included; filaments *c.* 5 mm; simple; stigma 3-lobed. Capsule *c.* 5 mm. $2n = 14$. *Screes.* ● *S.W. Alps and their foothills; once found in N.W. Portugal.* Ga It Lu.

16. A. insubricum Boiss. & Reuter, *Cat. Graines Jard. Bot. Genève* **1856**: 4 (1857). Bulbs 0·5 cm in diameter, oblong, clustered on a short rhizome; outer tunics membranous, thin, sometimes with a few parallel fibres at base. Stem 16–30 cm, 2-edged. Leaves 3–4, 12–20 cm × 2–5 mm, sheathing the stem in its lower part all to about the same level, linear, flat. Spathe up to 1·8 cm, 1-valved, acute, persistent. Umbel permanently nodding, fastigiate, with 3–5 flowers; pedicels 8–20 mm. Perianth campanulate; segments 18 mm, purple, the outer 6 mm wide, oblanceolate, apiculate, the inner *c.* 9 mm wide, narrowly obovate, rounded at apex. Stamens included; filaments 6 mm, simple. Stigma 3-lobed. $2n = 14$. *Calcareous rocks and screes*, 800–2100 *m.* ● *S. Alps, between Lago di Como and Lago di Garda.* It.

17. A. inderiense Fischer ex Bunge in Goebel, *Reise Steppen Russl.* **2**: 311 (1838). Bulbs 0·7–1·5 cm in diameter, narrowly conical, clustered on a short rhizome; outer tunics reticulately fibrous. Stem 20–40 cm, terete. Leaves 3–5, up to 6 cm × 1–3 mm, sheathing the lower ¼ of the stem, linear, canaliculate. Spathe 2-valved; valves up to 1·5 cm, shortly beaked, persistent. Umbel 1·5–3 cm in diameter, fastigiate or hemispherical, few-flowered; pedicels 5–15 mm in fruit. Perianth campanulate; segments 7–10 × 2·5–3 mm, purplish, with darker mid-vein, lanceolate, acute. Stamens equalling or slightly longer than the perianth; filaments 8 mm or more, simple, adnate to the perianth at base for 1·5 mm; anthers violet. *Steppes. S.E. Russia, W. Kazakhstan.* Rs (E). *(W.C. Asia.)*

Sect. SCHOENOPRASUM Dumort. (Sect. *Schoenoprason* F. Hermann). Bulbs cylindrical or very narrowly conical, on a short rhizome. Stems terete. Leaves almost basal or sheathing the lower ¼–⅓ of the stem, cylindrical, fistular. Spathe equalling or shorter than pedicels, which are without bracteoles at base. Perianth campanulate. Stamens simple. Ovary with deep, rounded nectariferous pits; ovules 2 in each loculus; stigma entire. Seeds angular.

18. A. schoenoprasum L., *Sp. Pl.* 301 (1753). Bulbs 0·5–1 cm in diameter, very narrowly conical, clustered on a short rhizome; outer tunics membranous, sometimes splitting into coriaceous strips. Stem 5–50 cm, hollow. Leaves 1–2, up to 35 cm × 1–6 mm, sheathing up to the lower ¼ of the stem, sometimes almost basal, cylindrical, fistular. Spathe up to 1·5 cm, with the 2–3 ovate lobes mucronate, equalling or shorter than umbel, persistent. Umbel 1·5–5 cm in diameter, hemispherical or ovoid, dense, with 8–30 flowers; pedicels 2–15 mm. Perianth-segments 7–15 × 2·5–4 mm, lilac or pale purple, occasionally white, usually lanceolate, acute or acuminate. Stamens included; filaments 3–6 mm, *c.* ½ as long as segments; anthers yellow. Capsule 4 mm. $2n = 16$. *Streamsides, damp meadows, damp mountain rocks and rocky pastures. Much of Europe, but only on mountains in the south; cultivated for its edible leaves and frequently naturalized.* Au Br Bu Co Cz Da Fe Ga Ge Gr *Hb He Ho Hs It Ju Lu No Po Rm Rs (N, B, C, W, E) Su [Az Be].

Very variable and plastic, with some local differentiation. Numerous variants have been described but they show considerable overlap in characters. Possibly the most distinct is a robust arctic-montane taxon (*A. montanum* Schrank, non F. W.

Schmidt, *A. foliosum* Clarion ex DC.) up to 50 cm high with the umbel 3–5 cm in diameter and long-acuminate perianth-segments 10–15 mm, sometimes distinguished as var. *alpinum* DC., var. *sibiricum* (L.) Garcke or subsp. *sibiricum* (L.) Čelak. (though doubtfully identical with the probably tetraploid *A. sibiricum* L. of Siberia).

19. A. schmitzii Coutinho, *Bol. Soc. Brot.* **13**: 103 (1896). Bulbs 1–1·5 cm in diameter, very narrowly conical, with a very short rhizome; outer tunics membranous. Stem 30–60 cm. Leaves 1–3, up to 22 cm × 0·5–2·5 mm, sheathing the lower ¼–⅓ of the stem, linear, fistular. Spathe 2-valved; valves unequal, the larger up to 1·4 cm, shortly acuminate, persistent. Umbel 2·5–6·5 cm in diameter, hemispherical; pedicels 15–25 mm, almost equal. Perianth-segments 5–7 × 1·5–2 mm, purple or pink, with dark mid-vein, lanceolate, acute. Stamens equalling perianth; filaments *c.* 4·5 mm, connate at base into an annulus *c.* 1 mm high; anthers brownish. Ovary subglobose. Capsule 3 mm. $2n=16$. *River banks and rock-crevices.* ● *E. Portugal.* Lu.

Sect. CEPA (Miller) Prokh. (incl. Sect. *Phyllodolon* (Salisb.) Prokh.). Bulbs cylindrical to subglobose, usually clustered on a short rhizome. Leaves sheathing lower part of stem, distichous, fistular. Stem terete, fistular. Spathe shorter than or almost equalling pedicels. Perianth stellate to campanulate. Stamens simple or with small teeth at base of inner filaments. Ovary with distinct nectariferous pores; ovules 2 in each loculus; stigma entire. Seeds angular.

20. A. cepa L., *Sp. Pl.* 301 (1753) (incl. *A. ascalonicum* auct., non L.). Bulbs varying in size and shape from cultivar to cultivar, often depressed-globose and up to 10 cm in diameter; outer tunics membranous. Stem up to 100 cm and up to 30 mm in diameter, tapering from inflated lower part. Leaves up to 10, up to 40 cm and up to 20 mm in diameter, usually almost semicircular in section and slightly flattened on upper side, basal in first year, in second year their bases sheathing the lower ⅙ of the stem. Spathe often 3-valved, persistent, shorter than the umbel. Umbel 4–9 cm in diameter, subglobose or hemispherical, dense, many-flowered; pedicels up to 40 mm, almost equal. Perianth stellate; segments 3–4·5 × 2–2·5 mm, white, with green stripe, slightly unequal, the outer ovate, the inner oblong, obtuse or acute. Stamens exserted; filaments 4–5 mm, the outer subulate, the inner with an expanded base up to 2 mm wide and shortly toothed on each side. Ovary whitish. Capsule *c.* 5 mm. $2n=16$. *Cultivated on a field scale throughout most of Europe for its edible bulbs (onions).*

The common onion exists in numerous cultivars resulting from some 3,000 years of cultivation and is usually grown as a biennial, but there are perennial variants with narrow leaves or with large bulbils and usually few flowers in the umbel (cf. H. A. Jones & L. K. Mann, *Onions and their Allies* 32–36 (1963)). It is unknown in a wild state, though probably derived from *A. oschaninii* B. Fedtsch. (*A. cepa* var. *sylvestre* Regel) of C. Asia. **A. cornutum** G. C. Clementi ex Vis., *Fl. Dalm.* **1**: 139 (1842), from S.W. Jugoslavia (near Budva), may be a bulbilliferous form derived from former cultivation. The name *A. ascalonicum* L. was based on a Palestinian species later named *A. hierochuntinum* Boiss., but has long been applied to variants of *A. cepa* called shallots (cf. W. T. Stearn, *Bull. Brit. Mus.* (*Bot.*) **2**: 181 (1960)).

21. A. fistulosum L., *Sp. Pl.* 301 (1753). Bulbs 1–2·5 cm in diameter, cylindrical, adnate to a short rhizome; outer tunics membranous. Stem 12–70 cm, 10–20 mm in diameter, tapering from the inflated middle part. Leaves 2–6, 6–30 cm × 5–15 mm, their bases sheathing the lower ¼–⅓ of the stem, fistular, circular in section, terete. Spathe 1- to 2-valved; valves up to 2 cm, ovate, acute, almost equalling the umbel. Umbel 1·5–5 cm in diameter, subglobose or broadly ovoid, dense, many-flowered; pedicels 3–20 mm, unequal. Perianth conically campanulate; segments 6–7 × 2 mm, yellowish-white, unequal, the outer cymbiform, lanceolate, the inner 7–9 × 3 mm, narrowly ovate, acuminate. Stamens long-exserted; filaments 8–12 mm, simple; anthers yellow. Capsule 4 mm. $2n=16$. *Cultivated locally as a vegetable, and found as an occasional escape from gardens; naturalized in S.C. Norway on turf roofs.* [No.]

Unknown in a wild state, but originally from E. Asia, where it is widely cultivated; closely allied to **A. altaicum** Pallas, *Reise* **2**: 737 (1773), from C. Asia.

Sect. ANGUINUM G. Don ex Koch (Sect. *Nikeprason* F. Hermann). Bulbs almost cylindrical, clustered on a short rhizome, with dense, reticulately fibrous tunics. Stem 2-edged below. Leaves sheathing lower ⅓–½ of the stem, shortly petiolate, with broad lamina. Spathe shorter than pedicels, 1- to 2-valved, persistent. Perianth stellate or cup-shaped. Stamens simple. Ovary with distinct nectariferous pores; ovules 2 in each loculus; stigma simple. Seeds subglobose.

22. A. victorialis L., *Sp. Pl.* 295 (1753). Bulbs 5–6 × 1–2 cm. Stem 30–60 cm. Leaves 2–3, the lamina 8–25 cm × 16–90 mm, narrowly lanceolate to broadly elliptical, acute or obtuse, narrowed at base into a short petiole. Umbel 3–5 cm in diameter, globose or hemispherical, many-flowered; pedicels 10–30 mm, unequal. Perianth-segments 4–5 × 2–2·5 mm, dull or greenish-white, the outer lanceolate, the inner narrowly ovate, acute or obtuse, ultimately deflexed. Stamens exserted; filaments *c.* 6 mm, simple; anthers yellow. Capsule *c.* 4 mm. $2n=16$. *Rocky places and mountain pastures. Mountains of Europe, from the Vosges, Sudeten Mts. and C. Ural southwards to C. Spain and S.W. Bulgaria.* Au Bu Cz Ga Ge He Hs Hu It Ju Lu Po Rm Rs (C, W).

Sect. MOLIUM G. Don ex Koch (incl. Sect. *Rhodoprason* F. Hermann, Sect. *Xanthoprason* F. Hermann). Bulbs ovoid or subglobose; not rhizomatous. Leaves almost basal, with short above-ground sheath, flat. Stem terete or angled. Spathe shorter than or equalling pedicels. Perianth stellate to campanulate or cylindrical. Ovary with distinct nectariferous pores; ovules 2 in each loculus; stigma entire. Seeds angular.

23. A. roseum L., *Sp. Pl.* 296 (1753). Bulbs *c.* 1·5 cm in diameter, broadly ovoid or subglobose, with numerous bulblets; outermost tunic crustaceous, pitted with numerous minute often hexagonal perforations, inner tunics smooth. Stem 10–65 cm, terete. Leaves 2–4, 12–35 cm × 1–14 mm, sheathing the lower ⅓ of the stem, linear, glabrous, or with scabrid margin. Spathe up to 1·5 cm, 1-valved, deeply 3- to 4-lobed, shorter than pedicels, persistent. Umbel up to 7 cm in diameter, fastigiate or hemispherical, with 5–30 flowers, without bulbils and usually many-flowered and fertile (var. *roseum*), or with bulbils and then usually few-flowered and sterile (var. *bulbiferum* DC.); pedicels 7–45 mm. Perianth campanulate to broadly cup-shaped; segments 7–12 × 3–5 mm, pink or white, the inner narrowly elliptical, the outer narrowly obovate, acute to rounded at apex. Stamens included; filaments *c.* 5 mm, subulate, simple; anthers yellow. Capsule 4 mm. $2n=16, 32$. *Cultivated ground and dry, open habitats. S. Europe.* Al Bl Co Cr Ga Gr Hs It Ju Lu Sa Si Tu [Br].

A common, widespread, variable species which has been divided into numerous named taxa based on width of leaf, length of pedicels, presence or absence of bulbils in the umbel and colour of flowers, with little or no coherence between the characters. Variants with bulbils replacing flowers in the umbel have

probably arisen independently in different populations and, owing to their ease of vegetative multiplication, form clones; these have been named *A. ambiguum* Sm., non DC., *A. carneum* Targ.-Tozz., *A. amoenum* G. Don, *A. roseum* subsp. *bulbiferum* (DC.) E. F. Warburg, var. *bulbiferum* DC., var. *bulbilliferum* Vis. and var. *carneum* (Targ.-Tozz.) Reichenb. Possibly worthy of taxonomic recognition is a dwarf variant long known from Corse, Sardegna and Isola di Giglio, which has been named *A. confertum* Jordan & Fourr. (*A. roseum* var. *insulare* Genn., *A. roseum* var. *humile* Sommier).

24. A. circinnatum Sieber, *Reise Kreta* **2**: 316 (1823). Bulbs 0·7 cm in diameter, ovoid; outer tunics chartaceous, pitted. Stem 5–18 cm, terete, hairy. Leaves 2–5, up to 24 cm × 1–1·5 mm, almost basal, linear, twisted or coiled especially at the apex into up to 10 coils, covered with long, patent hairs. Spathe 6–10 mm, 1-valved, 1- or 2-lobed at the apex, about as long as pedicels, persistent. Umbel fastigiate, with 2–5 flowers; pedicels 3–11 mm. Perianth stellate; segments 5–6 × 1·5–2 mm, white, with pink mid-vein, the outer oblong, the inner lanceolate, acute or obtuse. Stamens included; filaments *c.* 4 mm, simple; anthers yellow. Capsule 3 mm. Flowering March–April. *Dry, stony hillsides.* ● *Kriti.* Cr.

25. A. massaessylum Batt. & Trabut, *Bull. Soc. Bot. Fr.* **39**: 74 (1892). Bulbs 1–1·5 cm in diameter, ovoid or subglobose; outer tunics chartaceous, often with faint jigsaw pattern. Stem 15–40 cm, terete. Leaves 2–3, up to 20 cm × 5–10 mm, basal, linear, glabrous, canaliculate. Spathe 2-valved, persistent, shorter than pedicels. Umbel 3–5·5 cm in diameter, fastigiate, many-flowered, lax; pedicels 10–20 mm, unequal. Perianth cup-shaped; segments 10–14 × 3·5–5 mm, white, with purple mid-vein, the outer elliptical, the inner narrowly elliptical, somewhat acute. Stamens included; filaments 5–6 mm, simple; anthers yellow. $2n = 14$. *Portugal, S.W. Spain.* Hs Lu.

26. A. phthioticum Boiss. & Heldr. ex Boiss., *Fl. Or.* **5**: 274 (1882). Bulbs 1·5 cm in diameter, subglobose; outer tunics membranous, not pitted. Stem up to 55 cm, terete. Leaves 3–4, up to 30 cm × 10 mm, sheathing the lower part of the stem, linear. Spathe up to 1–5 cm, 1- or 2-valved, 3- to 4-lobed, persistent. Umbel fastigiate, with 12–15 flowers, sometimes bulbilliferous; pedicels 30–65 mm, very unequal. Perianth cylindrical; segments *c.* 13 × 2·5–4·5 mm, whitish, the outer lanceolate, the inner narrowly lanceolate, acute. Stamens included; filaments 8–9 mm; anthers yellow. *Mountain pastures.* ● *S.C. Greece (Oiti, S.W. of Lamia).* Gr.

27. A. breviradium (Halácsy) Stearn, *Ann. Mus. Goulandris* **4**: 138 (1978) (*A. neapolitanum* var. *breviradium* Halácsy). Bulbs 1·5–2 cm in diameter, ovoid; outer tunics membranous, not pitted. Stem 30–35 cm, slightly angled. Leaves 2–4, up to 24 cm × 10 mm, sheathing the lower $\frac{1}{6}$ of the stem and almost basal, linear. Spathe 1-valved, 3- to 4-lobed, persistent, about as long as the pedicels. Umbel fastigiate, with 5–30 flowers, not bulbilliferous; pedicels 10–15 mm, almost equal. Perianth cylindrical-campanulate; segments 9–12 × 3 mm, whitish, narrowly lanceolate, acuminate. Stamens included; filaments 7 mm, simple. Capsule 4 mm. ● *Mountains of S. Albania, S. Jugoslavia and N.C. Greece.* Al Gr Ju.

28. A. neapolitanum Cyr., *Pl. Rar. Neap.* **1**: 13 (1788). Bulbs 1–2 cm in diameter, subglobose; outer tunics membranous or crustaceous, not pitted. Stem 20–50 cm, triquetrous, with 2 edges slightly winged. Leaves usually 2, 8–35 × 5–20 mm, sheathing the lower $\frac{1}{3}$–$\frac{1}{4}$ of the stem and almost basal, very narrowly lanceolate to linear, keeled beneath, glabrous, sometimes with denticulate margin. Spathe 1-valved, entire, persistent, shorter than pedicels. Umbel 5–8 cm in diameter, fastigiate or hemispherical, many-flowered; pedicels 15–35 mm. Perianth cup-shaped or stellate; segments 7–12 × 4–6 mm, white, the outer broadly elliptical, the inner elliptical, obtuse. Stamens included; filaments *c.* 5 mm, simple. Capsule 5 mm, enclosed within the connivent, glistening perianth-segments. $2n = 14$, 21, **28**, **31**, 32, 33, 34, 35, 36. *Pastures, cultivated ground and dry, open habitats. Mediterranean region, Portugal.* Co Cr Ga Gr Hs It Ju Lu Sa Si Tu.

29. A. longanum Pamp., *Bull. Soc. Bot. Ital.* **1912**: 116 (1912). Bulbs 0·8–1·5 cm in diameter, ovoid; outer tunics membranous, not pitted. Stem 15–42 cm, terete. Leaves 2–3, up to 30 cm × 3–8 mm, linear, sparsely or profusely ciliate. Spathe up to 1·5 cm, 1-valved, often 2-lobed, persistent, a little shorter than pedicels. Umbel 2–4·5 cm in diameter, fastigiate, with 6–25 flowers; pedicels 8–20 mm. Perianth campanulate; segments white, pink-tinged, narrowly oblong, unequal, the outer 7–12 × 4·5–6 mm, the inner 6–10 × 3–4·5 mm, truncate-rounded and emarginate at apex. Stamens included; filaments unequal, the outer 3·5–4·5 mm, the inner 5–6·5 mm, narrowly triangular; anthers yellow. Capsule 4 mm. *S. Aegean region (Kriti, Sirna, Astipalaia).* Cr Gr. (*Cyrenaica, Egypt.*)

30. A. subhirsutum L., *Sp. Pl.* 295 (1753) (*A. clusianum* Retz.). Bulbs up to 1·5 cm in diameter, subglobose; tunic membranous, not pitted. Stem 7–30 cm, terete. Leaves 2–3, 6–45 cm × 2–10 mm, almost basal, linear, ciliate. Spathe up to 1·3 cm, 1-valved, persistent, shorter than pedicels. Umbel 2·5–7 cm in diameter, hemispherical and lax, or fastigiate; pedicels up to 40 mm, 3–5 times as long as the perianth-segments, irregularly patent. Perianth stellate; segments 7–9 mm, white, lanceolate to oblanceolate, obtuse to acute. Stamens $\frac{1}{2}$–$\frac{2}{3}$ as long as perianth; filaments 4–6 mm, subulate, simple; anthers usually brown, occasionally yellow. Capsule 3 mm. $2n = 14$, 28. *Rocky or sandy places. Mediterranean region.* Bl Co Cr Ga Gr Hs It Ju Sa Si [Az].

A. permixtum Guss., *Fl. Sic. Prodr.* **1**: add. 8 (1827), from the C. Mediterranean region (Corse to Malta), differs chiefly in having the leaves not ciliate; it needs further study.

31. A. trifoliatum Cyr., *Pl. Rar. Neap.* **2**: 11 (1792). Bulbs up to 1·2 cm in diameter, subglobose; outer tunic membranous, not pitted. Stem 15–45 cm, terete. Leaves 2–3, 5–60 cm × 2–15 mm, almost basal, linear, sparsely hairy. Spathe up to 2 cm, 1-valved, persistent. Umbel 2·5–4 cm in diameter, fastigiate; pedicels up to 20 mm, $1\frac{1}{2}$–3 times as long as perianth-segments. Perianth stellate; segments 7–10 mm, white, tinged with pink or with a pink vein, often reddening with age, lanceolate, acute. Stamens $\frac{1}{2}$ as long as perianth; filaments 4–5 mm, subulate, simple; anthers yellowish. Capsule 4–5 mm. *Pastures and stony ground. Mediterranean region, from Kriti to S.E. France.* Cr Ga It Sa Si.

32. A. subvillosum Salzm. ex Schultes & Schultes fil., *Syst. Veg.* 7: 1104 (1830). Bulbs up to 1·5 cm in diameter, subglobose; outer tunics membranous. Stem 5–40 cm, terete. Leaves 2–5, 6–30 cm × 2–20 mm, almost basal, linear, ciliate. Spathe up to 1·5 cm, 1-valved, often becoming 3-lobed, persistent. Umbel 2·5–4·5 cm in diameter, hemispherical, many-flowered; pedicels up to 20 mm, up to twice as long as the perianth-segments. Perianth broadly cup-shaped; segments 5–9 × 1·5–2 mm, completely white, the outer narrowly ovate, the inner narrowly elliptical, obtuse or acute. Stamens slightly shorter to slightly longer than perianth; filaments 6–11 mm; anthers yellow. Capsule 3·5–4 mm. $2n = 28$. *Maritime sands and grasslands. S.*

Portugal, S. Spain, Mallorca; islands of C. Mediterranean region. Bl Hs Lu Si.

33. A. moly L., *Sp. Pl.* 301 (1753). Bulb up to 2·5 cm in diameter, subglobose; outer tunic chartaceous. Stem 12–35 cm, terete. Leaves (1–)2(–3), 20–30 cm × 15–35 mm, almost basal, linear-lanceolate to lanceolate, glabrous, glaucous, keeled below. Spathe 2-valved, persistent, shorter than pedicels. Umbel 4–7 cm in diameter, fastigiate or hemispherical, many-flowered, without bulbils (var. *moly*), rarely with bulbils and few flowers (var. *bulbilliferum* Rouy); pedicels 15–35 mm, unequal, ascending. Perianth stellate; segments 9–12 × 4–5 mm, yellow, with greenish line outside, the outer elliptical, the inner oblanceolate, acute. Stamens shorter than segments; filaments 5–6 mm, yellow, simple. Ovary not prominently angled. Capsule covered by persistent, connivent perianth-segments. $2n=14$. *Shady mountain rocks.* ● *E. Spain, S.W. France.* Ga Hs.

34. A. scorzonerifolium Desf. ex DC. in Redouté, *Liliacées* **2**: t. 99 (1804). Bulb *c.* 1·5 cm in diameter, subglobose; outer tunics papery. Stem 14–30 cm, angled above. Leaves 1–3, 18–40 cm × 3–7 mm, almost basal, linear, keeled below, glaucous. Spathe 1-valved, caducous. Umbel 4–5 cm in diameter, fastigiate, with up to 15 flowers and without bulbils (var. *xericiense* (Pérez Lara) R. Fernandes), or with bulbils and few flowers (var. *scorzonerifolium*); pedicels 15–30 mm, ascending. Perianth stellate; segments 7–10 × 2–4 mm, yellow, lanceolate or narrowly elliptical, acute or obtuse. Stamens shorter than segments; filaments 4–6 mm, yellow, simple. Ovary distinctly angled, with 6 minute crests. $2n=14$. *Rock crevices.* ● *W. & C. Spain, N.W. Portugal.* Hs Lu.

Sect. BRISEIS (Salisb.) Stearn. Bulbs subglobose; not rhizomatous. Leaves almost basal, with short above-ground sheath, so strongly keeled as to be triquetrous. Stem triquetrous, flaccid after anthesis. Spathe shorter than pedicels, 2-valved, persistent. Perianth campanulate or stellate. Stamens simple, included. Ovary with minute nectariferous pores; ovules 2 in each loculus; stigma 3-lobed. Seeds angular, with white elaiosome.

35. A. triquetrum L., *Sp. Pl.* 300 (1753). Bulbs 1·5 cm in diameter; outer tunic membranous. Stem 10–45 cm. Leaves usually 2–3, up to 42 cm × 17 mm. Spathe up to 2·5 cm. Umbel with 3–15 flowers, usually one-sided, lax, without bulbils; pedicels up to 25 mm. Perianth drooping, campanulate; segments 10–18 × 2–5 mm, white, with distinct longitudinal green stripe, lanceolate, acute. Stamens 6–7 mm. Capsule 6–7 mm. $2n=18$. *Woods, streamsides and damp, shady places. W. Mediterranean region.* Bl Co Ga Hs It Sa Si [Az Br Hb *Lu].

36. A. pendulinum Ten., *Prodr. Fl. Nap.* 22 (1810). Bulbs *c.* 1 cm in diameter; outer tunic membranous. Stem 6–25 cm. Leaves 2, up to 25 cm × 7 mm, soon withering. Umbel with 5–9 flowers, lax, not secund, without bulbils; pedicels up to 40 mm, ascending at anthesis, later drooping. Perianth stellate; segments 3–5 × 1·1–1·4 mm, white, with longitudinal green stripe, lanceolate, acute. Filaments 4·5 mm. Capsule 4–6 mm. $2n=14$. *Woods and damp, shady places.* ● *C. Mediterranean region.* Co It Sa Si.

37. A. paradoxum (Bieb.) G. Don, *Monogr. Allium* 72 (1827). Bulbs 0·5–1 cm in diameter; tunic membranous. Stem 15–30 cm. Leaf 1, up to 30 cm × 20 mm. Umbel usually reduced to 1 flower (in Europe), usually with small green subglobose bulbils and often then without flowers; pedicel 20–45 mm. Perianth campanulate; segments 12 × 6 mm, white, with faint longitudinal green stripe, obtuse. Filaments 5 mm. Capsule rarely produced in Europe. $2n=16$. *Cultivated as a curiosity and locally naturalized in C. & N.W. Europe.* [Br Cz Da Ge Ho.] (*Caucasus, Iran.*)

Sect. CHAMAEPRASON F. Hermann. Bulbs subglobose; not rhizomatous. Leaves basal. Stem very short, the umbel almost sessile in the rosette of leaves. Spathe shorter than the pedicels which are recurved in fruit. Ovary with 2 ovules in each loculus. Stigma entire. Seeds angular.

38. A. chamaemoly L., *Sp. Pl.* 301 (1753). Bulbs 0·5–1 cm in diameter; outer tunic chartaceous, pitted. Leaves 2–5, 3–27 cm × 3–10 mm, usually spread flat on the ground, their bases entirely sheathing the stem, linear, ciliate at margin, sometimes hairy on the surface. Spathe 1-valved, 2- to 4-lobed, persistent. Umbel 1·5–2·5 cm in diameter, fastigiate, with 2–20 flowers; pedicels 5–10 mm. Perianth stellate; segments 5–9 × 1·5–2 mm, white, with a green or purplish mid-vein, oblong, acute or obtuse. Stamens shorter than segments; filaments *c.* 4 mm. Capsule *c.* 4 mm. Flowering December to March. $2n=22$. *Grassland and sandy ground. Mediterranean region.* Al Bl Co Ga Gr Hs It Ju Sa Si.

Sect. OPHIOSCORODON (Wallr.) Bubani (Sect. *Arktoprason* F. Hermann). Bulbs subcylindrical, not rhizomatous. Leaves basal, petiolate, with broad, resupinate blade. Stem sharply angled. Spathe shorter than pedicels, 2-valved, persistent. Perianth stellate. Stamens simple. Ovary with 2 ovules in each loculus. Stigma simple. Seeds subglobose.

39. A. ursinum L., *Sp. Pl.* 300 (1753). Bulbs *c.* 4 × 1 cm, narrow; outer tunic papery, with a few parallel fibres at base. Stem 10–50 cm, usually 2-angled and semi-cylindrical, sometimes 3-angled. Leaves 2–3; lamina 6–20 cm × 15–80 mm, narrowly elliptical to narrowly ovate, acute, attenuate into the petiole and rounded or subcordate at base. Umbel 2·5–6 cm in diameter, with 6–20 flowers, lax; pedicels 10–15 mm, ascending. Perianth-segments 7–12 × 2–2·5 mm, white, lanceolate, acute. Stamens *c.* 7 mm. Capsule 3–4 mm. $2n=14$. *Woods. Most of Europe, northwards to 64°N. in Norway, but absent from much of the north-east and E. Russia, and rare in the Mediterranean region.* Au Be Br Bu Co Cz Da Fe Ga Ge Gr Hb He Ho Hs Hu It Ju No Po Rm Rs (B, C, W) Si Su.

(a) Subsp. **ursinum**: Pedicels scabrid with numerous papillae. *W. & C. Europe, N. & C. Italy.*

(b) Subsp. **ucrainicum** Kleopow & Oxner, *Sched. Herb. Fl. Ucr.* 1. 10 no. 37 (1935): Pedicels smooth. *E. & S.E. Europe, C. & S. Italy, Sicilia.*

Transitional populations between these subspecies occur in E.C. Europe (cf. J. Soják, *Preslia* **40**: 294–300 (1968)).

Sect. SCORODON Koch (incl. Sect. *Crommyum* Subsect. *Haplostemon* Ser. *Brachyspatha* Boiss., Sect. *Haplostemon* (Boiss.) Halácsy, Sect. *Brevispatha* Valsecchi, Sect. *Cupanioscordum* Češchm.). Bulbs ovoid or subglobose; not rhizomatous. Stem terete. Leaves sheathing the lower $\frac{1}{4}$–$\frac{1}{2}$ of the stem, usually filiform. Spathe usually shorter than the pedicels. Perianth tubular to stellate. Stamens simple or the inner sometimes with 2 short basal teeth. Ovary with distinct nectariferous pores; ovules 2 in each loculus. Stigma entire. Seeds angular.

40. A. moschatum L., *Sp. Pl.* 298 (1753). Bulbs *c.* 1 cm in diameter, narrowly ovoid, clustered; outer tunics separating into fibres, reticulate at apex but parallel below. Stem 10–30 cm. Leaves 3–6, up to 14 cm × 0·5 mm, sheathing the lower ($\frac{1}{4}$–$\frac{1}{2}$) of the stem, filiform. Spathe 2-valved; valves patent, shorter than pedicels, persistent. Umbel fastigiate, with 3–12 flowers; pedicels 10–15 mm, almost equal. Perianth campanulate; segments 6–7 × 1·5–2 mm, pink, with darker mid-vein or white with brown

mid-vein, lanceolate, acute. Stamens included; filaments *c.* 4 mm. Capsule 3 mm. $2n=16$. *Dry places.* ● *S. Europe, extending northwards to Hungary.* Al Bu Ga Gr Hs Hu It Ju Rm Rs (K) Tu.

41. A. inaequale Janka, *Linnaea* **30**: 603 (1860). Like **40** but the pedicels 10–30 mm, very unequal, 3–6 times as long as the flowers; perianth-segments usually 4–5 mm. *Steppes and sandy or rocky slopes. S. part of U.S.S.R., northwards to* 52°30′ *N.* Rs (C, W, K, E).

42. A. bornmuelleri Hayek, *Feddes Repert.* **21**: 260 (1925). Bulbs *c.* 0·5 cm in diameter, narrowly ovoid; outer tunics becoming fibrous. Stem 10–20 cm. Leaves 2–3, up to 3 cm × 0·5 mm, sheathing the lower ¼–⅓ of the stem, very shortly pubescent, filiform, minutely ciliate. Spathe 0·5–1·5 cm, 2-valved; valves unequal, ovate at base, contracted above into a slender appendage, persistent. Umbel 1·5–2·5 cm in diameter, lax, few-flowered; pedicels 4–12 mm, slightly unequal. Perianth cup-shaped; segments 4–4·5 × 1·5 mm, pink, narrowly elliptical, subacute or obtuse. Stamens included; filaments *c.* 4 mm, simple; anthers purple. Capsule 3·5 mm. ● *Macedonia.* Gr Ju.

43. A. rubellum Bieb., *Fl. Taur.-Cauc.* **1**: 264 (1808) (incl. *A. albanum* Grossh.). Bulbs 1–1·5 cm in diameter, ovoid; outer tunics coriaceous; bulblets pale yellowish or brownish. Stem 10–60 cm. Leaves 3–5, up to 30 cm × 1–5 mm, sheathing the lower ¼ of the stem, narrowly linear to filiform, fistular. Spathe shorter than umbel, long-beaked, caducous. Umbel 2·5–4 cm in diameter, hemispherical, many-flowered, dense; pedicels 5–15 mm, almost equal. Perianth campanulate; segments 5–6 × 1·5–2 mm, pink, with darker mid-vein, lanceolate, acute. Stamens included; filaments *c.* 3 mm, simple, the inner narrowly triangular and 1½–2 times as wide at base as the outer; anthers yellow. Capsule 3 mm. *Dry steppes and semi-deserts. S.E. Russia, W. Kazakhstan.* Rs (?C, E). (*Caucasus and Caspian region.*)

44. A. meteoricum Heldr. & Hausskn. ex Halácsy, *Consp. Fl. Graec.* **3**: 250 (1904). Bulb 0·8–1·2 cm in diameter, ovoid; outer tunics membranous. Stem 10–40 cm. Leaves 2–3, up to 12 cm × 2·3 mm, sheathing the lower ⅓–½ of the stem, filiform, scabrid. Spathe *c.* 0·5–1 cm, 2-valved; valves unequal, ovate at base, contracted above into a slender appendage, persistent. Umbel 1–3 cm in diameter, fastigiate or hemispherical; pedicels 3–25 mm, unequal. Perianth cylindrical; segments 4·5–6 mm, the outer 1·5–1·8 mm wide, the inner 1–1·5 mm wide, pink, lanceolate, acute to obtuse. Stamens included; filaments 3·5–4 mm, simple; anthers yellow. Ovary subglobose. Capsule 3·5 mm. $2n=16$. *Dry hillsides and mountain rocks.* ● *C. part of Balkan peninsula.* Al Gr Ju.

45. A. delicatulum Sievers ex Schultes & Schultes fil., *Syst. Veg.* **7**: 1133 (1830). Bulbs 0·5–1·5 cm in diameter, ovoid; outer tunics papery. Stem 9–45 cm. Leaves 2–3, up to 6 cm or more × 0·3–1·5 mm, sheathing the lower ⅓–½ of the stem, filiform. Spathe up to 0·7 cm, 2-valved; valves unequal, beaked, persistent. Umbel 1–3 cm in diameter, hemispherical or fastigiate; pedicels 5–10 mm, almost equal. Perianth campanulate; segments 4–6 × 1 mm, whitish or pink, with darker mid-vein, lanceolate, acute. Stamens included; filaments 4–5 mm, simple, adnate to the segments for 0·5 mm; anthers yellowish. Capsule 3 mm. *S.E. Russia, W. Kazakhstan.* Rs (C, E). (*W.C. Asia.*)

46. A. frigidum Boiss. & Heldr. in Boiss., *Diagn. Pl. Or. Nov.* **2(13)**: 34 (1853). Bulbs 0·5–1 cm in diameter, subglobose or ovoid; outer tunics membranous. Stem 10–20 cm. Leaves 2–3, up to 5 cm × 0·7 mm, sheathing the lower ½–⅔ of the stem, filiform, canaliculate, both lamina and sheaths pubescent with white hairs, or glabrous. Spathe 0·8–1·2 cm, 2-valved; valves narrowly ovate or lanceolate at base, narrowed above, equalling or shorter than the umbel. Umbel 1·5–4 cm in diameter, fastigiate, lax, with 3–16 flowers; pedicels 5–15 mm, very unequal. Perianth narrowly infundibuliform; segments 5–6 × 1–1·5 mm, yellowish or pink, narrowly oblong-elliptical, acute to obtuse. Stamens with exserted anthers; filaments 6 mm, simple. Ovary ellipsoid. Capsule 5 mm. *Mountain rocks and screes, 1250–2300 m.* ● *S. Greece (Peloponnisos).* Gr.

47. A. chrysonemum Stearn, *Ann. Mus. Goulandris* **4**: 149 (1978). Bulbs *c.* 1·5 cm in diameter, ovoid; outer tunics membranous, breaking at apex into parallel fibres. Stem 30–60 cm. Leaves 3–4, up to 15 cm × 2 mm, filiform, fistular, withered at anthesis, sheathing the lower ⅓ of the stem, the lamina and sheath with sparse, long hairs. Spathe 2-valved; valves unequal, the larger up to 1·5 cm, shortly beaked, persistent. Umbel *c.* 4 cm in diameter, lax, many-flowered; pedicels 10–15 mm and mostly nodding in flower, up to 45 mm and erect in fruit. Perianth cup-shaped; segments 4·5–5 × 2–2·4 mm, pale greenish-yellow, with green mid-vein, the outer narrowly ovate, almost truncate, the inner oblong, obtuse or subacute. Stamens slightly exserted; filaments 5 mm, yellow, sometimes reddish in upper part, simple; anthers yellow. Capsule *c.* 4 mm. $2n=32$. *Stony soil among rocks,* 670–2000 *m.* ● *S.E. Spain (prov. Jaén).* Hs.

48. A. grosii Font Quer, *Butll. Inst. Catalana Hist. Nat.* **24**: 145 (1924). Bulbs 1·5 cm in diameter. Stem 30–40 cm. Leaves linear, sheathing the lower ⅓ of the stem, flat, withered at anthesis. Spathe 2-valved; valves unequal, the larger up to 2·5 cm, long-acuminate, persistent. Umbel up to 5·5 cm in diameter, lax, many-flowered; pedicels 10–25 mm, the outer recurved. Perianth cylindrical; segments 6 × 1·5 mm, violet-purple, with darker mid-vein, narrowly oblong, obtuse. Stamens included; filaments *c.* 4 mm, simple, connate at base into an annulus 1 mm high; anthers purple. Ovary almost globose. *Among rocks.* ● *Islas Baleares (Ibiza).* Bl.

49. A. cupani Rafin., *Caratt.* 86 (1810). Bulbs 0·7–1·5 cm in diameter, narrowly ovoid; outer tunics reticulately fibrous. Stem 9–30 cm. Leaves 3–5, up to 8 cm × 0·4 mm, sheathing the lower ⅓–¾ of the stem, glabrous or pubescent, filiform. Spathe 1·5–2 cm, 1-valved, tubular at base, persistent. Umbel fastigiate, with 3–15 flowers; pedicels up to 40 mm, very unequal. Perianth cylindrical; segments 5·5–9 × 1·5–2 mm, whitish or pink, narrowly oblong, acute to obtuse. Stamens included; filaments *c.* 5 mm, simple; anthers yellow. Capsule 4 mm. *Dry, rocky ground. Mediterranean region and S. part of Balkan peninsula.* Al Bl Bu Cr Gr It Ju Si.

(a) Subsp. **cupani**: Bulb-tunics adherent at base of bulb. $2n=32$. *Throughout the range of the species except Islas Baleares and Aegean region.*

(b) Subsp. **hirtovaginatum** (Kunth) Stearn, *Ann. Mus. Goulandris* **4**: 151 (1978): Bulb-tunics breaking away from base of bulb. $2n=16$. *Islas Baleares (Cabrera); S. Greece and Aegean region.*

50. A. callimischon Link, *Linnaea* **9**: 140 (1835). Bulbs *c.* 1 cm in diameter, narrowly ovoid; outer tunics coriaceous, ultimately breaking into parallel fibres. Stem 9–38 cm. Leaves 3–5, the lowest up to 30 cm × 1 mm, sheathing the stem almost up to the umbel, filiform, slightly canaliculate, glabrous. Spathe 2–4 cm, 1-valved, erect, persistent. Umbel fastigiate, with 8–25 flowers; pedicels 7–25 mm, very unequal. Perianth cup-shaped or

infundibuliform; segments 5–7 × 1·5 mm, white, with brown or reddish mid-vein, often becoming pink with age, oblanceolate, truncate. Stamens included or with anthers exserted; filaments *c.* 6 mm, simple; anthers red before dehiscence. Capsule 5 mm. $2n=16$. Flowering September–October. *Rocky ground.* ● *S. Greece, Kriti.* Cr Gr.

(a) Subsp. **callimischon**: Perianth-segments unspotted. $2n=16$. *S. Greece.*

(b) Subsp. **haemostictum** Stearn, *Ann. Mus. Goulandris* **4**: 151 (1978): Perianth-segments with dark red spots in upper part. $2n=16$. *Kriti.*

51. A. obtusiflorum DC. in Redouté, *Liliacées* **2**: t. 118 (1805) (*A. maritimum* Rafin.). Bulbs *c.* 1 cm in diameter, subglobose; outer tunics membranous. Stem 4–18 cm. Leaves 2–3, 3–15 cm × 0·2–0·5 mm, sheathing the lower ⅓–½ of the stem, filiform. Spathe 2-valved, shorter than pedicels, persistent. Umbel up to 1·5 cm in diameter, subglobose, many-flowered; pedicels 2–12 mm, very unequal, the outermost recurved, the innermost erect and longer. Perianth tubular-ellipsoid; segments 3–4 × 1–2 mm, white or pale pink, with darker mid-vein, oblong, the outer wider, truncate-rounded. Stamens included; filaments 2·5 mm, simple, narrowly triangular. Capsule 2·5 mm. *Maritime sands, cliffs and hillsides.* ● *Sicilia; a few isolated stations in S. & E. Greece.* Gr Si.

52. A. parciflorum Viv., *Fl. Cors., App.* **1**: 2 (1825). Bulbs 1–1·5 cm in diameter, ovoid; outer tunics coriaceous, breaking into strips of parallel fibres. Stem 9–30 cm. Leaves 3–4, up to 10 cm × 0·4 mm, withered at anthesis, sheathing the lower ⅓–½ of the stem, filiform. Spathe 2-lobed, tubular below, the lobes unequal, the longest up to 1·4 cm. Umbel fastigiate, with 2–10 flowers; pedicels very unequal, erect or ascending, the shortest 5 mm, the longest up to 35 mm. Perianth tubular-campanulate; segments 5–6 × 1–1·3 mm, pink, lanceolate, acute. Stamens included; filaments 3 mm, simple. Capsule 4·5 mm. $2n=16$. *Among rocks.* ● *Corse, Sardegna.* Co Sa.

53. A. rouyi Gaut. in Rouy, *Ill. Pl. Eur. Rar.* **10**: 81 (1898). Bulbs *c.* 0·8 cm in diameter, ovoid; outer tunics membranous. Stem 19–27 cm. Leaves 3–4, up to 5 cm × 0·4 mm, sheathing the lower ¼–⅝ of the stem, filiform. Spathe 2-valved; valves 0·6–0·8 cm, ovate to lanceolate, acuminate, almost equal, persistent. Umbel fastigiate, lax, with 5–14 flowers; pedicels 5–15 mm, very unequal, ascending. Perianth campanulate; segments 5·5–6 × 1·5–1·8 mm, yellowish, oblong-lanceolate, obtuse. Stamens included; filaments 5 mm, simple, connate at base into an annulus 0·5 mm high; anthers yellow, becoming brownish. Capsule 4 mm. ● *S.W. Spain (Sierra Bermeja, prov. Málaga).* Hs.

54. A. caeruleum Pallas, *Reise* **2**: 737 (1773). Bulbs 1–2 cm in diameter, subglobose; outer tunics membranous. Stem 20–80 cm. Leaves 2–4, 7 cm × 2–4 mm, sheathing the lower ¼–⅓ of the stem, linear, triquetrous with prominent keel. Spathe up to 1·5 cm, 2-valved; valves ovate, acute or acuminate, persistent. Umbel 3–4 cm in diameter, subglobose or hemispherical, many-flowered; pedicels 10–20 mm, almost equal. Perianth cup-shaped; segments 3·5–4·5 × 1·2–1·4 mm, blue, with darker mid-vein, lanceolate, acute. Stamens equalling or slightly longer than segments; filaments 4 mm, simple, broadly triangular at base, narrowed above, connate into an annulus at base; anthers blue. Capsule 3 mm. *Salt-marshes and steppes. S.E. Russia.* Rs (E). (*C. Asia.*)

55. A. sabulosum Steven ex Bunge in Goebel, *Reise Steppen Russl.* **2**: 311 (1838). Bulbs 1·5–2 cm in diameter, narrowly ovoid; outer tunics coriaceous, striate; bulblets pale brown. Stem 20–60 cm, fistular. Leaves 3–4, up to 18 cm × 1–3 mm, sheathing the lower ¼ of the stem, linear, fistular. Spathe almost equalling the umbel, caducous. Umbel *c.* 3 cm in diameter, subglobose or hemispherical, many-flowered, dense; pedicels *c.* 10 mm, almost equal. Perianth hemispherical; segments 3–4 mm, the outer *c.* 1·5 mm wide, cymbiform, the inner *c.* 2·5 mm wide, greenish or whitish, elliptical to broadly elliptical, truncate to emarginate, papillose. Stamens exserted; filaments 4 mm, simple; anthers yellow. Capsule 3 mm. $2n=16$. *Sandy deserts. S.E. Russia, W. Kazakhstan.* Rs (E). (*C. Asia.*)

Sect. CODONOPRASUM Reichenb. (incl. Sect. *Macrospatha* G. Don ex Kunth, Sect. *Rhynchoprason* F. Hermann, Sect. *Haemoprason* F. Hermann, Sect. *Phalerea* Zahar.). Bulbs ovoid; not rhizomatous. Stem terete. Leaves sheathing up to ⅔ of the stem. Spathe 2-valved, the valves unequal, each with an ovate or lanceolate, usually strongly veined base, narrowed above into a tail-like appendage, longer than the pedicels. Perianth cup-shaped, campanulate, funnel-shaped, cylindrical or obovoid, never stellate. Stamens simple. Ovary with or without minute inconspicuous nectariferous pores; ovules 2 in each loculus. Stigma entire. Seeds angular.

56. A. paniculatum L., *Syst. Nat.* ed. 10, **2**: 978 (1759). Bulbs 1–2·5 cm in diameter; outer tunics membranous. Stem 30–70 cm. Leaves 3–5, up to 25 cm × (1–)2(–5) mm, sheathing the lower ⅓–½ of the stem, linear, canaliculate above, prominently ribbed beneath. Spathe 2-valved; valves unequal, ovate to narrowly lanceolate at base, contracted above into a long appendage, the longer valve 5–14 cm, greatly exceeding the pedicels. Umbel 3·5–7 cm in diameter, diffuse, hemispherical to ovoid, usually many-flowered, without bulbils; pedicels 10–70 mm, very unequal, the outer curving outwards, the inner erect. Perianth campanulate, becoming narrowly ovoid; segments 4·5–7 × 1·5–2·5 mm, narrowly obovate to elliptical, usually obtuse. Stamens included or slightly exserted; filaments *c.* 5 mm, connate at base into an annulus *c.* 1·5 mm high, sometimes with a small tooth in the sinus; anthers yellow. Ovary ellipsoid, twice as long as wide, narrowed at base and apex; style 1–2 mm, slightly exserted. Capsule *c.* 5 mm. $2n=16, 40$. *Europe, northwards to N.C. France, S.E. Czechoslovakia and C. Russia.* Al Bu Co Cr Cz Ga Gr Hs Hu It Ju Lu Rm Rs (C, W, K, E) Sa Si Tu [Az].

Very variable; the following classification is provisional.

1 Leaf-sheath hairy — **(d)** subsp. **villosulum**
1 Leaf-sheaths glabrous
 2 Perianth lilac-pink or white — **(a)** subsp. **paniculatum**
 2 Perianth brownish, yellowish or dirty white, sometimes tinged with pink or with reddish streaks
  3 Spathe-valves usually 2–many times as long as umbel; perianth 5–6 mm — **(b)** subsp. **fuscum**
  3 Spathe-valves not more than twice as long as umbel; perianth 4–4·5 mm — **(c)** subsp. **euboicum**

(a) Subsp. **paniculatum**: Leaf-sheaths glabrous. Spathe-valves usually 2–many times as long as umbel. Perianth 4·5–7 mm, lilac-pink to white. $2n=24, 32$. *Almost throughout the range of the species.*

(b) Subsp. **fuscum** (Waldst. & Kit.) Arcangeli, *Comp. Fl. Ital.* ed. 2, 136 (1894) (*A. fuscum* Waldst. & Kit.): Leaf-sheaths glabrous. Spathe-valves usually 2–many times as long as umbel. Perianth 5–6 mm, greenish-brown or dirty white, sometimes tinged with pink. $2n=16, 32$. *Romania to Greece.*

(c) Subsp. **euboicum** (Rech. fil.) Stearn, *Ann. Mus. Goulandris* **4**: 161 (1978) (*A. euboicum* Rech. fil.): Leaf-sheaths glabrous. Spathe-valves not more than twice as long as umbel. Perianth

4–4·5 mm, brownish or yellowish, often with reddish streaks. ● *E. Greece* (*Evvoia*).

(d) Subsp. **villosulum** (Halácsy) Stearn, *op. cit.* **4**: 161 (1978) (*A. paniculatum* var. *villosulum* Halácsy, *A. rhodopeum* Velen.): Leaf-sheaths hairy. Spathe-valves twice as long as umbel. Perianth 4·5–5·5 mm, purplish or brownish-pink, with darker mid-vein. $2n=16$. ● *Greece and Bulgaria.*

57. A. pallens L., *Sp. Pl.* ed. 2, 427 (1762). Bulbs 1–1·5 cm in diameter; outer tunic membranous. Stem 10–30(–65) cm. Leaves 3–4, 6–16(–30) cm × 0·5–2(–5) mm, filiform to linear, sheathing the lower ⅓–½ of the stem. Spathe 2-valved; valves unequal, persistent, narrowly ovate or lanceolate at base, contracted above into a slender appendage, longer than the pedicels, the longest 2·5–10 cm. Umbel 1·5–3·5 cm in diameter, hemispherical or fastigiate, compact, 10- to 70-flowered; pedicels 5–15 mm, almost equal, up to 25 mm in fruit. Perianth narrowly campanulate; segments 3·5–5 × 1·5–2 mm, white or pink, narrowly oblong, slightly wider above than below the middle. Stamens included, with partly exserted anthers; filaments 3·5–4 mm, almost as long as segments, connate at base into an annulus 1 mm high; anthers yellow. Ovary narrowly ellipsoid, 2–3 times as long as wide at anthesis. Capsule 4 mm. $2n=16$. *S. Europe.* Bl Bu Co Gr Hs It Ju Lu ?Rs (K) Sa Si Tu.

In their usual states *A. paniculatum* and *A. pallens* are readily distinguished, but some herbarium specimens are difficult to allocate. The inrolling of the upper edges of the perianth-segments in drying often makes them appear more acute than they really are.

(a) Subsp. **pallens** (*A. paniculatum* var. *pallens* (L.) Regel, *A. coppoleri* Tineo, *A. amblyanthum* Zahar.): Umbel compact. Perianth usually white; segments truncate-rounded at apex. *Throughout most of the range of the species.*

(b) Subsp. **tenuiflorum** (Ten.) Stearn, *Ann. Mus. Goulandris* **4**: 161 (1978) (*A. tenuiflorum* Ten., *A. paniculatum* subsp. *tenuiflorum* (Ten.) Brand): Umbel often lax. Perianth usually pink; segments obtuse to acute, *c.* 2 mm wide. Capsule almost equalling perianth-segments. *From Sardegna to Bulgaria*

(c) Subsp. **siciliense** Stearn, *loc. cit.* (1978): Umbel lax. Perianth pink; segments acute, *c.* 1·5 mm wide. Capsule much shorter than perianth-segments. ● *Sicilia.*

A. convallarioides Grossh. in Grossh. & Schischkin, *Sched. Herb. Pl. Or. Exsicc.* **1924**: no. 107 (1924), originally described from Armenia and known to occur in Iran and Iraq, has been recorded from Krym by T. J. Omelczuk, *Ukr. Bot. Žur.* **19(2)**: 27 (1962). It has white flowers with almost truncate perianth-segments and dehisced anthers 1 mm long. Takhtajan & Fedorov, *Fl. Erevana* 323 (1972), consider it conspecific with *A. myrianthum* Boiss. (vide **71**).

58. A. sipyleum Boiss., *Diagn. Pl. Or. Nov.* **1(5)**: 58 (1844). Bulbs *c.* 1·5 cm in diameter; outer tunics membranous. Stem 10–30 cm. Leaves 3–4, 3–16 × 0·3–1 mm, sheathing the lower ⅓–¾ of the stem, filiform, canaliculate above, ribbed beneath, minutely scabrid. Spathe-valves unequal, very narrowly lanceolate at base, gradually contracted into a long appendage, the longer valve 3–5 cm and exceeding the pedicels. Umbel 2–4 cm in diameter, fastigiate, few- to many-flowered, without bulbils; pedicels 5–30 mm, very unequal, ascending or erect. Perianth narrowly campanulate; segments 5–5·5 × 1–1·5 mm, pale pink, with red mid-vein, very narrowly oblong, acute. Stamens included; filaments *c.* 4·5 mm; anthers pale yellow. Ovary ellipsoid. Capsule *c.* 4 mm. *S.E. Aegean region* (*Astipalaia*). Gr. (*Khios, W. Anatolia.*)

59. A. rupestre Steven, *Mém. Soc. Nat. Moscou* **3**: 260 (1812). Bulbs *c.* 1 cm in diameter; outer tunics membranous. Stem 25–40 cm. Leaves 2–3, up to 12 cm × 0·5–1 mm, filiform, sheathing the lower ½ of the stem. Spathe 2-valved; valves unequal, linear at base, narrowed above into a long slender appendage, longer than the pedicels, the longer up to 5 cm. Umbel 2–3 cm in diameter, fastigiate or hemispherical, few-flowered; pedicels 5–10 mm, almost equal. Perianth narrowly campanulate; segments 5–6 × 1·5 mm, pale pink, narrowly elliptical, obtuse, apiculate. Stamens included or scarcely exserted; filaments *c.* 4·5 mm; anthers violet. Ovary ellipsoid. Capsule *c.* 4·5 mm. *Rocks and stony slopes. Krym.* ?Bu Rs (K). (*Caucasus, Anatolia.*)

60. A. favosum Zahar., *Biol. Gallo-Hellen.* **6**: 54 (1975). Bulbs 1–1·5 cm in diameter; outer tunics membranous. Stem 15–25 cm. Leaves 3–5, up to 10 cm × 1–3·5 mm, filiform or linear, glabrous, sheathing the lower ⅓–½ of the stem, the ribs of the sheaths papillose with rows of cells as wide as long (visible at × 30). Spathe 2-valved; valves persistent, unequal, lanceolate at base, narrowed above into a slender appendage, the longer up to 8 cm. Umbel 3–4·5 cm in diameter, fastigiate or hemispherical; pedicels 10–35 mm, unequal. Perianth cup-shaped; segments 4–5 × 2 mm, pink or whitish and with a pale pink mid-vein, elliptical-oblong, obtuse but apiculate. Stamens slightly exserted; filaments *c.* 4·5 mm; anthers yellow. Ovary ellipsoid, scabrid above; style 2–3 mm. Capsule 4·5 mm. ● *N. Greece* (*Makedhonia*). Gr.

61. A. macedonicum Zahar., *op. cit.* 56 (1975). Bulbs 0·6–1 cm in diameter; outer tunics membranous, breaking into longitudinal strips. Stem 8–25 cm. Leaves 3–5, up to 30 cm × 0·5–4 mm, linear, sheathing the lower ⅓–½ of the stem. Spathe 2-valved; valves unequal, persistent, narrowly lanceolate at base, contracted above into a long slender appendage much longer than the pedicels, the longer up to 17 cm. Umbel 2–4·5 cm in diameter, fastigiate, usually many-flowered; pedicels 10–40 mm, unequal. Perianth cup-shaped; segments *c.* 5 × 2·5 mm, pale purplish, elliptical, acute, apiculate, pink. Stamens included; filaments *c.* 4·5 mm, almost as long as segments, united at base into an annulus *c.* 1 mm high; anthers yellow. Ovary oblong-cylindrical, papillose above, rounded-truncate at apex. Capsule *c.* 4 mm. *Sandy ground*, 1650–1700 *m.* ● *N.E. Greece* (*Pangaion*).

62. A. podolicum Błocki ex Racib. & Szafer, *Fl. Polska* **1**: 124 (1919). Bulbs 0·5–1 cm in diameter; outer tunics membranous. Stem 15–50 cm. Leaves 3–5, up to 14 cm × 0·4–1 mm, filiform, sheathing the lower ½ or more of the stem. Spathe 2-valved; valves unequal, persistent, both much longer than the umbel, the longer up to 20 cm, lanceolate at base, contracted above into a very long, slender appendage. Umbel 2·5–4·5 cm in diameter, many-flowered, lax, without bulbils; pedicels 5–30 mm, very unequal, slightly flattened or winged, curved, the inner ascending, the outer deflexed. Perianth campanulate; segments 6 × 2 mm, clear pink, the outer narrowly elliptical, rounded, the inner oblanceolate, almost truncate. Stamens included; filaments *c.* 5 mm, connate at base into an annulus *c.* 1 mm high; anthers yellow. Ovary at anthesis ellipsoid, nearly twice as long as wide, rounded-truncate at apex. Capsule *c.* 5 mm. *Dry steppes and stony slopes.* ● *E. Hungary to W. Ukraine.* Hu Rm Rs (W).

63. A. oleraceum L., *Sp. Pl.* 299 (1753). Bulbs 1–1·5 cm in diameter; outer tunics membranous. Stem 25–100 cm. Leaves 2–4, up to 25 cm × 0·5–4 mm, linear to filiform, fistular in lower part, canaliculate above, prominently ribbed beneath, the veins usually scabrid with minute teeth; sheathing the lower ½ or more of the stem. Spathe 2-valved; valves unequal, lanceolate at base,

contracted above into a long slender appendage longer than the pedicels, the longer up to 20 cm. Umbel diffuse, lax, 5- to 40-flowered, with few or many bulbils, sometimes with bulbils only, the outermost pedicels curving downwards at anthesis; pedicels 15–60 mm, unequal, slightly flattened or winged. Perianth campanulate; segments 7 × 2·5–3 mm, whitish, variably tinged with green, pink or brown, the outer narrowly obovate, the inner oblong-elliptical, obtuse, mucronate. Stamens included; filaments 4·5–5·5 mm, connate at base into an annulus *c.* 1·5 mm high; anthers yellow or reddish. Ovary at anthesis narrowly obovoid, *c.* 4 times as long as wide, rounded-truncate at apex. Capsule rarely produced. $2n = 32, 40$. *Cultivated land, roadsides, rocky ground and scrub. Much of Europe, but rare in most of the south.* Au Be Br Bu Co Cz Da Fe Ga Ge He Ho Hu It Ju No Po Rm Rs (N, B, C, W, E) Si Su [Is].

64. A. parnassicum (Boiss.) Halácsy, *Consp. Fl. Graec.* **3**: 255 (1904). Bulbs *c.* 1 cm in diameter; outer tunics membranous. Stem 10–24 cm, terete, slightly angled above. Leaves 2–3, 5 cm or more × 0·6–0·8 mm, semiterete, scabridulous, sheathing the lower ⅓–½ of the stem. Spathe 2-valved; valves unequal, the longest 2·5–6 cm, longer than the umbel, narrowly lanceolate at base, contracted above into a slender appendage. Umbel lax, 2·5–3 cm in diameter, 5- to 25-flowered, fastigiate; pedicels up to 15 mm, unequal. Perianth funnel-shaped; segments *c.* 7 × 2 mm, pink, narrowly oblong-elliptical, obtuse. Stamens included; filaments *c.* 6 mm; anthers yellow. Ovary narrowly obovoid. Capsule 4 mm. *Rocky ground.* ● *Mountains of S. Greece.* Gr.

65. A. staticiforme Sibth. & Sm., *Fl. Graec. Prodr.* **1**: 225 (1809). Bulbs 0·8–1·5 cm in diameter; outer tunics coriaceous, often breaking at apex into parallel fibres. Stem 7–30 cm, often curved in lower part. Leaves 2–4, up to 13 cm × 0·5–2 mm, filiform, fistular, glabrous at base, sheathing the lower ⅓–½ of the stem. Spathe 2-valved; valves unequal, shorter than to longer than the umbel, ovate at base, contracted above into a slender appendage, the larger 1–3 cm, the smaller 0·5–2 cm. Umbel 1·5–2·5 cm in diameter, hemispherical, usually dense, 10- to 60-flowered; pedicels 5–12 mm, almost equal. Perianth obovoid; segments 3–3·5 × 1·4–1·6 mm, elliptical, pink, with red mid-vein (forma *staticiforme*), or white, with green or lilac mid-vein (forma *flexuosum* (D'Urv.) Zahar.), elliptical, the inner slightly wider than the outer, rounded at apex. Stamens slightly exserted; filaments 3·5–4 mm; anthers red or yellow. Ovary obovoid, shortly stipitate. Capsule *c.* 3 mm. ● *S. Greece, S. Aegean region.* Cr Gr.

66. A. pilosum Sibth. & Sm., *loc. cit.* (1809). Bulbs 1 cm in diameter; outer tunics coriaceous. Stem 2·5–15 cm. Leaves 2–4, up to 9 cm × 0·5 mm, filiform, semi-cylindrical, sheathing the lower ⅓ of the stem, the lamina and sheath with long patent hairs. Spathe 2-valved; valves up to 3 cm, persistent, lanceolate at base, narrowed above into an appendage exceeding the umbel. Umbel 1·5–4 cm in diameter, hemispherical, dense, few- to many-flowered; outer pedicels 5–15 mm, almost equal, curved. Perianth cup-shaped; segments 3–4 × 1–1·5 mm, narrowly elliptical, obtuse, lilac. Stamens with exserted anthers; filaments 4–5 mm; anthers yellow. Capsule 3·5 mm. *Kikladhes.* Gr.

A closely allied, if not conspecific plant, with a few-flowered, fastigiate umbel, shorter spathe, unequal pedicels up to 12 mm and longer stamens, occurs in the Peloponnisos (near Messini).

67. A. luteolum Halácsy, *Consp. Fl. Graec.* **3**: 256 (1904). Bulbs 0·5–0·8 cm in diameter; outer tunics membranous. Stem 3–20 cm. Leaves 2–3, up to 10 cm × 0·5 mm, filiform, semiterete, canaliculate above, sheathing the lower ¼–⅓ of the stem. Spathe 2-valved; valves narrowly triangular at base, narrowed above, the longer up to 3 cm and longer than the umbel. Umbel 1–2·5 cm in diameter, lax, 5- to 25-flowered; pedicels up to 10 mm, unequal, patent or curved. Perianth narrowly cup-shaped; segments 3–4 × 1–1·5 mm, yellowish (very rarely pink; forma *roseolum* Stearn), elliptical, obtuse. Stamens included; filaments 3–4 mm; anthers yellow. Ovary subglobose. Capsule 3–3·5 mm. *Cliffs and scrub.* ● *Kikladhes.* Gr.

68. A. flavum L., *Sp. Pl.* 298 (1753). Bulbs 1–1·5 cm in diameter; outer tunics membranous. Stem 8–50 cm, glaucous. Leaves 2–3, up to 20 cm × 2 mm, solid, glaucous, smooth, sheathing the lower ⅓–½ of the stem. Spathe 2-valved; valves unequal, narrowly triangular at base, contracted above into a long slender appendage longer than the pedicels, the longer up to 11 cm. Umbel diffuse, fastigiate or hemispherical, without bulbils, 9- to 60-flowered, the outer pedicels usually curving downwards at anthesis; pedicels 3–25 mm, unequal, erect in fruit. Perianth campanulate; segments 4·5–5 × 2 mm, oblong, rounded at apex. Stamens exserted; filaments *c.* 7 mm; anthers yellow to violet. Ovary subglobose, contracted at base into a very short stipe. Capsule *c.* 4 mm. *Dry slopes.* ● *S. & S.C. Europe, extending northwards to c.* 50°30′ *N. in S. Russia, but absent from the Iberian peninsula.* Al Au Bu Cz Ga Gr Hu It Ju Rm Rs (C, W, K, E) Si Tu.

(a) Subsp. **flavum** (incl. *A. guicciardii* Heldr.): Perianth lemon yellow. Filaments yellow. Ovary about as long as wide. $2n = 16, 32$. *Throughout the range of the species except the U.S.S.R.*

(b) Subsp. **tauricum** (Besser ex Reichenb.) Stearn, *Ann. Mus. Goulandris* **4**: 167 (1978) (*A. flavum* var. *tauricum* Besser ex Reichenb., *A. paczoskianum* Tuzson, *A. tauricum* (Besser ex Reichenb.) Grossh., *A. pulchellum* auct. ross., non G. Don): Perianth yellowish, or almost white, tinged with green, pink or brown. Filaments often purple in upper part. Ovary slightly longer than wide. $2n = 32$. *S.E. Europe, from Greece to S.E. Russia.*

Dwarf mountain variants of subsp. (a) have been distinguished as var. *minus* Boiss., var. *calabrum* (N. Terracc.) Fiori, *A. nebrodense* Guss., *A. webbii* G. C. Clementi and *A. guicciardii* Heldr. **A. sphaeropodum** Klokov in Kotov & Barbarich, *Fl. RSS Ucr.* **3**: 405 (1950), from W. Ukraine and Moldavia, may belong to subsp. (b).

69. A. melanantherum Pančić, *Elem. Fl. Bulg.* 64 (1883). Bulbs 1–1·5 cm in diameter; outer tunics membranous, with fine, close, parallel fibres separating at the top. Stem 13–40 cm. Leaves 1–3, up to 20 cm × 2 mm, filiform, sheathing the lower ¼–½ of the stem; margins scabrid. Spathe 2-valved; valves unequal, one 0·5–2 cm, the other 1–6 cm, persistent, longer than the pedicels, narrowly ovate or lanceolate at base, abruptly contracted above into a filiform appendage. Umbel fastigiate, 3- to 25-flowered, with a few bulbils; pedicels 1–2·5 mm, unequal. Perianth cylindrical; segments 8–10 × 1–2 mm, pink, with red mid-vein, very narrowly oblong, obtuse. Stamens included; filaments *c.* 6 mm; anthers blackish; pollen yellow. Capsule 4 mm. $2n = 16, 24 + 1B, 32$. *Meadows and pastures, up to* 2000 *m.* ● *Mountains of Bulgaria, E. Jugoslavia and N. Greece.* Bu Gr Ju.

70. A. tardans W. Greuter & Zahar., *Biol. Gallo-Hellen.* **6**: 51 (1975). Bulbs 1–1·5 cm in diameter; outer tunics membranous, breaking into strips, continued upwards as a neck around base of stem. Stem 10–30 cm. Leaves 3–4, up to 16 cm × 0·5 mm, filiform, withered at anthesis, much longer than the stem, sheathing the lower ⅝ of the stem. Spathe 2-valved; valves persistent, unequal, one 2·5–4 cm, much longer than umbel, narrowly triangular at base, contracted above into a long appen-

dage, the other valve 0·7–2 cm. Umbel 1–2·5 cm in diameter, fastigiate, 6- to 15-flowered. Perianth campanulate, erect; segments 5–6·5 × 1·8–2 mm, pale pink, with green mid-vein, the outer narrowly oblong, the inner oblanceolate, rounded and almost truncate at apex. Stamens included or with anthers partly exserted; filaments 5–5·5 mm, connate at base into an annulus 1·5 mm high; anthers pink before dehiscence, later whitish. Ovary narrowly oblong-ellipsoid, deeply sulcate. Capsule *c.* 4·5 mm. *Rocky places*, 400–800 *m.* ● *Kriti.* Cr.

71. A. carinatum L., *Sp. Pl.* 297 (1753). Bulbs *c.* 1 cm in diameter; outer tunics membranous, sometimes breaking into longitudinal strips. Stem 30–60 cm. Leaves 2-4, up to 20 cm × 1–2·5 mm, linear, slightly canaliculate above, ribbed below with 3–5 prominent veins, sheathing the lower ⅓–⅜ of the stem. Spathe 2-valved; valves unequal, persistent, lanceolate at base, contracted above into a long slender appendage, the longest up to 12 cm, longer than the pedicels. Umbel diffuse, the outer pedicels curving downwards; pedicels 10–25 mm, unequal. Perianth cup-shaped; segments 4–6 × 1·5–2 mm, purple, cymbiform, oblong-elliptical, obtuse. Stamens long-exserted; filaments 6·5–9 mm; anthers purple; pollen yellow. Ovary narrowly obovoid, narrowed at the base, rounded at apex. Capsule 5 mm. *Meadows, heaths and scrub. S. & C. Europe, extending northwards to S. Sweden and Estonia; naturalized in N.W. Europe.* Al Au Bu Cz Da Ga Ge Gr He Hs Hu It Ju Po Rm Rs (B) Su Tu [Be Br Hb Ho].

(a) Subsp. **carinatum**: Umbel with bulbils. Flowers 0–30. Capsules rarely produced. $2n = 16$, 24, 26. *Throughout the range of the species except S. part of Balkan peninsula.*

(b) Subsp. **pulchellum** Bonnier & Layens, *Fl. Fr.* 299 (1894) (*A. pulchellum* G. Don, nom. illegit., *A. flavum* var. *pulchellum* Regel): Umbel without bulbils. Flowers often numerous. Capsules with fertile seed abundantly produced. $2n = 16$. *S. Europe, westwards to S.E. France.*

A. myrianthum Boiss., *Diagn. Pl. Or. Nov.* **1(5)**: 59 (1844), from S.W. Asia, has been recorded from Turkey-in-Europe (near Istanbul), but probably only as a casual introduction; it can be distinguished from **71** most easily by its hemispherical or subglobose umbel, cylindrical perianth, with white segments 2–3 × 0·7–1 mm, filaments 2·5–4 mm and yellow anthers. *A. convallarioides* Grossh. (cf. **57**) may be synonymous.

72. A. hirtovaginum P. Candargy, *Bull. Soc. Bot. Fr.* **44**: 142 (1897). Bulb *c.* 1 cm in diameter; outer tunics membranous. Stem 10–20 cm. Leaves 3, up to 14 cm × 0·4 mm, sheathing the lower ½ or more of the stem, filiform, canaliculate above, the lamina and sheath with many ascending hairs. Spathe 2-valved; valves unequal, narrowly lanceolate or linear at base, narrowed above into a long slender appendage longer than the pedicels, the longer 5–12 cm. Umbel 2–3·5 cm in diameter, diffuse, with 10–25 flowers; pedicels up to 20 mm, unequal. Perianth campanulate; segments 4–4·3 × 1–2 mm, pink, oblong, obtuse. Stamens exserted; filaments *c.* 5 mm; anthers yellow. Ovary subglobose, contracted at base into a very short stipe. *E. Greece* (*Prov. Trikkala*). Gr.

73. A. hymettium Boiss. & Heldr. in Boiss., *Diagn. Pl. Or. Nov.* **3(4)**: 120 (1859). Bulbs 0·5–1 cm in diameter; outer tunics membranous. Stem 4–30 cm. Leaves 3–4, up to 11 cm × 0·5 mm, filiform, usually scabridulous with minute teeth along the veins beneath, sheathing the lower ¾–¾ of the stem. Spathe 2-valved; valves unequal, up to 9 cm and longer than the pedicels, lanceolate at base, contracted above into a slender filiform appendage. Umbel 1–3 cm in diameter, hemispherical or fastigiate, 8- to 30-flowered; pedicels 5–12 mm, almost equal. Perianth cup-shaped; segments 3·5–4 mm, greenish, yellow- sometimes brown-tinged (sometimes reddish when dry), the outer narrowly elliptical, *c.* 1·5 mm wide, the inner elliptical, *c.* 2 mm wide, obtuse. Stamens exserted; filaments *c.* 5 mm, connate at base into an annulus *c.* 0·5 mm high; anthers yellow. Ovary subglobose or broadly ellipsoid, stalked. Capsule *c.* 3 mm. ● *S. & E. Greece.* Gr.

74. A. stamineum Boiss., *op. cit.* 119 (1859). Bulbs *c.* 1 cm in diameter; outer tunics membranous. Stem 10–35 cm. Leaves 3–4, up to 15 cm × 0·5–1 mm, filiform, sheathing the lower ⅓–½ of the stem. Spathe 2-valved; valves unequal, persistent, lanceolate at base, contracted above into a slender appendage, the longer 1·5–7 cm, usually not much longer than the pedicels. Umbel 2·5–7 cm in diameter, usually many-flowered, lax; pedicels 10–40 mm, very unequal. Perianth cup-shaped; segments 3·5–5 × 1·6–2·2 mm, pale purplish, the outer oblong, rounded at apex, the inner narrowly ovate, obtuse. Stamens exserted; filaments *c.* 5 mm, connate at base into an annulus *c.* 0·6 mm high. Ovary subglobose, sessile; style *c.* 3 mm. Capsule *c.* 3 mm. *S.E. part of Balkan peninsula.* Gr Tu.

A. amphipulchellum Zahar., *Biol. Gallo-Hellen.* **6**: 57 (1975), described from N. Greece (Makedhonia), is said to vary in flower-colour from yellowish-green to violet within the same population; it may be conspecific with **74**.

Sect. ALLIUM (Sect. *Alliotypus* Dumort., Sect. *Porrum* (Miller) G. Don ex Koch). Bulbs ovoid or subglobose; not rhizomatous. Stem usually terete. Leaves linear, flat or fistular, sheathing the lower ¼ or more of the stem. Spathe 1- or 2-valved, usually beaked and caducous. Perianth cylindrical, campanulate or ovoid, with permanently connivent segments. Stamens usually dimorphic, the outer 3 usually simple, rarely toothed or tricuspidate, the inner 3 always tricuspidate with a broad flat basal lamina topped by a central anther-bearing cusp and two (rarely 4) sterile, usually much elongated cusps. Ovary with distinct nectariferous pores; ovules 2 in each loculus; stigma entire. Seeds angular.

A difficult section including many closely allied taxa; bulbs, bulblets and notes on flower-colour may be needed for their separation.

75. A. sativum L., *Sp. Pl.* 296 (1753). Bulbs 3–6 cm in diameter, depressed-ovoid, composed of 5–15(–60) bulblets; outer tunics membranous. Stem 25–100(–200) cm. Leaves 6–12, up to 60 cm × 12(–30) mm, linear, flat, keeled, sheathing the lower ½ of the stem. Spathe up to 25 cm, 1-valved, with long beak, caducous. Umbel 2·5–5 cm in diameter, usually with few flowers (which often abort and wither in bud) and many bulbils; pedicels 10–20 mm, unequal. Perianth cup-shaped; segments 3–5 mm, greenish-white, pink, rarely white or purple, smooth, the outer lanceolate, acute, the inner ovate-lanceolate. Stamens included or equalling perianth; outer 3 filaments 6–8 mm, simple or tricuspidate, the inner 3 with the basal lamina broadly oblong, 1·5–2 mm wide and ⅓ as long to about as long as the central cusp, lateral cusps 2 or 4, much longer than the central cusp. *Cultivated widely in S. Europe for its bulbs* (*garlic*) *used for flavouring.*

Very variable, and probably derived from *A. longicuspis* Regel from C. Asia. Before anthesis the stem of var. *ophioscorodon* (Link) Döll (*A. controversum* Schrader, *A. ophioscorodon* Link, *A. sativum* subsp. *ophioscorodon* (Link) J. Holub) is coiled in one or two wide loops.

76. A. ampeloprasum L., *Sp. Pl.* 294 (1753). Bulbs 2–6 cm in diameter, broadly ovoid or subglobose; outer tunic membranous;

bulblets usually numerous, yellowish. Stem 45–180 cm, stout. Leaves 4–10, up to 50 cm × 5–40 mm, linear, flat, canaliculate, with scabrid margin, sheathing the lower ⅓–½ of the stem. Spathe 1-valved, caducous. Umbel 5–9 cm in diameter, globose, usually dense, with up to 500 flowers, but with as few as 30 flowers in variants with bulbils; pedicels 15–50 mm, unequal. Perianth cup-shaped or campanulate; segments 4–5·5 × 1·3–2·4 mm, white, pink or dark red, the outer mostly oblong-lanceolate, concave, subacute, mucronate, the inner mostly narrowly ovate or spathulate, obtuse or rounded at apex, equalling or a little shorter than the outer, both with large papillae especially on the keel. Stamens slightly or distinctly exserted; outer 3 filaments 4–6 mm, usually simple, the lower ⅓ oblong and 0·5–1 mm wide, contracted above, the inner 3 with the basal lamina oblong-elliptical and 1·5–2·5 mm wide, usually at least as wide as the perianth-segments, nearly twice as long as the central cusps. Capsule 4 mm. $2n = 16$, 32, 40, 48, 56, 80. *Mainly on disturbed ground. S. & W. Europe.* Al Bl *Br Bu Cr Ga Gr *Hb Hs It Ju Lu Rm Sa Si Tu [Az Co Cz].

Variable, and probably spread by human activity. Normally the umbel has no bulbils. Var. *babingtonii* (Borrer) Syme (*A. babingtonii* Borrer), with few flowers and bulbils 8–15 mm, occurs in W. Ireland and S.W. England; var. *bulbiferum* Syme (*A. ampeloprasum* var. *bulbilliferum* Lloyd), with bulbils 6–8 mm, occurs in the Channel Islands and W. France (Ile d'Yeu, Vendée); both are possibly relics of former cultivation. The species forms a polyploid series; the nomenclatural type from Steep Holm Island, Bristol Channel, England (var. *holmense* Ascherson & Graebner) has $2n = 48$. Variants with white flowers of this and of **81** have been thought to be conspecific with *A. leucanthum* C. Koch (*A. ampeloprasum* subsp. *leucanthum* (C. Koch) Hayek), an allied species from the Caucasus. **A. scopulicola** Font Quer, *Butll. Inst. Catalana Hist. Nat.* **24**: 144 (1924), from Islas Baleares (Ibiza), is probably conspecific with **76**. **A. porrum** L., *Sp. Pl.* 295 (1753) (*A. ampeloprasum* var. *porrum* (L.) Gay), the cultivated leek, is a cultigen (with $2n = 32$) derived from **76** but distinct enough in bulb, life-cycle and chemistry through many centuries of cultivation and selection to be kept apart (cf. B. Bonnet, *Saussurea* 7: 121–155 (1976)).

77. A. polyanthum Schultes & Schultes fil., *Syst. Veg.* **7**: 1016 (1830). Bulbs 1·5–2 cm in diameter, ovoid; outer tunics membranous; bulblets yellowish. Stem 40–80 cm. Leaves 3–6, 10–25 cm × 3–20 mm, linear, flat, with smooth margin, sheathing the lower ¼ of the stem. Spathe 1-valved, long-beaked, caducous. Umbel 4–8 cm in diameter, subglobose, many-flowered, lax; pedicels up to 40 mm, unequal. Perianth ovoid; segments 4–5 × 1·2–2 mm, narrowly elliptical, pink, the inner wider than the outer, acute or slightly obtuse, scabrid or papillose on keel. Stamens included, variable in length; outer 3 filaments up to 4·5 mm, simple, the inner 3 with the basal lamina much longer than the central cusp, the lateral cusps 2–3 times as long as the central cusp. Capsule *c.* 3 mm. $2n = 20$, 32. *S.W. Europe.* Bl Co Ga Hs.

78. A. scaberrimum Serres, *Bull. Soc. Bot. Fr.* **4**: 439 (1857). Bulbs small, ovoid; outer tunics membranous; bulblets yellow. Stem 40–80 cm. Leaves usually 4, up to 30 cm × 12 mm, linear, flat, not reaching the umbel, sheathing almost the lower ½ of the stem, the margin denticulate. Spathe caducous. Umbel 3–5 cm in diameter, hemispherical, many-flowered; pedicels up to 25 mm, unequal. Perianth narrowly ovoid; segments 4·5 × 1·5 mm, whitish, narrowly oblong to lanceolate, obtuse, papillose. Stamens slightly exserted; outer 3 filaments 5 mm, subulate, the inner 3 with the basal lamina ciliate and much longer than the central cusp, the lateral cusps much longer than the central cusp; anthers pale yellow. Capsule 3 mm. ● *S.E. France* (*Hautes-Alpes, near Gap*). Ga.

Possibly a naturalized species of uncertain provenance.

79. A. atroviolaceum Boiss., *Diagn. Pl. Or. Nov.* **1(7)**: 112 (1846). Bulbs 1–2·5 cm in diameter, ovoid; outer tunics membranous, becoming fibrous; bulblets yellowish-brown. Stem 50–120 cm. Leaves 3–6, up to 20 cm × 4–12 mm, flat, with denticulate margin, sheathing the lower ⅓–½ of the stem. Spathe 1-valved, long-beaked, caducous. Umbel 3–6 cm in diameter, globose, rarely ovoid; pedicels up to 30 mm, unequal. Perianth cup-shaped; segments 3·5–5 × 1·2–2·5 mm, usually dark purple, rarely paler or greenish-tinged, the outer narrowly ovate, acute, the inner ovate, obtuse, with a few large papillae on the keel. Stamens exserted; outer 3 filaments 4–5 mm, simple, the inner with the basal lamina narrower than the inner perianth-segments and 1½ times as long as the central cusp, the lateral cusps much longer than the central cusp. Capsule 2·5 mm. $2n = 16$, 24, 32, 40, 48. *Cultivated ground and dry grassland. S.E. & E.C. Europe.* Bu Cz Gr Hu It Ju Rm Rs (W, K) Tu.

Plants from S. Ukraine have been referred to *A. atroviolaceum* var. *firmotunicatum* (Fomin) Grossh. (*A. firmotunicatum* Fomin), but it is uncertain whether the differential characters are constant.

80. A. bourgeaui Rech. fil., *Ann. Naturh. Mus.* (*Wien*) **47**: 150 (1936). Bulbs *c.* 1·5 cm in diameter, ovoid; outer tunics membranous; bulblets 8–16 mm, yellowish-brown to brown. Stem 45–115 cm. Leaves 4–11, 6–25 mm wide, linear, flat, keeled, with the margin scabrid, sheathing the lower ⅓–½ of the stem, withered at anthesis. Spathe 1-valved, quickly caducous, ovate at base, abruptly contracted above into a beak up to 15 cm. Umbel 3–6 cm in diameter, subglobose or hemispherical, many-flowered; pedicels 10–25 mm, almost equal. Perianth cylindrical, campanulate, ellipsoid or ovoid; segments 2·5–5·5 × 1–2·5 mm, cymbiform, the outer mostly lanceolate and acute or obtuse, the inner narrowly oblong and obtuse or truncate. Stamens long-exserted; outer 3 filaments 3·5–4·5 mm, simple, the inner 3 with the basal lamina about twice as long as the central cusp, ciliate; anthers yellow, red or purple. Capsule *c.* 4 mm. *Cliffs and rocky slopes. S. Aegean region.* Cr Gr.

1 Perianth ellipsoid or ovoid, reddish; outer segments 4–5 mm, with small and large papillae especially along keel **(c)** subsp. **creticum**

1 Perianth campanulate or cylindrical; outer segments 2·5–4 mm, with uniform small papillae

2 Perianth pale green; anthers yellow **(a)** subsp. **bourgeaui**

2 Perianth purple; anthers purple **(b)** subsp. **cycladicum**

(a) Subsp. **bourgeaui**: Stem 45–90 cm. Umbel 3–5 cm in diameter. Perianth cylindrical, rarely almost campanulate, pale green; outer segments 2·5–4 mm, densely covered with small papillae. Anthers yellow. $2n = 16$. *Karpathos, Kasos.*

(b) Subsp. **cycladicum** Bothmer, *Op. Bot.* (*Lund*) **34**: 23 (1974): Stem 45–100 cm. Umbel 3–6 cm in diameter. Perianth campanulate to cylindrical, dark purple; outer segments 2·5–4 mm, densely covered with small papillae. Anthers purple. $2n = 16$, 24, 32. *E. Peloponnisos, Kikladhes* (*Astipalaia*).

(c) Subsp. **creticum** Bothmer, *Mitt. Bot. Staatssamm.* (*München*) **12**: 272 (1975): Stem 60–115 cm. Umbel 5–6 cm in diameter. Perianth ellipsoid or ovoid, pink to red; outer segments 4–5 mm, covered with small papillae and also with some larger papillae along the keel. Anthers yellow. $2n = 32$. ● *Kriti.*

81. A. commutatum Guss., *Enum. Pl. Inar.* 339 (1854) (*A. ampeloprasum* var. *commutatum* (Guss.) Fiori, *A. bimetrale*

Gand., *A. ampeloprasum* subsp. *bimetrale* (Gand.) Hayek). Bulbs up to 6 cm in diameter, subglobose; outer tunics membranous or coriaceous, enclosing large yellowish bulblets. Stem up to 180 cm, solid. Leaves 5–11, up to 50 × 5 cm, sheathing the lower ¼–⅔ of the stem, canaliculate but not keeled, glabrous. Spathe 1-valved, with ovoid base *c.* 2 cm, abruptly contracted above into a 2-edged beak 16–30 cm, caducous. Perianth ovoid; segments 4 × 1·5 mm, whitish-pink or dull magenta with green or purple keel, the outer lanceolate, acute, strongly concave, the inner narrowly obovate, obtuse, with serrate margin, all covered externally with minute papillae (only visible under microscope). Stamens exserted; outer 3 filaments *c.* 5 mm, usually tricuspidate with the basal lamina *c.* 0·5 mm wide, or sometimes simple; inner with the base *c.* 1 mm wide, the base and the lateral cusps about as long as the central cusp. Capsule *c.* 4 mm. $2n = 16$, 24, 32. *Open habitats near the sea. C. & E. Mediterranean region.* Co Cr Gr It Ju Sa Si.

82. A. pardoi Loscos, *Trat. Pl. Arag.* **1**: 9 (1876). Bulbs 3–4 cm in diameter, ovoid; outer tunic membranous, ultimately breaking into parallel fibres; bulblets numerous. Stem *c.* 90 cm, the apex nodding before anthesis. Leaves 4–5, up to 45 cm × 12 mm, linear, flat, keeled beneath, sheathing the lower ⅓–½ of the stem; margin and keel minutely denticulate. Spathe 1-valved, *c.* 4·5 cm, beaked, caducous. Umbel 3–5 cm in diameter, subglobose or ovoid, many-flowered; pedicels unequal, the longest up to 30 mm. Flowers cylindrical; segments smooth, dull white, with green mid-vein, the outer *c.* 4·2 mm, lanceolate, the inner 2·8 mm, narrowly ovate, acute. Stamens exserted; outer 3 filaments simple, the inner 3 with the basal lamina slightly longer than the central cusp, the lateral cusps longer than the central cusp; anthers yellow. *Near cultivated land. N.E. Spain (Teruel and Zaragoza prov.).* *Hs. (*?Algeria, ?Tunisia.*)

Possibly a variant of **76.**

83. A. talijevii Klokov in Kotov & Barbarich, *Fl. RSS Ucr.* **3**: 406 (1950). Bulbs 2·5–3 cm in diameter, ovoid; outer tunics membranous, becoming indistinctly reticulately fibrous; bulblets yellowish. Stem 45–50 cm. Leaves 5–7, 45–50 cm × 5–12 mm, linear, sheathing the lower ¾ of the stem, the uppermost long-overtopping the umbel; margin very scabrid. Spathe caducous. Umbel hemispherical; pedicels 12–25 mm, unequal. Perianth ovoid-campanulate; segments *c.* 3·5 mm, whitish, the outer oblong-lanceolate, with the keel smooth or slightly scabrid at the apex, the inner oblong-elliptical. Stamens exserted; outer 3 filaments simple, the inner 3 not ciliate. ● *S.E. Ukraine (S.E. of Donetsk).* Rs (W).

84. A. baeticum Boiss., *Diagn. Pl. Or. Nov.* **1(7)**: 113 (1846). Bulbs 2–2·5 cm in diameter, narrowly ovoid; outer tunic coriaceous, breaking from above downwards into parallel or partly reticulate fibres elongated into a neck 2·5–9 cm. Stem 30–90 cm. Leaves 3–6, up to 40 cm × 6 mm, flat, usually withered at anthesis, sheathing the lower ½ of the stem. Spathe *c.* 3 cm, 1-valved, long-beaked, caducous. Umbel 3–6 cm in diameter, hemispherical; pedicels up to 25 mm, unequal. Perianth cylindrical; segments 4–5 × 1·2–2 mm, white, narrowly oblong, obtuse or subacute, usually papillose, particularly on the keel. Stamens included or slightly exserted; outer 3 filaments *c.* 6 mm, simple, the inner 3 with the basal lamina slightly shorter than or as long as the central cusp. Capsule *c.* 4 mm. $2n = 32$. *Rock-crevices. S. Spain, W.C. Portugal.* Hs Lu. (*N.W. Africa.*)

85. A. acutiflorum Loisel. in Desv., *Jour. Bot. Rédigé* **2**: 279 (1809). Bulbs 1–1·5 cm in diameter, ovoid; outer tunics membranous or coriaceous, splitting longitudinally. Stem 15–50 cm. Leaves 2–3, 8–20 cm × 1–6 mm, linear, flat, sheathing the lower ⅓–½ of the stem; margin minutely denticulate. Spathe up to 2 cm, 1- to 2-valved, shortly beaked, often persistent. Umbel 1·5–5 cm in diameter, hemispherical, many-flowered. Perianth campanulate; segments 6–7·5 × 2 mm, lanceolate, acuminate, purplish, smooth; keel slightly papillose. Stamens included; outer 3 filaments *c.* 4 mm, simple, very narrowly triangular, the inner 3 with the basal lamina ciliate and much longer than the central cusp, the lateral cusps twice as long as the central cusp; anthers yellowish. Capsule *c.* 4 mm. *Sandy or rocky ground, mainly near the sea.* ● *S. France, Corse, N.W. Italy.* Co Ga It.

86. A. pyrenaicum Costa & Vayr. in Costa, *Introd. Fl. Cataluña* ed. 2, *Supl.* 92 (1877). Bulbs 2–3 cm in diameter, ovoid; outer tunics membranous. Stem 55–100 cm. Leaves 5–6, up to 45 cm × 15 mm, linear, flat, keeled beneath, sheathing the lower ¼–½ of the stem; margin minutely denticulate. Spathe *c.* 7 cm, 1-valved, long-beaked, caducous. Umbel 4–7 cm in diameter, subglobose, many-flowered; pedicels up to 25 mm, almost equal. Perianth narrowly campanulate; segments 7–9 × 2 mm, lanceolate, acuminate, dull white, with green mid-vein; margin minutely serrate; keel scabrid. Stamens included except for their filiform cusps; outer 3 filaments *c.* 4 mm, simple, very narrowly triangular, the inner 3 with the basal lamina a little longer than the central cusp, the lateral cusps twice as long as the central cusp; anthers brown. Capsule *c.* 6 mm. *Among rocks, 900–1200 m.* ● *E. Pyrenees.* Hs.

87. A. scorodoprasum L., *Sp. Pl.* 297 (1753). Bulbs 1–2 cm in diameter, ovoid; outer tunics membranous, sometimes breaking into fibrous strips; bulblets reddish-black. Stem 25–90 cm. Leaves 2–5, up to 27 cm × 20 mm, linear, narrowed at base, flat or canaliculate, solid, sheathing the lower ⅓–½ of the stem. Spathe *c.* 1·5 cm, shortly beaked, deciduous. Umbel 1–5 cm in diameter; pedicels up to 20 mm, unequal. Perianth ovoid; segments lilac to dark purple, the outer 4–6·5 × 1·5–2·5 mm, lanceolate or narrowly ovate, the inner 4–7 × 1·5–3·5 mm, narrowly oblong or ovate, subacute or obtuse, papillose along the keel. Stamens included, usually papillose; outer 3 filaments 2·5–4·5 mm, simple, very narrowly triangular, the inner 3 with the basal lamina 3 or more times as long as the central cusp, the lateral cusps 2–3 times as long as the central cusp; anthers yellow. Capsule *c.* 5 mm. *Most of Europe, northwards to England and S. Finland, but rare in the south-west.* Au ?Bl Br Bu Co Cz Da Fe Ga Ge Gr He Ho Hs Hu It Ju No Po Rm Rs (B, C, W, K, E) Su Tu [Be Hb].

The following are usually treated as distinct species.

1 Umbel with purplish bulbils and 0–12 flowers, apparently sterile **(d)** subsp. **scorodoprasum**
1 Umbel without bulbils, many-flowered, subglobose or hemispherical
2 Perianth pinkish or rose-violet; Krym **(c)** subsp. **jajlae**
2 Perianth dark purple
3 Outer perianth-segments dark purple, the inner paler, with broad, whitish margin **(a)** subsp. **rotundum**
3 Outer and inner perianth-segments uniformly dark purple **(b)** subsp. **waldsteinii**

(a) Subsp. **rotundum** (L.) Stearn, *Ann. Mus. Goulandris* **4**: 178 (1978) (*A. rotundum* L.): Leaves 2–10 mm wide. Umbel many-flowered, subglobose or hemispherical, without bulbils. Perianth with outer segments dark purple; inner segments paler, with broad whitish margins and purple median stripe. Capsule *c.* 5 mm; seeds freely produced. $2n = 16 + 0$–$2B$, 32, $38 + 1B$, $40 + 1$–$4B$, $48 + 1B$. *S. Europe, extending northwards to C. Germany, Czechoslovakia and S.C. Ukraine.*

(b) Subsp. **waldsteinii** (G. Don) Stearn, *op. cit.* 179 (1978) (*A. waldsteinii* G. Don, *A. rotundum* subsp. *waldsteinii* (G. Don) Soó): Leaves 2–10 mm wide. Umbel subglobose or hemispherical, without bulbils. Perianth with outer and inner segments uniformly dark purple. $2n=16$, 32, 40, 48. *U.S.S.R., northwards to c.* 55° *N., Hungary, E. Romania, N. Jugoslavia, N.E. Italy.*

(c) Subsp. **jajlae** (Vved.) Stearn, *loc. cit.* (1978) (*A. jajlae* Vved.): Leaves 3–5 mm wide. Umbel many-flowered, subglobose, without bulbils. Perianth uniformly rose-violet. *Mountains of Krym* (*Nikita Yaila*). (*Caucasus.*)

(d) Subsp. **scorodoprasum**: Leaves 5–20 mm wide. Umbel lax, with 0–12 flowers and numerous purple bulbils. Capsule rarely produced. $2n=16$, 24. *Mainly in N. & C. Europe, but extending locally southwards to Bulgaria and Krym.*

Apparently a derivative of subsp. (a), owing its wide and scattered distribution partly to former cultivation as a culinary plant.

88. A. albiflorum Omelczuk, *Ukr. Bot. Žur.* **19(2)**: 19 (1962). Bulbs 1–1·8 cm in diameter; outer tunics membranous; bulblets reddish-brown. Stem 40–70 cm. Leaves 3–4, 2·5–3 mm wide, sheathing the lower ½ of the stem, flat, with scabrid margin. Spathe shortly beaked, caducous. Umbel fastigiate, many-flowered; pedicels of perfect flowers 10–15 mm, ascending, of almost sessile male flowers much shorter. Perianth ovoid; segments white, the outer 4·5 × 1·3 mm, broadly lanceolate, subacute, scabrid on the keel, the inner 5 × 2·5 mm, obovate, obtuse. Stamens included; outer 3 filaments simple, subulate; inner 3 with the basal lamina 3½ times as long as the central cusp, the lateral cusps twice as long as the central cusp. Capsule *c.* 3·5 mm. ● *Mountains of Krym.* Rs (K).

Distinguished most readily from **87** by its white flowers.

89. A. pervestitum Klokov in Kotov & Barbarich, *Fl. RSS Ucr.* **3**: 406 (1950). Bulbs 1–1·8 cm in diameter, ovoid; outer tunics membranous, becoming finely reticulately fibrous; bulblets dark purple or purplish-brown. Stem 35–55 cm. Leaves 3–5, 6–8 mm wide, linear, flat, sheathing the lower ¾ of the stem; margin scabrid or minutely ciliate. Spathe caducous. Umbel subglobose or fasciculate; pedicels 6–15 mm, unequal. Perianth ovoid-campanulate; segments *c.* 4 mm, yellowish-white, often tinged with pink, the outer ovate-lanceolate, scabrid on the keel and margin, the inner oblong, smooth. Stamens slightly exserted; outer 3 filaments *c.* 4 mm, simple, the inner 3 with the basal lamina 3 times as long as the central cusp, the lateral cusps 3 times as long as the central cusp. Capsule *c.* 3 mm. *Saline marshes.* ● *S. Ukraine* (*estuary of the R. Moločnaja, S. of Melitopol'*). Rs (W).

90. A. sphaerocephalon L., *Sp. Pl.* 297 (1753). Bulbs 1–2 cm in diameter, ovoid; outer tunics membranous or coriaceous, sometimes breaking into parallel fibres; bulblets white or yellowish, acuminate, stalked and enclosed within sheath on lower part of the stem. Stem 5–90 cm. Leaves 2–6, up to 30 cm × 1–4 mm, fistular, semicylindrical, canaliculate, sheathing the lower ¼–½ of the stem. Spathe up to 2 cm, usually 2-valved, shortly beaked, persistent, shorter than the umbel. Umbel 1–6 cm in diameter, usually less than 3 cm, subglobose to very broadly ovoid, sometimes with bulbils; pedicels 2–30 mm, unequal. Perianth cylindrical to narrowly ovoid; segments 3·5–5·5 × 1·2–2·5 mm, pink to dark reddish-purple or white with green or yellowish keel, the outer mostly narrowly ovate or lanceolate, keeled, the inner slightly narrower, obtuse to almost truncate or subacute, papillose or smooth on keel and surface. Stamens exserted; outer 3 filaments 4–7 mm, simple or rarely tricuspidate, the inner 3 with the basal lamina 1–2 times as long as the central cusp, the lateral cusps shorter to longer than the 1·5–3 mm central cusp; anthers reddish before dehiscence. Capsule *c.* 4 mm. *Cultivated ground and other dry, open habitats. Europe, northwards to Belgium and S.C. Russia.* Al Au Be ?Bl Br Bu Co Cz Ga Ge Gr He Hs Hu It Ju Lu Po Rm Rs (C, W, K, E) Sa Si Tu. (*N. Africa.*)

A very variable and plastic species with some local differentiation. Variants with bulbils in the umbel have been named **A. loscosii** K. Richter, *Pl. Eur.* **1**: 199 (1890) (*A. purpureum* Loscos, non Salisb.).

The following are sometimes treated as distinct species.

1 Perianth-segments pink or reddish-purple **(a) subsp. sphaerocephalon**
1 Perianth-segments white with green or yellowish keel
2 Perianth and pedicels smooth **(b) subsp. arvense**
2 Perianth and pedicels papillose **(c) subsp. trachypus**

(a) Subsp. **sphaerocephalon**: $2n=16+0$–2B. *Throughout the range of the species.*

(b) Subsp. **arvense** (Guss.) Arcangeli, *Comp. Fl. Ital.* 702 (1882) (*A. arvense* Guss., *A. sphaerocephalum* var. *viridi-album* Tineo): *C. to E. Mediterranean region.*

(c) Subsp. **trachypus** (Boiss. & Spruner) Stearn, *Ann. Mus. Goulandris* **4**: 181 (1978): *Greece.*

91. A. proponticum Stearn & N. Özhatay, *Ann. Mus. Goulandris* **3**: 48 (1977). Bulb 1·5–2·5 cm in diameter, ovoid; outer tunics membranous; bulblets white, acuminate. Leaves 3, up to 35 cm × 7 mm, fistular, semicylindrical, canaliculate, sheathing the lower ¼ of the stem. Stem *c.* 120 cm. Spathe up to 2·5 cm, 2-valved, beaked, persistent. Umbel *c.* 6·5 cm in diameter, hemispherical, without bulbils; pedicels up to 35 mm, almost equal, papillose towards the apex. Perianth narrowly ovoid; segments pale pinkish-purple, the outer 3·5 × 2 mm, broadly oblong, keeled, the inner 4 × 2·5 mm, ovate, subacute, papillose on keel and surface. Stamens exserted; outer 3 filaments *c.* 5·5 mm, simple, the inner 3 with the basal lamina 1½ times as long as the central cusp, the lateral cusps longer than the *c.* 2 mm central cusp. $2n=16$. *Rocky slopes.* ● *Turkey-in-Europe* (*near Tekirdağ*). Tu.

92. A. melananthum Coincy, *Jour. Bot.* (*Paris*) **9**: 336 (1895). Bulbs *c.* 0·8 cm in diameter, narrowly ovoid; outer tunics membranous. Stem 25–60 cm. Leaves 3–4, up to 10 cm or more × 2 mm, filiform, fistular, striate, sheathing the lower ⅓–½ of the stem. Spathe up to 0·5 cm, 2-valved, acuminate, persistent. Umbel 1–2 cm in diameter, subglobose, dense; pedicels 2–6 mm. Perianth very broadly ovoid; segments 3–3·5 × 1·5–2 mm, dark purple, the outer narrowly ovate, subacute, the inner oblong, obtuse, concave, strongly papillose. Stamens slightly exserted; outer 3 filaments *c.* 2·5 mm, simple, narrowly triangular at base, narrowed above, the inner 3 with the basal lamina 2–3 times as long as the central cusp, the lateral cusps slightly longer than the central cusp; anthers purplish. Capsule *c.* 3 mm. ● *S.E. Spain.* Hs.

93. A. pruinatum Link ex Sprengel, *Syst. Veg.* **2**: 35 (1825) (*A. welwitschii* Regel). Bulbs *c.* 1 cm in diameter, ovoid; outer tunics membranous, becoming split into narrow segments. Stem 20–40 cm. Leaves *c.* 3, up to 7 cm or more × 0·3 mm or more, filiform, sheathing the lower ¼–⅓ of the stem, withered at anthesis. Spathe up to 1 cm, 2-valved, shortly beaked, persistent. Umbel 1–2 cm in diameter, hemispherical, rarely with bulbils

(var. *bulbiferum* Coutinho); pedicels 2–15 mm, unequal. Perianth cylindrical; segments 4·5 × 1·5–2 mm, narrowly ovate, acute, purple, papillose on keel. Stamens included; outer 3 filaments simple, subulate, the inner 3 with the broad part twice as long as the central cusp, the lateral cusps more than twice as long as the central cusp; central cusp 0·1 mm; anthers yellowish or reddish. Capsule 3 mm. $2n=16$. *Dry scrub.* ● *C. & S. Portugal.* Lu.

94. A. regelianum A. Becker, *Bull. Soc. Nat. Moscow* **55(1)**: 146 (1880). Bulbs *c.* 1 cm in diameter, ovoid; outer tunics membranous; bulblets dark purplish-brown. Stem 33–60 cm. Leaves 3, up to 20 cm × 0·5–2 mm, linear, fistular, many-veined, with minutely denticulate margin, sheathing the lower ¼–½ of the stem. Spathe caducous. Umbel 1·5–2 cm in diameter, hemispherical or ovoid, many-flowered; pedicels unequal, the longest up to 20 mm. Perianth cylindrical; segments *c.* 4·5 × 1·5 mm, oblong-lanceolate, acute, smooth, purplish. Stamens slightly exserted; outer 3 filaments up to 4 mm, simple, the inner 3 with the basal lamina not ciliate and nearly twice as long as the central cusp, the lateral cusps slightly or much longer than the central cusp. Capsule 2·5–3 mm. ● *S. & E. Ukraine, S.E. Russia.* Rs (W, E).

A. scythicum Zoz, *Učen. Zap. Khar'kovsk. Derž. Univ.* **4**: 65 (1936), reported from steppes in S. Ukraine (E. of Herson), with whitish or pale lilac perianth and the lateral cusps of the inner stamens *c.* 3 times as long as the central cusp, is doubtfully distinct from **94.**

95. A. vineale L., *Sp. Pl.* 299 (1753). Bulbs 1–2 cm, ovoid; outer tunics splitting into strips with parallel fibres; bulblets yellowish. Stem 30–120 cm. Leaves 2–4, 15–60 cm × 1·5–4 mm, sub-cylindrical, fistular, sheathing the lower ⅓–¾ of the stem. Spathe usually 3 cm or more, 1-valved, caducous, the beak as long as or a little longer than the base. Umbel 2–5 cm in diameter, subglobose, ovoid or hemispherical, many-flowered, and with few or no bulbils, or few-flowered and with several bulbils; pedicels 5–30 mm, unequal. Perianth campanulate; segments 2–4·5 × 1·2–1·5 mm, pink to dark red or greenish-white, the outer narrowly oblong-ovate, subacute or obtuse, very concave, the inner narrowly oblong or almost narrowly obovate, rounded at apex, rarely narrowly oblong-ovate and subacute, smooth. Stamens almost included to distinctly exserted; outer 3 filaments 3·5–4 mm, simple, the inner 3 with the basal lamina slightly or distinctly longer than the central cusp, the lateral cusps much longer than the central cusp; anthers yellow. Capsule 3–3·5 mm. $2n=16$, 32, 40. *Dry pastures, cultivated ground and roadsides. Most of Europe except the extreme north and C. & E. Russia.* All except Az Cr Fa Is Rs (N, E) Sb, but doubtfully native in some territories.

A variable species widespread as a weed in cultivated land and its vicinity, with extreme variants of very different aspect. The variant with the flowers completely replaced by bulbils in the umbel has been distinguished as var. *compactum* (Thuill.) Cosson & Germ. (*A. compactum* Thuill.), that with bulbils and flowers as var. *typicum* Ascherson & Graebner (*A. vineale* L. sensu stricto), and that with flowers but without bulbils as var. *capsuliferum* Koch (*A. rilaense* Panov, *A. vineale* subsp. *capsuliferum* (Koch) Češchm.), but all may occur in the same population or only one may be present. A constant variant with dark red flowers, distinguished as var. *purpureum* H. P. G. Koch (*A. kochii* Lange), occurs in the Baltic region. Plants from the Balkan peninsula with greenish-white flowers have been named var. *virens* Boiss. (*A. affine* Boiss. & Heldr., non Ledeb., *A. assimile* Halácsy). **A. ebusitanum** Font Quer, *Butll. Inst. Catalana Hist. Nat.* **24**: 145 (1924), from Islas Baleares (Ibiza), apparently belongs to this complex.

96. A. amethystinum Tausch, *Syll. Pl. Nov. Ratisbon.* (*Königl. Baier. Bot. Ges.*) **2**: 256 (1828) (*A. descendens* auct., non L., *A. segetum* Jan ex Schultes & Schultes fil., *A. stojanovii* Kovatschev). Bulbs 1·5–2 cm in diameter, subglobose; outer tunics membranous; bulblets absent or few, yellowish. Stem 20–120 cm, often reddish in upper part. Leaves 3–7, up to 50 cm × 8 mm, linear, fistular, canaliculate, sheathing the lower ¼–⅓ of the stem, usually withered at anthesis. Spathe 2–7 cm, 1-valved, long-beaked, caducous. Umbel 2·5–6·5 cm in diameter, subglobose, many-flowered; pedicels 10–25 mm at anthesis, the central ones sometimes up to 50 mm in fruit, often reddish. Perianth cylindrical; segments purple, the outer 3–4·5 × 1–1·8 mm, narrowly oblong or oblong-elliptical, usually longer and narrower than the inner, obtuse or truncate, smooth. Stamens exserted, ciliate below; outer 3 filaments 4·5–6 mm, simple, the inner 3 with the basal lamina slightly wider than the inner segments and shorter than or equalling the central cusp, the lateral cusps 1½ or more times as long as the central cusp. Capsule *c.* 4 mm. $2n=16$, 24, 32. *Cultivated ground and rocky places. C. & E. Mediterranean region, extending to S.E. Bulgaria.* Al Bu Cr Gr It JuSi.

97. A. guttatum Steven, *Mém. Soc. Nat. Moscou* **2**: 173 (1809). Bulbs 1–2 cm in diameter, ovoid; outer tunics membranous or coriaceous, sometimes breaking into parallel fibres; bulblets yellowish. Stem 10–90 cm. Leaves 2–5, up to 30 cm × 3 mm, filiform, semi-terete or flattened, fistular, sheathing the lower ⅓–¾ of the stem. Spathe 1–5 cm, 1-valved, with beak 1·5–4 cm, caducous. Umbel 1·5–5 cm in diameter, subglobose, ovoid or hemispherical, many-flowered; pedicels unequal, the central erect in fruit and up to 30 mm, the outer much shorter and deflexed, thus sometimes forming an apparently double umbel, with large membranous bracteoles at base like an involucre. Perianth cylindrical; segments 2·5–4·5 × 1–1·2 mm, the outer oblong, keeled, obtuse or subacute, the inner narrowly oblong-spathulate, truncate-rounded, smooth. Stamens exserted; outer 3 filaments 3·5–4 mm, simple, the inner 3 with the basal lamina slightly longer than the central cusp, the lateral cusps usually much longer than the central cusp; anthers yellow or dark red. Capsule *c.* 3 mm. *Dry places. S. Europe.* Al Bu Gr Hs It Ju Lu Rm Rs (W, K) Sa Si Tu.

This species comprises three major vicarious populations, distinguishable by flower-colour and with little geographical overlap.

1 Perianth-segments bright pink to deep purple
(c) subsp. **dalmaticum**
1 Perianth-segments whitish, apart from keel and purple blotch
2 Perianth-segments with conspicuous suborbicular purple blotch **(a)** subsp. **guttatum**
2 Perianth-segments with green or pink stripe
(b) subsp. **sardoum**

(a) Subsp. **guttatum** (*A. margaritaceum* var. *guttatum* (Steven) Gay): $2n=16$. *From the Aegean region to E.C. Ukraine.*

(b) Subsp. **sardoum** (Moris) Stearn, *Ann. Mus. Goulandris* **4**: 184 (1978) (*A. margaritaceum* Sm., non Moench, *A. sardoum* Moris, *A. gaditanum* Pérez Lara ex Willk., *A. confusum* Halácsy): $2n=16$, 32, 48. *From Portugal to Turkey-in-Europe.*

(c) Subsp. **dalmaticum** (A. Kerner ex Janchen) Stearn, *loc. cit.* (1978) (*A. dalmaticum* A. Kerner ex Janchen). $2n=24$. ● *From Albania and W. Jugoslavia to E. Bulgaria.*

98. A. dilatatum Zahar., *Ann. Mus. Goulandris* **3**: 88 (1977). Bulbs 1·5–2 cm in diameter, ovoid; outer tunics membranous.

Stem 25–50 cm. Leaves 3–4, 1–2 mm wide, filiform, fistular, sheathing the lower ½–⅘ of the stem, withered at anthesis. Spathe 1-valved, caducous. Umbel 1·5–4 cm in diameter, hemispherical, with 15–35 flowers; pedicels 5–15 mm. Perianth narrowly cylindrical; segments white, with broad green keel, the outer 4 × 0·8–1·4 mm, lanceolate, acute or subacute, the inner 4·5–5 × 0·8–1·6 mm, oblong-spathulate, almost truncate at apex, mucronate, papillose on the keel. Stamens exserted; outer 3 filaments 4·5–5 mm, simple, the inner 3 with the basal lamina nearly 3 times as long as the central cusp, the lateral cusps twice as long as the central cusp; anthers greenish. Capsule 3·5–4 mm. *Rocky places*, 400–800 *m*. ● *S.W. Kriti*. Cr.

Perhaps best treated as a further subspecies of **97**.

99. A. gomphrenoides Boiss. & Heldr. in Boiss., *Diagn. Pl. Or. Nov.* **1(7)**: 114 (1846). Bulbs 0·6–1 cm in diameter, ovoid; outer tunics reticulately fibrous. Stem 8–24 cm. Leaves 2–3, up to 15 cm × 1 mm, filiform, sheathing the lower ⅙–⅓ of the stem. Spathe up to 1 cm, 2-lobed, short-beaked, persistent. Umbel 1–2 cm in diameter, hemispherical, dense; pedicels 2–8 mm, slightly unequal. Perianth campanulate; segments 5·5–7 × 1·5–2·5 mm, oblong-elliptical, obtuse and emarginate to lanceolate and acute, smooth, pink to deep purple. Stamens included; outer 3 filaments *c.* 3·5 mm, simple, the inner 3 with the basal lamina *c.* 3 times as long as the central cusp, the lateral cusps twice as long as the central cusp; anthers pale yellow. Capsule *c.* 3·5 mm. *S. Greece* (*S. Peloponnisos*, *Kithira*). Gr.

100. A. jubatum Macbride, *Contr. Gray Herb.* nov. ser., **56**: 7 (1918) (*A. cristatum* Boiss., non S. Watson). Bulbs *c.* 1 cm in diameter, ovoid; outer tunics membranous. Stem 30–38 cm. Leaves 2–3, up to 18 cm × 1–2 mm, fistular, semiterete, sheathing the lower ⅓ of the stem. Spathe up to 1 cm, 2- to 3-lobed, persistent. Umbel *c.* 2 cm in diameter, subglobose, dense, many-flowered; pedicels up to 8 mm, almost equal. Perianth oblong; segments dimorphic, the outer *c.* 6·5 × 2 mm, purplish, oblong, acute, cymbiform, scabrid on the keel, the inner 7–7·5 × 2·5 mm, whitish, narrowly oblong, the apex almost truncate and with numerous short teeth, papillose outside. Stamens included; outer 3 filaments 3·5 mm, simple, the inner 3 with the basal lamina *c.* 5 times as long as the central cusp, the lateral cusps more than twice as long as the central cusp; anthers pale yellow. *Woods. C. Bulgaria* (*near Kalofer*) . Bu. (*N.W. Anatolia.*)

Not found again in Bulgaria since the original collection.

101. A. rubrovittatum Boiss. & Heldr. in Boiss., *Diagn. Pl. Or. Nov.* **(2)13:** 29 (1853). Bulbs 0·5–1 cm in diameter, narrowly ovoid; outer tunics coriaceous. Stem 2·5–20 cm, slightly ribbed. Leaves 3–4, 2·5–15 cm × 2–5 mm, filiform, sheathing the lower ⅓ of the stem. Spathe 2-valved, up to 0·5 cm, shortly beaked, persistent. Umbel 0·8–2 cm in diameter, hemispherical or broadly ovoid, dense, 5- to 30-flowered; pedicels 1–6(–12) mm, unequal. Perianth campanulate; segments 3·5–4 × 1·5 mm, narrowly ovate, obtuse or subacute, strongly papillose, reddish, with a broad white margin. Stamens finally just exserted; outer 3 filaments 3–4 mm, simple, the inner 3 with the basal lamina 3 times as long as the central cusp, the lateral cusps about twice as long as the central cusp; anthers usually dark purple, but sometimes yellow. Capsule *c.* 3 mm. *Dry, rocky ground.* ● *Kriti, Karpathos*. Cr.

102. A. integerrimum Zahar., *Ann. Mus. Goulandris* **3**: 90 (1977). Bulbs 0·8–1 cm in diameter, ovoid; outer tunics coriaceous. Stem 30–40 cm. Leaves 3–4, 1–1·5 mm wide, filiform, sheathing the lower ¼–⅓ of the stem. Spathe shorter than umbel, 2-valved, persistent. Umbel 1–2·5 cm in diameter, subglobose, dense; pedicels 1–12 mm, unequal. Perianth campanulate; segments 4 × 1·5–2 mm, pink, the outer lanceolate, the inner narrowly ovate, inconspicuously papillose, obtuse. Stamens slightly exserted; outer 3 filaments 4·5 mm, simple, the inner 3 with the basal lamina twice as long as the central cusp, the lateral cusps twice as long as the central cusp. Capsule *c.* 3 mm. ● *E. Greece* (*Olimbos*). Gr.

103. A. chamaespathum Boiss., *Diagn. Pl. Or. Nov.* **1(7)**: 113 (1846). Bulbs 1·8–2·5 cm in diameter, ovoid, without bulblets; outer tunics papery, thin. Stem (10–)25–30(–60) cm. Leaves 2–3, up to 30 cm × 4 mm, fistular, canaliculate above, almost withered at anthesis, sheathing the stem up to the umbel. Spathe 2·5–5 cm, 1-valved, beaked, caducous, but often held in place by uppermost leaf. Umbel 3–4·5 cm in diameter, globose or hemispherical; pedicels 10–15 mm, almost equal. Perianth cylindrical; segments 4–4·5 × 1·3–1·8 mm, white or dull green, narrowly oblong, the outer rounded at apex, the inner truncate. Stamens slightly exserted; outer 3 filaments 1·5–2·5 mm, simple, the inner 3 with the basal lamina about twice as long as the central cusp, the lateral cusps as long as or shorter than the central cusp. Capsule *c.* 5 mm. $2n=16$. Flowering September–October. *Rocky limestone slopes.* ● *S. half of Balkan peninsula, Kriti*. Al Cr Gr.

104. A. heldreichii Boiss., *op. cit.* **3(4)**: 116 (1859). Bulb *c.* 1 cm in diameter, broadly ovoid; outer tunics membranous, blackish. Stem 20–60 cm. Leaves 2–4, 5–30 cm × 0·5–3 mm, terete, fistular, erect, sheathing the lower ¼–⅓ of the stem. Spathe 2-valved; valves 1–1·5 cm, unequal, lanceolate, acuminate, persistent. Umbel 2·5–4·5 cm in diameter, globose or hemispherical; pedicels 5–15 mm, unequal. Perianth campanulate; segments *c.* 10 × 2·5–3 mm, pink, lanceolate, acute, smooth. Stamens included; outer 3 filaments *c.* 5·5 mm, simple, the inner 3 with the broad base much narrower than the inner perianth-segment and 4 times as long as the central cusp, the lateral cusps 2–3 times as long as the central cusp, ciliate in lower part; anthers yellow. Capsule 4–5 mm. $2n=16$. *Among rocks*, 700–2000 *m*. ● *Mountains of N. Greece*. Gr.

Sect. MELANOCROMMYUM Webb & Berth. (Sect. *Melamprason* F. Hermann). Bulbs subglobose or broadly ovoid; not rhizomatous. Leaves basal, with no above-ground sheath. Stem usually longer than leaves, terete. Spathe shorter than pedicels, becoming 2- to 4-fid, persistent. Perianth usually stellate, with segments ultimately deflexed. Stamens simple. Ovary with 4–8 ovules in each loculus; stigma entire. Seeds angular.

105. A. atropurpureum Waldst. & Kit., *Pl. Rar. Hung.* **1**: 16 (1800) (*A. nigrum* var. *atropurpureum* (Waldst. & Kit.) Vis.). Bulbs 1·5–3 cm in diameter, subglobose; outer tunics membranous. Stem 40–100 cm. Leaves 3–7, 15–35 cm × 10–40 mm, broadly linear. Spathe 2-valved; valves up to 2 cm, ovate, acute. Umbel 3–7 cm in diameter, fastigiate, many-flowered; pedicels 20–40 mm. Perianth stellate at anthesis, later deflexed; segments 7–9 × 1 mm, dark purple, linear, acute. Stamens shorter than perianth-segments; filaments 4–5 mm, connate into an annulus at the base, shortly triangular at base, abruptly narrowed above into a subulate filament; anthers purple. Capsule 6–8 mm. $2n=16$. *Cultivated ground and dry, open habitats.* ● *Hungary, Romania and N. & E. parts of Balkan peninsula*. Bu Hu Ju Rm Tu [Au].

106. A. nigrum L., *Sp. Pl.* ed. 2, 430 (1762) (incl. *A. multibulbosum* Jacq., *A. magicum* auct., ? an L.). Bulbs 2·5–3 cm in diameter, ovoid; outer tunics membranous. Stem 60–90 cm. Leaves 3–6, up to 50 × 8 cm, broadly linear. Spathe becoming

2- to 4-fid; valves up to 3 cm, narrowly triangular, acuminate. Umbel 5–10 cm in diameter, hemispherical or fastigiate, many-flowered, very rarely with bulbils; pedicels 25–45 mm. Perianth stellate at anthesis, later deflexed; segments 6–9 × 1·5–3·5 mm, white or pale lilac, with a greenish mid-vein, narrowly oblong-elliptical, obtuse. Stamens shorter than perianth-segments; filaments *c.* 5 mm, connate into an annulus at base, 1–1·5 mm wide and triangular at base, narrowed above into a subulate or very narrowly triangular filament; anthers yellowish. Capsule 6–8 mm. $2n=16$. *Cultivated ground and waste places. S. Europe.* Al Bl Bu Co Cr Ga †Ge Gr Hs It Ju Lu ?Rs (K) Sa Si Tu [?Au].

A. auctum Omelczuk, *Ukr. Bot. Žur.* **19(2)**: 22 (1962), from Krym, with pinkish-violet perianth, is doubtfully distinct from **106**.

107. A. cyrilli Ten., *Fl. Nap.* **3**: 364 (1828–1829). Bulbs 1–2 cm in diameter, broadly ovoid; outer tunics membranous. Stem 50–60 cm. Leaves 3–5, 20–30 cm × 10–35 mm, all basal, broadly linear. Spathe becoming 2- to 3-fid; valves up to 2 cm, narrowly triangular, acuminate. Umbel 4–7 cm in diameter, hemispherical or fastigiate, many-flowered; pedicels 15–25 mm, almost equal. Perianth cup-shaped at anthesis, later deflexed; segments 6–7 × 1–1·5 mm, white, with broad green median stripe, linear, acute, the apices curving inwards at anthesis. Stamens about as long as perianth-segments; filaments *c.* 6·5 mm, connate into an annulus at the base, 1·5–2 mm wide and narrowly triangular at base, gradually narrowed above into a subulate, fleshy filament; anthers yellowish. Capsule *c.* 5 mm. *Cultivated ground. S. & E. Greece; S. Italy.* Gr It.

108. A. decipiens Fischer ex Schultes & Schultes fil., *Syst. Veg.* **7**: 1117 (1830). Bulbs 1–1·5 cm in diameter, broadly ovoid; outer tunics membranous. Stem 20–50 cm. Leaves 1–3, up to 25 cm × 2–10 mm, linear. Spathe 2-valved; valves up to 1 cm, broadly ovate. Umbel 2·5–5 cm in diameter, hemispherical or fastigiate, few- to many-flowered; pedicels 10–30 mm, almost equal. Perianth stellate, later deflexed; segments 3·5–4·5 × 1–2 mm, narrowly oblong-elliptical, acute, white or pink. Stamens about as long as perianth-segments; filaments 3·5–4·5 mm, connate into an annulus at base, triangular at base, narrowed above into a subulate filament; anthers yellowish. Capsule *c.* 3·5 mm. $2n=16$. *Steppes and rocky slopes.* ● *S. part of U.S.S.R.* ?Bu Rs (C, W, E).

109. A. orientale Boiss., *Diagn. Pl. Or. Nov.* **2(13)**: 25 (1853). Bulb *c.* 1·5 cm in diameter, subglobose; outer tunics membranous. Stem 10–40 cm. Leaves 3–4, up to 40 cm × 5–20 mm, all basal, very narrowly lanceolate to linear, about as long as or longer than the stem. Spathe up to 2 cm, 2- to 4-lobed. Umbel 3–5 cm in diameter, hemispherical, many-flowered; pedicels 1–2·5 cm, almost equal. Perianth stellate, later deflexed; segments 5–9 × 2–2·5 mm, white, with green mid-vein, narrowly lanceolate, obtuse or subacute. Stamens included; filaments 4–5 mm, connate into an annulus at the base, narrowly triangular below, gradually narrowed above into a subulate filament; anthers yellowish. Capsule *c.* 5 mm. *Doubtfully recorded from S. Jugoslavia (S.E. Makedonija) but of possible occurrence in E. Aegean region.* ?Ju ?Gr.

Sect. KALOPRASUM C. Koch. Bulbs subglobose, not rhizomatous. Stem about as long as leaves, terete. Leaves basal, with no above-ground sheath. Spathe shorter than pedicels, 2-valved, persistent. Perianth campanulate to stellate; segments erect or deflexed after anthesis. Stamens simple, long-exserted. Ovary with 6–14 ovules in each loculus; stigma entire. Seeds angular.

110. A. caspium (Pallas) Bieb., *Fl. Taur.-Cauc.* **1**: 265 (1808). Bulbs 2–4·5 cm in diameter, subglobose; outer tunics membranous. Stem 10–35 cm, stout. Leaves 3–6, 15–25 cm × 0·5–3·5 cm, linear to very narrowly oblong. Spathe 1·2–2·5 cm, much shorter than the umbel, 2-valved, persistent. Umbel 5–20 cm in diameter, globose, hemispherical or fasciculate, lax, many-flowered, up to 10 cm in diameter in fruit; pedicels 30–90 mm, unequal, elongating in fruit. Perianth broadly campanulate; segments 5–10 × 2–3 mm, lilac, tinged with green, the outer lanceolate, the inner narrowly ovate, obtuse or subacute. Stamens long-exserted; filaments *c.* 11 mm, connate into an annulus at the base; anthers greenish. Capsule *c.* 5 mm. *Sandy deserts. S.E. Russia.* Rs (E). (*S.W. & W.C. Asia.*)

39. Nectaroscordum Lindley[1]

Bulbous, scapose, perennial herbs, smelling strongly of garlic; bulbs solitary, composed of several scales, tunicate. Leaves basal, linear, with sheathing base, strongly keeled. Flowers in a terminal umbel, at first completely enclosed in a 1-valved spathe. Perianth-segments persistent, free, 3- to 7-veined, the outer 3 oblong, the inner 3 pandurate. Stamens free; anthers dorsifixed, introrse. Ovary semi-inferior, turbinate, 3-locular, with 3 large nectariferous pores on its conical upper surface; ovules numerous. Style gynobasic; stigma entire. Capsule membranous; seeds angled, black.

1. N. siculum (Ucria) Lindley, *Bot. Reg.* **22**: t. 1913 (1836). Bulb 1·5–3 cm in diameter, subglobose; outer tunics membranous. Leaves 3–4, 30–60 × 1–5 cm. Scape 50–125 cm, terete, covered for the lower ¼ of its length by an erect sheathing leaf. Spathe 6–7·5 cm, beaked, quickly deciduous. Umbel many-flowered, lax; pedicels 2–7 cm, unequal, curved downwards at anthesis, erect in fruit. Perianth broadly campanulate; segments coriaceous, the outer 14 × 8 mm, obtuse, the inner 16 × 11 mm, abruptly contracted into a cuneate base, slightly apiculate. Stamens included. Capsule 5–7 mm. $2n=18$. *Damp or shady woods. S. Europe, eastwards from S. France.* Bu Co Ga It Rm Rs (K) Sa Si Tu.

(a) Subsp. **siculum** (*Allium siculum* Ucria): Perianth dull greenish-red. ● *W. Mediterranean region.*

(b) Subsp. **bulgaricum** (Janka) Stearn, *Ann. Mus. Goulandris* **4**: 104 (1978) (*N. bulgaricum* Janka, *Allium bulgaricum* (Janka) Prodan, *A. meliophilum* Juz., *A. dioscoridis* auct., non Sibth. & Sm.): Perianth dull greenish-white tinged with pale pink outside, with green midveins, red inside near base. *S.E. Europe, from Turkey to Krym.*

40. Nothoscordum Kunth[1]

Bulbous, scapose perennial herbs, not smelling of onion or garlic. Bulbs composed of several scales, tunicate. Leaves basal, linear, with sheathing bases. Flowers in a terminal umbel, at first enclosed within a spathe of 2 bracts connate at base. Perianth-segments connate at base into a short tube, 1-veined. Stamens adnate to lower part of perianth; anthers dorsifixed, introrse. Ovary superior, 3-locular; ovules 4–12 in each loculus. Style terminal; stigma entire. Capsule membranous; seeds angled, black.

1. N. inodorum (Aiton) Nicholson, *Ill. Dict. Gard.* **3**: 457 (1885) (*Allium fragrans* Vent., *A. odorum* auct. hisp., non L.,

[1] By W. T. Stearn.

Nothoscordum fragrans (Vent.) Kunth). Bulb *c.* 1·5 cm in diameter, ovoid; outer tunics membranous. Leaves 20–40 cm × 4–10 mm. Scape 30–60 cm, terete. Spathe shorter than umbel, persistent. Umbel up to 4 cm in diameter, fastigiate, with 10–15 fragrant flowers, lax; pedicels 2–6 cm, unequal. Perianth 10–15 mm, infundibuliform, white above, with pink mid-vein, greenish beneath; segments *c.* 4 mm wide, oblanceolate, obtuse. Stamens included; filaments 7–10 mm, simple; anthers dark brown. Capsule *c.* 6·5 mm, obovoid. $2n=18$. *Naturalized locally in cultivated ground in S.W. Europe.* [Az Ga Hs Lu Si.] (*Warm-temperate South America; widely naturalized elsewhere.*)

41. Ipheion Rafin.[1]

Glabrous, bulbous, scapose perennial herbs. Leaves linear. Scape 1-flowered; spathes 2, connate below; pedicel not articulated. Perianth rotate-infundibuliform; lobes somewhat longer than the tube. Stamens included, 3 inserted near base of perianth-tube, 3 higher up; anthers dorsifixed, introrse. Stigma small, obscurely 3-lobed. Fruit a loculicidal capsule; seeds numerous.

1. I. uniflorum (R. C. Graham) Rafin., *Fl. Tellur.* **2**: 12 (1837). Plant smelling of garlic. Bulb *c.* 25 × 10 mm, narrowly ovoid, white; roots fleshy, contractile. Leaves 20–35 cm × 5–8 mm (including 6–8 cm underground), obtuse, somewhat keeled and channelled, flaccid. Scape 25–35 cm (including pedicel and underground part), slender. Spathes 25–30 mm, scarious. Pedicel 3–5 cm. Perianth-tube 15 mm, obconical, dull purple tinged with green; perianth-lobes 20 × 9–12 mm, imbricate, white or violet-blue; abaxial surface with a dark purple stripe and, in the outer segments, tinged with green. *Cultivated for ornament, and locally naturalized in W. Europe.* [Br Ga.] (*Argentina, Uruguay.*)

42. Convallaria L.[2]

Glabrous, scapose, perennial herbs with a creeping, branched rhizome. Leaves arising from the rhizome, but with convolute, sheathing bases which simulate a leafy stem; each such stem consists of *c.* 5 scales and 1–4 foliage-leaves. Inflorescence racemose; pedicels usually deflexed. Flowers white or pink. Perianth more or less campanulate, the segments usually connate for about ⅔ of their length. Stamens usually 6; anthers attached near the base, introrse. Style simple. Fruit a berry.

Literature: J. Ponert, *Biosistematičeskaja Monografija Roda* Convallaria *L. s. str.* Leningrad. 1968.

1. C. majalis L., *Sp. Pl.* 314 (1753). Stems up to 37 cm, with green or violet scales. Leaf-sheaths 1–24 cm; lamina 3–22 × 0·5–10·5 cm, acute or acuminate, pruinose above. Bracts shorter than pedicels. Flowers fragrant, nodding. Perianth 5–9(–11) × (5–)8–11 mm, white or pink; buds ellipsoid. Fruit red; seeds 2–6. $2n=38$. *Woods, scrub and mountain meadows. Most of Europe except the extreme north and parts of the south. Cultivated for ornament, perfume, and as a medicinal plant.* Al Au Be Br Bu ?Co Cz Da Fe Ga Ge Gr He Ho Hs Hu It Ju No Po Rm Rs (N, B, C, W, K, E) Su.

Polymorphic; plants with violet, patent-deflexed scales and a pink perianth are relatively common in parts of C. & E. Europe.

C. transcaucasica Utkin ex Grossh., *Fl. Kavk.* **1**: 242 (1928), described from the Caucasus, with pyriform or truncate-pyrimadal flower-buds, may occur in parts of S.E. Europe; further study is required.

[1] By D. A. Webb.
[2] By J. Ponert.
[3] By D. H. Valentine.
[4] By R. A. DeFilipps.

43. Maianthemum Weber[3]

Perennial, with creeping rhizome. Stems erect, with 2 scale leaves at the base and 2 foliage leaves near the apex. Leaves alternate. Inflorescence a terminal raceme. Flowers white; pedicels slender, articulated. Perianth of 4 free, patent segments. Stamens 4, shorter than perianth; anthers dorsifixed, introrse. Ovary 2-locular with 2 ovules in each loculus. Fruit a berry; seeds 1–3.

1. M. bifolium (L.) F. W. Schmidt, *Fl. Boëm.* **4**: 55 (1794). Stem 5–20(–25) cm. Leaves 4–6(–8) × 2·5–5 cm, cordate with wide sinus, ovate, acute. Inflorescence 1–4 cm, with 15–20 flowers. Perianth-segments 2–3 mm. Style equalling ovary. Berry *c.* 5 mm, red, usually 1-seeded. $2n=36$. *On humus-rich soils in woods and other shady places; somewhat calcifuge. Europe southwards to N. Spain, N. Appennini, S. Carpathians and Krym.* Au Be Br Cz Da Fe Ga Ge He Ho Hs Hu It Ju No Po Rm Rs (N, B, C, W, K, E) Su.

44. Smilacina Desf.[3]

Rhizomatous perennials with leafy stems. Leaves sessile, amplexicaul. Inflorescence a terminal raceme. Flowers small, white. Perianth-segments 6, patent, stellate, free or connate only at the base. Stamens introrse, inserted at the base of the perianth. Ovary 3-locular with 2 ovules in each loculus. Fruit a berry; seeds 1–2.

1. S. stellata (L.) Desf., *Ann. Mus. Hist. Nat.* (*Paris*) **9**: 52 (1807). Stems 30–60 cm, unbranched. Inflorescence relatively short and lax, with up to 20 flowers. Perianth-segments *c.* 5 mm, linear-lanceolate to lanceolate. Berry dark red; remains of style persistent. *Shady places. Cultivated for ornament and locally naturalized in S. Fennoscandia.* [No Su.] (*North America.*)

45. Streptopus Michx[3]

Herbaceous, rhizomatous perennials. Stems leafy. Inflorescence 1- to 2-flowered; flowers small, extra-axillary; pedicels slender, strongly recurved near the middle. Perianth campanulate; segments 6, slightly connate at base. Stamens inserted at base of perianth. Style 3-fid. Ovary ovoid, 3-locular. Fruit a many-seeded berry.

1. S. amplexifolius (L.) DC. in Lam. & DC., *Fl. Fr.* ed. 3, **3**: 174 (1805). Stems 40–100 cm, rather stout below, branched above. Lower leaves 7–12 × 3–6 cm, decreasing somewhat in size from the base, oblong-ovate, cordate, amplexicaul, glabrous. Pedicels up to 5 cm. Perianth-segments up to 1 cm, lanceolate, greenish-white. Filaments very short. Style *c.* 5 mm, scarcely divided at the apex. Berry red. *Damp woods and scrub. Mountains and hill-country of C. & S. Europe, from C. Germany and S.C. Poland southwards to N. Spain, S. Italy and S.W. Bulgaria.* Au Bu Co Cz Ga Ge He Hs It Ju Po Rm Rs (W).

46. Polygonatum Miller[4]

Perennials with stout, creeping rhizome. Stem simple, usually arching. Leaves alternate or verticillate, entire, usually glaucous beneath. Flowers usually hermaphrodite, pendent, greenish- or yellowish-white, solitary to several on axillary peduncles. Perianth tubular to campanulate, with 6 short lobes puberulent at the apex. Stamens 6, included, adnate to the perianth-tube;

anthers basifixed. Ovary superior, 3-locular; placentation axile; style linear. Fruit a small, globose, several-seeded berry.

Width of the perianth is measured at the middle of the tube.

1 Middle and upper leaves in whorls, linear to narrowly oblong **1. verticillatum**
1 Leaves alternate, broadly lanceolate, elliptical, oblong or ovate
2 Leaves minutely puberulent on the veins beneath
3 Upper part of stem and peduncles sparsely puberulent; perianth 10–18(–25) × 4–7 mm **2. latifolium**
3 Stem and peduncles glabrous; perianth 8–12 × 2–3 mm **3. orientale**
2 Leaves glabrous
4 Peduncles in the lower ½ of the inflorescence with 2–6 flowers; flowers not scented; perianth somewhat contracted in the middle; stem terete **4. multiflorum**
4 Peduncles usually with 1–2 flowers; flowers scented; perianth not contracted in the middle; stem angled **5. odoratum**

1. P. verticillatum (L.) All., *Fl. Pedem.* **1**: 131 (1785). Stem 20–80 cm, angled, glabrous, rarely sparsely puberulent. Middle and upper leaves 40–150 × 3–25 mm, in whorls of 3–8, linear, narrowly elliptical, narrowly lanceolate or narrowly oblong, glabrous above, minutely puberulent on the veins beneath, sessile or shortly petiolate. Peduncles with 1–2 flowers, glabrous. Flowers not scented; perianth 5–10 × 1·5–3 mm, somewhat contracted in the middle; filaments sparsely puberulent. Fruit red, becoming dark purple. $2n=28$. *Woods, scrub and rocky ground. From Arctic Norway southwards to N. Spain, C. Italy and S.W. Bulgaria and eastwards to c.* 26°*E. in Latvia and Romania.* Al Au Be Br Bu Cz Da Ga Ge He Ho Hs Hu It Ju No Po Rm Rs (B) Su.

2. P. latifolium (Jacq.) Desf., *Ann. Mus. Hist. Nat.* (*Paris*) **9**: 50 (1807). Stem 20–100 cm, angled, sparsely puberulent above. Leaves 70–125 × 30–70 mm, alternate, elliptical, lanceolate or ovate, glabrous above, sparsely and minutely puberulent on the veins beneath, shortly petiolate. Peduncles with 1–5 flowers, puberulent. Flowers not scented; perianth 10–18(–25) × 4–7 mm, not contracted in the middle; filaments glabrous or sparsely puberulent. Fruit bluish-black. $2n=20$. *Woods. E.C. & S.E. Europe, extending to N.E. Italy and to c.* 51°*N. in S.C. Russia.* ?Al Au Bu Cz Gr Hu It Ju Rm Rs (C, W, K, E) Tu.

3. P. orientale Desf., *loc. cit.* (1807) (*P. polyanthemum* Link). Like **2** but stem and peduncles glabrous; perianth 8–12 × 2–3 mm. *Mountain woods. Krym.* Rs (K). (*Caucasus, Anatolia.*)

4. P. multiflorum (L.) All., *Fl. Pedem.* **1**: 131 (1785). Stem 30–80 cm, terete, glabrous. Leaves 50–150 × 20–75 mm, alternate, elliptical, lanceolate, oblong or ovate, glabrous, sessile or shortly petiolate. Peduncles in lower ½ of inflorescence with 2–6 flowers, glabrous. Flowers not scented; perianth 9–20 × 2–4 mm, somewhat contracted in the middle; filaments sparsely puberulent. Fruit bluish-black. $2n=18$, 32. *Woods and scrub; calcicole. Much of Europe, but absent from parts of the south-west, extreme east, and many islands.* Al Au Be Br Bu Cz Da Fe Ga Ge Gr He Ho Hs Hu It Ju No Po Rm Rs (B, C, W, K, E) Si Su Tu.

Variants which are usually dioecious (var. *broteri* (Guss.) Baker) occur in the Mediterranean region.

The hybrid **4 × 5** (**P. × hybridum** Brügger, *Jahresb. Naturf. Ges. Graubündens* **29**: 160 (1886) (*P. intermedium* Boreau, non Dumort.)) is more or less intermediate between the parents and is sometimes fertile. It is the *Polygonatum* most often cultivated in gardens, and has been recorded from numerous stations in N. & W. Europe as a garden escape.

5. P. odoratum (Miller) Druce, *Ann. Scott. Nat. Hist.* **1906**: 226 (1906) (*P. officinale* All., *P. pruinosum* Boiss.). Stem 15–65 cm, angled, glabrous. Leaves 30–145 × 11–85 mm, alternate, elliptical, lanceolate, oblong or ovate, glabrous, sessile or shortly petiolate. Peduncles with 1–2(–5) flowers, glabrous. Flowers scented; perianth 12–30 × 4–9 mm, not contracted in the middle; filaments glabrous. Fruit bluish-black. $2n=20$. *Woods and rocky ground; somewhat calcicole. Europe, northwards to* 66° *N. in Finland, but absent from most of the islands.* Al Au Be Br Bu Co Cz Da Fe Ga Ge Gr He Ho Hs Hu It Ju Lu No Po Rm Rs (N, B, C, W, K, E) Si Su.

47. Paris L.[1]

Glabrous, rhizomatous perennial herbs. Stem long, erect, bearing at the apex a whorl of (3–)4–8 obovate, acuminate leaves. Flowers solitary. Sepals 4–6, lanceolate, green. Petals 4–6, linear-subulate, yellowish-green. Stamens 6–10; filaments short, flat; anthers linear, about as long as the filaments, with a long connective. Styles 4(–5). Fruit a berry-like capsule.

1. P. quadrifolia L., *Sp. Pl.* 367 (1753). Rhizome creeping, covered with scales. Stems 10–40 cm. Leaves 5–16 cm, obovate, cuneate at base, shortly petiolate, with 3–5 prominent veins and reticulate veins between. Sepals and petals 2–3·5 cm. Fruit globose, subglaucous-black, finally dehiscent. $2n=20$. *Woods and other damp or shady places. Most of Europe but rare in the Mediterranean region.* Au Be Br Bu Co Cz Da Fe Ga Ge Gr He Ho Hs Hu Is It Ju No Po Rm Rs (N, B, C, W) Sa Su.

48. Asparagus L.[2]

Rhizomatous perennials with usually fusiform tubers. Stems sometimes overwintering. Cladodes fasciculate or solitary, in the axils of reduced, scarious leaves; leaves usually with a spiny basal spur. Pedicels articulate, usually bracteolate at the base. Perianth campanulate to rotate, the 6 segments shortly connate at the base. Stamens 6, inserted at the base of the perianth-segments; anthers usually about as long as filaments. Fruit a globose berry, with 1–6 seeds.

The length of the spur refers to leaves on the main stem. The number of cladodes in a fascicle refers to those on the primary branches. Size of perianth-segments in dioecious species refers to male plants.

Literature: A. Bozzini, *Caryologia* **12**: 199–264 (1959).

1 Cladodes more than 5 mm wide, leaf-like **1. asparagoides**
1 Cladodes less than 2 mm wide, not leaf-like
2 Spur 5 mm or more, strongly spiny, patent **2. albus**
2 Spur less than 5 mm, scarcely spiny, appressed to erecto-patent
3 Cladodes strongly triquetrous, with three acute ribs **6. verticillatus**
3 Cladodes not triquetrous
4 Cladodes strongly spiny; stems woody
5 Base of pedicels with 0–2 small bracteoles; cladodes in fascicles of 1–3 **5. stipularis**
5 Base of pedicels surrounded by bracteoles; cladodes in fasicles of 3–30(–50)
6 Cladodes subequal, less than 10 mm, in fascicles of (5–)10–30(–50) **3. acutifolius**
6 Cladodes distinctly unequal, usually more than 10 mm, in fascicles of 3–7 **4. aphyllus**
4 Cladodes not strongly spiny; stems herbaceous
7 Pedicels not more than 3 mm **7. bresleranus**
7 Pedicels more than 3 mm

[1] By V. H. Heywood. [2] By B. Valdés.

8 Anthers 0·4–0·5 mm, $\frac{1}{4}$–$\frac{1}{6}$ as long as filaments; cladodes less than 0·2 mm wide **15. tenuifolius**
8 Anthers 0·7–1·6 mm, about as long as filaments; cladodes more than 0·2 mm wide
9 Stem and branches smooth to slightly striate
10 Stem flexuous; branches patent to deflexed; cladodes patent **8. persicus**
10 Stem straight; branches and cladodes usually erecto-patent
11 Spur (0·5–)1–3(–4) mm; cladodes usually less than 0·5 mm wide; pedicels usually articulate near the middle **13. officinalis**
11 Spur *c.* 0·5 mm; cladodes 0·5–1 mm wide; pedicels articulate in the upper part **12. litoralis**
9 Stem and branches with longitudinal ridges of cartilaginous papillae
12 Pedicels distinctly longer than cladodes; flowers mixed with the cladodes **14. pseudoscaber**
12 Pedicels shorter than cladodes; flowers often not mixed with the cladodes
13 Pedicels not more than $\frac{1}{4}$ as long as cladodes; cladodes 0·7–1 mm wide, cylindrical **10. kazakstanicus**
13 Pedicels more than $\frac{1}{2}$ as long as cladodes; cladodes 0·3–0·8 mm wide, somewhat flattened
14 Stem flexuous; cladodes 4·5–10(–20) mm **9. brachyphyllus**
14 Stem ±straight; cladodes mostly 10–30 mm **11. maritimus**

Subgen. **Myrsiphyllum** (Willd.) Baker. Hermaphrodite. Spur very reduced. Cladodes wide, leaf-like, solitary, unarmed. Perianth campanulate.

1. A. asparagoides (L.) Druce, *Rep. Bot. Exch. Club Brit. Is.* **3**: 414 (1914) (*A. medeoloides* (L. fil.) Thunb.). Stem up to 150 cm, twining, smooth to slightly ridged. Branches patent or deflexed. Cladodes (15–)20–30(–35) × (6–)8–15(–20) mm, patent, ovate-lanceolate, acute. Pedicels (4–)5–7(–8·5) mm, articulate in the upper part. Nodes with 1–3(–4) flowers. Perianth-segments (4·5–)5–6(–7) mm. Anthers $\frac{1}{6}$–$\frac{1}{3}$ as long as filaments. Berry 6–8 mm, reddish, with 1–4(–6) seeds. *Cultivated for ornament, and naturalized locally in S. Europe.* [Az Lu Si.] (*S. Africa.*)

Subgen. **Asparagopsis** (Willd.) Baker. Hermaphrodite. Spur strongly spiny, patent. Cladodes fasciculate, unarmed, deciduous. Perianth rotate.

2. A. albus L., *Sp. Pl.* 314 (1753). Stem up to 90 cm, woody. Stem and branches flexuous, smooth to very slightly striate, white. Spur 5–12(–16) mm. Cladodes 5–25 × 0·5–1·5 mm, in fascicles of 10–20. Pedicels 3–5(–7) mm, articulate below the middle. Nodes with (2–)6–15(–20) flowers. Perianth-segments 2–3 mm. Berry 4–7 mm, black, with 1–2 seeds. $2n=20$. *Hedges and scrub. W. & C. Mediterranean region, Portugal.* Bl Co Hs It Lu Sa Si.

Subgen. **Asparagus**. Dioecious. Spur appressed to erecto-patent, sometimes absent. Cladodes narrow, fasciculate to solitary, unarmed or spiny. Perianth campanulate to rotate.

3. A. acutifolius L., *Sp. Pl.* 314 (1753). Stem up to 200 cm, woody, white or grey. Stem and branches longitudinally striate, papillose or almost smooth. Cladodes 2–8(–10) × 0·3–0·5 mm, subequal, in fascicles of (5–)10–30(–50), patent, strongly spiny. Pedicels 3–7(–8) mm, surrounded by bracteoles at the base. Nodes with (1–)2–4 flowers mixed with the cladodes. Perianth-segments 3–4 mm. Berry 4·5–7·5(–10) mm, black, with 1–2 seeds. $2n=40$. *S. Europe, eastwards to Kriti and S.E. Bulgaria.* Al Bl Bu Co Cr Ga Gr Hs It Ju Lu Sa Si Tu.

Widely eaten as a vegetable although not cultivated.

The cladodes are generally shorter in populations from the western than from the eastern part of the Mediterranean region. Plants from coastal areas, mainly from the islands, are sometimes only slightly woody and have thin, scarcely spiny cladodes (var. *gracilis* Baker).

4. A. aphyllus L., *Sp. Pl.* 314 (1753). Stem up to 100 cm, woody, green. Stem and branches smooth or papillose-scabrid. Cladodes (5–)10–20(–30) mm, distinctly unequal, in fascicles of 3–7, patent, strongly spiny. Pedicels 2·5–5 mm, surrounded by bracteoles at the base. Nodes with 3–6(–9) flowers mixed with the cladodes. Perianth-segments (2·5–)3–4 mm. Berry *c.* 8 mm, black, with 1–3 seeds. $2n=40$. *Mediterranean region, Portugal and N.W. Spain.* ?Co Cr Gr Hs It Lu Sa Si Tu.

5. A. stipularis Forskål, *Fl. Aegypt.* 72 (1775) (*A. horridus* L. fil.). Stem up to 60 cm, woody. Stem and branches with numerous smooth to papillose ridges. Cladodes (10–)15–30(–60) mm, solitary or in fascicles of 2–3, patent, strongly spiny. Pedicels 1–3(–5) mm, with 0–2 bracteoles at the base. Nodes with 2–6(–8) flowers mixed with the cladodes. Perianth-segments 3·5–4 mm. Berry 5·5–8 mm, with 1–4 seeds. $2n=20$. *Mediterranean region, C. & S. Portugal.* Bl Cr Gr Hs It Lu Sa Si.

6. A. verticillatus L., *Sp. Pl.* ed. 2, 450 (1762). Stem up to 250 cm. Branches patent or deflexed, strongly sulcate, smooth to papillose. Cladodes (10–)20–50(–60) × 0·5–1·2 mm, in fascicles of (1–)10–20(–30), strongly triquetrous, papillose on the margins. Pedicels 1·5–5 mm. Nodes with (1–)2–10(–20) flowers mixed with the cladodes. Perianth-segments 2–3·5 mm. Berry 5·5–8 mm, black, with 1–3 seeds. *S.E. Europe.* Bu Gr Ju Rm Rs (W, K, E) Tu.

In populations from the Balkan peninsula the stems, branches and cladodes are covered with longish cartilaginous papillae.

7. A. bresleranus Schultes in Schultes & Schultes fil., *Syst. Veg.* **7**: 323 (1829). Stem up to 50 cm, herbaceous, flexuous. Branches flexuous. Cladodes (5–)10–20 × 0·5–1·5 mm, very unequal, in fascicles of (1–)3(–6), patent, terete, spiny. Pedicels 1–3 mm, articulate below the perianth. Nodes with (1–)2 flowers. Perianth-segments 3·5–5 mm. Berry 6–7 mm, black, with 1–2 seeds. *S.E. Russia.* Rs (E). (*S.W. & S.C. Asia.*)

8. A. persicus Baker, *Journ. Linn. Soc. London* (*Bot.*) **14**: 603 (1875). Stem up to 200 cm, herbaceous, flexuous, smooth. Branches flexuous, patent or deflexed, smooth. Cladodes 10–40 (–55) × 0·3–0·8 mm, in fascicles of 1–6(–8), flattened to terete, slightly falcate. Pedicels 3–10 mm. Nodes with 1–2(–4) flowers. Berry 5–7 mm, red, with 1–3 seeds. *Saline and calcareous soils. S.E. Russia* (*Volga delta*), *W. Kazakhstan.* Rs (E). (*W. & C. Asia.*)

9. A. brachyphyllus Turcz., *Bull. Soc. Nat. Moscou* **13**: 78 (1840) (*A. pallasii* Miscz., *A. trichophyllus* auct. ross., non Bunge). Stem up to 80 cm, striate-papillose. Cladodes 4·5–10(–20) mm, in fascicles of 3–5(–10), ascending, falcate. Pedicels (4–)5–10 mm. Nodes with 2 flowers, usually not mixed with the cladodes. Perianth-segments 4–6 mm. Berry 4·5–7 mm, red. $2n=40$. *Calcareous and saline soils. S. part of U.S.S.R., E. Romania.* Rm Rs (W, K, E).

10. A. kasakstanicus Iljin in Komarov, *Fl. URSS* **4**: 747 (1935). Stem up to 70 cm, herbaceous. Stem and branches longitudinally striate-papillose. Cladodes 20–40(–60) × 0·7–1 mm, in fascicles of 3–6, terete. Pedicels 4–6 mm. Nodes with 2–4 flowers mixed with the cladodes. Perianth-segments 5–6 mm. Berry 6–8 mm,

red, with 3–4 seeds. *Calcareous soils. S.E. part of U.S.S.R., Krym.* Rs (K, E).

11. A. maritimus (L.) Miller, *Gard. Dict.* ed. 8, no. 2 (1768) (*A. scaber* Brignoli, *A. levinae* Klokov). Stem up to 100 cm, herbaceous, erect. Stem and branches longitudinally striate-papillose. Cladodes (5–)10–30(–50) × 0·3–0·8 mm, in fascicles of (3–)4–7(–11), ascending to patent, somewhat flattened. Pedicels (4·5–)6–10(–12) mm. Nodes with (1–)2(–4) flowers usually not mixed with the cladodes. Perianth-segments 4–6 mm. Berry (5–)6–12(–13) mm, red, with 2–6 seeds. $2n=40$. *Sandy soils, mainly near the coast. Mediterranean region and S.E. Europe.* Al ?Bu Co Ga Gr Hs It Ju Rs (W, K) Sa ?Si.

12. A. litoralis Steven, *Bull. Soc. Nat. Moscou* **30(3)**: 92 (1857). Stem up to 60 cm, herbaceous, straight, smooth. Branches patent to ascending, smooth. Spur *c.* 0·5 mm. Cladodes (5–)15–30 × 0·5–1 mm, in fascicles of 4–8(–10), flattened. Pedicels 7–12 mm. Nodes with 1–4 flowers usually mixed with the cladodes. Perianth-segments 5–6·5 mm. Berry 5–7 mm, red. *Coastal rocks.* ● *Krym.* Rs (K).

Doubtfully distinct from **13(a)**; further information is required.

13. A. officinalis L., *Sp. Pl.* 313 (1753) (*A. tenuifolius* auct., non Lam.). Herbaceous. Stem and branches smooth. Spur (0·5–)1–3(–4) mm. Cladodes in fascicles of 4–15(–25), somewhat flattened to filiform, usually appressed. Nodes with (1–)2(–3) flowers. Perianth-segments (4–)4·5–6·5(–10) mm. Berry 6–10 mm, red, with (1–)2–4(–6) seeds. *Most of Europe, northwards to S.E. Ireland and S. Denmark; widely cultivated as a vegetable and naturalized within its native range and further north.* ?Al Au Be Br Bu Co Cz Da Ga Ge Gr Hb He Ho Hs Hu It Ju Lu Po Rm Rs (C, W, K, E) Si *Su Tu [Fe No Rs (B) Sa].

A very polymorphic species. The following two subspecies can be recognized:

(a) Subsp. **officinalis** (*A. polyphyllus* Steven, *A. caspicus* Hohen.): Stem 40–200 cm, erect, with long internodes. Cladodes (5–)10–25(–30) mm. Pedicels (6·5–)10–20(–25) mm. Flowers rarely mixed with the cladodes. $2n=20$. *Almost throughout the range of the species.*

(b) Subsp. **prostratus** (Dumort.) Corb., *Nouv. Fl. Normand.* 568 (1894): Stem 10–30(–40) cm, decumbent, with short internodes. Cladodes 5–10 mm. Pedicels 2–6(–8) mm. Flowers often mixed with the cladodes. $2n=40$. *Maritime sands and coastal rocks.* ● *Coasts of W. Europe, from N. Spain to S.E. Ireland and N.W. Germany.*

14. A. pseudoscaber Grec., *Consp. Fl. Roman.* 556 (1898). Stem up to 200 cm, herbaceous, erect. Stem and branches longitudinally striate-papillose. Cladodes 5–15(–20) × 0·2–0·5 mm, in fascicles of 10–20(–25), smooth to slightly scabrid. Pedicels (7–)10–26 mm, longer than cladodes. Nodes with 1–2(–4) flowers mixed with cladodes. Perianth-segments 4–6 mm. Berry 7–11 mm, red, with 1–4 seeds. ● *From N.E. Jugoslavia to W. Ukraine.* ?Bu Ju Rm Rs (W).

15. A. tenuifolius Lam., *Encycl. Méth. Bot.* **1**: 294 (1783). Stem up to 100 cm, herbaceous, erect. Stem and branches smooth. Cladodes 10–25(–30) × 0·1–0·2 mm, in fascicles of 15–40(–80), filiform, ascending to patent. Pedicels (7–)10–25(–30) mm, articulate below the perianth. Nodes with 1–2 flowers mixed with the cladodes. Perianth-segments (5–)6–8 mm. Anthers 0·4–0·5 mm, $\frac{1}{6}$–$\frac{1}{4}$ as long as filaments. Berry 10–16 mm, red, with 2–6 seeds. $2n=20$. *S. & S.C. Europe; some isolated stations in N.C. France.* Au Bu Ga ?Gr He It Ju Rm Rs (?C, W, K) ?Sa ?Si Tu.

49. Ruscus L.[1]

Evergreen, rhizomatous, perennial herbs or shrubs with simple or branched stems of limited growth arising from the axils of rhizome scales. Cauline leaves small, scarious, subtending branches or leaf-like cladodes. Inflorescence a condensed raceme in the axil of a bract borne medially on the cladode. Flowers unisexual, emerging singly; perianth-segments 4–5 mm, free, dull green, with violet spots. Stamens with filaments united into a dark violet column. Ovary unilocular, rarely partly septate; fruit a red berry 10–15 mm; seeds 1–4.

Literature: P. F. Yeo, *Notes Roy. Bot. Gard. Edinb.* **28**: 237–264 (1968).

1 Cladodes usually not more than 4 cm, spinose at apex; stems much-branched **1. aculeatus**
1 Cladodes usually more than 4 cm, unarmed; stems simple or with one lateral branch
2 Bract 1–2 mm wide, lanceolate to linear, often scarious **2. hypophyllum**
2 Bract 3·5–13 mm wide, ovate to lanceolate, herbaceous **3. hypoglossum**

1. R. aculeatus L., *Sp. Pl.* 1041 (1753) (incl. *R. ponticus* Woronow). Subdioecious. Stems 10–100 cm, with 7–20 branches. Cladodes 1–4(–6) cm, broadly ovate to lanceolate, spinose at apex. Inflorescences adaxial. Staminal column *c.* 2 mm. $2n=40$. *Scrub, woods and sea-cliffs. W., S. & S.C. Europe, northwards to C. England and C. Hungary.* Al Az Bl Br Bu Co Cr Ga Gr He Hs Hu It Ju Lu Rm Rs (K) Sa Si Tu.

Widely cultivated for ornament. Highly fertile andromonoecious clones occur in cultivation.

R. hyrcanus Woronow, *Monit. Jard. Bot. Tiflis* **7**: 33 (1907), with branches at only one node, is reported from one locality in Krym (E. Transcaucasia, N. Iran).

2. R. hypophyllum L., *Sp. Pl.* 1041 (1753). Monoecious. Stems 10–70(–100) cm, simple, rarely with one lateral branch, erect. Cladodes (2·2–)5–9(–12·5) × (0·9–)1·2–5·5(–7) cm, ovate, occasionally lanceolate to obovate-lanceolate. Inflorescences adaxial, abaxial or both. Bract 4·5–9(–13) × 1–2 mm, scarious or sometimes herbaceous, with 1–3(–4) veins. Staminal column 2·75–4 mm. *Woods. S. & E. Spain; S.E. Sicilia; doubtfully native in S.E. France (Îles d'Hyères).* *Ga Hs ?It Si. (*N.W. Africa.*)

3. R. hypoglossum L., *Sp. Pl.* 1041 (1753). Dioecious. Stems 20–40 cm, simple, suberect or slightly spreading. Cladodes 3–10(–11) × 1–3·3(–5·2) cm, elliptical to obovate-lanceolate, the lower sometimes ovate to broadly ovate. Inflorescences adaxial. Bract 11·5–33 × 3·5–13 mm, herbaceous, with 5–11(–15) veins. Staminal column 2·5–3·5 mm. $2n=40$. *Deciduous woods and scrub. S.E. & E.C. Europe, extending westwards to N.W. Italy.* Au Bu Cz Gr Hu It Ju Rm Rs (K) Tu.

R. microglossus Bertol., *Fl. Ital.* **10**: 401 (1855), is probably a hybrid of garden origin between **2** and **3**. It has apparently been naturalized in S. Italy since the 19th century, and in S.E. France and W. Jugoslavia more recently. It is female, with stems up to 60 cm, cladodes usually obovate-lanceolate to oblanceolate, the inflorescences adaxial or abaxial, and the bract 5·5–15 × 1·5–3 mm, herbaceous, with 3–4 veins.

[1] By P. F. Yeo.

50. Smilax L.[1]

Dioecious, perennial, glabrous, often prickly, creeping, climbing or scrambling herbs, often woody below. Leaves alternate, simple, rounded to sagittate at base, reticulately veined between several parallel veins; petiole with 2 tendrils near base. Flowers in umbels or fascicles which are solitary or arranged on an elongated axis. Perianth-segments 6, free, small, white or greenish. Stamens 6, free, deciduous and abortive in female flowers. Ovary superior, 3-locular; stigmas 3, sessile; ovules 1–2 per loculus. Berry 1- to 3-seeded; seeds smooth, shiny.

Literature: S. Ferri, *Webbia* **21**: 475–486 (1966). P. Vernet, *Bull. Soc. Bot. Fr., Mém.* **1966**: 140–146 (1967).

1 Leaves cordate, hastate or sagittate at base; flowers in fascicles or subsessile umbels arranged along terminal and axillary axes **1. aspera**
1 Leaves rounded or subcordate at base; flowers in solitary, axillary, long-pedunculate umbels
2 Stems and branches angled, prickly; leaves membranous to subcoriaceous, broadly ovate or orbicular; petiole not thickened towards apex **2. excelsa**
2 Stems terete, the branches indistinctly angled above, unarmed; leaves coriaceous, elliptical, lanceolate or ovate; petiole often gradually thickened and rugose in distal ⅓–½ **3. canariensis**

1. S. aspera L., *Sp. Pl.* 1028 (1753) (*S. mauritanica* Poiret, *S. nigra* Willd.). Stems up to 15 m, creeping, scrambling or climbing, angled, unarmed or sparsely to densely prickly. Leaves up to 11 × 10 cm (often smaller), usually coriaceous, narrowly to broadly lanceolate, triangular, oblong or ovate-lanceolate (rarely reniform), often abruptly narrowed above the cordate, hastate or sagittate (rarely more or less truncate) base, unarmed or with prickles on petiole, margin and principal veins beneath; petiole not thickened towards apex. Flowers 5–30 in fascicles or subsessile umbels on terminal and axillary axes 2–15(–45) cm. Perianth-segments 2–4 mm. Berry red or black. $2n = 32$. *S. Europe.* Al Az Bl Co Cr Ga Gr Hs It Ju Lu Sa Si ?Tu.

2. S. excelsa L., *Sp. Pl.* 1029 (1753). Stems up to 20 m, scrambling or climbing, angled, sparsely to densely prickly. Leaves up to 12·5 × 9 cm, membranous or subcoriaceous, broadly ovate or orbicular, the base rounded or subcordate, unarmed or with minute prickles on the margin and midvein beneath; petiole not thickened towards apex. Flowers 4–12 in simple, solitary, axillary umbels; peduncles 7–20 mm. Perianth-segments 4–5(–6) mm. Berry red. *E. half of Balkan peninsula.* Bu Gr Tu.

3. S. canariensis Brouss. ex Willd., *Sp. Pl.* **4**: 784 (1806). Like **2** but main stems terete, the branches indistinctly angled above, unarmed; leaves coriaceous, elliptical, lanceolate or ovate, unarmed; petiole often gradually rugose-thickened in distal ⅓–½. *Açores.* Az. (*Islas Canarias.*)

CLXXXIV. AGAVACEAE[2]

Trees, shrubs or large, scapose herbs; leaves ensiform, coriaceous, very fibrous, mostly aggregated into dense rosettes. Inflorescence a large terminal panicle; flowers hermaphrodite, regular. Perianth-segments 6, petaloid, free or connate at base. Stamens 6. Ovary superior or inferior, 3-locular. Fruit a loculicidal capsule, rarely indehiscent and more or less succulent; seeds numerous.

A family founded primarily on cytological and anatomical characters, and almost impossible to define in morphological terms; the description above is applicable only to the genera naturalized in Europe. These agree to some extent in habit, but most authors include in the family herbaceous genera such as *Polianthes*, in which the leaves are neither large nor coriaceous.

1 Leaves spinose-dentate; flowers erect; stamens exserted **1. Agave**
1 Leaves entire; flowers nodding; stamens included
2 Ovary inferior; anthers large, versatile, well differentiated from filament **2. Furcraea**
2 Ovary superior; anthers small, scarcely differentiated from filament **3. Yucca**

1. Agave L.[3]

Rhizomatous herbs or short-stemmed shrubs, usually stoloniferous. Flowers tubular, erect. Hypanthial tube half as long to nearly as long as perianth-segments. Stamens and style strongly exserted; filaments tapering gradually from base to apex; anthers large, introrse, versatile. Ovary inferior; style cylindrical; stigma small, 3-lobed. Seeds flat.

It is probable that other species, in addition to the two described below, are locally naturalized in S.E. France and N.W. Italy, but reliable information is not available.

Leaves ± glaucous, with terminal spine 2–3 cm; peduncle equalling or shorter than the panicle **1. americana**
Leaves dark green, with terminal spine 4–6(–10) cm; peduncle 2–3 times as long as the panicle **2. atrovirens**

1. A. americana L., *Sp. Pl.* 323 (1753). Very robust, stoloniferous herb; stem scarcely developed. Leaves 1–2 m × 15–25 cm, constricted above the broad, sheathing base, glaucous, remotely spinose-dentate, with a stout, blackish terminal spine 2–3 cm long. Scape (including inflorescence) 4–7(–10) m. Peduncle 8–15 cm in diameter, woody at maturity, equal to or shorter than the panicle, bearing triangular, leaf-like bracts. Panicle pyramidal; flowers aggregated in dense clusters at the ends of horizontal branches; leafy buds sometimes present in axils of bracteoles, replacing some or all of the flowers. Flowers (including ovary) 70–90 mm; perianth-segments linear-oblong, obtuse, erect, greenish-yellow. Filaments 70–80 mm, inserted on the hypanthial tube; anthers 30–35 mm. Capsule oblong, trigonous. *Widely naturalized, mainly near the coast, in the Mediterranean region, C. & S. Portugal and Açores.* [Al Az Bl Co Cr Ga Gr Hs It Ju Lu Sa Si.] (*Mexico.*)

A rosette requires at least 10 years' growth before flowering, and often much longer. After flowering it dies, but most plants perennate by stolons.

The appearance of leafy buds in the inflorescence appears to be, at least in part, a response to injury to the flowers by frost.

2. A. atrovirens Karwinski ex Salm-Dyck, *Hort. Dyck.* 302 (1834). Like **1** but leaves up to 40 cm wide, dark green, with

[1] By R. A. DeFilipps. [2] Edit. D. A. Webb. [3] By D. A. Webb.

terminal spine 4–6(–10) cm; peduncle 2–3 times as long as the panicle. *Naturalized near the coast in S. & C. Portugal and perhaps elsewhere.* [Lu.] (*Mexico.*)

2. Furcraea Vent.[1]
(*Fourcroya* auct.)

Shrubs or trees; stem erect, simple. Flowers in clusters of 2–3, nodding, campanulate. Hypanthial tube short, sometimes almost obsolete. Stamens and style included; filaments strongly dilated at base; anthers introrse, versatile. Ovary inferior; style trigonous, somewhat dilated at base; stigma very small.

1. F. foetida (L.) Haw., *Syn. Pl. Succ.* 73 (1812) (*F. gigantea* Vent.). Monocarpic. Stem up to 1 m. Leaves 1–2 m × 10–15 cm, entire, erect to patent, apiculate but scarcely pungent, yellowish-green, persistent for some time after withering. Inflorescence (with peduncle) 6–12 m; peduncle equalling or shorter than panicle. Bracts of peduncle leaf-like, coriaceous, those of panicle brown, scarious. Pedicels 6–12 mm, articulated. Perianth-segments 20–25 mm, lanceolate, greyish-white; ovary with hypanthial tube *c.* 15 mm. Flowers infertile in Europe; reproduction is effected by leafy bulbils which replace some of the flowers. *Planted for hedges in S. Portugal and naturalized.* [Lu.] (*Tropical America.*)

3. Yucca L.[1]

Leaves usually pungent. Flowers pedicellate, nodding or pendent. Perianth campanulate, white, of 6 free segments. Stamens and style included. Filaments wide, fleshy; anthers small, more or less immersed in apex of filament. Ovary superior; style cylindrical, usually short and thick; stigma shortly 3-lobed. Fruit a capsule or fleshy and berry-like.

Literature: W. Trelease, *Ann. Rep. Missouri Bot. Gard.* **13**: 42–116 (1902). G. Molon, *Le Yucche.* Milano. 1914.

Stoloniferous herb, without woody stem above ground; leaves with conspicuous filaments shredding from their margins **1. filamentosa**

Shrub, with woody stem above ground; leaves with few marginal filaments or none **2. gloriosa**

1. Y. filamentosa L., *Sp. Pl.* 319 (1753). Shortly stoloniferous, scapose herb, with tufts of suberect, slightly glaucous leaves 45–60 × 4–5 cm, with whitish margins from which white, fibrous filaments are constantly separating. Panicle usually *c.* 100 cm, with ascending, somewhat flexuous branches. Flowers creamy-white; perianth-segments 35–50 × 15–30 mm, oblong-lanceolate. Fruit dry, dehiscent. *Naturalized from gardens in S.E. France and N.W. Italy.* [Ga It.] (*E. United States.*)

2. Y. gloriosa L., *Sp. Pl.* 319 (1753). Shrub; stem 50–120(–200) cm, usually branched in older plants. Leaves 50–100 × 5–8 cm, very rigid and with strong, pungent apex, dark green, with reddish-brown margins which are remotely denticulate in young leaves but usually entire at maturity. Peduncle 50–100 cm, with several bract-like leaves. Panicle 100–150 cm; branches patent to ascending. Flowers white, usually tinged with purplish-red; perianth-segments 40–60 mm. Fruit dry but indehiscent, with 6 prominent ribs. *Naturalized on sand-dunes and waste ground in N. & C. Italy.* [It.] (*S.E. United States.*)

Y. aloifolia L., *Sp. Pl.* 319 (1753), also from the S.E. United States, which is like **2** but with taller and usually simple stem, narrower leaves with whitish, denticulate margins, shorter peduncle and succulent fruit, has been recorded as a garden escape from several parts of Italy, but does not appear to be fully naturalized.

CLXXXV. AMARYLLIDACEAE[2]

Glabrous, bulbous, scapose (rarely more or less acaulescent), perennial herbs. Leaves all basal, linear to lorate or oblanceolate, often distichous. Flowers in an umbel (sometimes reduced to a single flower), subtended by a spathe of 1 or more usually scarious valves. Flowers hermaphrodite, regular or slightly zygomorphic. Perianth of 6 petaloid segments, arising from the apex of the ovary, or from a hypanthial tube. Corona sometimes present. Stamens 6. Ovary inferior, 3-locular; stigma capitate or shortly 3-lobed. Fruit a loculicidal or irregularly dehiscent capsule, sometimes with fleshy pericarp and transitional to a berry.

Literature: J. G. Baker, *Handbook of the Amaryllideae.* London. 1888.

1 Corona present, in the form of a tube or collar
 2 Lower part of stamens adnate to corona, the upper part widely exserted from it **7. Pancratium**
 2 Stamens free from corona, and usually included in it or in hypanthial tube **6. Narcissus**
1 Corona absent, or represented by inconspicuous scales
 3 Flowers yellow
  4 Hypanthial tube at least 5 mm; leaves at least 5 mm wide **2. Sternbergia**
  4 Hypanthial tube *c.* 2 mm; leaves *c.* 1 mm wide **6. Narcissus**
 3 Flowers white or pink
  5 Flowers stellate, erect **5. Lapiedra**
  5 Flowers campanulate, nodding or inclined
   6 Perianth-segments 50–80 mm **1. Amaryllis**
   6 Perianth-segments not more than 25 mm
    7 Perianth-segments all alike **3. Leucojum**
    7 Outer perianth-segments ± acute, the inner much shorter and emarginate **4. Galanthus**

1. Amaryllis L.[1]

Umbel of 4–8(–12) flowers; spathe 2-valved; each flower subtended by a linear bracteole. Flowers campanulate, bright pink, fragrant, inclined or somewhat nodding, usually slightly zygomorphic. Hypanthial tube present; corona absent. Filaments much longer than anthers. Fruit subglobose, dehiscing irregularly; pericarp somewhat fleshy; seeds rather few.

1. A. bella-donna L., *Sp. Pl.* 293 (1753). Bulb *c.* 10 cm in diameter. Leaves 30–45 cm × 15–30 mm, appearing after anthesis. Peduncle 30–60 cm, stout. Pedicels 2–4 cm. Hypanthial tube *c.* 10 mm, broadly infundibuliform. Perianth-segments 50–80 mm, obovate-cuneate, erecto-patent. Flowering in autumn. *Widely cultivated for ornament; a frequent garden escape in Portugal and the Açores, and locally naturalized.* [Az Lu.] (*South Africa.*)

[1] By D. A. Webb. [2] Edit. D. A. Webb.

2. Sternbergia Waldst. & Kit.[1]

Flowers solitary, or in umbels of 2(–3); spathe 1-valved, tubular below. Flowers campanulate to stellate, yellow, erect. Hypanthial tube present; corona absent. Filaments much longer than anthers. Fruit subglobose, intermediate between a capsule and berry; seeds numerous.

Scape 1–2 cm, mostly underground; hypanthial tube nearly as long as perianth-segments **1. colchiciflora**
Scape usually at least 4 cm at anthesis; hypanthial tube less than ¼ as long as perianth-segments **2. lutea**

1. S. colchiciflora Waldst. & Kit., *Pl. Rar. Hung.* **2**: 172 (1803–1804). Bulb 1–2 cm in diameter. Leaves 4–10 cm × 2–5 mm, linear, obtuse, very minutely denticulate or fimbriate, appearing after anthesis. Scape 1–2 cm at anthesis, concealed by the tunics of the bulb and mostly underground, elongating to 4–6 cm in fruit. Spathe 2·5–5 cm. Hypanthial tube 25–30 mm, slender. Perianth-segments 30–40 × 2–5 mm, linear to narrowly oblanceolate, erect or connivent, later patent. Fruit 8–10 mm in diameter. Flowering in autumn. $2n = 20, 26$. *Dry, stony ground. S. Europe, extending northwards to Hungary.* Bu Ga Gr Hs Hu It Ju Rm Rs (W, K) Si.

2. S. lutea (L.) Ker-Gawler ex Sprengel, *Syst. Veg.* **2**: 57 (1825) (*Oporanthus luteus* (L.) Herbert). Like **1** but leaves up to 15 mm wide, subentire to minutely crenulate, appearing before or during anthesis; scape 4–10 cm at anthesis, the upper part not concealed; hypanthial tube (2–)5–8 mm, obconical; perianth-segments 4–15 mm wide, linear to oblong-elliptical. *Stony slopes and dry scrub. Mediterranean region.* Al Bl Cr Gr Hs It Ju Sa Si [Ga].

(a) Subsp. **lutea**: Leaves 4–15 mm wide, usually entire or obscurely crenulate. Perianth-segments 7–15 mm wide. $2n = 22$. *Almost throughout the range of the species.*

(b) Subsp. **sicula** (Tineo ex Guss.) D. A. Webb, *Bot. Jour. Linn. Soc.* **76**: 358 (1978) (*S. sicula* Tineo ex Guss.): Leaves 3–5 mm wide, minutely but distinctly crenulate. Perianth-segments 4–8 mm wide. $2n = 18$. *S. Italy and Sicilia; S. Greece and Aegean region.*

3. Leucojum L.[1]

Umbel of 1–5(–7) flowers; spathe 1- or 2-valved. Flowers white or pale pink, campanulate, nodding. Hypanthial tube and corona absent. Perianth-segments all more or less alike. Filaments usually much shorter than anthers; anthers not apiculate. Capsule pyriform to subglobose, erect; pericarp somewhat fleshy; seeds numerous.

Literature: F. C. Stern, *Snowdrops and Snowflakes*. London. 1956.

1 Leaves 5–25 mm wide; scape stout, with central cavity (sometimes small)
2 Scape usually exceeding the leaves; flowers usually solitary; seeds whitish, with strophiole **7. vernum**
2 Scape usually not exceeding the leaves; umbel of (1–)2–5(–7) flowers; seeds black, without strophiole **8. aestivum**
1 Leaves not more than 3 mm wide, often filiform; scape slender, solid
3 Flowering in August to November; leaves appearing after or towards the end of anthesis
4 Perianth white; epigynous disc prominent, 6-lobed; seeds with strophiole **6. valentinum**
4 Perianth pink, at least at the base; epigynous disc inconspicuous, entire; seeds without strophiole
5 Longer pedicels 15–25 mm; spathe 1-valved; umbel often with 2–3 flowers **1. autumnale**
5 Longer pedicels 2–5 mm; spathe 2-valved; flowers usually solitary **2. roseum**
3 Flowering in January to April; leaves usually well developed at anthesis
6 Seeds with strophiole **5. nicaeense**
6 Seeds without strophiole
7 Pedicels not exceeding the spathe; perianth-segments 8–11 mm, not apiculate; style shorter than stamens **3. longifolium**
7 Longest pedicel usually exceeding the spathe; perianth-segments 12–25 mm, the outer 3 apiculate; style slightly exceeding stamens **4. trichophyllum**

1. L. autumnale L., *Sp. Pl.* 289 (1753). Bulb 8–15 mm in diameter. Leaves 12–16 cm, filiform, appearing during or just after anthesis. Scape 7–15(–25) cm, very slender. Umbel of 1–3 flowers; spathe 10–20 mm, 1-valved; longer pedicels 15–25 mm, the longest usually exceeding the spathe. Perianth-segments 9–14 mm, white, tinged with pink at the base, rarely pink throughout, the outer 3 apiculate or 3-dentate. Style filiform, slightly exceeding the stamens. Seeds black, without strophiole. Flowering in autumn. $2n = 14$. *Portugal, W. & C. Spain; Sardegna, Sicilia.* ?Cr Hs Lu Sa Si.

2. L. roseum F. Martin, *Biblioth. Phys.-Econ.* ser. 2, **1**: 344 (1804). Bulb 10–15 mm in diameter. Leaves 2–2·5 cm, narrowly linear, developed after anthesis. Scape 4–12 cm, filiform. Flowers solitary (very rarely 2–3); spathe 5–10 mm, 2-valved; pedicels 1–5 mm. Perianth-segments 5–9 mm, pink, acute to somewhat apiculate. Style filiform, considerably exceeding the stamens. Seeds black, without strophiole. Flowering in autumn. $2n = 16$. *Dry pastures and rocky ground.* ● *Corse, Sardegna.* Co Sa.

3. L. longifolium (Gay ex M. J. Roemer) Gren. in Gren. & Godron, *Fl. Fr.* **3**: 252 (1855). Bulb 7–10 mm in diameter. Leaves 12–25 cm × 1–2·5 mm, narrowly linear, well-developed at anthesis. Scape 15–27 cm, fairly slender. Umbel of 1–4 flowers; spathe 15–25 mm, 2-valved; longest pedicel usually exceeding the spathe. Perianth-segments 8–11 mm, white, not apiculate. Style filiform, shorter than the stamens. Seeds without strophiole. Flowering in spring. $2n = 16$. *Rocky ground and dry slopes.* ● *Corse.* Co.

4. L. trichophyllum Schousboe, *Vextr. Marokko* 154 (1800) (incl. *L. grandiflorum* DC.). Bulb 10–20 mm in diameter. Leaves 4–12(–20) cm, narrowly linear, developed before anthesis. Scape 8–30 cm, slender. Umbel of 2–4 flowers; spathe 15–30 mm, 2-valved; pedicels up to 60 mm, the longest usually exceeding the spathe. Perianth-segments 12–20(–25) mm, white, sometimes tinged with pink, the outer 3 apiculate. Style filiform, slightly exceeding the stamens. Seeds without strophiole. Flowering in spring. $2n = 14$. *Dry, sandy ground. S.W. & S.C. Spain, S. & C. Portugal.* Hs Lu.

5. L. nicaeense Ardoino, *Fl. Alp. Marit.* 371 (1867) (*L. hiemale* DC. pro parte). Bulb 15–20 mm in diameter. Leaves 10–30 cm × 1·5–2·5 mm, narrowly linear, developed before anthesis. Scape 5–18 cm, slender. Flowers usually solitary, rarely 2–3; spathe 15–25 mm, 2-valved; pedicels 10–18 mm, not exceeding the spathe. Perianth-segments 8–12 mm, white, the outer 3 apiculate. Epigynous disc prominent, 6-lobed. Style filiform, slightly exceeding the stamens. Seeds 2–3 mm, black, with strophiole. Flowering in spring. $2n = 18$. ● *S.E. France (from Nice to the Italian frontier).* Ga ?It.

[1] By D. A. Webb.

6. L. valentinum Pau, *Bol. Soc. Arag. Ci. Nat.* **13**: 42 (1914). Like **5** but flowering in late summer or autumn; spathe sometimes 1-valved; leaves filiform, developing after anthesis; perianth-segments 11–14 mm. $2n=16$. ● *E. Spain (N. of Valencia); N.W. Greece (Ionioi Nisoi).* Gr Hs ?Si.

Resembles **1** in time of flowering and general habit, and previously confused with it; very distinct, however, in structure of epigynous disc and seed. Perhaps overlooked elsewhere in Mediterranean region; similar plants have been reported from Sicilia.

7. L. vernum L., *Sp. Pl.* 289 (1753). Bulb 15–30 mm in diameter. Leaves 10–25 cm × 5–25 mm, lorate, appearing during anthesis. Scape 12–35 cm, usually exceeding the leaves, stout, with a small central cavity and 2 narrow wings. Flowers usually solitary, rarely 2; spathe 25–40 mm, 1-valved, convolute below, about equalling the pedicel. Perianth-segments 15–25 mm, white with a green or yellow spot just below the thickened apex. Style clavate, slightly exceeding the stamens. Seeds *c.* 7 mm, whitish, with strophiole. Flowering in spring. $2n=20$, 22. *Damp or shady places.* ● *C. Europe, extending locally to Belgium, the Pyrenees, N. Italy and C. Jugoslavia; cultivated for ornament and occasionally naturalized.* Au Be Cz Ga Ge He Hs Hu It Ju Po Rm Rs (W) [Br Da Ho].

8. L. aestivum L., *Syst. Nat.* ed. 10, **2**: 975 (1759). Bulb 25–40 mm in diameter. Leaves up to 10 cm × 5–20 mm, broadly linear. Scape 35–60 cm, equalling the leaves or slightly shorter, stout, hollow, compressed, 2-winged. Umbel of (1–)2–5(–7) flowers; spathe 30–50 mm, 1-valved; pedicels 25–70 mm, the longest equalling or exceeding the spathe. Perianth-segments white, with a green spot just below the thickened apex. Style slightly clavate, usually exceeding the stamens. Seeds 5–7 mm, black, without strophiole; testa spongy. *Marshes and wet meadows. From Ireland, the Netherlands and Czechoslovakia southwards to Sardegna, Greece and Krym.* Al Au Be Bl Br Bu Co Cz Ga Ge Gr Hb He Ho Hu It Ju Rm Rs (W, K) Sa Tu [Da Hs].

Widely cultivated for ornament, and naturalized both within and outside its native range.

(a) Subsp. **aestivum**: Robust. Leaves 7–20 mm wide. Wings of scape with hyaline, remotely denticulate margin. Umbel of (2–)3–5(–7) flowers. Spathe 7–11 mm wide. Perianth-segments 13–22 mm. Flowering in late spring. $2n=22$, 24. *Throughout the range of the species except the Mediterranean islands.*

(b) Subsp. **pulchellum** (Salisb.) Briq., *Prodr. Fl. Corse* **1**: 323 (1910) (*S. pulchellum* Salisb.): Less robust. Leaves 5–12 mm wide. Wings of scape entire, without hyaline margin. Umbel of (1–)2–4 flowers. Spathe 4–6 mm wide. Perianth-segments 8–14 mm. Flowering 3–4 weeks earlier than subsp. (a). $2n=22$. *W. Mediterranean region.*

4. Galanthus L.[1]

Leaves 2, the base enclosed in a tubular, membranous sheath. Flowers solitary, white, nodding. Spathe apparently 1-valved (actually of 2 connate valves). Hypanthial tube and corona absent. Outer perianth-segments acute to subobtuse, with short claw, erecto-patent; inner segments ⅓ to ½ as long as outer, deeply emarginate, cuneate, erect, with a green patch near the apex and sometimes also at the base. Filaments much shorter than anthers; anthers apiculate. Capsule ellipsoid to subglobose. Seeds with strophiole.

[1] By D. A. Webb.

The vernation of the leaves is an important taxonomic character; it can be deduced in all but fully mature leaves from an inspection of the basal part still enclosed in the sheath. The colour of the leaves (glaucous or not) is said to be correlated with a difference in the shape of the epidermal cells, those of glaucous leaves being rhombic and of bright green leaves narrowly rectangular.

Literature: Z. T. Artiushenko, *Bot. Žur.* **50**: 1430–1447 (1965); **51**: 1437–1451 (1966). D. Delipavlov, *Naučni Trud. Agron. Fak. Plovdiv* **17**: 205–209 (1968); *Izv. Bot. Inst. (Sofia)* **21**: 161–168 (1971). P. von Gottlieb-Tannenhain, *Abh. Zool.-Bot. Ges. Wien* **2(4)**: 1–95 (1904). F. C. Stern, *Snowdrops and Snowflakes.* London. 1956.

1 Leaves bright, shining green, not glaucous (Kikladhes) **4. ikariae**

1 Leaves glaucous
- 2 Leaves with replicate margins in bud **2. plicatus**
- 2 Leaves flat or with involute margins in bud
  - 3 Leaves flat in bud; inner perianth-segments with green patch only at apex **1. nivalis**
  - 3 Leaves with involute margins in bud; inner perianth-segments with green patch at base as well as apex **3. elwesii**

1. G. nivalis L., *Sp. Pl.* 288 (1753). Bulb 10–20 mm in diameter. Leaves 5–13 cm × 2·5–7 mm during anthesis, up to 25 cm at maturity, flat and parallel in bud, linear to lorate, glaucous. Scape 10–25(–40) cm. Spathe 22–30 mm, about equalling pedicel. Outer perianth-segments 12–35 × 4–11 mm, oblong-lanceolate to elliptical; inner segments 6–11 mm, without green patch at base. *Deciduous woodland and shady streamsides.* ● *From N.C. France and White Russia southwards to the Pyrenees, Sicilia and S. Greece. Cultivated for ornament and widely naturalized; the northern limit of its native range is therefore uncertain.* Al Au Bu Cz Ga Ge Gr He Hs Hu It Ju Po Rm Rs (C, W, ?K, E) Si Tu [Be Br Ho No Su].

A record from S. Spain (Sierra Nevada) requires confirmation.

Very variable; a full account of the variation is given by A. Trotter, *Ann. Bot. (Roma)* **13**: 185–236 (1915). Many cultivars exist and some are naturalized, notably cv. 'Scharlokii' (*G. scharlokii* Caspary, *G. nivalis* subsp. *scharlokii* auct.), in which the spathe-valves are separate instead of connate and are much longer than usual. Variants from S. & S.C. Europe in which all parts, and especially the perianth, are larger than usual have been distinguished under various names, notably **G. imperati** Bertol., *Fl. Ital.* **4**: 5 (1839) (*G. nivalis* subsp. *imperati* (Bertol.) Baker), but they are connected by numerous intermediates to the smaller, typical plant.

Autumn-flowering variants are known from the E. & C. Mediterranean region, and as this character shows some (though imperfect) correlation with larger perianth, two subspecies may be recognized as follows:

(a) Subsp. **nivalis**: Flowering in January to April; leaves appearing just before or during anthesis. Outer perianth-segments 12–25(–30) × 4–8(–11) mm. $2n=24$. *Throughout the range of the species except S. Greece.*

(b) Subsp. **reginae-olgae** (Orph.) Gottl.-Tann., *Abh. Zool.-Bot. Ges. Wien* **2(4)**: 32 (1904) (incl. *G. corcyrensis* (G. Beck) F. C. Stern): Flowering in October to December; leaves appearing after (more rarely during) anthesis. Outer perianth-segments 20–35 × 6–11 mm. *S.W. part of Balkan peninsula; Sicilia.*

2. G. plicatus Bieb., *Fl. Taur.-Cauc.* **3**: 255 (1819). Bulb 10–30 mm in diameter. Leaves 5–12 cm × 4–10 mm at anthesis,

up to 30 cm × 25 mm at maturity, flat and parallel in bud except for sharply replicate margins, which remain more or less revolute at maturity, linear-lorate to narrowly oblanceolate, glaucous, with a depressed, paler band on the upper surface. Scape 12–25 cm. Spathe 25–35 mm, often 2-fid at apex, shorter or longer than pedicel. Outer perianth-segments 14–28 × 4–10 mm; inner segments 7–11 mm, without a distinct green patch at the base, but with apical patch sometimes prolonged so as to cover most of the segment. Flowering in spring. $2n=24$. *Woodland and scrub. From E. Romania to Krym.* Rm Rs (W, K).

G. byzantinus Baker, *Gard. Chron.* ser. 3, **13**: 226 (1893), which differs only in the presence of a distinct green patch at the base of each inner perianth-segment, and sometimes in being less robust, has been reported from Turkey-in-Europe, but apparently in error. It is native to N.W. Anatolia, and is probably best treated as a subspecies of **2.**

3. G. elwesii Hooker fil., *Bot. Mag.* **101**: t. 6166 (1875). Bulb 10–20 mm in diameter. Leaves with incurved margins in bud, somewhat keeled towards the base, lorate to oblong, glaucous. Scape 8–27 cm. Spathe 25–40 mm, longer than pedicel. Outer perianth-segments 15–28 mm; inner segments 8–13 mm, with green patches at both apex and base. Flowering in spring. $2n=24$, 48. *Woods, scrub and rocky pastures. S.E. Europe, from C. Jugoslavia and S.W. Ukraine southwards to E. Greece.* Bu Gr Ju Rm Rs (W).

(a) Subsp. **elwesii**: Leaves 6–13 cm × 7–13 mm at anthesis, up to 20 cm × 20 mm at maturity, the larger partly enveloping the smaller, cucullate at apex, twisted or straight. Outer perianth-segments 11–15 mm wide, very strongly convex. *From S. Bulgaria northwards.*

(b) Subsp. **minor** D. A. Webb, *Bot. Jour. Linn. Soc.* **76**: 312 (1978) (*G. graecus* auct., ? an Orph. ex Boiss.): Leaves 3–8 cm × 4–8 mm at anthesis, up to 13 cm × 12 mm at maturity, with margins apposed in bud (neither leaf enveloping the other), scarcely cucullate at apex, more or less twisted at maturity. Outer perianth-segments 7–11 mm wide, flatter than in subsp. **(a)**. *Bulgaria and N. Aegean region.*

Typical plants of the two subspecies are very distinct, but intermediates occur commonly almost throughout Bulgaria, and in parts of N. Greece. They are often referred to **G. maximus** Velen., *Fl. Bulg.* 540 (1891), and have been variously treated by later authors (*G. elwesii* var. *maximus* (Velen.) G. Beck, *G. graecus* var. *maximus* (Velen.) Hayek, *G. nivalis* var. *maximus* (Velen.) Stoj. & Stefanov). The original description of *G. maximus*, however, suggests that it may represent merely a minor variant of subsp. (*a*). **G. graecus** Orph. ex Boiss., *Fl. Or.* **5**: 145 (1882) (*G. nivalis* subsp. *graecus* (Orph. ex Boiss.) Gottl.-Tann.), described from the E. Aegean region, outside the limits of Europe, appears to be intermediate between the two subspecies, though closer to subsp. **(b)**.

4. G. ikariae Baker, *Gard. Chron.* ser. 3, **13**: 506 (1893). Like **3(a)** but leaves recurved at apex, not cucullate, bright shining green; inner perianth-segments without the basal green patch but with apical patch often extending to below the middle. *Kikladhes* (*Andros, Tinos*). Gr. (*Ikaria; ?Caucasian region.*)

5. Lapiedra Lag.[1]

Umbel of 4–9 flowers; spathe 2-valved. Flowers greenish-white, erect, stellate. Hypanthial tube and corona absent. Filaments as long as anthers or somewhat shorter. Capsule depressed-globose; perianth dry; seeds few.

1. L. martinezii Lag., *Gen. Sp. Nov.* 14 (1816). Bulb up to 5 cm in diameter. Leaves up to 25 cm × 10 mm, appearing after anthesis, broadly linear, with a longitudinal pale band on upper surface. Scape up to 20 cm. Spathe 15–30 mm; pedicels 10–20 mm. Perianth-segments 8–12 mm, white, with a green stripe on outer surface, patent at anthesis, erect and persistent in fruit. Capsule 7–12 mm in diameter; seeds *c.* 5 mm, black. Flowering in late summer. $2n=22$. *Crevices of calcareous rocks. S. & S.E. Spain.* Hs.

6. Narcissus L.[1]

Flowers solitary or in umbels of 2–15, yellow, white or bi-coloured (rarely green), sometimes fragrant. Spathe 1-valved, usually scarious; bracteoles small or absent. Hypanthial tube present. Corona free from the stamens, usually conspicuous, rarely reduced to a small rim or scales. Capsule ellipsoid to subglobose; pericarp dry.

This genus exhibits, perhaps more acutely than any other, the taxonomic difficulties which arise from long-established cultivation, hybridization and selection, and subsequent escape and naturalization. For many populations, especially in S. France and N.W. Italy, it is impossible to say with confidence whether they are native or naturalized; and nearly all the early binomials are based on cultivated plants of which the origin was only guessed at. This not only gives rise to nomenclatural problems, but it means also that the geographical background for specific delimitation is confused and defective.

Cytological investigation has helped greatly in establishing the hybrid nature of taxa formerly regarded as independent species. Of the innumerable hybrids in cultivation a large number have become naturalized, at least temporarily, in a few localities (especially in places where plants of the genus are grown on a commercial scale). Only those hybrids which are long-established, widespread, not too variable, and of agreed parentage are included below.

Literature: F. W. Burbidge, *The Narcissus: its History and Culture*. London. 1875. H. W. Pugsley, *Jour. Roy. Hort. Soc.* **58**: 17–93 (1933). E. A. Bowles, *A handbook of* Narcissus. London. 1934. A. Fernandes, *Bol. Soc. Brot.* ser. 2, **25**: 113–190 (1951); *Daff. Tulip Year Book* **33**: 37–66 (1967); *V. Simposio de Flora Europaea, Trabajos y Comunicaciones* 245–284. Sevilla. 1969.

1 Flowering in autumn (September to November)
2 Perianth green **16. viridiflorus**
2 Perianth yellow or white
3 Perianth yellow; corona rudimentary, consisting of a low rim or 6 small scales; hypanthial tube 1–2 mm **1. humilis**
3 Perianth white; corona small, but forming a distinct collar; hypanthial tube at least 10 mm
4 Leaves 2–4·5 mm wide, present during anthesis; flowers in umbels of (2–)3–7 **6. elegans**
4 Leaves *c.* 1 mm wide, not present during anthesis; flowers solitary or in umbels of 2–3 **2. serotinus**
1 Flowering in winter, spring or early summer (January to June)
5 Perianth and corona white or very pale cream
6 Perianth-segments sharply deflexed **17. triandrus**
6 Perianth-segments patent or erecto-patent
7 Flowers solitary; corona at least as long as perianth
8 Leaves at least 5 mm wide; corona cylindrical **23. pseudonarcissus**
8 Leaves not more than 1·5 mm wide; corona broadly infundibuliform **21. cantabricus**

[1] By D. A. Webb.

7 Flowers in umbels of 2–15; corona much shorter than perianth
9 Leaves 8–15 mm wide; flowers 20–40 mm in diameter **4. papyraceus**
9 Leaves 3–6 mm wide; flowers 15–20 mm in diameter **5. dubius**
5 Corona pale yellow to orange; perianth white or yellow
10 Corona not more than 7·5 mm long
11 Perianth white or very pale cream
12 Flowers solitary; margin of corona red or scarious **7. poeticus**
12 Flowers usually in umbels of 2 or more; margin of corona similar to the remainder
13 Flowers usually 2; hypanthial tube 20–25 mm **29. × medioluteus**
13 Flowers usually 3–15; hypanthial tube 12–18 mm **3. tazetta**
11 Perianth pale to deep yellow
14 Hypanthial tube broadly obconical, about as long as corona; filaments curved **18. bulbocodium**
14 Hypanthial tube cylindrical or narrowly infundibuliform, considerably longer than corona; filaments straight
15 Leaves at least 5 mm wide
16 Scape terete; leaves subcylindrical, deeply canaliculate on adaxial side **30. × intermedius**
16 Scape compressed, 2-edged; leaves ±flat, not deeply canaliculate **3. tazetta**
15 Leaves not more than 4·5 mm wide
17 Perianth-segments sharply deflexed
18 Perianth-segments at least 10 mm, usually at least as long as hypanthial tube **17. triandrus**
18 Perianth-segments not more than 8 mm, much shorter than hypanthial tube **(8–11). jonquilla** group
17 Perianth-segments patent or slightly deflexed, shorter than hypanthial tube
19 Leaves smooth and rounded on abaxial surface, usually dark green **(8–11). jonquilla** group
19 Leaves with 2 keels on abaxial surface, ±glaucous **(12–15). rupicola** group
10 Corona at least 8 mm long
20 Perianth-segments sharply deflexed
21 Stamens ±equal in length **26. cyclamineus**
21 Stamens unequal, 3 much longer than the other 3 **17. triandrus**
20 Perianth-segments patent or suberect
22 Filaments curved, more than twice as long as anthers
23 Pedicel (3–)5–25 mm; scape erect **18. bulbocodium**
23 Pedicel absent; scape decumbent to ascending **19. hedraeanthus**
22 Filaments straight, not more than twice as long as anthers
24 Hypanthial tube narrowly obconical or infundibuliform, its length 3–4 times its greatest width
25 Flowers concolorous; pedicels 20–30 mm **28. × odorus**
25 Corona considerably deeper in colour than perianth; pedicels 12–15 mm **27. × incomparabilis**
24 Hypanthial tube broadly obconical, its length not more than 1½ times its greatest width
26 Perianth-segments less than 15 mm; corona somewhat constricted near the middle **25. asturiensis**
26 Perianth-segments at least 15 mm; corona not constricted near the middle
27 Spathe 60–100 mm; pedicel 40–90 mm **21. longispathus**
27 Spathe not more than 60(–65) mm; pedicel not more than 35 mm
28 Hypanthial tube 12–25 mm **22. pseudonarcissus**
28 Hypanthial tube 8–15 mm
29 Corona 16–25 mm **24. minor**
29 Corona 35–40 mm **23. bicolor**

Sect. TAPEINANTHUS (Herbert) Traub. Flowering in autumn. Leaves filiform, not present at anthesis. Flowers usually solitary, yellow, concolorous. Hypanthial tube very short, almost obsolete. Corona very short, often rudimentary. Filaments straight, much longer than anthers. Anthers dorsifixed, widely exserted.

1. N. humilis (Cav.) Traub, *Plant Life* **25**: 46 (1969) (*Carregnoa humilis* (Cav.) Gay, *Braxireon humile* (Cav.) Rafin.). Bulb 8–15 × 7–12 mm. Leaves up to 20 cm × 1 mm, 1 (rarely 2) from each bulb, but often none from a bulb which has flowered, appearing in spring. Scape 7–20 cm, slender. Spathe 12–20 mm, hyaline, tubular below. Flowers solitary (very rarely 2), erect, yellow, concolorous. Pedicel 6–12 mm. Hypanthial tube not more than 2 mm. Perianth-segments 10 × 2–3 mm, oblong-lanceolate. Corona consisting of a low rim or 6 small scales not more than 1 mm. $2n=28$. *Grassland and open woods. S.W. Spain.* Hs.

Sect. SEROTINI Parl. Flowering in autumn. Leaves filiform, not present at anthesis. Flowers usually solitary, bicoloured. Hypanthial tube slender, cylindrical. Corona short. Filaments straight, shorter than anthers or only slightly longer; anthers dorsifixed, included.

2. N. serotinus L., *Sp. Pl.* 290 (1753). Bulb 15–25 × 12–20 mm. Leaves 10–20 cm × 1 mm, cylindrical, somewhat glaucous, 1–2 on non-flowering bulbs, usually absent from a bulb which has flowered, appearing in spring. Scape 10–25 cm, slender. Flowers solitary, less often 2(–3), erect, fragrant. Spathe 15–35 mm, hyaline, tubular in lower half. Pedicel 7–20(–30) mm. Hypanthial tube 12–20 mm. Perianth-segments 10–16 × 3–7 mm, oblong-lanceolate, patent, white. Corona 1–1·5 × 3–4 mm, 6-lobed, orange. Flowering in autumn. $2n=10, 20, 30$. *Stony hillsides and other dry places. Mediterranean region, S. Portugal.* Bl Co Cr Gr Hs It Ju Lu Sa Si.

Sect. TAZETTAE DC. (Sect. *Hermione* (Salisb.) Sprengel). Flowering in spring, rarely in autumn. Leaves flat or canaliculate. Flowers in umbels, concolorous or bicoloured. Hypanthial tube cylindrical. Corona fairly short. Filaments straight, much shorter than anthers; anthers dorsifixed, included, or the upper whorl slightly exserted.

3. N. tazetta L., *Sp. Pl.* 290 (1753). Bulb up to 50 × 35 mm. Leaves 20–50 cm × 5–25 mm. Scape 20–45 cm, stout. Flowers in umbels of (2–)3–15, fragrant. Spathe 30–50 mm, scarious. Pedicels unequal, the longest 25–75 mm. Hypanthial tube 12–18 mm. Perianth-segments 8–22 mm, patent, usually broadly ovate and contiguous or imbricate, more rarely narrower. Corona 3–6 × 6–11 mm, about twice as wide as high, yellow or orange. Upper whorl of stamens exserted from hypanthial tube, at least in part, but included in corona. *Meadows, pastures and cultivated fields. Mediterranean region, S. Portugal.* Al Bl Co Cr Ga Gr Hs It Ju Lu Sa Si.

Very polymorphic, but as the plant has been cultivated for centuries, and as many populations are derived from cultivated plants, it seems probable that some of this polymorphism originated in horticultural selection. Apart from the variation in colour of perianth and corona, on which are founded the subspecies recognized below, there is variation in size of flower, colour and width of leaves, shape of scape in cross-section and other characters, but these show so little correlation that if they are taken into account in defining species or subspecies the number of taxa becomes unmanageably large.

1 Perianth pure white; corona bright to deep yellow **(a)** subsp. **tazetta**
1 Perianth cream-coloured or yellow
2 Perianth cream-coloured or very pale yellow; corona medium to bright yellow **(b)** subsp. **italicus**

2 Perianth bright or golden-yellow; corona deep yellow to orange **(c)** subsp. **aureus**

(a) Subsp. **tazetta** (incl. subsp. *patulus* (Loisel.) Baker): *W. Mediterranean region.*

(b) Subsp. **italicus** (Ker-Gawler) Baker, *Handb. Amaryll.* 8 (1888) (*N. italicus* Ker-Gawler, *N. tazetta* subsp. *lacticolor* (Haw.) Baker): $2n=22$. *N. & E. parts of Mediterranean region.*

(c) Subsp. **aureus** (Loisel.) Baker, *op. cit.* 9 (1888) (*N. aureus* Loisel.): $2n=22$. *S.E. France, N.W. Italy, Sardegna; naturalized elsewhere.*

N. corcyrensis (Herbert) Nyman, *Syll.* 365 (1855) (*N. tazetta* subsp. *corcyrensis* (Herbert) Baker), described from N.W. Greece (Kerkira), has flowers like those of subsp. **(b)**, but solitary, and with narrow, deflexed perianth-segments. It is perhaps a hybrid between **2** and **3(b)**.

4. N. papyraceus Ker-Gawler, *Bot. Mag.* **24**: t. 947 (1806). Like **3(a)** but flowers up to 20 in the umbel; hypanthial tube 10–20 mm; perianth-segments 8–18 mm; corona pure white. *Mediterranean region and S.W. Europe.* Ga Gr Hs It Ju Lu Si [Co].

1 Flowers 20–25 mm in diameter; scape compressed, 2-edged **(c)** subsp. **panizzianus**

1 Flowers 25–40 mm in diameter

2 Leaves glaucous; scape compressed, 2-edged; corona usually crenulate **(a)** subsp. **papyraceus**

2 Leaves not glaucous; scape almost terete; corona usually entire **(b)** subsp. **polyanthus**

(a) Subsp. **papyraceus**: *Throughout the range of the species.*

(b) Subsp. **polyanthus** (Loisel.) Ascherson & Graebner, *Syn. Mitteleur. Fl.* **3**: 390 (1906) (*N. polyanthus* Loisel.): ● *S. France; naturalized in Spain and Italy.*

(c) Subsp. **panizzianus** (Parl.) Arcangeli, *Comp. Fl. Ital.* ed. 2, 148 (1894): $2n=22$. ● *S.E. France and N. Italy; Portugal and S.W. Spain.*

It would perhaps be more logical to include **4** under **3** as another subspecies, since its only constant difference is in the white corona; but as this distinction is well-marked and without intermediate states, the arrangement given here seems to be of more practical value.

5. N. dubius Gouan, *Obs. Bot.* 22 (1773). Leaves 12–25 cm × 3–5 mm, flat, glaucous. Scape 10–20 cm, strongly compressed. Flowers in umbels of 2–6. Spathe 25–40 mm, scarious. Pedicels 20–45 mm. Hypanthial tube *c.* 12 mm, cylindrical to narrowly infundibuliform. Perianth-segments 6–8 mm, broadly elliptical, imbricate, white. Corona 3–4 × 5–6 mm, white. $2n=50$. ● *S. France, N.E. Spain.* Ga Hs.

An allopolyploid, derived from **4(a)** and **9**, but containing two genomes of the former and four of the latter. As it is fertile and genetically isolated from its parents it is best treated as an independent species in Sect. *Tazettae*.

6. N. elegans (Haw.) Spach, *Hist. Vég. (Phan.)* **12**: 452 (1841). Bulb up to 35 × 30 mm. Leaves 8–25 cm × 2–4·5 mm, canaliculate, glaucous, appearing before or with the flowers. Scape 15–35 cm. Flowers in umbels of (2–)3–7, fragrant. Spathe 20–40 mm, scarious. Pedicels up to 45 mm, unequal. Hypanthial tube 11–16 mm, green. Perianth-segments 12–20 × 3–6 mm, narrowly oblong to elliptical, not imbricate, somewhat deflexed, white. Corona 1–2 × 3–4 mm, yellowish- or brownish-green. Stamens included. Flowering in autumn. *W. & S. Italy, Sicilia.* *Bl It Si.

Sect. NARCISSUS. Flowering in spring or early summer. Leaves flat, usually fairly wide. Flowers solitary, bicoloured. Hypanthial tube cylindrical, slender. Perianth-segments patent or slightly deflexed. Corona small. Filaments much shorter than anthers; anthers dorsifixed, partly exserted, or the lower whorl included.

7. N. poeticus L., *Sp. Pl.* 289 (1753). Bulb 17–40 × 12–35 mm. Leaves 20–40 cm × 5–13 mm, flat, more or less glaucous. Scape 20–50 cm, compressed. Spathe 30–50 mm, scarious. Pedicel 10–45 mm. Hypanthial tube 20–30 mm. Perianth-segments 15–30 × 6–22 mm, ovate-orbicular to oblanceolate-cuneate, white or pale cream. Corona 1–2·5 × 8–14 mm, discoid to very shortly cylindrical, yellow, with red or scarious margin, crenulate. *Mountain meadows.* ● *From E.C. France southwards to C. Spain, S. Italy and N.W. Greece.* Al Au Ga Gr He Hs Hu It Ju Rm Rs (W) [Be Br Cz Ge].

Variable, especially in width of perianth-segments, height of corona, and relative position of the two whorls of stamens. It is often divided into two or more species, but the reticulate nature of the variation makes these difficult to define. Two fairly distinct subspecies may be recognized:

(a) Subsp. **poeticus**: Leaves 6–10(–12) mm wide. Perianth-segments usually 20–25 mm, obovate-suborbicular, imbricate, without distinct claw. Corona more or less discoid, *c.* 14 mm in diameter. Lower whorl of stamens included. $2n=14$. *Throughout the range of the species except E.C. Europe.*

(b) Subsp. **radiiflorus** (Salisb.) Baker, *Handb. Amaryll.* 12 (1888) (subsp. *angustifolius* Hegi, *N. radiiflorus* Salisb.): Leaves 5–8 mm wide. Perianth-segments 22–30 mm, narrowly obovate-cuneate, with more or less distinct claw, scarcely imbricate. Corona 2–2·5 × 8–10 mm, shortly cylindrical. All stamens partly exserted. $2n=14$. *S.C. Europe and W. part of Balkan peninsula.*

Plants on the borders of Switzerland and Italy, intermediate in most respects between subspp. **(a)** and **(b)** have been named **N. verbanensis** (Herbert) Pugsley, *Jour. Bot. (London)* **53**, *Suppl.* **2**: 35 (1915). Plants from N. Greece (Pindhos Oros), like subsp. **(a)** but with rather smaller flowers, often wider leaves, and corona up to 2 mm long, have been named **N. hellenicus** Pugsley, *op. cit.* 36 (1915) (*N. poeticus* subsp. *hellenicus* (Pugsley) Hayek). These latter require further investigation, but are probably best treated as belonging to subsp. **(a)**.

Sect. JONQUILLAE DC. (incl. Sect. *Apodanthi* A. Fernandes). Flowering in spring, rarely in autumn. Leaves narrow. Flowers solitary or in umbels of 2–5(–8), more or less concolorous, yellow (rarely green). Hypanthial tube cylindrical to narrowly infundibuliform, slender. Perianth-segments patent or deflexed, usually wide, often imbricate. Corona small to fairly large, usually wider than long. Filaments much shorter than anthers; anthers dorsifixed, included, or the upper whorl partly exserted.

(8–11). N. jonquilla group. Bulb 10–30 × 10–25 mm. Leaves 1–4 mm wide, dark green, rarely somewhat glaucous, subcylindrical, canaliculate. Spathe 15–50 mm, scarious. Flowers solitary, or in umbels of 2–5(–8), 10–35 mm in diameter, fragrant, bright or deep yellow. Pedicels 10–50 mm. Perianth-segments 4–15 mm, broadly elliptical, patent or deflexed. Corona 3–7 × 4·5–17 mm, usually considerably wider than long, usually crenulate.

A confusing group, still requiring critical examination. It seems probable that at least some of the taxa here treated as species would be better regarded as subspecies, as populations with mixed or intermediate characters are very frequent. The information at present available, however, seems insufficient to justify changes in nomenclature.

1 Flowers 22–32 mm in diameter; hypanthial tube (17–)20–30 mm **8. jonquilla**
1 Flowers 12–24 mm in diameter; hypanthial tube 8–18(–20) mm
2 Longest pedicel longer than spathe at anthesis **10. willkommii**
2 All pedicels shorter than spathe at anthesis
3 Leaves usually shorter than scape; hypanthial tube straight; corona more than 9 mm wide **9. requienii**
3 Leaves usually longer than scape; hypanthial tube usually curved; corona less than 9 mm wide **11. gaditanus**

8. N. jonquilla L., *Sp. Pl.* 290 (1753). Leaves 2–4 mm wide. Flowers 22–32 mm in diameter, in umbels of 2–5. Pedicels 15–50 mm at anthesis, shorter or longer than the spathe. Hypanthial tube (17–)20–30 mm, straight. Perianth-segments 10–15 mm, patent. Corona 3–5 × 9–15 mm. $2n=14$. *Meadows and damp places.* ● *C. & S. Spain, S. & E. Portugal; widely cultivated for its perfume, and naturalized elsewhere in S. Europe.* Hs Lu [Ga It Ju.]

9. N. requienii M. J. Roemer, *Syn. Monogr.* **4**: 236 (1847) (*N. juncifolius* auct., non Salisb., nec Lag., *N. pallens* Freyn ex Willk.). Leaves 1–2 mm wide. Flowers 16–22 mm in diameter, solitary or in pairs. Pedicels 11–22 mm at anthesis, shorter than spathe. Hypanthial tube 12–18(–20) mm, straight. Perianth-segments 7–10 mm, patent. Corona 4–6 × 10–17 mm. $2n=14$. *Rocky hillsides and meadows.* ● *S. France, S. & E. Spain.* ?Co Ga Hs.

Plants recently reported from Sardegna are like **9** but with leaves up to 4·5 mm wide and corona not more than 7 mm wide. They require further investigation.

10. N. willkommii (Samp.) A. Fernandes, *Bol. Soc. Brot.* ser. 2, **40**: 213 (1966) (*N. jonquilloides* Willk., non Willd. ex Schultes fil.). Leaves 2–3 mm wide, somewhat glaucous, erect. Flowers 14–19 mm in diameter, in umbels of 2–3. Pedicels 20–45 mm at anthesis, the longest exceeding the spathe. Hypanthial tube 11–15 mm, straight. Perianth-segments 6–9 mm, patent. Corona 4–5 × 7–11 mm. $2n=14$. *Damp grassland.* ● *S. Portugal, S.W. Spain.* Hs Lu.

11. N. gaditanus Boiss. & Reuter in Boiss., *Diagn. Pl. Or. Nov.* **3(4)**: 96 (1859) (incl. *N. minutiflorus* Willk.). Leaves 1–2 mm wide, usually procumbent. Flowers 10–20 mm in diameter, in umbels of 2–5(–8), rarely solitary. Pedicels 13–35 mm at anthesis, usually shorter than spathe. Hypanthial tube 8–17 mm, usually curved. Perianth-segments 4–9 mm, patent or deflexed. Corona 2·5–7 × 4·5–8 mm. $2n=14, 21$. ● *S. Portugal, S. Spain.* Hs Lu.

N. fernandesii G. Pedro, *Bol. Soc. Brot.* ser. 2, **21**: 60 (1947), is known from two populations in S.C. Portugal; somewhat similar plants are found in S.W. Spain. It is in most characters intermediate between **10** and **11**; its taxonomic status is obscure.

(12–15). N. rupicola group. Bulb 15–22 × 8–18 mm. Leaves 8–30 cm × 1·5–5 mm, more or less glaucous, canaliculate and with 2 keels on the convex surface, or rarely 4-angled. Spathe 15–35 mm, scarious, tubular below, open above. Flowers solitary or in umbels of 2–5, 13–30 mm in diameter, seldom strongly fragrant, deep yellow, concolorous. Pedicels 1–15 mm. Hypanthial tube 10–25 mm, narrowly cylindrical. Perianth-segments 7–14 × 5–11 mm, patent or slightly deflexed. Corona 2–8 × 5–10 mm, entire or lobed.

A group of four closely related taxa whose diagnostic characters, though rather slight, seem, in contrast to those of the preceding group, to be sufficiently clear-cut for specific separation.

1 Flowers solitary; spathe tubular for ¾ of its length; pedicel not more than 3 mm, often absent **12. rupicola**
1 Flowers 1–4; spathe tubular for only ¼–⅓ of its length; pedicel 6–15 mm
2 Leaves 4-angled, ±procumbent, usually minutely scabrid; flowers 12–17 mm in diameter **15. scaberulus**
2 Leaves canaliculate, with 2 dorsal keels, ±erect, smooth; flowers 17–33 mm in diameter
3 Corona almost as long as wide; scape with (1–)2–4 flowers **14. calcicola**
3 Corona 1¾–2 times as wide as long; flowers solitary, rarely in pairs **13. cuatrecasasii**

12. N. rupicola Dufour in Schultes & Schultes fil., *Syst. Veg.* **7**: 958 (1830). Leaves 1·5–3 mm wide, erect to decumbent, with 2 dorsal keels; margin smooth. Spathe 20–35 mm, tubular for *c.* ¾ of its length. Flowers 15–30 mm in diameter, solitary. Pedicel absent, rarely up to 3 mm. Hypanthial tube (13–)18–25 mm. Perianth-segments 7–13 × 5–10 mm. Corona 2–5 × 7–10 mm, at least twice as wide as long, subentire to conspicuously 6-lobed. All stamens included. $2n=14$. *Rock-crevices and stony mountain pastures; calcifuge.* ● *C. Spain, N. Portugal.* Hs Lu.

13. N. cuatrecasasii Casas, Laínz & Ruiz Rejón, *Cuad. Ci. Biol. Granada* **2**: 4 (1973) (*N. rupicola* subsp. *pedunculatus* (Cuatrec.) Laínz ex Meikle). Leaves 2·5–4·5 mm wide, erect, with 2 dorsal keels; margin smooth. Spathe 20–25 mm, tubular for *c.* ¼ of its length. Flowers 22–30 mm in diameter, solitary (rarely in pairs). Pedicel (6–)9–12 mm. Hypanthial tube (10–)12–15 mm. Perianth-segments 9–12 × 7–11 mm. Corona 4–6 × 8–10 mm, 1¾–2 times as wide as long; margin entire or crenulate. Upper whorl of stamens slightly exserted. $2n=14$. *Rock-crevices; calcicole.* ● *Mountains of C. & S. Spain.* Hs.

14. N. calcicola Mendonça, *Bol. Soc. Brot.* ser. 2, **6**: 318 (1930). Leaves 2–5 mm wide, erect, with 2 dorsal keels; margins smooth. Spathe 16–25 mm, tubular for *c.* ¼ of its length. Flowers 17–25 (–33) mm in diameter, in umbels of (1–)2–5. Pedicels 6–15 mm. Hypanthial tube 13–18 mm. Perianth-segments 7–10(–14) × 5–8 mm. Corona 4–8 × 6–9 mm, only slightly wider than long; margin obscurely crenulate. Upper whorl of stamens exserted. $2n=14$. *Crevices of limestone rocks.* ● *W.C. Portugal.* Lu.

15. N. scaberulus Henriq., *Bol. Soc. Brot.* **6**: 45 (1888). Leaves 1–3·5 mm wide, usually decumbent, with 2 dorsal keels; margin usually minutely scabrid. Spathe 15–20 mm, tubular for *c.* ¼ of its length. Flowers 12–17 mm in diameter, solitary or in umbels of 2–3. Pedicels 8–15 mm. Hypanthial tube 12–17 mm. Perianth-segments 4·5–7 × 3–5 mm. Corona 2–5 × 5–7 mm, usually 1½–2 times as wide as long; margin entire or crenulate. Upper whorl of stamens exserted. $2n=14$. *Rocky places.* ● *N.C. Portugal (Mondego valley).* Lu.

16. N. viridiflorus Schousboe, *Vextr. Marokko* 157 (1800). Bulb 22–30 × 17–30 mm. Leaves up to 30 cm × 4 mm, cylindrical, hollow, glaucous, appearing shortly after the flowers. Scape 15–40 cm. Flowers in umbels of 2–5, dull green, concolorous, somewhat fetid. Spathe 20–50 mm. Pedicels unequal, up to 70 mm. Hypanthial tube 10–15 mm, narrowly infundibuliform. Perianth-segments 10–16 × 2–3·5 mm, linear-oblong, acute, patent or somewhat deflexed. Corona 1 × 3–5 mm, deeply 6-lobed. Stamens included. Flowering in autumn. *Damp places.* ● *S.W. Spain (Gibraltar region).* Hs. (*Morocco.*)

Sect. GANYMEDES Salisb. ex Schultes & Schultes fil. Flowering in spring. Leaves flat or subcylindrical, fairly narrow. Flowers solitary or in umbels of 2–6, concolorous. Hypanthial tube infundibuliform. Perianth-segments narrow, sharply deflexed. Corona medium-sized, obconical-campanulate to subcylindrical,

about as wide as long or slightly wider. Filaments straight, very unequal, those of one whorl about as long as anthers, deeply included in hypanthial tube, those of the other whorl much longer than the anthers, exserted. Anthers dorsifixed. Plants heterostylic.

17. N. triandrus L., *Sp. Pl.* ed. 2, 416 (1762). Bulb 12–20 × 8–17 mm. Leaves 15–30 cm × 1·5–3 mm, dark green. Scape about equalling leaves. Flowers drooping, white to bright yellow. Spathe 15–40 mm. Pedicels 8–40 mm. Hypanthial tube 10–20 mm. Perianth-segments 10–22(–30) mm, lanceolate to linear-oblong. Corona 5–15(–25) × 7–25 mm. *Hedges, woods and rocky pastures.* ● *Spain and Portugal; N.W. France.* Ga Hs Lu.

Variable, but the variation is insufficient to justify the numerous segregate species that have been described. Plants of this section have long been cultivated, and several of the described taxa are known only from gardens. The characters which seem to show the best correlation with each other and with geographical range are colour of flower, number of flowers on a stem, and size of floral parts, especially the corona. On this basis 3 somewhat ill-defined subspecies may be recognized.

1 Flowers usually solitary, more rarely in umbels of 2–3, pale cream to bright yellow; hypanthial tube 10-16 mm; perianth-segments 10–18 mm; corona 5–12 mm **(a)** subsp. **pallidulus**

1 Flowers often in umbels of 2–3(–6), less often solitary, white to very pale yellow; hypanthial tube 12–20 mm; perianth-segments 15-22(–30) mm; corona 10–15(–25) mm

2 Corona 10–15 mm **(b)** subsp. **triandrus**

2 Corona 15–25 mm **(c)** subsp. **capax**

(a) Subsp. **pallidulus** (Graells) D. A. Webb, *Bot. Jour. Linn. Soc.* **76**: 303 (1978) (*N. pallidulus* Graells; incl. *N. concolor* (Haw.) Link): $2n = 14$. *Portugal, C., S. & E. Spain.*

(b) Subsp. **triandrus** (incl. *N. cernuus* Salisb., *N. pulchellus* sensu Willk., ? an Salisb.): $2n = 14$. *N. Spain, N. Portugal.*

(c) Subsp. **capax** (Salisb.) D. A. Webb, *loc. cit.* (1978) (*Queltia capax* Salisb., *N. capax* (Salisb.) Schultes & Schultes fil.): $2n = 14$. *N.W. France (Îles de Glénans, dépt. Finistère).*

Sect. BULBOCODII DC. Flowering in winter or spring. Leaves narrow, semicylindrical. Flowers solitary, concolorous. Hypanthial tube broadly obconical. Perianth-segments narrow, erecto-patent. Corona large, obconical or broadly infundibuliform. Filaments curved, ascending distally, much longer than anthers. Anthers dorsifixed, widely exserted from hypanthial tube and sometimes from corona.

18. N. bulbocodium L., *Sp. Pl.* 289 (1753). Bulb 15–20 × 10–15 mm, whitish or pale brown. Leaves up to 45 cm, but usually much less, 1–1·5(–3) mm wide, dark green, 2–4(–7) from each bulb. Scape erect, usually slightly longer than leaves. Flowers more or less horizontal, pale yellow to deep orange-yellow. Spathe 17–35 mm. Pedicel (3–)5–25 mm. Hypanthial tube 4–25 mm. Perianth-segments 6–15 × 1·5–5 mm, linear to narrowly triangular, acute or mucronate. Corona 7–25 × 9–35 mm. Stamens usually included in corona but sometimes exserted. *Scrub, rocky ground and mountain pastures. Spain and Portugal, S.W. France.* Ga Hs Lu.

Very variable, especially in size and colour of flower. These characters vary continuously and show little correlation with geographical distribution or chromosome number. On the basis of other characters two subspecies may be distinguished:

(a) Subsp. **bulbocodium** (*N. nivalis* Graells, *N. graellsii* Graells, *N. tenuifolius* Salisb., *N. aureus* DC., non Loisel.): Leaves usually more or less erect. Hypanthial tube and perianth usually tinged with green. Corona regularly obconical, not narrowed at margin. $2n = 14$, 21, 28, 35, 42, 49, 56. *Throughout the range of the species.*

(b) Subsp. **obesus** (Salisb.) Maire in Jahandiez & Maire, *Cat. Pl. Maroc* **1**: 138 (1931) (*N. obesus* Salisb.): Leaves very narrow, mostly procumbent or arcuate-deflexed. Flowers only slightly tinged with green. Corona slightly narrowed at margin. $2n = 26$, 39. *W. & S. Portugal, S.W. Spain.*

19. N. hedraeanthus (Webb & Heldr.) Colmeiro, *Enum. Pl. Penins. Hisp.-Lusit.* **5**: 80 (1889). Bulb *c.* 15 × 10 mm, dark brown. Leaves solitary, 6–12 cm × 1 mm, dark green, more or less erect. Scape decumbent or ascending, usually shorter than leaves. Flowers directed obliquely upwards, pale yellow, only slightly tinged with green. Spathe 12–20 mm. Pedicel absent. Hypanthial tube 10–15 mm. Perianth-segments 8–13 × 3–4·5 mm, oblong, obtuse. Corona *c.* 10 × 15 mm, regularly obconical. Stamens at full anthesis widely exserted from corona. $2n = 14$. *Mountain meadows and rocky ground.* ● *S.E. & S.C. Spain.* Hs.

20. N. cantabricus DC. in Redouté, *Liliacées* **8**: sub t. 486 (1815) (*N. clusii* Dunal). Bulb 15–25 × 12–20 mm, dark brown to black. Leaves usually solitary, 15–30 cm × 1–1·5 mm. Scape 10–25 cm, erect. Flowers horizontal, white. Spathe 20–30 mm. Pedicel 3–9 mm. Hypanthial tube 12–20 mm. Perianth-segments 8–12 × 2–4·5 mm, linear-lanceolate. Corona 12–18 × 20–35 mm, broadly infundibuliform, with conspicuously expanded and recurved margin. Stamens slightly shorter than corona. $2n = 14$. *Scrub. S. Spain.* Hs. (*N. Africa.*)

Sect. PSEUDONARCISSI DC. (Sect. *Ajax* (Salisb. ex Haw.) Dumort.). Flowering in spring or early summer. Leaves flat, usually fairly wide. Flowers usually solitary, rarely in umbels of 2–4. Hypanthial tube broadly obconical. Perianth-segments usually patent to erecto-patent, rarely deflexed, fairly narrow. Corona large, more or less cylindrical, at least as long as wide. Filaments straight, as long as anthers or up to twice as long. Anthers subbasifixed (rarely dorsifixed), exserted from hypanthial tube but usually concealed within the corona.

21. N. longispathus Pugsley, *Jour. Roy. Hort. Soc.* **58**: 54 (1933). Bulb *c.* 30 mm. Leaves 40–60 cm or more, 10–15 mm wide. Scape 30–175 cm. Spathe 60–100 mm, green. Flowers solitary or in pairs, directed obliquely upwards. Pedicel 40–90 mm. Hypanthial tube 10–15 mm. Perianth-segments 25–32 mm, medium yellow, patent, not or only slightly twisted. Corona 25–30 mm, slightly deeper in colour than perianth, expanded at apex, crenate. $2n = 14$. *In or near mountain streams.* ● *S.E. Spain (Sierra de Cazorla).* Hs.

Distinct in its very long spathe and pedicel. The height of the plant seems to vary greatly in accordance with water supply and perhaps other factors.

22. N. pseudonarcissus L., *Sp. Pl.* 289 (1753). Bulb 20–50 mm. Leaves 8–50 cm × 5–15 mm, usually glaucous. Scape 12–50(–90) cm. Spathe 20–60 mm, scarious. Flowers solitary, or rarely in umbels of 2–4, horizontal, drooping or suberect, concolorous or bicoloured. Hypanthial tube 15–25 mm. Perianth-segments 18–40(–55) mm, white to deep yellow, patent to erecto-patent, sometimes twisted. Corona 15–45 mm, white to deep yellow; margin subentire to fimbriate or 6-lobed. *Woods, meadows and rocky ground.* ● *W. Europe, northwards to N. England; long cultivated for ornament and locally naturalized elsewhere.* Br Ga Ge He Ho Hs Lu [Al Au Bu Cz It Ju Rm].

Every author has given a different circumscription to this species, which lies at the centre of the most difficult section of the genus. Even Pugsley, who recognized 27 other species within the section *Pseudonarcissi*, admitted the great variability of *N. pseudonarcissus*, and it is clear that if all his variants are taken into account the separation of many of his other species becomes impossible. Fernandes (1951) included 19 of Pugsley's species under *N. pseudonarcissus* (leaving only 3 other species in the section); but in 1969 he restored 16 of these to specific rank. An intermediate treatment is attempted here, giving to *N. pseudonarcissus* a moderately wide circumscription and recognizing 7 subspecies within it, as well as 5 other species in the section.

1 Corona white to medium yellow
 2 Pedicel 10–25 mm; corona white to very pale yellow **(c)** subsp. **moschatus**
 2 Pedicel 3–10 mm; corona pale to medium yellow
  3 Corona 30–40 mm, distinctly expanded and usually lobed at margin **(b)** subsp. **pallidiflorus**
  3 Corona 20–35 mm, scarcely expanded at margin and usually only slightly lobed **(a)** subsp. **pseudonarcissus**
1 Corona deep golden-yellow
 4 Perianth-segments less than 20 mm
  5 Perianth-segments twisted; corona expanded at margin **(e)** subsp. **major**
  5 Perianth-segments not twisted; corona not expanded at margin **(g)** subsp. **nevadensis**
 4 Perianth-segments at least 20 mm
  6 Perianth-segments whitish to medium yellow, paler than corona
   7 Pedicel 8–15(–25) mm; corona distinctly expanded at margin; flowers horizontal or directed upwards **(d)** subsp. **nobilis**
   7 Pedicel 3–12 mm; corona scarcely expanded at margin; flowers horizontal or drooping **(a)** subsp. **pseudonarcissus**
  6 Perianth-segments deep golden-yellow, almost the same colour as the corona
   8 Leaves not more than 15 cm; perianth-segments not twisted **(f)** subsp. **portensis**
   8 Leaves at least 20 cm; perianth-segments twisted **(e)** subsp. **major**

(a) Subsp. pseudonarcissus: Leaves 12–35 cm × 6–12 mm. Flowers horizontal or drooping. Pedicel 3–12 mm. Perianth-segments 20–35 mm, whitish to medium yellow, more or less twisted. Corona 20–35 mm, pale to deep yellow, usually somewhat deeper in colour than the perianth; margin not markedly expanded or lobed. *Throughout the range of the species except Portugal and S. Spain.*

(b) Subsp. **pallidiflorus** (Pugsley) A. Fernandes, *Bol. Soc. Brot.* ser. 2, **25**: 182 (1951): Leaves 15–30 cm × 5–12 mm. Flowers horizontal or drooping. Pedicel 3–10 mm. Perianth-segments 30–40 mm, cream-coloured to pale yellow, more or less twisted. Corona 30–40 mm, pale to medium yellow, slightly deeper in colour than perianth; margin expanded and usually recurved. *Pyrenees, Cordillera Cantábrica.*

(c) Subsp. **moschatus** (L.) Baker, *Handb. Amaryll.* 4 (1888) (*N. moschatus* L.): Leaves 10–40 cm × 5–12 mm. Flowers horizontal or drooping, concolorous or nearly so. Pedicel 10–25 mm. Perianth-segments 20–35 mm, white to cream-coloured, twisted. Corona 25–40 mm, white to very pale yellow; margin scarcely expanded. *Pyrenees, Cordillera Cantábrica.*

(d) Subsp. **nobilis** (Haw.) A. Fernandes, *Bol. Soc. Brot.* ser. 2, **25**: 182 (1951): Leaves 15–50 cm × 8–15 mm. Flowers horizontal or directed upwards. Pedicel 8–15(–25) mm. Perianth-segments 30–40(–55) mm, pale yellow, usually twisted. Corona 30–40(–45) mm, deep yellow; margin expanded. $2n=28$. *N. Portugal, N.W. & N.C. Spain.*

(e) Subsp. **major** (Curtis) Baker, *Handb. Amaryll.* 4 (1888) (*N. major* Curtis): Leaves 20–50 cm × 5–15 mm. Flowers horizontal to suberect, concolorous or nearly so. Pedicel 8–30 mm. Perianth-segments 18–40 mm, medium to deep yellow, twisted. Corona 20–40 mm, deep yellow; margin more or less expanded. *Spain, Portugal, S. France; naturalized further north.*

(f) Subsp. **portensis** (Pugsley) A. Fernandes, *Bol. Soc. Brot.* ser. 2, **25**: 183 (1951): Leaves 8–12 cm × 5–7 mm, considerably shorter than scape. Flowers horizontal or slightly drooping, concolorous, deep yellow. Pedicel 5–15 mm. Perianth-segments 20–30 mm, not twisted. Corona 25–35 mm, somewhat obconical but not expanded at margin. *N. Portugal, N.W. & C. Spain.*

(g) Subsp. **nevadensis** (Pugsley) A. Fernandes, *loc. cit.* (1951): Leaves 12–30 × 5–10 mm. Flowers horizontal to suberect, often in umbels of 2–4. Pedicel 20–35 mm. Perianth-segments 15–20 mm, pale yellow, not twisted. Corona 15–25 mm, medium to bright yellow; margin slightly expanded. *S. Spain (Sierra Nevada).*

N. obvallaris Salisb., *Prodr.* 221 (1796) (*N. pseudonarcissus* subsp. *obvallaris* (Salisb.) A. Fernandes), is a variant intermediate between subspp. (e) and (f) (but closer to the former), which probably arose in cultivation. It is naturalized in Britain (S.W. Wales).

23. N. bicolor L., *Sp. Pl.* ed. 2, 415 (1762). Bulb 25–35 mm. Leaves 30–35 cm × 10–14 mm. Scape 30–40 cm. Spathe 25–40 mm, scarious. Flowers solitary, horizontal. Pedicel 15–35 mm. Hypanthial tube 8–12 mm. Perianth-segments 35–40 mm, cream-coloured to pale yellow, erecto-patent, not twisted. Corona 35–40 mm, deep yellow; margin scarcely expanded, entire or slightly crenulate. *Mountain meadows.* ● *Pyrenees and Corbières.* Ga Hs.

Described from a cultivated plant; the wild populations have been separated as **N. abscissus** (Haw.) Schultes & Schultes fil., *Syst. Veg.* 7: 941 (1830), but the differences are slight.

24. N. minor L., *Sp. Pl.* ed. 2, 415 (1762). Bulb 20–30 mm. Leaves 8–20(–25) cm × 3–10 mm, glaucous. Scape 8–25 cm. Spathe 25–40 mm, scarious. Flowers solitary, horizontal or drooping. Pedicel 3–20 mm. Hypanthial tube 9–15 mm. Perianth-segments 16–22 mm, very pale to deep yellow, erecto-patent, sometimes twisted. Corona 16–25 mm, deep yellow; margin variously lobed or dentate. $2n=14$. *Mountain grassland and open scrub.* ● *Pyrenees and N. Spain; naturalized in S.E. France.* Ga Hs.

The circumscription and distribution of this species are subject to some doubt. Records from N. Portugal and N.W. Spain appear to be referable to **25**, or perhaps in some cases to hybrids between **22** and **25**.

25. N. asturiensis (Jordan) Pugsley, *Jour. Roy. Hort. Soc.* **58**: 40 (1933). Bulb 15–20 mm. Leaves 5–15 cm × 2–6 mm, glaucous. Scape 7–10(–20) cm. Spathe 15–22(–28) mm, greenish at anthesis, scarious later. Flowers solitary, usually drooping, concolorous, medium yellow. Pedicel 3–10 mm. Hypanthial tube 5–9 mm. Perianth-segments 7–14 mm, erecto-patent, not twisted. Corona 8–16 mm, constricted in the middle and expanded towards the apex; margin somewhat lobed or laciniate. $2n=14, 15$. ● *N. Portugal, N.W. & N.C. Spain.* Hs Lu.

N. lagoi Merino, *Fl. Galic.* **3**: 615 (1909), described from a single gathering near Lugo (N.W. Spain), has very small flowers rather like those of **25**, but much larger leaves and longer scape.

It is probably a variant of **25**, or a hybrid between **25** and some variant of **22** or **24**.

26. N. cyclamineus DC. in Redouté, *Liliacées* **8**: sub t. 486 (1815). Bulb *c.* 15 mm. Leaves 15–30 cm × 4–6 mm, bright green. Scape 15–20(–30) cm. Spathe *c.* 20 mm, green at anthesis, scarious later. Flowers solitary, drooping or pendent, concolorous, deep yellow. Pedicel 15–25 mm. Hypanthial tube 2–3 mm. Perianth-segments *c.* 20 mm, strongly deflexed so as to lie almost parallel to pedicel. Corona *c.* 20 mm, narrow; margin subentire to crenate-serrate, slightly expanded. Anthers dorsifixed. $2n=14$. *River-banks and damp mountain pastures.* ● *N.W. Portugal, N.W. Spain.* Hs Lu.

INTERSECTIONAL HYBRIDS

27. N. × incomparabilis Miller, *Gard. Dict.* ed 8., no. 3 (1768) (*N. poeticus* × *pseudonarcissus*). Bulb 25–30 mm. Leaves 17–35 cm × 8–12 mm, somewhat glaucous, nearly flat. Scape 17–40 mm, compressed. Spathe *c.* 35 mm. Flowers solitary, scarcely fragrant. Hypanthial tube 20–25 mm, narrowly obconical or narrowly infundibuliform. Perianth-segments 25–30 × 12–16 mm, narrowly obovate, pale yellow, patent. Corona 13–22 × 17–20 mm, deep orange-yellow; margin undulate and lobulate. *Meadows.* ● *Probably native in S. & S.C. France; widely cultivated and naturalized elsewhere.* Ga [Au He Hs It Ju].

28. N. × odorus L., *Cent. Pl.* **2**: 14 (1756) (*N. jonquilla* × *pseudonarcissus*). Bulb 25–30 mm. Leaves 35–50 cm × 6–8 mm, strongly keeled, bright green. Scape 25–40 cm, more or less terete. Spathe 50–70 mm, scarious. Flowers 1–4, concolorous, bright yellow, usually fragrant. Pedicel 20–30 mm. Hypanthial tube *c.* 20 mm, narrowly infundibuliform. Perianth-segments *c.* 25 × 13 mm. Corona 13–18 × 17–20 mm, lobed or subentire. *Of garden origin; naturalized in S. Europe.* [Ga ?Hs It.]

29. N. × medioluteus Miller, *Gard. Dict.* ed. 8, no. 4 (1768) (*N. biflorus* Curtis; *N. poeticus* × *tazetta*). Bulb 60 × 45 mm. Leaves 45–70 cm × 7–10 mm, flat, glaucous. Scape 25–60 cm, compressed. Spathe 35–45 mm, scarious. Flowers (1–)2(–3), fragrant. Pedicel 25–35 mm. Hypanthial tube 20–25 mm, cylindrical, expanded at the mouth. Perianth-segments 18–22 mm, suborbicular, white. Corona 3–5 × 9–12 mm, bright yellow. $2n=24$. ● *Native in S. France; cultivated elsewhere for ornament and widely naturalized.* Ga [Br Hb He Hs It Ju Lu].

30. N. × intermedius Loisel. *Fl. Gall.* 191 (1806) (*N. jonquilla* × *tazetta*). Leaves 30–45 cm × 5–8 mm, deeply canaliculate, bright green. Scape 25–40 cm, more or less terete. Spathe 30–40 mm, scarious. Flowers in umbels of 3–6, fragrant. Pedicels 20–40 mm. Hypanthial tube 14–20 mm, cylindrical-trigonous, slender. Perianth-segments 10–14 mm, ovate, bright yellow. Corona 3–4 × 6–7 mm, slightly deeper in colour than perianth. ● *W. Mediterranean region; perhaps native in parts of S.W. France and N.E. Spain, elsewhere an escape from cultivation.* *Ga *Hs [Bl It].

7. Pancratium L.[1]

Umbel of 3–15 flowers; spathe 2-valved; some or all of the flowers subtended by linear bracteoles. Flowers white, fragrant, erect to inclined. Hypanthial tube present. Corona conspicuous, adnate to lower part of filaments. Capsule subglobose, obscurely trigonous; pericarp dry.

Flowers 10–15 cm; perianth-segments shorter than hypanthial tube and less than twice as long as corona **1. maritimum**
Flowers 6–9 cm; perianth-segments longer than hypanthial tube and more than twice as long as corona **2. illyricum**

1. P. maritimum L., *Sp. Pl.* 291 (1753). Bulb very large, deeply sunk, tapered to a long neck. Leaves up to 50 cm × 20 mm, lorate, glaucous, appearing before anthesis. Scape stout, compressed. Spathe 4–7 cm. Pedicels 5–10 mm, shorter than ovary. Hypanthial tube 60–80 mm, very slender. Perianth-segments 30–50 mm, linear-lanceolate, erecto-patent to patent. Corona *c.* ⅔ as long as perianth-segments; margin with 12 triangular teeth. Free part of filament about equalling anther. Flowering in mid-summer. $2n=22$. *Maritime sands. S. Europe, extending northwards to* 47°30′ *in W. France.* Al ?Az Bl Bu Co Cr Ga Gr Hs It Ju Lu Sa Si Tu.

2. P. illyricum L., *Sp. Pl.* 291 (1753). Like **1** but leaves up to 30 mm wide; pedicels 10–15 mm, about equalling ovary; hypanthial tube 15–25 mm, stouter; corona less than half as long as perianth-segments, deeply cleft into 6 bidentate lobes; free part of filament much longer than anther; flowering in late spring. $2n=22$. *Rocky ground, mainly near the sea.* ● *Islands of W. Mediterranean region* (*Corse, Sardegna, Capraia*). Co It Sa.

Records from Malta and the mainland of Italy appear to be referable to **1**.

CLXXXVI. DIOSCOREACEAE[2]

Dioecious perennial herbs with subterranean tubers. Leaves cordate or rarely truncate at base, entire. Flowers small, in axillary clusters, spikes or racemes; sometimes the female flowers solitary. Perianth persistent, the male campanulate, 6-lobed, the female deeply lobed or with 6 minute segments, greenish to whitish. Ovary superior, 3-locular, with 2 ovules in each loculus; styles 3. Fruit a capsule or berry.

1 Fruit a berry; seeds globose, unwinged **3. Tamus**
1 Fruit a capsule; seeds flat
2 Stem twining; leaf-veins branched seeds winged **1. Dioscorea**
2 Stem straight; leaf-veins unbranched; seeds unwinged **2. Borderea**

1. Dioscorea L.[3]

Tuber cylindrical. Stem twining. Leaves alternate or subopposite. Flowers in lax spikes of fasciculate clusters. Perianth of male flowers campanulate; stamens 6, inserted at base of perianth. Perianth of female flowers deeply 6-lobed; styles short, with 2-fid stigmas. Fruit a 3-winged capsule. Seeds flat, winged.

1. D. balcanica Košanin, *Österr. Bot. Zeitschr.* **64**: 37 (1914). Stems up to 60 cm, spreading or ascending, unbranched, twining dextrally. Leaves up to 7 × 6 cm, acute, with 9 curved, branched veins, long-petiolate. Flowers *c.* 2 mm, greenish. Fruiting spike up to 7 cm, pendent. Capsule 2–2·5 cm in diameter. Seeds with

[1] By D. A. Webb. [2] Edit. V. H. Heywood. [3] By V. H. Heywood.

suborbicular, membranous wings. *Scrub.* ● *S.W. Jugoslavia, N. Albania.* Al Ju.

2. Borderea Miégeville[1]

Like *Dioscorea* but tuber napiform; stem not twining, leaf-veins unbranched; seeds unwinged.

Leaves not narrowing below the apex, not translucent; capsule 12–20 × 12–15 mm **1. pyrenaica**
Leaves narrowing below the apex, translucent; capsule 8–9 × 6–7 mm **2. chouardii**

1. B. pyrenaica Miégeville, *Bull. Soc. Bot. Fr.* **13**: 374 (1866) (*Dioscorea pyrenaica* Bubani & Bord. ex Gren.). Stem up to 20 cm, branched above, angled-striate. Leaves 2–2·5 × 2 cm, broadly cordate-ovate, not narrowing below the acute or obtuse apex, dark green, not translucent, with 5–7 curved, unbranched veins, long-petiolate. Male racemes 3–6 cm. Female racemes very short, 1- to 3-flowered. Capsule 12–20 × 12–15 mm, the valves subrectangular; seeds lenticular. $2n=24$. *Limestone rocks and screes.* ● *C. Pyrenees.* Ga Hs.

2. B. chouardii (Gaussen) Heslot, *Compt.-Rend. Acad. Sci. (Paris)* **237**: 434 (1953). Like **1** but leaves narrowing below the mucronate apex, very shiny, translucent; capsule 8–9 × 6–7 mm, subcuneate at base, the valves oblong-orbicular. $2n=24$. *Limestone rock-crevices.* ● *C. Pyrenees (valley of the R. Noguera Ribagorzana).* Hs.

3. Tamus L.[1]

Tuber large, cylindrical to ovoid, often irregular. Stem twining. Leaves alternate. Flowers in axillary racemes. Perianth of male flowers urceolate-campanulate, with 6 subequal lobes; stamens 6, inserted at base of perianth. Perianth of female flowers with 6 minute, narrow segments. Fruit a berry. Seeds globose, unwinged.

1. T. communis L., *Sp. Pl.* 1028 (1753). Stem up to 4 m, longitudinally striate, sometimes branched, glabrous, twining sinistrally. Leaves 8–15(–20) × 4–11(–16) cm, broadly ovate, long-acuminate, dark shining green, with 3–9 curved and branched veins, long-petiolate. Flowers 3–6 mm in diameter, greenish-yellow. Berry 10–12 mm in diameter, red, rarely yellowish. $2n=48$. *Woods and hedgerows. S., S.C. & W. Europe, northwards to N. England.* Al Az Au Be Bl Br Bu Co Cr Ga Ge Gr He Hs Hu It Ju Lu Rm Rs (K) Sa Si Tu [Hb].

Plants with the leaves hastate-trilobed, the lateral lobes orbicular and the terminal lanceolate, occur in various parts of the range; they have been called **T. cretica** L., *Sp. Pl.* 1028 (1753), but are not worth more than varietal status.

CLXXXVII. PONTEDERIACEAE[2]

Perennial, rhizomatous, aquatic herbs. Leaves petiolate. Inflorescence a spike or raceme, subtended by a spathe-like bract. Flowers hermaphrodite, more or less zygomorphic, usually ephemeral. Perianth-segments 6, petaloid, connate at least at the base. Stamens 3 or 6. Ovary superior, 3-locular, or 1-locular by abortion, 1- to many-seeded. Fruit a capsule, tightly invested by the persistent perianth.

1 Perianth divided almost to the base; flowers distinctly pedicellate **4. Monochoria**
1 Perianth with a distinct tube, at least half as long as the lobes; flowers sessile
2 Stamens 3 **2. Heteranthera**
2 Stamens 6
3 Plant rooted in the substratum; petioles not inflated; perianth 2-lipped **1. Pontederia**
3 Plant usually floating; petioles inflated at the base; perianth not 2-lipped **3. Eichornia**

1. Pontederia L.[3]

Rhizome stout, creeping. Leaves mostly basal. Stem erect, with a single cauline leaf in addition to the spathe. Inflorescence a spike; flowers numerous, small, violet-blue. Perianth with a distinct tube; limb 2-lipped, with both lips 3-lobed. Stamens 6, 3 inserted at base of upper lip of perianth, the other 3 lower down on the tube. Ovary 1-locular. Fruit 1-seeded; perianth indurated in fruit.

1. P. cordata L., *Sp. Pl.* 288 (1753). Stem 30–100 cm. Leaves 5–25 × 4–15 cm, erect, long-petiolate, narrowly deltate-ovate, cordate. Spike dense, glandular-pubescent. Flowers trimorphic. Perianth *c.* 8 mm across. Anthers blue. Stigma 3- to 6-partite. Capsule 6–10 mm. *Occasionally planted in wild situations in W. Europe, and naturalized on lake-margins and in drains in N. Italy and S. Switzerland.* [He It.] (*E. North America.*)

2. Heteranthera Ruiz & Pavón[4]

Rhizome creeping and rooting at the nodes. Inflorescence a small, inconspicuous spike, emerging from the sheathing petiole of a leaf. Flowers pale blue or white, small. Perianth nearly regular, with a long, slender tube and 6 subequal lobes. Stamens 3, unequal. Ovary 3-locular; capsule many-seeded.

1. H. reniformis Ruiz & Pavón, *Fl. Peruv.* **1**: 43 (1798). Leaves up to 3 × 3·5 cm, mostly reniform, but a few sometimes ovate-cordate; petiole up to 10 cm. Spike 2- to 5-flowered. Perianth-tube *c.* 8 mm; lobes shorter, oblong. Posterior stamen with a large, greenish anther, the other two with smaller, yellow anthers. Stigma capitate. *Naturalized as a weed in rice-fields in N. Italy.* [It.] (*North and South America.*)

3. Eichornia Kunth[4]

Rhizome fairly stout, horizontal. Inflorescence a conspicuous spike. Flowers violet-blue, large. Perianth nearly regular, with a slender tube equalling or somewhat shorter than the lobes, of which the dorsal is slightly larger than the others. Stamens 6; filaments curved, 3 short and 3 long. Ovary 3-locular; capsule many-seeded.

1. E. crassipes (C. F. P. Mart.) Solms-Laub. in A. & C. DC., *Monogr. Phan.* **4**: 527 (1883). Plant usually floating. Leaves

[1] By V. H. Heywood. [2] Edit. D. H. Valentine.
[3] By D. H. Valentine. [4] By D. A. Webb.

aerial, arising in tufts, up to 8 × 8 cm, rhombic to suborbicular; petiole variable in length, the shorter ones much inflated in the lower half, and all consisting largely of spongy aerenchyma. Spike *c.* 15 cm, with 8–12 flowers 5–7 cm across. Anthers yellow, variably tinged with blue. Stigma capitate, coarsely papillose. *Naturalized in W.C. Portugal.* [Lu.] (*Brazil; extensively naturalized elsewhere in the tropics and subtropics.*)

4. Monochoria C. Presl[1]

Rhizome short, vertical or oblique. Inflorescence a raceme, sometimes with the axis very short so as to become almost an umbel. Flowers blue, fairly large. Perianth-tube very short, almost obsolete; segments subequal. Stamens 6, one larger than the other 5. Ovary 3-locular; capsule many-seeded.

1. M. korsakowii Regel & Maack, *Mém. Acad. Sci. Pétersb.* ser. 7, **4(4)**: 155 (1861). Leaves 6–12 × 4–9 cm, cordate-ovate; petiole up to 40 cm. Perianth 2–3·5 cm across; segments elliptic-oblong, blue with a median yellow stripe. Anther of larger stamen blue, of the others yellow. Stigma capitate. *Naturalized in rice-fields in S. part of U.S.S.R.* [Rs (W, K, E).] (*Temperate E. Asia.*)

Doubtfully distinct from *M. vaginalis* (Burm. fil.) C. Presl from S.E. Asia.

CLXXXVIII. IRIDACEAE[2]

Herbaceous perennials, usually with a bulb, corm or rhizome. Leaves usually equitant, ensiform, occasionally linear. Inflorescence terminal, 1- to many-flowered. Perianth petaloid, 6-partite, radially or bilaterally symmetrical, usually with a hypanthial tube. Stamens 3, opposite the outer perianth-segments. Ovary inferior, usually 3-locular and with many ovules. Style 3-lobed, branches entire or divided, sometimes petaloid. Fruit a capsule.

1 Style-branches petaloid
 2 Stock with long, digitate root-tubers; ovary unilocular **2. Hermodactylus**
 2 Stock a corm, bulb or rhizome; ovary trilocular
  3 Stock a rhizome or bulb; hypanthial tube present **3. Iris**
  3 Stock a corm; hypanthial tube absent **4. Gynandriris**
1 Style-branches not petaloid
 4 Inflorescence not spicate
  5 Stock a slender rhizome; stem compressed, winged **1. Sisyrinchium**
  5 Stock a corm; stem neither compressed nor winged
   6 Hypanthial tube not more than 1 cm; ovary above ground, enclosed in a green bract and a bracteole; leaves subterete, 4-grooved **8. Romulea**
   6 Hypanthial tube more than 1·5 cm; ovary below ground, enclosed in a membranous bract and sometimes also a bracteole; leaves flat or canaliculate with a white stripe **7. Crocus**
 4 Inflorescence spicate
  7 Stem zig-zag; style-branches deeply divided **6. Freesia**
  7 Stem straight; style-branches undivided
   8 Hypanthial tube straight **5. Ixia**
   8 Hypanthial tube bent or curved
    9 Flowers orange or yellow: stigmas filiform **9. Tritonia**
    9 Flowers pink or purple; stigmas obovate to obcordate **10. Gladiolus**

1. Sisyrinchium L.[3]

Stock a short, slender rhizome. Plant glabrous. Leaves equitant, isobilateral, mostly basal, linear-ensiform. Stem compressed and winged. Flowers actinomorphic, in umbel-like cymes of 2–6, subtended by a 2-valved, herbaceous spathe. Perianth-segments all similar. Stamens inserted at the top of the very short hypanthial tube. Style-branches undivided.

Literature: R. Ingram, *Watsonia* **6**: 283–289 (1967).

1 Flowers yellow; capsule 9–12 mm **3. californicum**
 Flowers blue; capsule *c.* 5 mm
 2 Stem usually bearing 2–3 inflorescences; flowers 15–20 mm in diameter, light blue; fruiting pedicels arcuate or nodding, clearly exceeding the shorter spathe-valve **1. bermudiana**
 2 Stem usually bearing a single inflorescence; flowers 25–35 mm in diameter, violet-blue; fruiting pedicels erect, scarcely exceeding the shorter spathe-valve **2. montanum**

1. S. bermudiana L., *Sp. Pl.* 954 (1753) (*S. angustifolium* Miller). Leaves 7–15 cm × 1–5 mm. Stems 15–45 cm, ascending to suberect, narrowly winged, usually bearing 2 terminal inflorescences and sometimes a third lower down, each peduncle subtended by a leaf-like bract. Spathe-valves usually subequal. Flowers 15–20 mm in diameter, light blue; perianth-segments obovate-cuneate, apiculate. Filaments connate almost throughout their length, equalling or shorter than the style. Capsule *c.* 5 mm, globose-trigonous, blackish-purple when ripe. Fruiting pedicels arcuate or nodding, clearly exceeding the inner spathe-valve. $2n=64$, 88. *Damp grassland and lake-shores. W. & N. Ireland.* Hb[Ga]. (*E. North America.*)

Possibly naturalized elsewhere in W. Europe, but reliable information is lacking.

Plants which have been cut or grazed early in the season may produce stems with a single inflorescence; in such plants the spathe-valves are more unequal, as in **2.**

2. S. montanum E. L. Greene, *Pittonia* **4**: 33 (1899) (*S. angustifolium* Miller pro parte, *S. bermudiana* sensu Coste, non L.). Like **1** but stems more stiffly erect, usually bearing only 1 inflorescence; outer valve of spathe usually *c.* 1½ times as long as inner; flowers 25–35 mm in diameter, violet-blue; filament-tube always equalling the style; fruiting pedicels erect, scarcely exceeding the inner spathe-valve. $2n=96$. *Dry grassland and disturbed ground. Widely naturalized, mainly in C. Europe.* [Au Br Cz Ga Ge He It No Rm Rs (C, W).] (*E. North America.*)

The plant found in Europe is var. *crebrum* Fernald.

Occasional plants develop 2 inflorescences, with subequal spathe-valves, as in **1.**

3. S. californicum (Ker-Gawler) Aiton fil. in Aiton, *Hort. Kew.* ed. 2, **4**: 135 (1812). Plant glaucous. Leaves 12–30 × 3–6 mm. Stem 15–50 cm, broadly winged, erect, bearing a single inflorescence. Spathe-valves distinctly unequal, the longer 3–4·5 cm.

[1] By D. A. Webb. [2] Edit. D. H. Valentine. [3] By R. Ingram.

Flowers 25–30 mm in diameter, bright yellow; perianth-segments elliptic-oblong, acute. Filaments connate only at base. Capsule 9–12 mm, ellipsoid-trigonous, blackish-purple when ripe. Fruiting pedicels erect, shorter than the shorter spathe-valve. *Wet grassland. Naturalized in Ireland.* [Hb.] (*Oregon, California.*)

2. Hermodactylus Miller[1]

Like *Iris* but stock with long, digitate tubers; leaves quadrangular in section; flowers solitary; ovary 1-locular.

1. H. tuberosus (L.) Miller, *Gard. Dict.* ed. 8 (1768) (*Iris tuberosa* L.). Stock with 2–4 tubers. Stems 20–40 cm, slender, erect. Leaves exceeding stems, 1·5–3(–5) mm wide. Flowers yellowish-green except for dark brownish-violet limb of falls; pedicel 10–50 mm; spathes 1–2, equalling or exceeding flower, herbaceous. Hypanthial tube *c.* 5 mm, infundibuliform. Falls 40–50 mm; limb shorter than claw, ovate-orbicular to obovate-oblong, patent. Standards 20–25 mm, linear-oblanceolate, mucronate or cuspidate. Ovary with a very slender sterile upper portion 6–8 mm. *Dry, usually rocky places. Mediterranean region, eastwards from S.E. France.* Al ?Co Cr Ga Gr It Ju Si [Br].

3. Iris L.[2]

(incl. *Xiphion* Miller)

Stock a rhizome or bulb. Plant usually caulescent. Leaves equitant, mostly basal. Flowers actinomorphic, usually large, in cymose inflorescences (rarely solitary). Perianth-segments dimorphic, the outer (*falls*) patent or deflexed, the inner (*standards*) erect (rarely patent), often smaller than the outer. Style divided above into 3 conspicuous petaloid branches, each of which overlies a stamen and the claw of one of the falls, and bears a stigma in the form of a membranous flap on the lower surface, near the apex. Ovary 3-locular, surmounted by a distinct (though sometimes very short) hypanthial tube.

In some species the upper part of the ovary is sterile, and forms a narrow, solid or 3-locular beak, persistent in fruit. This can be confused with the hypanthial tube, but the latter is tubular, with a single cavity, containing the style, and usually differs somewhat in colour or texture.

Measurements of the stem are taken from ground-level to the base of the ovary of the terminal flower.

Many of the species described below, as well as others from Asia and North America, are cultivated in gardens. The majority of garden irises, however, especially within Sect. *Iris*, are hybrids, of which *I. germanica* probably represents the most widespread and oldest established. The parentage of these hybrids is often difficult to determine; the majority appear to be derived from **13, 14, 18, 19** and **22.**

Literature: W. R. Dykes, *The genus* Iris. Cambridge. 1913. G. M. Lawrence, *Gentes Herb.* **8**: 346–371 (1953). J. Mitra, *Bot. Gaz.* **117**: 265–293 (1956) (karyology).

1 Stock a bulb; leaves not isobilateral
 2 Roots fleshy, persistent in dormant season; lower leaves 10–30 mm wide; standards patent, less than ½ as long as falls; flowering in winter **24. planifolia**
 2 Roots fibrous (rarely a few fleshy, but not persistent in dormant season); lower leaves not more than 8 mm wide; standards ±erect; flowering in spring or summer (Sect. *Xiphion*)
  3 Hypanthial tube not more than 7 mm
   4 Standards 7–10 × 0·3–0·5 mm **30. serotina**
   4 Standards at least 40 × 15 mm
    5 Claw of falls 25–30 mm wide, shorter than or equalling the limb **25. latifolia**
    5 Claw of falls not more than 10 mm wide, 1½–2 times as long as the limb **26. xiphium**
  3 Hypanthial tube at least 12 mm
   6 Falls sparsely bearded; pedicel not more than 15 mm **29. boissieri**
   6 Falls glabrous; pedicel usually more than 15 mm
    7 Flowers yellow; hypanthial tube 35–50 mm **28. juncea**
    7 Flowers purple; hypanthial tube 12–25 mm **27. filifolia**
1 Stock a rhizome; leaves isobilateral
 8 Falls glabrous, or puberulent with unicellular hairs (Sect. *Spathula*)
  9 Hypanthial tube 50–200 mm
   10 Leaves rigid, with base long-persistent after withering, very fibrous and dark brown; style-branches glabrous **2. tenuifolia**
   10 Leaves flexuous, often persistent after withering, but pale brown and not fibrous; margins of style-branches yellow-glandular-puberulent **3. unguicularis**
  9 Hypanthial tube not more than 20 mm
   11 Stem strongly compressed, 2-winged; flowers with fruity fragrance **9. graminea**
   11 Stem cylindrical or slightly compressed, not winged; flowers without fruity fragrance
    12 Upper part of ovary sterile, forming a narrow beak 12–40 mm
     13 Stem 30–90 cm; basal leaves 6–20 mm wide, somewhat fetid **8. spuria**
     13 Stem not more than 35 cm; basal leaves 2–6 mm wide, not fetid
      14 Stem at least 10 cm; spathes herbaceous; outer perianth-segments 35–45 mm **10. sintenisii**
      14 Stem 1–4 cm; spathes membranous; outer perianth-segments 45–55 mm **11. pontica**
    12 Upper part of ovary fertile, not narrowed
     15 Stem not more than 20 cm **4. ruthenica**
     15 Stem at least 30 cm
      16 Stem hollow; basal leaves usually less than 10 mm wide **1. sibirica**
      16 Stem solid; basal leaves usually more than 10 mm wide
       17 Leaves evergreen, fetid; seeds scarlet, persisting in capsule after dehiscence **5. foetidissima**
       17 Leaves not evergreen, not fetid; seeds brown, shed soon after dehiscence of capsule
        18 Flowers yellow; leaves with conspicuous midrib **6. pseudacorus**
        18 Flowers purple; leaves without conspicuous midrib **7. versicolor**
 8 Falls with a beard of multicellular hairs
  19 Stem simple or absent
   20 Both spathes acutely keeled
    21 Hypanthial tube about as long as perianth-segments **17. suaveolens**
    21 Hypanthial tube much shorter than perianth-segments **16. reichenbachii**
   20 Spathes rounded, or the outer slightly keeled
    22 Rhizome slender, emitting slender stolons which are often tuberous at apex; hypanthial tube 5–10 mm; seeds with an aril **12. humilis**
    22 Rhizome stout, of ±uniform diameter throughout; hypanthial tube 25–90 mm; seeds without an aril
     23 Stem not more than 1 cm; plant leafless in winter **13. pumila**
     23 Stem at least 3 cm; plant with leaves present through the winter
      24 Spathes narrow, closely investing the whole of the hypanthial tube and partly concealed by the leaves; hypanthial tube 50–75 mm **15. pseudopumila**
      24 Spathes ovate to oblong, not investing the upper part of the hypanthial tube and not concealed by the leaves; hypanthial tube 20–50 mm **14. lutescens**

[1] By A. O. Chater. [2] By D. A. Webb and A. O. Chater.

19 Stem branched (sometimes from ground-level)
25 Spathes entirely scarious at anthesis **23. pallida**
25 Spathes herbaceous at anthesis, at least in lower part
26 Spathes entirely herbaceous, except for a very narrow scarious margin
27 Stem branched below middle; flowers violet to purple **18. aphylla**
27 Stem branched only in upper half; flowers predominantly white or yellow, but the falls with violet or reddish-brown veins **19. variegata**
26 Spathes scarious in upper half
28 Lower flowers ±sessile, enclosed by subtending bract up to anthesis **22. albicans**
28 Lower flowers on distinct branches, well-exserted from subtending bract before anthesis
29 Stem usually with 4 flowers, the 2 uppermost very close together; spathes 35–55 mm, scarcely exceeding the hypanthial tube; perianth-segments 40–60 mm wide **20. germanica**
29 Stem usually with 3 flowers, the uppermost well separated from the others; spathes 55–65 mm, clearly exceeding the hypanthial tube; perianth-segments not more than 45 mm wide **21. marsica**

Subgen. **Iris**. Stock a rhizome. Stem usually solid. Leaves isobilateral.

Sect. SPATHULA Tausch (incl. Sect. *Apogon* Baker). Rhizome usually slender, of uniform diameter. Stems simple or branched. Falls glabrous, or puberulent with unicellular hairs. Seeds with an aril.

1. I. sibirica L., *Sp. Pl.* 39 (1753). Stems 50–120 cm, hollow, somewhat compressed, with usually 3 small cauline leaves. Basal leaves 25–80 cm × (2–)4–10 mm. Flowers 1–3(–5), violet-blue, rarely white; pedicels up to 100 mm; spathes 30–50 mm, brown and scarious at anthesis. Hypanthial tube 4–7 mm. Falls 30–50 mm; limb obovate to orbicular. Standards 25–45 × 12–20 mm; limb narrowly elliptical. Capsule 3–4 cm, obtusely trigonous to subcylindrical. Seeds flat. $2n=28$. *Damp grassland. C. & E. Europe; Italy; one station in W. France.* Au Bu Cz Ga Ge He Hu It Ju Po Rm Rs (N, B, C, W, E) [Su].

2. I. tenuifolia Pallas, *Reise* **3**: 714 (1776). Densely caespitose. Stems up to 6(–15) cm, concealed by persistent, dark brown, fibrous leaf-bases. Leaves 20–40 cm × 3–5 mm, **rigid**. Flowers 1–2, lilac to violet-blue, fragrant; pedicels very short; spathes 70–100 mm, more or less herbaceous. Hypanthial tube 50–80 mm, filiform. Falls 40–60 mm; limb broadly elliptical, scarcely distinct from claw. Standards slightly shorter than falls. Style-branches narrow. Capsule 2·4–4·5 cm, oblong, obtusely trigonous. Seeds cubical, rugose, dark brown. *Sandy steppes and semi-deserts. S.E. Russia, W. Kazakhstan.* Rs (E). (*Temperate Asia.*)

3. I. unguicularis Poiret, *Voy. Barb.* **2**: 86 (1789). Stems very short or absent; dead leaves persistent, pale brown, eventually detaching in their entirety and not leaving fibrous bases. Leaves 10–50 cm × 1–5 mm, flexuous. Flowers solitary, fragrant; pedicel short; spathes 60–130 mm, mainly herbaceous. Falls with purple apex, the remainder whitish, with purple veins; standards lilac. Hypanthial tube 60–200 mm, very slender. Falls 45–55 × 12–25 mm; limb oblong-elliptical. Standards 45–55 × 7–10 mm, oblanceolate. Style-branches yellow-glandular-puberulent above near the margins. Seeds few, globose to cuneate, finely rugose. *Banks and stony places. S. & W. Greece, S. Aegean region.* Cr Gr. (*E. Mediterranean region, N. Africa.*)

Very variable. The plants of N. Africa, which include the type of the species, are larger in all their parts, with leaves up to 10 mm wide and perianth segments up to 80 mm, with most of the limb of the falls uniformly lilac. Among the European populations those from Kriti differ most markedly from the type, and would be entitled to subspecific or perhaps even specific status as **I. cretensis** Janka, *Österr. Bot. Zeitschr.* **18**: 382 (1868) (*I. cretica* Herbert ex Baker, *I. humilis* subsp. *cretensis* (Janka) Nyman), were it not for the existence of intermediate and variable populations in the rest of the European range and in Anatolia and Syria. For detailed information on this complex see W. Schulze, *Österr. Bot. Zeitschr.* **112**: 331–343 (1965).

4. I. ruthenica Ker-Gawler, *Bot. Mag.* **28**: t. 1123 (1808). Stems 3–10(–20) cm, with *c.* 2 small leaves. Basal leaves 10–30 cm × 4–6 mm. Flowers solitary, violet, the falls white with violet veins; pedicels *c.* 10 mm; spathes 30–50 mm, membranous, pale green with pink margins. Hypanthial tube 8–10 mm. Falls 45–50 × 15–18 mm, oblong-obovate; limb not distinct from claw. Standards 40–45 × 7–8 mm, oblong-lanceolate. Capsule 10–20 mm, ovoid to subglobose. Seeds globose, shining brown, with a large, white aril. *Meadows and open woodland. C. & E. Romania.* Rm ?Rs (E). (*Temperate C. & E. Asia.*)

I. triflora Balbis, *Mém. Acad. Sci.* (*Turin*) **10–11**: 6 (1804) (*I. ensata* auct., non Thunb., *Xiphion triflorum* (Balbis) Cesati), from C. & E. Asia, has been reported as naturalized in N.W. Italy. It differs from **4** chiefly in its much shorter hypanthial tube (*c.* 2 mm) and its cylindrical capsule 5–8 cm, with 6 longitudinal ridges.

5. I. foetidissima L., *Sp. Pl.* 39 (1753). Stems 30–90 cm, somewhat compressed, with a single longitudinal ridge, bearing 3–4 leaves. Basal leaves 30–70 cm × 10–25 mm, dark green, evergreen, fetid. Flowers 1–5, dull violet more or less tinged with dull yellow, rarely clear yellow; pedicels 20–100 mm; spathes 50–100 mm, herbaceous. Hypanthial tube *c.* 10 mm, stout. Falls 30–50 × 10–20 mm, oblong-obovate to oblanceolate. Standards 25–40 × 5–9 mm, oblanceolate. Style-branches pale yellow. Capsule 4–7 cm, oblong-ellipsoid. Seeds 5–7 mm, globose, orange-scarlet, long-persistent in dehisced capsule. $2n=40$. *S. & W. Europe, northwards to England and eastwards to N.E. Italy; cultivated for ornament and naturalized elsewhere.* Az Br Co Ga Hs It Lu Sa Si [Hb He].

6. I. pseudacorus L., *Sp. Pl.* 38 (1753) (incl. *I. monnieri* auct. aeg., non DC.). Stems 60–120 cm, slightly compressed, bearing several leaves. Basal leaves 50–90 cm × 10–30 mm, rather glaucous, with conspicuous midrib. Flowers 4–12, yellow, the lower on long, suberect peduncles; pedicels 20–50 mm; spathes 40–100 mm, herbaceous, with membranous margins. Hypanthial tube 10–15 mm, narrowly infundibuliform. Falls 50–75 × 20–30 mm; limb broadly ovate. Standards 20–30 × 4–8 mm, linear-oblong, shorter and narrower than the style-branches. Capsule 40–80 mm, cylindrical, with a short beak. Seeds dark brown, smooth. $2n=24$, 30, 32, 34, 40. *Wet places. Most of Europe.* All except Az Is Sb.

7. I. versicolor L., *Sp. Pl.* 39 (1753). Stems 50–100 cm, bearing 2–3 leaves. Basal leaves 35–60 cm × 8–25 mm, often pinkish at the base. Flowers 2–9, lilac-purple, the lower on long, ascending peduncles; pedicels 25–55 mm; spathes 30–80 mm, more or less herbaceous. Hypanthial tube 7–10 mm, stout. Falls 40–60 × 15–27 mm; limb broadly elliptical to suborbicular, about as long as the claw. Standards 25–40 × 8–12 mm, oblanceolate. Capsule 3·5–5 cm, oblong, obtusely trigonous. Seeds flat, pale brown. *Cultivated for ornament, and naturalized on lake-shores and river-banks in Britain.* [Br ?Ge.] (*E. North America.*)

8. I. spuria L., *Sp. Pl.* 39 (1753). Stems 30–90 cm, bearing several leaves. Basal leaves 25–90 cm × 6–20 mm, somewhat fetid. Flowers (1–)2–4; pedicels 5–20 mm; spathes 40–80(–120) mm, herbaceous, but often with membranous apex or margins. Hypanthial tube 7–10 mm, campanulate; sterile beak of ovary up to 40 mm. Falls 30–80 × 10–30 mm; limb elliptical to orbicular, shorter than the claw. Standards 30–60 × 8–20 mm, narrowly obovate. Capsule 2·5–4 cm (excluding beak), with 6 conspicuous longitudinal ridges. Seeds angular, brown, with loose, membranous testa. *Wet places, on calcareous or saline soils. From S. Sweden to C. Spain, N.E. Greece and S. Ukraine.* Au *Br Cz Da Ga Ge Gr Hs Hu Rm Rs (W) Su [It].

Very variable. The taxa here treated as subspecies have been variously regarded as varieties or as separate species.

A fifth, subspecies subsp. **notha** (Bieb.) Ascherson & Graebner, *Syn. Mitteleur. Fl.* **3**: 496 (1906) (*I. notha* Bieb.), described from the Caucasus, has been doubtfully reported from S.E. Russia. It resembles subsp. **(a)** in most characters, but is larger in all its parts.

1 Flowers violet, at least in part
 2 Upper cauline leaves shorter than internodes; falls usually more than 45 mm **(a)** subsp. **spuria**
 2 Upper cauline leaves longer than internodes; falls usually less than 45 mm **(b)** subsp. **maritima**
1 Flowers yellow or white, without any violet tint
 3 Basal leaves 7–12 mm wide; falls usually less than 60 mm, yellow **(c)** subsp. **halophila**
 3 Basal leaves 10–20 mm wide; falls usually more than 60 mm, white with yellow centre **(d)** subsp. **ochroleuca**

(a) Subsp. **spuria**: Stems (50–)60–80 cm. Basal leaves 8–12 mm wide. Upper cauline leaves shorter than internodes. Spathes membranous at apex. Falls 45–60 mm, lilac, with violet veins and yellow central stripe. $2n=22$. ● *C. Europe, extending to S. Sweden and (doubtfully native) E. England.*

(b) Subsp. **maritima** P. Fourn., *Quatre Fl. Fr.* 190 (1935) (*I. maritima* Lam., non Miller): Stems 30–40(–50) cm. Basal leaves 6–8(–10) mm wide. Upper cauline leaves longer than internodes. Spathes entirely herbaceous. Falls 30–45 mm, cream, with violet-blue veins. *S.W. Europe.*

(c) Subsp. **halophila** (Pallas) D. A. Webb & Chater, *Bot. Jour. Linn. Soc.* **76**: 315 (1978) (*I. halophila* Pallas): Stems 40–90 cm. Basal leaves 7–12 mm wide. Upper cauline leaves longer than internodes. Spathes with membranous apex and margins. Falls 40–60 mm, pale yellow with deeper veins, patent. $2n=20$. *From S. Romania to E. Ukraine.*

(d) Subsp. **ochroleuca** (L.) Dykes, *Gen. Iris* 63 (1913) (*I. ochroleuca* L.): Like subsp. **(c)** but basal leaves 10–20 mm wide; falls 60–80 mm, white, with yellow centre, deflexed. *N.E. Greece (near Alexandropoulos). (Anatolia and E. Mediterranean region.)*

9. I. graminea L., *Sp. Pl.* 39 (1753). Stems (10–)20–40 cm, strongly compressed and 2-winged, with 1–3 leaves, the uppermost exceeding the inflorescence. Basal leaves 35–100 cm × 5–15 mm. Flowers (1–)2, with a strong, fruity fragrance; pedicels 10–50 mm; spathes unequal, the lowest usually leaf-like and up to 250 mm, the others 40–70 mm, partly or wholly scarious. Hypanthial tube 2–5 mm, campanulate; ovary with somewhat narrowed sterile upper portion up to 5 mm. Falls 30–50 × 12–15 mm; limb ovate-orbicular, violet with white veins; claw dull pink, as wide as limb. Standards 25–40 × 8–12 mm, oblanceolate, purple. Style-branches pink with purple apex. Capsule 2·5–5 cm, broadly ellipsoid, beaked, with 6 conspicuous longitudinal ridges. Seeds pale brown, with loose, membranous testa. $2n=34$. *Grassland and open scrub. C. & S. Europe, westwards to S.W. France, and extending eastwards to C. Ukraine.* Au Bu Cz Ga Ge He Hs Hu It Ju Po Rm Rs (W).

10. I. sintenisii Janka, *Term. Füz.* **1**: 244 (1877). Like **9** but stems cylindrical or slightly compressed, not winged; basal leaves 20–50 cm × 1·5–5 mm; spathes 40–70 mm, all alike, keeled; falls 8–12 mm wide; flowers violet-blue, not fragrant; sterile upper portion of ovary 12–22 mm, very slender. *S.E. Europe, from S. Albania to Moldavia; S. Italy.* Al Bu Gr It Ju Rm Rs (W) Tu.

(a) Subsp. **sintenisii**: Leaves 3–5(–6) mm wide, with 6–10 prominent veins, smooth. Spathe not inflated; veins inconspicuous. $2n=16$, 18. *Dry grassland and open scrub. Throughout the range of the species except the extreme north-east.*

(b) Subsp. **brandzae** (Prodan) D. A. Webb & Chater, *Bot. Jour. Linn. Soc.* **76**: 315 (1978) (*I. brandzae* Prodan): Leaves 1·5–3·5 mm wide, with 2–5 prominent veins, scabrid. Spathe usually strongly inflated; veins conspicuous. $2n=10$. *Wet, saline soils. N. & E. Romania, Moldavia.*

The plants from Italy are said to be distinct in their very long, pale green leaves and green, herbaceous spathes; they have been named **I. lorea** Janka, *Term. Füz.* **1**: 245 (1877) (*Xiphion gramineum* subsp. *loreum* (Janka) Arcangeli), but do not seem to merit more than varietal status.

11. I. pontica Zapał., *Consp. Fl. Galic.* **1**: 191 (1906) (*I. humilis* Bieb., non Georgi). Stems 1–4 cm, bearing 2–3 long leaves. Basal leaves 10–45 cm × 2–5 mm. Flowers solitary, purplish, variegated with white, yellow, or brown; pedicel 4–7 mm; spathes 40–70 mm, membranous. Hypanthial tube 8–13 mm, infundibuliform; sterile upper portion of ovary 18–25 mm, slender. Falls 45–55 × 15–18 mm; limb obovate-orbicular; claw spathulate, as wide as the limb. Standards 35–50 × 8–12 mm, oblanceolate. Capsule 1·5–2·5 cm (excluding beak), ellipsoid, with 6 inconspicuous longitudinal ridges. Seeds brownish, with loose, membranous testa. *Dry grassland. C. Romania, Moldavia, W. Ukraine.* Rm Rs (W). *(S.W. & C. Asia.)*

Sect. REGELIA Lynch. Rhizome slender, stolon-like, but expanded at apex. Stems simple. Falls with a beard of multicellular hairs. Seeds with a conspicuous, whitish, circular aril.

12. I. humilis Georgi, *Bemerk. Reise* **1**: 196 (1775) (*I. flavissima* Pallas, *I. arenaria* Waldst. & Kit.). Stems 5–12 cm, slender, erect or ascending. Leaves 5–17 cm × 1·5–6(–8) mm. Flowers 1–2, the falls yellowish-white with purple veins, the standards purple, with darker veins; pedicels *c.* 6 mm; spathes 20–35 mm, scarious at least above. Hypanthial tube 5–10 mm, infundibuliform. Falls 30–35 mm, suborbicular, with a distinct claw. Standards 27–33 mm, oblanceolate, with a short claw. Withered perianth spirally coiled. Seeds globose or pyriform, brown. $2n=22$. *From C. Czechoslovakia to S.E. Russia.* Au Cz Hu ?Ju Rm Rs (C, W, E).

Sect. IRIS (Sect. *Pogiris* Tausch, Sect. *Pogoniris* (Spach) Baker). Rhizome stout, of uniform diameter. Stems simple or branched. Falls with a beard of multicellular hairs. Seeds without an aril.

13. I. pumila L., *Sp. Pl.* 38 (1753). Plant leafless in winter. Stems not more than 1 cm. Leaves 3–15 cm × 4–17 mm, straight or somewhat falcate. Flowers solitary, yellow, blue or purple, sessile; spathes 50–100 mm, scarious above, rounded or very slightly keeled on the back. Hypanthial tube 40–90 mm, slender.

Falls 35–60 × 12–20 mm, oblong-cuneate. Standards 40–80 × 15–23 mm, oblong, with a distinct claw. Seeds globose, pale brown. *E.C. & S.E. Europe, extending northwards to c. 54° N. in C. Russia.* Al Au Bu Cz Gr Hu Ju Rm Rs (C, W, K, E) [Ge].

(a) Subsp. **pumila**: Leaves up to 15 cm × 17 mm, straight or very slightly falcate. $2n=32$. *Throughout the range of the species except Greece and Macedonia.*

(b) Subsp. **attica** (Boiss. & Heldr.) Hayek, *Prodr. Fl. Penins. Balcan.* **3**: 119 (1932): Leaves not more than 8 cm × 9 mm, strongly falcate. $2n=14, 16$. ● *Greece and Macedonia.*

Some plants from E. Russia differ from subsp. (a) in their shorter hypanthial tube and more scarious spathes. These differences are probably due to introgression from *I. scariosa* Willd. ex Link, a related species of W. & C. Asia.

14. I. lutescens Lam., *Encyl. Méth. Bot.* **3**: 297 (1789). Plant with leaves present through the winter. Stems 3–35 cm. Leaves 5–30(–35) cm × 5–25 mm, more or less straight. Flowers 1–2, violet, sometimes variegated with yellow or entirely yellow or rarely whitish; pedicels very short; spathes herbaceous, sometimes scarious or purplish towards apex, ovate to oblong, not investing the upper part of the hypanthial tube and not concealed by the leaves. Hypanthial tube 20–50 mm. Falls 50–75 × 20–35 mm, oblong-lanceolate, without a distinct claw. Standards 55–75 × 20–40 mm, with broadly elliptical limb and short claw. Seeds pyriform, rugose, brown. *Dry places.* ● *W. Mediterranean region, C. Portugal.* ?Cr Ga Hs It Lu [He Si].

(a) Subsp. **lutescens** (*I. pumila* auct., non L.; incl. *I. chamaeiris* Bertol.): Stems usually less than 20 cm. Flowers violet or yellow, rarely whitish; beard of falls yellow; spathes 30–55 mm. Hypanthial tube 20–35 mm. $2n=40$. *Italy, S. France, N.E. Spain.*

(b) Subsp. **subbiflora** (Brot.) D. A. Webb & Chater, *Bot. Jour. Linn. Soc.* **76**: 316 (1978) (*I. subbiflora* Brot.): Stems usually more than 20 cm. Flowers deep violet; beard mainly violet, yellow only near the claw; spathes 45–80 mm. Hypanthial tube 35–50 mm. *Portugal, S.W. Spain.*

Recorded from N.W. Africa, but probably only as an escape from gardens.

15. I. pseudopumila Tineo, *Cat. Pl. Horti Panorm.* 283 (1827). Like **14(a)** but leaves not more than 15 mm wide; flowers solitary; spathes up to 120 mm, narrower, closely investing the whole of the hypanthial tube and partly concealed by the leaves; hypanthial tube 50–75 mm. $2n=16$. ● *S.E. Italy, Sicilia, W. Jugoslavia.* It Ju Si.

Intermediate in many characters between **13** and **14**; its chromosome number, however, suggests that it is more closely related to **13**.

16. I. reichenbachii Heuffel, *Verh. Zool.-Bot. Ges. Wien* **8**: 206 (1858) (incl. *I. balkana* Janka, *I. bosniaca* G. Beck, *I. skorpilii* Velen.). Stems 4–30 cm, slender. Leaves 8–35 cm × (3–)5–15 mm. Flowers 1–2, violet to brownish-purple, or greenish-yellow, sometimes with violet veins; pedicels very short; spathes 32–55 mm, navicular, keeled, herbaceous, with scarious apex and narrow scarious margin. Hypanthial tube 15–25(–35) mm, much shorter than the perianth-segments. Falls 40–60 × 15–30 mm, obovate-cuneate, without a distinct claw. Standards 40–60 × 25–30 mm, with broadly elliptical limb and short claw. Seeds pyriform, rugose, brown. $2n=24, 48$. *Rocky and grassy places, mainly in the mountains.* ● *From C. Jugoslavia and S.W. Romania southwards to E.C. Greece.* Bu Gr Ju Rm.

17. I. suaveolens Boiss. & Reuter in Boiss., *Diagn. Pl. Or. Nov.* **2(13)**: 15 (1853) (incl. *I. rubromarginata* Baker). Like **16** but stems 1–6(–17) cm; leaves not more than 22 cm × 10 mm; hypanthial tube (25–)35–50(–65) mm, about as long as the perianth-segments; falls 30–55 mm; seeds subglobose, reddish-brown. $2n=24$. *Dry, rocky or grassy places. C. & N.E. parts of Balkan peninsula, extending to S.E. Romania.* Bu Gr Ju Rm Tu.

18. I. aphylla L., *Sp. Pl.* 38 (1753). Plant leafless in winter. Stems 15–30(–70) cm, slender, branched usually below the middle and often from the base. Leaves 15–40 cm × 6–22 mm, the lower usually falcate. Flowers (1–)3–5, violet to purple; pedicels very short; spathes 30–60 mm, ovate to oblong, herbaceous, often purplish at apex. Hypanthial tube 14–22 mm. Falls 40–65 × 20–25 mm, narrowly obovate. Standards 40–65 × 22–30 mm, with broadly elliptical limb and short claw. Seeds globose to pyriform, rugose, dark reddish-brown. $2n=24, 40, 48$. *E.C. Europe and S. half of U.S.S.R., extending westwards very locally to C. Germany and S.W. Alps, and southwards to Albania.* Al Cz Ga Ge Hu It Ju Po Rm Rs (C, W, E).

Variable, especially in length of stem, colour of flowers and length of hypanthial tube relative to ovary. Several variants have been described as subspecies.

Hybrids between **18** and **13** (**I. × binata** Schur, *Österr. Bot. Zeitschr.* **10**: 354 (1860)) occur, especially in C. Romania; they resemble **13** in most characters but have a distinct stem.

19. I. variegata L., *Sp. Pl.* 38 (1753). Stems 15–40(–55) cm, usually branched in upper half. Leaves 12–30 cm × 7–28 mm, more or less falcate, deep green. Flowers (2–)3–6, the falls yellowish-white, with conspicuous deep violet to brownish-red veins, the standards and style-branches yellow; pedicels very short; spathes 30–55 mm, inflated, herbaceous, sometimes tinged with purple and scarious only at extreme apex. Hypanthial tube 18–25 mm. Falls 45–60 × 15–20 mm, oblong-lanceolate, without a distinct claw. Seeds more or less pyriform, greyish-brown. $2n=24$. ● *C. & S.E. Europe, from S.C. Germany and W. Ukraine to S. Jugoslavia.* Au Bu Cz Ge Hu Ju Rm Rs (W) [He It].

Records for E. Ukraine and S.E. Russia require confirmation.

A wide range of nothomorphs of the hybrid **19 × 23** (**I. × lurida** Aiton, *Hort. Kew.* **1**: 68 (1789)) is in cultivation and some of them have become naturalized in Romania and elsewhere.

A plant whose origin is given with some doubt as S. Jugoslavia has been described as **I. reginae** I. & M. Horvat, *Period. Biol. (Zagreb)* ser. 2, B, **1**: 18 (1947). It differs from **19** in its longer hypanthial tube (25–30 mm), and in its standards which, like the falls, are white veined with violet; it has $2n=24$.

20. I. germanica L., *Sp. Pl.* 38 (1753). Stems 40–90 cm, stout, with branches at least 5 cm long in the upper half, the lower flowers well-exserted from the subtending bract even in bud. Leaves 30–70 cm × 20–35 mm, somewhat glaucous, more or less straight. Flowers (3–)4(–5), bluish-violet, or white tinged with blue; pedicels very short; spathes 35–55 mm, scarcely exceeding the hypanthial tube, scarious in the upper ½–⅔, often tinged with purple. Hypanthial tube 17–25 mm. Falls 55–90 × 40–60 mm, cuneate-obovate, without a distinct claw. Standards 55–90 × 45–60 mm, broadly elliptical, with a short, wide claw. Seeds pyriform, rugose, reddish-brown. $2n=36, 44, 48$. *Dry, rocky or grassy places. Widely cultivated for ornament and for the perfume extracted from its rhizome and naturalized in most of Europe except the north; of unknown and probably hybrid origin but perhaps native in the E. Mediterranean region.* [Al Au Az Be Bl Br

Bu Co Cr Cz Da Ga Ge *Gr He Hs Hu It Ju Lu Rm Rs (C, W, K, E) Sa Si.]

Var. *florentina* Dykes (*I. florentina* auct., vix L.), with whitish flowers, is cultivated for perfume, especially in Italy; none of the morphological characters used to distinguish it from **20** appear to be constant. Many records of var. *florentina* are, however, referable to **22**.

21. I. marsica I. Ricci & Colasante, *Ann. Bot.* (*Roma*) **32**: 218 (1975). Like **20** but leaves up to 50 mm wide, somewhat falcate; flowers 3(–4); spathes 55–65 mm, clearly exceeding the hypanthial tube; hypanthial tube up to 35 mm; falls 20–40 mm wide; standards 23–45 mm wide. $2n=40$. *Calcareous rocky hillsides*, 1100–1700 *m*. ● *C. Appennini* (*S.E. of Avezzano*). It.

The relationship of this species to other taxa in the section is obscure. Its morphology allies it most closely to **20** (though in some features it resembles **23(b)**), and its occurrence in an apparently native station in C. Italy is difficult to reconcile with the generally assumed eastern origin of **20**.

22. I. albicans Lange, *Vid. Meddel. Dansk Naturh. Foren. Kjøbehavn* **1860**: 76 (1861). Like **20** but flowers pure white, the lower subsessile on the main axis and enclosed by the subtending bract up to anthesis. *Originally planted in Moslem cemeteries in S. Europe and locally naturalized.* [Cr Ga Hs ?Ju Lu.] (*?S. Arabia.*)

23. I. pallida Lam., *Encycl. Méth. Bot.* **3**: 294 (1789). Stems 15–120 cm, usually branched in the upper half. Leaves 20–60 cm × 10–40 mm. Flowers 2–6, lilac to violet; pedicels very short; spathes 20–35 mm, entirely scarious at anthesis. Hypanthial tube 8–11 mm. Falls 50–75 × 30–50 mm, obovate-cuneate, without a distinct claw. Standards 50–75 × 30–45 mm, obovate-elliptical, with a short claw. $2n=24$. ● *N. Italy, W. Jugoslavia; naturalized elsewhere in S. Europe.* It Ju [*Al Bl Ga Rm Sa Si].

(a) Subsp. **pallida**: Leaves glaucous, thick, finely ribbed, some of them usually persisting through the winter. Flowers 3–6, lilac; spathes silvery-white. Seeds *c.* 10 × 7 mm, angled, reddish-brown. *Probably native only in W.C. Jugoslavia; naturalized elsewhere.*

(b) Subsp. **cengialti** (Ambrosi) Foster, *Gard. Chron.* ser. 2, **25**: 555 (1886) (*I. cengialti* Ambrosi): Leaves scarcely glaucous, thin, strongly ribbed, usually all withering in winter. Flowers usually 2, violet; spathes brownish. Seeds *c.* 5 × 3 mm, ovoid, greyish-brown. *N.E. Italy, westwards to Lago di Garda.*

In N.W. Jugoslavia plants are usually intermediate in character between the two subspecies. They have been described as **I. illyrica** Tommasini, *Veg. Isola Veglia* 63 (1875) (*I. germanica* subsp. *illyrica* (Tommasini) Nyman).

Subgen. **Xiphion** (Miller) Spach. Stock a bulb. Stem simple, hollow. Leaves not isobilateral.

Sect. JUNO (Tratt. ex Roemer & Schultes) Bentham. Roots fleshy, persistent in the dormant season. Leaves conduplicate. Standards patent, less than ½ as long as falls. Seeds without an aril.

24. I. planifolia (Miller) Fiori & Paol., *Fl. Anal. Ital.* **1**: 227 (1896) (*Costia scorpioides* (Desf.) Willk.). Bulb cylindrical, invested by numerous membranous leaf-bases. Stem very short and subterranean. Leaves 10–30 cm × 10–30 mm, numerous, undulate, more or less recurved. Flowers 1(–3), blue to violet, rarely white; pedicel very short at anthesis, elongating in fruit; spathes *c.* 100 mm, more or less hidden by the leaves. Hypanthial tube 100–200 mm, whitish. Falls 50–80 × 20–30 mm. Standards 20–25 × 7–10 mm. Style-branches almost as long as the falls. Seeds ovoid or pyriform, rugose, dark reddish-brown. Flowering in winter. $2n=24$. *Mediterranean region, S. & C. Portugal.* Cr Gr Hs Lu Sa Si.

Sect. XIPHION. Roots fibrous (rarely a few fleshy, but not persistent in dormant season). Stems simple, hollow. Leaves linear, canaliculate. Standards suberect, at least ½ as long as falls. Seeds without an aril.

25. I. latifolia (Miller) Voss in Siebert & Voss, *Vilmorin's Blumengärtnerei* **1**: 982 (1895) (*I. xiphioides* Ehrh.). Plant leafless in winter. Bulb ovoid, invested by thin, more or less fibrous leaf-bases. Stem 25–50 cm. Lower leaves 25–65 cm × 5–8 mm, whitish on the concave surface, the upper shorter and wider and merging gradually into the spathes. Flowers 2(–3), violet-blue, the falls with a yellowish centre; pedicels 25–70 mm; spathes 75–100 mm, herbaceous, inflated. Hypanthial tube *c.* 5 mm. Falls 60–75 × 30–35 mm; limb ovate-oblong, not sharply delimited from claw; claw 25–30 mm wide, obovate, shorter than or equalling the limb. Standards 40–60 × 15–20 mm, oblanceolate. Seeds globose, rugose, dark reddish-brown. *Damp, grassy places.* ● *Pyrenees, Cordillera Cantábrica.* Ga Hs.

26. I. xiphium L., *Sp. Pl.* 40 (1753). Plant with leaves present through the winter. Bulb ovoid, invested by thin, membranous leaf-bases. Stem 25–50(–80) cm. Lower leaves 20–70 cm × (1–) 3–5 mm, glaucous, the upper shorter and wider and merging gradually into the spathes. Flowers 1(–2), usually violet, with a yellow or orange centre to the falls, rarely mostly yellow; pedicels up to 120 mm; spathes 60–100 mm, herbaceous. Hypanthial tube 1–3 mm. Falls 45–65 × 18–25 mm, glabrous; limb suborbicular; claw 7–10 mm wide, narrowly oblong, distinctly longer than the limb, concealed by the style-branches. Standards 45–65 × 15–20 mm, oblanceolate. Seeds compressed, semicircular, yellowish-brown. Flowering in early (rarely mid-) summer. $2n=34$. *S.W. Europe, extending eastwards to* 13°30′ *E. in W.C. Italy.* Co Ga Hs It Lu Sa.

Plants from Portugal with yellow flowers have been called **I. lusitanica** Ker-Gawler, *Bot. Mag.* **18**: t. 679 (1803); yellow-flowered variants occur elsewhere in the range of the species, and it is not clear whether in Portugal this character is correlated with any other.

27. I. filifolia Boiss., *Voy. Bot. Midi Esp.* **2**: 602 (1842). Like **26** but leaves 0·5–3 mm wide; flowers usually 2, dark reddish-purple, with a conspicuous orange patch on the falls; pedicels not more than 70 mm; hypanthial tube 12–20(–32) mm. *Dry, rocky places. S.W. Spain.* Hs.

Records from Spain of **I. tingitana** Boiss. & Reuter, *Pugillus* 113 (1852) (incl. *I. fontanesii* Godron), appear to be erroneous; it differs from **27** chiefly in the much narrower and more acute standards, and is endemic to Morocco.

28. I. juncea Poiret, *Voy. Barb.* **2**: 85 (1789). Like **26** but bulb invested by coriaceous leaf-bases becoming fibrous above; lower leaves 1–3 mm wide; flowers entirely yellow; pedicels not more than 30 mm; spathes with scarious margin or apex; hypanthial tube 35–50 mm, very slender; standards 30–45 × 5–12 mm; seeds dark brown. *S.W. Spain; Sicilia.* Hs Si [It]. (*N. Africa.*)

29. I. boissieri Henriq., *Bol. Soc. Brot.* **3**: 183 (1885). Like **26** but leaves yellowish-green; flowers deep purple; pedicels not more than 15 mm; spathes sometimes with scarious margin or apex; hypanthial tube (25–)30–45 mm; yellow stripe on falls

sparsely bearded; standards 25–35 mm, obovate; seeds globose or pyriform, rarely somewhat compressed, dark reddish-brown. $2n = 36$. ● *N.W. Spain, N. Portugal.* Hs Lu.

30. I. serotina Willk. in Willk. & Lange, *Prodr. Fl. Hisp.* **1**: 141 (1861). Bulb ovoid, invested by membranous leaf-bases. Stem 40–60 cm. Lower leaves 30–60 cm × 2–6 mm, the upper shorter and wider and merging gradually into the spathes. Flowers 2–3, bluish-violet, with deeper violet veins and yellowish centre to the falls; pedicels 50–60 mm; spathes 60–90 mm, herbaceous, with a narrow scarious margin. Hypanthial tube 5–7 mm. Falls 35–45 × 12–20 mm, glabrous; limb ovate-orbicular; claw *c.* 6 mm wide, somewhat longer than limb. Standards 7–14 × 1–2 mm, greenish. Seeds semicircular, compressed, yellowish. Flowering in late summer. Pinus-*woods and dry grassland. Mountains of S.E. Spain.* Hs.

Distinct from all other species in Sect. *Xiphion* in its very small standards; it has for this reason been referred by some authors to Sect. *Juno*, but the characters of the bulbs and roots and the erect position of the standards make it clear that it belongs to Sect. *Xiphion*.

4. Gynandriris Parl.[1]

Like *Iris* but stock a corm; stamens closely adherent to style-branches, though not truly adnate; hypanthial tube absent, the perianth-segments inserted on the slender, sterile, terminal beak of the ovary.

A mainly South African genus, with one European representative. The latter has often been included in *Iris*, mainly because the sterile beak of the ovary has been mistaken for a hypanthial tube. The genus is more closely related to *Moraea*, which is also centred in South Africa.

1. G. sisyrinchium (L.) Parl., *Nuovi Gen. Sp. Monocot.* 52 (1854) (*Iris sisyrinchium* L.). Corm 15–30 mm in diameter, globose, surrounded by numerous tunics, the outer coarsely fibrous. Plant 10–30(–45) cm. Leaves 1–2, with long, sheathing base, the free portion 10–50 cm × 1·5–5 mm, flexuous, procumbent or ascending, convolute when dry. Flowers fugitive, in 1–4 compact cymes, each with 1–6 flowers. Spathes 4–6 cm, scarious. Perianth violet-blue to purple, the falls with a white or yellow patch. Falls *c.* 30 × 10 mm, with elliptic-obovate limb; standards *c.* 25 × 5 mm, with slender, canaliculate claw and lanceolate limb. Style-branches suberect, deeply 2-fid. Beak of ovary 20–30 mm, very slender. Capsule (excluding beak) 20 × 4 mm. Seeds 1·5 mm, pyriform, brown. $2n = 24$. *Dry places, especially near the coast. Mediterranean region, C. & S. Portugal.* Bl Co Cr Gr Hs It Lu Sa Si Tu.

5. Ixia L.[2]

Stock a corm. Leaves linear or lanceolate, the basal 2–6, the cauline fewer, shorter. Inflorescence a spike; bracts numerous. Hypanthial tube straight, slender; perianth campanulate or salver-shaped, actinomorphic, its segments equal, obtuse. Stamens straight, shorter than the perianth-segments. Style straight, exserted; style-branches short, curved, undivided. Capsule small.

Hypanthial tube 5–8 mm, not widening above; flowers orange **1. maculata**

Hypanthial tube 40–70 mm, widening above; flowers creamy white **2. paniculata**

1. I. maculata L., *Sp. Pl.* ed. 2, 1664 (1763). Stem 20–50 cm, simple. Leaves 5–8, 10–35 × 0·2–0·7 cm. Spike 4- to many-flowered, capitate, dense. Bracts reddish-brown. Flowers orange or orange-yellow, the centre dark, with a stellate yellow pattern in the middle; hypanthial tube 5–8 mm; perianth-segments 1·5–3 × 0·8–1·2 cm, patent. Stamens usually connate at base. *Cultivated for ornament and naturalized in S.E. France* (*Var*). [Ga.] (*Cape of Good Hope.*)

2. I. paniculata Delaroche, *Descr. Pl. Nov.* 26 (1766). Stem 30–100 cm, usually branched. Leaves 15–60 × 0·3–1·2 cm. Spike 4–14 cm, 5- to 18-flowered, more or less dense. Bracts pale brown. Flowers pale to deep cream; hypanthial tube 40–70 mm, infundibuliform; perianth-segments 1·5–2·5 × 0·3–0·8 cm. Stamens free. *Cultivated for ornament and locally naturalized on the western margin of Europe.* [Az Br Hs ?Lu.] (*Cape of Good Hope.*)

6. Freesia Ecklon ex Klatt[2]

Stock a corm. Stem leafy, branched. Spike secund; flowers usually horizontal; bracts short, 2- to 3-toothed at apex. Flowers zygomorphic, scented; hypanthial tube straight, infundibuliform; perianth-segments short, oblong, unequal, not spreading; stamens included. Style filiform, its branches deeply divided. Capsule verrucose.

1. F. refracta (Jacq.) Ecklon ex Klatt, *Linnaea* **34**: 673 (1866). Stem *c.* 45 cm, zig-zag. Leaves 5 or 6, linear-lanceolate. Bracts scarious. Flowers 3–4 cm, white or yellow with a few violet lines, 2-lipped; perianth-segments *c.* 1 cm. *Cultivated for ornament and naturalized in S.E. France.* [Ga.] (*South Africa.*)

7. Crocus L.[3]

Corm usually symmetrical, enclosed by several tunics of variable texture and colour. Cataphylls up to 5, sheathing the aerial shoot. Leaves appearing with or after the flowers. Leaves all basal, flat or canaliculate on the upper surface; lower surface usually strongly keeled, usually with 2 grooves. Scape absent. Flower one to several, each on a short, subterranean pedicel which is sometimes subtended by a membranous, sheathing prophyll. Bract membranous; bracteole similar or reduced or absent. Perianth regular; tube long and narrow, glabrous or with a ring of hairs in the throat at the insertion of the filaments; segments usually subequal. Anthers usually extrorse. Style 3-lobed to multifid. Ovary subterranean. Capsule cylindrical or ellipsoid, maturing at or above ground level by elongation of pedicel. Seeds numerous, usually globose or ellipsoid, brownish or reddish, with a strophiole.

Literature: W. Herbert, *Jour. Hort. Soc.* (*London*) **2**: 249–293 (1847). G. Maw, *A Monograph of the genus* Crocus. London. 1886. E. A. Bowles, *A Handbook of* Crocus *and* Colchicum. London. 1924.

The following key does not take into account albino plants, which occur sporadically in populations of practically all species.

1 Flowers produced from September to January; never wholly yellow
2 Inner and outer perianth-segments very unequal; anthers introrse **43. banaticus**
2 Inner and outer perianth-segments equal or subequal; anthers extrorse
3 Corm-tunic with obvious non-fibrous rings at base; upper tunic never fibrous

[1] By D. A. Webb. [2] By D. H. Valentine. [3] By B. F. Mathew.

4 Style divided into 3 branches **(23–25). biflorus group**
4 Style divided into more than 3 branches
5 Anthers white; filaments densely pubescent **42. pulchellus**
5 Anthers yellow; filaments glabrous or minutely papillose **41. speciosus**
3 Corm-tunic without rings, or with fibrous rings at base; tunic sometimes fibrous
6 Anthers and pollen white (discolouring with age)
7 Corm-tunic tough and coriaceous, splitting into acute, triangular teeth at base; filaments glabrous, or papillose only at base **36. laevigatus**
7 Corm-tunic papery, laciniate at base; filaments papillose or pubescent for most of their length
8 Flowers lilac-blue; filaments densely pubescent; flowers remaining open at night **38. tournefortii**
8 Flowers creamy-white, sometimes veined or tinged with purple; filaments papillose-pubescent; flowers closing in dim light **37. boryi**
6 Anthers and pollen yellow
9 Outer corm-tunics smooth and coriaceous, completely non-fibrous but splitting at base into coarse teeth **32. goulimyi**
9 Outer corm-tunics fibrous at least in part, and laciniate at base
10 Fibres of outer corm-tunic parallel, not at all reticulate
11 Leaves not developed at anthesis; perianth-tube (5–)10–22(–29) cm **34. nudiflorus**
11 Leaves at least partially developed at anthesis, though sometimes concealed by scale-leaves; perianth-tube 3–11 cm
12 Leaves less than 1 mm wide; perianth-segments 1·4–1·8(–2·1) cm **4. cambessedesii**
12 Leaves at least 1 mm wide; perianth-segments 2·3–6 cm **33. serotinus**
10 Fibres of outer corm-tunic finely to coarsely reticulate, sometimes obscurely so
13 Style deeply divided into 3 simple branches, not at all subdivided at the apex
14 Bract and bracteole present, white-membranous, rather flaccid, not closely sheathing the perianth-tube **(26–29). cartwrightianus group**
14 Bracteole absent; bract usually greenish, closely sheathing the perianth-tube **31. longiflorus**
13 Style divided into more than 3 branches, or rather obscurely divided, or deeply branched with each branch lobed or expanded and fimbriate
15 Throat of perianth deep yellow; segments white, rarely pale lilac; corm-tunic finely fibrous **30. niveus**
15 Throat of perianth pale yellow, white or lilac; segments lilac to purple, rarely white; corm-tunic very coarsely fibrous
16 Bracteole present and visible; throat of perianth usually pale yellow
17 Style distinctly divided into several slender branches; perianth usually with distinctly darker veins **39. cancellatus**
17 Style obscurely and shallowly divided into *c.* 3 branches, each much expanded and fimbriate; perianth without darker veins **40. robertianus**
16 Bracteole absent; throat of perianth white or lilac
18 Leaves not developed at anthesis; corm with a persistent, long, dark brown papery neck **35. medius**
18 Leaves usually developed at anthesis, but sometimes only the tips showing; corm without papery neck **33. serotinus**
1 Flowers produced from January to July
19 Flowers wholly yellow or orange, sometimes striped or tinged with purple or brown outside
20 Corm-tunic fibrous
21 Fibres of tunic tough and very coarsely reticulate **16. angustifolius**
21 Fibres of tunic delicate and finely reticulate
22 Leaves up to 1 mm wide, with no white central stripe; corm with a long, fibrous neck **19. scardicus**
22 Leaves 1–3 mm wide, with a white central stripe; corm without a long neck **18. cvijicii**
20 Corm-tunic papery or coriaceous, sometimes splitting longitudinally
23 Style divided clearly into 6 slender branches **22. olivieri**
23 Style divided clearly into 3 branches, or obscurely divided and expanded at the apex
24 Corm-tunic splitting into rings at the base, scarcely splitting vertically; leaves 0·5–2·5 mm wide **(23–25). biflorus group**
24 Corm-tunic with no rings at the base, splitting vertically; leaves 2·5–4 mm wide **21. flavus**
19 Flowers not wholly yellow or orange, but sometimes with a yellow throat
25 Leaves semi-terete, with several shallow grooves on the abaxial surface **12. carpetanus**
25 Leaves with 1 deep groove on each side of the flattish abaxial surface
26 Stigma whitish, obscurely 3-lobed, the lobes expanded and fimbriate **11. nevadensis**
26 Stigma yellow to reddish-orange, usually divided into 3 or more distinct branches
27 Bract and bracteole present, equal or subequal in length and width
28 Anthers creamy-white; corm-tunic smooth and coriaceous, with no obvious basal rings but splitting into triangular teeth **36. laevigatus**
28 Anthers yellow; corm-tunic fibrous, papery or coriaceous
29 Corm-tunic with obvious non-fibrous rings at base **(23–25). biflorus group**
29 Corm-tunic without obvious non-fibrous rings at base
30 Throat of perianth yellow
31 Corm-tunic of parallel fibres, or rather papery **2. imperati**
31 Corm-tunic of reticulate fibres
32 Flowers white or pale lilac-blue, with prominent dark stripes outside **17. reticulatus**
32 Flowers white, lilac or purple, sometimes with darker veins or transverse bands but not with prominent dark stripes
33 Leaves 1–2(–3) mm wide; flowers usually buff or silvery outside, sometimes with dark veins **15. dalmaticus**
33 Leaves 1·5–6 mm wide; flowers white or lilac outside, sometimes banded or tinged with purple **13. sieberi**
30 Throat of perianth white or lilac
34 Corm-tunic papery or with parallel fibres **4. cambessedesii**
34 Corm-tunic with reticulate fibres
35 Flowers strongly marked with dark stripes externally; corm-tunic with very coarse fibres **17. reticulatus**
35 Flowers not striped externally; corm-tunic with fine fibres
36 Flowers white or cream **18. cvijicii**
36 Flowers lilac to violet, rarely white tinged with purple at base
37 Leaves with a white central stripe; corm without a long neck **14. veluchensis**
37 Leaves without a white central stripe; corm with a long, fibrous neck **20. pelistericus**
27 Bracteole absent or much shorter or narrower than bract
38 Outer corm-tunics coriaceous or papery, with distinct rings at the base **(23–25). biflorus group**
38 Outer corm-tunics fibrous
39 Bracteole present and visible, but much narrower than the bract
40 Throat deep yellow; perianth-segments without dark veins and stripes outside **1. malyi**

40 Throat white or pale yellow; perianth-segments with dark veins and stripes outside
41 Leaves 0·5–1 mm wide, green; usually longer than flower; throat of perianth white **5. minimus**
41 Leaves more than 1 mm wide, greyish-green, usually not well-developed at anthesis and shorter than flower; throat of perianth usually yellow **3. versicolor**
39 Bracteole absent, or completely concealed by the bract
42 Throat of perianth yellow
43 Fibres of tunic distinctly reticulate, at least at the apex of the corm
44 Corm-tunic entirely reticulate, fibres robust; throat of perianth sparsely pubescent **9. etruscus**
44 Corm-tunic reticulate at apex only, fibres delicate; throat of perianth glabrous **10. kosaninii**
43 Fibres of tunic parallel
45 Leaves greyish-green, with distinct ribs in the grooves on the abaxial surface **3. versicolor**
45 Leaves deep green, without ribs in the grooves on the abaxial surface **2. imperati**
42 Throat of perianth white, lilac or purple
46 Leaves 0·5–1·5 mm wide **6. corsicus**
46 Leaves (2–)4–8 mm wide
47 Style divided into 3 branches, each branch shortly lobed **3. versicolor**
47 Style shortly divided into 3 branches, each branch fimbriate at apex
48 Flowers lilac-blue or purple, with a white perianth-tube **8. tommasinianus**
48 Flowers wholly white or lilac or purple, or white with a coloured perianth-tube **7. vernus**

1. C. malyi Vis., *Mem. Ist. Veneto* **16**: 221 (1871). Corm-tunic finely fibrous, the fibres more or less parallel or obscurely reticulate at the apex of the corm. Leaves 3–5, 1·5–2·5 mm wide, present at anthesis. Flowers 1–2, white, sometimes tinged with blue or brown at the base externally; throat deep yellow, pubescent. Prophyll present. Bract and bracteole present, well-exserted from the cataphylls, membranous, white, very unequal, the bracteole much narrower than the bract, more or less linear. Perianth-tube 4–9 cm, white, sometimes suffused yellow, brown or purple; segments 2–4 × 0·8–1·3 cm, oblanceolate, subacute or obtuse. Anthers yellow. Style yellow to deep orange, exceeding the stamens, divided into 3 branches, each branch expanded and often shortly lobed at the apex. Capsule and seeds unknown. Flowering from March to April. $2n=30$. *Grassland and wood-margins.* ● *W. Jugoslavia.* Ju.

In spite of statements to the contrary in the literature, this species grows in the Velebit Planina as well as reportedly on the borders of Crna Gora and Hercegovina.

2. C. imperati Ten., *Mem. Crochi Fl. Nap.* 10 (1826). Corm-tunic fibrous, the fibres parallel; inner tunics somewhat papery. Leaves 3–6, 2–3 mm wide, deep glossy green, present at anthesis. Flowers 1–3, purple, usually buff or yellowish externally and striped with purple; throat yellow to orange, glabrous. Prophyll present. Bracteole absent, or both bract and bracteole present, more or less equal, well-exserted from the cataphylls, membranous, usually green at the apex. Perianth-tube 3–20 cm, white, or tinged with yellow or purple towards the apex; segments (2·5–)3–4·5 × 0·9–1·7 cm, oblanceolate or obovate, obtuse to rounded, glabrous. Anthers yellow. Style deep orange or reddish, shorter than to much exceeding the stamens, divided into 3 branches, each branch expanded and shortly lobed. Capsule 1·4–2·4 cm, ellipsoid; seeds subglobose, with indistinct strophiole. Flowering January to March. *Woods and pastures.* ● *W. Italy, from near Roma southwards.* It.

(a) Subsp. **imperati**: Bracteole present, more or less equalling bract. Filaments 0·6–0·9 cm; anthers 1·2–2·1 cm. Style deep orange or red. $2n=26$. *From Napoli southwards.*

(b) Subsp. **suaveolens** (Bertol.) Mathew, *Kew Bull.* **32**: 46 (1977) (*C. suaveolens* Bertol.): Bracteole absent. Filaments 0·3–0·5 cm; anthers 0·8–1·2 cm. Style yellow or orange. $2n=26$. *In the northern part of the range of the species.*

3. C. versicolor Ker-Gawler, *Bot. Mag.* **28**: t. 1110 (1808). Like **2(a)** but leaves grey-green above and prominently veined on either side of the keel beneath; flowers white to lilac or purple, usually conspicuously striped outside; throat pale yellow to white; bracteole, if present, narrower than the bract; segments obtuse or subacute. Flowering from February to April. $2n=26$. *Rocky ground and open woods.* ● *S.E. France, just extending into N.W. Italy.* Ga It.

4. C. cambessedesii Gay, *Bull. Sci. Nat. Geol.* **25**: 320 (1831). Corm-tunic papery, splitting into many parallel vertical fibres at the base. Leaves present at anthesis, 3–5, 0·5–1 mm wide. Flowers 1–2, varying from white to deep lilac, usually conspicuously striped and veined purple externally, sometimes on a yellowish background; throat white, glabrous. Prophyll present. Bract and bracteole present, subequal, well-exserted from the cataphylls, membranous, white. Perianth-tube 5–11 cm, white or lilac near the apex; segments 1·4–1·8(–2·1) × 0·4–0·8 cm, oblanceolate, obtuse. Anthers yellow. Style orange to red, usually much shorter than the stamens, but sometimes equalling or slightly exceeding the stamens, deeply divided into *c.* 3 branches, each branch either expanded and fimbriate or obscurely lobed. Capsule and seeds unknown. Flowering from September to March. $2n=16$. *Pinewoods and rocky hillsides.* ● *Islas Baleares.* Bl.

5. C. minimus DC. in Redouté, *Liliacées* **2**: t. 81 (1804). Like **4** but bract and bracteole often brown or greenish-spotted, unequal, the bracteole more or less narrowly linear; perianth-segments (1·7–)2–2·7 cm, sometimes stained dark purple externally; style usually equalling or exceeding the stamens, usually yellow to orange. Flowering from January to April. $2n=24$. *Scrub.* ● *S. Corse, Sardegna.* Co Sa.

6. C. corsicus Vanucci ex Maw, *Gard. Chron.* ser. 2, **10**: 367 (1878). Like **4** but corm-tunic fibrous, finely reticulate towards the apex; bracteole absent; bract often brown-spotted; perianth-segments (1·8–)2–3·5(–5) cm; style usually equalling or exceeding the stamens. Flowering from January to April. $2n=18$, 22. *Scrub and mountain pastures.* ● *Corse.* Co.

7. C. vernus (L.) Hill, *Veg. Syst.* **10**: 1 (1765). Corm-tunic with fine parallel or slightly reticulate fibres. Leaves 2–4, (2–)4–8 mm wide, present but often very short at anthesis. Flowers 1(–2), white, purple or striped. Prophyll present. Bracteole absent; bract membranous, white, rarely veined green or purplish. Perianth-tube 2·5–15 cm, white or purple, but never white if rest of flower is coloured; segments 1·5–5·5 × 0·4–2 cm, oblanceolate to obovate, obtuse. Anthers yellow. Style deep yellow to orange-red, rarely whitish, much shorter than to much exceeding the stamens, shortly 3-branched, each branch much expanded and fimbriate at the apex. Capsule 1·5–2 cm, ellipsoid; seeds globose, reddish-brown, with a small strophiole. Flowering from March to June. *Grassland and open woods, mainly in the mountains.* ● *C. & S. Europe, from the Jura and Czechoslovakia southwards to the Pyrenees, Sicilia and Macedonia, and extending eastwards to W. Ukraine.* Al Au Cz Ga Ge He Hs Hu It Ju Po Rm Rs (W) Si [Br].

One of the most polymorphic species in Europe. Studies by C. A. Brighton (*Kew Bull.* **31**: 33–46 (1976)) have shown that many different chromosome numbers occur, sometimes within one population. Morphological differentiation of the populations is very weak and they are best divided into two subspecies.

(a) Subsp. **vernus** (*C. heuffelianus* Herbert, *C. albiflorus* Kit. subsp. *heuffelianus* (Herbert) Hegi and *neapolitanus* (Ker-Gawler) Hegi): Style usually equalling or exceeding the stamens. Flowers often purple, lilac or striped; segments (2·5–)3–5·5 × 0·9–2 cm. $2n = 8$, 10, 12, 16, 18, 19, 20, 22, 23. *Woods and mountain meadows. From Italy eastwards; naturalized in Britain.*

(b) Subsp. **albiflorus** (Kit.) Ascherson & Graebner, *Syn. Mitteleur. Fl.* **3**: 446 (1906) (*C. albiflorus* Kit.): Style usually much shorter than the stamens. Flowers often white; segments 1·5–3·5(–5) × 0·4–1·2 cm. $2n = 8$. *Mountain grassland. From Czechoslovakia and Albania westwards.*

The plants occurring at the eastern end of the range of subsp. (a) tend to have larger more rounded flowers and often have purple V-shaped markings near the apex of the segments. It has not been possible to find any consistent characters which enable these populations to be recognized as a distinct taxon. There are, however, cytological differences, and varieties of subsp. (a) based on *C. heuffelianus* Herbert and *C. scepusiensis* (Rehmann & Wołoszczak) Borbás can be recognized. *C. siculus* Tineo is cytologically similar to subsp. (a) although in morphological characters it closely resembles subsp. (b).

Hybrids between subsp. (a) and (b) are liable to occur wherever the two overlap; they are intermediate between the parents in their morphology and chromosomes. They have been described as C. × **fritschii** Derganc, *Österr. Bot. Zeitschr.* **47**: 18 (1897); plants from Austria and Jugoslavia have $2n = 13$.

C. montenegrinus A. Kerner ex Maw, *Gard. Chron.* ser. 2, **16**: 368 (1881), from S.W. Jugoslavia (Orjen), appears to be a mutation of subsp. (b) in which the anthers have stylar appendages at the apex.

8. C. tommasinianus Herbert, *Jour. Hort. Soc. London* **2**: 273 (1847). Like **7(a)** but flowers clear lilac to purple, with a white perianth-tube; leaves 2–3 mm wide, usually well-developed at anthesis; bract densely spotted and veined greyish and greenish. Flowering from March to May. $2n = 16$. *Deciduous woods and shady banks.* ● *From S. Hungary to N.W. Bulgaria.* Bu Hu Ju [Br Ho].

9. C. etruscus Parl., *Fl. Ital.* **3**: 228 (1860). Like **7(a)** but corm-tunic consisting of coarser, distinctly reticulate fibres; flowers usually paler externally and often purple-veined; throat yellowish; segments 3–4(–5) × 0·9–1·3 cm. Flowering from February to April. $2n = 8$. *Deciduous woods and pastures.* ● *W.C. Italy (Arcipelago Toscano and adjoining mainland).* It.

10. C. kosaninii Pulević, *Glasn. Rep. Zavoda Zašt. Prir. (Titograd)* **9**: 40 (1976). Like **7(a)** but leaves 2(–3); throat of perianth yellow; filaments yellow. Flowering in March. *Deciduous woods.* ● *S. Jugoslavia (north of Skopje).* Ju.

11. C. nevadensis Amo, *Fl. Iber.* **1**: 537 (1871). Corm-tunic with fine, parallel fibres. Leaves 3–5, 1–2·5 mm wide, present at anthesis. Flowers 1(–2), cream, white or pale lilac, with darker veins; throat whitish or pale yellow, pubescent. Prophyll absent. Bract and bracteole well-exserted from the cataphylls, membranous, white, subequal or the bracteole much narrower. Perianth-tube 3–6 cm, whitish or lilac; segments 2–4 × 0·6–1 cm, oblanceolate, obtuse. Anthers yellow. Style whitish, about equalling the stamens, obscurely divided into *c.* 3 branches, each branch much-expanded and fimbriate. Capsule and seeds unknown. Flowering from February to April. $2n = 26$, 28, 30. *Mountain meadows and stony places. E.C. & S.E. Spain.* Hs. (*N. Africa.*)

12. C. carpetanus Boiss. & Reuter, *Diagn. Pl. Nov. Hisp.* 24 (1842). Corm-tunic fibrous, the fibres finely reticulate and extended into a distinct neck. Leaves 2–4, 1–2·5 mm wide, present at anthesis, semi-terete, shallowly grooved below. Flowers solitary, pale lilac, often finely veined darker; throat whitish or slightly yellowish, glabrous. Prophyll absent. Bract and bracteole subequal, well-exserted from the cataphylls, membranous, white. Perianth-tube 4–8 cm, whitish or purplish; segments 2–3·6 × 0·8–1·5 cm, oblanceolate, rounded. Anthers yellow. Style whitish or pale yellow, shorter than to slightly exceeding the stamens, divided obscurely into 3 branches, which are much-expanded and fimbriate at the apex. Capsule *c.* 1 cm, subglobose; seeds subglobose, pale brown; strophiole indistinct. Flowering from April to May. $2n = 64$. *Meadows and stony places in mountains.* ● *C. & N.W. Spain, N. Portugal.* Hs Lu.

13. C. sieberi Gay, *Bull. Sci. Nat. Geol.* **25**: 320 (1831) (*C. nivalis* Bory & Chaub., *C. atticus* Boiss.). Corm-tunic strongly fibrous, reticulate; corm capped with a persistent neck of old cataphylls. Leaves 2–7(–10), 1·5–6 mm wide, present at anthesis. Flowers 1–3, pale lilac to deep lilac-purple, or with purple and white zones, or white tinged with purple on the external surfaces of the segments, or pure white; throat yellow, glabrous or pubescent. Prophyll absent. Bract and bracteole subequal, well-exserted from the cataphylls, membranous, white often stained greenish. Perianth-tube 3–10 cm, white to purple, yellowish at the apex; segments 1·5–4·5 × 0·7–1·8 cm, oblanceolate or obovate. Anthers yellow. Style yellow to orange-red, shorter than to exceeding the stamens, obscurely divided into 3 branches, each much-expanded and fimbriate or lobed. Capsule and seeds unknown. Flowering from (January) March to June (–July). $2n = 22$. *Alpine pastures, coniferous woods and scrub.* ● *S. part of Balkan peninsula, W. & S. Aegean region.* Al Cr Gr Ju.

The colour variants of **13** have fairly distinct geographical ranges and have been recognized at various taxonomic levels. B. L. Burtt (*Jour. Roy. Hort. Soc.* **74**: 12–17 (1949)) describes these variants and their nomenclature.

14. C. veluchensis Herbert, *Bot. Reg.* **31**, Misc. 80 (1845). Like **13** but fibres of corm-tunic very fine; flowers pale to deep lilac-blue, rarely white stained with purple-blue at the base; throat of perianth white, pubescent. Flowering from April to June (–July). $2n = 26$. *Rocky ground, mountain grassland and snow-patches.* ● *S. part of Balkan peninsula.* Al Bu Gr Ju.

15. C. dalmaticus Vis., *Fl. Dalm.* **1**: 119 (1842). Like **13** but leaves 1–2(–3) mm wide; flowers pale to deep lilac, with a yellow throat, usually silvery, buff or yellowish externally and often veined darker purple. Flowering from January to April. $2n = 24$. *Scrub and rocky grassland.* ● *Mountains of S.W. Jugoslavia and N. Albania.* Al Ju.

16. C. angustifolius Weston, *Univ. Bot.* **2**: 238 (1771) (*C. susianus* Ker-Gawler). Corm-tunic strongly fibrous, coarsely reticulate. Leaves 3–6, 0·5–1·5 mm wide, present at anthesis. Flowers 1–2, yellow, often heavily tinged or striped externally with purple-bronze; throat glabrous or papillose. Prophyll absent. Bract and bracteole well-exserted from the cataphylls, membranous, white, subequal but the bracteole somewhat narrower. Perianth-tube 3–6 cm, yellow or purplish; segments

1·7–3·4 × 0·6–1·3 cm, elliptic or oblanceolate, obtuse to subacute. Anthers yellow. Style yellow to deep orange-red, equalling or exceeding the stamens, deeply divided into 3 branches. Capsule *c.* 1·5 cm, ellipsoid; seeds subglobose, reddish-brown; strophiole indistinct. Flowering from February to March. $2n=12$. *Open slopes, scrub and* Juniperus-*woods.* ● *Krym.* Rs (K).

17. C. reticulatus Steven ex Adams in Weber fil. & Mohr, *Beitr. Naturk.* **1**: 45 (1805) (*C. variegatus* Hoppe & Hornsch.). Like **16** but flowers white or lilac, strongly striped with purple externally; segments acute to subacute. Flowering from February to March. $2n=12$. *Meadows and open woods. S.E. Europe, extending to S.C. Russia, Hungary and N.E. Italy.* Bu Hu It Ju Rm Rs (C, W, K, E).

18. C. cvijicii Košanin, *Glas Srpske Kralj. Akad.* **119**: 23 (1926). Corm-tunic finely fibrous, reticulate. Leaves 2–4, 1·5–3 mm wide, present at anthesis. Flowers solitary, pale cream to deep orange-yellow; throat pubescent. Prophyll absent. Bract and bracteole present, well-exserted from the cataphylls and more or less equalling the perianth-tube. Perianth-tube 1·5–3·5 cm, whitish or rarely purple; segments 1·5–4 × 0·6–0·9 cm, oblanceolate, obtuse. Anthers orange-yellow. Style orange, about equalling the stamens, obscurely divided into 3 expanded stigmatic branches. Capsule 1–1·5 cm, ellipsoid; seeds subglobose, with a distinct strophiole, reddish-brown. Flowering from April to June. $2n=18$. *Snow-patches*, 1800–2300 *m.* ● *Mountains of Macedonia and E. Albania.* Al Gr Ju.

19. C. scardicus Košanin, *op. cit.* 24 (1926). Corm-tunic finely fibrous, reticulate, extended into a persistent neck at the apex. Leaves 3–4, 0·5–1 mm wide, with no median stripe. Flowers solitary, orange-yellow, usually purple towards the base of the segments; throat minutely papillose. Prophyll present. Bract and bracteole present, well-exserted from the cataphylls and equalling or slightly shorter than the perianth-tube. Perianth-tube 2–4 cm, purple, rarely white; segments 2–3·6(–4) × 0·8–1·1 cm, oblanceolate, obtuse. Anthers yellow. Style orange, equalling or exceeding the stamens, shortly divided into 3–5 expanded and shallowly lobed branches. Capsule and seeds unknown. Flowering from May to July. $2n=32$, 34, 35, 36. *Snow-patches*, 1700–2500 *m.* ● *Mountains of S.W. Jugoslavia.* Ju.

20. C. pelistericus Pulević, *Glasn. Rep. Zavoda Zašt. Prir.* (*Titograd*) **9**: 39 (1976). Like **19** but leaves 3–5, 1–2 mm wide; flowers 1(–2) deep violet; throat glabrous or minutely papillose; style whitish, exceeding the stamens, shortly divided into 3 whitish shallowly lobed branches. Capsule and seeds unknown. Flowering from May to June. *Snow-patches and damp mountain meadows*, 1900–2300 m. ● *S. Jugoslavia* (*Jakupica and Baba Pl.*). Ju.

21. C. flavus Weston, *Univ. Bot.* **2**: 237 (1771) (*C. maesiacus* Ker-Gawler, *C. aureus* Sibth. & Sm.). Corm-tunic membranous, splitting into parallel fibres; corm capped with a persistent brown neck of old cataphylls. Leaves (2–)4–8, 2·5–4 mm wide, present at anthesis. Flowers 1–4, pale yellow to deep orange-yellow; throat glabrous or pubescent. Prophyll absent. Bract and bracteole membranous, white, often tinged with brown, well-exserted from the cataphylls, very unequal, the bract tubular, the bracteole narrowly linear. Perianth-tube 5–20 cm, yellow, sometimes brownish; segments 1·5–3·5 × 0·5–1·2 cm, oblanceolate or obovate, obtuse to subacute. Anthers yellow. Style yellow to orange, usually much shorter than the stamens, obscurely divided into 3 short branches. Capsule 1·2–3 cm, ellipsoid; seeds reddish, subglobose; strophiole prominent, winged. Flowering from March to April. $2n=8$. *Woods, scrub and grassland. E. & C. parts of Balkan peninsula, S. Romania.* Bu Gr Ju Rm *Rs (K) Tu.

22. C. olivieri Gay, *Bull. Sci. Nat. Geol.* **25**: 319 (1831). Like **21** but corm not capped with a persistent brown neck of old cataphylls; style distinctly divided into 6 slender branches. Flowering from February to April. $2n=6$. *Grassland and open woods. S. part of Balkan peninsula, Aegean region.* Al Bu ?Cr Gr Ju Tu.

(23–25). C. biflorus group. Corm-tunic smooth, papery to coriaceous, splitting into smooth or dentate rings at the base. Leaves 3–5(–6), 0·5–2·5 mm wide, present at anthesis. Flowers 1–3. Prophyll absent. Bract and bracteole membranous, white, well-exserted from the cataphylls, the bracteole much narrower than the bract. Perianth-tube 2–8 cm, white, lilac, yellow or bronze; segments 1·5–4·5 × 0·4–1·8 cm, oblanceolate or obovate, subacute to rounded. Style yellow to orange-red, divided into 3 slender or expanded branches. Capsule 1–1·5 cm, ellipsoid; seeds brown or reddish, subglobose; strophiole distinct, expanded, flattened at one end. Flowering from October to May.

A confusing group of taxa, occurring from Italy eastwards to Iran. In Europe three species can be distinguished, but intermediates occur and the group is in need of critical study over its whole range.

1 Flowers pale to deep yellow; spring-flowering **23. chrysanthus**
1 Flowers white to lilac or blue, often striped; autumn- or spring-flowering
2 Anthers usually blackish-purple before dehiscence, but sometimes nearly wholly yellow; usually autumn-flowering **25. crewei**
2 Anthers yellow; spring-flowering **24. biflorus**

23. C. chrysanthus (Herbert) Herbert, *Bot. Reg.* **29**, Misc. 83 (1843). Flowers pale to deep yellow, sometimes with a purplish or brownish perianth-tube. Anthers yellow, sometimes with blackish basal lobes, rarely wholly blackish-purplish or with a greyish connective. Flowering from January to May. $2n=8$, 12, 20. *Balkan peninsula, E. Romania.* Al Bu Gr Ju Rm Tu [Cz].

Plants with yellow flowers, flushed and striped with purple externally, have been recorded from S.C. Jugoslavia (near Niš). These are thought to be hybrids between **23** and **24**, and have been named **C. × hybridus** Petrović, *Fl. Agr. Nyss.* 821 (1882).

24. C. biflorus Miller, *Gard. Dict.* ed. 8, no. 4 (1768) (*C. adami* Gay, *C. tauricus* (Trautv.) Puring). Flowers white or lilac-blue, often strongly striped and veined, or strongly tinged with deep purple-blue or brownish-purple; throat white, lilac or yellow. Anthers yellow, sometimes with blackish basal lobes or a greyish connective. Flowering from January to April. $2n=8$, 12, 16. *S. Europe, from Sicilia eastwards.* Bu It Gr Ju Rs (W, K) Si Tu.

White-flowered plants of this group from Turkey-in-Europe may be **24** or pale forms of **23**. There are some populations of normal yellow-flowered **23** with a high percentage of white-, cream- and occasionally bluish-flowered plants; these may be colour variants and albinos, or hybrids between **23** and pale **24**. *C. pallidus* Kitanov & Drenk., described from Jugoslavia, apparently belongs to this group, but more work is needed to determine its status.

25. C. crewei Hooker fil., *Bot. Mag.* **101**: t. 6168 (1875). Flowers white outside, usually with purple veins or stripes, sometimes dotted with grey, blue or yellow; throat yellow. Anthers blackish or with blackish connective, rarely yellow.

Flowering from October to January. $2n=12$. *S. Greece and Kikladhes*. Gr.

(26–29). C. cartwrightianus group. Corm-tunic finely fibrous, the fibres reticulate. Leaves 5–11, 1–2 mm wide, present or absent at anthesis. Flowers 1–4, purple, lilac or white. Prophyll present. Bract and bracteole very unequal or subequal, well-exserted from the cataphylls, membranous, white. Perianth-tube 3–13 cm, white, lilac or yellowish; segments obovate or oblanceolate, obtuse. Anthers yellow. Style bright red or deep orange, shorter than to much exceeding the stamens, deeply divided into 3 branches. Capsule 1·5–2·5 cm, ellipsoid; seeds red, angular or subglobose; strophiole prominent, winged. Flowering from October to December.

A group of closely related species which requires further investigation.

1 Style-branches more than ½ as long as perianth-segments **26. cartwrightianus**
1 Style-branches not more than ½ as long as perianth-segments
2 Flowers white, rarely tinged with lilac; throat yellow or rarely white **29. hadriaticus**
2 Flowers lilac; throat yellow, white or lilac
3 Throat and filaments yellowish; leaves usually present at anthesis **28. thomasii**
3 Throat and filaments white or lilac; leaves often absent at anthesis **27. pallasii**

26. C. cartwrightianus Herbert, *Bot. Reg.* **29**, Misc: 82 (1843). Leaves usually present at anthesis. Flowers deep lilac-purple with darker veins, white, or white with a purple base; throat glabrous or pubescent, white or lilac. Perianth-segments 1·4–3·2 cm. Style-branches (0·7–)1–2·7 cm. $2n=16$. *Rocky hillsides.* ● *S. Aegean region.* Cr Gr.

The plants from higher altitudes in Kriti were formerly distinguished as a separate taxon, **C. oreocreticus** B. L. Burtt, *Phyton (Austria)* **1**: 224 (1949). It is probably not distinct enough to be given separate status but can often be recognized in the living state by the pale, whitish exterior to the perianth-segments.

C. sativus L., *Sp. Pl.* 36 (1753) is like **26**, but has perianth-segments 3·5–5 cm and style-branches 2·5–3·2 cm. It is a sterile triploid, with $2n=24$, and its origin is unknown. It is not known in the wild state but was formerly widely cultivated in S. & W. Europe for its styles which were used as a spice (saffron). It persisted in several localities after its cultivation was abandoned, but does not appear to be thoroughly naturalized.

27. C. pallasii Goldb., *Mém. Soc. Nat. Moscou* **5**: 157 (1817). Leaves often absent at anthesis. Flowers lilac, sometimes with darker veins; throat white or lilac, pubescent. Perianth-segments 2·5–4·5 cm. Style-branches 0·6–1·5 cm. $2n=14$. *Stony or grassy slopes. S.E. Europe, from Turkey to Krym.* Bu Rm Rs (K) Tu.

28. C. thomasii Ten., *Mem. Crochi Fl. Nap.* 12 (1826). Leaves usually present at anthesis. Flowers lilac, usually without darker veins; throat yellowish, pubescent. Perianth-segments 2–4·5 cm. Style-branches 1–1·6(–2) cm. $2n=16$. *Stony hillsides.* ● *S. Italy; W. Jugoslavia.* It Ju.

29. C. hadriaticus Herbert, *Bot. Reg.* **31**, Misc: 82 (1845) (*C. peloponnesiacus* Orph.). Leaves usually present at anthesis. Flowers white or rarely tinged with pale lilac; throat yellow or rarely white, pubescent. Perianth-segments 2–4·5 cm. Style-branches 1–1·6 cm. $2n=16$. *Pastures and open scrub.* ● *W. & S. Greece, Kikladhes.* Gr.

30. C. niveus Bowles, *Gard. Chron.* ser. 3, **28**: 335 (1900). Corm-tunic fibrous, finely reticulate and usually extended into a persistent neck. Leaves (4–)5–8, 1–2 mm wide, present at anthesis. Flowers 1–2, white or sometimes pale lilac; throat deep yellow, sparsely pubescent. Prophyll present. Bract and bracteole very unequal, well-exserted from the cataphylls, green- or purple-veined or spotted. Perianth-tube 9–18 cm, yellow or brownish; segments 3–6 × 1·5–3·5 cm, obovate, rounded to obtuse. Anthers orange-yellow. Style orange to bright red, shorter than to exceeding the stamens, divided into 3 to many branches, often expanded and lobed at the apex. Capsule 1–2 cm, ellipsoid, sometimes broadly so; seeds subglobose, reddish-brown; strophiole indistinct. Flowering from October to November. $2n=28$. *Olive-groves and scrub.* ● *S. Greece (S. part of Peloponnisos).* Gr.

31. C. longiflorus Rafin., *Caratt.* 84 (1810). Corm-tunic finely fibrous, reticulate. Leaves 1–3 mm wide, present but sometimes very short at anthesis. Flowers 1–2, lilac to purple, often with darker veins externally; throat yellow, glabrous or sparsely pubescent. Prophyll present. Bracteole absent; bract membranous, white, tinged and veined with green towards the apex, well-exserted from the cataphylls. Perianth-tube 5–16 cm, yellow, sometimes with purple stripes; segments 2·2–4·3 × 0·7–1·6 cm, oblanceolate or obovate, obtuse to subacute. Anthers yellow. Style orange-red, rarely yellow, shorter than to exceeding the stamens, 3-branched; branches expanded and fimbriate or lobed at the apex. Capsule 1·2–1·5 cm, ellipsoid; seeds brown, subglobose; strophiole indistinct. Flowering from October to November. $2n=28$. *Grassland and wood-margins.* ● *S.W. Italy, Sicilia, Malta.* It Si.

32. C. goulimyi Turrill, *Kew Bull.* **10**: 59 (1955). Corm-tunic smooth, coriaceous, splitting vertically into narrow triangular teeth. Leaves 4–6, 1–2·5 mm wide, present at anthesis. Flowers 1–2, pale to deep lilac-purple, the inner segments often paler than the outer; throat white, pubescent. Prophyll present. Bracteole absent; bract well-exserted from the cataphylls, strongly greenish- or purplish-spotted and veined. Perianth-tube 8–21 cm, white; segments 1·6–3·8 × 1–1·8 cm, broadly obovate, rounded to obtuse. Anthers yellow. Style white to orange, shorter than to slightly exceeding the stamens, the 3 branches expanded and sometimes lobed. Capsule *c.* 1 cm, broadly ellipsoid; seeds subglobose, reddish-brown; strophiole indistinct. Flowering from October to November. $2n=12$. *Cultivated ground and by walls.* ● *S. Greece (Lakonia, near Areopolis).* Gr.

33. C. serotinus Salisb., *Parad. Lond.* t. 30 (1806). Corm-tunic papery, with parallel or reticulate fibres, the old tunics becoming wholly fibrous; corm rarely stoloniferous. Leaves 4–7, (1–)1·5–3·5 mm wide, present at anthesis, or appearing immediately afterwards. Flowers 1–2, lilac, sometimes with darker veins; throat white, lilac or pale yellow, usually pubescent. Prophyll present. Bracteole absent; bract membranous, white- sometimes green at apex. Perianth-tube 3–10·5(–13·5) cm, white, tinged with lilac towards the apex; segments 2·3–5 × 0·6–1·5 cm, oblanceolate, obovate or elliptical. Filaments pale yellow. Anthers yellow. Style yellow to orange-red, equalling or exceeding the stamens, the 3 or more branches expanded or subdivided and fimbriate or lobed at the apex. Capsule *c.* 1·5 mm, ellipsoid; seeds brown, ellipsoid, strophiole indistinct. Flowering from September to December. *Pinewoods, scrub and rocky grassland. W., C. & S. Spain, Portugal.* Hs Lu.

(a) Subsp. **serotinus** (*C. clusii* auct. lusit., non Gay): Fibres of corm-tunic robust, coarsely reticulate. Flowering from October to November. $2n=22, 23$. ● *C. & S. Portugal.*

(b) Subsp. **clusii** (Gay) Mathew, *Kew Bull.* **32**: 46 (1977) (*C. clusii* Gay, *C. asturicus* auct. lusit., non Herbert): Fibres of corm-

tunic silky, finely reticulate. Flowering from October to November. $2n=22$, 24. ● *Portugal, W. Spain.*

(c) Subsp. **salzmannii** (Gay) Mathew, *loc. cit.* (1977) (*C. asturicus* Herbert, *C. salzmannii* Gay): Fibres of corm-tunic parallel. Flowering from September to December. $2n=22$, 44. *W., C. & S. Spain.*

34. C. nudiflorus Sm. in Sowerby, *Engl. Bot.* **7**: t. 491 (1798). Corm-tunic papery, with parallel fibres, the older tunics becoming fibrous; corm usually stoloniferous. Leaves 3–4, 2–4 mm wide, absent at and for long after anthesis. Flowers solitary, deep lilac-purple; throat white or lilac, glabrous or finely papillose-pubescent. Prophyll present. Bracteole absent; bract membranous, white, tinged with green at the apex, well-exserted from the cataphylls. Perianth-tube (5–)10–22(–29) cm, white, tinged with lilac or purple at the apex; segments 3–6 × 0·9–2 cm, elliptical to oblanceolate, obtuse. Filaments white. Anthers yellow. Style orange, equalling or exceeding the stamens, dissected into short, slender branches. Capsule *c.* 1·3 cm, ellipsoid; seeds brown, ellipsoid; strophiole indistinct. Flowering from September to October. $2n=48$. *Meadows.* ● *S.W. France, N., E. & C. Spain.* Ga Hs [Br].

35. C. medius Balbis, *Add. Fl. Pedem. Elenco* 83 (1801). Corm-tunic fibrous, reticulate and bristly at the apex; corm capped with a neck of old cataphylls. Leaves 2–3, 2·5–4 mm wide, absent at anthesis. Flowers 1(–2), lilac to deep purple with darker veins; throat white, glabrous. Prophyll present. Bracteole absent; bract membranous, white, sometimes greenish or brownish at apex, well-exserted from the cataphylls. Perianth-tube 4–20 cm, white, tinged with lilac or purple towards the apex; segments (2–)2·5–5 × (0·7–)1·2–1·7 cm, oblanceolate or obovate, subacute to mucronate. Anthers deep yellow. Style deep orange to scarlet, equalling or exceeding the stamens, dissected into many spreading branches. Capsule *c.* 1·3 cm, ellipsoid; seeds reddish-brown, subglobose-ellipsoid; strophiole indistinct. Flowering from September to November. $2n=24+0$–5B. *Grassland and woods.* ● *N.W. Italy, just extending into S.E. France.* Ga It.

36. C. laevigatus Bory & Chaub. in Bory, *Expéd. Sci. Morée* **3(2)**: t. 3, fig. 2 (1832) (*C. veneris* Maw, non Tappeiner ex Poech). Corm-tunic smooth, coriaceous, splitting at the base into long triangular teeth. Leaves 3–8, 1–3 mm wide, present at anthesis. Flowers white or lilac, often purple-striped externally; throat yellow, glabrous. Prophyll absent. Bract and bracteole subequal, membranous, white, sometimes green at the apex, well-exserted from the cataphylls. Perianth-tube 2–8 cm, white, often yellowish or purplish at the apex; segments 1·3–3 × 0·4–1·8 cm, obovate, oblanceolate or elliptical, obtuse. Filaments yellow, usually glabrous or papillose at the base, sometimes sparsely papillose-pubescent throughout. Anthers creamy-white. Style yellow to deep orange, equalling or exceeding the stamens, dissected into many slender branches. Capsule 1–1·3 cm, ellipsoid; seeds subglobose, reddish-brown; strophiole indistinct. Flowering from October to December (January). $2n=26$. *Scrub or stony grassland.* ● *S. & S.C. Greece, S. Aegean region.* Cr Gr.

Plants from Kriti have slightly less coriaceous corm-tunics than those from the rest of the area.

37. C. boryi Gay, *Bull. Sci. Nat. Géol.* **25**: 320 (1831). Like **36** but corm-tunic papery, splitting into parallel vertical fibres; leaves 1–3·5 mm wide; flowers creamy-white, sometimes slightly veined externally with purple, rarely tinged with lilac; throat glabrous or slightly papillose; perianth-tube 2–15 cm; segments 1·5–5 × 0·4–2·3 cm, elliptical to obovate; filaments papillose-pubescent; capsule 0·5–1 cm, subglobose to broadly ellipsoid. Flowering from September to December. $2n=30$. *Olive-groves, stony hillsides and scrub.* ● *S. & W. Greece, S. Aegean region.* Cr Gr.

38. C. tournefortii Gay, *loc. cit.* (1831). Like **36** but corm-tunic papery, splitting into parallel, vertical fibres; flowers lilac, rarely with darker veins; throat yellow or sometimes whitish, glabrous or pubescent; perianth-tube 3–10 cm; segments 1·5–3·5 × 0·4–1·3 cm, obovate or elliptical; filaments densely pubescent; capsule 1–1·2 cm, ellipsoid. Flowering from September to December. $2n=30$. *Scrub and stony ground. S. Aegean region (Kikladhes, Idhra, Karpathos).* Cr Gr.

39. C. cancellatus Herbert, *Bot. Mag.* **67**: sub t. 3864 (1841). Corm-tunic strongly fibrous, coarsely reticulate. Leaves 4–5, 1–2 mm wide, absent or very rarely appearing at anthesis. Flowers 1–3, white to deep blue-purple, often with darker veins; throat usually yellowish, glabrous or pubescent. Prophyll absent. Bract and bracteole subequal to unequal, membranous, white. Perianth-tube 5–15 cm, white or tinged with purple; segments 2·5–5 × 0·8–1·8 cm, oblanceolate or obovate. Filaments pale yellow, glabrous or papillose-pubescent. Anthers deep yellow. Style yellow to deep orange, shorter than or exceeding the stamens, divided into several slender branches. Capsule and seeds not known. Flowering from September to November. $2n=16$. *Rocky hillsides and open woods. Greece, S. Jugoslavia.* Gr Ju.

40. C. robertianus C. D. Brickell, *Jour. Roy. Hort. Soc.* **98**: 362 (1973). Corm-tunic strongly fibrous, coarsely reticulate. Leaves 3–4, 4–6 mm wide, absent at anthesis. Flowers 1–2, pale to lilac; throat pale yellow or whitish, glabrous or pubescent. Prophyll absent. Bract and bracteole unequal, well-exserted from the cataphylls, greenish towards the apex. Perianth-tube 4–18 cm, purplish or whitish; segments 2·5–6 × 0·9–2·1 cm, equal or subequal, oblanceolate to more or less elliptical, rounded to obtuse. Filaments whitish or pale yellow, glabrous or minutely papillose. Anthers yellow. Style orange-red, usually exceeding the stamens, shortly divided into 3 much-expanded and fimbriate branches. Capsule and seeds not known. Flowering from October to November. $2n=20$. *Clearings in scrub.* ● *N. Greece (Pindhos Oros, between Ioannina and Metsovon).* Gr.

41. C. speciosus Bieb., *Beschr. Länd. Terek. Casp.* 129 (1800). Corm-tunic smooth and papery to subcoriaceous, splitting into rings at the base. Leaves 3–4, 4–5 mm wide, absent at anthesis. Flowers 1(–2), lilac-blue, strongly veined and often with darker spots externally; throat white or rarely pale yellow, glabrous or sparsely pubescent. Prophyll absent. Bract and bracteole subequal, membranous, white, included within the cataphylls. Perianth-tube 6–20 cm, white or tinged with purple; segments 2·7–6 × 1·1–1·7 cm, equal, oblanceolate or obovate. Filaments white or yellow, glabrous or minutely papillose. Anthers yellow. Style yellow to deep orange, much exceeding the stamens, dissected into many branches. Capsule 2–2·5 cm, ellipsoid; seeds subglobose, deep reddish-brown; strophiole indistinct. Flowering from October to November. $2n=18$. *Woods and meadows. Krym.* Rs (K) ?Tu.

Reports of this species from Macedonia and S.E. Bulgaria are erroneous and probably refer to **42.**

42. C. pulchellus Herbert, *Bot. Mag.* **67**: sub t. 3862 (1841). Like **41** but flowers less strongly veined and never spotted externally; throat of perianth deep yellow; tube often tinged

with yellow near the apex; segments 2·3–4 × 1·3–2 cm, obovate; filaments yellow, densely pubescent; anthers white. Flowering from September to October. $2n=12$. *Open woods. S.E. part of Balkan peninsula.* Bu Gr Ju Tu.

43. C. banaticus Gay, *Bull. Sci. Nat. Géol.* **25**: 320 (1831). Corm-tunic finely fibrous, the fibres parallel at the base, reticulate at the apex. Leaves 1–3, 5–7(–10) mm wide, absent at anthesis. Flowers solitary, lilac to purple, slightly veined; throat lilac, glabrous. Prophyll present. Bracteole absent; bract membranous, green at the apex, well-exserted from the cataphylls. Perianth-tube 10–21 cm, white at base, lilac at the apex; segments very unequal, the inner 2·3–3 × 1·2–1·3 cm, the outer 3·7–5 × 1·3–2·5 cm, oblanceolate to obovate, acute. Anthers yellow. Style lilac, exceeding the stamens, dissected into many slender branches. Capsule 1·2–1·5 cm, ellipsoid; seeds reddish-brown, ellipsoid, with a distinct strophiole. Flowering from September to October. $2n=26$. *Meadows, woods and thickets.* ● *N.C. & W. Romania, just extending into N.E. Jugoslavia and W. Ukraine.* Ju Rm Rs (W).

8. **Romulea** Maratti[1]

Corm usually asymmetrical, obliquely flattened into a crescentic basal ridge on one side. Tunics brown, hard, smooth. Cataphylls 1–2, tubular below, sheathing the aerial shoot. Leaves appearing before the flowers. Basal leaves usually 2, distichous, subterete, 4-grooved, erect, twisted or curved. Cauline leaves similar, usually shorter. Scape usually underground at anthesis. Pedicels semi-terete, recurving after flowering, each in the axil of a cauline leaf. Bract herbaceous or with hyaline margin; bracteole herbaceous to entirely scarious. Perianth regular; tube usually short, glabrous or hairy in the throat at the insertion of the filaments; segments equal or subequal. Anthers extrorse. Style filiform with three 2-fid branches. Capsule oblong to globose. Seeds usually numerous, globose, brownish, without a strophiole.

The following account must be regarded as provisional. Treatment is made difficult by the occurrence of gynodioecism, which is probably widespread. The large numbers of endemic species described from S.W. Europe and Sicilia may reflect a situation in which sexuality is linked with flower-size and intensity of colour. These species are described by A. Jordan & J. P. Fourreau, *Breviarum Plantarum novarum* **1**: 48–50. Paris. 1866; **2**: 106–108. Paris. 1868; *Icones ad Floram Europae* **1**: 39–41. Paris. 1867; **2**: 41–47. Paris. 1903; by A. Béguinot, *Bol. Soc. Brot.* **22**: 3–20 (1906), and in his papers cited under *Literature*; by M. Lojacono-Pojero, *Flora sicula* 59–66. Palermo. 1909; and by P. B. Merino y Román, *Flora descriptiva é ilustrada de Galicia* **3**: 122–141. Santiago. 1909. They cannot be adequately evaluated at present and are accordingly omitted from this account. A large number can be attributed to **1** and the remainder mostly to **7** and **8**.

In all species the size of the corm depends on age and vigour. The pedicels become curled or strongly recurved after flowering, but as they dry out on ripening they straighten again; in some species this movement is known to be hygroscopic.

Literature: A. Béguinot, *Malpighia* **21**: 49–122, 364–478 (1907); **22**: 377–469 (1908); **23**: 55–117, 185–239, 257–296 (1909).

1 Corm subglobose, rounded at the base; tunic split at the base into acuminate teeth bent to one side **9. rosea**
1 Corm asymmetrical, obliquely flattened on one side; tunic split at the base into a fringe of parallel fibres
2 Throat of perianth yellow or orange
3 Bracteole usually herbaceous
4 Flowers deep violet; stigmas below the top of the anthers **6. melitensis**
4 Flowers violet or lilac-blue with darker veins, often paler and almost white distally; stigmas at or above the top of the anthers **7. ramiflora**
3 Bracteole usually scarious
5 Flowers almost white, pale lilac or pale violet, with darker veins; stigmas below the top of the anthers; perianth 0·9–1·9 cm **8. columnae**
5 Flowers variable in colour, but not with darker veins inside; stigmas usually above the top of the anthers; perianth (1–)2–3·5(–5·5) cm **1. bulbocodium**
2 Throat of perianth white, lilac or purple
6 Anthers reaching less than ½ way up the perianth; stigmas below the top of the anthers **2. ligustica**
6 Anthers reaching more than ½ way up the perianth; stigmas below or above the top of the anthers
7 Stigmas well above the anthers
8 Flowers deep violet with obtuse segments; anthers reaching ⅔ or more of the way up the perianth **3. requienii**
8 Flowers pale violet or lilac, with acute segments; anthers reaching ½–⅔ of the way up the perianth
9 Bracteole mostly herbaceous, fairly rigid, closely and conspicuously veined **7. ramiflora**
9 Bracteole mostly scarious, weakly veined **1. bulbocodium**
7 Stigmas below or just above the top of the anthers
10 Bracteole mostly herbaceous, fairly rigid, closely and conspicuously veined **7. ramiflora**
10 Bracteole mostly scarious, weakly veined
11 Flowers concolorous; stigmas below the top of the anthers **5. linaresii**
11 Flowers with a paler or white throat; stigma at or just above the top of the anthers **4. revelierei**

1. R. bulbocodium (L.) Sebastiani & Mauri, *Fl. Rom.* 17 (1818) (*Trichonema bulbocodium* (L.) Ker-Gawler). Basal leaves 2, 5–30 cm × 0·8–2 mm, curved and procumbent or straight and ascending. Cauline leaves up to 5. Scape 1- to 6-flowered. Flowers very variable in colour; tube and throat usually yellow; segments white to lilac or violet, greenish or with 1–5 dark lines outside. Bract 1–2·1 cm, purplish or with reddish-brown dots, with a very narrow scarious margin. Bracteole equalling the bract but wider, acute, (obtuse when flattened out), scarious, or with a narrow green keel, brownish. Perianth (1–)2–3·5(–5·5) cm; tube 3·5–8 mm; segments elliptical to oblong-oblanceolate, usually acute. Filaments hairy below; top of anthers reaching to about the middle of the segments or a little higher. Stigmas usually overtopping the anthers but variable in length. $2n=34$, 36, 42. *Mediterranean region, extending to N.W. Spain and S. Bulgaria.* Al Bu Co Cr Ga Gr Hs It Ju Lu Sa Si.

R. clusiana (Lange) Nyman, *Syll., Suppl.* 62 (1865) (*Trichonema clusianum* Lange) and **R. uliginosa** G. Kunze, *Flora* (*Regensb.*) **29**: 690 (1846), both from the Iberian peninsula, cannot be regarded as more than varieties.

2. R. ligustica Parl., *Fl. Ital.* **3**: 249 (1860). Basal leaves 2, 15–30 cm × 1–1·5 mm, erect or recurved; cauline leaves up to 5. Scape up to 5 cm at anthesis, sometimes not produced above ground. Pedicels up to 4 cm. Flowers lilac to violet, the throat not yellow. Bract 1·1–1·8 cm, herbaceous, with a narrow, spotted, scarious margin. Bracteole almost entirely scarious, ovate, obtuse, densely spotted. Perianth 1·9–3·5 cm; tube 5–7·5 mm; segments obovate-elliptical, rounded to subacute. Filaments hairy at the base; anthers reaching less than ½ way up the segments. Stigmas not overtopping the anthers, usually somewhat shorter. *Coasts of N.W. Italy, Corse and Sardegna.* Co It Sa.

[1] By W. Marais.

R. limbarae Béguinot, *Bot. Jahrb.* **38**: 325 (1907), from Sardegna, is intermediate between **2** and **3** and is probably a hybrid.

3. R. requienii Parl., *Fl. Ital.* **3**: 248 (1860). Basal leaves 2, 3–12(–17) cm × 0·75–1·25 mm, very slender, usually procumbent; cauline leaves 1–4(–9). Scape 1- to 3(–6)-flowered. Pedicels short. Flowers deep violet-purple throughout or with a whitish throat. Bract 0·9–1·3 cm, ovate, herbaceous, with a scarious margin, often tinged with purple or spotted with reddish-brown. Bracteole ovate, obtuse, scarious except for a green keel, brown or purplish, spotted. Perianth 2–2·5 cm; tube 5–8 mm, narrowly infundibuliform; segments 5–6 mm wide, obovate-oblong, rounded at apex. Anthers reaching ⅔ or more of the way up the segments, overtopped by the stigmas which are usually just below the apex of the segments. $2n=34$. *Moist, sandy ground near the sea.* ● *W.C. Italy, Corse, Sardegna.* Co It Sa.

4. R. revelierei Jordan & Fourr., *Brev. Pl. Nov.* **1**: 49 (1866). Small slender plant. Basal leaves 2, up to 15 cm, 0·75–1·1 mm wide, suberect or recurved. Scape not produced above ground. Cauline leaves 2–3. Pedicels 1–2, short. Flowers small, violet, with darker veins, with a paler or white throat. Bract 0·8–1·4 cm, herbaceous, with a very narrow scarious margin. Bracteole green-keeled, with a wide scarious margin spotted with reddish-brown. Perianth 1·2–1·6 cm; tube 3–5 mm; segments up to 3·5 mm wide, elliptic-oblanceolate to elliptical, rounded to subacute. Filaments hairy below; top of anthers reaching ½–⅔ of the way up the segments. Stigmas at the top of the anthers or just above. Capsule oblong-obovoid. *Damp or seasonally inundated ground near the coast.* ● *Corse, Capraia and islands off N. Sardegna.* Co It Sa.

Some larger plants from W. Corse (Cargèse) may be hybrids with **3**.

5. R. linaresii Parl., *Fl. Panorm.* **1**: 38 (1839). Basal leaves 2, 5–20 cm × 0·9–1·5 mm, mostly recurved and procumbent. Scape with 1–4 cauline leaves, 1- to 2(–3)-flowered. Pedicels short, not elongating after flowering. Flowers violet-purple, concolorous. Bract 0·9–2·3 cm, sometimes tinged with purple, herbaceous, with a very narrow scarious margin. Bracteole with a narrow green keel or almost completely scarious, spotted with reddish-brown. Perianth 1·3–2·6 cm, the tube 4–7 mm; segments oblanceolate, rounded to acute. Filaments purple, hairy at the base; anthers reaching ½–⅔ of the way up the segments. Stigmas below the top of the anthers. Capsule obovoid. *Greece and Aegean region; Sicilia.* ?Cr Gr Si Tu.

(a) Subsp. **linaresii**: Bract and bracteole 1·3–2·3 cm. Perianth 2–2·6 cm, the segments rounded at apex. *Coastal sands.* ● *Sicilia.*

(b) Subsp. **graeca** Béguinot, *Bot. Jahrb.* **38**: 325 (1907): Bract and bracteole 0·9–1·6 cm. Perianth 1–3·2 cm, the segments acute. *Rocky and grassy places. Greece and Aegean region.*

6. R. melitensis Béguinot, *op. cit.* 327 (1907). Like **5** but flowers dark violet, with a yellow throat; bracteole with a wider herbaceous keel, somewhat similar to that of **7** but less strongly veined, the scarious margin only lightly spotted with reddish-brown. *Damp places.* ● *Malta, Gozo.* Si.

7. R. ramiflora Ten., *App. Ind. Sem. Horti Neap.* **1827**: 3 (1827) (*Trichonema ramiflorum* (Ten.) Sweet). Basal leaves 2, 6–30 cm × 0·75–1·5 mm, erect or recurved. Cauline leaves up to 4(–6), one on lower part of scape, the others more or less terminal. Scape usually below ground at anthesis, later up to 30 cm, 1- to 4(–6)-flowered. Pedicels elongating after flowering to up to 10 cm. Flowers lilac-blue, sometimes with darker veins, sometimes pinkish inside, yellow-green outside; throat white or yellow. Bract 1–2·2 cm, herbaceous, strongly veined. Bracteole with a hyaline margin. Perianth 1–3 cm, the tube 2·5–7 mm; segments oblanceolate or oblanceolate-elliptical, acute. Anthers reaching about ⅔ of the way up the segments. Stigmas just below or just above the top of the anthers. Capsule 1·2–1·6 cm, cylindrical to oblong. $2n=36$. *Mediterranean region, Portugal.* Bl Co Cr Ga Gr Hs It Lu Sa Si Tu.

(a) Subsp. **ramiflora**: Leaves usually fairly thick. Perianth 1–1·8 cm. Style slightly shorter than stamens. Bracteole with a narrow hyaline margin. *Throughout the range of the species.*

(b) Subsp. **gaditana** (G. Kunze) Marais, *Kew Bull.* **30**: 708 (1975) (*R. linaresii* var. *gaditana* G. Kunze, *R. gaditana* (G. Kunze) Béguinot): Leaves long and slender. Perianth 2–3 cm, lilac or pink, green outside. Style slightly exceeding stamens. Bracteole with a wide hyaline margin. ● *W. & S. parts of Iberian peninsula.*

8. R. columnae Sebastiani & Mauri, *Fl. Rom.* 18 (1818) (*Trichonema columnae* (Sebastiani & Mauri) Reichenb.). Basal leaves 2; cauline leaves 1–6 ,0·6–1 mm in diameter, fairly short, erect or appressed, or long and slender. Scape 1- to 3-flowered. Pedicels short. Flowers pale lilac to pale violet, with purple veins; throat yellow, occasionally almost white. Bract 0·6–1·3 cm, herbaceous, with a narrow scarious margin, tinged purple or spotted with reddish-brown. Bracteole almost entirely scarious. Perianth 0·9–1·9 cm; tube 2·5–5·5 mm; segments lanceolate or oblanceolate, acute. Anthers reaching about ½ way up the perianth. Stigmas below the top of the anthers. Capsule 0·5–1·1 cm, obovoid-triquetrous to subglobose-triquetrous. Fruiting scape up to 5 cm above ground. *Mediterranean region and W. Europe, northwards to S.W. England, mainly near the coast.* Az Bl Br Co Cr Ga Gr Hs It Lu Sa Si Tu.

(a) Subsp. **columnae**: Leaves 3–8(–20) cm × 0·75–0·9 mm. Filaments often glabrous. *Throughout the range of the species.*

(b) Subsp. **rollii** (Parl.) Marais, *Kew Bull.* **30**: 707 (1975) (*R. rollii* Parl.): Leaves 15–30 cm × 0·3–0·75 mm, slender. Filaments always hairy. *Maritime sands. Mediterranean region, eastwards from S. France.*

9. R. rosea (L.) Ecklon, *Topogr. Verzeichn.* 19 (1827) (*Trichonema purpurascens* Sweet.). Corm subglobose, the basal teeth of the tunic bent to one side. Basal leaves several, up to 25 cm, 1–2·5 mm in diameter, usually spreading; cauline leaves 5–6. Pedicels 3–8 cm. Flowers magenta-pink, pale lilac, pink or white; throat yellow, sometimes marked with violet-blue. Bract 1·5–2·5 mm, herbaceous, with a narrow scarious margin. Bracteole with a wide scarious margin, brown or spotted. Perianth 1·5–4·5 cm; tube 2–8 mm. Anthers reaching about ½ way up the perianth. Stigmas below or above the top of the anthers. *Naturalized in Channel Islands (Guernsey), and S.E. France (St. Tropez).* [Ga.] *(South Africa.)*

Two varieties have become naturalized: var. *rosea* at St. Tropez, and var. *australis* (Ewart) De Vos in Guernsey.

9. Tritonia Ker-Gawler[1]

Glabrous perennials with corms. Leaves linear or ensiform. Inflorescence a lax spike. Spathes membranous, the outer 3-pointed, the inner entire. Flowers slightly zygomorphic; hypanthial tube slender, widening slightly upwards; perianth-segments

[1] By D. H. Valentine.

oblong or obovate; limb concave or broadly campanulate. Style filiform, curved, exserted, its branches short, simple. Capsule and seeds small.

Not stoloniferous; anthers purple **1. crocata**
Stoloniferous; anthers yellow **2. × crocosmiflora**

1. T. crocata (L.) Ker-Gawler, *Bot. Mag.* **16**: sub t. 581 (1802). Scape 15–35 cm, slender, simple or with 1–2 short branches. Leaves 4–7, up to 20 cm, distichous, linear-lanceolate, acute, shorter than scape. Spike up to 10-flowered, secund. Hypanthial tube up to 5 mm, infundibuliform; limb bright orange, often with yellow streaks at throat, forming an open cup 2·5 × 1·2 cm. Stamens curved, *c.* ½ as long as the obovate perianth-segments; anthers purple. *Cultivated for ornament and naturalized in S.E. France* (*Var*). [Ga.] (*Cape of Good Hope.*)

2. T. × crocosmiflora (Lemoine) Nicholson, *Ill. Dict. Gard.* **4**: 94 (1887) (*Crocosmia crocosmiflora* (Lemoine) N.E. Br.). Stoloniferous; corms often several in a row. Leaves 4–8, (7–)10–30(–40) cm × 5–20 mm, ensiform. Scape 30–90 cm, slender, simple or with 1–2(–4) branches. Spike 10- to 20-flowered, secund, distichous. Flowers orange-yellow; hypanthial tube infundibuliform, slightly bent at apex; perianth-segments oblong, the dorsal segment slightly larger than rest. Stamens and style extending nearly to apex of perianth; anthers yellow. *Woods, river-banks and sea-cliffs. Widely naturalized in W. Europe.* [Az Br Ga Hb Lu.]

Originated in cultivation from a cross between *T. aurea* Pappe ex Hooker and *T. pottsii* (Baker) Baker (*Montbretia pottsii* Baker), both from South Africa. It is capable of producing some fertile seed.

Records of *T. cinnabarina* Pax from the Açores refer to this hybrid.

10. Gladiolus L.[1]

Stock a corm; tunic usually with coarse fibres. Leaf-sheaths 2–4, basal. Leaves 1–16, the basal usually ensiform, the cauline usually reduced, bract-like. Flowers zygomorphic, in a simple or branched, usually secund spike. Bract and bracteoles usually large, green, persistent. Perianth-segments 6, in 2 whorls, ovate to lanceolate, often attenuated below to form a claw. Hypanthial tube usually curved, infundibuliform. Stamens usually curved towards the upper side of the perianth. Style terete, filiform; stigmatic branches 3, obovate to obcordate, with a fimbriate to papillose margin. Capsule oblong-globose to cylindrical. Seeds usually broadly winged.

A large genus, centred in South Africa, with a secondary centre in the Mediterranean region. The close similarity of most of the European species, especially in the reddish-purple colour of the perianth, together with the occurrence of inter-specific hybridization, has led to some taxonomic confusion.

Several species from South Africa and their hybrids are frequently grown in gardens and sometimes escape where the climate is suitable. Among the commonest are **G. cardinalis** Curtis, *Bot. Mag.* **4**: t. 135 (1790), **G. tristis**, L., *Sp. Pl.* ed. 2, 53 (1762), **G. liliaceus** Houtt., *Natuurl. Hist.* (*Handleid.*) **12**: 55 (1780) (*G. grandis* (Thunb.) Thunb.), **G. carneus** Delaroche, *Descr. Pl. Nov.* 30 (1766) (*G. blandus* Aiton), and those of their hybrids collectively named **G. × colvillii** Sweet, *Brit. Fl. Gard.* ser. 1, t. 155 (1826). All are diploid, with $2n = 30$.

1 Anthers longer than filaments (or aborted); seeds not winged **5. italicus**
1 Anthers equalling or shorter than filaments; seeds winged
2 Spike dense; hypanthial tube strongly curved; lowest leaf obtuse **4. imbricatus**
2 Spike lax; hypanthial tube slightly curved; lowest leaf narrowing gradually to an acute apex
3 Spike ± distichous, with 3–20 flowers; axillary branches often present **(1–2). illyricus group**
3 Spike strongly secund, with not more than 6 flowers; axillary branches absent **3. palustris**

(1–2). G. illyricus group. Plant 25–100 cm. Basal sheaths pale green, sometimes red-veined. Leaves 4–5, 10–70 cm × 4–22 mm. Spike 3- to 20-flowered, usually lax, weakly distichous, with 1–3 axillary branches. Perianth reddish-purple to pink. Perianth-segments 25–45 × 6–25 mm, obovate, rhombic or oblanceolate, the lower often blotched or lined with white and dark red. Anthers shorter than filaments in flowers with obovate segments, but equalling filaments in flowers with rhombic or oblanceolate segments. Capsule obovoid in flowers with obovate segments, but ellipsoid in flowers with oblanceolate segments.

A group of 2 closely related species and 2 subspecies which differ mainly in size and chromosome number.

Plant 25–50 cm; leaves 10–40 cm × 4–10 mm; spike 3- to 10-flowered, rarely branched; perianth-segments 25–40 × 6–16mm **1. illyricus**
Plant 50–100 cm; leaves 30–70 cm × 5–22 mm; spike 10- to 20-flowered, frequently branched; perianth-segments 30–45 × 10–25 mm **2. communis**

1. G. illyricus Koch, *Syn. Fl. Germ.* 699 (1837). Plant 25–50 cm. Basal sheaths green, sometimes tinged with red, usually along the veins. Leaves 10–40 cm × 4–10 mm. Spike 3- to 10-flowered, occasionally with 1 axillary branch in larger specimens. Perianth red to reddish-purple; segments 25–40 × 6–16 mm. $2n = 60, 90$. *Heaths, scrub and open woodland. S. & W. Europe, northwards to S. England.* Al Bl Br Bu ?Co Ga Gr Hs It Ju Lu Rm Sa Si.

This species shows considerable variation in characters of flower and leaf. Some variants appear to be stable and confined to definite geographical areas. Thus **G. reuteri** Boiss. in Boiss. & Reuter, *Pugillus* 112 (1852), from Spain (Aranjuez), has narrow, glaucous leaves; **G. glaucus** Heldr. ex Halácsy, *Consp. Fl. Graec.* **3**: 186 (1904), from S. Greece, is very dwarf and has the perianth-segments mucronulate; while the plants from Britain have uniformly obovate perianth-segments and a chromosome number of $2n = 90$, unlike the $2n = 60$ of continental populations.

2. G. communis L., *Sp. Pl.* 36 (1753). Plant 50–100 cm. Basal sheaths green- or red-veined. Leaves 30–70 cm × 5–22 mm; spike 10- to 20-flowered, often with 1–3 axillary branches. Flowers sometimes connivent. Perianth pink, red or purplish-red; segments 30–45 × 10–25 mm; upper lateral segments oblanceolate to rhombic; lower segments frequently blotched or with white and dark red central lines. *S. Europe.* Al Bu Co Ga Gr Hs It Ju ?Rs (K) Sa Si.

(a) Subsp. **communis**: Plant 50–80 cm. Basal sheaths usually green- or pink-veined. Leaves 30–50 cm × 5–15 mm. Spike often with 2 or 3 axillary branches. Perianth frequently pink; segments 30–40 × 10–20 mm. $2n = 120$. *Throughout the range of the species.*

(b) Subsp. **byzantinus** (Miller) A. P. Hamilton, *Bot. Jour. Linn. Soc.* **76**: 358 (1978) (*G. byzantinus* Miller): Plant 50–100 cm. Basal sheaths frequently with dark red veins. Leaves 30–70 cm × 8–22 mm. Spike often with 1–2 axillary branches. Perianth red to purplish-red; segments 30–45 × 15–25 mm. $2n = 90, 120$. *Mainly in* Chamaerops-*garrigue. S. Spain; Sicilia.* (*N.W. Africa.*)

[1] By A. P. Hamilton.

Frequently cultivated for ornament. The typical plant of subsp. (b), which was described from a garden specimen, and is known only in cultivation, is a hexaploid ($2n=90$) of low fertility. It differs slightly from wild specimens, which are octoploid ($2n=120$) and fertile.

Hybrids between **1**, **2a** and **2b** are found where the taxa meet, for example in S. Spain, but **1** is often separated from **2a** and **2b** by altitude or latitude. **G. dubius** Guss., *Fl. Sic. Prodr., Suppl.* 8 (1832), widespread in the C. Mediterranean region, is intermediate between **1** and **2**, but its taxonomic status is uncertain.

3. G. palustris Gaudin, *Fl. Helv.* **1**: 97 (1828). Plant 25–50 cm. Basal sheaths green, sometimes tinged with red usually along the veins. Leaves 10–40 cm × 4–10 mm; usually only 1 bract-like cauline leaf and 2 basal leaves. Spike strongly secund, with up to 6 flowers. Perianth red to reddish-purple. Perianth-segments 25–40 × 6–16 mm, the upper subequal, obovate, the lateral rhombic, the lower *c.* 1⅓ as long as the upper, oblong-cuneate; claw as long as the limb. $2n=60$. *Wet meadows and scrub.* ● *C. Europe, extending southwards to S.E. France, C. Italy and Bulgaria; some isolated stations in S.E. White Russia and N. Ukraine.* Al Au Bu Cz Ga Ge He Hu It Ju Po ?Rm Rs (C).

Some abnormally wide-leaved specimens superficially resembling **2** are recorded from France and Switzerland.

4. G. imbricatus L., *Sp. Pl.* 37 (1753). Plant 30–80 cm. Corm-tunics finely fibrous to papery thin. Leaves usually 3, the lowest 16–35 cm × 15 mm, obtuse, the cauline up to 5 mm wide, subulate. Spike dense, 4- to 12-flowered, strongly unilateral. Perianth-tube strongly curved; segments subequal, connivent; upper lateral segments lanceolate. $2n=60$. *Wet meadows and scrub. E. & C. Europe.* ?Au Bu Cz Ge Gr ?He Hu It Ju Po Rm Rs (B, C, W, K, E) [Fe Ga].

Polymorphic; the perianth in the north and west of the range is reddish-purple, but in the south and east it is frequently violet-purple. Some plants may produce axillary branches. The width of the wing of the seed is also variable. Plants with seeds with vestigial wings have been described from the Ukraine as **G. apterus** Klokov in Kotov & Barbarich, *Fl. RSS Ucr.* **3**: 407 (1950). Abnormally large specimens, with additional leaves, superficially resembling **2**, are occasionally found throughout the range of **4**.

5. G. italicus Miller, *Gard. Dict.* ed. 8, no. 2 (1768) (*G. segetum* Ker-Gawler). Plant 50–100 cm. Basal sheaths usually pale to dark red, often spotted white or pale green. Leaves 3–5, the lowest 18–40 cm × 16 mm, the other basal leaves 35–65 cm, the cauline 5–10 mm wide, irregularly veined. Inflorescence 6- to 16-flowered, lax, usually weakly distichous. Bract always exceeding bracteole; lower bracts frequently resembling and grading into cauline leaves. Perianth bright purplish-red to light pink. Lateral perianth-segments oblong. Anthers longer than filaments, or aborted. Capsule torulose when mature. Seeds globose-pyriform, not winged. $2n=120$, 171 ± 2. *Cultivated land. S. Europe, extending northwards to W.C. France.* Al Bl Bu Co Cr Ga Gr †He Hs It Ju Lu Rm Rs (K) Sa Si Tu.

A weed of arable crops, not recorded from natural habitats; its range as a native is therefore unknown. It may be either hermaphrodite or gynodioecious. Female plants (**G. guepinii** Koch, *Flora* (*Regensb.*) **23**: 666 (1840)) have a small perianth and aborted anthers, and occur in most populations.

Records from the Açores are referable to *G. carneus* Delaroche, a native of South Africa, which has escaped from cultivation.

G. atroviolaceus Boiss., *Diagn. Pl. Or. Nov.* **2(13)**: 14 (1853), native to S.W. Asia, has been reported as an occasional cornfield weed in N.E. Greece and Turkey-in-Europe. It differs from **5** mainly in its deep violet perianth and in its leaves, which have prominent, equidistant, parallel veins.

JUNCALES

CLXXXIX. JUNCACEAE[1]

Herbs, usually perennial. Leaves long and narrow, with sheathing base, sometimes reduced to scales. Flowers actinomorphic, hermaphrodite, protogynous, usually crowded in monochasial cymes which are sometimes condensed into heads, or solitary. Perianth-segments 6, in 2 whorls. Stamens free, in (1–)2 whorls of 3. Ovary superior, 1- or 3-locular; stigmas 3; ovules 3 or numerous. Fruit a dehiscent, loculicidal capsule; seeds endospermic, often with a basal appendage.

Literature: F. Buchenau *Bot. Jahrb.* **12**: 1–498 (1890).

Leaves not ciliate; capsule many-seeded **1. Juncus**
Leaves usually ciliate, at least when young; capsule 3-seeded **2. Luzula**

1. Juncus L.[2]

Glabrous, rhizomatous perennials or annuals. Inflorescence sympodial, usually many-flowered, the ultimate divisions forming cymes often contracted into heads. Bracteoles absent, or one 2-fid and two or more simple and forming an involucre. Perianth-segments in two whorls of three. Stamens 6 or fewer; anthers basifixed, opposite and attached to the base of perianth-segments; pollen shed in tetrads. Fruit a 1- or 3-locular capsule. Ovules numerous. Testa usually prominently sculptured; embryo small.

Variation in vegetative characters is very great. The subgenera are most easily characterized by the different structure and arrangement of the leaves. The relative length of anthers and filaments, which is often important for differentiating species, should be measured in late flower or in fruit. In species where the perianth-segments are unequal, the outer should be assumed the longer, unless otherwise stated.

Literature: F. Buchenau in Engler, *Pflanzenreich* **25 (IV. 36)**: 98–284 (1906). S. Snogerup in K. H. Rechinger, *Flora Iranica* **75**. Wien. 1971. P. J. Van Loenhoud & A. A. Sterk, *Acta Bot. Neerl.* **25**: 193–204 (1976) (*J. bufonius* group).

1 Flowers each with 2 involucral bracteoles
2 Leaves of adult plants terete, not flattened or with enlarged cells on the adaxial side
3 Flowering stems with 2–4 cauline leaves **14. subulatus**

[1] Edit. D. M. Moore. [2] By S. Snogerup.

3 Leaves solitary on specialized shoots and as bracts below the inflorescence (Subgen. *Genuini*)
4 Lowest bract clearly lateral **6. jacquinii**
4 Lowest bract forming an apparent continuation of the stem
5 Subepidermal sclerenchyma-bundles absent; stems smooth even when dry; with a creeping rhizome
6 Anthers 0·5–0·7 mm, not longer than filaments **8. arcticus**
6 Anthers 0·8–2 mm, longer than filaments
7 Anthers 0·8–1·5 mm; seeds 0·85–1·05 mm **9. balticus**
7 Anthers 1·5–2 mm; seeds 0·65–0·75 mm **10. pyrenaeus**
5 Subepidermal sclerenchyma-bundles present; stems striate at least when dry; caespitose or with a creeping rhizome
8 Rhizome creeping; bract at least ⅓ as long as stem **7. filiformis**
8 Caespitose; bract less than ¼ as long as stem
9 Stem almost smooth, with 40–70 weak striae **12. effusus**
9 Stem with 10–30 ridges below inflorescence
10 Capsule acute to obtuse; pith interrupted **11. inflexus**
10 Capsule emarginate to obtuse; pith continuous **13. conglomeratus**
2 Bracts and leaves flat or subterete, canaliculate or with enlarged cells on the adaxial side
11 Annual, without a rhizome; basal leaves without auricles (Subgen. *Poiophylli*)
12 Capsule ovoid to prismatic or ellipsoid **(24–29). bufonius group**
12 Capsule globose or subglobose
13 Inner perianth-segments obtuse; inflorescence occupying less than ½ the height of the plant **22. tenageia**
13 Inner perianth-segments acute; inflorescence occupying at least ½ the height of the plant **23. sphaerocarpus**
11 Perennial, usually with a conspicuous rhizome; all leaves with auricles
14 Seeds with long appendages
15 Inflorescence 1- to 3-flowered; auricles lacerate **15. trifidus**
15 Inflorescence 5- to 15-flowered; auricles entire **6. jacquinii**
14 Seeds without or with very small appendages
16 Leaves numerous, in a basal rosette **16. squarrosus**
16 Leaves 1–4(–6) on each stem, cauline or sub-basal
17 Perianth-segments obtuse
18 Anthers not more than twice as long as filaments; capsule usually exceeding perianth **17. compressus**
18 Anthers 2–6 times as long as filaments; capsule about equalling perianth **18. gerardi**
17 Perianth-segments apiculate to aristate
19 Capsule 5–6 mm; anthers (0·8–)1·2–1·4 mm, usually about as long as filaments **21. imbricatus**
19 Capsule less than 5 mm; anthers 0·7–0·8 mm, ½–⅔ as long as filaments
20 Auricles long, thin, whitish **19. tenuis**
20 Auricles short, cartilaginous, yellowish **20. dudleyi**
1 Flowers without involucral bracteoles, in ± distinct heads
21 Small annual, without a rhizome
22 Leaves flat to canaliculate, not septate; auricles absent **31. capitatus**
22 Leaves terete, septate; auricles present
23 Perianth-segments subequal; anthers not more than ½ as long as filaments **35. pygmaeus**
23 Inner perianth-segments exceeding the outer; anthers 3–5 times as long as filaments **36. tingitanus**
21 Perennial, rhizomatous or with bulb-like swellings, or aquatic
24 Leaves flat or with involute margins, not septate, with a compact pith (Subgen. *Graminifolii*) **30. planifolius**
24 Leaves terete, or flat and pluritubulose with septa at apex
25 Leaves terete, not septate, pungent, with a compact pith and several centrally placed vascular bundles (Subgen. *Juncus*)
26 Inner perianth-segments without apical auricles
27 Anthers about twice as long as filaments; capsule about equalling perianth **1. maritimus**
27 Anthers 2½–5 times as long as filaments; capsule exceeding perianth **2. rigidus**
26 Inner perianth-segments with wide, apical auricles
28 Capsule 4–6 mm, with 80–120 seeds, conical or trigonous at apex **3. acutus**
28 Capsule 2·5–4 mm, with 25–75 seeds, conical or obtuse at apex
29 Capsule obtuse at apex; flowers dark brown **4. littoralis**
29 Capsule conical at apex; flowers light brown **5. heldreichianus**
25 Leaves septate (rarely inconspicuously so), usually not pungent, uni- or pluritubulose, the tubes empty or with lax aerenchyma; vascular bundles only in marginal layer and walls
30 Leaf transversely septate only in upper part, often inconspicuously so; filaments 3–8 times as long as anthers (Subgen. *Alpini*)
31 Capsule distinctly emarginate **50. biglumis**
31 Capsule obtuse to acute
32 All bracts short, wide, not resembling leaves; leaves bitubulose in middle and upper part **51. triglumis**
32 Lowest bract of inflorescence leaf-like; leaves pluritubulose throughout
33 Anthers 1–1·5 mm; capsule dark **53. castaneus**
33 Anthers 0·4–0·7 mm; capsule pale brown **52. stygius**
30 Leaf transversely septate throughout, usually conspicuously so; filaments ⅛–3 times as long as anthers
34 Leaf ensiform; stem flat, winged (Subgen. *Ensifolii*) **32. ensifolius**
34 Leaf and stems terete (Subgen. *Septati*)
35 Leaf pluritubulose
36 Plant 40–130 cm, with a rhizome **34. subnodulosus**
36 Plant 1–30 cm, without a rhizome **39. bulbosus**
35 Leaf unitubulose
37 Anthers 1·8–2·5 mm; plant aquatic or semiterrestrial, without a rhizome
38 Perianth-segments obtuse; anthers 2–4 times as long as filaments **37. heterophyllus**
38 Perianth-segments acuminate-cuspidate; anthers 4–6 times as long as filaments **38. emmanuelis**
37 Anthers 0·4–1·5 mm; plant usually rhizomatous, normally not aquatic
39 Seeds with long appendages **33. canadensis**
39 Seeds without appendages
40 Capsule broadly obtuse and shortly mucronate
41 Perianth-segments sharply acute to acuminate **41. thomasii**
41 At least the inner perianth-segments obtuse
42 Rhizome slender, with long internodes; plant 2–10 cm high, mat-forming **48. requienii**
42 Rhizome stout, with short internodes, sometimes absent
43 Outer perianth-segments acute; plant caespitose or without a rhizome **49. articulatus**
43 Outer perianth-segments obtuse; plant with a creeping rhizome
44 Anthers ½–⅔ as long as filaments; capsule obtuse **46. alpinus**
44 Anthers 1–1½ times as long as filaments; capsule usually acute **47. anceps**
40 Capsule acute, or abruptly contracted at apex and with a long mucro
45 Rhizome absent or very weakly developed **45. fontanesii**
45 Rhizome well-developed
46 Anthers 2–3 times as long as filaments; leaves longitudinally sulcate **44. striatus**
46 Anthers ½–2 times as long as filaments; leaves smooth or finely striate
47 Perianth-segments 6–8 times as long as wide; inflorescence of 1–4 globose, many-flowered heads **43. valvatus**
47 Perianth-segments 2–3(–4) times as long as wide; inflorescence of (1–)10–250 usually few-flowered heads

48 Perianth-segments obtuse **47. anceps**
48 Perianth-segments acute to cuspidate
49 Perianth-segments acute, equal or subequal **49. articulatus**
49 Perianth-segments acuminate to cuspidate, the inner considerably longer than the outer
50 Leaves 5- to 7-angled, collapsing when dried, with obvious longitudinal striae; basal sheaths usually absent **40. atratus**
50 Leaves circular to elliptical in section, remaining terete when dried, without or with small and irregular striae; basal sheaths 2–3 **42. acutiflorus**

Subgen. **Juncus**. Perennials. Leaves at base of stems, terete, non-septate, pungent, stem-like, with pith of rounded cells and vascular bundles distributed over most of the cross-section; stomata depressed. Auricles absent. Lowest two bracts leaf-like, pungent. Inflorescence usually apparently terminal. Involucral bracteoles absent. Seeds with appendages.

Hybrids occur between **3**, **4** and **5**.

1. J. maritimus Lam., *Encyl. Méth. Bot.* **3**: 264 (1789). Plant with a creeping rhizome, sometimes laxly caespitose; intravaginal shoots absent. Stems 50–100 cm, usually 1·5–2 mm in diameter, with 2–4 leaves. Inflorescence many-flowered, usually lax; first bract long, forming an apparent prolongation of the stem, the second usually short. Perianth-segments unequal; outer ovate, more or less boat-shaped, acute, shortly mucronate; inner shorter, narrowly elliptical, obtuse, without auricles. Stamens *c.* ⅔ as long as perianth; anthers about twice as long as filaments. Capsule 2·5–3·5 mm, trigonous-ovoid, obtuse or subacute, mucronate, equalling or slightly exceeding the perianth. Seeds 0·8–1·2 mm. $2n=48$. *Salt-marshes and saline meadows. Coasts of Europe, northwards to Scotland and S.E. Sweden; locally inland in E.C. Europe and the Mediterranean region.* Al Au Az Be Bl Br Bu Co Cr Da Ga Ge Gr Hb Ho Hs Hu It Ju Lu Rm Rs (W, K, E) Sa Si Su Tu.

2. J. rigidus Desf., *Fl. Atl.* **1**: 312 (1798) (*J. arabicus* (Ascherson & Buchenau) Adamson, *J. nevskii* V. Krecz. & Gontsch.). Like **1** but stems 75–150 cm, usually 2–5 mm in diameter; anthers 3–4 times as long as filaments; capsule 3·5–5 mm, narrowly trigonous-ovoid, narrowly pyramidal at apex, exceeding the perianth. *Salt-marshes and maritime sands. Italy, Sardegna, Sicilia.* It Sa Si.

3. J. acutus L., *Sp. Pl.* 325 (1753). Plant densely caespitose; intravaginal shoots present. Stems (15–)50–150 cm, usually 2–4 mm in diameter, rigid, with 2–5 leaves. Inflorescence many-flowered, usually dense, globose, rarely lax and elongated; lowest two bracts well-developed and strongly pungent, usually short. Perianth-segments equal or subequal, oblong, with a wide, scarious margin; outer obtuse or acute; inner wide, with scarious apical auricles. Stamens equalling or slightly shorter than perianth; anthers 1·5–2 mm, several times as long as filaments. Capsule 4–6 mm, much exceeding the perianth, obovoid to ovoid, with a broadly conical to obtuse apex, shortly mucronate. Seeds 80–120, 1·5–2·5 mm; appendages equal. $2n=48$. *Maritime sands; rarely on damp or saline soils inland. Mediterranean region and W. Europe, northwards to Ireland.* Al Az Bl Br Co Cr Ga Gr Hb Hs It Ju Lu Sa Si Tu.

(a) Subsp. **acutus**: Inflorescence usually dense. Capsule usually 5–6 mm, ovoid, conical at apex, variable in colour. *Throughout the range of the species.*

(b) Subsp. **leopoldii** (Parl.) Snogerup, *Bot. Not.* **131**: 187 (1978) (*J. leopoldii* Parl.): Inflorescence more or less lax. Capsule 4–5 mm, usually obovoid, obtuse, dark or reddish-brown. *Açores, Portugal.*

4. J. littoralis C. A. Meyer, *Verz. Pfl. Cauc.* 34 (1831) (*J. tommasinii* Parl., *J. tyraicus* (Pacz.) V. Krecz. & Gontsch.). Plant densely caespitose; intravaginal shoots present. Stems 50–100 cm, 2–4 mm in diameter, rigid. Inflorescence many-flowered, dense or with several branches. Basal bracts short or rather long; upper bracts rarely with a small pungent lamina. Flowers dark brown. Perianth-segments 2·5–3 mm, oblong with a wide scarious margin; outer obtuse, mucronate, usually thickened and more or less conspicuously keeled at base; inner usually longer, with wide, scarious apical auricles, usually shortly mucronate. Stamens slightly shorter than perianth; anthers 1·2–1·9 mm, several times as long as filaments. Capsule 2·5–4 mm, globose to trigonous-ovoid, obtuse at apex, mucronate, dark brown; seeds 25–40, 1·5–2 mm; appendages subequal. $2n=48$. *Maritime sands and shores of saline lakes. Mediterranean region and S.E. Europe.* Al Bu Cr Ga Gr Hs It Ju Rm Rs (W, K) Tu.

5. J. heldreichianus Marsson ex Parl., *Fl. Ital.* **2**: 315 (1857). Like **4** but stems usually 1·5–2·5 mm in diameter; inflorescence lax; lowest bract usually shorter than the inflorescence, the second short, the upper mostly with a small pungent lamina; flowers light brown; perianth-segments equal or subequal; anthers 1·5–2·2 mm; capsule 3–4(–4·5) mm, ovoid, conical to slightly angular at apex, often shortly mucronate, usually light brown; seeds 40–75, 1–1·5 mm; appendages unequal. $2n=48$. *Salt-marshes, maritime sands and damp places inland. Greece and Aegean region.* Cr Gr Tu.

Subgen. **Genuini** Buchenau. Perennials with a strong rhizome producing flowering stems and short shoots bearing one large leaf. Leaves and bracts not pungent. Leaves of adult plants terete, non-septate, stem-like, with pith of stellate cells and with vascular bundles in the subepidermal layer only. Lowest bract usually large, forming an apparent prolongation of the stem. Flowers with involucral bracteoles. Seeds usually without appendages.

6. J. jacquinii L., *Mantissa* 63 (1767). Plant caespitose. Stems 10–40 cm, with 4–5 basal sheaths having a very small lamina and one stem-like cauline leaf near the inflorescence; non-flowering shoots rarely with two leaves. Leaves more or less canaliculate at base. Inflorescence dense, with 5–15 flowers; flowers dark reddish-brown. Perianth-segments 5–6 mm, equal or subequal, lanceolate to narrowly ovate, apiculate. Anthers 2½–3 times as long as filaments. Capsule trigonous-ovoid to prismatic, obtuse or slightly emarginate, mucronate, equalling perianth. Seeds 2–2·5 mm, fusiform, with two equal, white appendages. $2n=c.$ 170. *Streamsides, damp grassland and screes, 1500–3300 m; calcifuge. Alps, N. Appennini.* ● Au Ga Ge He It Ju.

7. J. filiformis L., *Sp. Pl.* 326 (1753). Rhizome with short internodes, horizontal. Stems 10–60 cm, the uppermost basal sheath with a short lamina. Non-flowering shoots usually few or absent. Lowest bract (⅓–)1–1½ times as long as stem; second bract sometimes leaf-like, though short. Inflorescence with 4–10 flowers, dense. Perianth-segments 2·5–3·5 mm, unequal, ovate to narrowly ovate or the inner oblong; outer aristate; inner obtuse. Anthers *c.* 0·5 mm, ⅓–½ as long as filaments. Capsule (2·5–)3–3·5(–4·5) mm, trigonous-ovoid to globose, usually shortly mucronate, light brown, about equalling perianth. Seeds 0·5 mm, obliquely ovoid, faintly reticulate, with one incon-

spicuous appendage. $2n=84$. *Marshes, fens and wet grassland. Much of Europe, but rare in the Mediterranean region and absent from most of the south-east and the islands.* Au Be Br Bu Cz Da Fe Ga Ge He Ho Hs Is It Ju No Po Rm Rs (N, B, C, W) Si Su.

8. J. arcticus Willd., *Sp. Pl.* **2**: 206 (1799). Plant glaucous; rhizome horizontal. Stems 10–40 cm, erect, rigid; non-flowering stems few or absent. Lowest bract $\frac{1}{8}$–$\frac{1}{4}$ as long as stem. Inflorescence compact, with 3–8 flowers. Perianth-segments 3–4·5 mm, unequal, ovate to elliptical; outer obtuse to mucronate or apiculate; inner obtuse to acute. Anthers 0·5–0·7 mm, $\frac{1}{3}$ as long to as long as filaments. Capsule 3·5–4·5 mm, equalling or exceeding the perianth, trigonous-ovoid to trigonous-ellipsoid, obtuse, shortly mucronate, dark brown to reddish-brown at apex. Seeds 0·6–1·1 mm, obovoid, without or with inconspicuous appendages. $2n=84$. *Streamsides and damp, open habitats. Arctic and subarctic Europe and mountains of Fennoscandia; Alps; C. Appennini.* Au Fe Ga He ?Hs Is It No Rs (N) Sb Su.

Hybrids between **7** and **8**, with intermediate morphology, have low pollen-fertility and reproduce vegetatively. They are well-established in some parts of Fennoscandia and the Alps.

9. J. balticus Willd., *Ges. Naturf. Freunde Berlin Mag.* **3**: 298 (1809) (*J. arcticus* subsp. *balticus* (Willd.) Hyl.). Plant glaucous; rhizome horizontal, with short internodes. Stems (10–)25–100 cm, erect, rigid; non-flowering stems few or absent. Lowest bract $\frac{1}{3}$–$\frac{1}{2}$ as long as stem. Inflorescence lax, with (5–)25–60(–80) flowers. Perianth-segments 3·2–5 mm, usually subequal, ovate to narrowly ovate, obtuse to mucronate or apiculate. Anthers 0·8–1·5 mm, $1\frac{1}{2}$–2 times as long as filaments. Capsule 3–4·5 mm, equalling or exceeding perianth, trigonous-ovoid, shortly mucronate, usually dark brown. Seeds 0·8–1 mm, ovoid, with inconspicuous appendages. $2n=$?80, 84. *Damp, sandy places. N. Europe, southwards to N. England and the Netherlands, mainly near the coast.* Br Da Fa Fe Ge Ho Is No Po Rs (N, B, C) Su.

The usually sterile hybrid between **7** and **9** is locally common. It is tall but otherwise intermediate between the parents.

10. J. pyrenaeus Timb.-Lagr. & Jeanb., *Bull. Soc. Sci. Phys. Nat. Toulouse* **6**: 232 (1883). Like **9** but inflorescence with 5–25 flowers; anthers 1·5–2 mm, 2–6 times as long as filaments; seeds 0·65–0·75 mm. ● *E. Pyrenees (near Mont-Louis).* Ga.

11. J. inflexus L., *Sp. Pl.* 326 (1753) (*J. glaucus* Sibth., *J. longicornis* Bast.). Plant caespitose. Stems 50–120 cm, the basal sheaths usually reddish-brown. Stems and leaves with 10–20 ridges; pith interrupted. Lowest bract long. Inflorescence many-flowered, usually lax. Perianth-segments 2·5–4 mm, unequal, narrowly ovate, acuminate. Stamens 6, *c.* $\frac{1}{2}$ as long as perianth; anthers 0·8–1 mm, 1–$1\frac{1}{2}$ times as long as filaments. Capsule exceeding or rarely equalling perianth, trigonous-ovoid to trigonous-ellipsoid, acute to obtuse and mucronate. Seeds *c.* 0·5 mm, obliquely ovoid, reticulate. $2n=40$, 42. *Fens, wet grassland and damp, open habitats; usually calcicole. Europe, northwards to Scotland and S. Sweden.* All except Az Fa Fe Is No Rs (N) Sb.

12. J. effusus L., *Sp. Pl.* 326 (1753). Plant densely caespitose. Stems 50–150 cm, the basal sheaths often reddish-brown. Stems and leaves smooth or with 30–70 weak striae; pith continuous. Lowest bract long, with a narrow sheath. Inflorescence many-flowered, dense or lax; flowers usually pale brown. Perianth-segments 1·5–3 mm, subequal, ovate, acuminate. Stamens 3(–6), $\frac{1}{2}$–$\frac{3}{4}$ as long as perianth; anthers 0·6–0·8 mm, as long as the filaments. Capsule ovoid to globose, obtuse, not or slightly emarginate, usually shorter than perianth. Seeds *c.* 0·5 mm, obliquely ovoid, reticulate. $2n=40$, 42. *Damp places. Almost throughout Europe except the arctic.* All except Bl Is Sb.

13. J. conglomeratus L., *Sp. Pl.* 326 (1753) (*J. leersii* Marsson, *J. subuliflorus* Drejer). Like **12** but stems 40–100 cm; stem with 12–30 usually conspicuous ridges below the inflorescence; lowest bract with a wide sheath; inflorescence usually compact, sometimes of several clusters; perianth-segments 2–4 mm; stamens $\frac{1}{2}$–$\frac{2}{3}$ as long as perianth; anthers 0·4–0·7 mm, usually shorter than filaments; capsule usually emarginate, mucronate, about equalling perianth. $2n=42$. *Damp places; somewhat calcifuge. Most of Europe.* All except Al Az Bl Cr Is Sb.

Subgen. **Subulati** Buchenau. Like Subgen. *Genuini* but leaves all cauline; pith of stellate cells; lowest bract much shorter than the inflorescence, not forming an apparent prolongation of the stem; seeds with short appendages.

14. J. subulatus Forskål, *Fl. Aegypt.* 75 (1775) (*J. multiflorus* Desf., non Retz.). Stems 30–120 cm, with basal sheaths and 2–4 cauline leaves. Pith continuous. Inflorescence lax, many-flowered. Perianth-segments 2–3·5 mm, equal or subequal, pale green to brownish; outer lanceolate, apiculate to acute; inner wider, obtuse. Stamens *c.* $\frac{1}{2}$ as long as perianth; anthers 1–1·2 mm, 4–5 times as long as the filaments. Capsule equalling perianth, trigonous-ovoid, obtuse, mucronulate, brown, shiny. Seeds 0·6–0·7 mm. $2n=42$. *Salt-marshes and other saline habitats. Mediterranean region, C. & S. Portugal.* Al Bl Co Cr Ga Gr Hs It Ju Lu Sa Si [*Br].

Subgen. **Pseudotenageia** V. Krecz. & Gontsch. Perennials, with a more or less slender rhizome. Leaves and bracts not pungent. Leaves several, all cauline, flat or canaliculate, with marginal sclerenchyma-strands. Inflorescence apical; flowers with involucral bracteoles. Seeds with or without appendages.

15. J. trifidus L., *Sp. Pl.* 326 (1753). Plant densely caespitose to mat-forming, with stems in very dense rows from a branching rhizome. Stems 5–40 cm, slender, with 4–6 basal sheaths, rarely with one lower cauline leaf up to 10 cm, and 2–4 upper leaves. Auricles lacerate; leaf-margin finely serrulate. Upper leaves usually appearing as bracts of the inflorescence. Flowers 1–3(–4). Perianth-segments 2–5 mm, equal or subequal, dark brown, lanceolate to ovate, acute to apiculate, the outer sometimes aristate. Stamens 6, $\frac{2}{3}$–$\frac{3}{4}$ as long as perianth; anthers 1·2–1·5 mm, about twice as long as the filaments. Capsule exceeding perianth, trigonous-ovoid, mucronate, dark brown at apex. Seeds 0·9–1·3 mm, irregular and variable in form, including the unequal appendages 1·2–1·6 mm. $2n=30$. *Arctic and subarctic Europe, extending southwards to S.W. Scotland; mountains of C., S. & E. Europe southwards to C. Spain, S. Italy and N. Greece.* Au Br Bu Cz Fa Fe Ga Ge Gr He Hs Is It Ju No Po Rm Rs (N, C, W) Su.

(a) Subsp. **trifidus**: Stems 5–25 cm. Uppermost basal sheath with a very short lamina. Cauline leaves appearing as bracts of the inflorescence. Inflorescence usually 2- to 3-flowered; perianth-segments 3–4 mm. *Rocks, stony ground and heathy grassland; calcifuge. Throughout the range of the species.*

(b) Subsp. **monanthos** (Jacq.) Ascherson & Graebner, *Syn. Mitteleur. Fl.* **2(2)**: 427 (1904): Stems 20–40 cm. Uppermost basal sheath with lamina up to 10 cm. Cauline leaves 2 or 3, usually only the uppermost appearing as a bract of the inflorescence. Inflorescence usually 1-flowered; perianth-segments 4–5 mm. *Calcicole; usually on cliffs or rocks.* ● *Alps, Appennini.*

16. J. squarrosus L., *Sp. Pl.* 327 (1753). Plant caespitose to densely mat-forming, with a short, suberect, branched rhizome. Stems 15–50 cm, rigid, with a basal rosette of many leaves and rarely one cauline leaf or leafless sheath. Leaves 7–30 cm × 1–2 mm, subcoriaceous, canaliculate, with auricles of varying length. Inflorescence with 10–30(–40) flowers. Perianth-segments 4–5 mm, subequal, obtuse, dark brown, with a whitish hyaline margin; outer narrowly ovate; inner lanceolate. Stamens 6, usually ½ as long as perianth; anthers 1·5–2 mm, 2½–6 times as long as the filaments. Capsule equalling perianth, ovoid to ellipsoid, obtuse, mucronate. Seeds 0·6–0·8 mm, obliquely ovoid, with conspicuous, verrucose striae; appendages absent. $2n=42$. *Moorland and damp heaths. C., W. & N.W. Europe, extending to N. Italy and eastwards to c.* 31°*E. in N.W. Russia and N. Ukraine.* Au Be Br Cz Da Ga Ge Hb He Ho Hs Is It Lu No Po Rs (B, C, W) Su.

Plants from W.C. Spain have been described as **J. ellmanii** C. E. Hubbard, Sandwith & Turrill, *Kew Bull.* **1928**: 153 (1928). They have narrow, semiterete leaves and anthers up to 4 mm, almost as long as the perianth. These characters do not seem to be constantly correlated and no taxonomic recognition seems necessary.

17. J. compressus Jacq., *Enum. Stirp. Vindob.* 60, 235 (1762). Plant with a creeping rhizome or laxly caespitose. Stems 10–40 cm, usually slightly compressed, with 0–3 basal sheaths, 1–4 basal and 1–2 upper cauline leaves. Leaves 5–25 cm × 0·8–2 mm, flat or rarely canaliculate, glaucous; auricles obtuse. Inflorescence usually lax, with 10–60 flowers. Perianth-segments 2–3 mm, equal, ovate, obtuse. Stamens ½–⅔ as long as perianth; anthers 0·5–1 mm, 1–2 times as long as the filaments. Capsule up to 1½ times as long as perianth, globose to ovoid, often slightly trigonous at apex, mucronate. Seeds 0·35–0·5 mm, with *c.* 12 striae, without appendages. $2n=44$. *Damp grassland and disturbed ground. Most of Europe.* All except Az Bl Cr Fa Is Sb.

18. J. gerardi Loisel. in Desv., *Jour. Bot. Rédigé* **2**: 284 (1809). Plant caespitose or with a creeping rhizome. Stems 5–50 cm, sometimes compressed, with 0–2 basal sheaths, 4–5 basal and 0–2 upper cauline leaves. Leaves 2–30 cm × 0·5–2·5 mm, flat to subterete. Inflorescence usually lax. Perianth-segments 2·5–4 mm, equal, ovate, obtuse. Stamens ⅔ as long to almost as long as perianth; anthers 1–2·2 mm, 2–6 times as long as the filaments. Capsule about equalling perianth, ovoid to broadly ellipsoid, usually trigonous at apex, obtuse and mucronate or rarely acute. Seeds 0·4–0·5 mm, without appendages. $2n=84$. *Salt-marshes and damp, usually saline grassland. Most of Europe.* ?Al Au Be Br Bu Co Cz Da Fe Ga Ge Gr Hb Ho Hs Hu It Ju Lu No Po Rm Rs (N, B, C, W, K, E) ?Sa Si Su Tu.

1 Outer tepals with a conspicuous mucro, dark
(*e*) subsp. **libanoticus**
1 Tepals with no or very small mucro, variously coloured
2 Plant with at least one well-developed upper cauline leaf
3 Uppermost leaf at least 3 times as long as sheath
(*a*) subsp. **gerardi**
3 Uppermost leaf less than 3 times as long as sheath
(*b*) subsp. **atrofuscus**
2 Most stems without upper cauline leaves
4 Inflorescence usually 30- to 60-flowered; first bract long
(*d*) subsp. **soranthus**
4 Inflorescence usually 5- to 20-flowered; first bract short
(*c*) subsp. **montanus**

(a) Subsp. **gerardi**: Stems usually slender, equalling or rarely exceeding the leaves. Inflorescence usually more than 7 cm, lax, with 20–50 flowers. Bracteoles usually acute. Anthers 2–3 times as long as the filaments. *Throughout most of the range of the species.*

(b) Subsp. **atrofuscus** (Rupr.) Printz, *Veg. Siber.-Mong. Front.* 177 (1921): Stems stout, much exceeding the leaves. Inflorescence less than 7 cm, more or less dense, with 5–20 flowers. Bracteoles obtuse. Flowers blackish-brown. Anthers 3½–5 times as long as the filaments. *Arctic coasts of Norway and Russia.*

(c) Subsp. **montanus** Snogerup, *Bot. Not.* **131**: 185 (1978): Stems stout, exceeding the leaves. Inflorescence less than 5 cm, dense, with 5–20 flowers. Bracteoles acute. Flowers dark brown. Anthers 3–4 times as long as the filaments. *E. Spain (mountains of Teruel prov.).*

(d) Subsp. **soranthus** (Schrenk) Snogerup in Rech. fil., *Fl. Iran.* **75**: 14 (1971): Stems stout, exceeding the leaves. Leaves 1–2 mm wide, flat. Inflorescence 3–13 cm, with (15–)30–60(–120) flowers. Bracteoles acute or obtuse. Flowers light brown, with dark stripes. Anthers 2½–4½ times as long as filaments. *S.E. Russia and S. Ukraine.*

(e) Subsp. **libanoticus** (J. Thiéb.) Snogerup in Rech fil., *Fl. Iran.* **75**: 13 (1971). Stems stout, exceeding the leaves. Inflorescence 3–10 cm. Flowers dark. Anthers 3–6 times as long as filaments. *Turkey-in-Europe.*

19. J. tenuis Willd., *Sp. Pl.* **2**: 214 (1799) (*J. macer* S. F. Gray). Plant densely caespitose. Stems 10–80 cm, rigid to weak, with a few basal sheaths and 2–3 basal cauline leaves. Leaves about as long as stem, 0·5–2 mm wide, flat, often conspicuously convolute; auricles long, obtuse, thin, whitish. Inflorescence with 5–40 flowers, usually lax, rarely with the flowers in a few clusters. Two lowest bracts leaf-like, usually exceeding the inflorescence. Perianth-segments 3·5–4 mm, subequal, narrowly ovate, long-acute. Stamens ½ as long as perianth; anthers 0·7–0·8 mm, ½–⅔ as long as the filaments. Capsule shorter than perianth, broadly ovoid, obtuse to truncate, shortly mucronate. Seeds 0·3–0·4 mm, obliquely ovoid, with short appendages. $2n=84$. *Roadsides and other damp, open habitats; rarely in damp grassland. Widely naturalized, mainly in N., W. & C. Europe.* [Au Az Be Br Bu Cz Da Fe Ga Ge Hb He Ho Hs Hu It Ju No Po Rm Rs (B, C, W, K, E) Su.] (*Temperate North America.*)

20. J. dudleyi Wieg., *Bull. Torrey Bot. Club* **27**: 524 (1900). Like **19** but leaves only ⅓ as long as the stem; auricles short, cartilaginous, yellowish. $2n=84$. *Naturalized in two localities in Scotland; casual in C. Europe.* [Br.] (*Temperate North America.*)

21. J. imbricatus Laharpe, *Mém. Soc. Hist. Nat. Paris* **3**: 149 (1827). Perennial, densely caespitose. Stems 15–40(–80) cm, with several basal sheaths and 1–4 sub-basal leaves. Leaves (5–) 15–30 cm, shorter than the stem, 0·5–1 mm wide, canaliculate. Inflorescence with 5–25 flowers, usually dense. Perianth-segments equal, the outer ovate, acute to apiculate, the inner lanceolate, acute to obtuse and mucronate, with a wide scarious margin. Stamens ½–⅔ as long as perianth; anthers (0·8–)1·2–1·4 mm, usually about as long as filaments. Capsule 5–6 mm, exceeding perianth, trigonous-ovoid to -ellipsoid, obtuse. Seeds *c.* 0·4 mm, obliquely ovoid. *Naturalized in rice-fields in Portugal.* [Lu.] (*Temperate South America.*)

The plants from Portugal have been referred to var. *chamissonis* (Kunth) Buchenau, which is doubtfully distinguishable from the typical variant.

Subgen. **Poiophylli** Buchenau. Annuals, without a rhizome, usually caespitose. Leaves and bracts pungent. Leaves all cauline on flowering stems, flat or subterete, with marginal sclerenchyma-strands. Inflorescence apical; flowers with involucral bracteoles. Seeds without appendages.

22. J. tenageia L. fil., *Suppl.* 208 (1781). Plant caespitose or rarely with one stem. Stems 5–35 cm, erect, usually with 3

cauline leaves. Leaves shorter than the stem, 0·5–1 mm wide. Inflorescence occupying only upper part of the stem, often rather dense. Perianth-segments 2–2·5 mm, equal or subequal, ovate to lanceolate; outer acute, often mucronate; inner obtuse. Stamens ½ as long as perianth; anthers as long as the filaments. Capsule equalling perianth, trigonous-globose, emarginate. Seeds 0·3–0·4 mm, conspicuously striate. *Damp, open habitats; usually calcifuge. C. & S. Europe, extending to the Netherlands and N. France.* Au Be Bu Co Cz Ga Ge He Ho Hs Hu It Ju Lu Po Rs (W, E) Sa Si Tu.

23. J. sphaerocarpus Nees, *Flora* (*Regensb.*) **1**: 521 (1818). Stems 5–30 cm, thin, erect or slightly recurved, with 0–2 leaves below the inflorescence; lower bracts long and leaf-like. Leaves 1–5 cm × 0·5–1·5 mm, flat or slightly convolute. Inflorescence lax, occupying at least the upper ½ of stem; flowers solitary. Perianth-segments 2·5–4·5 mm, unequal; outer narrowly ovate, apiculate; inner lanceolate, acute to apiculate. Stamens ⅓–½ as long as perianth; anthers 0·1–0·4 mm, ⅓–½ as long as the filaments. Style short; stigmas contorted. Capsule shorter than perianth, trigonous-globose, obtuse. Seeds 0·3–0·45 mm, ovoid to ellipsoid, smooth or inconspicuously striate. $2n=36$. *Ditches, river-banks and damp, open habitats. Iberian peninsula and S. France; C. Europe; S. margin of U.S.S.R.* Au Cz Ga Ge Gr Hs Hu Ju Lu Rs (W, K, E).

Rare and inconstant over most of its range. Small specimens are difficult to distinguish from **22.**

(24–29). J. bufonius group. Inflorescence usually occupying at least the upper ½ of the stem. Perianth-segments unequal, narrowly ovate to lanceolate, the outer apiculate to cuspidate. Capsule ovoid to ellipsoid or subprismatic.

1 Anthers 3–5 times as long as filaments; seeds 0·55–0·65 mm, with longitudinal ridges **24. foliosus**
1 Anthers ¼–1½ times as long as filaments; seeds 0·3–0·55 mm, almost smooth
2 Inner perianth-segments obtuse to subacute, equalling or shorter than capsule
3 Seeds *c.* 0·5 mm; most flowers usually solitary **28. ranarius**
3 Seeds 0·3–0·4 mm; most flowers usually in dense clusters **29. hybridus**
2 Inner perianth-segments acute to acuminate, longer than capsule
4 Capsule subprismatic to trigonous-ellipsoid, ± abruptly contracted at apex **25. sorrentini**
4 Capsule ovoid to ellipsoid, acute to obtuse
5 Capsule 3–5 mm; anthers at least ⅔ as long as filaments **26. bufonius**
5 Capsule 2·5–3 mm; anthers ¼–⅓ as long as filaments **27. minutulus**

24. J. foliosus Desf., *Fl. Atl.* **1**: 315 (1798). Stems 10–50 cm, erect, with 1–2 large leaves below the inflorescence, the lower bracts leaf-like. Leaves up to 20 cm × 1·5–3 mm, flat. Inflorescence often occupying most of the stem, many-flowered, lax. Perianth-segments 4–6 mm, unequal, usually with dark brown lines between the herbaceous centre and scarious margin; outer narrowly ovate, apiculate; inner lanceolate to narrowly ovate, subacute to apiculate. Stamens 6, ½–⅔ as long as perianth; anthers 1·2–2 mm, usually 3–5 times as long as the filaments. Capsule about equalling the inner perianth-segments, obtusely angled, obtuse, with a raised style-base. Seeds 0·5–0·65 mm, ovoid, with 20–25 prominent longitudinal and weaker transverse striae. $2n=26$. *Damp, open habitats. W. Europe, northwards to Scotland.* Br Ga Hb Hs Lu Sa.

25. J. sorrentini Parl., *Fl. Ital.* **2**: 356 (1857). Plant with few to many stems, densely caespitose. Stems 8–12 cm, erect, with most leaves sub-basal. Leaves 3–8 cm, usually 0·5–1 mm wide, flat, with involute margins. Inflorescence of 1–3(–5) dense, capitate clusters of 5–10(–20) flowers, each cluster usually subtended by 1–2 basal bracts 1–5 cm long. Outer perianth-segments 6–8·5 mm, narrowly ovate, acuminate to cuspidate with a usually rather long and sharp apex; inner shorter, acuminate, with a broad scarious margin. Stamens 6, *c.* ½ as long as outer perianth-segments; anthers 0·7–1·2 mm, ⅓–1⅔ times as long as filaments. Capsule 3–4·5 mm, shorter than perianth, trigonous-ellipsoid to sub-prismatic, more or less abruptly contracted to a conical apex. Seeds 0·4–0·5 mm, broadly ellipsoid, obtuse, with small darker apex, smooth. $2n=28$. *Damp places in the mountains. C. Mediterranean region.* Co Sa Si.

26. J. bufonius L., *Sp. Pl.* 328 (1753). Plant usually with many stems. Stems 5–50 cm, usually weak, erect, ascending or sometimes slightly recurved, with 1–5 leaves below the inflorescence, the lower bracts leaf-like. Leaves 1–12 cm × 0·5–2 mm, flat, often with slightly convolute margins. Inflorescence usually lax, rarely with some flowers in clusters. Perianth-segments (4·5–) 6–8 mm, narrowly ovate; outer usually herbaceous, with a narrow scarious margin; inner acute to apiculate, often mostly scarious. Stamens 6, ⅓–½ as long as perianth; anthers 0·5–1 mm or rarely longer, ⅖ as long to as long as the filaments. Capsule (3–)3·5–5 mm, shorter than perianth, ovoid to almost ellipsoid, acute to obtuse, very variable in colour; style usually persisting as a short beak. Seeds 0·4–0·55 mm, ellipsoid, usually apiculate at base and apex, smooth or finely striate. Flowers often cleistogamous. $2n=100$–110. *Wet, usually open habitats. Throughout Europe.* All except Sb.

27. J. minutulus Albert & Jahandiez, *Cat. Pl. Vasc. Dép. Var* 501 (1908). Plant caespitose, rarely with only one stem. Stems 0·5–5(–15) cm, slender, erect or ascending, with at most one short leaf below the inflorescence, the lower bracts leaf-like. Leaves 0·5–2 cm, less than 1 mm wide, flat to subterete. Inflorescence with 2–15(–20) flowers; flowers solitary or in few-flowered clusters. Perianth-segments narrowly ovate, with a wide scarious margin; outer 4–6·5 mm; inner apiculate. Stamens 3 or rarely 6, ⅓–½ as long as perianth; anthers 0·2–0·6 mm, ¼–⅓ as long as the filaments. Capsule 2·5–3 mm, shorter than perianth, ovoid, obtuse; style-base persisting as a mucro 0·1–0·2 mm. Seeds 0·35–0·4(–0·5) mm, ovoid to ellipsoid, smooth or finely striate. Flowers usually cleistogamous. $2n=c.\ 70$. *Open, usually sandy ground. Much of Europe, but rare in the east; distribution imperfectly known* . Au Be Br Cz Da Ga Ge Gr He Ho Hs Hu It Lu No Po Rm Rs (?N, C, E) Si Su Tu

28. J. ranarius Song. & Perr. in Billot, *Annot.* 192 (1860) (*J. ambiguus* auct. plur., non Guss.). Plant usually with many stems. Stems 3–20 cm, erect or ascending, often weak, with 1–3 leaves below the inflorescence, the lower bracts long, leaf-like. Leaves 1–10 cm × 0·5–1 mm, flat with convolute margins to subterete. Inflorescence lax or usually with some flowers in capitate clusters. Perianth-segments 3·5–6 mm; outer narrowly ovate; inner lanceolate, obtuse or rarely subacute, mostly scarious. Stamens 6, ⅓–½ as long as perianth; anthers 0·4–0·8 mm, ½ as long to as long as the filaments. Capsule 3·5–5 mm, usually equalling or slightly exceeding the inner perianth-segments, obtusely angled, obtuse to more or less truncate; style usually deciduous. Seeds *c.* 0·5 mm, very broadly ellipsoid to ovoid, obtuse at base and apex, smooth. Flowers often cleistogamous. $2n=34$. *Salt-marshes, wet grassland and damp, open habitats. N., C. & E. Europe, mainly near the coast.* Au Be Br Bu Cz Da Fe Ga Ge Hb He Ho Hu Is No Po Rs (N, B, C, W, K, E) Su.

29. J. hybridus Brot., *Fl. Lusit.* **1**: 513 (1804) (*J. ambiguus* Guss., *J. insulanus* Viv.). Plant with few to many stems. Stems (5–)10–20(–30) cm, erect and usually stout, with 1–4 usually long leaves below the inflorescence, the lower bracts long, leaf-like. Leaves 2–7(–10) cm, usually 0·5–1 mm wide, flat, with convolute margins. Flowers usually in 1–10 capitate clusters. Perianth-segments 3·5–8·5 mm, usually mostly scarious; outer narrowly ovate to lanceolate; inner narrowly ovate to lanceolate, obtuse or subacute. Stamens 6, ⅓–½ as long as the perianth; anthers 0·4–0·8 mm, ⅔–⅘ as long as the filaments. Capsule 3·5–4·5 mm, equalling or slightly shorter than the inner perianth-segments, obtusely angled to ellipsoid, subacute to obtuse, often with a raised style-base; style usually deciduous. Seeds 0·3–0·4 mm, broadly ellipsoid to ovoid, usually obtuse, smooth. Flowers occasionally cleistogamous. $2n=34$. *Wet, usually saline habitats. Mediterranean region, Portugal.* Bl Co Cr Ga Gr Hs It Ju Lu ?Rm Sa Si Tu.

Subgen. **Graminifolii** Buchenau. Perennials with a rhizome. Leaves several, basal and cauline, flat or involute to rarely canaliculate, without marginal sclerenchyma-strands. Inflorescence terminal; involucral bracteoles absent. Seeds with or without appendages.

30. J. planifolius R. Br., *Prodr. Fl. Nov. Holl.* 259 (1810). Caespitose perennial, often flowering in the first year. Stems 10–30(–60) cm, with usually *c.* 10 basal leaves. Leaves much shorter than the stem, 2–5(–10) mm wide, flat or slightly involute; auricles absent. Inflorescence of (1–)4–12(–50) dense, globular heads, each head usually 8- to 10-flowered. Perianth-segments 1·5–3 mm, subequal, ovate to lanceolate, dark brown, the outer acuminate, the inner obtuse. Stamens 3, almost as long as the perianth; anthers ¼ as long as the filaments. Capsule exceeding the perianth, trigonous-obovoid, with a mucro *c.* 0·5 mm, dark brown. Seeds 0·35–0·4 mm, broadly ellipsoid, without appendages. *Bogs and lake-margins. Naturalized in W. Ireland.* [Hb.] (*Temperate South America, New Zealand, Australia.*)

Subgen. **Juncinella** V. Krecz. & Gontsch. Small annuals, caespitose or with a single stem. Leaves and bracts not pungent. All leaves basal on flowering stems. Sheaths large, leaf-like, the lamina small, flat to subterete, without sclerenchyma-strands in the margin. Flowers solitary on the stem or in clusters; involucral bracteoles absent. Seeds prominently reticulate.

31. J. capitatus Weigel, *Obs. Bot.* 28 (1772). Stems 1–20 cm, with several short basal leaves. Leaves 0·5–5 cm, narrow, flat to canaliculate; auricles absent. Inflorescence of 1–4 heads, or dwarf specimens rarely with one flower; clusters with two basal leaf-like bracts and usually 5–10 flowers. Perianth-segments unequal; outer (2–)3–4 mm, ovate, acuminate; inner shorter, almost entirely scarious, acute to acuminate. Stamens 3, ½–⅔ as long as the perianth; anthers 0·2–0·7 mm, *c.* ½ as long as the filaments. Style short; stigmas short, directed downwards. Capsule (1–)1·5–2 mm, usually much shorter than perianth, ovoid to globose, obtuse, not or shortly mucronate, light brown, reticulate to dark reddish-brown. Seeds *c.* 0·3 mm, ovoid. $2n=18$. *Fens, wet grassland and margins of streams. Much of Europe, but rare in the north.* All except ?Al Fa Fe Hb Is No ?Rm Rs (N, K) Sb.

Subgen. **Ensifolii** (Snogerup) Snogerup. Perennials; rhizome well-developed. All leaves on flowering stems. Leaves ensiform, pluritubulose, imperfectly septate throughout. Flowers in heads; involucral bracteoles absent. Stamens shorter than perianth-segments. Seeds without appendages.

32. J. ensifolius Wikström, *Kungl. Svenska Vet.-Akad. Handl.* **1823**: 274 (1823). Laxly caespitose or with a creeping rhizome. Stems 25–80 cm, compressed and narrowly winged, with a few basal sheaths and 4–6 cauline leaves. Leaves 2–5 mm wide. Inflorescence of 1–6 globose, many-flowered heads. Perianth-segments 3–4 mm, equal or the inner slightly; shorter outer narrowly ovate, acuminate; inner oblong-lanceolate, acute. Stamens 3(–6), *c.* ½ as long as perianth; anthers 0·5–0·8 mm, about as long as filaments. Capsule equalling or slightly exceeding perianth, trigonous-prismatic, attenuate into a short mucro. Seeds 0·6–0·7 mm, turbinate to ellipsoid, dark and acute at both ends, reticulate. $2n=40$. *Locally naturalized in Finland.* [Fe.] (*North America.*)

Subgen. **Septati** Buchenau. Perennials or rarely annuals; rhizome usually well-developed. All the leaves usually on flowering stems. Leaves terete or subterete, with transverse septa, unitubulose or, if pluritubulose (divided longitudinally), either perfectly septate (septa of the individual tubes coincident) or imperfectly septate (septa of the individual tubes not coincident). Flowers in heads; involucral bracteoles absent. Stamens shorter than perianth-segments, the filaments more or less rigid.

33. J. canadensis Gay in Laharpe, *Monogr. Jonc.* 134 (1825). Caespitose perennial. Stems 15–100 cm, with 2–3 cauline leaves. Leaves shorter than the stem, 1·5–3 mm wide, unitubulose, perfectly septate; auricles short, obtuse. Inflorescence of 5–100 or more heads, very variable; heads 5- to 50-flowered, of various shapes. Perianth-segments 2·7–4 mm, the inner slightly longer, narrowly ovate, acute to very narrowly apiculate. Stamens 3(–6), shorter than the perianth; anthers 0·2–0·7 mm, ⅐–½ as long as filaments. Capsule 3·5–4·5 mm, exceeding the perianth, trigonous-ovoid to subprismatic, usually more or less abruptly contracted into a mucro up to 0·5 mm long. Seeds 0·65–0·75 mm, fusiform, with 2 long, pale, equal appendages. $2n=80$. *Naturalized in the Netherlands and Belgium.* [Be Ho.] (*North America.*)

34. J. subnodulosus Schrank, *Baier. Fl.* **1**: 616 (1789) (*J. obtusiflorus* Ehrh. ex Hoffm.). Perennial; rhizome creeping, thick, with internodes usually *c.* 1 cm. Stems 40–130 cm, with 3–4 basal sheaths and 1–2 cauline leaves; non-flowering shoots short, with one long leaf. Leaves 20–100 cm × 2–4 mm, pluritubulose with a wider central tube and a central vascular bundle, perfectly septate; auricles short, wide, firm. Inflorescence of 10–50(–100) heads; branches usually patent; heads hemispherical to subglobose, with 5–10(–30) flowers. Perianth-segments 2–2·5 mm, equal, elliptical, obtuse; outer boat-shaped. Stamens 6, ⅔–¾ as long as perianth; anthers 0·8–1·1 mm, 1½–2 times as long as the filaments. Capsule slightly exceeding perianth, trigonous-ovoid, compressed laterally, attenuate, mucronate, 3-locular. Seeds 0·5–0·6 mm, pyriform, markedly reticulate with *c.* 30 longitudinal ridges. $2n=40$. *Wet places; usually calcicole. W., C. & S. Europe, extending northwards to Estonia.* Au Be Bl Br Bu Co Cz Da Ga Ge Gr Hb He Ho Hs Hu It Ju Lu Po Rm Rs (B, W) Sa Si Su Tu.

35. J. pygmaeus L. C. M. Richard in Thuill., *Fl. Paris* ed. 2, 178 (1800). Caespitose annual, usually with few stems. Stems 1–10 cm, erect or rarely ascending, with a few basal sheaths, 0–1 cauline leaves and 1–2 leaf-like bracts. Leaves short, usually not more than 0·5 mm wide, unitubulose, perfectly septate but septa rarely visible externally in fresh material, with scarious auricles. Inflorescence of 1–5 heads each with 2–15 flowers. Perianth-segments 4–7 × 0·5–1 mm, subequal, lanceolate, obtuse to apiculate; inner acuminate. Stamens 3–6, variable and often unequal; outer usually ¼–½ as long as perianth; inner often smaller or absent; anthers 0·3–1 mm, not more than ½ as long as filaments. Capsule 2·5–3·5(–4) mm, shorter than perianth, narrowly pyramidal to narrowly ovoid, sometimes shortly mucronate,

unilocular, thin-walled, straw-coloured. Seeds 0·4–0·45 mm, turbinate to ellipsoid, reticulate. Flowers usually cleistogamous. $2n=40$. *Wet, sandy ground. W. Europe, northwards to Denmark, and extending eastwards to S.E. Italy and N.W. Jugoslavia.* ?Be Br Co Da Ga Ge Ho Hs It Ju Lu Sa Si.

36. J. tingitanus Maire & Weiller in Maire, *Fl. Afr. Nord* **4**: 284 (1957) (*J. fasciculatus* Schousboe, non Schrank). Annual, with one or a few stems. Stems 8–12 cm, erect. Leaves up to 0·5 mm thick, unitubulose, perfectly septate. Inflorescence usually of 2 heads each with 4–12 flowers. Inner perianth-segments 7–9 mm, much longer than the outer, very narrowly ovate, subulate. Stamens 6, *c.* ½ as long as perianth; anthers 2–2·5 mm, 3–5 times as long as the filaments. Capsule exceeding the perianth, narrowly pyramidal, with a long beak. Seeds *c.* 0·4 mm, pyriform, reticulate. *S. Spain* (*W. of Málaga*). Hs. (*N. Morocco.*)

37. J. heterophyllus Dufour, *Ann. Sci. Nat.* **5**: 88 (1825). Aquatic perennial, without a rhizome. Stems branched at base, with several leaves, rooting at the nodes. Emergent leaves up to 6 mm wide, unitubulose, perfectly septate; submerged leaves narrower, filiform; some leaves with 5–7 more or less conspicuous ridges, adaxially flattened at base; auricles large, obtuse. Inflorescence of 5–20 heads each with 2–6 flowers. Perianth-segments 6–8 mm, equal or the inner slightly longer than the outer, ovate, obtuse, with a white margin. Stamens shorter than perianth; anthers 1·8–2·5 mm, 2–4 times as long as the filaments. Style and stigma usually very long. Capsule exceeding perianth, trigonous-ovoid, with a long beak. Seeds *c.* 0·5 mm, turbinate, reticulate. *In shallow water. S. W. Europe.* Co Ga Hs It Lu Sa Si.

38. J. emmanuelis A. Fernandes & García, *Bol. Soc. Brot.* ser. 2, **21**: 6 (1947). Semiterrestrial perennial, without a rhizome. Stems erect, branched and creeping at base, with several leaves. Leaves 2–4(–5) mm wide, unitubulose, perfectly septate; auricles small, obtuse. Inflorescence of (1–)3–8 heads, each with (3–)10–30(–50) flowers. Perianth-segments 4·5–6 mm, equal or the outer slightly exceeding the inner, very narrowly ovate to narrowly lanceolate, acuminate or the outer cuspidate, often recurved apically, with a narrow scarious margin. Stamens 6, shorter than the perianth; anthers 1·8–2·5 mm, 4–6 times as long as filaments. Style and stigmas exserted. Capsule shorter than perianth, elongate ovoid-pyramidal, with a long beak. Seeds *c.* 0·6 mm, ovoid, reticulate. *Damp, sandy places.* ● *C. & S. Portugal, S.W. Spain.* Hs Lu.

39. J. bulbosus L., *Sp. Pl.* 327 (1753) (*J. supinus* Moench, *J. kochii* F. W. Schultz). Caespitose perennial; rhizome absent; new shoots produced from the basal internodes of the stem. Stems 1–30 cm, sometimes up to 100 cm when floating or submerged, with a basal bulb-like swelling. Leaves mostly more or less basal, terete and slightly flattened to furrowed dorsally, pluritubulose, imperfectly or partly perfectly septate. Inflorescence of 3–20 heads each with 2–15 flowers; flowers often partly replaced by adventitious shoots. Perianth-segments 2–3 mm, equal or the inner slightly longer than the outer, ovate to lanceolate or the inner oblong, obtuse or outer acute, with a wide scarious margin. Stamens 3–6, ½–⅔ as long as perianth; anthers 0·3–1 mm, ⅓ as long to as long as the filaments. Capsule 2·2–3·5 mm, equalling or exceeding perianth, trigonous, obtuse to truncate at apex, unilocular. Seeds 0·5–0·6 mm, turbinate, reticulate. $2n=40$. *Wet places, often submerged; somewhat calcifuge. Most of Europe except the south-east.* Au Az Be Br Co Cz Da Fa Fe Ga Ge Hb He Ho Hs Hu Is It Ju Lu No Po ?Rm Rs (N, B, C, W) Sa Su.

40. J. atratus Krocker, *Fl. Siles.* **1**: 562 (1787). Perennial with a creeping, sparingly branched rhizome. Stems 40–120 cm, with 3–5 cauline leaves; basal sheaths absent. Leaves 7- to 11-angled, the adaxial side the widest, unitubulose, perfectly septate. Inflorescence of 15–50(–200) heads each with 5–10 dark brown flowers. Perianth-segments 2·5–3·5 mm, equal or the inner longer than the outer, narrowly ovate, acuminate. Stamens shorter than perianth; anthers 0·8–1·3 mm, about as long as the filaments. Capsule exceeding the perianth, trigonous-ovoid, abruptly contracted into a long, usually oblique beak. Seeds 0·5–0·7 mm. $2n=40$. *C. & E. Europe, northwards to Latvia.* Au Bu Cz Ge Gr Hu It Ju Po Rm Rs (B, C, W, E).

41. J. thomasii Ten., *Ind. Sem. Horti Neap.* **1827**: 3 (1827) (*J. alpigenus* auct., non C. Koch). Perennial, with a creeping, sparingly branched rhizome. Stems 25–100 cm, with 0–2 basal sheaths and 2–4 cauline leaves. Leaves 10–30 cm, unitubulose, perfectly septate, 7- to 11-angled when fresh, with the adaxial side the widest, collapsing when dried, with distinct longitudinal ridges. Inflorescence dense, with few, large confluent heads, or lax and with up to 50(–200) smaller heads; heads hemispherical to globose, with 5–50 dark to reddish-brown flowers. Perianth-segments 2·5–3·5 mm, equal or the outer (rarely the inner) slightly longer, ovate to lanceolate, acute to acuminate-cuspidate. Stamens 6, ½–⅔ as long as perianth; anthers 0·5–1 mm, ⅔ as long to as long as the filaments. Capsule 2–3·5 mm, equalling or slightly shorter than the perianth, trigonous-ellipsoid, obtuse, shortly mucronate. Seeds 0·45–0·5 mm, ellipsoid to pyriform, pointed at both ends. ● *Balkan peninsula, S. & E. Carpathians, S. Italy.* Al Bu Gr It Ju Rm Rs (W) Tu.

42. J. acutiflorus Ehrh. ex Hoffm., *Deutschl. Fl.* 125 (1791) (*J. sylvaticus* auct., non Reichard). Perennial with a thick, creeping, sparingly branched rhizome, the internodes usually 0·5–1·5 cm. Stems 30–110 cm, with 2–3 basal sheaths and 2–4 cauline leaves. Leaves 5–50 cm, unitubulose, perfectly and usually distinctly septate. Inflorescence of (10–)50–80(–250) heads, each with (3–)5–8(–20) flowers. Perianth-segments 2–2·7 mm, the inner longer than the outer, ovate to narrowly ovate, apiculate to cuspidate, often deflexed at apex. Stamens 6, ½–⅔ as long as perianth; anthers 0·8–1 mm, 1½–2 times as long as the filaments. Capsule 2–3 mm, usually exceeding the perianth, trigonous-ovoid to narrowly pyramidal, usually gradually narrowed into a beak 0·5–1 mm. Seeds *c.* 0·5 mm, ovoid to ellipsoid, reticulate. $2n=40$. *Wet meadows and marshes. W., C. & S. Europe, extending to W. Ukraine.* Al Au Be Br Bu Co Cz Da Fa Ga Ge Hb He Ho Hs It Ju Lu No Po Rm Rs (C, W, *K) Sa.

Hybrids between **42** and **49** (*J. acutiflorus* var. *multiflorus* Weihe) are laxly caespitose or with a creeping rhizome, and with the inflorescence usually composed of 20–40 heads, the perianth-segments acute to apiculate, equal or the inner longer than the outer, and the capsule narrow and tapering. They have $2n=60$ and are frequent in C. & W. Europe, are usually sterile and propagate vegetatively. Putative backcrosses to **49** have $2n=80$.

Plants from Portugal with rugose leaves and stems have been called subsp. **rugosus** (Steudel) Coutinho, *Fl. Port.* 118 (1913), but seem not worth subspecific rank.

43. J. valvatus Link in Schrader, *Jour. für die Bot.* **1799(2)**: 316 (1800). Perennial with horizontally creeping rhizome having short internodes. Stems 10–30 cm, with 2–4 cauline leaves. Leaves somewhat laterally compressed, unitubulose, perfectly septate. Inflorescence of 1–4 globose, many-flowered heads, crowded or rarely one head pedunculate; flowers pale. Perianth-segments 4–5 mm, equal or unequal, very narrowly ovate, subulate at apex. Stamens *c.* ⅔ as long as perianth; anthers 0·5–0·8

mm, ½ as long to as long as the filaments. Capsule distinctly exceeding the perianth, narrowly pyramidal, tapering to a short beak, unilocular. Seeds 0·3–0·4 mm. *C. & S. Portugal.* Lu.

44. J. striatus Schousboe ex E. H. F. Meyer, *Syn. Junc.* 27 (1822). Perennial with a horizontally creeping rhizome. Stems 30–70 cm, with several basal sheaths and 2–5 cauline leaves. Leaves unitubulose, perfectly and distinctly septate. Leaves, sheaths and stems strongly longitudinally sulcate. Inflorescence of 2–20 heads; heads hemispherical to globose, with 8–30 flowers. Perianth-segments 3·5–5 mm, the inner markedly longer than the outer, narrowly ovate to lanceolate, cuspidate, the outer acute or mucronate. Stamens ½–⅔ as long as perianth; anthers 1·2–1·8 mm, 2–3 times as long as the filaments. Capsule exceeding the perianth, trigonous-ovoid, tapering to a beak. Seeds 0·5–0·6 mm. *Damp places. Mediterranean region and S.W. Europe.* Ga Gr Hs It Lu Tu.

45. J. fontanesii Gay in Laharpe, *Mém. Soc. Hist. Nat. Paris* **3**: 130 (1827) (*J. striatus* auct., non Schousboe). Perennial, with rhizome weakly developed or absent, the new shoots arising from the nodes of creeping stems. Leaves unitubulose, perfectly and usually distinctly septate. Perianth-segments 2·5–4 mm, the inner longer than the outer, ovate to narrowly ovate, acute to acuminate. Stamens ½–⅔ as long as perianth; anthers 0·8–1·5 mm, 1½–3 times as long as the filaments. Capsule equalling or exceeding the perianth, with a beak 0·4–2 mm. Seeds 0·4–0·5 mm, pyriform to ovoid or subglobose, reticulate. *Fens and streamsides. S. Europe.* Al Bl Ga Gr Hs It Ju Lu Sa Si.

(a) Subsp. **fontanesii**: Plant with stolons up to 200 cm; rhizome usually absent. Capsule usually much exceeding the perianth, trigonous-ovoid, tapering to a beak usually 1–2 mm. *Throughout the western and central parts of the range of the species.*

(b) Subsp. **pyramidatus** (Laharpe) Snogerup in Rech. fil., *Fl. Iran.* **75**: 25 (1971). Plant with few or no stolons; rhizome usually present, though weak. Capsule slightly exceeding the perianth, narrowly pyramidal or rarely trigonous-ovoid, often abruptly contracted to a beak usually 0·5–1 mm. $2n=40$. *E. Mediterranean region.*

Intermediates between the subspecies are rather frequent in Sicilia and S. Italy. Plants from S. Spain and S. Portugal described as **J. webbianus** V. Krecz., *Bull. Jard. Bot. URSS* **30**: 98 (1932), have unusually large flowers and capsules with a long beak, but are best included in subsp. (a).

46. J. alpinus Vill., *Hist. Pl. Dauph.* **2**: 233 (1787) (*J. geniculatus* auct., non Schrank, *J. alpino-articulatus* auct., non Chaix). Perennial with a horizontally creeping rhizome. Stems 5–60(–80) cm, usually weak, with 0–1(–2) basal sheaths and (2–)3(–5) cauline leaves. Leaves unitubulose, perfectly septate, with a rather conspicuous adaxial furrow at base. Inflorescence very variable in form and size. Perianth-segments 2–3(–3·8) mm, equal or subequal; inner broadly obtuse; outer obtuse or subacute, often mucronate. Stamens 6, ½–⅔ as long as perianth; anthers 0·4–0·7 mm, ½–⅔ as long as the filaments. Capsule equalling or exceeding the perianth, obtuse, shortly mucronulate. Seeds 0·55–0·6 mm, ovoid, sometimes oblique, reticulate. *Damp places. Most of Europe.* Al Au Br Bu Cz Da Fe Ga Ge Gr He Ho Hs Hu Is It Ju No Po Rm Rs (N, B, C, W, ?E) Su.

1 Flowers usually greenish to light brown; pedicellate flowers usually present — (b) subsp. **nodulosus**
1 Flowers dark or reddish-brown; pedicellate flowers few or absent
2 Stems usually 30–60 cm; heads usually 25–60 — (a) subsp. **geniculatus**
2 Stems usually 10–20 cm; heads 1–7 — (c) subsp. **alpestris**

(a) Subsp. **alpinus** (*J. fuscoater* Schreber, *J. alpinus* subsp. *arthrophyllus* (Brenner) Hyl.): Stems usually 30–60 cm. Inflorescence rather wide, with erecto-patent branches; heads usually 25–60; pedicellate flowers few or absent. Flowers small, dark or reddish-brown. Perianth-segments usually 2–2·5 mm, obtuse, the outer usually mucronate. Capsule equalling or slightly exceeding the perianth, ovoid. $2n=40$. *Throughout the range of the species except Iceland and northern Fennoscandia.*

(b) Subsp. **nodulosus** (Wahlenb.) Lindman, *Svensk Fanerogamfl.* 155 (1918): Stems usually 20–40 cm. Inflorescence usually narrow, with rather long, erect primary and secondary branches; heads usually 5–25, with few to many, usually greenish to light brown flowers; some pedicellate flowers usually present. Perianth-segments usually 2·2–3 mm, the outer subacute to obtuse, mucronate. Capsule usually much exceeding the perianth, subcylindrical. $2n=40$. *Fennoscandia, Iceland and N. Russia.*

(c) Subsp. **alpestris** (Hartman) A. & D. Löve, *Rep. Dept. Agric. Univ. Inst. Appl. Sci.(Reykjavik)* ser. B, **3**: 23 (1948). Stems usually 10–20 cm, the rhizomes often with short nodes. Inflorescence of 1–7 heads, with short branches; heads usually with 6–8 dark- to reddish-brown flowers; pedicellate flowers few or absent. Perianth-segments 2–3(–3·8) mm, broadly obtuse, the outer mucronate. Capsule slightly to much exceeding the perianth, usually somewhat tapering but abruptly contracted at apex. $2n=40$. *N. Europe, southwards to S. Norway.*

The hybrid between **46** and **49** is usually laxly caespitose, and intermediate between the parents in the shape of the perianth-segments and capsule, except that the capsule has concave sides, and the plant sets little or no seed and reproduces vegetatively. It is locally common in N. & C. Europe.

47. J. anceps Laharpe, *Mém. Soc. Hist. Nat. Paris* **3**: 126 (1827). Perennial with a stout, creeping rhizome. Stems 20–60 cm, usually rigid, with 0–2 basal sheaths and 3–5 cauline leaves. Leaves unitubulose, perfectly septate, with a rather conspicuous adaxial furrow and often an abaxial edge basally. Inflorescence usually of 50–80 heads, lax or crowded, often divided into two parts; primary branches more or less erect; secondary erecto-patent; heads with 3–4(–8) usually dark- to reddish-brown flowers. Perianth-segments 2–2·7 mm, subequal, ovate to oblong; outer subacute, mucronulate; inner obtuse. Stamens 6, *c.* ⅔ as long as perianth; anthers 0·7–1 mm, equalling or slightly longer than the filaments. Capsule slightly exceeding perianth, trigonous-ovoid, tapering at apex or in inland variants subobtuse, with a mucro usually 0·3–0·5 mm. Seeds *c.* 0·5 mm, reticulate. $2n=40$. *Wet places. W. & S. Europe, extending to S. Sweden.* Al Be Co Da Ga Ge Gr Ho Hs It Ju Sa Su.

The hybrid between **47** and **49** is laxly caespitose, with rigid stems. It resembles **47** in perianth-segments and capsules although the capsule is rather small and with concave sides, but the inflorescence consists of many small heads, and is contracted. It sets little or no seed and reproduces vegetatively. It is locally common in Denmark, Sweden, France and Italy.

48. J. requienii Parl., *Fl. Ital.* **2**: 346 (1857). Perennial, mat-forming by means of slender, branching rhizomes with long internodes. Stems 2–10 cm, slender, with 1–3 basal sheaths and 2–3 cauline leaves. Leaves up to 4 cm, unitubulose, perfectly septate, sulcate at base. Inflorescence of 1–6 heads; heads usually with 3–4 dark- to reddish-brown flowers. Perianth-segments 1·7–2·2 mm, equal or subequal, ovate or the inner oblong, obtuse; outer often mucronate. Stamens 6, ¾–⅘ as long as perianth; anthers 0·6–0·9 mm, 1–1½ times as long as the filaments. Capsule 2·2–2·5 mm, much exceeding the perianth, trigonous-ovoid, more or less abruptly contracted into a short beak. Seeds *c.* 0·5 mm, reticulate. *Fens and streamsides.* ● *Corse.* Co.

49. J. articulatus L., *Sp. Pl.* 327 (1753) (*J. lampocarpus* Ehrh. ex Hoffm.). Perennial, caespitose or with a creeping rhizome, rarely with submerged stems rooting and branching at the nodes. Stems 5–60 cm, rarely up to 100 cm and floating, erect or ascending, with 0–2 basal sheaths and 3–6 cauline leaves. Leaves unitubulose, perfectly septate, terete or somewhat laterally compressed. Inflorescence usually wide, with (1–)5–20(–80) heads; heads with 5–15(–30) flowers. Perianth-segments 2·5–3·5 mm, equal or unequal, ovate or rarely lanceolate; outer acute or rarely obtuse and mucronate; inner acute to obtuse, often mucronate. Stamens 6, ½–¾ as long as the perianth; anthers 0·7–1 mm, equalling or longer than the filaments. Capsule 2·5–3·5(–4) mm, usually exceeding the perianth, trigonous-ovoid or rarely ellipsoid, acute or rarely obtuse, mucronate. Seeds 0·5–0·6 mm, ovoid, reticulate. $2n=80$. *Wet places. Throughout Europe.* All except Sb.

Subgen. **Alpini** Buchenau. Small or medium rhizomatous perennials. Leaves and bracts not pungent. Leaves often transversely septate, terete or canaliculate. Flowers in heads, usually strongly coloured and often large; involucral bracteoles absent. Filaments usually slender. Seeds with appendages.

50. J. biglumis L., *Sp. Pl.* 328 (1753). Plant usually caespitose, the rhizome with short internodes and producing leafy, non-flowering shoots and often long subterranean runners. Stems 2–20 cm, erect, with several basal leaves. Leaves short or occasionally up to 8 cm, 1- to 3-tubulose at base, unitubulose above; transverse septa usually present but not visible externally. Inflorescence with a single (1–)2(–4)-flowered head; flowers in a vertical row, the first bract erect, exceeding the flowers and often with a small lamina. Perianth-segments 2·5–3 mm, equal, elliptical to ovate or the inner slightly obovate, mostly dark brown to blackish. Stamens 6, usually slightly exceeding or equalling perianth. Anthers 0·3–0·4 mm, ⅛–⅙ as long as the filaments. Capsule 4–5 mm, 1½–2 times as long as the perianth, obtusely angled, emarginate, mucronate. Seeds 0·7–0·9 mm, with 2 subequal appendages 0·3–0·6 mm. $2n=60$. *Wet places, mainly in the mountains; calcicole. N. Europe, southwards to* 56°15′ *N. in Scotland; one station in C. Austria.* Au Br Fa Fe Is No Rs (N) Sb Su.

51. J. triglumis L., *Sp. Pl.* 328 (1753). Like **50** but stems sometimes with one upper cauline leaf; leaves 1–10 cm, 2-tubulose at middle, often up to 5-tubulose at base; heads with (2–)3(–5) flowers, the flowers in a horizontal row; bracts wide, erecto-patent, usually shorter than the flowers; perianth-segments *c.* 4 mm, equal or subequal, usually yellowish-white, dark at apex; stamens almost equalling the perianth; anthers 0·7–0·9 mm, ¼–⅓ as long as the filaments; capsule 5–6 mm, trigonous-ellipsoid, obtuse, mucronate; seeds 2–2·5 mm. $2n=50$, *c.* 134. *Wet places, mainly in the mountains. N. Europe, extending southwards in the mountains to the Pyrenees, C. Appennini and S.W. Bulgaria.* Au Br Bu Cz Fa Fe Ga Ge He Hs Is It No Po Rm Rs (N, W) Sb Su.

52. J. stygius L., *Syst. Nat.* ed. 10, **2**: 987 (1759). Plant with solitary stems or a few together arising from a rhizome with short internodes also producing short subterranean runners. Stems 10–25 cm, slender, with a few basal and 1–3 upper cauline leaves. Leaves up to 15 cm, thin, terete to slightly canaliculate, pluritubulose; septa usually present but not visible externally. Stems and leaves often reddish. Inflorescence of 1–2(–4) heads; heads with 2–3(–5) flowers usually in a horizontal row, the basal bracts of the inflorescence leaf-like, those of the heads small, almost entirely scarious. Perianth-segments 3·5–4·5 mm, equal or subequal, ovate or the inner elliptical, obtuse to subacute, green to light brown. Stamens 6, equalling or slightly shorter than the perianth; anthers 0·4–0·7 mm, ⅓–¼ as long as the filaments. Capsule 5–6·5 mm, *c.* 1½ times as long as the perianth, trigonous-ovoid to ellipsoid, obtuse, light brown to straw-coloured. Seeds 2–2·5 mm. *Bogs; calcifuge. N. Europe, westwards to Norway; S. Germany and Switzerland.* Fe Ge He No Po Rs (N, B, C) Su.

53. J. castaneus Sm., *Fl. Brit.* **1**: 383 (1800). Plant with a creeping rhizome forming long subterranean runners between the usually solitary stems. Stem 10–32 cm × 2–3 mm, erect, with a few basal sheaths, 3–5 basal and sometimes one upper cauline leaf. Leaves up to 10(–15) cm × 4 mm, flat and more or less convolute, pluritubulose; septa present, sometimes visible externally at apex. Inflorescence of 1–3 heads with 3–10 flowers; bracts of the inflorescence leaf-like, those of the heads small. Perianth-segments 4·5–5·5 mm, equal or unequal, narrowly ovate, blackish-brown, lighter at apex; outer acute; inner obtuse. Stamens 6, equalling or slightly shorter than the perianth; anthers 1–1·5 mm, ¼–⅓ as long as the filaments, with a short, acute apex. Capsule (5–)6–7·5(–9) mm, *c.* 1½ times as long as the perianth, ovoid to ellipsoid, obtuse, mucronate, shiny and reddish-brown at apex, lighter at base. Seeds 2–3 mm. $2n=40$. *Wet grassland and damp, open habitats. Fennoscandia and arctic Russia; Scotland; Alps and Carpathians; N. & C. Ural.* Au Br Cz He Is It No Rm Rs (N, C, W) Sb Su.

2. Luzula DC.[1]

Perennial herbs, rarely annual. Leaves mostly basal, with closed sheath, without auricles, flat or canaliculate, usually with long, white cilia. Flowers in cymes, sometimes condensed into heads. Capsule 3-seeded; seeds usually with a basal appendage.

Literature: F. Buchenau in Engler, *Pflanzenreich* **25(IV.36)**: 42–98 (1906). H. Nordenskjöld, *Hereditas* **37**: 325–355 (1951); **42**: 7–73 (1956). J. Chrtek & B. Křísa, *Bot. Not.* **115**: 293–310 (1962); *Webbia* **19**: 1–10 (1964). P. Montserrat-Recoder, *Anal. Inst. Bot. Cavanilles* **21**: 409–523 (1963). J. E. Ebinger, *Mem. New York Bot. Gard.* **10(5)**: 279–304 (1964).

1 Flowers borne singly, or, rarely, some flowers in pairs, often long-pedicellate
 2 Appendage of seeds 0·6–1·5(–3) mm
  3 Plant with long stolons, laxly caespitose **31. luzulina**
  3 Plant caespitose, with short stolons
   4 Basal leaves (3·5–)5–10 mm wide; inflorescence-branches patent, deflexed in fruit **29. pilosa**
   4 Basal leaves 2·5–3·5(–5) mm wide; inflorescence-branches secund, not deflexed in fruit **30. forsteri**
 2 Appendage of seeds not more than 0·3 mm or absent
  5 Anthers longer than filaments
   6 Stem usually not more than 40 cm; cauline leaves 6–12 mm wide **24. glabrata**
   6 Stem up to 70 cm; cauline leaves 2–8 mm wide **25. desvauxii**
  5 Anthers shorter than to about as long as filaments
   7 Annual; anthers shorter than filaments; seeds less than 1 mm **28. elegans**
   7 Perennial; anthers as long as filaments; seeds at least 1 mm
    8 Bracteoles ciliate; lowest bract not more than 1 cm **26. wahlenbergii**
    8 Bracteoles not ciliate; lowest bract at least 1·5 cm **27. parviflora**
1 Flowers in groups of (2–)3 or more, in clusters or in heads, rarely some flowers solitary
 9 Inflorescence corymbose or a ±lax cyme

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10 Leaves glabrous or very sparsely ciliate
11 Inflorescence lax; perianth dark brown **23. alpinopilosa**
11 Inflorescence dense; perianth yellow or yellowish-brown **17. lutea**
10 Leaves ciliate
12 Perianth purplish **18. purpureosplendens**
12 Perianth brown or white, sometimes tinged with red
13 Perianth brown; basal leaves 3–20 mm wide
14 Basal leaves (5–)10–20(–30) mm wide **15. sylvatica**
14 Basal leaves 3–6 mm wide **16. sieberi**
13 Perianth white, sometimes tinged with red; basal leaves 3–6 mm wide
15 Capsule about ½ as long as perianth
16 Perianth-segments equal, subobtuse or acuminate **20. lactea**
16 Perianth-segments unequal, acute **19. nivea**
15 Capsule about as long as perianth
17 Basal leaves ±convolute; perianth-segments subequal **21. pedemontana**
17 Basal leaves flat; outer perianth-segments shorter than the inner **22. luzuloides**
9 Inflorescence capitate, spike-like or a subumbellate panicle
18 Inflorescence drooping, spike-like
19 Stock short, slender **(8–11). spicata** group
19 Stock long, stout
20 Basal leaves 3–6(–8) mm wide, flat **12. nutans**
20 Basal leaves 1·5–3 mm wide, convolute **13. caespitosa**
18 Inflorescence erect, ±capitate or subumbellate
21 Capsule 4–5 mm **14. nodulosa**
21 Capsule not more than 3 mm
22 Bracteoles ciliate
23 Outer clusters of flowers on recurved peduncles **5. arcuata**
23 Outer clusters of flowers on erect peduncles or subsessile **6. confusa**
22 Bracteoles entire or shallowly lacerate
24 Inflorescence of 1(–3) sessile clusters of flowers **7. arctica**
24 Inflorescence of one subsessile and several ±pedunculate clusters of flowers
25 Style shorter than ovary; perianth-segments unequal
26 All flower-clusters on erect branches; perianth-segments dark to purplish-brown **4. sudetica**
26 Central cluster of flowers subsessile; perianth-segments pale yellowish-brown **3. pallescens**
25 Style as long as or longer than ovary; perianth-segments ±equal
27 Laxly caespitose, with short stolons; style longer than ovary; anthers 2–6 times as long as filaments **1. campestris**
27 Densely caespitose, with few or no stolons; style about as long as ovary; anthers less than 1½ times as long as filaments **2. multiflora**

Subgen. **Luzula** (Subgen. *Gymnodes* (Griseb.) Buchenau). Perennials. Flowers in dense clusters. Inflorescence spike-like or a subumbellate panicle. Seeds with conspicuous basal appendage.

Sect. LUZULA. Inflorescence subumbellate, with pedunculate or subsessile clusters on straight erect branches at anthesis.

1. L. campestris (L.) DC. in Lam. & DC., *Fl. Fr.* ed. 3, **3**: 161 (1805) (*L. subpilosa* (Gilib.) V. Krecz.). Plant 10–30(–40) cm, laxly caespitose, with short stolons. Basal leaves 2–4 mm wide, sparsely ciliate. Inflorescence a panicle of one sessile and 3–8 pedunculate clusters of 5–12 flowers, the branches more or less deflexed in fruit. Perianth-segments 3–4 mm, reddish- to pale brown. Anthers 2–6 times as long as filaments. Style longer than ovary. Capsule 2·5–3 mm, shorter than perianth-segments, obovoid to globose. Seeds 1·1–1·3 mm; basal appendage up to ½ as long as seed. $2n=12$. *Grassland. Most of Europe, northwards to* 64° *N. in Norway.* All except Bl ?Cr Is Rs (N, ?E) Sb.

2. L. multiflora (Retz.) Lej., *Fl. Spa* **1**: 169 (1811) (*L. campestris* subsp. *multiflora* (Retz.) Buchenau, *L. multiflora* subsp. *occidentalis* V. Krecz.). Plant 10–30(–55) cm, densely caespitose, with few or no stolons, erect. Basal leaves 3–4(–6) mm wide, sparsely ciliate. Inflorescence subumbellate, of 3–10(–12) ovate to elongate 8- to 18-flowered clusters on erect branches, pedunculate or subsessile in rounded heads. Perianth-segments 2·5–3·5 mm, subequal, reddish- to pale brown, with hyaline margin. Anthers as long as or slightly longer than filaments. Style about as long as ovary. Capsule 2–2·8(–3) mm, ovoid to globose, about as long as or shorter than perianth-segments. Seeds 1·1–1·3 mm, about twice as long as wide; basal appendage up to ½ as long as seed. *Grassland, woods and moorland, mainly on acid, peaty soil. Most of Europe, but only on mountains in the south.* All except Bl Cr Sb.

1 Flower-clusters subsessile; lower bract usually longer than inflorescence; perianth-segments longer than capsule **(c)** subsp. **congesta**
1 Flower-clusters clearly stipitate; lower bract not longer than inflorescence; perianth-segments as long as capsule
2 Capsule-valves obovate, green to brown **(a)** subsp. **multiflora**
2 Capsule-valves ovate to elliptical, dark brown to black **(b)** subsp. **frigida**

(a) Subsp. **multiflora**: Flower-clusters pedunculate. Lower bract not longer than inflorescence. Perianth-segments as long as capsule. Seeds with a basal appendage (0·3–)0·4–0·7 mm. $2n=24$, 36. *Throughout the range of the species.*

(b) Subsp. **frigida** (Buchenau) V. Krecz., *Bot. Žur.* **12**: 490 (1928) (*L. frigida* (Buchenau) Sam.): Flower-clusters pedunculate. Lower bract not longer than inflorescence. Perianth-segments as long as capsule. Seeds with a basal appendage 0·25–0·4 mm. $2n=36$. *Arctic and subarctic Europe, extending southwards to S. Norway.*

(c) Subsp. **congesta** (Thuill.) Hyl., *Uppsala Univ. Årsskr.* **1945(7)**: 110 (1945): Flower-clusters subsessile. Lower bract usually longer than inflorescence. Perianth-segments distinctly longer than capsule. $2n=48$. *Mainly in S., W. & C. Europe.*

Many other subspecies have been described but their taxonomic status is uncertain.

3. L. pallescens Swartz, *Summa Veg. Scand.* 13 (1814). Plant 10–35(–45) cm, caespitose, pale to yellowish-green. Basal leaves (1–)2–5 mm wide. Inflorescence subumbellate, of 5–10 globose-oblong clusters of 12–20(–25) flowers, the central cluster subsessile, the others on straight, erect branches. Perianth-segments 1·5–2·5 mm, the inner shorter than the outer, pale yellowish-brown. Anthers slightly shorter than to as long as filaments. Style shorter than ovary. Capsule 1·5–2·1 mm, obovoid, usually shorter than the perianth-segments. Seeds 0·8–1·1 mm; basal appendage 0·2–0·4 mm, less than ½ as long as the seed. $2n=12$. *Grassland, fens and open woodland. N. & C. Europe.* Au Br Cz †Da Fe ?Ga Ge Ho Hu Is Ju No Po Rm Rs (N, B, C, W, ?E) Su.

4. L. sudetica (Willd.) DC. in Lam. & DC., *Fl. Fr.* ed. 3, **5**: 306 (1815) (*L. campestris* subsp. *sudetica* (Willd.) Čelak.). Plant (10–)15–35(–40) cm, laxly caespitose. Basal leaves 1·5–3(–3·5) mm wide. Inflorescence subumbellate, of 3–5(–8) ovoid to ellipsoid clusters of 5–10(–14) flowers on straight, erect branches. Perianth-segments 2–2·5(–3) mm, the inner shorter than the outer, dark to purplish-brown, with narrow pale brown to whitish margin. Anthers about as long as filaments. Style shorter than ovary, persistent in fruit. Capsule 1·5–2·5 mm, ovoid to ellipsoid, about equalling the perianth-segments. Seeds 1–1·2 mm; basal appendage 0·2–0·3 mm, up to ⅓ as long as seed. $2n=36$, 48. *Wet grassland, mainly on acid, peaty soils. N. Europe, southwards to* 59° *N. in Sweden; mountains of C. & S. Europe.* Au Bu Co Cz Fe Ga Ge He Hs Is It Ju No Po Rm Rs (N, W) Su.

Sect. NIVALES Chrtek & Křísa. Inflorescence a subumbellate panicle of several clusters on erect or recurved peduncles.

5. L. arcuata Swartz, *Summa Veg. Scand.* 13 (1814). Plant 5–25(–30) cm, caespitose, with short stolons. Basal leaves 1–3 mm wide, rigid, deeply canaliculate, usually glabrous. Inflorescence with 2–8 clusters of 3–10 flowers, the outer on long, recurved peduncles, the inner on short, erect peduncles. Bracteoles ciliate. Perianth-segments 2–2·3 mm, equal. Anthers as long as or shorter than filaments. Capsule *c.* 2 mm, broadly ovoid, about as long as perianth-segments. Seeds (0·8–)1–1·2 mm; basal appendage short, dark brown. $2n=36$, 42. *Stony mountainsides and tundra. N. Europe, southwards to 56°45′ N. in Scotland.* Br Fa ?Fe Is No Rs (N) Sb Su.

6. L. confusa Lindeb., *Bot. Not.* **1855**: 9 (1855). Like **5** but laxly caespitose; basal leaves sometimes not canaliculate; inflorescence with 2–5 clusters on erect peduncles, or sometimes subsessile; perianth-segments sometimes up to 3 mm, subequal; capsule sometimes up to 2·8 mm; seeds sometimes up to 1·6 mm, reddish-brown. $2n=48$. *Stony or sandy tundra or mountainsides. Arctic and subarctic Europe and mountains of Norway.* Fe Is No Rs (N) Su.

Perhaps not specifically distinct from **5.**

7. L. arctica Blytt, *Norg. Fl.* **1**: 299 (1861) (*L. nivalis* auct., non Sprengel). Plant (3–)8–12(–18) cm, laxly caespitose, with very short stolons. Basal and cauline leaves (1·5–)2·5–3·5(–5) mm wide, flat, rigid. Inflorescence with sessile to subsessile clusters of 5–10 flowers. Bracteoles entire or shallowly lacerate. Perianth-segments 1·5–1·7 mm, subequal, with hyaline margin. Anthers about as long as filaments. Capsule up to 2 mm, oblong-ovoid, slightly longer than perianth-segments. Seeds 0·9–1·2 mm, pale brown; basal appendage short. $2n=24$. *Stony mountain-sides and tundra; calcicole. Arctic Europe and mountains of Norway.* No Rs (N) Sb Su.

Sect. ALPINAE Chrtek & Křísa. Inflorescence dense, often interrupted, drooping, spike-like.

(8–11). L. spicata group. Caespitose, with short stock. Basal leaves usually canaliculate, glabrous to sparsely ciliate. Inflorescence usually interrupted. Lower bract about as long as the inflorescence. Perianth-segments subequal. Seeds with a short basal appendage.

1 Anthers about as long as filaments **8. spicata**
1 Anthers longer than filaments
2 Anthers 0·6–0·8 mm; capsule 1·4–2 mm; seeds 0·8–1·2 mm **11. hispanica**
2 Anthers 0·9–1·2 mm; capsule 2·3–2·9 mm; seeds 1·5–1·7 mm
3 Cauline leaves often canaliculate; capsule (1·4–)2·3–2·6 mm; seeds (1·1–)1·3–1·4(–1·5) mm **9. italica**
3 Cauline leaves flat; capsule (2·4–)2·5–2·9(–3·1) mm; seeds (1·4–)1·5–1·7(–2) mm **10. pindica**

8. L. spicata (L.) DC. in Lam. & DC., *Fl. Fr.* ed. 3, **3**: 161 (1805). Plant (5–)7–25(–45) cm. Basal leaves 1–2(–4) mm wide, slightly recurved. Perianth-segments (2–)2·5–3 mm, aristate. Anthers about as long as the filaments. Style as long as the ovary. Capsule broadly ellipsoid to globose, dark brown to blackish, equalling the perianth-segments. *Rocks, stony ground and heathy grassland; calcifuge. N. Europe, southwards to 56°15′ N. in Scotland; mountains of C. & S. Europe southwards to Corse, the Alps and the S. Carpathians.* Au Br Co Cz Fa Fe Ga Ge He Is It Ju No Po Rm Rs (N, W) Sb Su.

(a) Subsp. **spicata**: Plant usually 15–25 cm. Inflorescence oblong-elliptical. Capsule (1·9–)2·1–2·5(–2·6) mm; seeds (1–)1·1–1·5(–1·6) mm. $2n=24$. *N. Europe; locally in C. & S. Europe from S.W. Poland to S.C. France.*

(b) Subsp. **mutabilis** Chrtek & Křísa, *Bot. Not.* **115**: 302 (1962): Plant usually 7–15 cm. Inflorescence ovoid. Capsule (1·5–)1·7–2(–2·2) mm; seeds (0·7–)0·8–1·2(–1·3) mm. $2n=12$, 14. ● *Jura, Alps, Carpathians, N. Appennini, Corse.*

9. L. italica Parl., *Fl. Ital.* **2**: 309 (1857) (*L. spicata* auct., non (L.) DC.). Plant (7–)15–25(–35) cm. Inflorescence oblong-elliptical. Perianth-segments *c.* 2·5 mm. Anthers much longer than filaments. Capsule (2–)2·3–2·6(–2·8) mm, slightly longer than perianth-segments, oblong-ovoid, brown to blackish. Seeds (1·1–)1·3–1·4(–1·5) mm, brown to rusty brown. *Mountain rocks and alpine grassland. C. part of Balkan peninsula; C. Italy and Sardegna.* Al Bu ?Co Gr It Ju Sa.

10. L. pindica (Hausskn.) Chrtek & Křísa, *Webbia* **19**: 6 (1964) (*L. bulgarica* subsp. *pindica* (Hausskn.) Chrtek & Křísa). Plant (15–)20–35(–45) cm. Basal and cauline leaves (3–)5–8 mm wide, flat. Inflorescence oblong-elliptical. Perianth-segments *c.* 2·5 mm. Anthers much longer than filaments. Capsule (2·4–)2·5–2·9(–3·1) mm, ovoid, yellowish- to dark brown, distinctly longer than perianth-segments. Seeds (1·4–)1·5–1·7(–2) mm, brown to rusty brown. *Stony and grassy places.* ● *Mountains of S.W. Jugoslavia and N.W. Greece, and of S. Italy.* Gr It Ju.

11. L. hispanica Chrtek & Křísa, *Novit. Bot. Horti Bot. Univ. Carol. Prag.* **1965**: 28 (1965). Plant 6–20(–30) cm. Basal leaves slightly recurved. Inflorescence ovoid, rarely interrupted. Perianth-segments 1·5–2·5 mm. Anthers longer than filaments. Capsule 1·4–2 mm, ovoid, dark brown to blackish, usually slightly shorter than perianth-segments. Seeds 0·8–1·2 mm. *Stony and grassy places. Pyrenees and mountains of Spain.* Ga Hs.

12. L. nutans (Vill.) Duval-Jouve, *Bull. Soc. Bot. Fr.* **10**: 80 (1863) (*L. pediformis* (Chaix) DC.). Plant (15–)30–50(–70) cm, laxly caespitose, with long, stout stock. Leaf-sheaths decaying into a brownish fibrous mass; basal leaves 3–6(–8) mm wide, flat. Inflorescence 2–4(–6) cm, with 20–100 flowers, interrupted. Lower bract often longer than inflorescence. Perianth-segments 4–5(–5·5) mm, subequal, dark brown, with wide hyaline margin. Anthers 4–5 times as long as filaments. Style c. 2 or more times as long as ovary. Capsule 4–4·5(–5) mm, ovoid-pyriform. Seeds 2–2·3 mm, pale brown; basal appendage 0·2–0·5 mm. $2n=12$. *Open woods, rocks and mountain pastures.* ● *Mountains of S.W. Europe.* Ga Hs It.

13. L. caespitosa Gay, *Pl. Astur. Exsicc.* n. 216 (1836) (*L. pediformis* (Chaix) DC. subsp. *caespitosa* (Gay) Guinea). Plant (15–)20–30(–40) cm, more or less caespitose, with short and slender creeping stolons clothed with persistent leaf-sheaths. Basal leaves 1·5–3 mm wide, convolute. Inflorescence 0·9–3 cm, slightly interrupted, with 3–20 flowers. Lower bract longer than inflorescence. Perianth-segments 3·8–4·5 mm, subequal, with hyaline margin. Style about twice as long as ovary. Anthers 4–5 times as long as filaments. Capsule 2·8–3·6 mm, globose, about as long as perianth. Seeds 1·6–1·9 mm, pale brown; basal appendage short. *Rocks and stony pastures; usually calcifuge.* ● *Mountains of N. & C. Spain and N.C. Portugal.* Hs Lu.

Subspecies have been described from Spain by Montserrat-Recoder but require further investigation.

Sect. NODULOSAE Chrtek & Křísa. Inflorescence erect, condensed into few-flowered clusters in a cyme. Rhizomes robust, with short internodes.

14. L. nodulosa (Bory & Chaub.) E. H. F. Meyer, *Linnaea* **22**: 410 (1849). Plant 30–50(–70) cm, caespitose, with short nodulose stolons. Basal leaves 3–5(–6) mm wide, strongly ciliate. Inflorescence of 2–7(–12) stipitate clusters of 2–7 flowers on straight, erect branches. Lower bract distinctly shorter than inflorescence. Perianth-segments 4·5–5·5(–6) mm, equal, pale brown, with wide hyaline margin. Anthers much longer than filaments. Style short. Capsule 4–5 mm, about equalling the perianth-segments. Seeds *c.* 2 mm, greyish-brown. *Open woods and stony scrub. S. Greece and S. Aegean region.* Cr Gr.

Subgen. **Anthelaea** (Griseb.) Buchenau. Perennials or annuals. Flowers usually in pairs, sometimes borne singly or in larger groups. Seeds with short to inconspicuous basal appendage or appendage absent.

15. L. sylvatica (Hudson) Gaudin, *Agrost. Helv.* **2**: 240 (1811). Plant (30–)40–80(–100) cm, robust, laxly caespitose, with numerous short, ascending stolons. Basal leaves 5–20(–30) mm wide, spreading, sparsely to densely ciliate. Flowers in groups of 2–5. Bracteoles conspicuously lacerate to ciliate. Perianth-segments 2–4(–4·5) mm, brown; inner longer than outer, with wide hyaline margin. Anthers up to 6 times as long as filaments. Style longer than ovary. Capsule about equalling the perianth-segments, ovoid. Seeds slightly shiny; basal appendage small. *Damp woods, moorland and rocky places; usually calcifuge. S., W. & C. Europe.* Al Au Be Br Bu Co Cz Da Fa Ga Ge Gr Hb He Ho Hs It Ju Lu No Po Rm Rs (W) Si Tu [Su].

(a) Subsp. **sylvatica**: Bracts 8–10(–15) mm. Perianth-segments 3–4(–4·5) mm. Capsule (3·5–)4–4·4 mm; seeds 1·5–2(–2·2) mm. $2n=12$. *Throughout the range of the species, except Portugal and parts of N.W. Spain.*

(b) Subsp. **henriquesii** (Degen) P. Silva, *Agron. Lusit.* **12**: 359 (1950): Bracts (3·5–)4–8(–12) mm. Perianth-segments 2–3(–3·4) mm. Capsule 2·2–3 mm; seeds 1·3–1·5 mm. $2n=c.\ 84$. ● *N. & C. Spain, N.W. Portugal.*

Subsp. **croatica** Beyer, *Verh. Bot. Ver. Brandenb.* **41**: xix (1899), with capsules up to 2·5 mm, shorter than the perianth, was described from Jugoslavia. It requires investigation. Of similar uncertain taxonomic status is **L. sicula** Parl., *Fl. Ital.* **2**: 303 (1857), from S. Italy and Sicilia.

16. L. sieberi Tausch, *Flora* (*Regensb.*) **19**: 423 (1836). Plant (30–)40–60 cm, laxly caespitose. Basal leaves 3–6 mm wide, distinctly ciliate. Flowers borne 2–3 together. Perianth-segments 3–3·5(–4) mm, reddish-brown. Anthers longer than filaments. Style longer than ovary. Capsule 2·5–3(–3·5) mm, ovoid, equalling the perianth. Seeds 1·2–1·3 mm. *Coniferous woods.* ● *Alps; mountains of C. Jugoslavia.* Au Ge He It Ju.

17. L. lutea (All.) DC. in Lam. & DC., *Fl. Fr.* ed. 3, **3**: 159 (1805). Plant (10–)15–30 cm, laxly caespitose, with short stolons. Basal leaves 3–6 mm wide, with reddish-brown sheaths. Flower-clusters erect, pedunculate. Perianth-segments 2·5–3 mm, equal, yellow. Anthers about as long as or longer than filaments. Capsule *c.* 2·5 mm, subovoid to globose, dark brown to blackish, equalling perianth-segments. Style longer than ovary. Seeds 1–1·5 mm, rusty brown, oblong; basal appendage inconspicuous. $2n=12$. *Rocks and stony mountain pastures; calcifuge.* ● *Alps, Pyrenees, N. Appennini.* Au Ga He Hs It.

18. L. purpureosplendens Seub., *Fl. Azor.* 23 (1844). Plant 20–60 cm, caespitose, with stolons. Basal leaves 2–8 mm wide, flat, ciliate; leaf-sheaths purple at base; cauline leaves short. Perianth-segments 4·5–5 mm, the inner about equalling the outer, purplish. Anthers 2½–3 times as long as filaments. Capsule globose to ovoid, reddish-brown, shorter than perianth-segments. Seeds 1·2–1·7 mm, dark brown; basal appendage inconspicuous. *Open mountain woods.* ● *Açores.* Az.

19. L. nivea (L.) DC. in Lam. & DC., *Fl. Fr.* ed. 3, **3**: 158 (1805). Plant 40–60(–80) cm, laxly caespitose, with long stolons. Basal leaves 3–4(–5) mm wide, flat; cauline leaves 15–20 cm. Inflorescence with 6–20 flower-clusters; peduncles suberect to somewhat recurved. Perianth-segments *c.* 5 mm, whitish, unequal, acute. Anthers about as long as or shorter than filaments. Style longer than ovary. Capsule 2–2·5 mm, globose, *c.* ½ as long as perianth. Seeds *c.* 1·5 mm, reddish-brown. $2n=12$. *Woodland and scrub, mainly in the mountains.* ● *From N.C. France southwards to N.E. Spain, C. Italy and Slovenija.* Au Ga Ge He Hs It Ju ?Rm.

20. L. lactea (Link) E. H. F. Meyer, *Syn. Luzul.* 15 (1823). Plants 30–60(–70) cm, laxly caespitose, with long stolons; stem rigid. Basal leaves *c.* 4 mm wide, with slightly revolute margins; cauline leaves 6–10 cm; leaf-sheaths soon decaying into a brownish fibrous mass. Inflorescence with 8–20 clusters, each cluster of 8–25(–30) flowers. Perianth-segments 4·5–5(–5·5) mm, equal, subobtuse or acuminate, whitish, translucent. Anthers up to twice as long as filaments. Style longer than ovary. Capsule *c.* 2 mm, ovoid, ⅓–½ as long as perianth-segments. Seeds 1·1–1·2 mm, reddish-brown; basal appendage inconspicuous. $2n=12$. *Woods, scrub, heaths and mountain meadows.* ● *N. & C. Spain, N. Portugal; Açores.* Az Hs Lu.

21. L. pedemontana Boiss. & Reuter, *Pugillus* 115 (1852). Plant (25–)30–60 cm, caespitose, with short stolons. Basal leaves convolute; cauline leaves *c.* 2 mm wide, somewhat convolute to flat. Inflorescence lax, with (10–)20–40(–50) clusters, each with 2–3(–5) flowers. Perianth-segments (2·8–)3–3·3 mm, whitish, translucent, subequal. Anthers about twice as long as filaments. Style about twice as long as ovary. Capsule 2·8–3·2 mm, about as long as or slightly shorter than perianth-segments, oblong-ovoid. Seeds 1·2–1·5 mm, greyish-brown. *Open woods and scrub.* ● *S.W. Alps, N. Appennini, Corse.* Co Ga It.

22. L. luzuloides (Lam.) Dandy & Wilmott, *Jour. Bot.* (*London*) **76**: 352 (1938) (*L. nemorosa* (Pollich) E. H. F. Meyer, non Hornem.). Plant (30–)40–65(–75) cm, laxly caespitose, with short stolons. Basal leaves 3–6 mm wide, flat, long-ciliate. Inflorescence corymbose, lax or condensed with divaricate branches with clusters of 2–10 flowers. Perianth-segments (2–)2·5–3·5 mm, whitish, sometimes suffused with red, the outer shorter than the inner, acute. Capsule ovoid, about as long as perianth-segments. Anthers *c.* 3 times as long as filaments. Style longer than ovary. Seeds 1·1–1·2 mm, brown to black. $2n=12$. *Woods and meadows. From the Netherlands and Poland southwards to the Pyrenees, N. Appennini and Macedonia; introduced with grass-seed to N. Europe and widely naturalized.* Au Be Bu Cz Ga Ge Gr He Ho ?Hs Hu It Ju Po Rm Rs (W) Tu [Br Da Fe No Rs (B, C) Su].

(a) Subsp. **luzuloides**: Inflorescence lax. Perianth-segments whitish. *Almost throughout the range of the species.*

(b) Subsp. **cuprina** (Rochel ex Ascherson & Graebner) Chrtek & Křísa, *Preslia* **46**: 212 (1974): Inflorescence more or less condensed. Perianth-segments suffused with red. *Throughout most of the native range of the species, mainly in the mountains.*

23. L. alpinopilosa (Chaix) Breistr., *Bull. Soc. Sci. Dauph.* **61**: 609 (1947) (*L. spadicea* (All.) DC.). Plant (15–)25–40(–50) cm,

caespitose. Basal leaves 1–8 mm wide, sparsely ciliate, rarely with hairs only at the mouth of leaf-sheath. Flowers 2–5 together. Inflorescence erect or slightly drooping. Perianth-segments 1·5–3 mm, subequal, dark brown. Anthers 3–7 times as long as filaments. Style about as long as or slightly longer than ovary. Capsule 2–2·5(–2·8) mm, ovoid to globose. Seeds 1–1·3 mm, pale brown; basal appendage short. $2n=12$. *Shady rocks, wet screes and snow-patches; usually calcifuge.* ● *Mountains of Europe, from the Vosges and Carpathians to the Pyrenees, C. Appennini and Bulgaria.* Au Bu Cz Ga Ge He Hs It Ju Po Rm Rs (W).

1 Plant usually 40–50 cm; leaves 6–8 mm wide, glabrous **(d)** subsp. **velenovskyi**
1 Plant 10–30 cm; leaves 1–6 mm wide, sparsely hairy
2 Leaves 3–6 mm wide; perianth-segments 2·5–3 mm; anthers 5–7 times as long as filaments **(c)** subsp. **obscura**
2 Leaves 1–3·5(–5) mm wide; perianth-segments 1·5–2·5 mm; anthers 3–4 times as long as filaments
3 Leaves 1–2·5(–3) mm wide; perianth-segments up to 2·5 mm **(a)** subsp. **alpinopilosa**
3 Leaves 2·5–3·5(–5) mm wide; perianth-segments not more than 2 mm **(b)** subsp. **candollei**

(a) Subsp. **alpinopilosa**: Stem usually ascending. Leaves 1–2·5(–3) mm wide. Perianth-segments up to 2·5 mm. Anthers 3–4 times as long as filaments. *Pyrenees, mountains of S. France, Alps, Appennini.*

(b) Subsp. **candollei** (E. H. F. Meyer) Rothm., *Feddes Repert.* **67**: 4 (1963) (*L. spadicea* var. *candollei* E. H. F. Meyer): Stem erect. Leaves 2·5–3·5(–5) mm wide. Perianth-segments not more than 2 mm. Anthers 3 times as long as filaments. *Pyrenees, Vosges, Alps.*

(c) Subsp. **obscura** Fröhner, *Preslia* **40**: 426 (1968): Stem usually 10–30 cm, erect. Leaves 3–6 mm wide. Perianth-segments 2·5–3 mm. Anthers 5–7 times as long as filaments. $2n=12$. *Carpathians.*

(d) Subsp. **velenovskyi** (Kožuharov) Chrtek & Křísa, *Preslia* **46**: 212 (1974) (*L. spadicea* var. *velenovskyi* Kožuharov, *L. glabrata* auct. balcan., non (Hoppe) Desv.): Stem usually 40–50 cm, erect. Leaves 6–8 mm wide. Perianth-segments 2·5–3 mm. Anthers 6–7 times as long as filaments. *S. Jugoslavia, S.W. Bulgaria.*

24. L. glabrata (Hoppe) Desv., *Jour. Bot. Rédigé* **1**: 143 (1808). Plant 20–40(–60) cm, laxly caespitose, with short stolons. Basal and cauline leaves 6–12 mm wide, flat, glabrous or slightly pubescent at the mouth of leaf-sheath. Lower bract much shorter than inflorescence. Flowers usually borne singly, rarely in pairs. Perianth-segments (2·5–)2·7–3(–3·5) mm, subequal, reddish- or dark brown. Anthers *c.* 3 times as long as filaments. Style as long as ovary. Capsule 2·5–3(–3·5) mm, subglobose. Seeds 1·2–1·8 mm, greyish-brown; basal appendage *c.* 0·1 mm. *Mountain pastures and stony scrub; usually calcicole.* ● *E. Alps.* Au Ge It.

L. deflexa Kožuharov in Jordanov, *Fl. Rep. Pop. Bulg.* **2**: 402 (1964), described from Bulgaria, is said to be distinguished by the following characters: stem 40–60 cm; leaves 4–6 mm wide, glabrous or sparsely hairy; inflorescence corymbose, lax; perianth-segments *c.* 2 mm; anthers as long as filaments. Further investigation is needed.

25. L. desvauxii Kunth, *Enum. Pl.* **3**: 304 (1841). Plant (30–)40–60(–70) cm, laxly caespitose, with short stolons. Basal leaves 2·5–6(–7) mm wide; cauline leaves 2–8 mm wide, flat, glabrous or sparsely ciliate. Lower bract shorter than inflorescence. Flowers borne singly or in pairs or threes. Perianth-segments 2–2·5(–2·8) mm, subequal, dark brown. Anthers 3–4 times as long as filaments. Style slightly longer than ovary. Capsule 2–2·5 mm, subglobose, about as long as perianth. Seeds 1–1·2 mm, greyish-brown; basal appendage *c.* 0·2 mm. $2n=12$. *Wet, stony places in the mountains.* ● *S.W. & W.C. Europe, from S.W. Germany to the Cordillera Cantábrica.* Ga Ge Hs.

26. L. wahlenbergii Rupr., *Beitr. Pfl. Russ. Reich.* **2**: 58 (1845). Plant 20–30(–50) cm, caespitose. Basal leaves (2·5–)3–5 mm wide, sparsely hairy on margins; cauline leaves 2. Lowest bract 0·4–1 cm. Inflorescence with 10–30 flowers. Bracteoles strongly ciliate, dark brown. Perianth-segments 2–2·5 mm, acute. Anthers about as long as filaments. Style about as long as or shorter than ovary. Capsule 2·2–2·5(–2·7) mm, ovoid, as long as to slightly longer than the perianth. Seeds 1·2–1·4 mm, dark reddish-brown; basal appendages fibrous. $2n=24$, 36. *Wet grassland and mossy tundra. Arctic Europe, extending southwards to* 63° *N. in C. Sweden and to* 61° *N. in N. Ural.* Fe No Rs (N) Sb Su.

27. L. parviflora (Ehrh.) Desv., *Jour. Bot. Rédigé* **1**: 144 (1808). Plant (20–)30–50 cm, usually laxly caespitose. Basal leaves 5–9(–12) mm wide; cauline leaves 3–5. Lowest bract (1·5–)2–3·5 cm. Inflorescence with more than 30 flowers. Bracteoles subentire to lacerate. Perianth-segments 1·5–2(–2·5) mm, acute. Anthers about as long as filaments. Style about as long as or shorter than ovary. Capsule (2·2–)2·5–3 mm, ovoid, shorter to longer than perianth. Seeds 1–1·4 mm, reddish-brown; basal appendage inconspicuous. $2n=24$. *Tundra, damp grassland and wood-margins. Arctic and subarctic Europe, southwards to c.* 61° *N. in Norway and Ural.* Fe No Rs (N) Su.

28. L. elegans Lowe, *Trans. Cambr. Philos. Soc.* **6**: 532 (1838) (*L. purpurea* (Masson ex Buchenau) Link). Annual (10–)20–30(–45) cm, usually erect, slender. Basal leaves 1–3 mm wide, usually sparsely ciliate. Lower bract much shorter than inflorescence. Inflorescence with more than 20 flowers. Perianth-segments 2–2·5(–3) mm, mucronate-aristate. Anthers shorter than filaments. Style shorter than ovary. Capsule 1·5–1·7 mm, ovoid, shorter than perianth-segments. Seeds 0·7–0·9 mm, pale brown, without a basal appendage. $2n=6$. *Scrub on sandy soils. Naturalized in C. Portugal.* [Lu.] (*Madeira, Islas Canarias.*)

Subgen. **Pterodes** (Griseb.) Buchenau. Perennials. Flowers borne singly. Inflorescence a lax cyme. Seeds with a long basal appendage.

29. L. pilosa (L.) Willd., *Enum. Pl. Horti Berol.* 393 (1809). Plant (15–)20–35(–40) cm, caespitose, with short stolons. Basal leaves (3·5–)5–10 mm wide, sparsely to densely ciliate, flat. Inflorescence with unequal patent capillary branches deflexed in fruit. Perianth-segments 3–4·5 mm, subequal, acute, usually dark brown, with wide hyaline margin. Anthers longer than filaments. Style about as long as ovary. Capsule 3·5–4·5 mm, ovoid, very wide below, longer than perianth, yellowish-green. Seeds 1·2–1·8 mm, pale brown; basal appendage 0·8–1·5(–2·5) mm, hooked. $2n=66$, 72. *Woods. Most of Europe except the extreme south.* Al Au Be Br Bu Co Cz Da Fe Ga Ge Gr Hb He Ho Hs Hu It Ju No Po Rm Rs (N, B, C, W, E) Sa Su.

30. L. forsteri (Sm.) DC. in Lam. & DC., *Syn. Pl. Fl. Gall.* 150 (1806) (*L. caspica* Rupr. ex Bordz.). Plant (15–)20–30(–45) cm, caespitose, with short, slender stolons. Basal leaves 2·5–3·5(–5) mm wide, flat, with short yellowish apex. Inflorescence with unequal patent branches erect in fruit. Perianth-segments 3·5–5 mm, subequal, usually dark brown. Anthers 1–4 times as

long as filaments. Style as long as ovary. Capsule 2·8–4·5 mm, ovoid. Seeds 1·3–1·6 mm; basal appendage short, straight. $2n=24$. *Woods and hedges; somewhat calcifuge. S., W. & S.C. Europe, northwards to C. England.* Al Au Be Br Bu Co Cr Ga Ge Gr He Hs Hu It Ju Lu Rm Rs (W, K) Sa Si Tu.

The complex pattern of variation shown by **30** is still imperfectly known, especially in the Balkan peninsula, and it is therefore difficult to delimit subspecies (as proposed by Montserrat-Recoder for Spain) at this stage.

31. L. luzulina (Vill.) Dalla Torre & Sarnth., *Fl. Tirol* 6(1): 426 (1906) (*L. flavescens* (Host) Gaudin). Plant (10–)15–25(–30) cm, laxly caespitose, with long, slender stolons. Basal leaves 2–4 mm wide, flat, with short yellowish apex. Inflorescence with unequal patent branches, with *c.* 10 flowers. Perianth-segments 3·5–5 mm, subequal, with wide hyaline margin, yellowish to pale brown. Anthers as long as filaments. Style about as long as ovary. Capsule more or less ovoid, distinctly longer than perianth, yellowish-brown. Seeds 1·3–1·5 mm, reddish-brown; basal appendage usually as long as seeds, falcate. $2n=24$. *Coniferous woods.* ● *Mountains of C. & S. Europe.* Au Bu Co Cz Ga Ge Gr He Hs It Ju Po Rm Rs (W).

BROMELIALES

CXC. BROMELIACEAE[1]

Perennial herbs, often epiphytic. Leaves alternate or basal, usually with sheathing base, often furnished with absorbent, scale-like hairs. Flowers regular, hermaphrodite, in spikes, racemes or capitula, often with conspicuously coloured bracts. Perianth of distinct calyx and corolla, each of 3 segments, free or connate. Stamens 6. Ovary 3-locular, superior or inferior; ovules numerous. Fruit a berry or capsule.

An almost exclusively American family.

1. Fascicularia Mez[2]

Robust cushion-plants with short, branched stem and spinose-dentate leaves in dense, crowded rosettes. Inflorescence a sessile, terminal capitulum subtended by broadly oblong, spinose-dentate bracts. Sepals and petals free; ovary inferior, surmounted by a short hypanthial tube. Fruit a berry.

1. F. pitcairniifolia (Verlot) Mez in A. & C. DC., *Monogr. Phan.* **9**: 10 (1896). Leaves up to 35 cm, tapered from a wide, sheathing base to an acute apex, coriaceous, sparsely covered with white scales when young, dark, somewhat glaucous green, but the innermost, before and during anthesis, bright red on the proximal part of the upper surface; marginal spines pungent, *c.* 8 mm apart. Capitulum *c.* 5 cm in diameter. Sepals *c.* 20 mm, oblong-lanceolate, whitish, erect. Petals slightly exceeding sepals, oblong, pale blue, erect but with out-turned apex. Hypanthial tube *c.* 5 mm. *Naturalized on maritime rocks on islands off the coasts of S.W. England and N.W. France.* [Br Ga.] (*Chile.*)

COMMELINALES

CXCI. COMMELINACEAE[1]

Annual or perennial herbs; stems often swollen at the nodes. Leaves alternate, often distichous, entire, with a closed, somewhat membranous basal sheath. Flowers hermaphrodite, in terminal or axillary cymes, often closely invested by 1 or 2 large, leaf-like bracts. Perianth-segments 6, the 3 outer sepaloid, the 3 inner petaloid, usually fugitive. Stamens 6, of which 3 are sometimes reduced to staminodes. Ovary superior, 3-locular, with simple style and capitate or shortly 3-lobed stigma. Fruit a loculicidal capsule; seeds few, marked by a small callosity indicating the position of the embryo.

A mainly tropical and subtropical family, represented in Europe only by some ornamental species escaped from gardens.

1 Petals unequal — **3. Commelina**
1 Petals equal
2 Cymes subtended by paired, leaf-like bracts; stamens all similar — **1. Tradescantia**
2 Cymes not subtended by leaf-like bracts; stamens strongly dimorphic — **2. Tripogandra**

[1] Edit. D. A. Webb. [2] By D. A. Webb. [3] By N. A. Burges.

1. Tradescantia L.[3]

Perennial. Inflorescences mostly terminal, subtended by paired, leaf-like bracts. Flowers actinomorphic; sepals and petals free. Fertile stamens 6; filaments usually hairy.

Zebrina pendula Schnizlein, *Bot. Zeit.* **7**: 870 (1849), from Mexico, is similar to *T. fluminensis* in habit and foliage, and is often confused with it. It differs, however, in the petals, which are united below into a tube *c.* 5 mm long, and the leaves, which are usually marked with longitudinal bands of reddish-purple and white beneath. It has occasionally been recorded as a garden escape in S. Europe.

Stems erect; leaves up to 35 cm, linear-lanceolate — **1. virginiana**
Stems procumbent to ascending; leaves 3–6 cm, ovate — **2. fluminensis**

1. T. virginiana L., *Sp. Pl.* 288 (1753). Stems 30–60 cm, erect, caespitose. Leaves 15–35 cm × 5–25 mm, linear-lanceolate, glabrous or puberulent. Cymes many-flowered; pedicels 2–3 cm. Sepals 10–15 mm, hairy; petals 12–18 mm, broadly ovate, violet

(rarely white). Seeds 3–6. *Widely cultivated for ornament, and naturalized in S. Europe.* [Ga It ?Rm.] (*E. United States.*)

Many of the plants cultivated under this name are really hybrids between **1** and related species, and it is possible that some of the naturalized plants are also hybrids.

2. T. fluminensis Velloso, *Fl. Flum.* 140 (1825). Stems procumbent or decumbent, rooting at the nodes. Leaves 3–6 cm, broadly ovate, acute, rather fleshy, usually purplish beneath, glabrous except for some cilia at the mouth of the sheath. Cymes few-flowered; pedicels 1–2 cm, slender. Sepals up to 9 mm, lanceolate, glabrous except for pubescent midrib. Petals up to 12 mm, narrowly ovate, white or pale lilac. *Naturalized in shady places in S.W. Europe.* [Az Co Hs Lu ?Rm.] (*S.E. Brazil to Argentina.*)

2. Tripogandra Rafin.[1]

Inflorescences terminal and axillary, not subtended by leaf-like bracts. Flowers somewhat zygomorphic; sepals and petals equal, free; stamens 6, dimorphic, 3 with short filaments and 3 with long.

1. T. multiflora (Swartz) Rafin., *Fl. Tellur.* **2**: 16 (1837). A decumbent perennial, rooting at the nodes; flowering stems erect, up to 80 cm. Leaves 3–9 cm, ovate, acute, rather fleshy, glabrous or hairy. Pedicels 2–4 mm. Sepals 2–4 mm, ovate, glabrous or hairy. Petals 2–4 mm, ovate, white or pink. Filaments of longer stamens hairy. *Extensively naturalized in the Açores.* [Az.] (*Tropical America.*)

3. Commelina L.[2]

Annual or perennial. Inflorescences mostly axillary, not umbel-like but with the axis evident. Flowers zygomorphic; sepals free or connate; petals free, unequal. Fertile stamens 3; staminodes 3; filaments glabrous.

1. C. communis L., *Sp. Pl.* 40 (1753). Subglabrous annual, with procumbent to ascending stems up to 70 cm. Leaves 5–7 cm, ovate-lanceolate, acute, ciliate at mouth of sheath. Cymes subtended by a large, keeled, spathe-like bract. Sepals ovate, membranous, 2 of them partly united. 2 larger petals bright blue, with suborbicular limb and narrow claw, the third much smaller, ovate-lanceolate, white. Seeds usually 4 (one loculus of the ovary being sterile), rugose. *Naturalized in S. & C. Europe.* [Cz He It Ju Rm Rs (C, W).] (*Temperate Asia.*)

C. virginica L., *Sp. Pl.* ed. 2, 61 (1762), from the E. United States, has been recorded as naturalized in N. Italy. It is a suberect perennial up to 120 cm with conspicuous, reddish hairs at the mouths of the leaf-sheaths, blue petals more nearly equal than in **1**, and a capsule containing 3 smooth seeds.

CXCII. ERIOCAULACEAE[3]

Monoecious herbs, usually perennial. Leaves linear, usually in rosettes. Flowers small, numerous, 2- or 3-merous, in compact, bracteate capitula, the female near the outside, the male mainly near the centre. Perianth usually of 2 whorls, more or less glumaceous. Ovary superior, 2- or 3-locular, with 1 ovule in each loculus; stigmas 2–3. Fruit a loculicidal capsule.

1. Eriocaulon L.[2]

Glabrous, except sometimes for perianth. Roots with conspicuous transverse striations. Scapose, with leaves in basal rosettes. Flowers actinomorphic or slightly zygomorphic. Outer perianth-segments free or united; inner segments united in male flowers, free or absent in female. Stamens twice as many as inner perianth-segments.

Literature: W. Ruhland in Engler, *Pflanzenreich* **13(IV. 30)**: 30–117 (1903).

Each rosette usually with a single scape; flowers 2-merous; inner perianth-segments black, with conspicuous white cilia near apex **1. aquaticum**

Each rosette usually with numerous scapes; flowers 3-merous; inner perianth-segments absent or inconspicuous, not ciliate **2. cinereum**

1. E. aquaticum (Hill) Druce, *Pharm. Jour.* **83**: 700 (1909) (*E. septangulare* With.). Shortly stoloniferous, forming dense mats; usually submerged except for capitulum. Leaves 3–10 cm, 3–5 mm wide at the base, linear-subulate, pellucid, with a reticulum of opaque veins. Scape 7–20(–150) cm, 1(–3) from each rosette, fragile, the lower part enclosed by a loosely sheathing leaf. Capitulum 3–8 × 6–11 mm, hemispherical. Bracts 2–3 mm, greyish. Perianth of 2 whorls, each of 2 segments; those of female flowers *c.* 2 mm, free, greyish-black; outer segments of male flowers 3 mm, free, the inner united below, yellowish-grey. Inner segments of all flowers with black apex and conspicuously white-ciliate. Ovary 2-lobed; stigmas 2; seed 1 mm, smooth. $2n = 64$. *Margins of peaty lakes. W. Ireland, W. Scotland.* Br Hb. (*E. North America.*)

Some authors separate the American plant as **E. pellucidum** Michx, *Fl. Bor. Amer.* **2**: 166 (1803), mainly on the grounds of its different chromosome number ($2n = 32$), but the morphological differences are very slight, and until these differences and the chromosome numbers have been shown to be constant throughout the two populations they are best regarded as conspecific.

2. E. cinereum R.Br., *Prodr. Fl. Nov. Holl.* 254 (1810) (*E. sieboldianum* Sieb. & Zucc. ex Steudel). Like **1** but less robust; leaves not more than 2·5 mm wide at base; scapes 10–15(–40) cm, very slender, 5–30 from each rosette; capitulum 3–5 mm, subglobose; bracts 1·5–2 mm, flowers 3-merous, with inconspicuous, pale yellowish, glabrous perianth, the segments of the outer whorl connate in male flowers, free in female, the inner whorl tubular in the male, absent in the female. *Naturalized on wet mud in rice-fields in N. Italy.* [It.] (*S.E. & E. Asia, N. Australia.*)

[1] By D. R. Hunt. [2] By D. A. Webb. [3] Edit. D. A. Webb.

GRAMINALES

CXCIII. GRAMINEAE[1]

(Poaceae)

Annual or perennial herbs, or rarely woody, often with rhizomes or stolons. Flowering stems usually cylindrical, with hollow internodes and solid nodes, rarely solid throughout, with a meristem at the base of each internode. Leaves alternate, 2-ranked, consisting of sheath, ligule and lamina. Sheaths surrounding the stem, with free, overlapping, or connate margins, sometimes auriculate at the mouth. Ligule situated at the junction of sheath and lamina, usually membranous, sometimes a row of hairs or rarely absent. Lamina linear to filiform, rarely lanceolate to ovate, usually with more or less prominent, parallel ribs, usually constricted at the junction with the sheath, rarely shortly petiolate. Epidermis with long and short cells, some short cells usually filled with *silica-bodies*, others with corky walls; hairs of 2 kinds often present, *macro-hairs* which are stout, thick-walled, usually 1-celled, and *micro-hairs* which are microscopic and either slender or globose, usually 2-celled, with the distal cell thin-walled. Flowers usually hermaphrodite, consisting of 1–3(–6) stamens and an ovary with usually 2 styles, the stamens subtended by (0–)2(–3) small, hyaline scales (*lodicules*), enclosed between usually 2 bract-like structures, the whole forming a *floret*. Florets 1–many, inserted alternately on 2 sides of a slender, jointed axis (*rhachilla*) and subtended by (0–)2(–3) bracts (*glumes*), the whole forming a *spikelet*. Lower bract of the floret (*lemma*) often with a dorsal or apical awn; upper bract (*palea*) usually membranous and 2-keeled, sometimes very small or absent. Lemma with a thickened, sometimes elongate and pungent base (*callus*). Ovary 1-locular, superior; ovule 1, attached on the adaxial side of the loculus, to a point or line visible in fruit as the *hilum*. Fruit (*grain*) a caryopsis or rarely with a free, membranous pericarp.

In the following account *leaf* refers to the lamina only; *stem* refers to the flowering stem or culm, and the stigmas are plumose, unless the contrary is stated. Measurements of ligules refer to the ligule of the uppermost leaf on the flowering stem, unless the contrary is stated. Information about starch-grains refers to those in the endosperm.

Descriptions and measurements of spikelets refer to those around the middle of a well-developed inflorescence, excluding those at the apex of a branch; descriptions and measurements of lemmas refer to the lowest lemma in such a spikelet, unless otherwise stated.

The following occasional abnormalities are not allowed for in the key: the branching of normally unbranched inflorescences and *vice versa*; the occurrence of spikelets with 1 floret in genera which normally have 2 or more florets and *vice versa*.

Some grasses produce late inflorescences, especially after mowing or grazing; these are often abnormal and may have proliferating spikelets and have not been allowed for in the key.

Literature: M. Kerguélen, *Lejeunia* nov. ser., **75**: 1–343 (1975) (nomenclature). C. R. Metcalfe, *Anatomy of the Monocotyledones. 1. Gramineae*. Oxford. 1960 (vegetative anatomy). T. Tateoka, *Bot. Mag. (Tokyo)* **75**: 377–383 (1962) (starch-grains in the endosperm).

1 Stems woody; leaves on main stems with reduced lamina; leaves on branches shortly petiolate, articulated with the sheath

2 Internodes each with a longitudinal groove, the grooves alternating at each node between the 2 sides of the stem; branches 2(–3) at each node **3. Phyllostachys**

2 Internodes without grooves, at least in lower part of stem; branches 1 or several at each node, rarely 2 or 3

3 Stems ascending; leaves mostly 50–70 mm wide; setae at mouth of sheath scabrid **1. Sasa**

3 Stems erect or arching; leaves mostly 7–40 mm wide; setae at mouth of sheath smooth **2. Arundinaria**

1 Stems usually herbaceous; most leaves on main stems with well-developed lamina; leaves not petiolate, not articulated with the sheath

4 Spikelets proliferating

5 Callus with hairs 1–2 mm **74. Deschampsia**

5 Callus glabrous or ± scabrid

6 Leaves setaceous; lemma not keeled **4. Festuca**

6 Leaves flat or plicate; lemma strongly keeled **16. Poa**

4 Spikelets not proliferating

7 Inflorescence of 1 terminal spikelet enclosed in a sheath; palea much longer than lemma **117. Lygeum**

7 Not as above

8 Dioecious, densely caespitose perennials

9 Leaves sharply serrulate **110. Cortaderia**

9 Leaves not serrulate **16. Poa**

8 Monoecious or florets hermaphrodite

10 Male and female spikelets in separate inflorescences or in separate parts of the same inflorescence

11 Male spikelets in a terminal panicle, the female on stout axillary axes enclosed in leaf-sheaths **155. Zea**

11 Male and female spikelets in different parts of the same inflorescence

12 Spikelets numerous, in a panicle with the male below and the female above **131. Zizania**

12 Spikelets few, the female enclosed in a bony involucre from which the stigmas protrude, the male in a terminal spike **154. Coix**

10 Male or sterile, and female or hermaphrodite spikelets in groups of 2–7 throughout the inflorescence, or spikelets all hermaphrodite

13 Spikelets strongly dimorphic, mostly in groups of 3–7 with 1 central hermaphrodite spikelet and 2–6 male or sterile spikelets surrounding it

14 Male or sterile spikelets persistent **28. Cynosurus**

14 Sterile and fertile spikelets falling in groups

15 Lemma of fertile spikelets awned **29. Lamarckia**

15 Lemma of fertile spikelets unawned **99. Phalaris**

13 Spikelets not strongly dimorphic, solitary or in pairs (rarely threes)

16 Spikelets in pairs (rarely threes), 1 sessile, hermaphrodite, 1(–2) pedicellate, male or sterile

17 Inflorescence a panicle with elongate central axis

18 Panicle-branches terminating in a raceme of many spikelets **146. Sorghum**

18 Panicle-branches terminating in a group of 1 sessile and 2 pedicellate spikelets **147. Chrysopogon**

17 Inflorescence of solitary, paired or subdigitate racemes, with the central axis much shorter than the racemes

19 Spikelets unawned

20 Racemes 20–35 cm **152. Phacelurus**

20 Racemes 4–10 cm **153. Hemarthria**

19 Spikelets awned

21 Racemes solitary or few; awns forming a twisted spire **151. Heteropogon**

21 Racemes paired or subdigitate; awns not forming a twisted spire

[1] Edit. T. G. Tutin.

22 Racemes 3–20, subdigitate **148. Dichanthium**
22 Racemes paired
23 Stem simple; racemes 4–14 cm **149. Andropogon**
23 Stem usually branched; racemes 2–4 cm **150. Hyparrhenia**
16 Spikelets not in groups of 2(–3) with 1 sessile and 1(–2) pedicellate
24 Upper glume with hooked spines on the veins **128. Tragus**
24 Upper glume without hooked spines on the veins
25 Inflorescence a single, terminal spike or raceme
26 Palea with 2–4 dorsal awns; spikelets usually pendent **43. Pleuropogon**
26 Palea unawned; spikelets erect or patent
27 Glumes longer than the florets
28 Spikelets in pairs at each node of the rhachis **51. Crithopsis**
28 Spikelets solitary at each node of the rhachis
29 Spikelets not embedded in concavities of the rhachis **34. Mibora**
29 Spikelets ±embedded in concavities of the rhachis, except at anthesis
30 Spikelets with 3 or more florets **5. Lolium**
30 Spikelets with 1 or 2 florets
31 Lateral spikelets with 1 glume **98. Hainardia**
31 Lateral spikelets with 2 glumes
32 Spikelets with 2 florets; rhachis not disarticulating at maturity; lateral veins of lemma extending to apex **96. Pholiurus**
32 Spikelets with 1 floret; rhachis disarticulating at maturity; lateral veins of lemma very short **97. Parapholis**
27 Glumes shorter than the florets
33 Lower glume very small, the upper absent; leaves setiform, patent at maturity; sheaths coriaceous, whitish, erect, persistent **116. Nardus**
33 One or both glumes conspicuous; leaves and sheaths not as above
34 Spikelets with the back of the lemma towards the rhachis
35 Some lemmas in each spikelet with a geniculate, dorsal awn
36 Perennial **62. Avenula**
36 Annual
37 Lowest lemma awned, as long as the 2nd lemma **66. Gaudinia**
37 Lowest lemma unawned, shorter than the 2nd lemma **67. Ventenata**
35 Awns, if present, not dorsal and geniculate
38 Perennial or biennial
39 Lateral spikelets with 1 glume **5. Lolium**
39 Lateral spikelets with 2 glumes
40 Glumes unequal **45. Brachypodium**
40 Glumes subequal **46. Festucopsis**
38 Annual
41 Spikelets ±embedded in concavities of the rhachis, except at anthesis
42 Spikelets with 1 fertile floret **33. Psilurus**
42 Spikelets with 4–5 fertile florets **11. Narduroides**
41 Spikelets not embedded in concavities of the rhachis
43 Inflorescence of 1–2(–6) spikelets
44 Rhachilla concealed by the florets; palea conspicuously pectinate-ciliate **45. Brachypodium**
44 Rhachilla easily visible between the florets; palea not conspicuously pectinate-ciliate **15. Vulpiella**
43 Inflorescence of numerous spikelets
45 Lemma densely tuberculate **10. Castellia**
45 Lemma not tuberculate
46 Lemma with an apical awn
47 Glumes subequal **9. Micropyrum**
47 Glumes very unequal
48 Grain adherent to palea; hilum at least ¾ as long as grain **6. Vulpia**
48 Grain ±free from palea; hilum less than ½ as long as grain **7. Ctenopsis**
46 Lemma unawned
49 Inflorescence pectinate; spikelets at an angle of 45°–90° to the rhachis after anthesis **8. Wangenheimia**
49 Inflorescence not pectinate; spikelets ±appressed to the rhachis after anthesis
50 Glumes unequal
51 Inflorescence *c.* 10 mm wide **23. Sclerochloa**
51 Inflorescence not more than 2 mm wide **66. Gaudinia**
50 Glumes subequal
52 Glumes ±strongly keeled; grain with punctiform hilum **12. Desmazeria**
52 Glumes not keeled; grain with linear hilum **9. Micropyrum**
34 Spikelets with the side of the lemma towards the rhachis
53 Spikelets in groups of 2–6 at each node of the rhachis
54 Spikelets with usually 3–5 hermaphrodite florets; rhachis tough
55 Spikelets in groups of 2–6 at each node of the rhachis; glumes narrowly lanceolate to subulate; awn of lemma not more than 3 mm **47. Leymus**
55 Spikelets in pairs at each node of the rhachis, at least in the middle part of the spike; glumes narrowly lanceolate; awn of lemma 15–20 mm **48. Elymus**
54 Spikelets with 1–2 hermaphrodite florets; rhachis often fragile
56 Spikelets in pairs at each node of the rhachis, with 2 florets, the lower hermaphrodite, the upper sterile **59. Taeniatherum**
56 Spikelets usually in groups of 3 at each node of the rhachis
57 Spikelets sessile, with 2–3 florets, the lower 1–2 hermaphrodite, the upper sterile; rhachis fragile **56. Psathyrostachys**
57 At least the lateral spikelets in each group pedicellate, with 2 florets, the lower usually hermaphrodite and the upper sterile
58 Central spike sessile, hermaphrodite, the lateral pedicellate, hermaphrodite, male or sterile; glumes not connate at base; rhachis fragile or tough **57. Hordeum**
58 All spikelets pedicellate, the central hermaphrodite or male, the lateral hermaphrodite; glumes connate at base; rhachis tough **58. Hordelymus**
53 Spikelets solitary at each node of the rhachis
59 Glumes subulate, with 0–1 vein
60 Spikelets with 5–7 florets; glumes covering the sides of the lower florets, weakly keeled; lemma not keeled, glabrous **47. Leymus**
60 Spikelets with 2 florets; glumes covering the backs of the florets, strongly keeled; lemma strongly keeled, with rigid, pectinate cilia on the keel **55. Secale**
59 Glumes not subulate, with several ±distinct veins
61 Glumes with 2 prominent keels bearing tufts of hair **54. Dasypyrum**

61 Glumes without 2 prominent keels bearing tufts of hair
62 Veins of lemma not confluent towards the apex
63 Glumes with 1 or more teeth or awns at apex, usually rounded on the back; rhachis fragile **52. Aegilops**
63 Glumes with 1 or 2 teeth at apex, with 1 prominent and sometimes a second weaker keel; rhachis fragile or tough **53. Triticum**
62 Veins of lemma confluent towards the apex
64 Glumes not navicular, without a prominent keel; spikelets appressed to rhachis **48. Elymus**
64 Glumes navicular, with a prominent keel; spikelets usually pectinate, diverging from the rhachis at a wide angle
65 Glumes not connate at base; rhachis tough; perennial **49. Agropyron**
65 Glumes connate at base; rhachis fragile or spike breaking off whole at maturity; annual **50. Eremopyrum**

25 Inflorescence not a single, terminal spike or raceme
66 Inflorescence of 2 or more spikes or racemes
67 Spikes or racemes ± digitately arranged on a short main axis
68 Ligule membranous
69 Racemes usually 2; spikelets solitary on the rhachis; upper floret with crustaceous lemma and exposed palea **138. Paspalum**
69 Racemes usually more than 2; spikelets usually in groups of 2 or more on short, appressed branches; upper floret with cartilaginous lemma enfolding the palea **137. Digitaria**
68 Ligule a row of hairs
70 Strongly rhizomatous perennial **126. Cynodon**
70 Annual or caespitose perennial
71 Lemma unawned, acute **124. Eleusine**
71 Lemma with a curved awn or mucro **125. Dactyloctenium**
67 Spikes or racemes not digitate, the main axis easily visible between them
72 Main axis flattened, 3–5 mm wide, with numerous very short racemes ± sunk in it **139. Stenotaphrum**
72 Main axis less than 3 mm wide; racemes free
73 Ligule a row of hairs
74 Leaves not more than 5 cm, rigid and patent **119. Aeluropus**
74 Leaves mostly more than 5 cm, not conspicuously rigid and patent **127. Spartina**
73 Ligule membranous or rarely absent
75 Leaves lanceolate **133. Oplismenus**
75 Leaves linear
76 Spikelets with a bead-like swelling at base **136. Eriochloa**
76 Spikelets without a bead-like swelling at base
77 Lower glume absent or obscure **138. Paspalum**
77 Lower glume distinct, usually well-developed
78 Glumes equal **27. Beckmannia**
78 Glumes unequal
79 Spikelets usually in 4 irregular rows, often awned **134. Echinochloa**
79 Spikelets in 2 regular rows, unawned **135. Brachiaria**
66 Inflorescence not composed of spikes or racemes, though sometimes condensed and spike-like
80 Lemma with 9 awns **118. Enneapogon**
80 Lemma with 0–3 awns
81 Inflorescence a dense, ovoid to globose head of sessile spikelets
82 Lemma unawned **38. Ammochloa**
82 Lemma with an often recurved awn **39. Echinaria**
81 Inflorescence not a dense head of sessile spikelets
83 Inflorescence a short, dense panicle, surrounded by an obconical, membranous, toothed involucre **95. Cornucopiae**
83 Inflorescence not surrounded by an obconical, membranous involucre
84 Spikelets subtended by an involucre of setae or spines
85 Setae persisting on the rhachis after the spikelets have fallen **140. Setaria**
85 Setae or spines falling with the spikelets
86 Setae free to the base, arising from a pubescent, linear pedicel **141. Pennisetum**
86 Setae or spines connate below, arising from a glabrous, obconical pedicel **142. Cenchrus**
84 Spikelets not subtended by an involucre of setae or spines
87 Spikelets with 1 hermaphrodite floret only, sometimes with the rhachilla prolonged, but without a sterile floret above or below the fertile floret
88 Glumes absent
89 Stems at least 30 cm **130. Leersia**
89 Stems not more than 15(–25) cm
90 Perennial; spikelets not in globose clusters **22. Phippsia**
90 Annual; spikelets in dense, globose clusters **100. Coleanthus**
88 Glumes present
91 Glumes linear, pectinate-ciliate **73. Lagurus**
91 Glumes not linear and pectinate-ciliate
92 Lemma strongly indurate and shiny when mature
93 Lemma unawned; spikelets dorsally compressed
94 Lemma glabrous **102. Milium**
94 Lemma with short, clavate hairs on the back **103. Zingeria**
93 Lemma awned; spikelets laterally compressed
95 Lemma glabrous; awn often caducous **104. Piptatherum**
95 Lemma hairy; awn persistent
96 Glumes (6–)10–80 mm; awn at least 1·5 cm **105. Stipa**
96 Glumes not more than 7 mm; awn not more than 1 cm **106. Achnatherum**
92 Lemma not strongly indurate when mature
97 Lemma unawned
98 Glumes shiny, swollen and coriaceous below **88. Gastridium**
98 Glumes not shiny, swollen and coriaceous below
99 Ligule a row of hairs
100 Perennial; rhachilla disarticulating above the glumes **122. Sporobolus**
100 Annual; rhachilla disarticulating below the glumes **123. Crypsis**
99 Ligule membranous
101 Glumes shorter than floret; lemma and palea chartaceous, purplish, scabrid
102 Inflorescence 4–13 cm; leaves 2–7 mm wide **25. Arctagrostis**
102 Inflorescence 1–4 cm; leaves not more than 2 mm wide **22. Phippsia**
101 Glumes longer than floret; lemma and palea membranous or scarious, hyaline, smooth

103 Rhachilla disarticulating above the persistent glumes **87. Agrostis**
103 Rhachilla disarticulating below the glumes, the spikelet falling entire **89. Polypogon**
97 Lemma awned
104 Awn with 3 branches arising near its base
105 Branches of awn not plumose **114. Aristida**
105 At least the central branch of the awn plumose **115. Stipagrostis**
104 Awn simple
106 At least 1 glume awned
107 Upper glume unawned **92. Chaetopogon**
107 Both glumes awned
108 Awns short, terminal **93. Phleum**
108 Awns long, dorsal **89. Polypogon**
106 Glumes unawned
109 Spikelets 12–14 mm **90. Ammophila**
109 Spikelets less than 10 mm
110 Glumes shiny, swollen and coriaceous below **88. Gastridium**
110 Glumes not shiny, swollen and coriaceous below
111 Lemma with a geniculate awn from near the base and 2 long apical setae **86. Triplachne**
111 Lemma without 2 long apical setae
112 Ligule a row of hairs **123. Crypsis**
112 Ligule membranous
113 Rhachilla disarticulating below the glumes, the spikelet falling entire; inflorescence usually dense, ovoid or cylindrical **94. Alopecurus**
113 Rhachilla disarticulating above the persistent glumes; inflorescence a ±lax panicle
114 Annual
115 Glumes with pectinately arranged hairs along the veins, ±prickly between the veins **69. Lophochloa**
115 Glumes glabrous, not prickly
116 Awn usually at least 4 mm; upper glume 3-veined; palea about as long as lemma **32. Apera**
116 Awn not more than 3 mm; upper glume usually 1-veined; palea much shorter than lemma **87. Agrostis**
114 Perennial
117 Callus with hairs more than ½ as long as lemma **91. Calamagrostis**
117 Callus glabrous or with hairs not more than ½ as long as lemma
118 Rhachilla prolonged beyond the floret **91. Calamagrostis**
118 Rhachilla not prolonged beyond the floret
119 Lemma membranous or scarious; leaves less than 10 mm wide **87. Agrostis**
119 Lemma herbaceous; leaves mostly 10–20 mm wide **31. Cinna**
87 Spikelets with 2 or more florets, sometimes some sterile
120 Ligule a row of hairs
121 Rhachilla, callus or lemma with conspicuous, long, silky hairs
122 Stems not more than 60 cm; sheaths tight **143. Tricholaena**
122 Stems at least 80 cm; sheaths loose
123 Lemma with long hairs; rhachilla glabrous **108. Arundo**
123 Lemma glabrous; rhachilla with long hairs **109. Phragmites**
121 Rhachilla and lemma without conspicuous, long, silky hairs
124 Spikelet with 2 florets, the lower male or sterile, the upper hermaphrodite **132. Panicum**
124 Spikelet with 2–many florets, the lowest hermaphrodite
125 Glumes up to 2(–2·8) mm **121. Eragrostis**
125 At least the larger glume 3 mm or more
126 Annual; inflorescence a small, dense panicle **112. Schismus**
126 Perennial; inflorescence a lax panicle
127 Lemma 7- to 9-veined, 2-dentate at apex **111. Danthonia**
127 Lemma 3-veined or apparently veinless
128 Flowering stems with only 1 node; glumes subequal **113. Molinia**
128 Flowering stems with several nodes; glumes unequal **120. Cleistogenes**
120 Ligule membranous
129 Lowest floret male or sterile
130 Glumes much shorter than the florets **129. Oryza**
130 At least the upper glume longer than the florets
131 Spikelets with 2 male or sterile florets and a single terminal hermaphrodite floret, the sterile florets often reduced to small lemmas
132 Inflorescence a lax panicle; lower florets male **81. Hierochloe**
132 Inflorescence a dense, often ovoid or cylindrical panicle; lower florets sterile
133 Lemmas unawned; plant not smelling of coumarin **99. Phalaris**
133 Lemmas awned; plant smelling of coumarin **82. Anthoxanthum**
131 Spikelets with the lowest floret male or sterile and the second floret hermaphrodite or female
134 Lower floret male, with a geniculate, dorsal awn **64. Arrhenatherum**
134 Lower floret sterile, reduced to a hyaline lemma
135 Inflorescence a dense, cylindrical panicle **144. Imperata**
135 Inflorescence a lax panicle **145. Saccharum**
129 Lowest floret hermaphrodite
136 Awn articulated near the middle, with a ring of short hairs at the joint, thickened towards apex **84. Corynephorus**
136 Awn, if present, not articulated near the middle, not thickened towards apex
137 Lemma orbicular to broadly ovate, cordate at base **35. Briza**
137 Lemma usually lanceolate to ovate, not cordate at base

138 Lemma densely tuberculate
10. Castellia
138 Lemma smooth, scabridulous or hairy, but not tuberculate
139 Lemma with an awn extending at least 2 mm beyond the apex of the spikelet
140 Annual
141 Glumes distinctly shorter than the spikelet and not enclosing the florets; awn usually terminal or from the sinus of the 2-dentate apex of the lemma, usually straight
142 Glumes subequal **9. Micropyrum**
142 Glumes very unequal
143 Lemma with 3 keels, at least in the lower part **15. Vulpiella**
143 Lemma rounded on the back or with 1 keel
144 Ovary and grain densely hairy at apex
145 Lemma awned from the sinus
44. Bromus
145 Lemma awned from the apex
6. Vulpia
144 Ovary and grain glabrous
146 Grain adherent to palea; hilum at least ¾ as long as grain **6. Vulpia**
146 Grain ±free from palea; hilum less than ½ as long as grain **7. Ctenopsis**
141 Glumes nearly as long as to longer than the florets and ±enclosing them; awn usually dorsal, often geniculate
147 Glumes awned **83. Holcus**
147 Glumes unawned
148 Spikelets 10 mm or more
149 Spikelets pendent **60. Avena**
149 Spikelets erect to erecto-patent
67. Ventenata
148 Spikelets not more than 9 mm
150 Rhachilla glabrous; callus hairy or glabrous
151 Spikelets with 2 florets; rhachilla not prolonged; lemma shortly 2-dentate at apex
76. Aira
151 Spikelets with 2 or more florets; rhachilla prolonged; lemma 2-dentate to 2-fid at apex
152 Lemma 2-fid at apex, the teeth aristate; palea 3- to 4-dentate at apex
72. Parvotrisetum
152 Lemma 2-dentate at apex, the teeth not aristate; palea 2-fid at apex
69. Lophochloa
150 Rhachilla and callus hairy
153 Both glumes 3-veined
71. Trisetaria
153 Lower glume 1-, the upper 3-veined
154 Lemma 2-dentate at apex, the teeth not aristate
69. Lophochloa
154 Lemma 2-fid at apex, the teeth aristate **70. Trisetum**
140 Perennial
155 Ovary and grain densely hairy at apex or with a hairy appendage
156 Lemma with a usually straight awn arising from apex or sinus
157 Lemma very deeply 2-dentate; lodicules 3, hairy
63. Danthoniastrum
157 Lemma shallowly 2(–5)-dentate; lodicules 2, glabrous
158 Inflorescence dense, spike-like; spikelets often bluish or silvery **36. Sesleria**
158 Inflorescence a panicle with easily visible branches; spikelets green or purplish
159 Awn at apex of lemma; ovary with a hairy apex
4. Festuca
159 Awn from or below the sinus of the 2-dentate apex of lemma; ovary with a hairy appendage **44. Bromus**
156 Lemma with a dorsal, usually geniculate awn
160 Leaves with 2 distinct lines of bulliform cells along the midvein on the upper surface
62. Avenula
160 Leaves without 2 distinct lines of bulliform cells along the midvein on the upper surface
161 Awn of the lowest floret arising from the lower ¼ of the lemma; leaves not ribbed on the upper surface; lowest floret usually male
64. Arrhenatherum
161 Awn of the lowest floret arising at or above the middle of the lemma; leaves distinctly ribbed on the upper surface; lowest floret hermaphrodite
162 Spikelets with 2–4 fertile florets, usually all awned; lemma glabrous; rhachilla disarticulating between the fertile florets **61. Helictotrichon**
162 Spikelets with 2 fertile florets, the upper without an awn; lemma hairy; rhachilla disarticulating above the glumes only
65. Pseudarrhenatherum
155 Ovary and grain glabrous or with a very few hairs at the apex
163 Glumes a little shorter to longer than the florets and ±enclosing them; lemma with a dorsal awn
164 Glumes shiny, a little shorter than the florets
74. Deschampsia
164 Glumes not shiny, longer than the florets **83. Holcus**
163 Glumes distinctly shorter than and not enclosing the florets; lemma usually with an apical awn or awned from the sinus or close below
165 Inflorescence with usually not more than 10 spikelets; lemma with 7–9 prominent veins
41. Schizachne

165 Inflorescence usually with more than 10 spikelets; lemma with 3–5 veins, or veins obscure
166 Non-flowering shoots strongly compressed; spikelets strongly compressed, densely clustered in a usually ±lobed panicle **26. Dactylis**
166 Non-flowering shoots ±terete; inflorescence usually a dense, ovoid or cylindrical panicle
167 Lemma usually obtuse, awned from the apex **68. Koeleria**
167 Lemma 2-fid, the teeth usually setose, awned from below the sinus **70. Trisetum**
139 Lemma unawned or with an awn extending less than 2 mm beyond the apex of the spikelet
168 Annual
169 Spikelets 10 mm or more, pendent **60. Avena**
169 Spikelets usually less than 10 mm, erect to patent
170 Spikelets subsessile, in racemes on the branches of a sparingly branched inflorescence
171 Lemma strongly veined in upper half **23. Sclerochloa**
171 Lemma obscurely veined
172 Glumes with a rounded hyaline apex **11. Narduroides**
172 Glumes with an acute herbaceous apex **9. Micropyrum**
170 Spikelets usually distinctly pedicellate, in a richly branched inflorescence
173 Spikelets with 2 florets
174 Lower 1–2 whorls of panicle-branches almost or entirely without spikelets **79. Periballia**
174 All whorls of panicle-branches with spikelets
175 Lemma 5- to 7-veined, 2-fid at apex
176 Glumes about as long as florets; lemma obscurely veined **76. Aira**
176 Glumes shorter than florets; lemma conspicuously veined **77. Molineriella**
175 Lemma ±obscurely 3-veined, 3-fid at apex
177 Panicle very lax; branches patent or deflexed **80. Antinoria**
177 Panicle rather dense; branches ±erect **78. Airopsis**
173 Some or all spikelets with more than 2 florets
178 Longest glume not more than 1 mm **14. Sphenopus**
178 Longest glume at least 2 mm
179 Panicle dense, usually ovoid or cylindrical **69. Lophochloa**
179 Panicle lax, with obvious branches
180 Panicle-branches stout, rigid
181 Panicle-branches not divaricate **12. Desmazeria**
181 Panicle-branches divaricate at maturity **13. Cutandia**
180 Panicle-branches slender, flexuous
182 Lemma awned **85. Avellinia**
182 Lemma unawned
183 Pedicels mostly shorter than spikelets **16. Poa**
183 Pedicels much longer than spikelets **18. Eremopoa**
168 Perennial
184 Ovary and grain densely hairy at apex
185 Lemma rounded on the back **4. Festuca**
185 Lemma distinctly keeled
186 Panicle spicate, dense, ovoid or cylindrical; spikelets usually bluish or silvery **36. Sesleria**
186 Panicle lax, with long branches; spikelets not bluish or silvery
187 Ovary and grain without an appendage; styles inserted apically **101. Scolochloa**
187 Ovary and grain with a hairy terminal appendage; styles inserted laterally
188 Stems solid; lemma villous on the back in the lower ½ **107. Ampelodesmos**
188 Stems hollow; lemma glabrous **44. Bromus**
184 Ovary and grain glabrous
189 Glumes almost as long as to longer than the florets
190 Sheaths closed to the mouth; 2–3 sterile lemmas forming an apical, clavate structure **40. Melica**
190 Sheaths open for most of their length; sterile lemmas, if present, not forming an apical, clavate structure
191 Glumes not or scarcely longer than the florets
192 Awn dorsal; lemma glabrous on back **74. Deschampsia**
192 Awn apical; lemma usually hairy on back in lower half **24. Dupontia**
191 Glumes about twice as long as the florets
193 Spikelets 1·5–2 mm **80. Antinoria**
193 Spikelets at least 4 mm
194 Panicle-branches flexuous, mostly patent or deflexed **75. Vahlodea**
194 Panicle-branches not flexuous, mostly erect to erecto-patent **83. Holcus**
189 Glumes much shorter than the spikelet, usually about as long as the lowest floret
195 Lemma with an awn
196 Callus with rigid hairs 0·3–0·5 mm; rhachilla with rigid hairs 0·4–0·6 mm at apex **17. Bellardiochloa**
196 Callus glabrous or subglabrous; rhachilla often ±hairy but without long, rigid hairs at apex
197 Non-flowering shoots very strongly compressed; lemma strongly keeled **26. Dactylis**

197 Non-flowering shoots terete; lemma rounded or weakly keeled on back **4. Festuca**
195 Lemma without an awn
198 Glumes 1-veined; lemma with 7–9 prominent, ±parallel veins **42. Glyceria**
198 At least the upper glume 3-veined, the lateral veins sometimes short; lemma with not more than 5, often obscure veins
199 Inflorescence a dense, raceme-like panicle 5–15 mm, with distichously arranged spikelets on short branches **37. Oreochloa**
199 Inflorescence not a dense, raceme-like panicle with distichously arranged spikelets
200 Callus with rigid hairs 0·3–1·2 mm
201 Panicle-branches aculeolate; leaves setiform, 0·3–0·8 mm in diameter **17. Bellardiochloa**
201 Panicle-branches smooth and glabrous; leaves usually flat, 2–10 mm wide **20. Arctophila**
200 Callus glabrous or with very short or soft, flexuous hairs
202 Lemma 3-veined
203 Panicle cylindrical to ovoid, the branches densely puberulent; lemma with obscure veins **68. Koeleria**
203 Panicle diffuse, the branches glabrous; lemma with prominent veins **30. Catabrosa**
202 Lemma 5-veined
204 Lemma rounded on the back or weakly keeled near apex
205 Lemma 1·4–4·2 mm, usually hairy near the base, obtuse or acute; grain with a sub-basal punctiform hilum, without a ventral furrow **21. Puccinellia**
205 Lemma 2·5–7 mm, usually glabrous, acuminate; grain with a long, linear hilum and ventral furrow **4. Festuca**
204 Lemma strongly keeled throughout its length
206 Non-flowering shoots very strongly compressed **26. Dactylis**
206 Non-flowering shoots terete
207 Panicle-branches aculeolate; lemma mostly herbaceous **16. Poa**
207 Panicle-branches smooth
208 Stems bulbous at base; lemma with the distal half membranous **19. Catabrosella**
208 Stems not bulbous at base; lemma mostly herbaceous **16. Poa**

Tribe **Arundinarieae** Steudel

Woody, often monocarpic perennials. Stems hollow; internodes terete or flattened and grooved on alternate sides. Leaves flat, linear to oblong-lanceolate, often with a petiole-like base, those on the main stems (*stem-sheaths*) with lamina reduced or absent; sheaths often with bristles at the mouth (*oral setae*). Spikelets all similar, with 1-many florets. Glumes 2, sometimes more. Lemmas similar to the glumes but longer, unawned or with a short terminal awn, 5- to many-veined. Palea usually 2-keeled. Lodicules usually 3. Stamens 3–6; filaments sometimes connate. Styles 2–3; fruit a caryopsis.

Numerous species of this tribe, mostly from China, Japan and the Himalayan region, are cultivated in S. & W. Europe for ornament and for use as canes in horticulture etc. Many of these with long rhizomes show a tendency to spread in semi-natural vegetation, and to persist long after the garden or park in which they have been planted is abandoned, but it is very difficult to decide which should be regarded as fully naturalized; moreover, partly for this reason and partly on account of difficulties in identification, references in the literature are scanty. The species described below are known to have spread freely into natural vegetation, at least in Britain or Ireland; there are probably others whose naturalization elsewhere has not come to our notice.

Flowering in Europe occurs rarely in most species; attention, therefore, has been given mainly to vegetative characters in the descriptions.

Literature: C. E. Hubbard in P. M. Synge (ed.), *Supplement to the Dictionary of Gardening* ed. 2. Oxford. 1969. A. H. Lawson, *Bamboos*. London. 1968.

1. **Sasa** Makino & Shibata[1]

Rhizomes far-creeping. Stems ascending, fairly slender, terete, somewhat pruinose below the nodes; stem-sheaths persistent, glabrous. Branches 1 at each node. Leaves broadly lanceolate or oblong, relatively large; oral setae scabrid. Spikelets with several florets. Stamens 6.

1. S. palmata (Burbidge) E. G. Camus, *Bambus*. 25 (1913). Stems up to 2(–3) m × 12 mm. Leaves 15–30(–40) cm × 50–70 (–95) mm, broadly lanceolate, acuminate, shining green above, paler beneath, with (7–)10–13(–16) veins on each side of the midrib. *Widely naturalized in Britain, Ireland and the Channel Islands.* [Br Ga Hb.] (*Japan, Sakhalin.*)

S. veitchii (Carrière) Rehder, *Jour. Arnold Arb.* **1**: 58 (1919), from S. Japan, is frequently cultivated, but less fully naturalized. It has stems not more than 1·2 m, leaves not more than 25 cm × 60 mm, greyish-green and usually with withered, whitish margins, more abruptly tapered to the apex, and with only 6–9 veins on each side of the midrib.

2. **Arundinaria** Michx[1]

Rhizomes far-creeping or short; stems erect or arching, terete; sheaths persistent or deciduous. Branches 1 or several at each

[1] By D. McClintock and J. do Amaral Franco.

node. Leaves linear-lanceolate to narrowly oblong; oral setae smooth. Spikelets with 2–many florets. Stamens 3(–4).

The genus is here maintained in a comprehensive sense, as the limits of the segregate genera which have been established in this century by Japanese botanists do not seem to be generally agreed. These segregate names are, however, indicated in synonymy.

The information on the number of branches at each node refers to mature stems; on younger stems they may be fewer.

1 Stem-sheaths deciduous; branches several at each node
2 Rhizomes far-creeping; stems not more than 15 mm in diameter, the older ones arching **1. anceps**
2 Rhizomes short; stems up to 40 mm in diameter, all stiffly erect **2. fastuosa**
1 Stem-sheaths persistent
3 Branches several at each node; leaves ± glaucous on half of lower surface **4. simonii**
3 Branches single at each node
4 Rhizomes usually very short; stems up to 7 m; leaves ± glaucous on most of lower surface **3. japonica**
4 Rhizomes far-creeping; stems not more than 1·25 m; leaves concolorous beneath **5. vagans**

1. A. anceps Mitf., *Bamboo Garden* 181 (1896). Rhizomes far-creeping. Stems up to 4 m × 15 mm, greenish or brownish, the older ones arching. Stem-sheaths deciduous. Branches numerous at each node. Leaves (5–)7–10(–15) cm × (4–)7–8(–18) mm, linear-lanceolate, with 2–4(–6) veins on each side of the midrib; lower surface pale, concolorous. *Locally naturalized in Britain and the Channel Islands.* [Br Ga.] (*W. Himalaya.*)

2. A. fastuosa (Latour-Marliac ex Mitf.) Lehaie, *Bambou* (*Mons*) **2**: 215 (1907) (*Semiarundinaria fastuosa* (Latour-Marliac ex Mitf.) Makino). Rhizomes shortly creeping. Stems up to 8 m × 40 mm, stiffly erect, very thin-walled, usually terete, but sometimes unilaterally flattened on upper internodes. Stem-sheaths deciduous (rarely over-wintering in a partly decayed condition). Branches several at each node, short, erect, crowded. Leaves 10–20 cm × 15–20(–30) mm, narrowly oblong or lanceolate, long-acuminate, glabrous, with 4–8(–10) pairs of veins on each side of the midrib; lower surface dull green, concolorous. *Locally naturalized in Britain and Ireland.* [Br Hb.] (*C. & S. Japan.*)

3. A. japonica Siebold & Zucc. ex Steudel, *Syn.*[1] *Pl. Glum.* **1**: 334 (1855) (*Sasa japonica* (Siebold & Zucc. ex Steudel) Makino, *Pseudosasa japonica* (Siebold & Zucc. ex Steudel) Makino). Rhizomes usually very short. Stems up to 7 m × 20 mm, erect, thin-walled, leafless and without branches below; upper nodes each with a single branch. Stem-sheaths long-persistent, rough. Leaves 8–33 cm × (10–)20–40(–55) mm, narrowly lanceolate, long-acuminate, glabrous, with 4–8(–10) veins on each side of midrib; lower surface ¼ green, ¾ more or less glaucous. Oral setae often absent. *Frequently naturalized in W. Europe.* [?Az Br Ga Hb.] (*Japan, Korea.*)

4. A. simonii (Carrière) A. & C. Rivière, *Bambous* 286 (1878) (*Pleioblastus simonii* (Carrière) Nakai. Rhizomes creeping. Stems up to 7 m × 20 mm, the older ones arching. Stem-sheaths persistent. Branches several at each node. Leaves 5–30 cm × (5–)15–35 mm, narrowly lanceolate, with 4–6(–9) veins on each side of the midrib; lower surface ½ green, ½ more or less glaucous. *Locally naturalized in Britain.* [Br.] (*China and Japan.*)

5. A. vagans Gamble, *Kew Bull.* **1915**: 350 (1915). Rhizomes far-creeping. Stems up to 1·25 m × 5 mm, slightly zig-zag. Stem-sheaths persistent. Branches 1 at each node. Leaves 12–20 cm × (5–)10–25(–30) mm, narrowly lanceolate, sparsely hairy above, pubescent beneath, with (3–)5–6 veins on each side of the midrib; lower surface concolorous. *Locally naturalized in Britain.* [Br.] (*Origin unknown.*)

[1] By J. do Amaral Franco.

3. Phyllostachys Siebold & Zucc.[2]

Stems erect; internodes unilaterally flattened and grooved, the groove alternating at each node between the two sides of the stem. Stem-sheaths deciduous. Branches 2 at each node, unequal, patent; sometimes a very small third branch present. Leaves narrowly oblong-lanceolate, relatively small, serrulate on one margin, green above, glaucous beneath. Spikelets with few florets. Stamens 3.

A taxonomically difficult genus, of which several species, all from China, are widely cultivated, especially in the W. Mediterranean region. For none of them is there clear evidence of thorough naturalization, but a few can be met with in semi-natural vegetation in neglected parks and similar situations. Of these, the following appear to be the most widespread.

P. nigra (Loddiges) Munro, *Trans. Linn. Soc. London* **26**: 38 (1868). Stems up to 8 m, purplish-black when mature. Leaves 9–15 mm wide.

P. bambusoides Siebold & Zucc., *Abh. Akad. Wiss.* (*München*) **3**: 746 (1843) (incl. *P. quilioi* A. & C. Rivière). Rhizomes short. Stems up to 12(–20) m × 70(–125) mm, green, with basal internodes not conspicuously shorter than those above. Stem-sheaths concolorous, or spotted with purple. Leaves 8–32 mm wide.

P. aurea (Carrière) A. & C. Rivière, *Bull. Soc. Acclim.* (*Paris*) ser. 3, **5**: 716 (1878). Like *P. bambusoides* but stems pale yellowish-green, with one or more basal internodes much shorter than those above, and with leaves 6–22 mm wide.

P. viridiglaucescens (Carrière) A. & C. Rivière, *Bambous* 245 (1878). Rhizomes far-creeping. Stems not more than 6 m, very thin-walled, yellowish-green. Stem-sheaths longitudinally striped with purple. Leaves 8–20 mm wide.

Tribe Poeae

Leaves linear, flat, plicate or convolute; silica-bodies rounded or oblong; 2-celled micro-hairs absent; ligule membranous. Inflorescence a panicle, rarely a spike or raceme. Spikelets all hermaphrodite or rarely some sterile, laterally compressed or terete, with (1–)2–many florets. Rhachilla usually disarticulating above the glumes and between the florets. Glumes shorter than the spikelet. Lemma herbaceous, unawned or with a terminal awn, with (3–)5–13 veins, usually keeled. Palea 2-keeled. Lodicules 2, entire or lobed. Stamens 3, rarely 2 or 1. Ovary glabrous or hairy at apex; styles 2. Grain with punctiform or linear hilum; starch-grains compound. Chromosomes large; basic number 7, very rarely 5, 6 or 11.

4. Festuca L.[2]

Caespitose or rhizomatous perennials. Leaves plicate, involute, or flat; sheaths open or closed. Inflorescence a panicle. Spikelets pedicellate, with (2–)4–several florets, laterally compressed. Glumes 2, the lower usually 1-veined, the upper wider, usually 3-veined. Lemma with rounded back, not carinate, with or without a terminal or subterminal awn. Palea with 2 keels, scarious. Ovary oblong or obovoid; grain obovoid-oblong, ventrally sulcate, free or adnate to palea and lemma; hilum

[2] By I. Markgraf-Dannenberg.

linear, about as long as the grain, rarely elliptical and half as long.

In the following account the width of plicate leaves indicates the transverse measurement in cross-section, and the length of a spikelet is measured from the base of the lower glume to the apex of the fourth lemma (excluding the awn).

Plants with proliferating spikelets occur particularly among species related to *F. ovina*, e.g. **107** and **148**, but are also found in **67**, **68**, **87** and **90** and in many hybrids. Such plants occur mostly on high mountains and in the north; in identifying them reliance has to be placed mainly on vegetative characters and they are not accounted for in the key, except for *F. vivipara*, which always has proliferating spikelets.

Literature: B. Achtarov, *Izv. Bot. Inst.* (*Sofia*) **3**: 3–89 (1953). E. Alexeev, *Nov. Syst. Pl. Vasc.* (*Leningrad*) **12**: 11–43 (1975). P. Auquier, *Biosystématique, Taxonomie et Nomenclature du groupe de* Festuca ovina L., s.l. (Poaceae) *en Belgique et dans quelques Régions voisines*. Thesis, Univ. Liège. 1973–1974. M. Bidault, *Essai de Taxonomie expérimentale et numérique sur* Festuca ovina L., s.l. *dans le sud-est de la France*. Thesis, Univ. Paris, Fac. Sci. Orsay. 1967; *Rev. Cytol. Biol. Végét.* **31**: 217–356 (1968). E. Hackel, *Monographia Festucarum europaearum*. Kassel & Berlin. 1882. W. O. Howarth, *Rep. Bot. Exch. Club Brit. Is.* **13**: 338–346 (1948). A. Huon, *Les Fétuques de l'Ouest de la France, recherche de Biosystématique et de Biogéographie. Botanica Rhedonica* sér. A, no. 9: 7–298. Thesis, Univ. Rennes. 1970. M. Kerguélen, *Lejeunia* nov. ser., **75**: 9–16, 32–44, 145–182 (1975). V. Krajina, *Acta Bot. Bohem.* **9**: 184–220 (1930); *Spisy Vydáv. Přír. Fak. Karlovy Univ.* **106**: 1–44 (1930). R. de Litardière, *Bull. Soc. Bot. Belg.* **55**: 92–133, 149–154 (1923); *Condollea* **10**: 103–146 (1945); *Agron. Lusit.* **14**: 31–51 (1952). I. Markgraf-Dannenberg, *Ber. Bayer. Bot. Ges.* **28**: 195–211 (1950); *Veröff. Geobot. Inst. Rübel* (*Zürich*) **25**: 114–142 (1952); **56**: 92–176 (1976); Festuca, *Schlüssel der Schweizer Arten. Kartierung der Schweizer Flora, Bestimmungsschlüssel zu kritischen Sippen*. Bern. 1967. E. I. & A. Nyárády, *Studii Cerc. Biol.* (*Ser. Bot.*) **16**: 105–172 (1964). E. Patzke, *Österr. Bot. Zeitschr.* **108**: 505–507 (1961). S. Rauschert, *Feddes Repert.* **63**: 251–283 (1960). A. St-Yves, *Annu. Cons. Jard. Bot. Genève* **17**: 1–218 (1913); *Tentamen Clavis analyticae Festucarum veteris Orbis* (*Subgen.* Eu-Festucarum). Rennes. 1927; *Candollea* **3**: 321–466 (1928). R. de Soó, *Acta Bot. Acad. Sci. Hung.* **18**: 363–377 (1973). G. Stohr, *Wiss. Zeitschr. Univ. Halle* **9**: 393–414 (1960). N. N. Tzvelev, *Nov. Syst. Pl. Vasc.* (*Leningrad*) **9**: 15–46 (1972).

1 Stem with swollen tuberous base; ovary with rigid hairs
2 Sheaths thin, without fibres or ribs; stem 2·5–3 mm in diameter, the thickened base less than 10 mm in diameter; leaves flat; panicle-branches very slender, flexuous **1. triflora**
2 Sheaths thick, ribbed or breaking down into longitudinal fibres; stem 1–2 mm in diameter, the thickened base 10–20 mm in diameter; leaves convolute or plicate at least in part; panicle-branches stout, not flexuous
3 Leaves plicate throughout, with 3 low ribs above; lower glume 3-veined; lemma ovate, obscurely veined **4. durandii**
3 Leaves not plicate throughout, with numerous prominent ribs above; lower glume 1-veined; lemma lanceolate, strongly veined
4 Sheaths soon decaying into fibres; leaves plicate only near base; panicle linear; lemma *c.* 2 mm wide **2. coerulescens**
4 Sheaths tardily or not decaying into fibres, longitudinally ribbed; leaves plicate to the middle; panicle ovate to oblong; lemma at least 2·9 mm wide **3. paniculata**
1 Stem without swollen tuberous base; ovary glabrous, scabrid or with short, soft hairs, very rarely with long, rigid hairs
5 Ovary with long, rigid hairs **5. spectabilis**
5 Ovary without long, rigid hairs
6 Wider leaves at least 5 mm wide, flat or canaliculate, convolute in bud
7 Mouth of sheath without auricles; ligule short but distinct; lemma soft; ovary scabrid
8 Densely caespitose, not rhizomatous; lemma with 3(–5) veins, acute **6. altissima**
8 Laxly caespitose, rhizomatous; lemma with 5 veins, obtuse or rounded-subacute **7. drymeja**
7 Mouth of sheath with auricles; ligule usually a minute rim; lemma hard; ovary glabrous or with few long hairs
9 Leaves up to 18 mm wide, flaccid, glossy beneath, flat, not canaliculate; panicle-branches very long, nodding; awn at least 10 mm **8. gigantea**
9 Leaves 3–10 mm wide, not flaccid, not glossy beneath, canaliculate; panicle-branches not nodding; awn not more than 4 mm
10 Leaves almost smooth above; auricles glabrous; panicle-branches 2 at the lowest node, one with 1–3, the other with 4–6 spikelets **9. pratensis**
10 Leaves distinctly ribbed above; auricles ciliate; panicle-branches 2–3 at the lowest node, each with 5–15 spikelets **10. arundinacea**
6 All leaves less than 5 mm wide, usually plicate
11 Ovary obovoid; grain usually free from palea
12 Grain adnate to palea **15. scariosa**
12 Grain free from palea
13 Non-flowering shoots extravaginal; rhizomatous; outer basal leaves without lamina
14 Stolons medium to long; panicle-branches filiform
15 Leaves with 13–15 veins; ligules of cauline leaves not auriculate **13. calabrica**
15 Leaves with 7 veins; ligules of cauline leaves auriculate
16 Panicle rather lax; spikelets dirty green; upper glume less than 6 mm **11. laxa**
16 Panicle dense, narrow, except at anthesis; spikelets yellow-green; upper glume more than 7 mm **12. dimorpha**
14 Stolons very short; panicle-branches usually not filiform
17 Ligule 2–6 mm, lacerate; leaves plicate
18 Outer basal leaves without lamina; ligule 2–3 mm; leaves smooth, angular in transverse section, glabrous or nearly so on inner surface; lemma 3-veined **14. pseudeskia**
18 Outer basal leaves with lamina; ligule 4–6 mm; leaves scabrid, terete, with short conical hairs on inner surface; lemma 5-veined **15. scariosa**
17 Ligule a short rim, or absent; leaves flat or rarely slightly convolute
19 Densely caespitose and with long stolons; ligule a ciliate rim; sheaths open almost to base; panicle-branches patent only at anthesis **16. carpatica**
19 Laxly caespitose, with short stolons; ligule absent; sheaths open only above the middle; panicle-branches always patent **17. pulchella**
13 Non-flowering shoots intravaginal; rhizomes absent; outer basal leaves with lamina
20 Ligule 2–5(–7) mm, translucent, acute
21 Sheaths corrugated, forming a thick base to the non-flowering shoots; anthers more than ½ as long as palea **21. burnatii**
21 Sheaths smooth and thin; anthers *c.* ½ as long as palea
22 Leaves with 9–11(–13) veins; sclerenchyma present on upper surface of leaves; spikelets 9–10 mm **18. eskia**
22 Leaves with 5–9 veins; sclerenchyma absent on upper surface of leaves; spikelets 6–9 mm
23 Leaves 0·6–0·9 mm wide; veins 7–9, 5–7 projecting as low ribs; upper glume subobtuse; ovary very densely hispid **19. alpestris**

23 Leaves 0·4–0·5 mm wide; veins 5, 1 projecting as a rib, rarely with 1–2 indistinct lateral ribs; upper glume acute; ovary glabrous or almost so **20. elegans**

20 Ligule usually not more than 1 mm, opaque, truncate or rounded

24 Stems 65–105 cm × 1·3–4 mm; ligule truncate; panicle 9–13 cm **22. valida**

24 Stems not more than 80 cm × 1·8 mm; ligule rounded; panicle usually less than 9 cm

25 Leaves 0·3–0·7(–0·8) mm wide, with 5–7 veins

26 Stems (6–)10–20(–37) cm; spikelets 7–9(–10) mm; upper glume 4·5–5·5 mm

27 Upper glume oblong-lanceolate, with narrow scarious margin; keels of the palea ciliolate; anthers $\frac{1}{4}$–$\frac{1}{3}$ as long as palea **26. sardoa**

27 Upper glume ovate-lanceolate, with wide scarious margin; keels of palea long-ciliate; anthers $\frac{1}{2}$ as long as palea **27. quadriflora**

26 Stems 30–55 cm; spikelets 9–14·5 mm; upper glume 3·9–6·1 mm

28 Leaves pungent; panicle dense; palea scabrid only towards apex **23. gautieri**

28 Leaves not or scarcely pungent; panicle lax; palea scabrid in upper $\frac{1}{2}$

29 Lowest leaves $\frac{1}{40}$–$\frac{1}{70}$ as long as upper, rather flaccid, with 5 veins; ligule 0·5–1(–1·5) mm; spikelets bright yellow **24. flavescens**

29 Lowest leaves $\frac{1}{10}$–$\frac{1}{6}$ as long as upper, rather rigid, with 7 veins; ligule 0·8–1·7(–2) mm; spikelets green, variegated with violet **25. scabriculmis**

25 Leaves more than 0·7 mm wide, with 7–9, rarely more veins

30 Sclerenchyma absent from ribs on upper surface of leaves

31 Lowest leaves usually $\frac{1}{4}$–$\frac{1}{3}$ as long as the upper **28. versicolor**

31 Lowest leaves usually less than $\frac{1}{4}$ as long as the upper

32 Lemma lanceolate, long-acuminate; palea slightly scabrid above, with minutely ciliolate keels **29. acuminata**

32 Lemma broadly ovate-lanceolate, shortly acuminate; palea scabrid all over, with distinctly ciliate keels **30. varia**

30 Sclerenchyma present in the ribs on upper surface of some or all the leaves

33 Sclerenchyma present in the ribs on the upper surface of all leaves

34 Panicle-branches hairy

35 Leaf 0·4–0·85(–1) mm wide; upper glume rounded; palea $\frac{3}{4}$ as long as lemma, shortly tomentose **40. adamovicii**

35 Leaf 0·5–1·1 mm wide; upper glume acuminate; palea as long as lemma, scabrid **41. galicicae**

34 Panicle-branches glabrous, rarely sparsely hairy, often scabrid

36 Ligule densely setulose; panicle nodding; palea setulose over whole surface **36. pindica**

36 Ligule glabrous; panicle erect; palea shortly hairy in upper part **39. cyllenica**

33 Sclerenchyma present in the ribs on the upper surface of some leaves, absent in others on the same plant

37 Lemma ovate, shortly acuminate or obtuse; awn not more than 0·5 mm

38 Leaves rigid, pungent, 0·4–0·95 mm wide, the lowest $\frac{1}{25}$–$\frac{1}{8}$ as long as the uppermost; ligule 0·6–1·2(–1·5) mm; spikelets 9–10·5 mm **31. calva**

38 Leaves flaccid, not pungent, 0·4–0·75 mm wide, the lowest $\frac{1}{10}$–$\frac{1}{3}$ as long as the uppermost; ligule 0·9–1·6 mm; spikelets 9–14 mm

39 Leaves with not more than 7 veins and 3–5 ribs; upper glume 5·6 × 2 mm; lemma 6·5–7·5 × 2·5–3·4 mm, unawned, sometimes mucronate; palea scabrid only in upper part **32. xanthina**

39 Leaves with 7–9 veins and 5–7 ribs; upper glume 4·6 × 1·7 mm; lemma 5·3–6·3 × 2·3 mm; awn 0–0·3 mm; palea scabrid all over **33. balcanica**

37 Lemma lanceolate, long-acuminate; awn usually more than 0·5 mm

40 Leaves with 7–9 veins; ribs often without sclerenchyma **37. graeca**

40 Leaves with 7–13 veins; ribs usually with sclerenchyma

41 Panicle erect, the branches puberulent **35. penzesii**

41 Panicle nodding, the branches scabrid

42 Leaves pungent; ribs usually with sclerenchyma; awn *c.* $\frac{1}{2}$ as long as lemma **34. bosniaca**

42 Leaves scarcely pungent; ribs often without sclerenchyma; awn not more than $\frac{1}{8}$ as long as lemma **38. rechingeri**

11 Ovary ellipsoid or oblong; grain adnate to palea

43 Rhachilla visible between the florets at anthesis; ribs of leaves with inflated epidermal cells

44 Leaves flat, at least when fresh, with (5–)7 ribs; sheaths closed, decaying into longitudinal fibres

45 Leaves not more than 5 cm × 0·5 mm; lemma 7 mm, with awn not more than 1·5 mm **45. morisiana**

45 Leaves up to 22 cm × 2·5 mm; lemma 4–6 mm, with awn 2·5–4 mm **46. henriquesii**

44 Leaves plicate (rarely the cauline flat), with 3–5(–7) ribs; sheaths open to base, not decaying into longitudinal fibres

46 Stems up to 90 cm; leaves 7-veined; glumes shortly acuminate (Portugal and Spain) **42. ampla**

46 Stems not more than 60 cm; leaves 5(–7)-veined; glumes very long-acuminate (Açores)

47 Panicle-branches densely pubescent; spikelets 6–7 mm; lemma mucronate **43. petraea**

47 Panicle-branches scabrid; spikelets 9–10 mm; lemma awned **44. jubata**

43 Rhachilla hidden by the florets at anthesis; ribs of leaves with epidermal cells of normal size

48 Free part of margins of sheaths infolded; leaves with sclerenchyma-strands some of which are contiguous

49 Panicle linear; upper glume narrowly lanceolate

50 Sheaths closed almost to mouth, with infolded margin of 2 rows of cells; veins 7–8; ribs 5–6; panicle-branches scabrid **47. queriana**

50 Sheaths closed for $\frac{1}{2}$–$\frac{3}{4}$ of their length, with infolded margin of 1 row of cells; veins 5–7; ribs 1-3(–5); panicle-branches shortly hairy **48. capillifolia**

49 Panicle ovate-oblong; upper glume usually ovate or ovate-lanceolate

51 Leaves of non-flowering shoots plicate, the cauline flat; upper glume obtuse to very shortly acuminate

52 Leaves scabrid near apex, with 13 veins; lemma *c.* 6·2 mm, lanceolate, rather long-acuminate **49. porcii**

52 Leaves smooth, with 5–9(–13) veins; lemma 4·2–4·6 mm, ovate-lanceolate, shortly acuminate **50. tatrae**

51 All leaves plicate; upper glume acuminate

53 Stems 30–105 cm; panicle 6–22 cm; awn not more than 1·2 mm **55. amethystina**

53 Stems 10–55(–68) cm; panicle less than 5(–10) cm; awn at least 1·5 mm

54 Stems 22–68 cm × 1·4 mm; upper glume 5·8–6 × 1·4–1·7 mm, oblong-lanceolate, long-acuminate **54. norica**

54 Stems 10–55 cm × 0·7–1·2 mm; upper glume 3·4–5 × 1·3–2 mm, ovate-lanceolate, shortly acuminate
55 Leaves pungent; ribs 5; anthers less than half as long as palea **53. borderi**
55 Leaves scarcely pungent; ribs 3; anthers more than half as long as palea
56 Stems 30–55 cm; panicle 7–9 mm, the branches glabrous or shortly hairy; awn 3–4 mm **51. peristerea**
56 Stems (10–)15–30(–40) cm; panicle 3·5–6 cm, the branches long-tomentose; awn not more than 2·7 mm **52. korabensis**
48 Free part of margins of sheaths not infolded; leaves without contiguous sclerenchyma-strands
57 Ligule a narrow rim, without auricles; sclerenchyma-strands 5–9; non-flowering shoots usually extravaginal
58 Sheaths not decaying into fibres; veins 5–7; non-flowering shoots intra- and extravaginal
59 Anthers $\frac{1}{7}$–$\frac{1}{6}$ as long as palea, subglobose **64. baffinensis**
59 Anthers mostly more than $\frac{1}{2}$ as long as palea, ellipsoid
60 Basal leaves with 3 veins and 1 rib
61 Upper leaves 7- to 11-veined, flat when fresh; panicle 6–17 cm, lax **56. heterophylla**
61 Leaves all similar, plicate, 3-veined; panicle 2–4 cm, dense **57. plicata**
60 All leaves with more than 3 veins and with 3–5(–7) ribs
62 Leaves with 5–7(–9) veins; upper glume ovate, rarely ovate-lanceolate, obtuse or very shortly acuminate
63 Stems not more than 22 cm; leaves acute; sheaths thick, corrugated; panicle-branches sparsely hairy; spikelets 5·6–6 mm **62. clementei**
63 Stems up to 45 cm; leaves obtuse; sheaths thin, smooth; panicle-branches shortly tomentose; spikelets 6·3–8 mm **63. picta**
62 Leaves always with 5 veins; upper glume lanceolate, long-acuminate
64 Leaves usually not more than 0·4 mm in diameter, with narrow sclerenchyma-strands, that of the midrib not more than 10 cells wide
65 Panicle-branches glabrous or shortly hairy; ovary sparsely hairy, rarely glabrous **58. violacea**
65 Panicle-branches densely tomentose; ovary densely hairy **59. nitida**
64 Leaves up to 0·7 mm in diameter, with wider sclerenchyma-strands, that of the midrib more than 10 cells wide
66 Panicle 3–7 cm; branches glabrous or with few minute hairs; spikelets not more than 8 mm, pale violet; awn 1·3–2·7 mm **60. iberica**
66 Panicle 6–9 cm; branches hairy; spikelets (7·8–)8–10 mm, blackish-violet; awn 2–4·7 mm **61. puccinellii**
58 Sheaths usually decaying into fibres; veins 5–9(–13); non-flowering shoots extravaginal
67 Plant densely caespitose; stolons absent or very short; awn at least $\frac{1}{2}$ as long as lemma **65. nigrescens**
67 Plant ± laxly caespitose; stolons often present; awn not more than $\frac{1}{2}$ as long as lemma
68 Sheaths not or scarcely decaying into fibres; leaves stout and rigid, acute or subacute, usually with bulliform cells
69 Leaves with 5 very stout sclerenchyma-strands and sometimes 1 very slender intermediate strand; sheaths densely puberulent **78. cretacea**
69 Leaves with 3 very stout sclerenchyma-strands alternating with 4 smaller strands; sheaths glabrous or scabrid
70 Leaves 0·65–0·85 mm wide, without sclerenchyma in the ribs; sheaths glabrous; panicle very lax and wide **76. rothmaleri**
70 Leaves 0·5–1·4 mm wide, with sclerenchyma in the ribs; sheaths densely pubescent; panicle rather rigid and narrow, except at anthesis **77. nevadensis**
68 Sheaths usually decaying into fibres; leaves soft or slightly rigid, obtuse or acute, with or without bulliform cells
71 Basal leaves often flat, distinctly carinate, with bulliform cells; spikelets with at least 8 florets
72 Sheaths densely hairy; panicle very lax; epidermal cells subequal **74. diffusa**
72 Sheaths glabrous; panicle very narrow, except at anthesis; epidermal cells very unequal **75. rivularis**
71 Basal leaves usually plicate, rounded or weakly carinate on back, without bulliform cells; spikelets rarely with more than 6 florets
73 Leaves junciform, acute, with 7–11 veins and usually confluent sclerenchyma-strands
74 Densely caespitose, with short stolons; ribs usually without sclerenchyma; panicle dense; leaves with 7(–9) veins **72. oelandica**
74 Weakly caespitose, with long stolons; ribs with sclerenchyma; panicle very lax; leaves with 7–9(–11) veins **73. juncifolia**
73 Leaves setaceous to junciform, with 5–9 veins and separate sclerenchyma-strands
75 Leaves (0·4–)0·65–1·5 mm wide
76 Panicle usually more than 5 cm; lemma glabrous or hairy but not whitish; awn distinct **66. rubra**
76 Panicle usually not more than 4·5 cm; lemma densely hairy, whitish; awn absent or very short **67. richardsonii**
75 Leaves 0·3–0·65 mm wide
77 Laxly caespitose; sheaths decaying into fibres
78 Leaves glabrous, smooth, obtuse, with 7 veins; panicle not more than 3·5 cm, dense **68. pyrenaica**
78 Leaves ± scabrid towards apex, subacute, with (4–)5 veins; panicle at least 6 cm, lax **69. trichophylla**
77 Rather densely caespitose; sheaths not decaying into fibres
79 Leaves strongly scabrid, with bulliform cells; upper glume lanceolate **70. pseudotrichophylla**
79 Leaves smooth, without bulliform cells; upper glume subulate **71. cyrnea**
57 Ligule with auricles; sclerenchyma forming a ring or in 3 separate strands; non-flowering shoots intravaginal
80 Sheaths sometimes closed to the mouth, usually decaying into fibres; leaves always smooth, the sclerenchyma usually in 3 separate strands; ligule sometimes with indistinct auricles
81 Panicle compound, the lowest branch with 3 to many spikelets
82 Sheaths not or tardily decaying into fibres, closed for not more than $\frac{1}{4}$ of their length
83 Ligule distinct; lemma 3·2–4·6 × 1·4–1·6 mm; sheaths open to base **99. patzkei**
83 Ligule very short; lemma 4–6 × 1·5–2 mm; sheaths closed for $\frac{1}{6}$–$\frac{1}{4}$ of their length
84 Stems 35–50 cm; leaves with 7–9 veins, the sclerenchyma-strands in cross section laterally decurrent; spikelets 7–8(–9) mm **97. costei**

84 Stems 25–40 cm; leaves with 7 veins, the sclerenchyma-strands not decurrent; spikelets 6–6·5(–8) mm **98. hervieri**

82 Sheaths decaying into fibres, closed for at least ½ their length

85 Panicle 7–17 cm, linear-oblong; spikelets 5–7·8 mm; sheaths closed for ½ their length **93. jeanpertii**

85 Panicle (3–)4–7(–9·5) cm, wider; spikelets (6–)7–8 (–9) mm; sheaths closed for more than ½ their length

86 Leaves (0·3–)0·4–0·7(–0·9) mm wide; glumes and lemma subulate **94. stenantha**

86 Leaves (0·35–)0·5–1·1 mm wide; glumes and lemma lanceolate

87 Sheaths often densely setulose, closed for at least ¾ of their length; lemma 4·9–6·2 × 1–2·3 mm, broadly lanceolate **95. pseudodura**

87 Sheaths glabrous, closed for not more than ¾ of their length; lemma 4–5·8 × 1·4–2·5 mm, lanceolate **96. circummediterranea**

81 Panicle usually simple, the lowest branch with 1–2(–3) spikelets

88 Leaves 0·5–0·8 mm wide, with a ring of sclerenchyma **92. horvatiana**

88 Leaves usually 0·3–0·6 mm wide, always with 3 separate strands of sclerenchyma

89 Leaves with 5–7 veins

90 Sheaths closed to the mouth; awn more than ½ as long as lemma **84. halleri**

90 Sheaths rarely closed for more than ¾ of their length; awn ½ as long as lemma

91 Leaves 0·5–0·9 mm wide, with stout sclerenchyma-strands; anthers more than 2 mm **83. riloensis**

91 Leaves 0·25–0·7 mm wide, with slender sclerenchyma-strands; anthers less than 2 mm

92 Spikelets 7–8 mm **82. intercedens**

92 Spikelets 5–6·5(–7) mm

93 Leaves with 3 sclerenchyma-strands; lemma 3·6–4·9 × 1·5–1·6 mm, lanceolate; anthers 1·4–1·7 mm **81. pirinica**

93 Leaves with (3–)5(–7) sclerenchyma-strands; lemma 3–5·5 × 1·5–2 mm, broadly lanceolate; anthers 0·7–1·3 mm

94 Stems 15–30 cm; lemma 3·7–5·5 mm, with awn 1·2–2 mm; anthers 0·7–1·3 mm **79. brachyphylla**

94 Stems 7–10(–15) cm; lemma 3–3·5 mm, with awn 1–1·7 mm; anthers 0·5–0·6 mm **80. hyperborea**

89 Leaves with not more than 5 veins

95 Leaves always with 5 veins

96 Stems 4–7 cm; ligule with acuminate auricles; spikelets less than 6 mm **88. frigida**

96 Stems 6–30 cm; ligule with rounded auricles; spikelets more than 6 mm

97 Sheaths thickened at base; awn ⅓–½ as long as lemma **85. glacialis**

97 Sheaths not thickened at base; awn ⅓–½ as long as lemma

98 Stems 13–30 cm; leaves with 1 rib; spikelets pruinose; anthers 2–2·6 mm **86. rupicaprina**

98 Stems up to 12 cm; leaves with 3 ribs; spikelets not pruinose; anthers 1·8–2·2 mm **87. bucegiensis**

95 Leaves with 3–5 veins, not constantly 5

99 Leaves not more than 0·5 mm wide, with 3 veins and slender sclerenchyma-strands; lemma 3·6–4·2 mm; anthers less than ½ as long as palea **89. alpina**

99 Leaves 0·2–0·8 mm wide, with 3–5 veins; lemma 4·2–5·8 mm

100 Leaves with stout sclerenchyma-strands; spikelets 6·5–7·8 mm; anthers 2·5 mm, more than ½ as long as palea **90. olympica**

100 Leaves with slender sclerenchyma-strands; spikelets 8·4–9·5 mm; anthers 1·5–2 mm, less than ½ as long as palea **91. vizzavonae**

80 Sheaths mostly closed for not more than ½ their length, usually not decaying into fibres; leaves often scabrid, usually with the sclerenchyma forming a ring; ligule always with distinct auricles

101 Leaves with 3(–5) veins; ligule with ±acute auricles

102 Leaves (0·4–)0·5–0·7 mm wide, flattened at apex; sheaths closed to mouth; ligule not more than 0·8 mm **100. hystrix**

102 Leaves (0·3–)0·4–0·55 mm wide, not flattened at apex; sheaths open to base; ligule 2 mm **101. reverchonii**

101 Leaves with more than 3 veins; ligule with obtuse auricles

103 Leaves laterally compressed, with 3 sclerenchyma-strands (rarely confluent into an unequally thickened ring), always scabrid

104 Sclerenchyma in a ±interrupted, unequally thickened ring

105 Leaves 0·5–1·1 mm wide; veins usually 7

106 Leaves smooth or nearly so; sheaths glabrous **170. duvalii**

106 Leaves scabrid or hairy; at least some sheaths hairy

107 Stems 30–75 cm; sheaths closed at base only; panicle 4·5–13 cm **168. trachyphylla**

107 Stems up to 22 cm; sheaths closed in lower ⅓; panicle 3–4 cm **169. brevipila**

105 Leaves 0·4–0·6(–1·1) mm wide; veins usually 5

108 Sheaths glabrous or weakly scabrid; lemma subulate-lanceolate; awn at least ½ as long as lemma **165. callieri**

108 Sheaths densely tomentose; lemma ovate-lanceolate to lanceolate; awn not more than ½ as long as lemma

109 Leaves (0·4–)0·5–0·75(–0·8) mm wide; lemma ovate-lanceolate; awn up to ¼ as long as lemma **166. wolgensis**

109 Leaves 0·55–0·98 mm wide; lemma oblong-lanceolate; awn nearly ½ as long as lemma **167. stricta**

104 Sclerenchyma in 3 separate strands

110 Stems mostly more than 30 cm

111 Leaves (0·4–)0·5–1 mm wide; lemma ovate-lanceolate to lanceolate **161. rupicola**

111 Leaves 0·4–0·8 mm wide; lemma subulate-lanceolate to subulate

112 Leaves not pruinose; lemma 6·5–8·4 mm, subulate **162. taurica**

112 Leaves pruinose; lemma 5–6·5(–7·8) mm, subulate-lanceolate

113 Spikelets 7·8–10·5 mm; lemma (5·3–)5·6–6·5(–7·8) mm **163. dalmatica**

113 Spikelets 6·5–8 mm; lemma 5–5·6 mm **164. pseudodalmatica**

110 Stems rarely more than 30 cm

114 Leaves (0·4–)0·7–1 mm wide **160. carnuntina**

114 Leaves 0·3–0·5(–0·7) mm wide

115 Sheaths glabrous

116 Leaves always 5-veined; lemma subulate-lanceolate to subulate **159. valesiaca**

116 Leaves 5- to 7-veined; lemma oblong-lanceolate **158. makutrensis**

115 Sheaths ±hairy

117 Leaves with 5 veins; plant usually not pruinose; lemma 2·6–3·9 mm

118 Spikelets (4·2–)4·7–6 mm; lemma 2·6–3·4 mm **155. pseudovina**
118 Spikelets (6–)6·5–8·1 mm; lemma 3·1–3·9(–4·6) mm **156. illyrica**
117 Leaves with 5–7 veins; plant pruinose; lemma 4–5·2 mm
119 Stems pubescent; spikelets 6·5–7·5(–8) mm, not pruinose; lemma 4·6–5·2 mm **157. wagneri**
119 Stems weakly scabrid above; spikelets 5–6·5 mm, ± pruinose; lemma 4–4·5(–5) mm **158. makutrensis**
103 Leaves usually not laterally compressed, with sclerenchyma in a complete ring, smooth or scabrid
120 At least most leaves acute; panicle-branches thickened below the spikelets
121 Leaves very short, rigid, curled; awn ⅛–¼ as long as lemma **154. indigesta**
121 Most or all leaves long, not very rigid, not curled; awn usually more than ½ as long as lemma
122 Leaves usually pruinose, with 7(–9) veins; upper glume ovate, subobtuse; lemma usually densely pubescent **151. glauca**
122 Leaves usually not pruinose, with 7–9 veins; upper glume lanceolate, acuminate; lemma glabrous, scabrid or ciliate above
123 Stem pubescent above; lemma 4·6–5·5 mm; awn not more than ⅓ as long as lemma **152. vasconcensis**
123 Stems glabrous above; lemma 5·5–7·1 mm; awn ½ as long as lemma **153. durissima**
120 Most leaves obtuse; panicle-branches not thickened below spikelets
124 Spikelets proliferating **150. vivipara**
124 Spikelets not proliferating
125 Leaves 0·2–0·6(–0·8) mm wide
126 Leaves rigid, curved; sclerenchyma-ring often thickened at base
127 Leaves with 5 veins; sheaths closed in lower ¼; awn 1½ times as long as lemma **109. sipylea**
127 Leaves with 7 veins; sheaths closed for ¼–½ their length
128 Leaves strongly scabrid throughout; awn more than ½ as long as lemma **110 lapidosa**
128 Leaves smooth or scabrid towards apex; awn not more than ⅓ as long as lemma **111. occitanica**
126 Leaves not rigid, straight; sclerenchyma-ring not thickened at base
129 Lemma unawned, sometimes mucronate **102. tenuifolia**
129 Lemma awned
130 Leaves scabrid throughout; sheaths open almost or quite to base
131 Stems 10–15(–20) cm **105. niphobia**
131 Stems (10–)20–45(–70) cm
132 Spikelets (4–)4·8–6·3(–7·3) mm **103. ovina**
132 Spikelets (6·8–)7–7·5(–7·9) mm **104. ophioliticola**
130 Leaves usually smooth, except near apex; sheaths closed in lower ¼–⅓
133 Leaves keeled beneath; panicle lax, the branches numerous, patent **108. eggleri**
133 Leaves rounded beneath; panicle dense, with few branches
134 Leaves scabrid, at least near apex; lemma twice as long as wide **106. airoides**
134 Leaves smooth or weakly scabrid near apex; lemma 3 times as long as wide **107. armoricana**
125 Leaves (0·3–)0·5–0·85(–1·35) mm wide
135 Sclerenchyma-ring uniform or slightly thickened at base
136 Sheaths open to base
137 Panicle rather dense; upper glume rather abruptly acuminate
138 Pruinose; stems 12–32 cm; sheaths glabrous or puberulent; upper glume 3·9–4·9 mm **134. oviniformis**
138 Not pruinose; stems 30–57 cm; sheaths with patent hairs 2 mm; upper glume 5·2–6·2 mm **135. hirtovaginata**
137 Panicle rather lax; upper glume very gradually acuminate
139 Panicle-branches scabrid; awn not more than ½ as long as lemma **136. ticinensis**
139 Panicle-branches densely hairy; awn at least ½ as long as lemma
140 Lemma 6·9–7·3 mm, shortly setulose above; awn *c.* ½ as long as lemma **137. grandiaristata**
140 Lemma 5·5–6·7 mm, with long hairs above; awn at least ⅔ as long as lemma **138. thracica**
136 Sheaths usually closed below
141 Sclerenchyma-ring uniform
142 Lemma 6·2–7·5 mm; awn at least ⅔ as long as lemma **139. hercegovinica**
142 Lemma 5–6·5 mm; awn *c.* ½ as long as lemma **140. robustifolia**
141 Sclerenchyma-ring unevenly thickened or sclerenchyma in separate stout strands
143 Leaves angular in cross-section
144 Leaves 0·3–0·6 mm wide; sheaths closed in lower ¼–⅓; awn more than ½ as long as lemma **141. panciciana**
144 Leaves (0·5–)0·6–0·9 mm wide; sheaths closed in lower ⅓–½; awn not more than ½ as long as lemma
145 Leaves not pruinose; spikelets 8–9·4 mm; lemma 5·2–6·9 mm **142. apuanica**
145 Leaves pruinose; spikelets (8–)9·5–10 mm; lemma (5·5–)6·5–7·8 mm **143. koritnicensis**
143 Leaves not angular in cross-section
146 Leaves circular in cross-section, rigid, slender
147 Leaves smooth; veins 7 **146. polita**
147 Leaves scabrid above; veins usually 5
148 Lemma 3·8–4·7 mm; awn ¼–½ as long as lemma **144. pohleana**
148 Lemma 4·9–6·5 mm; awn about as long as lemma **145. macedonica**
146 Leaves laterally compressed, soft, stout
149 Leaves with 7 veins; sheaths closed for at least ⅔ their length; spikelets 7·2–7·3 mm **149. igoschiniae**
149 Leaves with 7–9(–12) veins; sheaths closed for not more than ⅓ their length; spikelets (7·5–)8–11 mm
150 Usually pruinose; upper glume lanceolate, long-acuminate **147. curvula**
150 Not pruinose; upper glume ovate-lanceolate, shortly acuminate **148. pachyphylla**
135 Sclerenchyma-ring uniform or slightly thickened at sides
151 Sheaths closed in at least the lower ¼
152 Leaves scabrid, at least above
153 Stems pubescent above; leaves scabrid throughout; lemma usually pubescent or ciliate **133. degenii**
153 Stems smooth or weakly scabrid above;

leaves ± scabrid above; lemma scabrid above
154 Leaves with 1 rib, often with 2 indistinct lateral ribs; panicle dense; awn 1·6–1·7 mm **131. brigantina**
154 Leaves with 3 distinct ribs; panicle lax; awn up to 0·7 mm **132. valentina**
152 Leaves smooth
155 Stems (5–)12–35(–44) cm; non-flowering shoots with numerous leaves
156 Stems (5–)12–25(–44) cm; ribs 1(–3); sheaths closed in the lower ¼–⅓ **127. huonii**
156 Stems 20–35 cm; ribs 3; sheaths closed in the lower ½ **128. gracilior**
155 Stems (20–)35–60 cm; non-flowering shoots with very few leaves
157 Stems smooth; upper glume 3·6–4·6 mm **129. liviensis**
157 Stems mostly pubescent above; upper glume 4·5–5 mm **130. ochroleuca**
151 Sheaths open for most of their length
158 Leaves scabrid, rarely pruinose
159 Leaves of the same non-flowering shoot differing greatly in width (0·45–1·35 mm); spikelets (7–)7·5–8·1(–9·5) mm **112. heteropachys**
159 Leaves of the same non-flowering shoot uniform in width (0·6–0·85 mm); spikelets 5·5–7·5 mm
160 Leaves 0·6–0·7(–0·85) mm wide; rib 1(–3); veins 7 **113. guestfalica**
160 Leaves (0·43–)0·62–0·79(–1·14) mm wide; ribs (1–)2–3; veins (5–)7(–9) **114. lemanii**
158 Leaves smooth or scabrid above, always pruinose
161 Leaves smooth
162 Veins 9–13; sheaths usually pubescent
163 Spikelets 4·3–6·5 mm; lemma ovate, rounded at apex; awn absent or very short **118. vaginata**
163 Spikelets 6·2–8 mm; lemma oblong-ovate or acuminate, shortly awned **119. psammophila**
162 Veins 7(–9); sheaths usually glabrous
164 Spikelets (6·4–)7·2–8·5(–9·4) mm; awn ⅓–½ as long as lemma **115. arvernensis**
164 Spikelets 5·5–7·7 mm; awn not more than ½ as long as lemma
165 Ligule glabrous; sheaths open to base; upper glume ovate-lanceolate; awn ¼–⅓ as long as lemma **116. longifolia**
165 Ligule pubescent; sheaths closed in lower ¼–½; upper glume lanceolate; awn usually absent **117. inops**
161 Leaves usually scabrid above
166 Lemma 5·2–5·8 mm; spikelets with 5–9 florets **120. pannonica**
166 Lemma 2·5–5·4 mm; spikelets with 3–6 (–7) florets
167 Leaves obtuse, not deciduous; sheaths glabrous; stems glabrous or scabrid above
168 Stems 18–35 cm; sheaths closed in the lower ⅛–¼; awn not more than ⅓ as long as lemma **125. cinerea**
168 Stems 30–40 cm; sheaths open to base; awn often at least ⅓ as long as lemma **126. pallens**
167 Leaves acuminate, deciduous; sheaths often pubescent; stems pubescent
169 Spikelets (5–)6·5–7·5(–8) mm; awn usually more than 1 mm
170 Leaves ± pungent; sclerenchyma forming an even ring; ribs 5–7(–9); upper glume 2·9–4·4 mm **122. polesica**
170 Leaves not pungent; sclerenchyma forming an interrupted or uneven ring; ribs 3(–5); upper glume 4–4·8 mm **123. javorkae**
169 Spikelets (4·5–)5·5–7 mm; awn usually less than 1 mm
171 Leaves with 7–9 veins; sclerenchyma-ring of even thickness **121. beckeri**
171 Leaves with 7–11(–13) veins; sclerenchyma-ring often thickened basally **124. arenicola**

(A) Stem-base usually tuberous. Ovary with rigid hairs.

1. F. triflora Desf., *Fl. Atl.* **1**: 87 (1798). Densely caespitose; stems 50–90 cm × 2·5–3 mm, with tuberous base *c.* 8 mm in diameter. Leaves 6–15 cm × 2–3·5 mm, flat, convolute in bud, glaucous, scabrid above and on the margin; veins 11, with sclerenchyma-strands above and below, running from upper to lower epidermis at the 3 main veins, with bulliform cells between the ribs; sheaths closed for ¼ of their length, thin; ligule 1·5–2 mm, truncate. Panicle 10–20 cm, lax, nodding; branches glabrous, very slender, flexuous. Spikelets 12 mm, often violet-tinged. Glumes broadly lanceolate, scarious, 3-veined. Lemma 7–9 × 2·3–2·5 mm, long-acuminate, scabrid, with 5 stout veins. $2n = 14$. *Shady places. Mountains of S., S.E. & C. Spain.* Hs.

2. F. caerulescens Desf., *loc. cit.* (1798). Like **1** but stems with tuberous base *c.* 20 mm in diameter; leaves up to 25 cm × 1–2 mm, plicate only near base; veins 7–11; sheaths soon decaying into longitudinal fibres, forming a dense felt; ligule not more than 1 mm; panicle very narrow, the branches densely hairy; spikelets 10 mm; glumes lanceolate; lemma 6–7 × 2·1 mm, mucronate. $2n = 14$. *S. Spain, Sicilia.* Hs ?It Si.

3. F. paniculata (L.) Schinz & Thell., *Viert. Naturf. Ges. Zürich* **58**: 40 (1913) (*F. aurea* Lam., *F. spadicea* L.). Like **1** but stems with tuberous base 10–20 mm in diameter; leaves with numerous veins, those of non-flowering shoots plicate to the middle; sheaths persistent, not or very tardily decaying into fibres; ligule not more than 0·5 mm on non-flowering shoots; panicle lax at anthesis, the branches smooth or scabrid; lower glume 1-veined; lemma 6·5–11 × 2·9–3·4 mm. *Rocky ground and dry grassland, mainly in the mountains. S. Europe, eastwards to Bulgaria, and extending northwards to S. Austria.* Al Au Bu Ga He Hs It Ju Lu Rm.

1 Leaves 2·2–4 mm wide (when flat); lemma less than 8 mm **(a)** subsp. **paniculata**
1 Leaves 1·5–3 mm wide (when flat); lemma more than 8 mm
2 Spikelets not more than 12 mm; lemma golden-yellow **(b)** subsp. **spadicea**
2 Spikelets more than 12 mm; lemma green **(c)** subsp. **baetica**

(a) Subsp. **paniculata**: Leaves 2·2–4 mm wide, flat from middle to apex. Spikelets (8–)9·3–11 mm; lemma 6·5–7·5 × 2·9 mm, golden-yellow. $2n = 14$. *Throughout the range of the species except most of the Iberian peninsula.*

(b) Subsp. **spadicea** (L.) Litard., *Candollea* **10**: 111 (1945) (*F. consobrina* Timb.-Lagr.): Leaves 1·5–3 mm wide, flat from middle to apex on flowering stems, filiform on non-flowering shoots. Spikelets 10–12 mm; lemma 8·3–9·4 × 3·2–3·4 mm, golden-yellow. $2n = 42$. ● *From W. Portugal to S.C. France.*

(c) Subsp. **baetica** (Hackel) Markgr.-Dannenb., *Bot. Jour. Linn. Soc.* **76**: 326 (1978) (*F. spadicea* var. *baetica* Hackel): Leaves 1·5 mm wide, flat only near apex. Spikelets 12–14 mm; lemma 9·1–11 × 3·4 mm, pale green. *S. Spain.* (*N. Africa.*)

4. F. durandii Clauson in Billot, *Annot.* 163 (1859). Like **1** but stems with tuberous base *c.* 10 mm in diameter; leaves with sclerenchyma-strands not contiguous with veins, those of non-flowering shoots 0·6–0·8 mm wide, plicate throughout; sheaths not decaying into fibres, longitudinally ribbed; ligule very short; panicle 6–14 cm, lax at anthesis; spikelets 8·4–9·5 mm; lemma 5·5–6·5 × 3·4 mm, indistinctly veined. $2n=28$. *Spain and Portugal.* Hs Lu.

5. F. spectabilis Jan, *Elench. Hort. Parm.* 2 (1827) (*F. sieberi* Tausch). Caespitose; stems 80–110 cm, not tuberous at base. Leaves flat, convolute in bud, glaucous and scabrid above, with many prominent veins and ribs; sclerenchyma-strands of all veins running from upper to lower epidermis, with bulliform cells between the ribs; basal sheaths leafless, persistent, longitudinally ribbed. Panicle nodding, with scabrid branches. Glumes scarious, the upper 3-veined, lanceolate. Lemma lanceolate, long-acuminate, unawned, scabrid, strongly 5-veined. $2n=42$. ● *S. Alps, N. Appennini and mountains of Balkan peninsula.* Al Bu Gr It Ju.

(a) Subsp. **spectabilis** (incl. subsp. *carniolica* (Hackel) Hayek): Leaves scarcely plicate when dry. Panicle 15–30 cm, lax. Spikelets *c.* 7 mm. Lemma 5·8–6·9 mm. Ovary with very long hairs. *S. Alps, N. Appennini, mountains of Slovenia.*

(b) Subsp. **affinis** (Boiss. & Heldr. ex Hackel) Hackel, *Monogr.* 189 (1882) (*F. affinis* Boiss. & Heldr. ex Hackel): Leaves always plicate when dry. Panicle 9–15 mm, dense. Spikelets 9–10 mm. Lemma 7·5–7·6 mm. Ovary with short hairs. *From N.E. Italy to S.C. Greece.*

(B) Stem-base not tuberous. Leaves at least 3 mm wide, usually convolute in bud.

(a) Ligule short, but distinct. Lemma soft. Ovary minutely aculeolate or setose.

6. F. altissima All., *Auct. Fl. Pedem.* 43 (1789) (*F. sylvatica* (Pollich) Vill., non Hudson). Densely caespitose; stems 50–120(–200) cm. Leaves flat, 4–14 mm wide, scabridulous on margins and sometimes on surface; sheaths persistent, open, the basal leafless; ligule 1–5 mm, denticulate, without clasping auricles. Panicle 10–18 cm, lax, nodding, the branches more or less smooth. Spikelets 5–8 mm, with 2–5 florets. Glumes subequal, scarious, the upper 3–4·1 × 1·2–1·5 mm. Lemma 4–6 × 1·6–1·7 mm, linear-lanceolate, acute, unawned, 3(–5)-veined, scabridulous. Anthers *c.* ½ as long as palea. Ovary setose. $2n=14$, 42. *Deciduous woods. From C. Norway, Estonia and C. Ural southwards to N. Spain, N. Greece and S.C. Russia.* Al Au Be Br Bu Cz Da Fe Ga Ge Gr Hb He Hs Hu It Ju No Po Rm Rs (B, C, W) Su.

7. F. drymeja Mert. & Koch in Röhling, *Deutschl. Fl.* ed. 3, **1**: 670 (1823) (*F. montana* Bieb., non Sternb. & Hoppe). Laxly caespitose and rhizomatous; stems 70–110 cm. Leaves flat, (4–)6–15 mm wide, scabridulous on margins and surface; sheaths decaying into fibres, open, the basal leafless; ligule 1·5–3 mm, fimbriate. Panicle 10–30 cm, lax, nodding. Spikelets 7–8 mm, with 4–6 florets. Glumes scarious, the upper 3·6–3·9 × 1·4–1·6 mm. Lemma 4·2–5 × 1·6–1·7 mm, ovate-lanceolate, obtuse or subacute, strongly 5-veined, scabridulous. Anthers more than ½ as long as palea. Ovary setose to subglabrous. $2n=14$. *Deciduous woods. E.C. Europe and Balkan peninsula; S. Italy and Sicilia.* Al Au Bu Cz Gr Hu It Ju Po Rm Rs (W) Si Tu.

(b) Ligule a minute rim. Lemma hard. Ovary glabrous or with a few long hairs.

8. F. gigantea (L.) Vill., *Hist. Pl. Dauph.* **2**: 110 (1787). Forming small tufts; stems 45–150 cm. Leaves flat, 6–18 mm wide, glossy beneath, with scabrid margin; sheaths thin, open, decaying into fibres; ligule up to 2·5 mm, with clasping auricles. Panicle 10–50 cm, very lax, nodding, the branches scabrid. Spikelets 8–13 mm, with 3–10 florets. Glumes subequal, with a scarious margin, the upper 5–8 mm. Lemma 6–9 × 2·1–2·6 mm, ovate-lanceolate, 5-veined; awn 10–18 mm, often flexuous. Anthers less than ½ as long as palea. Ovary glabrous. $2n=42$. *Woods and scrub. Most of Europe except the extreme north, but rare in the Iberian peninsula and much of the Mediterranean region.* Al Au Be Br Bu Co Cz Da Fe Ga Ge Hb He Ho Hs Hu It Ju No Po Rm Rs (?N, B, C, W, K, E) Su Tu.

9. F. pratensis Hudson, *Fl. Angl.* 37 (1762) (*F. elatior* subsp. *pratensis* (Hudson) Hackel). Laxly caespitose; stems 30–120 cm, stout. Leaves not very rigid, more or less smooth above, with sclerenchyma-strands all or mostly at the upper surface; old sheaths brown, decaying into fibres; ligule a short rim, with glabrous, clasping auricles. Panicle 10–20 cm; branches aculeolate; lowest node of the panicle with 2 branches, the longer with 4–6, the shorter with 1–3 spikelets. Spikelets (8·5–)11–12(–15) mm, with 5–12 florets. Glumes obtuse, broadly scarious towards the apex, the upper 3·2–7 × 2·4 mm. Lemma (5·3–)6·5–7(–7·5) × 2·5–3 mm. Ovary glabrous. $2n=14$ (42). *Meadows and other grassy places. Most of Europe, but rare in parts of the Mediterranean region and south-west, and doubtfully native in parts of the north.* All except Bl Cr Lu Sb Tu.

(a) Subsp. **pratensis**: Stems usually 30–70 cm. Leaves 3–5 mm wide, dark green; sheaths open. Spikelets 9–11 mm. Lemma obtuse, not 2-dentate at apex, unawned. $2n=14$. *Throughout the range of the species.*

(b) Subsp. **apennina** (De Not.) Hegi, *Ill. Fl. Mitteleur.* **1**: 343 (1908) (*F. apennina* De Not., *F. arundinacea* var. *megalostachys* Stebler): Stems usually 70–90 cm. Leaves 5–8 mm wide, slightly glaucous above; sheaths closed up to the middle. Spikelets 9–13(–15) mm. Lemma distinctly 2-dentate at apex, with an awn *c.* ½ as long as lemma. *Calcicole.* ● *Alps, Appennini, Sicilia; mountains of N.W. Jugoslavia; E. & S. Carpathians.*

10. F. arundinacea Schreber, *Spicil. Fl. Lips.* 57 (1771) (*F. elatior* subsp. *arundinacea* (Schreber) Hackel). Like **9(a)** but stems up to 200 cm; leaves prominently ribbed above, rather rigid, with sclerenchyma-strands on both sides of all or most veins; old sheaths pale, not decaying into fibres; ligule with ciliate auricles. Lowest node of panicle with 2–3 branches, each with 5–15 spikelets. Spikelets with 4–5 florets. Lemma 4–9 × 1·8–2·7 mm. $2n=28$, 42, 70. *Damp grassland, river-banks and seashores. Most of Europe, but absent from most of N., C. & E. Russia.* All except Fa Is Rs (N) Sb.

1 Spikelets 5–9 mm
2 Ribs of leaf subequal; lemma 2-dentate at apex, unawned (d) subsp. **fenas**
2 Main ribs of leaf distinctly higher than the lateral; lemma acuminate, awned (c) subsp. **atlantigena**
1 Spikelets 10–12 mm
3 Lemma entire; glumes subulate (e) subsp. **orientalis**
3 Lemma 2-dentate; glumes lanceolate
4 Panicle lax, wide; lemma ±unawned (a) subsp. **arundinacea**
4 Panicle dense, narrow; lemma with awn 1·5–2·6 mm (b) subsp. **uechtritziana**

(a) Subsp. **arundinacea**: Sheaths and upper part of stem smooth. Leaves 5–10 mm wide, with prominent ribs; auricles with sparse, short cilia. Panicle lax, wide. Spikelets 10–12 mm; glumes subequal, broadly lanceolate, the upper 4·5–5 × 1·8 mm. Lemma 6·3–8 × 2·2 mm, ovate-lanceolate, 2-dentate, more or less unawned. $2n=42$. *Throughout most of the range of the species except the S. half of the U.S.S.R.*

(b) Subsp. **uechtritziana** (Wiesb.) Hegi, *Ill. Fl. Mitteleur.* **1**: 345 (1908) (*F. uechtritziana* Wiesb.): Like subsp. (a) but sheaths and upper part of stem scabrid; leaves 3–7 mm wide; panicle dense, narrow; glumes very unequal, the upper 5·6–7·3 mm; lemma 7·1–8·8 mm, ovate, with awn 1·5–2·6 mm. ● *S.E. France; naturalized in C. Europe.*

(c) Subsp. **atlantigena** (St-Yves) Auquier, *Soc. Éch. Pl. Eur. Occ. Médit.* **16**: 142 (1976) (*F. elatior* subsp. *arundinacea* var. *atlantigena* St-Ives): Main ribs of leaf distinctly higher than the smaller; auricles with sparse, long cilia. Panicle narrowly linear, rigid. Spikelets 5–8·6 mm. Glumes unequal, the upper *c.* 5·3 × 2·1 mm. Lemma 4–6·5 × 1·75–2·7 mm, long-acuminate, with awn 1·5–2·5 mm. Ovary with some long hairs. $2n = 56$. *S.W. Europe.*

(d) Subsp. **fenas** (Lag.) Arcangeli, *Comp. Fl. Ital.* ed. 2, 61 (1894) (*F. fenas* Lag., *F. arundinacea* subsp. *interrupta* (Desf.) Tzvelev): Leaves 3–4 mm wide, with subequal, low ribs; auricles with dense, short cilia. Panicle narrowly linear, rigid, interrupted. Spikelets 5–7(–9) mm; glumes subequal, the upper 4·5 × 0·8 mm; lemma 5–6·5 × 1·6–1·8 mm, broadly lanceolate, 2-dentate, unawned. Ovary glabrous. $2n = 28$. *S. & S.E. Europe.*

(e) Subsp. **orientalis** (Hackel) Tzvelev, *Sched. Herb. Fl. URSS* **18**: 17 (1970) (*F. orientalis* A. Kerner ex Hackel): Leaves 5–10 mm wide, with prominent ribs. Panicle lax, wide. Spikelets 10–12 mm; glumes subequal, subulate; lemma *c.* 6 mm, entire at apex, with awn *c.* 1·5 mm. *S.E. & E.C. Europe.*

(C) Stem-base not tuberous. Leaves less than 3 mm wide, usually plicate in bud. Ovary obovoid; grain usually free from palea.

(a) Non-flowering shoots extravaginal; stolons with scale-like sheaths present.

11. F. laxa Host, *Gram. Austr.* **2**: 58 (1802). Laxly caespitose and rhizomatous; stems up to 60 cm. Basal leaves plicate, hairy above, the cauline flat; veins 7; sclerenchyma-strands contiguous, extending to each epidermis; ribs 7, prominent; sheaths closed only at base, the outer sheaths on non-flowering shoots leafless, the others with leaves gradually increasing in length; ligule short, subauriculate. Panicle 6–10 cm, lax, nodding, with glabrous, filiform branches. Spikelets 8–9 mm, violet-tinged. Glumes scarious, ovate, shortly acuminate; upper glume 5–5·5 × 2–2·3 mm. Lemma 5·8–7·7 × 2·6 mm, broadly lanceolate, shortly acuminate, with 5 indistinct veins, unawned. $2n = 14, 28, 42$. *Mountain rocks and screes.* ● *S.E. Alps.* Au Ju.

12. F. dimorpha Guss., *Pl. Rar.* 34 (1826). Like **11** but more densely caespitose; leaves glaucous, shortly pubescent, the margins scabrid towards the apex; ligule very short, ciliate; spikelets usually with 3 florets, those with 4 florets 9–11 mm, yellowish; glumes both 3-veined, the upper 7·3–7·5 × 1·7–2·5 mm; lemma 7·3–7·5 × 2·1–2·7 mm. $2n = 28$. *Stony mountain pastures.* ● *C. & S. Appennini; Maritime Alps.* Ga It.

13. F. calabrica Huter, Porta & Rigo ex Hackel, *Monogr.* 190 (1882). Like **11** but leaves convolute, glaucous; veins 13–15; outer sheaths of non-flowering shoots decaying into fibres; ligule 6–10 mm; panicle-branches strongly scabrid, flexuous, not spreading; spikelets 9·5–11 mm, yellowish-green; upper glume 6·9 × 2·5 mm; lemma 7·3 × 2·9 mm, lanceolate, distinctly 5-veined. ● *S. Italy.* It.

14. F. pseudeskia Boiss., *Elenchus* 91 (1838). Densely caespitose, with short rhizomes; stems up to 40 cm. Leaves plicate, glaucous, rigid, pungent; veins 9–15, the larger with sclerenchyma-strands on both sides, the smaller without sclerenchyma above; ribs 7; non-flowering shoots with long-persistent leafless sheaths; sheaths closed at the base only, violet; ligule 2–3 mm, obtuse, lacerate. Panicle linear-oblong, slightly wider at anthesis. Spikelets *c.* 5·8 mm, green variegated with violet. Glumes scarious, broadly ovate, obtuse. Lemma 3·5–3·9 × 2·3 mm, ovate-lanceolate, indistinctly 3-veined, unawned. Hilum about as long as grain. *Screes and rocky pastures.* ● *Mountains of S. Spain.* Hs.

15. F. scariosa (Lag.) Ascherson & Graebner, *Syn. Mitteleur. Fl.* **2(1)**: 502 (1900) (*F. granatensis* Boiss.). Like **14** but stems 60–100 cm; cauline leaves more or less flat when old, acute but not pungent, rather thin; veins 13–17, the main sclerenchyma-strands forming a ring, the smaller veins with or without sclerenchyma above; non-flowering shoots without leafless sheaths; ligule 4–6 mm; spikelets 5–6·6 mm, greenish-silvery; glumes shortly acuminate; lemma 3·5–4·2 × 1·6–1·7 mm, 5-veined, obtuse; hilum about $\frac{1}{2}$ as long as grain. $2n = 14$. *Mountains of S. & E. Spain.* Hs.

16. F. carpatica F. G. Dietr., *Vollst. Lexic., Nachtr.* **3**: 333 (1817). Densely caespitose, with creeping rhizomes; stems up to 70 cm. Leaves flat when fresh, becoming convolute, glaucous, scabrid above and on margin; veins and ribs numerous, with bulliform cells between the ribs; veins with sclerenchyma-strands extending to each epidermis; outer sheaths on the stout non-flowering shoots leafless, scale-like, orbicular, persistent; ligule a short, ciliate rim. Panicle lax, nodding, with smooth branches. Spikelets 7–9 mm, pale. Upper glume 6·3–6·5 × 2·1–2·5 mm, lanceolate, shortly acuminate. Lemma (5–)6·9–7·5 × 2·7 mm, lanceolate, distinctly 5-veined, hispid or scabrid, unawned. $2n = 28$. *Rocks and stony slopes; calcicole.* ● *Carpathians.* Cz Po Rm Rs (W).

17. F. pulchella Schrader, *Fl. Germ.* 336 (1806). Laxly caespitose, with short rhizomes; stems up to 55 cm. Leaves usually flat or convolute, flaccid, with numerous veins; sclerenchyma-strands contiguous to the main veins only; non-flowering shoots slender, with thin leafless sheaths; sheaths closed to the middle or above; ligule absent. Panicle lax, wide, with flexuous branches. Spikelets (6–)7–8 mm, few, green variegated with violet. Glumes subequal, long-acuminate, the upper 4·6–4·9 × 1·2–1·4 mm. Lemma (5–)5·8–6 × 2·1 mm, lanceolate, scabrid. Ovary glabrous or subglabrous. $2n = 14$. *Damp places; calcicole.* ● *Alps and Jura; ?E. Carpathians.* Au Ga Ge He It Ju ?Rm.

(b) Non-flowering shoots intravaginal; stolons absent.

18. F. eskia Ramond ex DC. in Lam. & DC., *Fl. Fr.* ed. 3, **3**: 52 (1805) (*F. varia* subsp. *eskia* (Ramond ex DC.) Hackel). Stems 32–50 cm × 1–2·2 mm. Leaves very rigid and pungent, 0·7–1·6 mm wide, often curved, smooth, glaucous, the lowest $\frac{1}{16}$–$\frac{1}{10}$($-\frac{1}{4}$) as long as the uppermost; veins 9–11(–13); ribs 5–11, very prominent, all with sclerenchyma-strands above; sheaths smooth, glabrous; ligule 3–7 mm. Panicle 5–9·5 cm, lax, nodding, interrupted; branches slender, glabrous or minutely hairy. Spikelets 9–10·5 mm, more or less variegated. Upper glume 5·1 × 2 mm, ovate-lanceolate, shortly acuminate. Lemma 6–6·9 × 2·6 mm; awn 0–1·5 mm. Palea subglabrous on the surface, ciliolate on the keels in the upper part. $2n = 14$. *Screes and rocky pastures; calcifuge.* ● *Pyrenees.* Ga Hs ?Rm.

19. F. alpestris Roemer & Schultes, *Syst. Veg.* **2**: 722 (1817) (*F. varia* subsp. *alpestris* (Roemer & Schultes) Hackel). Like **18** but stems 25–55 cm × 0·8–1·8 mm; leaves 0·6–0·9 mm wide, the lowest $\frac{1}{16}$–$\frac{1}{8}$ as long as the uppermost; veins 7–9; ribs 5–7, not very prominent, the sclerenchyma forming a ring, rarely with sclerenchyma-strands above; panicle 3–7 cm, the branches minutely hairy; spikelets (7·7–)8–9·1 mm, yellowish-green, sometimes slightly variegated; upper glume 3·5–4·9 mm; lemma

4·5–5·8 × 1·7 mm, minutely awned; palea with rather dense, long cilia on the keels. *Rocks, screes and pastures.* ● *S.E. Alps.* It Ju.

20. F. elegans Boiss., *Elenchus* 92 (1838). Stems (40–)60–90 cm × 1·5–2·2 mm, scabrid above. Leaves 0·4–0·5 mm wide, strongly scabrid, acute, the lowest as long as the uppermost; veins 5, the sclerenchyma forming a ring; rib 1, rarely with 2 indistinct lateral ribs; sheaths open, very scabrid, stramineous or violet-tinged; ligule (2–)2·5–4 mm, acute. Panicle 8–14 cm, slightly interrupted, the branches densely hispid. Spikelets (6·5–)7–8 mm, greenish or slightly variegated with violet. Upper glume 3–3·9 × 1·3–1·7 mm, ovate-lanceolate, broadly scarious. Lemma 3·9–4·8 × 2·2–2·3 mm, ovate, with a wide scarious margin, unawned. Anthers slightly more than ½ as long as palea. Ovary glabrous or sparsely hairy. $2n = 28$. *Mountain woods and scrub; calcifuge. Spain, N. Portugal.* Hs Lu.

21. F. burnatii St-Yves, *Annu. Cons. Jard. Bot. Genève* **15/16**: 347 (1913). Stems 15–25 cm × 1·2 mm, scabrid above. Leaves 0·5–0·7(–0·9) mm wide, smooth, slightly pungent; veins 5–7; ribs 3–5, prominent, the lateral with sclerenchyma above, the main sclerenchyma forming a ring; sheaths of non-flowering shoots more or less transversely corrugated; ligule 5–7 mm, silvery-scarious. Panicle 4–7 cm, lax, the branches patent at anthesis, scabrid, filiform. Spikelets 9–10 mm, shining, yellowish-green variegated with violet. Upper glume 5–5·5 × 2–2·5 mm, ovate-lanceolate, broadly scarious. Lemma 5·5–6 × 2–2·7 mm, lanceolate, narrowly scarious above, with an awn 2–3 mm. Palea subglabrous on the surface, densely ciliolate on ⅔ of the keels. Anthers much more than ½ as long as palea. $2n = 14$. *Limestone rocks.* ● *Mountains of N. Spain.* Hs.

22. F. valida (Uechtr.) Pénzes, *Borbásia* **3**: 13 (1941) (*F. varia* subsp. *valida* Uechtr.). Stems 65–106 cm × 1·3–4 mm. Lowest leaf $(\frac{1}{28}–)\frac{1}{25}–\frac{1}{6}$ as long as the uppermost; veins (7–)9–11, the sclerenchyma forming a ring; ribs 7–9, prominent, all with a sclerenchyma strand above; ligule (0·7–)1–1·8(–2·5) mm, truncate. Panicle 9–13 cm, lax, nodding, much interrupted, the branches slender, shortly hairy. Spikelets greenish, slightly variegated with violet. Upper glume 6–7 × 2·3–2·6 mm, ovate-lanceolate, broadly scarious, usually obtuse. Lemma 7·1–9·1 × 2·8–3·2 mm, oblong-lanceolate, long-acuminate, broadly scarious above; awn 1–1·8 mm. *Siliceous rocks and open pinewoods*, 1500–2600 *m.* ● *W. Bulgaria and N. Greece.* Bu Gr.

(a) Subsp. **valida**: Leaves scabrid or smooth above, (0·45–)0·55–1·5 mm wide. Spikelets 9–13 mm. Anthers *c.* ½ as long as palea. *W. Bulgaria.*

(b) Subsp. **leilaensis** Markgr.-Dannenb., *Veröff. Geobot. Inst. Rübel (Zürich)* **56**: 167 (1976): Leaves smooth, 0·45–1·15 mm wide. Spikelets 12·5–14 mm. Anthers distinctly more than ½ as long as palea. *N. Greece (mountains N. of Serrai).*

23. F. gautieri (Hackel) K. Richter, *Pl. Eur.* **1**: 105 (1890). Stems 20–50 cm × 0·9–1·7 mm. Leaves (0·3–)0·4–0·7 mm wide, smooth, pungent, often curved, the lowest at least ½ as long as the uppermost; veins 5–7; rib 1, in the upper ½ of the leaf only, low; sclerenchyma in separate strands or in a ring; sheaths closed for at least ⅔ of their length; ligule 0·5–1 mm, rounded, densely and shortly ciliate. Panicle 4·5–7 cm, dense, with few spikelets, the branches shortly hairy. Spikelets 9–12 mm, yellow-green to stramineous. Upper glume (4·3–)4·9–5·8 mm, ovate-lanceolate, shortly acuminate. Lemma 6–7·3 mm, lanceolate, acuminate, unawned or mucronate. Palea scabrid near apex, densely ciliolate on the keels. $2n = 14$, 28. *Rocks and scrub.* ● *S.W. France and N.E. Spain.* Ga Hs.

24. F. flavescens Bellardi, *App. Fl. Pedem.* 11 (1792). Stems 30–50 cm × 0·8–1·2 mm, stramineous, scabrid below the panicle. Leaves (0·3–)0·4–0·5 mm wide, soft, scabrid, slightly recurved, the lowest $\frac{1}{70}–\frac{1}{40}$ as long as the uppermost; veins 5; rib 1, in the upper ½ of the leaf only; sclerenchyma usually in separate strands; sheaths open nearly to base; ligule 0·6–1·1(–1·3) mm, ciliolate. Panicle (4–)7–9·5 cm, lax, slightly interrupted, the branches minutely hairy. Spikelets 9–11 mm, usually bright green. Upper glume 5·3 × 1·4 mm, lanceolate to ovate-lanceolate, shortly acuminate to subobtuse, broadly scarious. Lemma 5·5–7 × 2·5 mm, shortly acuminate; awn 0–0·8 mm. Palea distinctly shorter than the lemma, scabrid on the surface above, densely fine-ciliate on the keels. $2n = 14$. *Shady rocks.* ● *S.W. Alps.* Ga It.

25. F. scabriculmis (Hackel) K. Richter, *Pl. Eur.* **1**: 104 (1890). Stems (25–)33–55 cm. Leaves (0·3–)0·4–0·6(–0·8) mm wide, subpungent; rib 1 (rarely with 1–2 low, lateral ribs); sclerenchyma usually in a ring; sheaths closed for less than ¼ of their length; ligule 0·8–1·7 mm, ciliolate. Panicle lax, erect to slightly nodding, the branches scabrid. Spikelets (9–)10·3–14·5 mm, green, variegated with violet. Upper glume long-acuminate, with a narrow scarious margin. Lemma long-acuminate, with an awn up to 1·7 mm. Palea as long as the lemma, scabrid on the surface above, long-ciliate on the keels. Anthers *c.* ½ as long as palea. ● *S. Alps.* Ga He It.

(a) Subsp. **scabriculmis**: Stems 1–1·5 mm in diameter, shortly setose below the panicle. Leaves scabrid or smooth, the lowest $\frac{1}{10}–\frac{1}{6}(–\frac{1}{4})$ as long as the uppermost; sclerenchyma-ring unequally thickened, or sclerenchyma in separate strands; veins 5–7. Panicle 3–7·5 cm. Spikelets (9·5–)10·3–14·5 mm, with many florets. Upper glume 5·1–6·1 × 2–2·5 mm; lemma 6·1–9·5 × 2·9–3·6 mm. *S.W. Alps.*

(b) Subsp. **luedii** Markgr.-Dannenb., *Bot. Jour. Linn. Soc.* **76**: 324 (1978): Stems 0·6–1·3 mm in diameter, smooth. Leaves smooth, the lowest $\frac{1}{27}–\frac{1}{8}$ as long as the uppermost; sclerenchyma-ring thickened at base; veins 7. Panicle 4·5–10 cm. Spikelets mostly with 4 florets. Upper glume 3·9–5·6 × 1·5–2 mm; lemma 6–7·6 (–8) × 2–2·9 mm. *S.C. & S.E. Alps, eastwards to c.* 10° 45′ *E.*

26. F. sardoa (Hackel ex Barbey) K. Richter, *Pl. Eur.* **1**: 104 (1890). Stems 12–37 cm × 0·5–0·7 mm, strongly scabrid above. Leaves 0·3–0·4 mm wide, smooth, the lowest $(\frac{1}{4}–)\frac{1}{3}–\frac{1}{2}$ as long as the uppermost; veins 5–7; rib 1; sclerenchyma in a ring; sheaths closed for up to ¼ of their length; ligule 0·5–1 mm, ciliolate. Panicle 2–5 cm, rather lax, slightly interrupted, the branches minutely hairy. Spikelets 8–10 mm, bright green. Upper glume *c.* 4·6 × 1·7 mm, oblong-lanceolate, long-acuminate to subobtuse, with a narrow scarious margin. Lemma 5·2–5·8 × 2–2·1 mm, oblong-lanceolate, with a narrow scarious margin; awn up to 1·2 mm. Palea as long as lemma, scabrid on the surface and margin, shortly ciliate on keels. $2n = 14$. *Mountain rocks*, 1200–2700 *m.* ● *Corse, Sardegna.* Co Sa.

27. F. quadriflora Honckeny, *Vollst. Syst. Verz.* 268 (1782) (*F. pumila* Vill.). Stems (6–)10–20(–30) cm, scabrid below the panicle. Leaves (0·5–)0·6(–0·8) mm wide, scabrid above, scarcely pungent, the lowest $\frac{1}{6}–\frac{1}{4}$ as long as the uppermost; veins 5(–7); ribs 1, sometimes with low lateral ribs; sclerenchyma usually in separate strands; sheaths slightly scabrid; ligule 0·5–1 mm, truncate. Panicle 2–4 cm, lax, erect, with few spikelets, the branches scabrid. Spikelets (7–)8–9(–10) mm, usually glaucous, variegated with intense violet. Upper glume 3·8–5·2 × 1·5–2 mm, ovate-lanceolate, long-acuminate. Lemma 4–6 × 2–2·7 mm, broadly lanceolate, acuminate, with a scarious margin above; awn 0·2–1·3 mm. Palea strongly scabrid on the surface, long-ciliate on the keels. Anthers at least ½ as long as palea. $2n = 14$.

Rocks, screes and stony pastures; somewhat calcicole. ● *Mountains of Europe, from the Jura to the Pyrenees and N.W. Jugoslavia.* Au Ga Ge He Hs It Ju.

Records from C. & S. Jugoslavia and Romania are erroneous.

28. F. versicolor Tausch, *Flora* (*Regensb.*) **4**: 559 (1821). Stems 15–50 cm, more or less rigid. Leaves 0·4–1·2 mm wide, acute, the lowest $\frac{1}{3}$–$\frac{1}{2}$ as long as the uppermost; veins (5–)7–9(–11); ribs 3–5(–9), prominent, with bulliform cells between the ribs; sclerenchyma in a complete or somewhat interrupted ring; sheaths closed in lower $\frac{1}{3}$; ligule 0·2–1·8(–2·1) mm. Panicle 3–8(–10) cm, nodding. Glumes broadly scarious. Lemma 4·2–6·5 × 1·7–3 mm, ovate-lanceolate, acuminate, with an awn 0–1·3 mm. Palea as long as lemma. ● *Carpathians, Sudeten Mts. and E. Alps.* Au Cz Po Rm Rs (W).

1 Ligule 1·6–2·1 mm; panicle-branches scabrid **(d)** subsp. **dominii**
1 Ligule 0·2–1·5 mm; panicle-branches smooth or hairy
2 Panicle-branches hairy **(c)** subsp. **pallidula**
2 Panicle-branches glabrous
3 Palea sparsely setose, indistinctly ciliate on keels **(a)** subsp. **versicolor**
3 Palea densely white-setose, densely ciliate on keels **(b)** subsp. **brachystachys**

(a) Subsp. **versicolor**: Sheaths closed for $\frac{1}{4}$ their length; ligule 0·2–1·5 mm. Panicle 3–6 cm, the branches smooth. Spikelets 6·5–10 mm, with 4–6 florets. Upper glume 3·2–5·2 × 1·3–2·4 mm, ovate-oblong. Palea shortly but not densely setose. *Carpathians and Sudeten Mts.*

(b) Subsp. **brachystachys** (Hackel) Markgr.-Dannenb., *Bot. Jour. Linn. Soc.* **76**: 325 (1978) (*F. varia* subsp. *eu-varia* var. *brachystachys* subvar. *typica* Hackel, *F. varia* subsp. *brachystachys* (Hackel) Hegi): Sheaths closed for $\frac{1}{3}$ their length; ligule 0·4–0·7(–1·3) mm; ribs prominent, glabrous above. Panicle 2·5–6·5 cm, nodding, the branches smooth. Spikelets 8–10 mm, distinctly violet-tinged, with 2–4(–6) florets. Upper glume (2·5–)3·5–5·2 × 1·5–2 mm, ovate-oblong, the lateral veins reaching $\frac{1}{2}$ its length. Lemma long-acuminate; awn (0–)0·3–1·3 mm. Palea densely and shortly setose. $2n = 14$. 1600–2050 *m; calcicole. Mountains of E. Austria.*

(c) Subsp. **pallidula** (Hackel) Markgr.-Dannenb., *op. cit.* 326 (1978) (*F. varia* subsp. *eu-varia* var. *brachystachys* subvar. *pallidula* Hackel, *F. varia* subsp. *brachystachys* (Hackel) Hegi): Sheaths closed for $\frac{1}{4}$–$\frac{1}{3}$ their length; ligule 0·4–1·1 mm; ribs not prominent, long-hairy above. Panicle 2·5–5·5 cm, rigid, the branches hairy. Spikelets (6·6–)7–9·4(–10·9) mm, pale, glaucous, with 3–6 florets. Upper glume 3·6–4·5 × 1·3–2·3 mm, ovate, the lateral veins reaching $\frac{2}{3}$–$\frac{3}{4}$ its length. Lemma shortly acute; awn 0(–0·4) mm. Palea densely and shortly setose. 600–1300 *m; calcicole. Mountains of E. Austria.*

(d) Subsp. **dominii** Krajina, *Spisy Vydáv. Přír. Fak. Karlovy Univ.* **106**: 42 (1930): Sheaths closed for $\frac{1}{4}$ of their length; ligule 1·6–2·1 mm. Panicle 6–8 cm, the branches scabrid. Spikelets 9·5–10·8 mm, with 6–9 florets. Upper glume 4·3–4·7 × 1·9–2·1 mm, ovate-lanceolate; palea sparsely setose towards the apex. *E. Carpathians* (*Munţii Rodnei*).

29. F. acuminata Gaudin, *Agrost. Helv.* **1**: 272 (1811). Stems (20–)25–50 cm, rather rigid, more or less scabrid above. Leaves (0·3–)0·4–0·7(–0·9) mm wide, smooth, glaucous, acute, more or less pungent, the lowest $\frac{1}{10}$–$\frac{1}{6}$ as long as the uppermost; veins 7–9; ribs (3–)5(–7), not prominent; sclerenchyma forming a ring; sheaths closed for up to $\frac{1}{3}$ of their length; ligule 0·6–1·9 mm. Panicle 4–7·5(–8·5) cm, lax, nodding, with few spikelets, the branches with very dense short hairs. Spikelets 8·5–11 mm, with 4–9 florets, pale yellow, variegated with violet. Upper glume ovate-lanceolate to lanceolate, shortly acuminate to sub-obtuse. Lemma 5·1–6·5 × 2–2·7 mm, lanceolate, long-acuminate, mucronate or with an awn up to 0·6 mm. Palea as long as lemma, scabrid on the surface above, ciliolate on the keels. Anthers *c.* $\frac{1}{2}$ as long as palea. *Siliceous rocks.* ● *Alps, eastwards to c.* 10° 20′ *E.* Ga He It.

30. F. varia Haenke in Jacq., *Collect. Bot.* **2**: 94 (1789). Stems (15–)25–55 cm, more or less scabrid above. Leaves 0·4–1 mm wide, smooth, more or less pungent, the lowest $(\frac{1}{15}$–$)\frac{1}{11}$–$\frac{1}{4}(-\frac{1}{3})$ as long as the uppermost; veins (5–)7(–9); ribs 3–7, not very prominent; sclerenchyma forming a ring; sheaths closed for up to $\frac{1}{3}$ of their length; ligule (0·4–)0·6–2(–2·3) mm. Panicle (3–)3·5–7(–9) cm, rather lax, with few spikelets, the branches with very dense short hairs. Spikelets 8–11 mm, with (3–)4–7(–8) florets, glaucous, variegated with violet. Upper glume (3·4–)3·7–6 × 1·7–2·8 mm, broadly lanceolate to broadly ovate-lanceolate, shortly acuminate, with a wide scarious margin. Lemma 4·5–7·2 × 1·9–3·1 mm, ovate-lanceolate, scabrid above, ciliolate, with narrow scarious margin near apex; awn up to 1·2 mm. Palea as long as or slightly longer than the lemma, scabrid on the whole surface. Anthers slightly more than $\frac{1}{2}$ as long as palea. *Calcifuge.* ● *E. Alps, westwards to c.* 11° 30′ *E.* Au It Ju.

31. F. calva (Hackel) K. Richter, *Pl. Eur.* **1**: 104 (1890) (*F. varia* subsp. *calva* (Hackel) Hegi). Stems 32–55 cm, glabrous. Leaves (0·4–)0·5–0·95 mm wide, very pungent, smooth, the lowest $(\frac{1}{25}$–$)\frac{1}{12}$–$\frac{1}{4}$ as long as the uppermost; veins 7–9; ribs 7, not very prominent, with or without sclerenchyma above; sclerenchyma forming a ring; ligule 0·6–1·2(–1·5) mm. Panicle 6–9 cm, nodding, the branches glabrous. Spikelets (8·4–)9–10·5 mm, with 4–5 florets, variegated with pale violet. Upper glume 4–6·6 × 1·7–2·7 mm, ovate-lanceolate, acuminate, with a wide scarious margin. Lemma 4·6–6·7 × 2–2·9 mm, broadly ovate-lanceolate, acuminate, with a wide scarious margin above; awn 0–0·2(–0·6) mm. Palea usually as long as lemma, scabrid above. Anthers $\frac{1}{2}$–$\frac{2}{3}$ as long as palea. *Calcicole.* ● *E. Alps.* Au It Ju.

32. F. xanthina Roemer & Schultes, *Syst. Veg.* **2**: 721 (1817). Stems 25–58 cm. Leaves 0·3–0·7 mm wide, soft, smooth, subobtuse, the lowest $\frac{1}{3}$–$\frac{1}{2}$ as long as the uppermost; veins 7; ribs 3–5; sclerenchyma forming a ring; sheaths usually retrosely scabrid, closed for less than $\frac{1}{4}$ of their length; ligule 0·4–2 mm. Panicle 4–9·5 cm, lax, slightly nodding, the branches with more or less dense, short hairs. Spikelets 8–14(–15) mm, with 3–4 florets, yellowish-green or variegated. Upper glume 5–6 mm, elliptical, rounded. Lemma 4·6–8·5 × 2–3·4 mm, ovate-lanceolate, shortly acuminate, broadly scarious, unawned or mucronate. Palea shorter than to as long as lemma, shortly setose above. Anthers at least $\frac{1}{2}$ as long as palea. *Calcicole.* ● *Mountains of S.W. Romania and E. Jugoslavia.* Ju Rm.

33. F. balcanica (Acht.) Markgr.-Dannenb., *Bot. Jour. Linn. Soc.* **76**: 326 (1978) (*F. cyllenica* subsp. *balcanica* Acht.). Stems 20–50 cm, glabrous. Leaves 0·4–0·7(–0·8) mm wide, scarcely pungent, the lowest $\frac{1}{5}$–$\frac{1}{3}$ as long as the uppermost; veins 7–9; ribs 5–7, not very prominent, with or without sclerenchyma above; sclerenchyma forming a ring; ligule 1–2·3 mm. Panicle 4–6 cm, rather dense, nodding, the branches glabrous or with dense short hairs. Spikelets 9–11 mm, with 3–5 florets, variegated with pale violet. Upper glume *c.* 4·6 × 1·7 mm, ovate-lanceolate, subobtuse, with a wide scarious margin. Lemma 5·3–6·3 × 2·3 mm, ovate-lanceolate, abruptly acuminate; awn 0–0·3 mm. Palea slightly shorter than lemma, scabrid. Anthers *c.* $\frac{1}{2}$ as long as palea. *Calcifuge.* ● *Mountains of Bulgaria.* Bu.

1 Leaves scabrid above; spikelets green, variegated with violet (c) subsp. **rhodopensis**
1 Leaves smooth; spikelets yellowish, not or slightly variegated with violet
2 Lemma 5·3–6·3 mm; palea very densely hairy (a) subsp. **balcanica**
2 Lemma 4·6–5·6 mm; palea sparsely hairy (b) subsp. **neicevii**

(a) Subsp. **balcanica**: Leaves smooth. Spikelets yellowish, slightly variegated with violet. Lemma 5·3–6·3 × 2·3–2·5 mm. Palea very densely hairy and long-ciliate on the keels. *W. & C. Stara Planina.*

(b) Subsp. **neicevii** (Acht.) Markgr.-Dannenb., *Bot. Jour. Linn. Soc.* **76**: 327 (1978) (*F. xanthina* subsp. *neicevii* Acht.): Leaves smooth. Spikelets yellowish. Lemma 4·6–5·6 × 2·6–2·7 mm. Palea sparsely hairy, densely long-ciliate on the keels. *C. Stara Planina.*

(c) Subsp. **rhodopensis** Markgr.-Dannenb., *op. cit.* 324 (1978): Leaves scabrid above. Spikelets green, variegated with violet. Lemma 4·6–5·5 × 2–2·1 mm. Palea sparsely hairy, densely short-ciliate on the keels. *Rodopi.*

34. F. bosniaca Kummer & Sendtner, *Flora* (*Regensb.*) **32**: 756 (1849) (*F. pungens* Kit., non Lam., *F. varia* subsp. *pungens* (Kit.) Hegi). Stems 1·7–2·6 mm in diameter, scabrid above. Leaves smooth, mostly pungent, the lowest $(\frac{1}{17}-)\frac{1}{12}-\frac{1}{6}(-\frac{1}{4})$ as long as the uppermost; ribs 7–9, not prominent; sclerenchyma forming a ring; ligule 0·3–1·2(–1·6) mm. Panicle rather lax, nodding, the branches slender, often flexuous. Spikelets 8·4–13 mm, variegated with violet. Upper glume 4·1–7·8 × 1·7–2·3 mm, lanceolate to ovate-lanceolate, shortly acuminate to somewhat rounded. Lemma lanceolate to narrowly lanceolate, long-acuminate, with a narrow scarious margin above; awn (0·8–) 1·4–2·1 mm. Palea subglabrous. Anthers more than $\frac{1}{2}$ as long as palea. *Calcicole.* ● *Mountains of Balkan peninsula and S. Italy.* Al Bu It Ju.

1 Panicle-branches smooth (c) subsp. **pirinensis**
1 Panicle-branches scabrid
2 Leaves with 9–11 veins (a) subsp. **bosniaca**
2 Leaves with 7(–8) veins (b) subsp. **chlorantha**

(a) Subsp. **bosniaca**: Stems 30–88 cm. Leaves 0·3–1·2 mm wide; veins 9–11; all ribs with sclerenchyma on upper surface; ligule 0·4–1·6 mm. Panicle (6–)7–9·5 cm, the branches scabrid. Lemma 6·5–8·8 × 2·5–3·3 mm. *W. Jugoslavia and N. Albania; S. Italy.*

(b) Subsp. **chlorantha** (G. Beck) Markgr.-Dannenb., *Bot. Jour. Linn. Soc.* **76**: 326 (1978) (*F. pungens* var. *chlorantha* G. Beck): Stems not more than 62 cm. Leaves 0·3–0·75(–0·9) mm wide; veins 7(–8); ribs usually with sclerenchyma on upper surface; ligule 0·3–1(–1·2) mm. Panicle 6–7 cm, the branches scabrid. Spikelets yellowish. Lemma 5·5–8·4 × 2·3–2·7 mm. *Jugoslavia and N. Albania.*

(c) Subsp. **pirinensis** (Acht.) Markgr.-Dannenb., *op. cit.* 327 (1978) (*F. varia* subsp. *pirinensis* Acht.): Stems not more than 62 cm. Leaves 0·5–0·7(–0·8) mm wide; veins 7–9(–11); ribs usually without sclerenchyma on upper surface; ligule 0·3–1 (–1·2) mm. Panicle 6–7 cm, the branches smooth. Spikelets variegated with bright violet. Lemma 6–7·3 × 2·3 mm. *S.W. Bulgaria* (*Pirin*).

35. F. penzesii (Acht.) Markgr.-Dannenb., *op. cit.* 326 (1978) (*F. pungens* var. *penzesii* Acht.). Stems 30–50 cm × 0·7–1·3 mm. Leaves 0·4–0·75(–0·95) mm wide, rather soft, subpungent, smooth, glaucous, the lowest $\frac{1}{8}-\frac{1}{3}$ as long as the uppermost; veins 7–11; ribs 6–8, not very prominent; sclerenchyma forming a ring; rib sclerenchyma present, rarely absent from the middle rib; sheaths smooth or densely hispid; ligule 0·7–2·2 mm, rounded. Panicle 5–9·5 cm, erect, interrupted, the branches slender, flexuous, minutely hairy. Spikelets 9·1–11·5 mm, with 4 florets, yellowish-green or slightly variegated with violet. Upper glume 4·7–6·7 × 2–2·5 mm, ovate-lanceolate, shortly acuminate to subobtuse, broadly scarious above. Lemma 5·8–7·5 mm × 2·6–3 mm, lanceolate, long-acuminate, with a narrow scarious margin; awn 0·4–1·6 mm. Palea as long as lemma, scabrid above. *Calcicole.* ● *Mountains of E. Macedonia.* Bu Gr.

36. F. pindica (Markgr.-Dannenb.) Markgr.-Dannenb., *Bot. Jour. Linn. Soc.* **76**: 326 (1978) (*F. cyllenica* subsp. *pindica* Markgr.-Dannenb.). Stems 50–60 cm. Leaves 0·5–0·8(–1) mm wide, smooth, subpungent, the lowest $\frac{1}{7}-\frac{1}{3}$ as long as the uppermost; veins 7–9; ribs 5–7, not prominent; sclerenchyma forming a ring; rib sclerenchyma always present; sheaths often setulose; ligule 0·7–2·2 mm, densely setulose. Panicle 5–7·5(–9) cm, nodding, interrupted, the branches slender, flexuous, scabrid. Spikelets 9–11·3 mm, with 3–4 florets, slightly variegated with violet. Upper glume 4·6–6·4 × 2–2·9 mm, oblong, subacuminate to rounded, with a wide scarious margin. Lemma 5·5–7·5 × 2·3–2·9 mm, lanceolate, long-acuminate, with a narrow scarious margin; awn 0–1 mm. Palea minutely setulose. Anthers more than $\frac{1}{2}$ as long as palea. *Serpentine rocks*, 1600–2000 *m.* ● *Mountains of N. Greece* (*Pindhos*). Gr.

37. F. graeca (Hackel) Markgr.-Dannenb., *Veröff. Geobot. Inst. Rübel* (*Zürich*) **56**: 162 (1976) (*F. varia* subsp. *eu-varia* var. *genuina* subvar. *graeca* Hackel). Stems 30–50(–60) cm. Leaves (0·35–)0·4–0·75(–0·85) mm wide, smooth, subpungent, glaucous, often pruinose, the lowest $\frac{1}{6}-\frac{1}{3}$ as long as the uppermost; veins 7(–9); ribs 5, rounded, not prominent, hairy; sclerenchyma forming a ring; sheaths setulose; ligule 0·4–1·1(–2·3) mm, densely setulose. Panicle 5–6 cm, slightly nodding and interrupted, the branches slender, flexuous, weakly scabrid. Spikelets 8·5–12 mm, scarcely violet-tinged, sometimes pruinose. Upper glume 4·1–6 × 2·5–2·7 mm, ovate-lanceolate, obtuse, scabrid. Lemma 5·8–7·1 × 2·6–3·1 mm, ovate-lanceolate, long-acuminate, scabrid on the back, with a wide scarious margin; awn 0·1–1·1 mm. Palea as long as lemma. Anthers more than $\frac{1}{2}$ as long as palea. *Calcicole. Mountains of Greece.* Gr.

(a) Subsp. **graeca**: Leaf-ribs with or without sclerenchyma; sheaths closed for up to $\frac{1}{3}$ of their length. Panicle 5–6(–9) cm, dense. Palea scabrid. *Throughout the range of the species except Olimbos.*

(b) Subsp. **pawlowskiana** Markgr.-Dannenb., *op. cit.* 164 (1976): Leaf-ribs always with sclerenchyma; sheaths closed for $\frac{1}{3}-\frac{1}{2}$ of their length. Panicle 4–5·3 cm, lax. Palea nearly smooth. ● *Olimbos.*

38. F. rechingeri Markgr.-Dannenb., *op. cit.* 166 (1976). Stems 50–60 cm. Leaves 0·45–0·8 mm wide, subpungent, smooth, the lowest $\frac{1}{7}-\frac{1}{4}$ as long as the uppermost; veins 7–13; ribs 9, not very prominent, somewhat angular, with or without sclerenchyma-strands, rather densely hairy; sclerenchyma forming a ring; sheaths closed for $\frac{1}{3}$ of their length, setulose; ligule (0·4–)0·5–0·7(–1) mm, rounded, setulose. Panicle 5·5–6·5 cm, nodding, lax, the branches slender, flexuous, scabrid. Spikelets 8·7–10·2 mm, with 3–4 florets strongly variegated with violet, somewhat shiny. Upper glume 5–5·6 × 2·1–2·6 mm, broadly ovate, rounded, rarely subacuminate; lemma 6·5–7·1 × 2·5–2·9 mm, lanceolate, rather long-acuminate, with a wide scarious margin above; awn 0·3–1·1 mm. Palea as long as lemma, scabridulous and ciliate above. Anthers more than $\frac{1}{2}$ as long as palea. 1600–2200 *m; calcifuge.* ● *Mountains of W. Macedonia.* Gr Ju.

39. F. cyllenica Boiss. & Heldr. in Boiss., *Diagn. Pl. Or. Nov.* **2(13)**: 58 (1853) (*F. varia* subsp. *cyllenica* (Boiss. & Heldr.) Hayek). Stems 25–80 cm. Leaves 0·4–1(–1·15) mm wide, rather rigid and pungent, smooth, the lowest $\frac{1}{7}-\frac{1}{3}$ as long as the upper-

most; ribs 7–9, the lateral always with sclerenchyma; sclerenchyma forming a ring; sheaths scabridulous; ligule 1·5–3·2 mm. Panicle 4–10 cm, erect, somewhat interrupted, the branches glabrous or slightly hairy. Spikelets 9–13 mm, with 4–5 florets, yellowish-green slightly variegated with violet. Upper glume 4·6–7·1 × 2·2–2·9 mm. Lemma 6·5–9·1 × 2·6–3·4 mm, oblong-lanceolate to lanceolate, acuminate, with a scarious margin; awn 0·2–2·2 mm. Palea as long as lemma, shortly hairy and whitish above. Anthers more than ½ as long as palea. *Calcareous rocks*, 800–2000 *m. Mountains of Greece.* Gr.

1 Panicle dense; upper glume almost entirely scarious **(a)** subsp. **cyllenica**
1 Panicle lax; upper glume with a narrow scarious margin
2 Palea scabrid over whole surface **(b)** subsp. **pangaei**
2 Palea scabrid only in upper ⅓ **(c)** subsp. **thasia**

(a) Subsp. **cyllenica**: Veins (7–)9(–10); sheaths closed for ⅓ of their length. Panicle dense. Upper glume almost entirely scarious, acuminate. Lemma 6·5–9·1 × 2·3–3·4 mm, lanceolate, acuminate, smooth, with a narrow scarious margin. Palea scabrid near the apex; keels ciliate in upper ½. *Throughout the range of the species except the north-east.*

(b) Subsp. **pangaei** Markgr.-Dannenb., *Veröff. Geobot. Inst. Rübel (Zürich)* **56**: 159 (1976): Veins 7–9; sheaths closed for ⅙ of their length. Panicle lax. Upper glume acuminate, with a narrow scarious margin. Lemma 7·1–8·5 × 2·7–3·4 mm, lanceolate, acuminate, with a wide scarious margin. Palea scabrid over whole surface; keels ciliate throughout. ● *N.E. Greece (Pangaion.)*

(c) Subsp. **thasia** Markgr.-Dannenb., *op. cit.* 161 (1976): Veins 9(–10); sheaths open to the base. Panicle lax. Upper glume with a narrow scarious margin, rounded. Lemma 7–8·4 × 2·9–3 mm, lanceolate, acuminate, with a narrow scarious margin. Palea scabrid over whole surface; keels long-ciliate in upper ⅓. ● *Thasos.*

40. F. adamovicii (St-Yves) Markgr.-Dannenb., *Bot. Jour. Linn. Soc.* **76**: 326 (1978) (*F. varia* var. *adamovicii* St-Yves). Stems 30–80 cm, scabrid above. Leaves (0·4–)0·7–1 mm wide, smooth, pungent, the lowest (1/25–)1/10–1/5 as long as the uppermost; veins 7–9(–10); ribs 7–9, somewhat prominent, usually with a thick sclerenchyma-strand above; sclerenchyma forming a ring; ligule 1·3–2·5 mm. Panicle 7·5–8 cm, erect, slightly interrupted, the branches densely and shortly hairy. Spikelets 8·5–11(–12) mm, with 3–4 florets, distinctly variegated with violet. Upper glume 5·8–6·2 × 2–2·6 mm, ovate-lanceolate, rounded, with a wide scarious margin. Lemma 6·3–7·8 × 2·3–2·7 mm, lanceolate, shortly acuminate, with a scarious margin above; awn 0–1 mm. Palea distinctly shorter than lemma, densely hairy and whitish, ciliate in the upper ⅔. Anthers little more than ½ as long as palea. *Calcicole.* ● *Jugoslavia and Albania.* Al Ju.

41. F. galicicae I. Horvat ex Markgr.-Dannenb., *op. cit.* 324 (1978). Stems 40–65 cm. Leaves 0·5–1·1 mm wide, smooth, pungent, the lowest 1/20–1/9 as long as the uppermost; veins 7–11; ribs 5–7, with a thin sclerenchyma-strand above, except on mid-vein; sclerenchyma forming a ring; ligule (0·6–)1·5–2·3 mm. Panicle 6–8 cm, scarcely nodding, slightly interrupted, the branches rather short, minutely hairy. Spikelets 8·5–11·7 mm, with 3–4 florets, pale green, slightly variegated with violet. Upper glume 5·2–6·9 × 2·1–2·6 mm, ovate-lanceolate, acuminate. Lemma 6·2–7·8 × 2·6–2·9 mm, lanceolate, acuminate, with a narrow scarious margin above; awn 0·2–0·8 mm. Palea about as long as lemma, scabrid, the keels ciliate throughout. Anthers more than ½ as long as palea. *Alpine meadows*, 1680–2250 *m; calcicole.* ● *S.W. Jugoslavia (Galicica Planina, S. of Ohrid).* Ju.

(D) Stem-base not tuberous. Leaves less than 3 mm wide. Ovary ellipsoid or oblong; grain adnate to palea.

(a) Rhachilla visible between the florets. Ribs of leaves with bulliform epidermal cells. Ligule a very narrow rim. Sheaths decaying into fibres or not.

42. F. ampla Hackel, *Cat. Rais. Gram. Port.* 26 (1880). Stems 30–90 cm. Leaves (0·4–)0·6–0·9 mm wide, plicate, or the cauline sometimes flat, scabrid at apex; veins 7, with sclerenchyma-strands above and beneath; ribs 5–7, prominent, pyriform in cross-section; sheaths yellowish, open to the base, not decaying into fibres. Panicle 10–20 cm, more or less spreading. Spikelets 8–11 mm, with 4–9 florets, greenish or more or less purplish. Lemma 5–7·1 × 1·7–2 mm, conspicuously 3-veined; awn 0·15–0·2(–0·3) mm. Ovary usually glabrous. $2n = 28, 42, 56$. *Rocks, river-gravels and pastures. Portugal, C. & S. Spain.* Hs Lu.

43. F. petraea Guthnick ex Seub., *Fl. Azor.* 20 (1844). Caespitose; stems 30–60 cm. Leaves 0·6–0·8 mm wide, plicate, rigid, more or less erect, with many short conical and some longer hairs on upper surface; veins 5(–7), the main lower sclerenchyma-strands contiguous with the veins; ribs 3–5, with sclerenchyma present above, contiguous only with the midrib; sheaths purplish to brownish-grey, open to the base, not decaying into fibres. Panicle 3–8 cm, rather thick and dense, the branches densely pubescent. Spikelets 6–7 mm. Lemma *c.* 5 × 1·75 mm, long-acuminate, with rather long hairs; awn 0·5–1·5 mm. Palea scabrid. Anthers slightly less than ½ as long as palea. Ovary glabrous. *Rocks, mainly coastal.* ● *Açores.* Az.

44. F. jubata Lowe, *Trans. Cambr. Philos. Soc.* **6**: 530 (1838). Caespitose; stems up to 60 cm. Leaves 0·3–0·6 mm wide, plicate, recurved, smooth; veins 5, with sclerenchyma-strands on both sides, the marginal stouter than the others; ribs 5, prominent, pyriform in cross-section, with lower sclerenchyma-strands contiguous with all veins, the upper sclerenchyma only in 2 ribs; sheaths greyish, open to the base, not decaying into fibres. Panicle 3–10 cm, slender, the branches scabrid. Spikelets 7–8 (–10) mm. Lemma 6–7·5 × 1·5–1·8 mm, long-acuminate, glabrous to puberulent; awn 3–5(–8) mm. Palea with long hairs. Anthers less than ½ as long as palea. Ovary glabrous. *Açores.* Az. (*Madeira.*)

45. F. morisiana Parl., *Gior. Bot. Ital.* **1**: 1 (1809). Caespitose; stems 10–30 cm, slender. Leaves 0·2–0·5 mm wide, flat, smooth; veins 7; ribs 7, rather wide, not very prominent, with inflated cells and sclerenchyma-strands above; lower sclerenchyma-strands present at midrib and margin; sheaths closed, decaying into longitudinal fibres. Panicle more or less spike-like. Spikelets 7–7·7 mm. Lemma *c.* 5·5 mm, scarious near apex. Anthers 2·5 mm. Ovary hairy. ● *C. Sardegna (Mte Gennargentu).* Sa.

46. F. henriquesii Hackel, *Monogr.* 126 (1882). Caespitose; stems 20–40 cm. Leaves 2–2·5 mm wide, flat, becoming plicate when dry; veins 7–9; sclerenchyma-strands at the ridges of all ribs; lower sclerenchyma-strands present only at midrib and margin. Panicle short, lax, the branches scabrid. Spikelets 7–8·5(–9) mm. Lemma 4–6 × 1·9 mm, long-acuminate; awn 2·5–4 mm. Palea scabrid. Anthers 3·4 mm. Ovary glabrous. *Mountain grassland.* ● *N.C. Portugal (Serra da Estrêla).* Lu.

(b) Rhachilla hidden by the florets. Ribs of leaves without bulliform epidermal cells.

(i) Sheaths with deeply infolded thin margins, not or scarcely decaying into fibres, usually closed for ½–¾.

47. F. querana Litard., *Cavanillesia* **8**: 54 (1936). Densely caespitose; stems (16–)25–40 cm; non-flowering shoots intravaginal. Leaves plicate, somewhat pungent; veins 7–8, with very stout, more or less laterally confluent sclerenchyma-strands below each vein, some or all contiguous with the veins; ribs 5–6, very

prominent; epidermal cells rarely bulliform; sheaths closed almost to mouth, scarcely fibrous in decay, with infolded margin of 2 rows of cells; ligule very short, minutely auriculate. Panicle 6–8·5 cm, the branches scabrid. Spikelets 8–8·6 mm. Upper glume *c.* 4·8 × 1·3 mm, linear-lanceolate, shortly acuminate. Lemma 4·5–5·3 × 1·7–2 mm, lanceolate, acuminate. Anthers more than ½ as long as palea. Ovary sparsely hairy. *Mountain heaths.* ● *N.W. Spain* (*prov. León*). Hs.

48. F. capillifolia Dufour in Roemer & Schultes, *Syst. Veg.* **2**: 735 (1817) (*F. scaberrima* Lange, non Steudel). Densely caespitose; stems 35–60 cm; non-flowering shoots intravaginal. Leaves plicate, very slender, strongly scabrid, slightly pungent; veins 5–7, with a sclerenchyma-strand below but not touching each vein and at the margins; ribs 1–3(–5), not very prominent; epidermal cells large; sheaths closed for ½–¾ of their length, not decaying into fibres, with infolded margin of 1 row of cells; ligule minutely auriculate. Panicle 6–10 cm, the branches shortly hairy. Spikelets 7·5–9 mm. Upper glume 5·1–5·8 × 1·3–1·6 mm, narrowly lanceolate, long-acuminate. Lemma 5·2–6·2 × 1·7–2 mm, lanceolate, long-acuminate. Anthers *c.* ½ as long as palea. Ovary glabrous. *Woods and scrub; calcicole. S. & S.E. Spain.* Hs.

49. F. porcii Hackel, *Monogr.* 147 (1882). Laxly caespitose; stems up to 90 cm; non-flowering shoots extravaginal. Leaves 0·7–1·2 mm wide, the lower plicate, the upper flat; veins 13, with a sclerenchyma-strand below and usually touching each vein; ribs 7, alternately very prominent and lower, the more prominent ribs with contiguous sclerenchyma-strands on either side; epidermal cells bulliform; sheaths closed for ⅔ of their length, not decaying into fibres, with infolded margin of 1 row of cells; ligule very short, densely ciliate. Panicle 13–18 cm, lax, the branches rather long-setose. Spikelets *c.* 9·4 mm. Upper glume *c.* 4·9 × 1·4 mm, obovate, obtuse to very shortly acuminate. Lemma *c.* 6·2 × 2·1 mm, lanceolate, shortly acuminate. Anthers *c.* ½ as long as palea. Ovary glabrous or subglabrous. $2n = 14$. *Mountain meadows; calcicole.* ● *E. & S. Carpathians;* Cz Po Rm Rs (W).

50. F. tatrae (Csakó) Degen, *Magyar Bot. Lapok* **3**: 171 (1904) (*F. amethystina* var. *tatrae* Csakó). Densely caespitose; stems up to 45 cm; non-flowering shoots intravaginal. Leaves 0·7–0·9(–1·3) mm wide, plicate; veins (5–)9–11(–13) with 7–9 sclerenchyma-strands, some touching the veins from below; ribs (5–)7–11, prominent; sheaths closed for ½–⅔ of their length, with infolded margin of 1 row of cells; ligule minutely auriculate, densely ciliate. Panicle *c.* 10 cm, the branches sparsely hairy. Spikelets 7·9–8·6 mm. Upper glume 3–3·4 × 1·4–1·6 mm, ovate-lanceolate, shortly acuminate. Lemma 4·2–4·6 × 2·3–2·4 mm, ovate-lanceolate, shortly acuminate. Anthers more than ½ as long as palea. Ovary glabrous or subglabrous. $2n = 14$. *Mountain grassland; calcicole.* ● *W. Carpathians.* Cz Po.

51. F. peristerea (Vetter) Markgr.-Dannenb., *Veröff. Geobot. Inst. Rübel* (*Zürich*) **56**: 138 (1976) (*F. ovina* subsp. *frigida* var. *peristerea* Vetter). Densely caespitose; stems 30–55 cm; non-flowering shoots intravaginal. Leaves 0·4–0·73 mm wide, plicate, rigid, scabridulous above; veins 5, with sclerenchyma below, but not touching them; ribs 3, prominent; sheaths closed for *c.* ½ their length, persistent, ribbed, with infolded margin of 1 row of cells; ligule minutely auriculate, shortly ciliate. Panicle 7–9 cm, lax, the branches glabrous or shortly and rather densely hairy. Spikelets *c.* 8·5 mm. Upper glume 3·6–5 × 1·4–1·7 mm, ovate-lanceolate, acuminate. Lemma 4·9–6 × 2·1–2·3 mm, ovate-lanceolate; awn 3–4 mm. Anthers slightly more than ½ as long as palea. Ovary subglabrous. *Mountain meadows; calcifuge.* ● *W. Macedonia; one station in S.C. Bulgaria.* Bu Gr Ju.

52. F. korabensis (Ják. ex Markgr.-Dannenb.) Markgr.-Dannenb., *Bot. Jour. Linn. Soc.* **76**: 326 (1978) (*F. violacea* var. *korabensis* Ják. ex Markgr.-Dannenb.). Densely caespitose; stems (10–)15–30(–40) cm, densely hairy below the panicle; non-flowering shoots intravaginal. Leaves 0·2–0·5(–0·65) mm wide, plicate, rather rigid; veins 5–7; ribs 3, prominent, with slender sclerenchyma-strands below, but not touching the ribs; sheaths closed for ½–¾ of their length, with infolded margin of 2 rows of cells (rarely 1 row in the middle part); ligule minutely auriculate, ciliolate. Panicle 3–5(–6) cm, dense, the branches densely hairy. Spikelets 6·8–7·5 mm. Upper glume 3·4–4·8 × 1·3–2 mm, ovate-lanceolate, rather shortly acuminate. Lemma 4·6–5·5 × (1·7–)1·9–2·4 mm; awn 1·5–2·7 mm. Anthers more than ½ as long as palea. Ovary subglabrous. *Alpine grassland; calcicole.* ● *N.W. Macedonia and E. Albania.* Al Ju.

53. F. borderi (Hackel) K. Richter, *Pl. Eur.* **1**: 97 (1890). Densely caespitose; stems 10–30 cm; non-flowering shoots intravaginal. Leaves (0·5–)0·6–0·85 mm wide, plicate, pungent, often curved; veins 5–7, with a sclerenchyma-strand below each vein, that of mid-vein and margin touching the vein; ribs 5, very prominent, occasionally with sclerenchyma; sheaths closed for ⅔ of their length, scarcely fibrous, with infolded margin of 2 rows of cells; ligule short, ciliate. Panicle *c.* 5 cm, dense, the branches glabrous. Spikelets 7–7·6 mm. Upper glume 4·3–4·9 × 1·3–1·6 mm, ovate-lanceolate, shortly acuminate. Lemma 5·2–5·8 × 1·6–2 mm, acuminate. Anthers less than ½ as long as palea. Ovary glabrous or subglabrous. $2n = 14$. *Siliceous rocks*, 2300–2700 *m.* ● *Pyrenees.* Ga Hs.

54. F. norica (Hackel) K. Richter, *op. cit.* 99 (1890) (*F. violacea* subsp. *norica* (Hackel) Hegi). Densely caespitose; stems 22–68 cm; non-flowering shoots mostly intravaginal. Leaves 0·6–0·7 mm wide, plicate; veins 5–9, with sclerenchyma-strands extending from main veins to either epidermis; ribs 5–7, prominent and almost touching laterally; sheaths closed for ½ their length, sometimes decaying into fibres a little, with infolded margin of 1 row of cells; ligule very short, without auricles. Panicle 5–10 cm, lax, nodding. Spikelets 6·7–10 mm. Upper glume 5·8–6 × 1·4–1·7 mm, oblong-lanceolate, shortly acuminate. Lemma 4·3–6·5 × 2–2·7 mm, lanceolate, acuminate. Anthers much more than ½ as long as palea. Ovary rarely glabrous. *Dry mountain grassland*, 1600–2500 *m.* ● *E. Alps.* Au Ge He It Ju.

55. F. amethystina L., *Sp. Pl.* 74 (1753). Densely caespitose; stems 30–105 cm. Leaves plicate, veins with sclerenchyma-strands below and rarely confluent with them; ribs 3–5, rather low to prominent; sheaths closed for ½(–⅘) of their length, persistent, not decaying into fibres, ribbed, often violet; ligule minutely auriculate, ciliolate. Panicle-branches shortly hairy. Anthers more than ½ as long as palea. Ovary glabrous or subglabrous. *Dry places. Alps, C. Europe and Balkan peninsula.* Au Bu Cz Ga Ge Gr He Hu It Ju Po Rm Rs (W).

1 Extravaginal non-flowering shoots few; panicle dense; leaves scabrid
2 Upper glume 3–4·2 × 0·9–1·1 mm, lanceolate **(a)** subsp. **amethystina**
2 Upper glume 3·5–5·4 × 1–1·6 mm, ovate-lanceolate **(b)** subsp. **kummeri**
1 Extravaginal non-flowering shoots numerous; panicle lax; leaves smooth
3 Stems 75–100 cm; panicle 14–17 cm; upper glume lanceolate **(c)** subsp. **ritschlii**
3 Stems 30–60 cm; panicle 4–15 cm; upper glume lanceolate to ovate-lanceolate **(d)** subsp. **orientalis**

(a) Subsp. **amethystina**: Stems 45–80 cm × 1·3–2·3 mm; extravaginal non-flowering shoots few. Leaves 0·25–0·6(–0·7) mm

wide, strongly scabrid; veins 5–7. Panicle 8–13 cm, dense. Spikelets 6·9–8·5 mm. Upper glume 3–4·2 × 0·9–1·1 mm, lanceolate, long-acuminate. Lemma 4·4–5·6 × 1·7–2·1 mm, ovate-lanceolate, acuminate; awn 0–0·2 mm. $2n = 14$. *On limestone.* ● *Alps and C. Europe.*

(b) Subsp. **kummeri** (G. Beck) Markgr.-Dannenb., *Bot. Jour. Linn. Soc.* **76**: 326 (1978) (*F. amethystina* var. *kummeri* G. Beck): Stems 60–105 cm × (1·3–)1·6–2·7 mm; extravaginal non-flowering shoots few. Leaves (0·35–)0·4–0·75(–0·82) mm wide, strongly scabrid, rigid; veins 7. Panicle (7·5–)10–15 cm, dense. Spikelets (7·3–)8–8·6 mm. Upper glume 3·5–5·4 × 1–1·6 mm, ovate-lanceolate, long-acuminate. Lemma (4·2–)4·9–6·3 × 1·7–2·5 mm, ovate-lanceolate, acuminate. *On serpentine.* ● *C. Jugoslavia and W. Bulgaria.*

(c) Subsp. **ritschlii** (Hackel) Lemke ex Markgr.-Dannenb., *op. cit.* 327 (1978) (*F. amethystina* var. *ritschlii* Hackel): Stems 75–100 cm × 1·8–3·5 mm; extravaginal non-flowering shoots rather numerous. Leaves 0·35–0·75 mm wide; veins usually 7. Panicle 14–17 cm, lax. Spikelets 8–9·4(–10) mm. Upper glume 3·2–5·1 × 1·2–1·4 mm, lanceolate, long-acuminate. Lemma 4·6–5·9 × 1·7–2·3 mm; awn 0–1 mm. ● *N.C. Europe.*

(d) Subsp. **orientalis** Krajina, *Acta Bot. Bohem.* **9**: 214 (1930): Stems 30–60 cm × 1–2·1 mm; extravaginal non-flowering shoots numerous. Leaves 0·3–0·75(–0·8) mm wide, smooth, not rigid; veins 5–7. Panicle 4–15 cm, rather lax. Spikelets 6·5–8·6 mm. Upper glume 3·2–5·3 × 1–1·5 mm, lanceolate to ovate-lanceolate, rather shortly acuminate. Lemma 4·2–5·5 × 1·6–2·4 mm, broadly ovate-lanceolate, shortly acuminate, glabrous or hispidulous near apex; awn 0–0·4 mm. *E. & S. Carpathians; W. part of Balkan peninsula.*

(ii) Sheaths without deeply infolded thin margins. Ligule without auricles; sheaths usually closed to the mouth, usually decaying into fibres.

56. F. heterophylla Lam., *Fl. Fr.* **3**: 600 (1779). Densely caespitose; stems 60–120(–150) cm × 1–1·9 mm; non-flowering shoots mostly intravaginal. Cauline leaves 2–3 mm wide, flat when fresh, with 7–11 veins; basal leaves (0·2–)0·4–0·6 mm wide, plicate, scabrid, rather flaccid, triangular in cross-section, with 1 rib, 3(–5) veins and 5 very slender sclerenchyma-strands; sheaths closed to the mouth, scarcely fibrous in decay; ligule very short. Panicle 6–17 cm, the branches scabrid, patent at anthesis. Spikelets 8–11·5 mm, with (3–)4–6 florets. Upper glume 4·6–7 × 1·1–1·4 mm, oblong-lanceolate, more or less shortly acuminate. Lemma 5–8·4 × 1·7–2 mm, lanceolate to narrowly oblong-lanceolate, scabridulous above; awn up to 6 mm. Anthers *c.* ½ as long as palea. Ovary hairy at apex. $2n = 28$. *Mainly in woods. From S. England and Poland southwards to N.W. Spain and Greece.* Al Au Be Bl Br Bu Co Cz Ga Ge Gr He Ho Hs Hu It Ju Po Rm Rs (W) ?Si Tu [Da Su].

57. F. plicata Hackel, *Österr. Bot. Zeitschr.* **27**: 48 (1877). Stems 12–26 cm. Leaves 0·4–0·6 mm wide, acute; veins 3; sclerenchyma-strands 5, the central stout and often reaching the vein; rib 1; sheaths closed to the mouth, slightly fibrous in decay; ligule very short, not auriculate, ciliolate. Panicle 2–4 cm, dense. Spikelets *c.* 7·5 mm, pale green, slightly violet-tinged and shiny. Upper glume *c.* 3·9 × 1·1 mm, lanceolate, acuminate. Lemma 4·6–4·9 × 1·6 mm; awn at least as long as lemma. Anthers more than ½ as long as palea. Ovary subglabrous. *Calcareous rocks. Mountains of S. & S.E. Spain.* Hs.

58. F. violacea Schleicher ex Gaudin, *Alpina* (*Winterthur*) **3**: 57 (1808). Rather densely caespitose; stems 15–30 cm, slender. Basal leaves rather soft; veins 5; ribs 3; sclerenchyma-strands 7, unequal in width, slender; sheaths closed to the mouth, soon decaying into fibres; ligule a minute rim. Panicle 3–6 cm, rather lax, the branches slender, often flexuous, glabrous or with short, dense hairs. Spikelets 7–7·5(–8) mm, shiny. Upper glume lanceolate, acute to acuminate. Lemma lanceolate, glabrous or scabrid above. Ovary sparsely hairy to glabrous. ● *Alps, Appennini and mountains of Balkan peninsula.* Ga Gr He It Ju.

1 Lemma 5·3–5·5 × 2–2·1 mm — (b) subsp. **macrathera**
1 Lemma 4·3–4·7 × 1·6–2 mm
2 Spikelets pinkish-violet; epidermal cells small — (a) subsp. **violacea**
2 Spikelets green; epidermal cells large — (c) subsp. **handelii**

(a) Subsp. **violacea**: Leaves (0·2–)0·25–0·4(–0·5) mm wide; sclerenchyma-strands slender or very slender; epidermal cells rather small. Spikelets pinkish-violet. Upper glume 3·6–5·3 × 1–1·7 mm. Lemma 4·3–4·7 × 1·6–2 mm; awn 1–1·6(–2·8) mm. Anthers 2·3–2·8 mm. $2n = 14$. *Calcifuge. S.W. & C. Alps.*

(b) Subsp. **macrathera** (Hackel ex G. Beck) Markgr.-Dannenb., *Bot. Jour. Linn. Soc.* **76**: 326 (1978) (*F. violacea* var. *macrathera* Hackel ex G. Beck): Like subsp. (a) but leaves up to 0·6 mm wide; sclerenchyma-strands mostly rather stout or stout; epidermal cells large; upper glume 3·8–5·5 × 1·4–2 mm; lemma 5·3–5·5 × 2–2·1 mm; awn (2·1–)2·5–3·5 mm; anthers (2–)3·2–3·7 mm. *Calcicole. C. & S. Italy; C. Jugoslavia.*

(c) Subsp. **handelii** Markgr.-Dannenb., *Veröff. Geobot. Inst. Rübel* (*Zürich*) **56**: 139 (1976): Like subsp. (a) but leaves 0·4–0·55 mm wide; some sclerenchyma-strands stout; epidermal cells very large; spikelets green. *Calcicole. E. Greece* (*Olimbos*).

59. F. nitida Kit. in Schultes, *Österreichs Fl.* ed. 2, **1**: 239 (1814) (*F. violacea* var. *minor* Hackel). Rather densely caespitose; stems 20–40 cm. Leaves slender; veins 5; ribs 3; sclerenchyma-strands 7, very slender; sheaths closed to the mouth, decaying irregularly into fibres; ligule short, auriculate, glabrous. Panicle 4–5 cm, secund, the branches tomentose, patent at anthesis. Spikelets 6·9–8 mm, shiny. Upper glume 3·2–5·5 × 1·3–1·7 mm, linear-oblong, long-acuminate. Anthers more than ½ as long as palea. Ovary densely hairy. *Calcicole.* ● *S.E. Alps and mountains of N.W. Jugoslavia; E. & S. Carpathians.* Au It Ju Rm.

(a) Subsp. **nitida**: Stems more or less densely and shortly hairy above. Leaves 0·2–0·45 mm wide. Panicle oblong, slightly secund and nodding. Spikelets violet. Lemma 4·9–5·8 × 1·5–1·8 mm, mucronate or very shortly awned, usually glabrous; awn 0·3–1·2 mm. *S.E. Alps and mountains of N.W. Jugoslavia.*

(b) Subsp. **flaccida** (Schur) Markgr.-Dannenb., *Bot. Jour. Linn. Soc.* **76**: 326 (1978) (*F. flaccida* Schur): Stems densely lanate above. Leaves (0·25–)0·3–0·6 mm wide. Panicle wider and laxer. Spikelets yellowish-green, rarely slightly pinkish. Lemma 4·3–6 × 1·6–2·1 mm, lanceolate, hirtellous; awn up to ½ as long as lemma. *E. & S. Carpathians.*

60. F. iberica (Hackel) K. Richter, *Pl. Eur.* **1**: 99 (1890). Rather densely caespitose; stems 20–50 cm. Leaves (0·3–)0·4–0·6(–0·7) mm wide, strongly scabrid; veins 5(–7); ribs 3; sclerenchyma-strands 7, unequal in width; sheaths closed to the mouth, decaying into fibres. Panicle 3–7 cm, lax, erect or slightly nodding, the branches glabrous or minutely hairy. Spikelets 7–7·6(–8) mm, with 4–7 florets, glaucous, dirty violet. Upper glume 3–4 × 1–1·3 mm, acuminate. Lemma 4·2–5·5 × 1·5–2 mm, oblong-lanceolate, acuminate, scabrid above; awn 1·3–2·7 mm. Anthers more than ½ as long as palea. Ovary glabrous. *Siliceous screes.* ● *Pyrenees and mountains of Spain.* Ga Hs.

61. F. puccinellii Parl., *Fl. Ital.* **1**: 440 (1850) (*F. violacea* subsp. *nigricans* (Hackel) Hegi). Rather densely caespitose; stems 30–50 cm, usually glabrous above. Basal leaves 0·25–0·6 mm wide; veins 5; ribs 3; sclerenchyma-strands 7, slightly unequal in width, rather stout; cauline leaves wider, with 7–9 veins; sheaths closed to the mouth, scarcely decaying into fibres.

Panicle 6–9 cm, rather lax, the branches glabrous or hairy. Spikelets (7·8–)8–10 mm, dark violet or yellowish-green. Upper glume 3·3–6 × 0·9–1·7 mm, acuminate. Lemma (5·8–)6–7·1 × 1·6–2·5 mm, lanceolate to linear-lanceolate, long-acuminate, smooth or slightly scabrid above; awn (2–)2·4–4·7 mm. Anthers more than ½ as long as palea. Ovary rarely glabrous. *Stony mountain grassland*, 1050–2700 *m*. ● *Alps and Jura*. Au Ga Ge He It.

62. F. clementei Boiss., *Elenchus* 90 (1838). Stems 15–22 cm, with 1 node near base, hidden by numerous sheaths. Leaves 0·5–0·7 mm wide, rigid, very scabrid, densely covered with rather long hairs; veins 5–7, with 5–7 stout sclerenchyma-strands, that of the mid-vein expanded laterally; ribs 3–5, with several sclerenchyma-cells at their crests; sheaths closed to the mouth, decaying into fibres. Panicle 3–5·5 cm, dense, rigid. Spikelets 5·6–6 mm, variegated with pale violet. Upper glume 2·9–3·1 × 1·1–1·4 mm, ovate-lanceolate, obtuse to very shortly acuminate, with a wide scarious margin. Lemma 4–4·5 × 2 mm, mucronate or with an awn up to 0·6 mm. Anthers more than ½ as long as palea. Ovary subglabrous. $2n=14$. *Screes and rock-crevices*, 3200–3460 *m; calcifuge*. ● *S. Spain* (*Sierra Nevada*). Hs.

63. F. picta Kit. in Schultes, *Österreichs Fl.* ed. 2, **1**: 236 (1814) (*F. violacea* subsp. *picta* (Kit.) Hegi). Rather densely caespitose; stems 25–40(–45) cm, shortly tomentose above. Leaves (0·3–)0·4–0·6(–0·75) mm wide, somewhat rigid; veins 5–7(–9); sclerenchyma-strands 7–9(–11), some rather stout; ribs 5–7; sheaths closed nearly to the mouth, decaying irregularly into fibres. Panicle 4–7(–8) cm, rather rigid, the branches shortly tomentose. Spikelets (6·3–)6·5–7·5(–8) mm, green, variegated with dark violet. Upper glume 3·4–3·9 × 1·4–1·6 mm, ovate-lanceolate, obtuse to shortly acuminate. Lemma 4·2–5·2(–5·6) × (1·6–)2·1–2·2 mm, lanceolate, shortly acuminate; awn 1·2–2 mm. Anthers more than ½ as long as palea. Ovary hairy. $2n=14$. *Usually calcicole*. ● *E. Alps; Carpathians; mountains of Bulgaria*. Au Bu Cz Po Rm Rs (W).

64. F. baffinensis Polunin, *Bull. Nat. Mus. Canada* **92** Biol. Ser., **24**: 91 (1940). Stems 10–20 cm, rigid, with dense, short hairs especially above. Leaves (0·3–)0·4–0·6(–0·7) mm wide, somewhat flattened, more or less densely hairy above; veins 5; ribs 3; sclerenchyma-strands 7, very slender, sheaths closed for ¼–½ their length, decaying into fibres; ligule ciliolate, minutely auriculate. Panicle 2–4 cm, dense, the branches with more or less dense, short hairs. Spikelets *c.* 7·6 mm (when they have 4 florets), dark reddish-violet, shiny, slightly scabrid. Upper glume *c.* 4·9 mm, ovate-lanceolate, acuminate. Lemma 4·6–5·2 mm; awn 1·7–2 mm. Anthers *c.* ⅓ as long as palea. Ovary with sparse short hairs. $2n=28$. *Svalbard*. Sb. (*Arctic-circumpolar.*)

(iii) Sheaths without deeply infolded thin **margins.** Ligule without auricles; sheaths closed to the mouth, usually decaying into fibres. Non-flowering shoots extravaginal.

65. F. nigrescens Lam., *Encycl. Méth. Bot.* **2**: 460 (1788). Densely caespitose; stems 30–90 cm; stolons absent or very short. Leaves soft; sheaths closed to the mouth, pinkish, decaying into fibres; ligule a minute rim. Panicle 4–10 cm, secund, the branches scabrid, patent only at anthesis. Upper glume ovate-lanceolate to lanceolate. Lemma lanceolate, rather long-acuminate. ● *S., W. & C. Europe, extending to S. Sweden*. Au Be Br Bu Cz *Da Ga Ge Gr He Hs Hu It Ju Lu No Rm Rs (W) Su.

(a) Subsp. **nigrescens**: Leaves 0·4–0·7(–1) mm wide, dark green, usually smooth; veins 5–7; ribs occasionally with sclerenchyma. Spikelets (6·5–)7–9·5 mm. Upper glume 3·3–5·2 × 1·3–1·6 mm. Lemma 4·6–6·2 × 2·1–2·3 mm, usually glabrous; awn ½ as long as lemma. $2n=28$, 42. *Throughout the range of the species.*

(b) Subsp. **microphylla** (St-Yves) Markgr.-Dannenb., *Bot. Jour. Linn. Soc.* **76**: 327 (1978) (*F. rubra* subsp. *microphylla* St-Yves): Leaves 0·4–0·5 mm wide, glaucous, scabrid above; veins 5; ribs without sclerenchyma. Spikelets (7·5–)8–9·1 mm. Upper glume *c.* 4·4 × 1·2 mm. Lemma 4·8–6 × 2–2·3 mm; awn slightly more than ½ as long as lemma. *Mountains of S. Europe.*

66. F. rubra L., *Sp. Pl.* 74 (1753). Laxly, rarely densely caespitose, usually with more or less long rhizomes. Leaves of non-flowering shoots with 3–9 ribs, rarely with some sclerenchyma cells; main sclerenchyma in 7–11 separate strands; cauline leaves often flat; sheaths closed to the mouth, pinkish, decaying into fibres; ligule a minute rim. Panicle erect or slightly nodding, the branches glabrous or hairy, patent at anthesis. Lemma 4–9 mm; awn variable, but not more than ½ as long as lemma. $2n=14$, 28, 42, 56, 70. *Almost throughout Europe.* All except Bl Cr Sa Tu, but only as an alien in Az and Rs (E).

1 Plant ± laxly caespitose
2 Leaves rigid; veins (5–)7–9; sclerenchyma-strands conspicuously unequal; all ribs with sclerenchyma; spikelets 9–13 mm; lemma usually tomentose; stolons very long **(c) subsp. arenaria**
2 Leaves not rigid; veins (5–)7; sclerenchyma-strands not very unequal; ribs often without sclerenchyma; spikelets 7–11 mm; lemma not tomentose; stolons variable
3 Stems up to 80(–110) cm; leaves 0·65–0·85 mm wide when plicate; spikelets 7–10 mm **(a) subsp. rubra**
3 Stems not more than 45 cm; leaves 0·5–0·7 mm wide; spikelets 10–11 mm **(b) subsp. litoralis**
1 Plant ± densely caespitose; stolons short
4 Leaves strongly scabrid throughout **(g) subsp. asperifolia**
4 Leaves smooth or scabrid near apex only
5 Stems not more than 44 cm; leaves glabrous or subglabrous; veins 5–7; sclerenchyma-strands equal; ribs without sclerenchyma **(d) subsp. pruinosa**
5 Stems up to 65 cm; leaves usually with rather long, dense hairs; sclerenchyma-strands unequal; ribs often with sclerenchyma
6 Leaves smooth, obtuse; veins 7(–9); ribs nearly always with sclerenchyma; sheaths sometimes breaking down into fibres; upper glume 3·2–6 × 1·6–2 mm, ovate-lanceolate **(e) subsp. juncea**
6 Leaves slightly scabrid above, acute; veins 5–7(–9); ribs nearly always without sclerenchyma; sheaths persistent; upper glume 4–5·5 × 1·4–1·7 mm, subulate-lanceolate **(f) subsp. thessalica**

(a) Subsp. **rubra** (*F. rubra* subsp. *vulgaris* (Gaudin) Hayek): Stems up to 110 cm. Leaves 0·65–0·85 mm wide when plicate, smooth, rarely scabrid near the obtuse or abruptly acute apex, more or less hairy; veins (5–)7; sclerenchyma-strands not very stout; ribs usually without sclerenchyma; sheaths glabrous to sparsely hairy. Panicle 7–14 cm, lax. Spikelets 7–10 mm, bright green or glaucous, rarely pruinose. Upper glume 1·2–1·4(–1·6) mm wide, lanceolate, acuminate. Lemma 5–7 × 1·9–2·3 mm, glabrous or subglabrous. *Almost throughout the range of the species.*

(b) Subsp. **litoralis** (G. F. W. Meyer) Auquier, *Bull. Jard. Bot. Nat. Belg.* **38**: 191 (1968) (*F. rubra* var. *litoralis* G. F. W. Meyer): Stems not more than 45 cm. Leaves (0·4–)0·5–0·7(–0·8) mm wide, smooth, glabrous or very shortly hairy, obtuse; veins (5–)7; sclerenchyma-strands mostly rather thin; sheaths glabrous. Panicle 5·8–8 cm, rather dense, with few spikelets. Spikelets

(8–)10–11 mm, bright green or glaucous, glossy, rarely pruinose. Upper glume 4·6–5·2 × 1·6–2·1 mm, lanceolate, acuminate. Lemma 6·2–7·1 × 1–2·3 mm. $2n=42$. *Salt-marshes and damp maritime sands.* ● *Coasts of W. Europe and the Baltic region.*

(c) Subsp. **arenaria** (Osbeck) Syme in Sowerby, *Engl. Bot.* ed. 3, **11**: 147 (1872) (*F. arenaria* Osbeck): Stems up to 70 cm, stout, rigid. Leaves 0·6–1·1 mm wide, smooth, densely hairy, rigid, obtuse; veins (5–)7–9; sclerenchyma-strands unequal; all ribs with sclerenchyma; sheaths glabrous. Panicle 7–16 cm. Spikelets 9–13 mm, glaucous. Upper glume 5·2–8 × 1·4–1·8 mm, ovate-lanceolate, rather abruptly acuminate, more or less ciliate. Lemma 6·9–9·7 × 2·1–2·6 mm, lanceolate, acuminate, usually densely tomentose. $2n=56$. *Maritime sands.* ● *Coasts of N. W. Europe and the Baltic region.*

(d) Subsp. **pruinosa** (Hackel) Piper, *Contr. U.S. Nat. Herb.* **10**: 22 (1906): Stems up to 44 cm. Leaves 0·4–1·2 mm wide, glabrous or subglabrous, rather rigid; veins 5–7; sclerenchyma-strands not very stout; ribs without sclerenchyma; sheaths usually glabrous. Panicle 2–6 cm, rather dense, with few spikelets. Spikelets 7·6–10 mm, glaucous. Upper glume 3·7–6 × 1·3–1·7 mm, oblong-lanceolate, rather shortly acuminate. Lemma 4·5–6·8 × 2–2·1 mm, lanceolate, long-acuminate, glabrous or hairy, usually pruinose. $2n=42$. *Atlantic coasts of Europe, from Portugal to Iceland.*

(e) Subsp. **juncea** (Hackel) Soó, *Acta Bot. Acad. Sci. Hung.* **17**: 117 (1972): Stems up to 65 cm, stout. Leaves (0·4–)0·5–2 mm wide, smooth, usually with long, dense hairs, obtuse, rigid; veins 7(–9); sclerenchyma-strands unequal, some very stout; epidermal cells very large; ribs often with sclerenchyma; sheaths usually setose. Panicle (5–)6·5–12 cm, erect, rather dense. Spikelets 8·5–12 mm, glaucous. Upper glume 3·2–6 × 1·6–2 mm, ovate-lanceolate, acuminate. Lemma 5–6·9 × 2·1–2·6 mm, lanceolate, acuminate. Lemma 5–6·9 × 2·1–2·6 mm, lanceolate, long-acuminate, glabrous or shortly hairy. $2n=42$. *Mainly on disturbed ground. Throughout most of the range of the species except the U.S.S.R.*

(f) Subsp. **thessalica** Markgr.-Dannenb., *Veröff. Geobot. Inst. Rübel (Zürich)* **56**: 144 (1976): Stems 40–65 cm. Leaves 0·4–0·9 mm wide, rigid, long-hairy, acute, scabrid towards apex; veins 5–7(–9); sclerenchyma-strands unequal; sheaths persistent, setulose above. Panicle (5–)7–14·5 cm, very lax. Spikelets (8·5–)9·4–10·5 mm; upper glume 4–5·5 × 1·4–1·7 mm, subulate-lanceolate, long-acuminate. Lemma (5·4–)6·1–7·1 × (1·7–)2–2·4 mm, lanceolate. *Mountain springs.* ● *N. Greece (Pindhos).*

(g) Subsp. **asperifolia** (St-Yves) Markgr.-Dannenb., *op. cit.* 143 (1976): Stems up to 70 cm. Leaves (0·4–)0·5–1·1 mm wide, rigid, usually with long, dense hairs, more or less acute; veins 7–9(–10); sclerenchyma-strands unequal, some very stout; sheaths glabrous to long-setose. Panicle 7–20 cm, rigid. Spikelets (7·5–)8–10(–12) mm, glaucous. Upper glume 3·8–5·5 × 1·3–1·5 mm, oblong-lanceolate, long-acuminate. Lemma (5–)5·5–6·9(–7·5) mm, lanceolate, acuminate, scabrid above or shortly hairy all over. *Mountain rocks.* ● *S. Europe.*

67. F. richardsonii Hooker, *Fl. Bor.-Amer.* **2**: 250 (1840). Laxly caespitose, with some long rhizomes; stems (12–)22–40 (–52) cm. Leaves 0·5–1(–1·35) mm wide, plicate or partly flat, smooth or scabrid above, subrigid, obtuse; veins 7; sclerenchyma-strands usually of medium width; ribs 3–5, very prominent, some with sclerenchyma; sheaths closed to the mouth, pinkish, shortly hairy, decaying into fibres. Panicle (2–)4–7 cm, erect, usually very dense, the branches scabrid. Spikelets (6–)7–8·6 mm, usually densely covered with rather long, whitish hairs. Upper glume 3–3·6 × 1–1·1 mm, ovate to ovate-oblong, often rounded. Lemma 4–5·3(–6) × 1·7–2·1 mm; awn up to 1·6 mm. $2n=42$. *Arctic and subarctic Europe, southwards to the Færöer and C. Ural.* Fa Fe Is No Rs (N, C) Sb Su.

68. F. pyrenaica Reuter, *Cat. Graines Jard. Bot. Genève* **1861**: 4 (1862). Laxly or very laxly caespitose, with long rhizomes; stems 10–32 cm, ascending. Basal leaves 0·3–0·45(–0·6) mm wide, rather soft, somewhat hairy, obtuse; veins 5–7; sclerenchyma-strands 3–4, large, rarely with up to 4 additional small strands; ribs very prominent, usually with some sclerenchyma and with long hairs; sheaths closed to the mouth, pinkish, hirtellous, decaying into fibres. Panicle 2–3·5 cm, nearly simple. Spikelets 6–6·5 mm, variegated with greyish-violet. Upper glume 3·4–3·7 × 1·2–1·3 mm, oblong-lanceolate, long-acuminate. Lemma 4–4·2 × 1·5–1·6 mm, lanceolate, long-acuminate; awn up to 1·5 mm. $2n=28$. *Mountain rocks; calcicole.* ● *C. & E. Pyrenees.* Ga Hs.

69. F. trichophylla (Ducros ex Gaudin) K. Richter, *Pl. Eur.* **1**: 100 (1890). Laxly caespitose, with more or less long rhizomes; stems 30–68 cm × 0·7–1 mm. Leaves 0·3–0·5(–0·6) mm, plicate, scabrid above, more or less hairy, subacute; veins (4–)5; sclerenchyma-strands rather stout, subequal, rarely confluent; ribs not very prominent; sheaths closed to the mouth, glabrous, pinkish, decaying into fibres. Panicle 6–10 cm, rather lax but narrow, the branches very slender. Spikelets 7–8·6 mm, green. Upper glume 3·4–4·3 × 0·8–1·2 mm, oblong-lanceolate, acuminate. Lemma 4·9–5·4 × 1·6–2 mm, linear-lanceolate, glabrous, often dark below the apex; awn usually very short. $2n=42$. *Damp grassland, mainly in the mountains; usually calcicole. S. & S.C. Europe.* Au ?Bu Co Cz Ga Ge He Hs Hu It Ju Lu Rm.

70. F. pseudotrichophylla Patzke, *Decheniana* **117**: 195 (1964). Rather densely caespitose, with short rhizomes; stems 30–70 cm × 1·1–1·5 mm. Leaves $\frac{1}{6}$–$\frac{1}{4}$ as long as stems, 0·4–0·6 (–0·8) mm wide, plicate, scabrid, glabrous or subglabrous; veins 5; sclerenchyma-strands of medium width or stout; sheaths closed to the mouth, glabrous, pinkish, usually not fibrous in decay. Panicle 3–12 cm, rather lax, the branches glabrous or slightly scabrid. Spikelets (6·5–)7–9 mm, green, slightly violet-tinged. Upper glume 4·5–5 × 1·2–1·6 mm, lanceolate, acuminate. Lemma 5·5–6·2 × 1·4–2·1 mm, lanceolate, acuminate; awn *c.* $\frac{1}{2}$ as long as lemma. $2n=$?42. ● *Mountains of S.W. Europe.* Ga Hs Lu.

71. F. cyrnea (Litard. & St-Yves) Markgr.-Dannenb., *Bot. Jour. Linn. Soc.* **76**: 327 (1978) (*F. rubra* subsp. *eu-rubra* var. *cyrnea* Litard. & St-Yves). Rather densely caespitose, with creeping rhizomes; stems 30–40 cm. Leaves 0·35–0·55(–0·6) mm wide, smooth, glabrous or subglabrous, subacute; veins 5(–7); sclerenchyma-strands rather stout, sometimes confluent; sheaths closed to the mouth, sparingly hairy, not decaying into fibres. Panicle (3–)5–7 cm, erect, the branches scabrid. Spikelets 8–9 mm, pale green, violet-tinged. Upper glume *c.* 5 × 1·5 mm, subulate, acute, with a wide scarious margin. Lemma 5·4–6 × 2–2·1 mm, lanceolate-subulate; awn 1–2·5 mm. ● *Mountains of Italy and Corse.* Co It.

72. F. oelandica (Hackel) K. Richter, *Pl. Eur.* **1**: 100 (1890) (*F. rubra* var. *oelandica* Hackel). Rather densely caespitose, with short rhizomes; stems 20–37(–47) cm. Leaves more or less hairy, rigid, acute; veins 7(–9); sclerenchyma-strands stout, mostly confluent; ribs very prominent, very rarely with sclerenchyma; sheaths closed to the mouth, glabrous or hairy, pinkish, decaying into fibres. Panicle 4–6 cm, with few spikelets, the branches somewhat flexuous, smooth or slightly scabrid. Spikelets 6·5–8·7 mm, glaucous or dark violet, pruinose. Upper glume 2·8–4·9 × 1·1–1·3 mm, ovate-lanceolate, obtuse or

very shortly acuminate. Lemma 4–6·3 × 1·6–2·3 mm, ovate-lanceolate, acuminate, scabrid or densely hairy above, more or less ciliate, mucronate or with an awn up to 1·3 mm. $2n=42$. *Limestone pavement.* ● *S.E. Sweden (Öland).* Su.

73. F. juncifolia St-Amans, *Fl. Agen.* 40 (1821). Laxly caespitose, with creeping rhizomes; stems 30–75 cm. Leaves usually more than ½ as long as stems, (0·6–)0·7–1·5 mm wide, smooth, rigid, acute; veins 7–9(–11); sclerenchyma-strands stout, mostly confluent; ribs very prominent, with numerous sclerenchyma-cells and dense, long hairs; sheaths closed to the mouth, usually glabrous, pinkish, decaying into fibres. Panicle 8·5–18 cm, very lax and wide, the branches scabrid. Spikelets 10–12·8 mm, pale green, densely tomentose or glabrous. Upper glume (5–)5·5–8·3 × 1·4–2 mm, linear-lanceolate, long-acuminate, sometimes ciliate. Lemma 7–9·9 × 2·1–2·4 mm, awned. $2n=56$. *Maritime sands.* ● *W. Europe, from N. Spain to the Netherlands.* Be Br Ga Ho Hs.

74. F. diffusa Dumort., *Obs. Gram. Belg.* 106 (1824). Laxly caespitose, with stolons of varied length; stems 50–100 cm × 1·7–2·7 mm. Leaves often flat, strongly keeled, 0·6–1·35 mm wide when plicate, soft, smooth, obtuse; veins 7–11(–13); sclerenchyma-strands separate, not very stout, subequal in width; ribs very prominent, sometimes with sclerenchyma cells and few long hairs; sheaths closed to the mouth, usually hairy, pinkish, decaying into fibres. Panicle 9–15 cm, very lax and wide, the branches scabrid. Spikelets 8–12 mm, often with many florets, green or glaucous, more or less violet-tinged. Upper glume 5·7–6·3 × 1·4–1·6 mm, oblong-lanceolate, long-acuminate. Lemma 5–7·5 × 2·5 mm, awned. $2n=42$, 56. *Damp places.* ● *N. & C. Europe.* Au Be Cz Da Fa Fe Ga Ge He ?Hu It No ?Rm Sb Su.

75. F. rivularis Boiss., *Elenchus* 90 (1838). Laxly caespitose, rhizomatous; stems 30–70 cm. Leaves usually flat when fresh, bright green, strongly keeled, sparsely hairy, 0·6–1·1 mm wide when plicate, smooth or slightly scabrid towards apex; veins 7–9; sclerenchyma-strands not very stout, subequal in width; ribs very prominent, with sclerenchyma cells; sheaths closed to the mouth, more or less pubescent, scarcely fibrous in decay. Panicle (6–)10–22 cm, very lax, the branches slender, smooth or scabrid, patent at anthesis. Spikelets (7–)8–10 mm, green to violet. Upper glume 4·3–6 × 1·2–1·3 mm, lanceolate, rather long-acuminate. Lemma 6–7·1 × 2–2·1 mm, oblong-lanceolate, rather abruptly acuminate, almost glabrous; awn 0·3–2 mm. $2n=14$, 42. *Damp, shady places; calcifuge.* ● *Mountains of S.W. Europe.* Ga Hs Lu.

76. F. rothmaleri (Litard.) Markgr.-Dannenb., *Bot. Jour. Linn. Soc.* **76**: 325 (1978) (*F. rubra* var. *rothmaleri* Litard.). Laxly caespitose, with short creeping rhizomes; stems 35–50 cm. Leaves 0·6–0·75 mm wide, soft, smooth, with rather sparse, short hairs; veins 7–9; 3 stout sclerenchyma-strands, alternating with 4–5 very slender strands; ribs without sclerenchyma; sheaths closed to the mouth, glabrous, persistent or partially decaying into fibres; ligule of basal leaves indistinctly auriculate. Panicle 7–12·5 cm, the branches glabrous, patent. Spikelets c. 9·1 mm, green or pale violet. Upper glume 4·5–5 × 1–1·2 mm, subulate-lanceolate. Lemma 4·5–5 × 1·6–2 mm, lanceolate, acuminate; awn up to 2·5 mm. Ovary glabrous. *Calcifuge. Mountains of Spain.* Hs.

77. F. nevadensis (Hackel) Markgr.-Dannenb., *op. cit.* 327 (1978) (*F. rubra* subsp. *nevadensis* Hackel). Laxly caespitose, rhizomatous; stems 40–80 cm × 1·2–2 mm. Leaves 0·5–1·4 mm wide, with dense, rather long hairs, very rigid, acute, smooth or scabrid at apex; veins 7–9; 3 very stout sclerenchyma-strands, alternating with 4 very slender strands; ribs very prominent, with sclerenchyma; sheaths closed to the mouth, not decaying into fibres; ligule a short rim. Panicle 6–17 cm, rather rigid, erect, the branches scabrid. Spikelets (8–)10–10·3 mm, pale green or glaucous, sometimes violet-tinged. Upper glume 4·1–6·6 × 1·3–1·7 mm, subulate, rather abruptly acuminate. Lemma 5–6·6 × 1·8–2·3 mm, subulate-lanceolate, long-acuminate, smooth or scabrid towards apex; awn up to 2·1 mm. Ovary with scattered hairs. $2n=70$. *Calcifuge. Mountains of S.W. Europe.* Co Ga Hs.

78. F. cretacea T. Popov & Proskorj., *Bjull. Obšč. Estestv.-Voronež. Univ.* **2**: 46 (1927) (*F. rubra* var. *cretacea* Lavrenko). Rather densely caespitose; stems 30–50 cm. Leaves 0·55–1 (–1·4) mm wide, with dense, long hairs, very rigid, acute, glaucous, smooth except for the apex; veins 7; sclerenchyma-strands 5, very stout; ribs with sclerenchyma; sheaths closed to the mouth, densely tomentose, not or scarcely fibrous in decay; ligule a short rim. Panicle 7–13 cm, rather lax, erect, the branches patent at anthesis, with dense, short hairs. Spikelets 8·6–10 mm, green. Upper glume 3·4–6·5 × 1·4–1·7 mm, oblong-lanceolate, long-acuminate. Lemma 5–7·1 × 1·8–2·1 mm; awn 0·4–1·5 mm. *Chalk outcrops.* ● *S.C. Russia, E. Ukraine.* Rs (C, E).

(iv) Sheaths without deeply infolded thin margins. Ligule with auricles; sheaths usually closed for most of their length, usually decaying into fibres. Non-flowering shoots intravaginal. Leaves smooth; sclerenchyma nearly always in 3 separate strands.

79. F. brachyphylla Schultes in Schultes & Schultes fil., *Mantissa* **2**: 646 (1827) (*F. brevifolia* R. Br., non Muhl.). Stems 15–30 cm. Leaves 0·5–0·7 mm wide, rigid, glabrous or with sparse, short hairs; veins 5–7; sclerenchyma-strands (3–)5(–7), slender or rather stout; ribs 1–3; sheaths closed for at least ½ their length, decaying into fibres; ligule indistinctly auriculate, ciliate. Panicle 2–4 cm, dense. Spikelets 5·5–7·3 mm, often proliferating, glaucous, violet-tinged, more or less pruinose. Upper glume 3·2–4·1 × 1·4–1·6 mm, broadly lanceolate, acuminate. Lemma (3–)3·7–5·5 × 1·7–2·3 mm; awn 1·2–2 mm. Anthers 0·7–1·3 mm. Ovary glabrous. $2n=28$, 42. *Sandy or stony tundra. Svalbard, arctic Russia.* Sb Rs(N). (*N. & C. Asia, North America.*)

80. F. hyperborea Holmen, *Meddel. Grønl.* **124(9)**: 120 (1957). Like **79** but stems rarely more than 10 cm; leaves with dense, short hairs and usually sclerenchyma-strands; panicle 1·5–2·3 cm; spikelets (4·7–)5–6·2 mm; upper glume 3–3·5 × 1·7 mm; lemma 3–3·5 mm; anthers 0·5–0·8 mm. $2n=28$. *Snow-patches and other wet places. Svalbard.* ?Is Sb. (*Greenland to E. Siberia.*)

81. F. pirinica I. Horvat ex Markgr.-Dannenb., *Bot. Jour. Linn. Soc.* **76**: 324 (1978) (*F. alpina* Acht., non Suter). Stems *c.* 10 cm. Leaves 0·3–0·67 mm wide, smooth; veins 5–7; sclerenchyma-strands 3, rather slender, often alternating with 2 very slender strands; ribs 2 or 3, not prominent; sheaths closed for *c.* ½ their length, brownish, irregularly decaying into fibres; ligule shortly auriculate, ciliolate. Panicle *c.* 2·5 cm, rather dense, the branches minutely hairy. Spikelets *c.* 6·5 mm, with 3–4 florets, glaucous, slightly violet. Upper glume 3·2–4·2 × 1·1–1·4 mm, lanceolate, rather shortly acuminate. Lemma 3·6–4·9 × 1·5–1·7 mm, lanceolate; awn up to 2·3 mm. Anthers 1·6–1·9 mm. *Calcicole.* ● *S.W. Bulgaria (Pirin Pl.).* Bu.

82. F. intercedens (Hackel) Lüdi ex Becherer, *Ber. Schweiz. Bot. Ges.* **50**: 388 (1940). Stems 6–20(–26) cm, glabrous or shortly pubescent above. Leaves 0·3–0·6 mm wide, glaucous; veins 5–7; sclerenchyma-strands 3, slender, usually with 1–2 smaller lateral strands; ribs 1–2(–3), not prominent; sheaths closed for at least ½

their length, brownish, often hairy, scarcely fibrous in decay; ligule shortly auriculate, ciliolate. Panicle 2–5 cm, simply racemose, the branches with rather dense, short hairs. Spikelets 7–8 mm, with 3–4 florets, pale violet or glaucous, somewhat pruinose. Upper glume 3·8–4 × 1·7–1·8 mm, linear-lanceolate to lanceolate; lemma 4–5 × 1·7–1·8 mm, lanceolate; awn 1·6–2·6 mm. Anthers 1·2–1·75 mm. ● *C. & E. Alps.* Au He It.

83. F. riloensis (Hackel ex Hayek) Markgr.-Dannenb., *Bot. Jour. Linn. Soc.* **76**: 327 (1978) (*F. halleri* subsp. *riloensis* Hackel ex Hayek). Stems up to 20 cm. Leaves 0·5–0·8(–0·9) mm wide, smooth, pruinose; veins 7; sclerenchyma-strands 3; ribs 3; sheaths closed for *c.* ¾ their length; ligule shortly auriculate. Panicle up to 3·5 cm. Spikelets 6·5–8·5 mm, dark violet. Upper glume 2·9–3·6 × 1·2–1·4 mm, ovate-lanceolate, acuminate. Lemma 4·1–4·7 × 2–2·1 mm, ovate-lanceolate to lanceolate, scabrid above; awn 2·1–2·7 mm. Anthers *c.* ½ as long as palea. *Calcifuge.* ● *Mountains of W. Jugoslavia and S.W. Bulgaria.* Bu Ju.

84. F. halleri All., *Fl. Pedem* **2**: 253 (1785). Stems 6–15 cm. Leaves (0·3–)0·5–0·7 mm wide, smooth, glaucous, more or less pruinose; veins (5–)7; sclerenchyma-strands 3, stout, rarely 7, slender (var. *bicknellii* (St-Yves) Markgr.-Dannenb.); sheaths closed for at least ½ their length, brownish; ligule shortly auriculate, ciliolate. Panicle 1–3 cm, dense, the branches glabrous or minutely hairy. Spikelets 6–7·6 mm, with 4–5 florets, violet-brownish. Upper glume lanceolate, rather abruptly acuminate. Lemma lanceolate, acuminate; awn up to *c.* 5 mm. *Calcifuge.* ● *Alps; mountains of C. & S.W. Jugoslavia.* Au Ga He It Ju.

(a) Subsp. **halleri**: Leaves always with 3 ribs; sheaths glabrous. Upper glume 4–4·6 × 1·1–1·4 mm. Lemma 3·7–5 × 1·5–1·8 mm, scabridulous, at least above. $2n = 14$. *Alps.*

(b) Subsp. **scardica** (Griseb.) Markgr.-Dannenb., *Bot. Jour. Linn. Soc.* **76**: 327 (1978) (*F. ovina* var. *scardica* Griseb.): Leaves usually with 1 rib; sheaths with dense, short hairs. Upper glume 3·4–5·1 × *c.* 1·2 mm; lemma 4·9–5·7 × 1·7–1·8 mm, smooth. *Mountains of C. & S.W. Jugoslavia.*

85. F. glacialis (Miégeville ex Hackel) K. Richter, *Pl. Eur.* **1**: 97 (1890). Stems (6–)8–20 cm. Leaves (0·3–)0·4–0·7 mm wide, smooth, pruinose; veins 5; sclerenchyma-strands 3, stout, often with 2 smaller lateral strands; ribs 3, rather prominent; sheaths closed to the mouth, brownish, persisting round the base of the non-flowering shoots; ligule rounded, auriculate, ciliolate. Panicle 2–3·5 cm, sparingly branched, dense, the branches shortly setose. Spikelets 6·3–6·5 mm, with 3–5 florets, light violet. Upper glume 3·9–4·3 × 1·2–1·3 mm, lanceolate, shortly acuminate to subobtuse. Lemma 4·5–4·7 × 1·7–1·8 mm, acuminate, mucronate or with an awn up to 1·3 mm. Anthers (2–)2·3–2·8 mm. $2n = 14$. *Calcifuge.* ● *Pyrenees.* Ga Hs.

86. F. rupicaprina (Hackel) A. Kerner, *Sched. Fl. Exsicc. Austro-Hung.* **3**: 145 (1884). Stems 7–24(–30) cm. Leaves 0·3–0·6(–0·7) mm wide, smooth, soft, bright green; veins 5(7); sclerenchyma-strands 3, rather slender; rib 1; sheaths closed to the mouth, glabrous, brownish, decaying irregularly into fibres; ligule minutely auriculate, ciliolate. Panicle 2–4 cm, sparingly branched, the branches densely puberulent, patent at anthesis. Spikelets 5·8–7·5 mm, with (3–)4–6 florets, pruinose. Upper glume 2·7–3·9 × 0·8–1 mm, lanceolate, acuminate. Lemma 3·8–4·9 × 1·4–1·7 mm, lanceolate to oblong-lanceolate; awn 1·1–1·6(–2·6) mm. Anthers (1·8–)2–2·6 mm. $2n = 14$. *Calcicole.* ● *C. & E. Alps.* Au Ge He Ju.

87. F. bucegiensis Markgr.-Dannenb., *Bot. Jour. Linn. Soc.* **76**: 325 (1978) (*F. glacialis* auct., non (Miégeville ex Hackel) K. Richter). Stems 6–12(–20?) cm. Leaves 0·3–0·65(–0·7) mm wide; veins 5–7; sclerenchyma-strands 3, slender; ribs 3, rather prominent; sheaths closed to the mouth, brownish, decaying irregularly into fibres enveloping the base of the non-flowering shoots; ligule rounded, auriculate, glabrous or ciliolate. Panicle 1–2·5 cm, sparingly branched, the branches puberulent. Spikelets 5·2–6·2 mm, with 3 florets, pale violet. Upper glume 3–4·6 × 1–1·2 mm, lanceolate, long-acuminate. Lemma 3·8–4·7 × 1·6–2 mm, ovate-lanceolate; awn 1·6–2·1 mm. Anthers 1·8–2·3 mm. 2100–2500 *m; calcifuge.* ● *S. Carpathians.* Rm.

88. F. frigida (Hackel) K. Richter, *Pl. Eur.* **1**: 97 (1890). Stems 4–7 cm. Leaves 0·25–0·5 mm wide, smooth, pruinose; veins 5; sclerenchyma-strands 3, slender; rib 1; sheaths closed to the mouth, partly decaying into fibres; ligule acute, auriculate, glabrous. Panicle 1 cm, simple, with glabrous branches. Spikelets (4·5–)5·6–6 mm, slightly pruinose. Glumes subequal, the upper 3–3·2 × 1·2 mm. Lemma 3–3·6 × 1·5 mm, oblong-lanceolate; awn 1·7–1·9 mm. *c.* 2950 *m; calcifuge.* ● *S. Spain* (*Sierra Nevada*). Hs.

89. F. alpina Suter, *Fl. Helv.* **1**: 55 (1802). Stems 5–20(–28) cm. Leaves 0·2–0·4(–0·5) mm wide, smooth; veins 3(–5); sclerenchyma-strands 3, very slender; rib 1; sheaths closed to the mouth, brownish, decaying irregularly into fibres; ligule of non-flowering shoots shortly auriculate, glabrous. Panicle 1·5–3·5 cm, simple. Spikelets *c.* 6 mm, with 2–4 florets, yellowish-green, rarely slightly tinged with violet. Upper glume 3·2–3·6 × 0·8–1 mm, linear to oblong-lanceolate, long-acuminate. Lemma 3·6–4·2 × 1·3–1·5 mm, oblong-lanceolate; awn 3–4 mm. Anthers 0·7–1(–1·4) mm. $2n = 14$. *Calcicole.* ● *Alps, extending to mountains of W.C. Jugoslavia; Pyrenees* (*Gavarnie*). Au Ga Ge He It Ju.

F. malyi Widder, *God. Biol. Inst.* (*Sarajevo*) **5**: 450 (1953), is probably a hybrid (**89 × 83**). It is recorded from W. Jugoslavia (Bjelašnica Pl., Hercegovina).

90. F. olympica Vetter, *Beih. Bot. Centr.* **45(2)**: 307 (1928). Stems (5–)12–21 cm, glabrous or shortly pubescent above. Leaves 0·3–0·6(–0·8) mm wide, smooth, glaucous; veins 3–5; sclerenchyma-strands separate, unequal in width, mostly stout; ribs 1–3; sheaths closed to the mouth, brownish, decaying irregularly into fibres; ligule shortly auriculate, ciliolate. Panicle (2–)2·5–4·5 cm, the branches minutely hairy. Spikelets 6·5–7·8 mm, with 3–5 florets, glaucous, violet-tinged. Upper glume 3·2–4·6(–5) × 1·1–1·4 mm, linear- to oblong-lanceolate, long-acuminate. Lemma (4–)4·6–5·2(–5·8) × 1·6–1·9 mm, lanceolate, long-acuminate, glabrous; awn often as long as lemma. Anthers up to 2·5 mm. *Calcicole;* 2100–2850 *m.* ● *E. Greece* (*Olimbos*). Gr.

91. F. vizzavonae Ronniger, *Verh. Zool.-Bot. Ges. Wien* **68**: (226) (1918). Stems 6–30 cm. Leaves (0·2–)0·3–0·63 mm wide, smooth, rather soft; veins (3–)5(–7); sclerenchyma-strands 3, slender or rather stout; ribs 1–3, not prominent; sheaths closed to the mouth, glabrous, decaying irregularly into fibres; ligule shortly acuminate, glabrous. Panicle (2–)2·5–3(–5) cm, sparingly branched, the branches glabrous. Spikelets 8·4–9·5 mm, with 3–4 florets, green or violet-tinged. Upper glume 4·2–5·6 × 1·1–1·4 mm, subulate, more or less long-acuminate. Lemma 4·9–6·5 × 1·4–2 mm, subulate to narrowly lanceolate; awn 3–4·9 mm. Anthers 1·5–2 mm. ● *Mountains of C. Mediterranean region and Greece.* Co Gr It Sa.

92. F. horvatiana Markgr.-Dannenb., *Veröff. Geobot. Inst. Rübel* (*Zürich*) **56**: 132 (1976). Stems 20–25 cm. Leaves (0·4–)

0·5–0·7(–0·8) mm wide, smooth, glaucous, hard, subpungent; veins 7; sclerenchyma forming a complete or nearly complete ring; ribs 3, usually distinct; sheaths closed to the mouth, densely setose, decaying into abundant fibres enveloping the base of the non-flowering shoots; ligule shortly auriculate, ciliolate, shortly hairy. Panicle 2·5–3·5 cm, very dense, the branches glabrous or with sparse short hairs. Spikelets 6·9–7·8 mm, with 4–5 florets, slightly pruinose and dirty grey-violet. Upper glume 3·2–4·2 × 1–1·4 mm, oblong-lanceolate, long-acuminate. Lemma 5–5·8 × 1·6–2 mm, lanceolate to ovate-lanceolate, long-acuminate, glabrous; awn up to 2·9 mm. Anthers 2–3·2 mm. *Calcifuge.* ● *Mountains of Jugoslavia and N.W. Greece.* ?Al Gr Ju.

93. F. jeanpertii (St-Yves) Markgr. in Hayek, *Prodr. Fl. Penins. Balcan.* **3**: 276 (1933) (*F. heldreichii* (Hackel) Alexeev). Stems 30–60 cm. Leaves (0·4–)0·6–1(–1·2) mm wide, smooth, pruinose; veins 7; sclerenchyma-strands usually 3, stout or very stout; ribs 3; sheaths closed for *c.* ½ their length, more or less decaying into fibres. Panicle dense, the branches glabrous or minutely hairy. Spikelets with 5–8 florets, pale green, pruinose. Upper glume acuminate. *Calcicole. C. & E. Mediterranean region.* Gr It Ju.

1 Upper glume reaching ½–¾ of the way up the second lemma
(c) subsp. **campana**
1 Upper glume reaching ¾–¾ of the way up the second lemma
2 Panicle up to 17 cm; spikelets 6·3–7·8 mm
(a) subsp. **jeanpertii**
2 Panicle not more than 10·5 cm; spikelets 5·5–6(–7·1) mm
(b) subsp. **achaica**

(a) Subsp. **jeanpertii**: Panicle up to 17 cm, linear. Spikelets 6·3–7·8 mm. Upper glume 3·6–5 × 1·1–1·6 mm, reaching ¾–¾ of the way up the second lemma. Lemma 4·2–5·2 × 1·4–1·7 mm, narrowly lanceolate; awn 0–1·3 mm. *C. & S. Greece, Kikladhes.*

(b) Subsp. **achaica** (Markgr.-Dannenb.) Markgr.-Dannenb., *Bot. Jour. Linn. Soc.* **76**: 325 (1978): Panicle not more than 10·5 cm, oblong. Spikelets 5·5–6(–7·1) mm. Upper glume (3·2–)3·5–4·6 × 1–1·4 mm, reaching ¾–¾ of the way up the second lemma. Lemma (3·9–(4–4·6 × (1·3–)1·4–2 mm, linear-lanceolate; awn 0·4–1·3 mm. ● *S. Greece* (*N. Peloponnisos*).

(c) Subsp. **campana** (N. Terracc.) Markgr.-Dannenb., *loc. cit.* (1978) (*F. duriuscula* var. *campana* N. Terracc.): Panicle 7–13 cm, linear. Upper glume 3·6–4·2 × 0·9–1·3 mm, reaching ½–¾ of the way up the second lemma. Lemma 3·9–4·6 × 1·4–1·6 mm, narrowly linear-lanceolate; awn 0·2–0·9 mm. ● *S. Italy; islands of W. Jugoslavia.*

94. F. stenantha (Hackel) K. Richter, *Pl. Eur.* **1**: 96 (1890) (*F. halleri* subsp. *stenantha* (Hackel) Hegi). Stems 15–30 cm, smooth or slightly scabrid above. Leaves (0·3–)0·4–0·7(–0·9) mm wide, smooth; veins (5–)7; sclerenchyma-strands 3, very stout; ribs 3(–5); sheaths closed nearly to the mouth, brownish, glabrous or minutely hairy, decaying into fibres; ligule short or rather short, auriculate, ciliolate. Panicle 3·5–6·5 cm, oblong, lax, the branches more or less shortly hairy. Spikelets 7–8(–9) mm, pale yellowish-green, pruinose, rarely violet-tinged. Glumes subequal, the upper 4·9–5·5 × 1·2–1·3 mm, subulate. Lemma 5·2–5·8 × 1·5–1·9 mm, subulate-lanceolate; awn *c.* ½ as long as lemma. Anthers 1·7–2·3 mm. $2n=14$. *Calcareous cliffs.* ● *E. Alps and mountains of N.W. Jugoslavia; one locality in S.W. Alps.* Au Ga He It Ju.

95. F. pseudodura Steudel, *Syn. Pl. Glum.* **1**: 306 (1855) (*F. halleri* subsp. *dura* Hegi). Stems 15–30(–37) cm, glabrous or sparsely pubescent above. Leaves (0·4–)0·5–1(–1·1) mm wide, smooth, rigid, bright green; veins 7(–9); sclerenchyma-strands 3 rather stout, often alternating with 2 smaller strands; ribs 3(–5); sheaths usually closed to the mouth, brownish, often densely setulose, scarcely decaying into fibres; ligule very shortly auriculate, ciliolate. Panicle (2–)4–7 cm, dense, the branches glabrous or shortly hairy. Spikelets 7·1–8·4 mm, with (3–)4–6 florets, glaucous, slightly variegated with violet. Upper glume 3·5–5·3 × 1·2–1·7 mm, ovate-lanceolate to lanceolate, more or less shortly ciliate at apex. Lemma 4·9–6·2 × 2–2·5 mm, broadly lanceolate, acuminate, slightly scabrid above, more or less ciliate; awn *c.* ½ as long as lemma. Anthers up to 3·3 mm. $2n=28$. 1300–2900 *m; calcifuge.* ● *E. Alps.* Au He It.

96. F. circummediterranea Patzke, *Österr. Bot. Zeitschr.* **122**: 261 (1973) (*F. laevis* (Hackel) K. Richter). Stems 10–70 cm. Leaves (0·35–)0·5–1·1 mm wide, smooth, pruinose; veins 7(–9); sclerenchyma-strands 3, slender to rather stout; ribs 3; sheaths closed for ¼–½ of their length, often decaying into fibres; ligule shortly auriculate, densely ciliolate. Panicle 3–9·5 cm, dense or lax, the branches minutely hairy, patent at anthesis. Spikelets 6–8 mm, with 4–7 florets, green or violet-tinged. Upper glume (2·9–)3·1–5·5 × 1–1·7 mm, oblong-lanceolate. Lemma 4–5·8 × 1·4–2·5 mm, lanceolate, shortly acuminate, glabrous, rarely ciliate; awn up to 3·7 mm. $2n=14$. *Calcicole. C. & E. Mediterranean region.* Al Cr Gr It Ju.

97. F. costei (St-Yves) Markgr.-Dannenb., *Bot. Jour. Linn. Soc.* **76**: 327 (1978) (*F. ovina* subsp. *laevis* var. *gallica* subvar. *costei* St-Yves). Stems 35–50 cm. Leaves (0·63–)0·7–1·1 mm wide; veins 7–9; sclerenchyma-strands 3, rather stout, with small intermediate strands; ribs 3(–5); sheaths closed for *c.* ¼ of their length, rather persistent; ligule shortly auriculate, minutely hairy. Panicle up to 9 cm, rather dense, the branches glabrous. Spikelets 7–8(–9) mm, pruinose, green and violet-tinged. Upper glume 4–4·5 × 1·25–1·5 mm, oblong-lanceolate, shortly acuminate. Lemma 5·4–6 × 1·75–2 mm, lanceolate, long-acuminate; awn 1·3–2 mm. $2n=28$. ● *W. Europe, from Luxembourg to N. Italy and C. Spain.* Be Ga He Hs It.

98. F. hervieri Patzke, *Decheniana* **114**: 213 (1962). Stems 25–40 cm. Leaves (0·6–)0·7–0·8(–0·95) mm wide, smooth, often pruinose; veins 7; sclerenchyma-strands 3, usually rather slender; ribs 3; sheaths closed for ⅙–⅓(–½) of their length, rather persistent; ligule shortly auriculate, ciliolate. Panicle 6–9 cm, rather dense, the branches densely and minutely hairy. Spikelets 6–6·5(–8) mm, with 5–8 florets, green or violet-tinged, more or less pruinose. Upper glume 3·25–3·8 × 0·75–1·3 mm, oblong-lanceolate to lanceolate, shortly acuminate. Lemma 4–4·6(–5·5) × 1·5–2 mm, glabrous; awn 0·7–1(–1·4) mm. $2n=14$. ● *W. Europe, from Belgium to N.E. Spain.* Be Ga Hs.

99. F. patzkei Markgr.-Dannenb., *Bot. Jour. Linn. Soc.* **76**: 325 (1978). Stems 30–56 cm. Leaves 0·45–0·8(–1·2) mm wide, smooth; veins 7(8–10); sclerenchyma-strands 3, rather slender; ribs 3(–5); sheaths open to the base, persistent; ligule slightly elongate, auriculate, ciliolate. Panicle 6–9 cm, the branches densely and minutely ciliolate. Spikelets 6·5–7·3 mm, with 4–5 florets, green or slightly glaucous, pruinose. Upper glume 3·3–3·6 × 0·9–1·1 mm, oblong-lanceolate, rather shortly acuminate. Lemma 3·2–4·9 × 1·4–1·6 mm; awn (1·5–)1·7–2·1 mm. ● *N.E. France* (*N.E. of Metz*). Ga ?Ge.

(v) Sheaths without deeply infolded thin margins. Ligule with auricles; sheaths usually not closed for more than ½ their length, usually not decaying into fibres. Non-flowering shoots intravaginal. Leaves often scabrid; sclerenchyma usually forming a ring.

100. F. hystrix Boiss., *Elenchus* 89 (1838). Densely caespitose. Stems 8–33 cm, smooth or slightly scabrid above. Leaves (0·4–)0·5–0·6(–0·7) mm wide, often very short and curled, glaucous, smooth or scabrid, abruptly contracted to the acute, flat apex; veins 3; sclerenchyma forming a complete ring of 3–4 rows of cells; rib 1, with several sclerenchyma-cells above; sheaths closed to the mouth, silvery, hyaline, sometimes decaying into fibres; ligule 0·4–0·8 mm. Panicle 1·5–3·5 cm, dense, with few spikelets, the branches scabrid. Spikelets (5·7–)6·2–7 mm, with 3–5 florets, glaucous, slightly violet-tinged. Upper glume 3·8–4 × 1·2 mm, lanceolate, acuminate, scabrid above. Lemma 3·9–4·3 × 1·5–1·7 mm; awn ¼–½ as long as lemma. *Calcareous rocks and screes*, 1300–2300 *m*. *C. & S. Spain*. Hs.

101. F. reverchonii Hackel, *Österr. Bot. Zeitschr.* **53**: 30 (1903). Caespitose. Stems 18–32 cm, smooth. Leaves (0·3–)0·4–0·55 mm wide, strongly curved distally, scabrid, glaucous, more or less pruinose, obtuse or acute; veins 3(–5); sclerenchyma a thin complete ring; 1 distinct or rarely 2–3 indistinct ribs, with sclerenchyma cells above; sheaths open to the base, opaque, stramineous, not becoming fibrous; ligule 2 mm, with acute auricles. Panicle 2·5–4 cm, dense, the branches weakly scabrid. Spikelets 5·7–6·7(–7) mm, with 4–6 florets, dirty violet-glaucous. Upper glume 3·3 × 1·2 mm, lanceolate, acuminate. Lemma 3·8–4·2 × 1·4–1·6 mm, with yellow apex; awn at least ¾ as long as lemma. *Dry mountain-sides*, 1900–2000 *m; calcicole*. ● *S. Spain*. Hs.

102. F. tenuifolia Sibth., *Fl. Oxon.* 44 (1794) (*F. capillata* Lam.). Densely caespitose. Stems 20–30(–55) cm, usually strongly scabrid above. Leaves 0·2–0·4(–0·6) mm wide; veins (5–)7; sclerenchyma forming a complete ring; rib 1; sheaths open to the base. Panicle (2–)4–8 cm, lax, the branches scabrid. Spikelets (3·7–)4–5·2(–6·5) mm, greenish, sometimes proliferating. Upper glume (1·7–)2·5–3(–3·9) × 0·8–1·2 mm, oblong-lanceolate, acuminate, scabrid above. Lemma 2·3–3·6(–4·4) × 1·4–1·5(–1·7) mm, ovate-lanceolate, scabrid above or sometimes hairy on the back, unawned or with a mucro up to 0·4 mm. $2n = 14, 28$. *Rocks and sandy or peaty soils; usually calcifuge. W. & C. Europe, extending to S.W. Finland, C. Italy and C. Jugoslavia.* Au Be Br Cz Da Fe Ga Ge Hb He Ho Hs Hu It Ju Po Rm Rs (C, W) Su.

103. F. ovina L., *Sp. Pl.* 73 (1753) (*F. vulgaris* (Koch) Hayek). Densely caespitose. Stems (10–)20–45(–70) cm, usually scabrid above. Leaves 0·25–0·7 mm wide, scabrid at least towards apex, green or glaucous; veins 5–7; sclerenchyma forming a complete ring; rib 1; sheaths usually open to the base, glabrous or weakly scabrid. Panicle 2–12 cm, rather dense, the branches patent at anthesis, scabrid. Spikelets (4–)4·8–6·3(–7·3) mm, with 3–8 florets, green, glaucous or violet-tinged. Upper glume (2·2–)2·6–4·6 × 0·8–1·3 mm, ovate-lanceolate to lanceolate, acuminate. Lemma (2·6–)3·5–4·5(–5·1) × 1·4–1·7(–2) mm, lanceolate to oblong-lanceolate, glabrous, scabrid or hairy above; awn ¼–⅓ as long as lemma. $2n = 14$. *N. & C. Europe*. Au Be Br Cz Da *Fa Fe ?Ga Ge Hb He Ho Hu ?It Ju No Po Rm Rs (N, B, C, W) Su [Is].

104. F. ophioliticola Kerguélen, *Lejeunia* nov. ser., **75**: 13 (1975). Rather laxly caespitose. Stems (27–)30–40(–60) cm, smooth above. Leaves 0·55–0·7 mm, sometimes slightly scabrid near apex, often curved, dark green or violet-tinged; veins (5–)7(–9); sclerenchyma forming a complete ring of 2–3 rows of cells, rarely interrupted; rib 1, rarely 2–3 indistinct ribs; sheaths open almost to the base, glabrous, often violet-tinged. Panicle 3·5–5·7(–7·5) cm, the branches scabrid or hairy. Spikelets (6·8–)7–7·5(–7·9) mm, glaucous, often pruinose. Upper glume 3·6–4·3(–4·7) mm, oblong. Lemma (4–)4·3–4·9(–5·2) mm, glaucous and pink-tinged; awn 0·5–1·5 mm. $2n = 28$. *Serpentine rocks*. ● *N.W. France* (*W. of Quimper*). Ga.

105. F. niphobia (St-Yves) Kerguélen, *Bull. Soc. Bot. Fr.* **123**: 320 (1976). Densely caespitose. Stems 10–15(–20) cm, scabrid above. Leaves 0·6 mm wide, rigid, erect, scabrid; veins 7; sclerenchyma forming a complete ring; rib 1; sheaths open to the base. Panicle 2–3(–4) cm, dense, the branches scabrid. Spikelets 6 mm, green or violet-tinged. Lemma 4 × 1·25 mm, scabrid above; awn 1·5 mm. $2n = 28$. ● *E. Pyrenees*. Ga.

106. F. airoides Lam., *Encycl. Méth. Bot.* **2**: 464 (1788) (*F. supina* Schur, *F. ovina* var. *supina* (Schur) Hackel). Densely caespitose. Stems 10–30 cm, weakly scabrid to densely hairy above. Leaves (0·3–)0·5–0·7 mm wide, often longer than the stems, more or less curved, usually scabrid near the apex only; veins (5–)7; sclerenchyma in a continuous or somewhat interrupted ring; ribs 1, or 3 and indistinct; sheaths closed in the lower ¼–⅓(–½), glabrous or slightly hairy. Panicle 2–5·5(–7) cm, dense, the branches strongly scabrid. Spikelets (5–)6–7(–8) mm, with 3(–5) florets, glaucous, violet-tinged, sometimes proliferating. Upper glume 2·7–4·2(–5·3) × 1–1·5(–1·7) mm, ovate-lanceolate to lanceolate, acuminate. Lemma 3·3–4·6(–5·5) × 1·6–2·1(–2·3) mm, lanceolate, acuminate; awn usually less than ½ as long as lemma. $2n = 14, 28, 35$. *Alpine pastures and heaths; calcifuge*. ● *Mountains of Europe, from the Sudeten Mts and Carpathians to the Pyrenees and S.W. Bulgaria.* Au Bu Cz Ga Ge He Hs It Ju Po Rm Rs (W).

107. F. armoricana Kerguélen, *Lejeunia* nov. ser., **75**: 9 (1975). Densely caespitose. Stems 9–36 cm, glabrous to shortly hairy above. Leaves 0·3–0·8 mm wide, smooth or weakly scabrid above, green or glaucous, not pruinose; veins (5–)7(–9); sclerenchyma in a continuous or interrupted ring, with (1–)2(–4) rows of cells; sheaths usually closed in the lower ⅓–½, glabrous or sparsely hairy. Panicle 1·5–6(–7) cm, rather dense, the branches more or less hairy. Spikelets 6–7·4 mm, with 3–5(–6) florets, glaucous. Upper glume (3·3–)3·6–4·2(–4·9) × 1–1·3 mm, lanceolate, acuminate, more or less scabrid above. Lemma (3·8–)4·4–4·6(–5) × 1·4–2 mm, lanceolate, acuminate; awn (0·6–)1·3–1·7(–2·5) mm. $2n = 28$. *Maritime heaths and rocks; calcifuge*. ● *N.W. France and Channel Islands*. Ga.

108. F. eggleri Tracey, *Pl. Syst. Evol.* **128**: 290 (1977). Densely caespitose. Stems 27–44 cm, smooth or nearly so above. Leaves (0·25–)0·56–0·6 mm wide, lax, bright green, weakly scabrid above; veins (5–)7; sclerenchyma in a continuous or slightly interrupted ring; rib 1; sheaths closed in the lower ¼–⅓, glabrous or shortly hairy. Panicle (3–)4·5–6·5(–10·4) cm, rather lax, the branches scabrid, patent at anthesis. Spikelets 5·8–6·7(–7) mm, with 2–5 florets, bright green. Upper glume 2·6–3·6 × 0·8–1·3 mm, lanceolate, shortly acuminate. Lemma 3·4–3·9(–4·6) × 1·4–1·6(–1·8) mm, lanceolate, acuminate, usually glabrous; awn ⅓–½ as long as lemma. $2n = 28$. Pinus-*woods on serpentine*. ● *S.E. Austria* (*Mur valley*). Au.

109. F. sipylea (Hackel) Markgr.-Dannenb., *Veröff. Geobot. Inst. Rübel* (*Zürich*) **56**: 110 (1976) (*F. ovina* subsp. *sipylea* Hackel). Densely caespitose. Stems (5–)8–20 cm, nearly or quite smooth above. Leaves 0·3–0·5(–0·7) mm wide, rigid, smooth, glaucous, with obtuse, cartilaginous apex; veins 5; sclerenchyma forming a complete ring; ribs 1(–3), low; sheaths closed in the lower ¼–⅓. Panicle 2–2·5 cm, dense, with few spikelets, the branches shortly hairy. Spikelets 7·8 mm, with 2–3(–4) florets. Upper glume (3·7–)4–4·9 × 1·1–1·5 mm, subulate-lanceo-

late, long-acuminate. Lemma (4·2–)4·6–5·5 × 1·6–2·1 mm, lanceolate, long-acuminate, minutely hairy and sparsely ciliate; awn 1½ times as long as lemma. *Limestone rocks and screes*, 1500–2400 *m*. *Kriti*. Cr. (*W. Anatolia*.)

110. F. lapidosa (Degen) Markgr.-Dannenb., *Bot. Jahrb.* **96**: 271 (1975) (*F. ovina* var. *lapidosa* Degen, non *F. cinerea* var. *lapidosa* Stohr). Densely caespitose. Stems 15–30 cm, smooth or scabrid above. Leaves 0·35–0·6 mm wide, glaucous, pruinose, rigid, curved, strongly scabrid; veins 7; sclerenchyma forming a complete ring, often much thickened laterally; rib usually 1; sheaths closed for not more than the lower ¼, densely and minutely hairy. Panicle 3–5 cm, dense, the branches scabrid. Spikelets 6·5–7 mm, with (3–)5–7 florets, pale green, pruinose. Upper glume (3–)3·6–4·6 × 1–1·3 mm, subulate-lanceolate, acuminate. Lemma (3·8–)4·2–5·5 × 1·4–1·6 mm, narrowly lanceolate, acuminate; awn more than ½ as long as lemma. *Limestone rocks*. ● *N.W. Jugoslavia*. Ju.

111. F. occitanica (Litard.) Auquier & Kerguélen, *Lejeunia* nov. ser., **75**: 39 (1975). Densely caespitose. Stems 15–44 cm, nearly or quite smooth above. Leaves (0·3–)0·4–0·75 mm wide, green or glaucous, smooth or scabrid near apex, often curved; veins (?5–)7; sclerenchyma in a continuous or slightly interrupted ring; ribs 1–3; sheaths closed in the lower ⅓–½, glabrous. Panicle (2–)4–12 cm, the branches more or less hairy. Spikelets (5·5–)6·2–8·4 mm, with 4–6(–8) florets, green, sometimes violet-tinged. Upper glume (2·5–)3·3–4·6 × 0·8–1·6 mm, linear-lanceolate, acuminate. Lemma 4·2–5·5 × 1·4–1·8 mm, linear-lanceolate, mucronate or with an awn up to ½ as long as lemma. $2n = 14$. *Dwarf scrub on limestone*. ● *S.E. France*. Ga.

112. F. heteropachys (St-Yves) Patzke ex Auquier in De Langhe et al., *Nouv. Fl. Belg.* 759 (1973). Densely caespitose. Stems 30–72 cm, usually scabrid above. Leaves 0·45–1·35 mm wide, usually varying greatly in width within the same non-flowering shoot, green or glaucous, usually scabrid above, rather rigid; veins 7(–9); sclerenchyma in a continuous or slightly interrupted ring; ribs 1 or 2–3(–5), low; sheaths open to the base, usually densely hairy. Panicle 6–15 cm, lax, often interrupted, the branches strongly scabrid. Spikelets (7–)7·5–8·1(–9·5) mm, with 3–6 florets, green or glaucous, sometimes slightly violet-tinged. Upper glume (3·5–)3·9–5(–6·3) × 1·2–1·5 mm, oblong-lanceolate or lanceolate, acuminate. Lemma 4·6–6·2(–7) × 1·8–2(–2·3) mm, oblong-lanceolate or lanceolate, acuminate, scabrid or hairy above; awn *c*. ½ as long as lemma. $2n = 28$. ● *From Belgium to S. Germany and N. Switzerland*. Be Ga Ge He.

113. F. guestfalica Boenn. ex Reichenb., *Fl. Germ. Excurs.* 140 (3) (1831) (*F. ovina* var. *firmula* (Hackel) Hegi, *F. longifolia* auct., non Thuill.). Densely caespitose. Stems 30–60(–70) cm, usually scabrid or pubescent above. Leaves 0·6–0·7(–0·85) mm wide, glaucous, scabrid at least above; veins 7; sclerenchyma forming a complete ring; ribs 1(–3); sheaths open to the base, glabrous or densely villous. Panicle 5–12 cm, lax, the branches scabrid. Spikelets (5·5–)6–7·5 mm, with 3–7 florets. Upper glume (2–)2·8–4 4 × 1–1·4(–1·6) mm, lanceolate to ovate-lanceolate, smooth or weakly scabrid above. Lemma 3·6–5·3 × (1·4–)1·6–2·3 mm, ciliate, weakly scabrid or more or less pubescent above; awn up to ½ as long as lemma. $2n = 28$. *Dry places*. ● *N.W. & C. Europe*. Au Be Br Cz Ga Ge He Ho Po ?Rm.

114. F. lemanii Bast., *Essai Fl. Maine Loire* 36 (1809) (*F. longifolia* auct., non Thuill., *F. auriuscula* auct., ?an L.). Caespitose. Stems (11–)25–50(–90) cm, glabrous, rarely puberulent above. Leaves (0·43–)0·62–0·79(–1·14) mm wide, rigid, usually scabrid above, glaucous, subpruinose, sometimes puberulent near base; veins (5–)7(–9); sclerenchyma in a usually uniform, continuous or slightly interrupted ring; ribs (1–)2–3; sheaths open nearly to base, glabrous or puberulent. Panicle (2–)4–7(–9) cm, usually lax, the branches scabrid. Spikelets (5·6–)6·5–7·2(–8·3) mm, with (2–)3–4(–7) florets, glaucous. Upper glume (2·8–)3·5–4(–5·2) mm, lanceolate to oblong-lanceolate. Lemma (3·6–)4·2–4·6(–5·5) × *c*. 1·8 mm, oblong-lanceolate; awn less than ½ as long as lemma. $2n = 42$. *W. Europe*. Be Br Ga ?Hs.

115. F. arvernensis Auquier, Kerguelen & Markgr.-Dannenb., *Lejeunia* nov. ser. **89**: 15 (1977) (*F. glauca* Lam., non Vill.). Densely caespitose. Stems (22–)31–65(–76) cm, glabrous. Leaves (0·4–)0·55–1(–1·45) mm wide, smooth, glaucous, pruinose, irregularly curved; veins 7–9(–11); sclerenchyma in a continuous or slightly interrupted ring; ribs (1–)3–5; sheaths glabrous, closed at base or rarely in the lower ¼–⅓; ligule minutely ciliate. Panicle (2·3–)4–6·5(–9·6) cm, dense, the branches weakly scabrid. Spikelets (6·4–)7·2–8·5(–9·4) mm, with 3–5(–7) florets, glaucous, slightly violet-tinged. Upper glume 3·4–4·9(–5·3) × 1·4–1·9 mm, ovate-lanceolate, subobtuse. Lemma (4–)4·5–5·7(–6·2) × 1·8–2·1 mm, lanceolate, acuminate, glabrous, or ciliate or pubescent above; awn ⅓–½ as long as lemma. $2n = 28$. *Calcifuge*. ● *Mountains of S.C. & S.W. France*. Ga.

116. F. longifolia Thuill., *Fl. Paris* ed. 2, 50 (1800) (*F. caesia* Sm.). Densely caespitose. Stems 8–35(–45) cm, glabrous. Leaves (0·4–)0·6–0·9 mm wide, hard or soft, smooth, pruinose, pale green, irregularly curved; veins 7; sclerenchyma in a continuous or slightly interrupted thin ring; ribs 3–5; sheaths open to the base, glabrous; ligule glabrous. Panicle 2·5–7 cm, dense or rather lax, the branches scabridulous. Spikelets 5·5–7·5 mm, with 4–6(–8) florets. Upper glume 2·9–3·7 × 1–1·1 mm, ovate to ovate-lanceolate, rather abruptly acuminate. Lemma (3·5–)4·2–5 × 1·4–1·5(–2) mm, lanceolate, acuminate; awn ¼–⅓ as long as lemma. $2n = 14$. ● *N. & N.C. France and E. England*. Br Ga.

117. F. inops De Not., *Repert. Fl. Ligust.* 500 (1844). Densely caespitose. Stems (19–)25–50 cm, smooth or scabridulous above. Leaves 0·4–0·8 mm wide, hard, more or less smooth, pruinose; veins 7; sclerenchyma forming a complete ring; ribs 5; sheaths minutely ciliate, closed in the lower ¼–½. Panicle 3·5–6·5 cm, rather dense, the branches shortly hairy. Spikelets 6–7·7 mm, with 4–5(–7) florets, glaucous, violet-tinged. Upper glume 2·7–4·6 × 1–1·7 mm, ovate, shortly acuminate, usually glabrous. Lemma 3·9–5 × 1·6–2·1 mm, ovate-lanceolate, unawned or mucronate, rarely with an awn up to 1 mm. ● *N. & C. Appennini, Alpi Apuane*. It.

118. F. vaginata Waldst. & Kit. ex Willd., *Enum. Pl. Horti Berol.* 116 (1809). Stems (15–)25–60 cm, glabrous. Leaves (0·5–)0·6–1·2(–1·4) mm wide, smooth; veins (8–)9–11(–13); sclerenchyma forming a complete ring; ribs 3–5; sheaths open to the base, strongly pruinose and violet-tinged, sometimes densely hairy. Panicle (7–)9–15(–20) cm, the branches glabrous or subglabrous. Spikelets with 3–7 florets, glaucous, strongly pruinose. Upper glume ovate. Lemma ovate, obtuse or very shortly acuminate. $2n = 14$. *Sandy soils. From S. Czechoslovakia and W. Ukraine southwards to E. Bulgaria*. Au Bu Cz Hu Ju Rm Rs (W).

(a) Subsp. **vaginata**: Panicle-branches always patent. Spikelets 4·3–5·7 mm. Upper glume 2·4–3 × 1·3–1·4 mm, obtuse; lemma 3–4·2 mm × 1·4–1·6(–2) mm, obtuse, unawned. *Throughout the range of the species*.

(b) Subsp. **dominii** (Krajina) Soó, *Magyar Növ. Kéz.* 921 (1951): Panicle-branches patent only at anthesis. Spikelets 5·3–6·5 mm. Upper glume (2·7–)3–3·7 mm, very shortly acuminate; lemma (3·7–)3·9–4·5 mm, mucronate or with an awn up to 1 mm. *E.C. Europe.*

119. F. psammophila (Hackel ex Čelak.) Fritsch, *Excursionsfl. Oesterr.* 64 (1897). Stems 20–57 cm, glabrous. Leaves 0·5–1·1 mm wide, smooth, glaucous, pruinose; veins 9–13; sclerenchyma forming a complete, thin ring; ribs (3–)5; sheaths open to the base, glabrous or with dense, short hairs. Panicle 9–12 cm, the branches glabrous or scabridulous, patent at anthesis only. Spikelets 6·2–7·5(–8) mm, with 3–8 florets, glaucous, pruinose. Upper glume 3·2–4 × 1·3–1·4 mm, oblong-lanceolate, acuminate. Lemma 3·4–4·9 × 1·6–1·8 mm, oblong-ovate, acuminate; awn up to ¼ as long as lemma. $2n=14$. *Sandy soils.* ● *E. Germany, W. Czechoslovakia and Poland.* Cz Ge Po.

120. F. pannonica Wulfen ex Host, *Gram. Austr.* **4**: 36 (1809). Stems 30–60 cm, smooth or scabrid above. Leaves (0·65–)0·9–1·3 mm wide, rigid, glaucous, smooth or scabrid above; veins 7–11(–13); sclerenchyma forming a complete ring; ribs 5(–7); sheaths tomentose, open to the base. Panicle 7·5–13 cm, lax, usually interrupted, the branches strongly scabrid. Spikelets (6–)8·3–8·5(–10) mm, with 5–9 florets, glaucous, more or less pruinose. Upper glume (3·9–)4·6–5·7 × 1·6–1·7 mm, lanceolate, acuminate. Lemma 5·2–5·8 × 2·1–2·3 mm, lanceolate, acuminate, more or less ciliate, glabrous or scabrid above; awn ¼–⅓ as long as lemma. *Rocky slopes; somewhat calcicole.* ● *S.E. Austria, W. & S. Hungary.* Au Hu.

121. F. beckeri (Hackel) Trautv., *Acta Horti Petrop.* **9**: 325 (1884). Stems 20–60 cm, glabrous. Leaves 0·3–0·7 mm wide, deciduous, smooth or slightly scabrid near apex, more or less pruinose, more or less pungent; veins 7–9; sclerenchyma forming a complete ring; ribs 3, often indistinct; sheaths brownish, often ciliate. Panicle (4·5–)6–12(–18) cm, often interrupted, the branches more or less densely hairy. Spikelets 4·5–6(–7) mm, with 4–6 florets, pale green, more or less pruinose. Upper glume 2·9–3·5 × 1·2–1·4 mm, ovate-lanceolate, shortly acuminate. Lemma 2·5–3·8(–4·3) × 1·6–1·7 mm, lanceolate, rather long-acuminate; awn 0·4–0·8(–1·3) mm. *Sandy soils. S. part of U.S.S.R., northwards to c.* 48° 30′ *N.* Rs (W, K, E).

122. F. polesica Zapał., *Bull. Int. Acad. Sci. Cracovie* **1904**: 303 (1904) (?*F. sabulosa* (N. J. Andersson) Lindb. fil.). Densely caespitose. Stems 20–60 cm, scabrid-puberulent or densely hairy above. Leaves 0·4–0·8(–1) mm wide, caducous, glaucous, pruinose, smooth or weakly scabrid or scabrid-hispid beneath; veins 7–9(–11); sclerenchyma forming a ring; ribs (3–)5–7(–9); sheaths open to base, whitish to yellowish or pale brownish. Panicle (4·5–)6–10·5 cm, the branches scabrid. Spikelets (5–)6·5–6·9(–8) mm, with 4–5 florets, pale green, pruinose. Upper glume 3·2–4·1 × 1–1·4 mm, oblong-lanceolate, acuminate. Lemma (4–)4·6–5·2 × 1·6–1·7 mm, oblong-lanceolate, scabrid above; awn 0·3–1·4(–2) mm. $2n=14$. *Maritime sands; rarely inland.* ● *N. & E. Europe, westwards to N.W. Germany and southwards to Moldavia.* Da Fe Ge ?Ho Po Rs (N, B, C) Su.

123. F. javorkae Májovský, *Acta Fac. Rer. Nat. Univ. Comen. Bot.* **7**: 325 (1962) (excl. var. *wagneri* (Degen, Thaisz & Flatt) Májovský). Stems (30–)40–60(–80) cm, scabrid above. Leaves 0·5–1·1 mm wide, more or less scabrid, not pungent, glaucous; veins 5–7(–9); ribs 3(–5); sclerenchyma forming a continuous or interrupted uneven ring; sheaths usually scabrid or hirsute. Panicle 6–11(–15) cm, dense, the branches scabrid. Spikelets 6–8 mm, with (3–)4–7(–8) florets, glaucous or green and violet-tinged. Upper glume 4–4·8 mm, acuminate, scabrid or smooth above. Lemma 4·2–5(–5·8) mm, glabrous or densely hairy and ciliate above; awn (0·5–)1–3(–3·3) mm. *Sandy soils.* ● *E.C. Europe.* Au Cz Hu.

124. F. arenicola (Prodan) Soó, *Acta Bot. Acad. Sci. Hung.* **18**: 365 (1973). Stems 21–36 cm, scabrid-puberulent to densely hairy above. Leaves (0·3–)0·4–0·7(–0·9) mm wide, caducous, glaucous, more or less pruinose, scabrid, more or less pungent; veins 7–11(–13); sclerenchyma forming a sometimes interrupted ring, sometimes thickened at the base; ribs 5–7, often indistinct; sheaths ciliate, whitish to pale brownish. Panicle 3–12 cm, rigid, erect, the branches scabrid. Spikelets 5·5–7 mm, with 3–6 florets, pale green, more or less pruinose. Upper glume 3·1–3·6 × 1·1–1·4 mm, ovate-lanceolate to ovate, shortly acuminate. Lemma 3·5–4·6(–5) mm, lanceolate, scabrid above; awn 0·1–1·5 mm. *Maritime sands. E. Romania and N.E. Bulgaria.* Bu Rm.

125. F. cinerea Vill., *Hist. Pl. Dauph.* **2**: 98 (1787). Densely caespitose. Stems 18–35 cm, smooth or weakly scabrid above. Leaves 0·5–0·8(–1·2) mm wide, glaucous, more or less pruinose, rather hard, usually scabrid; veins 7(–9); sclerenchyma in a continuous or slightly interrupted, often laterally thickened ring; ribs 3(–5), rather low; sheaths closed in the lower ⅓–¼, glabrous. Panicle (2–)4–6 cm, rather dense, the branches glabrous or shortly hairy. Spikelets 7–7·3 mm, with 4–6(–7) florets, glaucous, more or less pruinose, violet-tinged. Upper glume 3·2–4·1 × 1–1·4 mm, lanceolate, acuminate, weakly scabrid or ciliate above. Lemma 4·6–5·2 × 1·7–2 mm, lanceolate, acuminate, scabrid or densely pubescent or ciliate above; awn ⅙–⅓ as long as lemma. $2n=28$. *Dry meadows on limestone.* ● *S.E. France, N.W. Italy.* Ga It.

126. F. pallens Host, *Gram. Austr.* **2**: 63 (1802). Densely caespitose. Stems (20–)30–40(–58) cm. Leaves rigid, glaucous, strongly pruinose, usually smooth; sclerenchyma forming a complete ring; sheaths open to the base, usually glabrous. Panicle lax, somewhat interrupted. Spikelets 6·5–8·4(–9·1) mm, with (3–)4–7 florets, glaucous, strongly pruinose. *Rocks and screes.* ● *C. Europe, extending to Belgium and S. Jugoslavia.* Au Be Cz Ga Ge He Hu Ju Po Rm Rs (W).

1 Awn at least ⅓ as long as lemma — (c) subsp. **treskana**
1 Awn not more than ½ as long as lemma
2 Leaves with (7–)9 veins and 5(–7) ribs — (a) subsp. **pallens**
2 Leaves with 9–11(–16) veins and 7–9 ribs — (b) subsp. **scabrifolia**

(a) Subsp. **pallens**: Stems smooth. Leaves 0·6–1 mm wide, smooth or slightly scabrid above; veins (7–)9; ribs 5(–7). Panicle 5–9·5 cm, the branches glabrous or weakly pubescent. Upper glume 3·3–5·2 × 1·2–1·7 mm, oblong-lanceolate. Lemma (3·7–)4·3–5·4(–5·8) × 1·7–2·3 mm, broadly lanceolate; awn less than ½ as long as lemma. $2n=14$, 28. *Throughout the range of the species except C. & S. Jugoslavia.*

(b) Subsp. **scabrifolia** (Hackel ex Rohlena) Zielonk., *Hoppea* **31**: 177 (1973) (*F. glauca* var. *scabrifolia* Hackel ex Rohlena): Stems smooth or scabrid above. Leaves 0·6–1·1(–1·5) mm wide, scabrid for most of their length, or smooth; veins 9–11(–16); ribs 7–9. Panicle 5–9 cm, the branches glabrous or densely puberulent. Upper glume 3·8–4·3 × 1·4–1·9 mm, oblong-lanceolate. Lemma 4·5–4·7 × 1·8–2 mm, oblong-lanceolate; awn less than ½ as long as lemma. *C. & S.E. Germany, W. Czechoslovakia.*

(c) Subsp. **treskana** Markgr.-Dannenb., *Bot. Jour. Linn. Soc.* **76**: 323 (1978). Stems smooth. Leaves 0·6–0·9 mm wide, smooth; veins 7; ribs 1–3. Panicle 4–6 cm, the branches scabridulous. Upper glume

4–5 × 1·1–1·2 mm, linear-lanceolate. Lemma 4·8–5·2 × 1·6–2 mm, oblong-lanceolate; awn ⅔–¾ as long as lemma. *C. & S. Jugoslavia.*

127. F. huonii Auquier, *Candollea* **28**: 16 (1973). Densely caespitose. Stems (5–)12–25(–44) cm, usually hairy above. Leaves (0·45–)0·6–0·8(–0·95) mm wide, smooth; veins (5–)7(–9); sclerenchyma in a continuous or slightly interrupted ring; ribs 1(–3); sheaths closed in the lower ¼–⅓, whitish to brownish, usually glabrous. Panicle 2–4·5(–6) cm, not much exserted, dense, the branches scabrid to puberulent. Spikelets (6–)6·4–7·2(–8) mm, with 3–4(–6) florets, glaucous, more or less pruinose. Upper glume (2·9–)3·3–3·9(–4·5) mm, oblong. Lemma (3·6–)4·2–4·8(–5·3) mm, oblong-lanceolate; awn 1–1·7(–2·3) mm. $2n=42$. *Cliff-tops* ● *N.W. France* (*Bretagne*). Ga.

128. F. gracilior (Hackel) Markgr.-Dannenb., *Bot. Jour. Linn. Soc.* **76**: 325 (1978) (*F. ovina* var. *duriuscula* subvar. *gracilior* Hackel). Densely caespitose. Stems 20–35 cm, glabrous above. Leaves 0·5–0·8 mm wide, irregularly curved, more or less smooth, somewhat pruinose; veins 7; sclerenchyma in a continuous or slightly interrupted ring; ribs 3, usually low; sheaths closed up to ½ way, glabrous or puberulent. Panicle 4–7·5 cm, rather dense, the branches subglabrous, patent at anthesis. Spikelets 6·5–7·5 mm, with 4–6 florets, green, often slightly violet-tinged. Upper glume 3·5–4·5 × 1·3–1·6 mm, oblong-lanceolate, acuminate. Lemma 4–4·4(–5·5) × 1·7–1·8(–2) mm, oblong-lanceolate to lanceolate, acuminate; awn 0·2–1·5 mm. $2n=14$. *Limestone rocks*, 800–2000 *m.* ● *S.W. Alps.* Ga It.

129. F. liviensis (Verguin) Markgr.-Dannenb., *op. cit.* 327 (1978) (*F. ovina* var. *liviensis* Verguin). Densely caespitose. Stems 35–45 cm, glabrous or scabridulous above. Leaves 0·6–0·95 mm wide, glaucous, pruinose, smooth, except for apex; veins 7–9; sclerenchyma in a continuous or slightly interrupted ring; ribs 1(–3); sheaths closed in the lower ¼–⅓(–½), glabrous. Panicle 4·5–8 cm, rather dense, the branches scabridulous. Spikelets 7–8 mm, with 4–5 florets, glaucous, pruinose. Upper glume 3·6–4·6 × 1·2–1·3 mm, oblong-lanceolate, with 3 conspicuous veins. Lemma 4·5–6·5 × 1·8–2·1 mm, oblong-lanceolate to lanceolate, acuminate, scabrid above, more or less ciliate; awn ¼–⅓ as long as lemma. $2n=14$. *Dry meadows.* ● *E. Pyrenees.* Ga Hs.

130. F. ochroleuca Timb.-Lagr., *Bull. Soc. Hist. Nat. Toulouse* **3**: 129 (1869). Densely caespitose. Leaves 0·5–0·85 mm wide, smooth, dark green, more or less pruinose; veins 7; sclerenchyma in a continuous or slightly interrupted ring; ribs 3; sheaths glabrous, up to ¼ as long as the stem. Panicle-branches densely puberulent. Spikelets pale green, more or less pruinose. Upper glume 4·5–5 × 1·4–1·5 mm, oblong-lanceolate, acuminate, with conspicuous veins. Lemma (4·8–)5·4(–6) × 1·5–2 mm, lanceolate, acuminate; awn ¼–⅓(–½) as long as lemma. $2n=28$. ● *Pyrenees and Cévennes.* Ga.

1 Spikelets at least 8 mm
2 Sheaths closed in the lower ⅓ — (a) subsp. **ochroleuca**
2 Sheaths closed to the middle — (d) subsp. **heteroidea**
1 Spikelets not more than 7·5 mm
3 Stems glabrous — (b) subsp. **gracilior**
3 Stems densely hairy above — (c) subsp. **bigorrensis**

(a) Subsp. **ochroleuca**: Stems 30–60 cm, densely hairy above. Sheaths closed in the lower ⅓. Panicle 6–10 cm, slightly lax. Spikelets 8–9 mm. Glumes and lemma glabrous or hairy, more or less pruinose. *Throughout the range of the species.*

(b) Subsp. **gracilior** (Verguin) Kerguélen, *Lejeunia* nov. ser., **75**: 163 (1975): Stems 25–30 cm, glabrous. Sheaths closed in the lower ⅓. Panicle 7–9·5 cm, lax. Spikelets 7–7·5 mm, more or less pruinose. Glumes and lemma glabrous. *C. Pyrenees* (*near Ax-les-Thermes*).

(c) Subsp. **bigorrensis** (St-Yves) Kerguélen, *loc. cit.* (1975): Stems 20–30 cm, densely hairy above. Sheaths closed in the lower ⅓. Panicle 4–6 cm, dense. Spikelets 7–7·5 mm, more or less pruinose. Glumes and lemma more or less tomentose. *C. Pyrenees* (*Lourdes to Gavarnie*).

(d) Subsp. **heteroidea** (Verguin) Markgr.-Dannenb., *Bot. Jour. Linn. Soc.* **76**: 327 (1978) (*F. ovina* subsp. *indigesta* var. *heteroidea* Verguin): Stems 30–40 cm, densely hairy above. Sheaths closed to the middle. Spikelets 8 mm, pruinose. Glumes and lemma glabrous or hairy. *Pyrenees and Corbières.*

131. F. brigantina (Markgr.-Dannenb.) Markgr.-Dannenb., *op. cit.* 328 (1978) (*F. ovina* subsp. *brigantina* Markgr.-Dannenb.). Densely caespitose. Stems 25–40 cm, smooth or weakly scabrid above. Leaves 0·5–0·75 mm wide, rather rigid, glaucous, more or less curved, scabrid at apex; veins 5–7; sclerenchyma in a continuous or slightly interrupted ring; ribs 1(–3); sheaths closed in the lower ⅓–½, smooth or scabrid. Panicle 5–7·5 cm, dense, the branches scabrid. Spikelets 8–8·5 mm, with 5–6 florets, glaucous, pruinose, violet-tinged. Upper glume (3·3–)4–4·3 × 1·6 mm, ovate-lanceolate, with a scarious margin. Lemma 5·5–6 × 2–2·2 mm, oblong-lanceolate; awn *c.* 1·6 mm. *Serpentine rocks.* ● *N.E. Portugal.* Lu.

132. F. valentina (St-Yves) Markgr.-Dannenb., *loc. cit.* (1978) (*F. ovina* var. *valentina* St-Yves). Densely caespitose. Stems 32–43 cm, usually smooth above. Leaves 0·4–0·8 mm wide, green, more or less weakly pruinose and slightly scabrid at apex; veins 5–7; sclerenchyma in a continuous or slightly interrupted ring; ribs 3; sheaths closed in the lower ¼–½, smooth or weakly scabrid. Panicle 5–9·5 cm, rather lax, the branches scabrid. Spikelets 8·1–8·4 mm, with 4–6 florets, somewhat pruinose. Upper glume (3·5–)4–4·6 × 1·2–1·5 mm, lanceolate, acuminate, with a narrow scarious margin, slightly ciliate above. Lemma (5–)5·2–5·8 × 1·7–2·1 mm, lanceolate, acuminate, somewhat scabrid above; awn up to 0·7 mm. *Scrub; calcicole.* ● *Mountains of E. Spain.* ?Ga Hs.

133. F. degenii (St-Yves) Markgr.-Dannenb., *loc. cit.* (1978) (*F. ovina* var. *glauca* subvar. *degenii* St-Yves). Densely caespitose. Stems 25–50 cm, usually pubescent above. Leaves 0·4–0·8 mm wide, rigid, usually strongly scabrid, with rather long dense hairs above, glaucous, more or less pruinose; veins 7; sclerenchyma forming a complete, rather thick ring; ribs 1–3; sheaths closed in the lower ⅖–½, glabrous. Panicle 4·5–9 cm, the branches more or less scabrid. Spikelets 7·5–9·1 mm, with 4–5 florets, glaucous, more or less pruinose, usually pubescent. Upper glume 3·5–4·9 × 1·3–1·4 mm, lanceolate, acuminate. Lemma 4·6–5·6 × 1·8–2·1 mm, lanceolate, acuminate; awn 0·7–1·7 mm. $2n=28$. *Rocky places; calcifuge.* ● *S.E. France* (*Massif de l'Esterel, near Cannes*). Ga.

134. F. oviniformis Vetter, *Bot. Jahrb.* **69**: 547 (1939). Stems 12–32 cm, smooth. Leaves 0·65–0·85 mm wide, rigid, scabrid above, pruinose; veins 5(–7); sclerenchyma forming a complete ring; ribs 3; sheaths open to the base, more or less puberulent. Panicle 3–8 cm, dense, the branches scabrid. Spikelets 7·8–9 mm, with 5–9 florets, green. Upper glume 3·9–4·9 × 1·3–1·7 mm, lanceolate, rather abruptly acuminate. Lemma 5–6 × 1·7–1·9 mm, oblong-lanceolate, acuminate, scabrid above; awn ½–¾ as long as lemma. *Calcifuge.* ● *N.E. Greece* (*mountains above Komotini*). Gr.

135. F. hirtovaginata (Acht.) Markgr.-Dannenb., *Veröff. Geobot. Inst. Rübel* (*Zürich*) **56**: 100 (1976). Stems 30–57 cm,

smooth. Leaves 0·5–0·9 mm wide, rigid, glaucous, weakly scabrid above; veins 7; sclerenchyma in a continuous or slightly interrupted ring; ribs 3; sheaths open nearly to the base, with dense, patent hairs *c.* 2 mm. Panicle 5·5–8 cm, rather dense, the branches scabrid. Spikelets 7·8–9·7 mm, with 4–5 florets, glaucous. Upper glume 5·2–6·2 × 1·3–1·7 mm, lanceolate, rather abruptly acuminate. Lemma 5·4–7·1 × 1·8–2·2 mm, oblong-lanceolate, acuminate, glabrous or scabrid above; awn usually ¾ as long as lemma. ● *Macedonia.* Bu Gr Ju.

136. F. ticinensis (Markgr.-Dannenb.) Markgr.-Dannenb., *Bot. Jour. Linn. Soc.* **76**: 328 (1978) (*F. ovina* subsp. *ticinensis* Markgr.-Dannenb.). Densely caespitose. Stems 30–60 cm, smooth, angular above. Leaves 0·45–1(–1·5) mm wide, bright green or glaucous, strongly scabrid at least above; veins 7; sclerenchyma forming a continuous or slightly interrupted ring; ribs 3; sheaths closed in the lower ¼ or less. Panicle 5·5–12·5 cm, very lax, the branches patent, scabrid. Spikelets (7·1–)8·1–9·7 mm, with 3–7 florets, bright green or glaucous. Upper glume 3·4–6·3 × 1·2–2·2 mm, oblong-lanceolate, long-acuminate, scabrid above, with a narrow scarious margin. Lemma 5·2–6·9 × 1·6–2·2 mm, oblong-lanceolate, long-acuminate, shortly cilate, scabrid above; awn ⅓–½ as long as lemma. *Limestone rocks and dry meadows.* ● *S. Alps (hills above Lago di Como and Lago di Lugano).* He It.

137. F. grandiaristata Markgr.-Dannenb., *Veröff. Geobot. Inst. Rübel (Zürich)* **56**: 101 (1976). Stems 30–40 cm, smooth. Leaves 0·45–0·8 mm wide, scabrid above, glaucous; veins 7; sclerenchyma forming a complete ring, thickened at base; ribs 3; sheaths open to the base, slightly hairy. Panicle 9 cm, rather lax, the branches densely hairy. Spikelets 8·5–9·7 mm, with 3–4 florets, glaucous. Upper glume 5·6 × 1·3–1·4 mm, linear to linear-lanceolate. Lemma 6·9–7·3 × 1·9–2 mm, oblong-lanceolate, long-acuminate; awn at least ½ as long as lemma. *Siliceous mountain rocks.* ● *N. Greece (E. Makedhonia).* Gr.

138. F. thracica (Acht.) Markgr.-Dannenb., *loc. cit.* (1976). Stems up to 57 cm, smooth. Leaves 0·4–0·65(–0·8) mm wide, scabrid, glaucous; veins (5–)7; sclerenchyma forming a usually interrupted ring; ribs 3; sheaths open to the base, more or less scabrid. Panicle 6–9 cm, the branches densely hairy. Spikelets 8·4–8·5 mm, with 3–4 florets, green, more or less pruinose. Upper glume 3·9–6·2 × 1·3–1·7 mm, lanceolate, acuminate, ciliate. Lemma 5·5–6·7 × 1·7–2·3 mm, oblong-lanceolate, acuminate, pubescent above, ciliate; awn ⅔ as long to as long as lemma. ● *S. Bulgaria, N. Greece.* Bu Gr.

139. F. hercegovinica Markgr.-Dannenb., *Bot. Jour. Linn. Soc.* **76**: 323 (1978). Densely caespitose. Stems 20–60 cm, smooth or weakly scabrid above. Leaves 0·4–0·9 mm wide, rigid, slightly pruinose, scabrid at least above; veins (5–)7; sclerenchyma forming a continuous or interrupted ring; ribs 3, often indistinct; sheaths closed in the lower ¼ at most, with deciduous lamina. Panicle 4–8·5 cm, dense, the branches more or less scabrid. Spikelets 8·1–10 mm, with 3–5 florets, pale green or glaucous, sometimes violet-tinged, more or less pruinose. Upper glume 4·6–6·9 × 1·5–2 mm, lanceolate, acuminate, sometimes shortly ciliate above, with a distinct scarious margin. Lemma 6·2–7·5 × 2·1–2·5 mm, lanceolate, acuminate, scabrid above and ciliate or pubescent; awn ⅔ as long to as long as lemma. *S. Jugoslavia, N. Greece.* Gr Ju.

140. F. robustifolia Markgr.-Dannenb., *op. cit.* 328 (1978) (*F. ovina* var. *duriuscula* subvar. *robusta* Hackel, non *F. robusta* Mutel). Densely caespitose. Stems 24–36 cm, smooth or scabrid above. Leaves 0·4–0·8(–1·1) mm wide, usually obtuse, rather hard, more or less pruinose; veins 7(–9); sclerenchyma in a complete ring; ribs 3; sheaths closed in the lower ⅓–½(–½), smooth or weakly scabrid. Panicle 3–5·5 cm, dense, the branches weakly scabrid to densely hairy. Spikelets 9–9·7 mm, with 3–5 florets, pale green to glaucous, more or less violet-tinged, and pruinose. Upper glume (3·9–)4·2–6 × 1·5–2 mm, lanceolate, acuminate, scabrid above or pubescent, with a distinct scarious margin. Lemma 5–6·7 × 2·1–2·4 mm, lanceolate, acuminate, scabrid above or pubescent; awn *c.* ½ as long as lemma. *Rocks, mainly in the mountains.* ● *C. & S. Italy, Sicilia.* It Si.

141. F. panciciana (Hackel) K. Richter, *Pl. Eur.* **1**: 96 (1890). Stems 15–35(–53) cm, glabrous, scabrid or hairy above. Leaves 0·3–0·6 mm wide, scabrid to nearly smooth at apex, scabrid to pubescent below; veins 5(–7); sclerenchyma-strands as many as the veins, sometimes confluent into an interrupted or complete ring which is thickened in places; ribs 3; sheaths often closed in the lower ¼–⅓, glabrous or pubescent. Panicle 3–6(–8·5) cm, dense, the branches shortly hairy. Spikelets 7·8–9·1 mm, with 3–florets, glaucous or dirty violet, rarely pruinose. Upper glume 3·4–5 × 1·3–1·7 mm, ovate-lanceolate, acuminate. Lemma 5·2–6·2 × 1·7–2·3 mm, lanceolate, acuminate; awn more than ½ as long as lemma. *Mountain rocks.* ● *N. & C. parts of Balkan peninsula.* Al ?Bu Ju.

142. F. apuanica Markgr.-Dannenb., *Bot. Jour. Linn. Soc.* **76**: 322 (1978). Rather densely caespitose. Stems 33–64 cm, glabrous or weakly scabrid above. Leaves 0·5–0·9 mm wide, smooth or weakly scabrid above; veins 5–7; sclerenchyma-strands separate or confluent into a ring which is thickened in places; ribs 1–3; sheaths closed in the lower ⅛(–½), smooth or weakly scabrid, Panicle 6–14 cm, rather lax, the branches scabrid, patent at anthesis. Spikelets 8–9·4 mm, with 3–5 florets. Upper glume 4·5–5·5 × 1·2–1·7 mm, oblong-lanceolate, acuminate, with a distinct scarious margin. Lemma 5·2–7 × 1·6–2·1 mm, oblong-lanceolate, acuminate, scabrid above, with a narrow scarious margin; awn 2–3·3 mm. *Mountain rocks and meadows; calcifuge.* ● *N. Italy (Alpi Apuane).* It.

143. F. koritnicensis Hayek & Vetter, *Denkschr. Akad. Wiss. Math.-Nat. Kl. (Wien)* **99**: 220 (1924) (*F. heteroglossa* Vetter pro parte). Stems (9–)30–48 cm. Leaves 0·6–0·9(–1·15) mm wide, nearly smooth, slightly hairy below, glaucous, pruinose; veins (5–)7; sclerenchyma of 3 stout and 2–4 slender strands, some confluent; ribs 3–5; sheaths closed in the lower ⅓–½, usually smooth. Panicle 5–8 cm, rather dense, the branches shortly hairy. Spikelets (8–)9·5–10 mm, with 4–5 florets, pruinose, glaucous, violet-tinged. Upper glume 4·7–6·7 × 1·6–1·8 mm, ovate-lanceolate, acuminate. Lemma (5·5–)6·5–7·8 × (1·8–)2·2–2·3 mm, lanceolate, acuminate, smooth or scabrid above; awn *c.* ½ as long as lemma. ● *W. part of Balkan peninsula, from Hercegovina to N.W. Greece.* Al Gr Ju.

The type material of *F. heteroglossa* Vetter is a mixture of *F. koritnicensis* and *Bellardiochloa violacea.*

144. F. pohleana Alexeev, *Bull. Soc. Nat. Moscou* **78(5)**: 144 (1973). Densely caespitose. Stems (10–)15–30 cm, smooth. Leaves 0·45–0·6 mm wide, glaucous, pruinose, scabrid; veins 5–7; sclerenchyma forming a continuous, unevenly thickened or somewhat interrupted ring; ribs 1–3; sheaths closed in the lower ¼–⅓, almost glabrous. Panicle (1·5–)3–4·5 cm, the branches scabrid. Upper glume 3·4–4·1 × 1·2 mm. Lemma 3·8–4·7 × 2 mm; awn 1·3–1·6 mm. *Limestone rocks.* ● *N.E. Russia (basin of R. Usa).* Rs (N).

145. F. macedonica Vetter, *Bot. Jahrb.* **69**: 547 (1939) (non *F. ovina* subsp. *macedonica* Stoj.). Stems 15–30(–40) cm, scabrid

or smooth above. Leaves 0·5–0·7 mm wide, scabrid above, glaucous, usually pruinose; veins 5; sclerenchyma forming a continuous or somewhat interrupted ring; ribs 3; sheaths closed in the lower ½(–¼), glabrous, sometimes weakly scabrid. Panicle 4–9·5 cm, rather dense, the branches scabrid. Spikelets 7–8·5 mm, with 4–7 florets, glaucous, violet-tinged. Upper glume 4·2–5·6 × 1·2–1·5 mm, oblong-lanceolate, acuminate, somewhat ciliate. Lemma 4·9–6·5 × 1·6–2 mm, oblong-lanceolate; awn often as long as lemma. *Mountain meadows.* ● *N.E. Greece.* Gr.

146. F. polita (Halácsy) Tzvelev, *Nov. Syst. Pl. Vasc.* (*Leningrad*) **9**: 43 (1972) (*F. ovina* var. *polita* Halácsy). Stems 14–52 cm, smooth. Leaves 0·4–0·85(–1·1) mm wide, rigid, more or less curved, smooth or nearly so; veins 7; sclerenchyma forming a continuous or slightly interrupted ring, thickened at the base; ribs 3; sheaths closed in the lower ¼ to nearly ⅓, usually smooth. Panicle (2·5–)4·5–6·5(–7·5) cm, usually dense, the branches smooth or weakly scabrid. Spikelets 7·5–9·7 mm, with (3–)4–6 florets, glaucous. Upper glume (4·4–)5–6·1 × 1·5–1·8 mm, oblong-lanceolate, acuminate. Lemma (5·2–)5·4–7·5 × 1·7–2·5 mm, oblong-lanceolate, acuminate; awn ½(–⅔) as long as lemma. ● *Greece and Kriti.* Cr Gr.

147. F. curvula Gaudin, *Agrost. Helv.* **1**: 239 (1811). Densely caespitose. Stems 25–40(–60) cm, smooth or scabrid above. Leaves (0·6–)0·8–1·1(–1·35) mm wide; sclerenchyma-ring unequally thickened, sometimes interrupted; ribs 3–5; sheaths closed for up to ⅓ of their length. Panicle 5–11 cm, rather dense, the branches scabrid. Spikelets (7·5–)8–11 with (3–)4–6 florets, green to glaucous. Upper glume 4–6·3 × (1·2–)1·4–2 mm, lanceolate, acuminate, glabrous or ciliate or scabrid above. Lemma lanceolate, acuminate; awn (⅓–)½ as long as lemma. *Dry grassland, rocks and screes.* ● *From the Pyrenees to the E. Alps.* Au Ga He It.

1 Upper glume with a distinct scarious margin (b) subsp. **crassifolia**
1 Upper glume without a scarious margin
2 Leaves usually not more than half as long as stems; sclerenchyma-ring thickened at midrib and margin, often interrupted (a) subsp. **curvula**
2 Leaves usually about as long as stems; sclerenchyma-ring not or scarcely thickened at midrib and margin, not interrupted (c) subsp. **cagiriensis**

(a) Subsp. **curvula**: Leaves slightly compressed laterally, smooth or slightly scabrid, pruinose; veins 7–9. Spikelets 8–9·7 mm, pruinose. Lemma (5·5–)6–7·5 × 2–2·5 mm, scabrid or pubescent above. $2n = 56 + 0$–1B. *Alps, eastwards to c.* 10° *E.*

(b) Subsp. **crassifolia** (Gaudin) Markgr.-Dannenb., *Bot. Jour. Linn. Soc.* **76**: 328 (1978) (*F. glauca* var. *crassifolia* Gaudin): Leaves not compressed laterally, scabrid above, pungent, usually not pruinose; veins 7–9; sclerenchyma-ring not thickened, continuous. Spikelets (7·5–)8–9·1 mm. Lemma (5–)5·5–7·5 × 2·1–2·6 mm, usually glabrous. $2n = 56 + 1$B. *S.W. Switzerland* (*Valais*).

(c) Subsp. **cagiriensis** (Timb.-Lagr.) Markgr.-Dannenb., *loc. cit.* (1978) (*F. cagiriensis* Timb.-Lagr.): Leaves not compressed laterally, smooth, pruinose; veins 7–9(–11). Spikelets 9–11 mm, pruinose. Lemma (5·8–)6·9–7·1 × 2·1–2·2 mm, glabrous or ciliate. *Pyrenees and mountains of S.C. France.*

148. F. pachyphylla Degen ex E. I. Nyárády, *Contr. Bot.* (*Cluj*) **1962**: 146 (1962). Densely caespitose. Stems 27–53(–60) cm, smooth or weakly scabrid above. Leaves (0·4–)0·9–1(–1·5) mm wide, glaucous, strongly carinate, smooth; veins 7–9(–12); sclerenchyma in 3 stout strands at the angles and 2 or more smaller lateral strands; ribs 3–5; sheaths open almost to the base or closed for up to ⅓ their length, glabrous or hairy. Panicle 5·5–8 cm, dense, the branches more or less hairy. Spikelets 8·1–9·1 mm, with (3–)4–5 florets, glaucous, violet-tinged. Upper glume 4–5·1 × 1·6–2·1 mm, ovate-lanceolate, acuminate, with a narrow scarious margin. Lemma (5–)5·4–6·5 × 2·2–2·4 mm lanceolate, acuminate; awn ⅓–½ as long as lemma. *Rocky hillsides*, 1400–2000 *m.* ● *W. part of S. Carpathians.* Rm.

149. F. igoschiniae Tzvelev, *Bot. Žur.* **56**: 1254 (1971) (*F. kryloviana* auct., non Reverdatto). Densely caespitose. Stems 20–50 cm, smooth or slightly scabrid above. Leaves (0·4–)0·55–0·85(–1) mm wide, nearly smooth, obtuse, glaucous; veins 7(–10); sclerenchyma in 3 rather slender strands, with several thin intermediate strands, rarely confluent; ribs 3(–5); sheaths closed in the lower ⅖–⅔, smooth or scabridulous. Panicle (2·5–)5–8(–10) cm, rather dense, the branches scabrid. Spikelets 7·2–7·3 mm, with 4–5 florets, pale green, violet-tinged. Upper glume 4·1–4·6 × 1·2–1·4 mm, linear-lanceolate to lanceolate, acuminate, with a distinct scarious margin. Lemma 5–5·5 × 1·7–2·1 mm, oblong-lanceolate, acuminate, smooth or scabrid above; awn 2–2·7 mm. *Mountain meadows and scrub.* ● *S. Ural.* Rs (C).

150. F. vivipara (L.) Sm., *Fl. Brit.* **1**: 114 (1800) (*F. ovina* var. *vivipara* L.). Densely caespitose. Stems 10–30(–43) cm. Leaves 0·3–0·7(–0·8) mm wide, scabrid or smooth, green or glaucous; veins 5–7(–9); sclerenchyma in a continuous or slightly interrupted ring; ribs 1(–3); sheaths usually closed in the lower ¼–⅓(–⅔), usually glabrous. Panicle usually 3–6 cm, the branches scabrid or pubescent. Spikelets with at least the upper florets proliferating, the lower sometimes sexual, with awned lemmas. $2n = 28$ (21, 35, 42, 49, 56). *Tundra, moorland and mountain cliffs. Arctic and N.E. Europe, southwards to S.W. Ireland.* Br Fa Fe Hb Is No Rs (N) Sb Su.

In the British Isles the leaves of this species resemble those of *F. tenuifolia*, while elsewhere they are more like those of *F. ovina*.

151. F. glauca Vill., *Hist. Pl. Dauph.* **2**: 99 (1787). Densely caespitose. Stems 18–46 cm, glabrous. Leaves 0·5–0·85 mm wide, erect, smooth, glaucous, pruinose, with long hairs on upper surface; veins 7(–9); sclerenchyma in a continuous or slightly interrupted ring; ribs 1(–3); sheaths closed in the lower ⅓–⅖. Panicle 4·4–5·5 cm, very dense, erect, the branches scabrid. Spikelets 6–8 mm, with 4–5 florets, strongly pruinose or not, glabrous or hairy. Upper glume 3·5–4·2(–5·1) × 1·4–1·7 mm, ovate, subobtuse. Lemma 4·2–4·7 × 1·7–2·5 mm, ovate-lanceolate, acuminate; awn ¼ as long as lemma. $2n = 42$. *Siliceous rocks*, 630–700 *m.* ● *S. France* (*Roussillon*). Ga.

152. F. vasconcensis (Markgr.-Dannenb.) Auquier & Kerguélen, *Bull. Soc. Bot. Fr.* **123**: 320 (1976) (*F. ovina* subsp. *vasconcensis* Markgr.-Dannenb.). Densely caespitose, sometimes with creeping rhizomes. Stems 24–50 cm, usually pubescent above. Leaves (0·4–)0·5–0·9(–1·2) mm wide, usually smooth, rarely pruinose, usually curved; veins 7(–9); sclerenchyma in a continuous ring; ribs 1(–3); sheaths closed in the lower ¼–⅓(–½), whitish, glabrous or shortly hairy. Panicle 5·5–10·5 cm, often interrupted, the branches scabrid. Spikelets 6·9–8·1 mm, with 3–4(–6) florets, green or glaucous, sometimes violet-tinged. Upper glume 3·3–4·6 × 1–1·7 mm, oblong-lanceolate, acuminate. Lemma 4·6–5·5 × 1·6–2 mm, oblong-lanceolate to lanceolate, acuminate, narrowly scarious, glabrous or ciliate; awn 0·1–1·8 mm. $2n = 42$. *Maritime sands.* ● *S.W. France and N.W. Spain.* Ga Hs.

153. F. durissima (Hackel) Kerguélen, *Lejeunia* nov. ser., **75**: 153 (1975). Densely caespitose. Stems 25–48 cm, smooth.

Leaves 0·6–1·2 mm wide, smooth, more or less pungent and curved, rigid, pale green or glaucous, sometimes pruinose; veins 7–9; sclerenchyma forming a continuous, usually rather thick ring; ribs 1(–3), rarely with single sclerenchyma-cells above; sheaths closed in the lower ¼–⅓(–½), glabrous. Panicle up to 6 cm, dense, the branches scabrid. Spikelets 8–10 mm, with 3–4(–5) florets, glaucous, sometimes violet-tinged. Upper glume 4·5–5·7 × (1·2–)1·4–1·9 mm, lanceolate, acuminate. Lemma 5·5–7·1 × 2–2·5 mm, lanceolate, acuminate, scabrid or ciliate above; awn *c.* ½ as long as lemma. $2n=42$, 56. *Alpine meadows.* ● *C. Spain, E. & C. Pyrenees, Cévennes.* Ga Hs.

154. F. indigesta Boiss., *Elenchus* 91 (1838). Densely caespitose; non-flowering shoots intravaginal. Leaves rarely pruinose, short, recurved, hard, usually pungent; veins (5–)7(–9); sclerenchyma in a continuous ring; sheaths usually closed in the lower ¼–½, rarely open, sometimes hairy. Panicle up to 7 cm, dense. Spikelets usually glabrous, sometimes pruinose. Glumes and lemma usually with a distinct scarious margin; awn ⅓–⅔ as long as lemma. *Rocks, screes and mountain meadows. S.W. Europe, extending to Elba; one station in W. Ireland.* Co Ga Hb Hs It Lu.

1 Stems 30–40 cm; sheaths open to the base; spikelets 9–11 mm, upper glume subulate-lanceolate **(f) subsp. litardierei**
1 Stems not more than 30 cm; sheaths closed in at least the lower ¼; spikelets 6–8(–9·7) mm; upper glume lanceolate to ovate-lanceolate
2 Stems scabrid or pubescent above; leaves scabrid at least above
3 Leaves 0·5–0·8 mm wide, scabrid above; awn 1·5–2 mm **(e) subsp. molinieri**
3 Leaves 0·45–0·55 mm wide, scabrid throughout; awn 1·25–1·45 mm **(d) subsp. alleizettei**
2 Stems smooth or nearly so; leaves smooth
4 Stems 10–23 cm; leaves 0·35–0·5(–0·75) mm wide, usually with 1 rib; spikelets (5·5–)6·3–7·5 mm; upper glume ovate-lanceolate **(c) subsp. aragonensis**
4 Stems 20–30 cm; leaves at least 0·6 mm wide, with 3 ribs; spikelets 7·8–8·7 mm; upper glume lanceolate
5 Leaves with 7(–9) veins; upper glume 4·8–5·2 mm **(a) subsp. indigesta**
5 Leaves with 5 veins; upper glume 3·6–4·2 mm **(b) subsp. hackeliana**

(a) Subsp. **indigesta**: Stems 20–30 cm, smooth or nearly so. Leaves 0·6–1·1 mm wide, pale green, smooth; veins 7(–9); ribs 3; sheaths closed to halfway, sometimes hairy. Panicle 3–7 cm, the branches somewhat scabrid or densely hairy. Spikelets 8–9·7 mm, with (3–)4–6(–7) florets. Upper glume 4·8–5·2 × 1·6–2 mm, lanceolate, acuminate. Lemma (5–)6–7·1 × 2·1–2·8 mm, lanceolate, acuminate; awn (1–)1·5–2·3 mm. $2n=42$. *Mountains of N.W. Portugal and Spain.*

(b) Subsp. **hackeliana** (St-Yves) Markgr.-Dannenb., *Bot. Jour. Linn. Soc.* **76**: 328 (1978) (*F. ovina* subsp. *indigesta* var. *hackeliana* St-Yves): Like subsp. (a) but leaves with 5 veins; sheaths closed to the mouth; spikelets 7·8–8 mm; upper glume 3·6–4·2 × 1·6–1·7 mm; lemma 5·2–5·6 × 2·1–2·4 mm. $2n=42$. ● *Mountains of S. Spain.*

(c) Subsp. **aragonensis** (Willk.) Kerguélen, *Lejeunia* nov. ser., **75**: 158 (1975). Stems 10–23 cm, smooth or nearly so. Leaves (0·35–)0·5(–0·75) mm wide, glaucous, smooth; veins 7; ribs 1(–3); sheaths closed in the lower ⅓–½. Panicle 2–5 cm, the branches shortly hairy. Spikelets (5·5–)6·3–7·5 mm, with 4–5 florets. Upper glume 3–3·8 × 1·2–1·5 mm, ovate-lanceolate, acuminate. Lemma 4–5 × 1·6–1·75(–1·9) mm, lanceolate, acuminate; awn 1·3–1·5 mm. ● *Mountains of Spain, N. Portugal and S.W. France.*

(d) Subsp. **alleizettei** (Litard.) Kerguélen, *loc. cit.* (1975): Stems 9–18 cm, pubescent above. Leaves 0·45–0·55 mm wide, not pruinose, scabrid and with rigid hairs *c.* 1 mm; veins 7; ribs 1(–3); sheaths closed in the lower ⅓–½, minutely hairy. Panicle 2–4·5 cm, lax, the branches hispid-scabrid. Spikelets 6 mm, with 4–5 florets. Upper glume 3 × 1 mm, broadly lanceolate. Lemma 4 × 1·3 mm, broadly lanceolate; awn 1·25–1·45 mm. ● *Foothills of C. Pyrenees.*

(e) Subsp. **molinieri** (Litard.) Kerguélen, *op. cit.* 159 (1975): Stems 10–17 cm, densely pubescent above. Leaves 0·5–0·7(–0·8) mm wide, glaucous, more or less scabrid above and pubescent below; veins (5–)7(–9); ribs 1, or 2–3 and indistinct; sheaths closed in the lower ¼–⅓, glabrous or hairy. Panicle 2–3 cm, the branches shortly hairy. Spikelets 6–7 mm, with 3–4 florets. Upper glume 3·5–4 × 1·4–1·5 mm, ovate-lanceolate. Lemma 3·9–4·2 × 1·75–2·1 mm, lanceolate, hispid-scabrid and ciliate above; awn 1·5–2 mm. ● *From the Pyrenees to W. Ireland.*

(f) Subsp. **litardierei** (St-Yves) Kerguélen, *loc. cit.* (1975): Stems 30–40(–60) cm, smooth, scabrid or puberulent above. Leaves 0·5–0·9 mm wide, glaucous, pruinose, usually scabrid at least above; veins 7; ribs 1(–3); sheaths open to the base, smooth or scabrid. Panicle 3–6 cm, the branches scabrid. Spikelets 9–11 mm, with 4–6 florets. Upper glume 5·2–6·5 × 1·5–2 mm, subulate-lanceolate. Lemma 6–7·5 × 1·7–2·3 mm, lanceolate, long-acuminate, scabrid or with dense short hairs above; awn *c.* 3 mm. ● *Corse; Elba.*

155. F. pseudovina Hackel ex Wiesb., *Österr. Bot. Zeitschr.* **30**: 126 (1880) (*F. valesiaca* subsp. *pseudovina* (Hackel ex Wiesb.) Hegi). Stems 20–36(–43) cm, smooth or almost so. Leaves 0·3–0·6 mm wide, scabrid, glaucous; veins 5; sclerenchyma-strands 3, stout, sometimes with 2 alternating small strands; ribs 3; sheaths open to the base, smooth or weakly scabrid. Panicle 2–4(–5·5) cm, somewhat interrupted, the branches scabrid. Spikelets (4·2–)4·7–6 mm, with (2–)4–5 florets, glaucous, slightly violet-tinged. Upper glume 2·2–2·9 × (0·8–)1–1·2(–1·4) mm, ovate-lanceolate, shortly acuminate. Lemma 2·6–3·4 × 1·2–1·6 mm, ovate-lanceolate, rather shortly acuminate, glabrous or pubescent; awn not more than ⅓ as long as lemma. $2n=14$, 28. *Dry meadows. C. & E. Europe, from C. Germany to White Russia and W. Kazakhstan.* Au Cz Ge Hu Ju Rm Rs (W, C, E).

156. F. illyrica Markgr.-Dannenb., *Bot. Jahrb.* **92**: 151 (1972). Stems 13–30 cm, smooth or scabrid above. Leaves 0·3–0·5(–0·6) mm wide, glaucous, scabrid; veins 5; sclerenchyma-strands 3, with 2–4 small strands alternating; ribs 3; sheaths open to the base, glabrous or slightly hairy. Panicle (2–)3–5(–6) cm, the branches scabrid. Spikelets (6–)6·5–7·8(–8·1) mm, with (2–)3–6 florets, green or glaucous, dirty violet-tinged. Upper glume 3·1–3·9(–4·6) × 1–1·4(–1·6) mm, ovate-lanceolate, shortly acuminate. Lemma (3·4–)3·8–4·6 × 1·4–1·6 mm, lanceolate, acuminate, glabrous or ciliate; awn usually less than ½ as long as lemma. ● *W. Jugoslavia.* Ju.

157. F. wagneri (Degen, Thaisz & Flatt) Krajina, *Acta Bot. Bohem.* **8**: 61 (1929). Stems 30–42 cm, pubescent. Leaves (0·3–)0·4–0·6(–0·7) mm wide, glaucous, scabrid, with conspicuous long hairs on both surfaces, particularly near the base; veins 5; sclerenchyma-strands 3, very stout, often with small strands alternating; ribs 3; sheaths closed only near the base, densely pubescent. Panicle 4–7·5 cm, scarcely interrupted, the branches hairy. Spikelets 6·5–7·5(–8) mm, with 4–8 florets, glaucous, glabrous or tomentose. Upper glume 3–4 × 1–1·2 mm, ovate-lanceolate, shortly acuminate. Lemma 4·6–5·2 × 1·8 mm, lanceolate, shortly acuminate; awn ⅓–⅔ as long as lemma. $2n=28$. ● *S.W. Romania and E. Jugoslavia.* ?Cz ?Hu Ju Rm.

158. F. makutrensis Zapał., *Kosmos* (*Lwów*) **35**: 783 (1910). Stems 20–50 cm, weakly scabrid above. Leaves 0·3–0·5(–0·6) mm wide, scabrid, glaucous; veins 5–7; sclerenchyma-strands 3, stout, sometimes with 2 smaller strands alternating, rarely confluent; ribs 3–5; sheaths open to the base, glabrous or more or less hairy, the lamina deciduous. Panicle 4·5–7 cm, rather lax. Spikelets 5–6·5 mm, with 3–4 florets, green or slightly violet, more or less pruinose. Upper glume 3·7–4(–4·2) × 1·1 mm, oblong-lanceolate. Lemma 4–4·5(–5) × 1·7 mm, oblong-lanceolate, long-ciliate; awn *c.* ½ as long as lemma. ● *Poland and W.C. part of U.S.S.R.* ?Ge Po Rs (C, W).

159. F. valesiaca Schleicher ex Gaudin, *Agrost. Helv.* **1**: 242 (1811). Stems 25–40(–50) cm, weakly scabrid above. Leaves (0·2–)0·3–0·5(–0·6) mm wide, scabrid, pruinose; veins 5; sclerenchyma-strands 3, stout, rarely with additional small strands and rarely confluent; ribs 3; sheaths open to the base, glabrous, the lamina sometimes deciduous. Panicle 3–7 cm, slightly interrupted, the branches weakly scabrid. Spikelets (5·5–)6–6·7 mm, with 3–5 florets, pruinose. Upper glume 2·6–3·9 × 1–1·4 mm, oblong-lanceolate, abruptly acuminate. Lemma 3·4–4·9(–5·2) × 1·3–1·5(–1·6) mm, subulate-lanceolate to subulate, glabrous or ciliate; awn rarely more than ½ as long as lemma. $2n = 14$, ?28. *From C. Germany and N.C. Russia southwards to the Pyrenees, C. Italy and S.C. Greece.* Au Bu Cz Ga Ge Gr He Hu It Ju Po Rm Rs (C, W, K, E).

160. F. carnuntina Tracey, *Pl. Syst. Evol.* **128**: 289 (1977). Densely caespitose. Stems 15–23 cm, scabrid above. Leaves (0·4–)0·7–1 mm wide, strongly scabrid, tomentose especially at the base, glaucous; veins 5; sclerenchyma-strands 3, very stout, rarely with small strands alternating; ribs 3; sheaths open to the base, densely tomentose. Panicle (2–)3–4·5 cm, almost simple, the branches hairy. Spikelets 6–6·4 mm, with 3–4 florets, glaucous. Upper glume 3·1–3·4 × 1·3–1·6 mm, ovate-lanceolate, shortly acuminate, tomentose above. Lemma 4·2 × 2 mm, ovate-lanceolate, rather shortly acuminate, tomentose; awn nearly ½ as long as lemma. $2n = 42$. *Dry meadows on limestone.* ● *E. Austria* (*Hainburger Berge, W. of Bratislava*). Au.

161. F. rupicola Heuffel, *Verh. Zool.-Bot. Ges. Wien* **8**: 233 (1858). Densely caespitose. Leaves rarely pruinose; sclerenchyma-strands 3, stout, rarely with 2 small strands alternating; ribs 3; sheaths open to the base. Panicle 4·5–8(–9·5) cm, rather lax, the branches scabrid. Spikelets with 3–5 florets, green. Upper glume 2·9–5·2 × (1–)1·2–1·9 mm, ovate-lanceolate, acuminate. Lemma lanceolate to ovate-lanceolate; awn up to ½ as long as lemma. $2n = 42$. *Dry places. C. Europe and Balkan peninsula, extending to N. Italy and W. Ukraine.* Au Bu Cz Ga Ge He Hu It Ju Po Rm Rs (C, W, E).

Records from the S.E. part of the U.S.S.R. require confirmation.

(a) Subsp. **rupicola** (*F. sulcata* (Hackel) Nyman, *F. vallesiaca* subsp. *sulcata* (Hackel) Schinz & Keller): Stems 23–52(–65) cm, scabrid above. Leaves (0·4–)0·6–0·8 mm wide, scabrid throughout, *c.* ½ as long as stems; veins 5(–7); sheaths scabrid-pubescent or glabrous. Spikelets 6·4–8·2 mm. Lemma (3·8–)4·2–4·8 × 1·7–2·3 mm, glabrous or pubescent. *Throughout the range of the species.*

(b) Subsp. **saxatilis** (Schur) Rauschert, *Feddes Repert.* **63**: 276 (1960) (*F. saxatilis* Schur): Stems 38–75 cm, smooth. Leaves (0·4–)0·5–1 mm wide, smooth but usually scabrid near apex, as long as stems; veins 5–7(–9); sheaths glabrous. Spikelets 8·5–9·2 mm. Lemma 5·9–6 × 2·3 mm, glabrous, often pruinose. *S. & E. Carpathians.*

162. F. taurica (Hackel) A. Kerner ex Trautv., *Acta Horti Petrop.* **9**: 327 (1884). Stems 40–50 cm, scabrid above. Leaves 0·35–0·6(–0·7) mm wide, strongly scabrid, densely hairy above, less so beneath, *c.* ¾ as long as stems; veins 5; sclerenchyma-strands 3, sometimes with several intermediate strands, or confluent; ribs 3; sheaths closed near base, glabrous or minutely hairy. Panicle 5–11 cm, somewhat interrupted, the branches hairy. Spikelets 8·4–10·7 mm, green, with 5 florets. Glumes subulate, the upper 6·5–7·4 × 1·4–1·5 mm. Lemma 6·5–8·4 × 1·7–2 mm, glabrous or weakly scabrid above; awn up to as long as lemma. *S.E. Europe, from N.E. Greece to Krym.* Bu Gr Rs (W, K).

163. F. dalmatica (Hackel) K. Richter, *Pl. Eur.* **1**: 95 (1890). Stems 30–58 cm. Leaves (0·4–)0·5–0·85 mm wide, strongly scabrid, usually pruinose; veins 5–7; sclerenchyma-strands 3, stout, often with 2 small strands alternating; ribs 3; sheaths closed at the base, glabrous or weakly scabrid. Panicles 5–12 cm, rather dense, the branches shortly hairy. Spikelets 7·8–8(–10·5) mm, with 4–6 florets, pruinose. Upper glume 4·6–4·9(–6·5) × 1·3–1·6(–1·8) mm, oblong-lanceolate, long-acuminate. Lemma 5·3–6·5(–7·8) × 1·6–2·1 mm, oblong-lanceolate, long-acuminate, glabrous or ciliate; awn more than ½ as long as lemma. $2n = 28$. ● *From Hungary to N. Greece.* Bu Gr Hu Ju.

164. F. pseudodalmatica Krajina ex Domin, *Acta Bot. Bohem.* **8**: 61 (1929). Stems (25–)30–50(–65) cm, scabrid above. Leaves 0·4–0·7(–0·8) mm wide, scabrid, glaucous or green, usually pruinose, more than ½ as long as stems; veins 5; sclerenchyma-strands 3, usually stout, often with 2 small strands alternating; ribs 3; sheaths open to the base, smooth or weakly scabrid. Panicle (6–)8–15 cm, lax, the branches scabrid. Spikelets 6·5–8 mm, with 4–7 florets, glaucous or green, sometimes pruinose. Upper glume 3·4–5 × 1·1–1·3 mm, subulate-lanceolate, acuminate. Lemma 5–5·6 × 1·4–1·6(–1·8) mm, subulate-lanceolate, long-acuminate, smooth, scabrid or ciliate above; awn ½–¾ as long as lemma. $2n = 28$. *Dry places. E.C. Europe and U.S.S.R., northwards to c.* 63° *N. in E. Russia.* Au Cz Hu Po Rm Rs (N, C, W, K, E).

165. F. callieri (Hackel ex St-Yves) Markgraf in Hayek, *Prodr. Fl. Penins. Balcan.* **3**: 278 (1933). Stems 12–35(–45) cm, scabrid above. Leaves 0·4–0·6(–0·8) mm wide, strongly scabrid, rigid, glaucous, pruinose, with short hairs at base; veins 5(–7); sclerenchyma forming a somewhat interrupted ring, thickened at the base; ribs 3; sheaths closed only at base, smooth or weakly scabrid, the lamina deciduous. Panicle 3–5·5 cm, rather dense, the branches densely hairy. Spikelets 6·5–7·5 mm, with (3–)4–5 florets, glaucous, pruinose. Upper glume 4–4·5 × 1·4–1·6 mm, linear-lanceolate, acuminate. Lemma 4·6–5·2(–5·5) × 1·6–1·7 mm, subulate-lanceolate, long-acuminate; awn ½–⅔ as long as lemma. *S. & E. parts of Balkan peninsula, E. Romania, Krym.* Bu Gr Ju Rm Rs (K).

F. uralensis (Tzvelev) Alexeev, *Bull. Soc. Nat. Moscou* **78(5)**: 143 (1973) (*F. callieri* subsp. *uralensis* Tzvelev), known from one locality in N. Ural, is like **165** but has dark green, subrigid leaves 0·6–0·7(–0·8) mm wide. with 7 veins. It requires further investigation.

166. F. wolgensis P. Smirnov, *op. cit.* **50 (1–2)**: 100 (1945). Stems up to 58 cm, strongly scabrid or tomentose. Leaves (0·4–)0·5–0·75(–0·8) mm wide, glaucous, densely hairy throughout; veins 5–7; sclerenchyma forming a continuous or somewhat interrupted ring thickened at the base; ribs 3–5; sheaths open to the base, densely tomentose. Panicle 7·5–12 cm, interrupted, the branches tomentose. Spikelets 7–8 mm, with 4–6 florets, green. Upper glume 3·7–4·1 × 1·4–1·5 mm, ovate-lanceolate to lanceo-

late, scabrid above. Lemma 5·2–5·8 × 2–2·2 mm, ovate-lanceolate to lanceolate, scabrid above, more or less ciliate; awn up to ¼ as long as lemma. *Calcifuge.* ● *E.C. Russia and N.E. Ukraine.* Rs (C, W, E).

167. F. stricta Host, *Gram. Austr.* **2**: 62 (1802) (*F. valesiaca* subsp. *stricta* (Host) Hegi). Stems 23–43 cm, scabrid above. Leaves 0·55–0·98 mm wide, rigid, glaucous, pruinose or not, strongly scabrid at least above, sometimes tomentose near base; veins 5(–7); sclerenchyma forming a continuous or somewhat interrupted, unevenly thickened ring; ribs 3; sheaths closed only at the base, usually densely tomentose. Panicle 4·5–6 cm, dense, the branches scabrid. Spikelets 7·1–8·3(–9·1) mm, with 3–6 florets, green or dirty violet. Upper glume (3·2–)3·4–5·4 × (1·2–)1·3–1·8 mm, ovate-lanceolate, acuminate, ciliate. Lemma 4·2–5·8 × (1·6–)1·7–2·3 mm, oblong-lanceolate, acuminate, scabrid above, more or less ciliate, or pubescent; awn usually less than ½ as long as lemma. $2n=42$. *Dry, calcareous soils.* ● *C. Europe, extending to C. Jugoslavia and E. Romania.* Au Cz Hu It Ju ?Po Rm.

168. F. trachyphylla (Hackel) Krajina, *Acta Bot. Bohem.* **9**: 190 (1930). Stems 30–75 cm, scabrid above. Leaves (0·5–)0·6–1·1 mm wide, strongly scabrid throughout, sometimes tomentose below, pruinose or not; veins 7; sclerenchyma forming an interrupted or continuous, unevenly thickened ring, or sometimes in 3 strands; ribs (3–)5–7; sheaths closed at base only, at least some densely pubescent. Panicle 4·5–13 cm, more or less interrupted, the branches strongly scabrid. Spikelets (6·2–)7–7·5(–10·8) mm, with 4–8 florets, glaucous, pruinose or not. Upper glume 3·5–4·5 × 1·3–1·4 mm, lanceolate to ovate-lanceolate. Lemma 4·2–4·9(–6·5) × 1·9–2 mm, lanceolate to ovate-lanceolate, often pubescent; awn *c.* ½ as long as lemma. $2n=42$. *Dry places.* ● *C. Europe, extending to Belgium and perhaps to S. Sweden; widely naturalized elsewhere.* Au Be Cz *Da Ge He Ho Po *Su [Br Fe Ga No Rs (B, C, W)].

169. F. brevipila Tracy, *Pl. Syst. Evol.* **128**: 287 (1977). Densely caespitose. Stems 18–37 cm, smooth above. Leaves (0·5–)0·8–1·1 mm wide, blue-green, often pruinose, scabrid, especially above, the upper surface with short, conical hairs; veins 7–9; sclerenchyma in several rather thin strands or sometimes forming an unevenly thickened ring; ribs 3; sheaths closed in the lower ⅓, more or less hairy. Panicle 3–4 cm, sparingly branched, lax at anthesis, the branches scabrid. Spikelets 6·8–7·2 mm, with 3–4 florets, glaucous, somewhat pruinose. Upper glume 3·4 × 1·4 mm, ovate-lanceolate, shortly accuminate, scabrid above, Lemma 4·3 × 3mm, lanceolate, long-acuminate, tomentose; awn ¼–⅓ as long as lemma. $2n=42$. *Dry places; calcifuge.* ● *N.E. Austria (near Gmünd).* Au.

170. F. duvalii (St-Yves) Stohr, *Wiss. Zeitschr. Univ. Halle* **4**: 732 (1955). Stems (16–)20–40 cm, smooth. Leaves (0·4–)0·5–1·1 mm wide, smooth or almost so, rigid, glaucous, pruinose; veins (5–)7(–8); sclerenchyma-strands 3, or sometimes more or less confluent; ribs 3–5; sheaths open to the base, glabrous. Panicle 3·5–6 cm, rather dense, the branches smooth or weakly scabrid. Spikelets 6–7(–7·5) mm, with 3–5(–6) florets, glaucous and strongly pruinose. Upper glume (2·9–)3·4(–4·3) × 1·2–1·6 mm, ovate-lanceolate, acuminate. Lemma 4–5·5 × 1·7–2·1 mm, lanceolate, smooth or scabrid above, ciliate; awn ¼–⅓ as long as lemma. $2n=28$. ● *N.C. Europe, extending to Belgium.* Be Cz Ga Ge Po.

[1] By C. J. Humphries.

× **Festulolium** Ascherson & Graebner[1]

(Festuca × Lolium)

Caespitose perennials. Inflorescence a simple spike with sessile spikelets, or a panicle with spikelets sessile or subsessile above and pedicellate below. Spikelets with numerous florets, arranged obliquely or at right angles to the rhachis. Glumes more or less equal, or the lower small or sometimes completely suppressed in lateral spikelets. Anthers indehiscent; pollen usually sterile.

Leaves flat or folded when young; lemma usually awnless **1. loliaceum**

Leaves convolute when young; lemma shortly awned **2. braunii**

1. × **F. loliaceum** (Hudson) P. Fourn., *Quatre Fl. Fr.* 81 (1935) (*F. pratensis* × *L. perenne*). Stems erect to decumbent, with 2–4 nodes. Leaves flat or folded when young; ligule up to 1 mm, inconspicuous; auricles glabrous. Rhachis glabrous or scabridulous on the angles. Glumes ¼–½ as long as the spikelet. Lemma 3–9 mm, usually awnless or mucronate. $2n=14$. *Damp meadows and roadsides. Most of Europe, except the east.* Au Be Br Cz Da Ga Ge ?Gr Hb He Ho Hs Hu It Ju No Po Rm Su.

2. × **F. braunii** (K. Richter) A. Camus, *Bull. Mus. Nat. Hist. Nat. (Paris)* **33**: 538 (1927) (*F. pratensis* × *L. multiflorum*). Like **1** but leaves convolute when young; rhachis scabridulous; lemma usually shortly awned. $2n=14$. *Mainly in C. & N.W. Europe, but distribution probably imperfectly known.* Au Be Br Ga Ge Hb Ho It Po Su.

The following hybrids have also been recorded, though rarely: *F. arundinacea* × *L. perenne* (× *F. holmbergii* (Dörfler) P. Fourn.), *F. arundinacea* × *L. multiflorum*, *F. gigantea* × *L. perenne* (× *F. brinkmanii* (A. Braun) Ascherson & Graebner), *F. gigantea* × *L. multiflorum*, *F. rubra* × *L. perenne* (× *F. fredericii* Cugnac & A. Camus).

5. Lolium L.[1]

Annual, biennial, or perennial herbs. Ligules obtuse. Inflorescence a simple (very rarely branched) spike with laterally compressed solitary spikelets lying edgeways to concavities of the rhachis. Spikelets with 2–22 florets; lateral spikelets without a lower glume, the terminal one with 2 glumes. Glumes membranous, 3- to 9-veined. Lemma membranous to chartaceous, sometimes indurate, sometimes turgid in fruit, with or without a subterminal awn. Palea like the lemma, narrowly keeled, usually ciliate.

Literature: E. E. Terrell, *Bot. Rev.* **32**: 138–164 (1966); *U.S. Dept. Agric. Techn. Bull.* **1392**: 1–65 (1968).

1 Lemma elliptical to ovate, very turgid at maturity especially towards the base; mature caryopsis not more than 3 times as long as wide
2 Lemma of lower florets 4·6–8·5 mm, usually with a scabrid awn; mature caryopsis (3·8–)4·2–7 mm **4. temulentum**
2 Lemma of lower florets 3·5–4·5(–5·4) mm, usually unawned; mature caryopsis 3·2–4·5 mm **5. remotum**
1 Lemma oblong to oblong-lanceolate, not turgid at maturity; mature caryopsis more than 3 times as long as wide
3 Perennial, with non-flowering shoots at anthesis; leaves flat or folded when young; lemma usually unawned **1. perenne**
3 Usually annual or biennial, without non-flowering shoots at anthesis; leaves convolute when young
4 Spikelets not sunk in concavities of the rhachis; spikelet with (5–)11–22 florets; lemma usually awned **2. multiflorum**
4 Spikelets ±sunk in concavities of the rhachis and ±concealed by the glume; spikelets with 2–11 florets; lemma usually unawned **3. rigidum**

1. L. perenne L., *Sp. Pl.* 83 (1753). Perennial (3–)8–90 cm; stems with 2–4 nodes. Leaf-blades 5–14(–30) cm × 2–4 mm, acute, glabrous, shiny beneath, flat or folded in young shoots; ligule up to 2·5 mm; auricles inconspicuous or absent. Spike 3–31 cm. Rhachis flexuous, slender, glabrous or scabridulous on the angles. Spikelets 5–23 × 1–7 mm, with 2–10 florets. Glumes lanceolate or narrowly oblong, ⅓ as long as to slightly longer than the spikelet. Lemma oblong to oblong-lanceolate, usually unawned, not turgid at maturity. Mature caryopsis more than 3 times as long as wide. $2n=14+1$–3 B. *Pastures, meadows, roadsides and waste places; widely cultivated for forage (perennial ryegrass). Almost throughout Europe but often introduced in the north.* All except Sb but only as a casual or recent introduction in Bl Fa Fe Is.

Hybridizes frequently with **2** (*L.* × *hybridum* Hausskn.), **3** and **5**. The hybrid with **2** is highly fertile, widespread throughout Europe and back-crosses with the parental species. It is an annual or short-lived perennial with the young leaf-blades convolute and the spikelets with 3–9 florets.

2. L. multiflorum Lam., *Fl. Fr.* **3**: 621 (1779) (*L. italicum* A. Braun). Annual, biennial or short-lived perennial up to 130 cm; stems with 4–5 nodes. Leaf-blades 11–22 cm × 3–8 mm, acute to obtuse, glabrous and shiny beneath, usually scabridulous above, convolute in young shoots; ligule up to 4 mm; auricles usually present. Spike 15–33(–45) cm. Rhachis slender, flexuous, scabridulous. Spikelets 8–31 × 2–10 mm, with (5–)11–22 florets. Glumes lanceolate to narrowly oblong, ¼–½(–¾) as long as the spikelet. Lemma oblong to oblong-lanceolate, usually awned, not turgid at maturity; awn up to 15 mm. Mature caryopsis more than 3 times as long as wide. $2n=14$. *S. Europe; widely cultivated for forage elsewhere and naturalized in meadows and on roadsides and field-margins (Italian ryegrass).* Al Az Bl Bu Co Cr Ga Gr Hs It Ju Lu Rm Sa Si Tu [Au Be Br Cz Da Fe Ge Hb He Ho Hu No Po Rs (C, W, K) Su].

Hybridizes freely with **1**, **3** (*L.* × *hubbardii* Jansen & Wachter), **4** and **5**.

3. L. rigidum Gaudin, *Agrost. Helv.* **1**: 334 (1811). Annual (6–)18–45(–70) cm; stems with 2–4 nodes. Leaf-blades up to 17 cm × 5–8 mm, acute to obtuse, glabrous beneath, glabrous or scabridulous above; ligule up to 1·5 mm; auricles inconspicuous or absent. Spike 3–30 cm. Rhachis usually somewhat rigid, slender to very thick, smooth to scabrid. Spikelets 5–18 × 1–3 (–7) mm, with (2–)5–8(–11) florets, often partly or completely concealed by the glumes in the concavities of the rhachis. Glumes lanceolate-oblong, obtuse, rarely acute to acuminate, (½–)¾ as long as to slightly longer than the spikelet. Lemma oblong to oblong-lanceolate, usually unawned, rarely with a subterminal awn up to 10 mm, not turgid at maturity. Mature caryopsis more than 3 times as long as wide. *Rocky hillsides, sandy ground and waste places. S. Europe; casual elsewhere.* Al Bu Co Cr Ga Gr He Hs It Ju Lu Rs (K) Sa Si Tu.

(a) Subsp. **rigidum** (*L. strictum* C. Presl): Rhachis (0·5–)1–1·5 (–2) mm wide at lowest nodes of the inflorescence. Glumes herbaceous to somewhat indurate. Lemma 4·5–8·5 mm. $2n=14$. *Almost throughout the range of the species.*

(b) Subsp. **lepturoides** (Boiss.) Sennen & Mauricio, *Cat. Fl. Rif Or.* 135 (1933) (*L. loliaceum* (Bory & Chaub.) Hand.-Mazz.): Rhachis 1·5–3·5 mm wide at the lowest nodes of the inflorescence. Glumes indurate. Lemma 3·2–5·5(–7) mm. *From Sicilia to Krym.*

L. subulatum Vis., *Fl. Dalm.* **1**: 90 (1842) was described from Jugoslavia; it is doubtfully distinct from **3(b)**.

4. L. temulentum L., *Sp. Pl.* 83 (1753) (*L. arvense* With.). Annual 20–120 cm. Stems with 3–5 nodes. Leaf-blades up to 27 cm × 1–12 mm, acuminate, scabridulous at the apex and margins above, glabrous and glossy to more or less scabridulous beneath; ligule 0·5–2·7 mm; auricles conspicuous to absent. Spike 5–40 cm. Rhachis rigid, thickened, glabrous. Spikelets 8–28 × 3–8 mm, with 2–15 florets. Glumes 7–30 mm, lanceolate, ¾–1½ times as long as the spikelet. Lemma of lower florets 4·6–8·5 mm, elliptical to ovate, very turgid at maturity, usually with a scabrid awn up to 23 mm. Mature caryopsis (3·8–)4·2–7 mm, 2–3 times as long as wide. $2n=14$. *Perhaps native in the Mediterranean region; formerly widespread in most of Europe as a weed of cereal crops (especially* Avena), *but now only a casual ruderal in most of N. & C. Europe.*

5. L. remotum Schrank, *Baier. Fl.* **1**: 382 (1789). Like **4** but stems and rhachis shorter and more slender; glumes 5–16 mm; lemma of lower florets 3·5–4·5(–5·4) mm, usually unawned; mature caryopsis 3·2–4·5 mm. $2n=14+1$B. *Of uncertain origin. Formerly widespread in most of Europe as a weed of* Linum*-fields; now only a casual ruderal, except in some parts of E. & E.C. Europe.*

It is impossible to provide detailed geographical data for **4** and **5**, as most Floras do not distinguish between old and recent records.

6. Vulpia C. C. Gmelin[1]

Annuals or rarely caespitose perennials; branches all intravaginal. Leaves flat, convolute when dry. Inflorescence a panicle or rarely a raceme, usually more or less secund. Spikelets with 3–12 florets, sometimes with a distal group of sterile florets, disarticulating variously below each fertile floret and at the base of the pedicel. Glumes very unequal; lower often minute, veinless or 1-veined; upper 1- to 3-veined, acute to acuminate, awned or not. Lemma (3–)5-veined, rounded dorsally, gradually tapered into a long, straight awn, chartaceous, with hyaline margins. Palea about equalling lemma, 2-veined, 2-fid. Anthers 1–3. Grain narrowly ellipsoid, adherent to palea; hilum linear, at least ¾ as long as grain.

In this account measurements of the lemmas refer to those of the two basal florets in any spikelet, unless otherwise stated, and measurements of the glumes are taken from spikelets which are not apical on the inflorescence or its branches.

4 intergeneric hybrids (× *Festulpia* Melderis ex Stace & R. Cotton) occur between **5**, **8** and **10** and *Festuca rubra* L. and *F. juncifolia* St-Amans in mainly maritime areas of England and Wales. They are sterile perennials.

Literature: R. Cotton & C. A. Stace, *Genetica* **46**: 235–255 (1976); *Bot. Not.* **130**: 173–187 (1977).

1 Florets chasmogamous; anthers usually 3, 2–5 mm
 2 Perennial; lower glume ⅓–¾ as long as upper **1. sicula**
 2 Annual
  3 Lower glume at least ½ as long as upper **2. geniculata**
  3 Lower glume less than ⅓ as long as upper
   4 Spikelets at least 10 mm (excluding awns); ovary glabrous **4. alopecuros**
   4 Spikelets not more than 10 mm (excluding awns); ovary pubescent at apex **3. ligustica**
1 Florets cleistogamous or the anthers just protruding at anthesis; anthers 1–3, 0·4–2 mm
 5 Lemma with pointed callus
  6 Lemma 4–8 mm (excluding awn); callus 1–1·5 mm, antrosely hispid **7. fontquerana**
  6 Lemma 7–18 mm (excluding awn); callus less than 1 mm, minutely scabrid

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7 Ovary pubescent at apex; anters 0·8–2 mm **5. fasciculata**
7 Ovary glabrous; anthers 0·6–0·9 mm **6. membranacea**
5 Lemma with rounded callus
8 Anthers 3, 0·7–1·3(–1·9) mm, exserted at anthesis; lemma 3–5 mm **12. unilateralis**
8 Anthers 1–3, 0·3–0·8 mm, usually included at anthesis; lemma 4–7·8 mm
9 Spikelets with 1–3 fertile florets and 3–7 distal sterile florets; lemma of fertile florets 3(–5)-veined **11. ciliata**
9 Spikelets with 2–5 fertile florets and 1–2 distal sterile florets; lemma 5-veined
10 Lemma 1·3–1·9 mm wide; lower glume 2·5–5 mm, $\frac{1}{2}$–$\frac{3}{4}$ as long as upper **8. bromoides**
10 Lemma 0·8–1·3 mm wide; lower glume 0·5–3 mm, usually less than $\frac{1}{2}$ as long as upper
11 Inflorescence usually not fully exserted from uppermost leaf-sheath; lower glume $\frac{1}{10}$–$\frac{2}{5}$ as long as upper **10. myuros**
11 Inflorescence usually well exserted from uppermost leaf-sheath; lower glume $\frac{1}{4}$–$\frac{1}{2}$ as long as upper **9. muralis**

Sect. LORETIA (Duval-Jouve) Boiss. (*Loretia* Duval-Jouve). Annual or perennial. Florets chasmogamous; anthers (1–)3, 2–5 mm. Inflorescence a panicle or raceme. Spikelets disarticulating below each fertile floret and at the base of the pedicel; pedicels conspicuously dilated distally; most florets fertile.

1. V. sicula (C. Presl) Link, *Hort. Berol.* **2**: 272 (1833) (incl. *V. setacea* Parl.). Densely caespitose perennial up to 70 cm. Inflorescence a diffuse or somewhat contracted panicle 5–13 cm; branches erect or patent; pedicels 1–2·5 mm. Spikelets 6·5–9·5 mm (excluding awns). Lower glume 1·5–3·5 mm, $\frac{1}{5}$–$\frac{3}{5}$ as long as upper; upper glume 5·5–10·5 mm (including awn up to 1 mm). Lemma 4·5–7 mm (excluding awn), glabrous to pubescent; callus *c.* 0·2 mm, rounded. $2n=14$. *Pastures. Mediterranean region, from S.E. France to Sicilia.* Co Ga It Sa Si.

Two varieties can be recognized: var. *setacea* (Parl.) Hackel (*V. setacea* Parl.), with taller, laxer habit, longer inflorescences, spikelets and floral parts, and upper glume exceeding (not shorter than) the adjacent lemma, and var. *sicula*, which is confined in Europe to Sardegna and Sicilia.

2. V. geniculata (L.) Link, *Hort. Berol.* **1**: 148 (1827) (*Loretia geniculata* (L.) Duval-Jouve). Caespitose annual up to 60 cm. Inflorescence a diffuse panicle 5–15 cm; branches erect or erecto-patent; pedicels 3·5–6·5 mm. Spikelets 6·5–9·5 mm (excluding awns). Lower glume 2·5–5·5 mm, $\frac{2}{5}$–$\frac{3}{5}$ as long as upper; upper glume 6–10·5 mm (including awn up to 1 mm). Lemma 5–7·5 mm (excluding awn), glabrous to ciliate or pubescent; callus *c.* 0·2 mm, rounded. $2n=14$. *Dry, open habitats. W. Mediterranean region, Portugal.* Bl Co Ga Hs ?It Lu Sa ?Si.

3. V. ligustica (All.) Link, *loc. cit.* (1827). Caespitose annual up to 60 cm. Inflorescence a diffuse panicle 5–13 cm; branches patent or nodding; pedicels 1·5–5·5 mm, often pendent at maturity. Spikelets 6·5–10(–16) mm (excluding awns). Lower glume 0·2–0·8 mm, less than $\frac{1}{2}$ as long as upper; upper glume 8–12(–18) mm (including awn up to 2 mm). Lemma 5–8·5 mm (excluding awn), glabrous to pubescent; callus *c.* 0·2 mm, rounded. Ovary pubescent at apex. $2n=14$. *Dry, open habitats. Mediterranean region, eastwards from S. France.* Co Cr Ga It Ju Sa Si Tu.

4. V. alopecuros (Schousboe) Dumort., *Obs. Gram. Belg.* 100 (1824). Caespitose annual up to 90 cm, usually stiffly erect. Inflorescence a rigid raceme 5–20 cm, with usually 1 spikelet at each node but up to 3 at lower nodes; pedicels 3–5 mm, erect except at anthesis. Spikelets 10–21 mm (excluding awns). Lower glume 0·8–2·7 mm, less than $\frac{1}{6}$ as long as upper; upper glume 9·5–22 mm (including awn up to 5 mm). Lemma 9–15 mm (excluding awn), glabrous to ciliate or pubescent; callus *c.* 0·5–0·8 mm, pointed, antrosely hispid. Ovary glabrous. $2n=14$. *Maritime sands and other open, sandy habitats. S. & W. Portugal, S. Spain.* Hs ?It Lu.

Particularly variable in the pubescence of the lemma and glumes.

Sect. MONACHNE Dumort. Annual. Florets cleistogamous or the anthers just exserted at anthesis; anthers 1–3, 0·5–2 mm. Inflorescence a panicle, rarely sub-racemose. Spikelets disarticulating below each fertile floret or additionally at the base of the pedicel; pedicels dilated distally; spikelets with a distinct apical group of small, sterile florets.

5. V. fasciculata (Forskål) Samp., *Lista Esp. Herb. Port.* 24 (1913) (*V. membranacea* auct., non (L.) Dumort., *V. uniglumis* (Aiton) Dumort.). Stems 8–50 cm, rigid, erect to decumbent. Inflorescence a rigid raceme or sparingly branched panicle 3–11 cm, with up to 6 spikelets at lower nodes, slightly exserted from to partly included in uppermost leaf-sheath; pedicels 3–7 mm, dilated distally, erect. Spikelets 10–18 mm (excluding awns), disarticulating below each fertile floret and at the base of the pedicel; proximal 2–5 florets fertile; distal 3–6 florets much smaller and sterile. Lower glume 0·1–2·6 mm, less than $\frac{1}{6}$ as long as upper; upper glume 10–30 mm (including awn 3–12 mm). Lemma 8–18 mm, with an awn up to twice as long, glabrous or minutely scabrid; callus 0·5–0·8 mm, pointed, minutely antrorsely scabrid, less than $\frac{1}{2}$ as long as rhachilla-segments. Anthers 1–3, 0·8–2 mm, slightly exserted at anthesis. Ovary pubescent at apex. $2n=28$. *Maritime sands and other open, sandy habitats. Coasts of S. & W. Europe, northwards to* 56° 30′ *in Scotland.* Al Bl Br Co Cr Ga Gr Hb Hs It Ju Lu Sa Si Tu.

6. V. membranacea (L.) Dumort., *Obs. Gram. Belg.* 100 (1824) (*V. longiseta* (Brot.) Hackel). Like **5** but stems usually more slender; inflorescence usually well exserted from uppermost leaf-sheath; spikelets 9–15 mm (excluding awns); lower glume 0·2–3 mm; lemma 7–15 mm (excluding awn); anthers 0·6–0·9 mm; ovary glabrous. $2n=14$. *Open, sandy habitats. W. Europe, northwards to* 50° 30′ *in N.W. France.* †Be Co Ga Hs Lu.

7. V. fontquerana Melderis & Stace, *Collect. Bot.* (*Barcelona*) **7**: 782 (1968). Stems 4–30 cm, slender, erect to decumbent. Inflorescence an erect raceme or sparingly branched panicle 2·5–7 cm, with up to 5 spikelets at lower nodes, usually exserted from uppermost leaf-sheath; pedicels 2–4 mm, slightly dilated distally, erect. Spikelets 6–10 mm (excluding awns), disarticulating below each fertile floret; proximal 1–2(–3) florets fertile; distal 2–3 florets much smaller and sterile. Lower glume 2–4 mm, $\frac{1}{4}$–$\frac{1}{2}$ as long as upper; upper glume 4–8 mm, with awn up to 4 mm. Lemma 4–8 mm, with awn usually 3–6 times as long, glabrous or minutely scabrid; callus 1–1·5 mm, pointed, antrorsely hispid, about as long as rhachilla-segments. Anthers 3, 0·5–0·8 mm, slightly exserted at anthesis. Ovary glabrous. $2n=14$. *Fixed, open dunes in* Pinus pinea *forest.* ● *S.W. Spain* (*near Sanlúcar de Barrameda, prov. Cádiz*). Hs.

Sect. VULPIA. Annual. Florets cleistogamous or the anthers just exserted at anthesis; anthers 1(–3), 0·3–0·8(–1·8) mm. Inflorescence a panicle, rarely subracemose. Spikelets disarticulating below each fertile floret; pedicels not or scarcely dilated; spikelets with most florets fertile or with an apical group of sterile but not smaller florets.

8. V. bromoides (L.) S. F. Gray, *Nat. Arr. Brit. Pl.* **2**: 124 (1821) (*V. sciuroides* (Roth) C. C. Gmelin, *V. dertonensis* (All.)

Gola). Stems 6–50 cm, usually erect. Inflorescence a sparingly branched, usually erect panicle or rarely a raceme 1–11 cm, usually well exserted from uppermost leaf-sheath; pedicels 0·5–3·5 mm. Spikelets 6·5–11·5 mm (excluding awns), disarticulating below each fertile floret; most florets fertile; distal 1–2(–3) florets gradually reduced and male or sterile. Lower glume 2·5–5 mm, ½–¾ as long as upper; upper glume 4·5–9 mm (including awn up to 2 mm). Lemma 4·5–7·5 mm, with an awn usually about as long, 1·3–1·9 mm wide, finely 5-veined; callus *c.* 0·2 mm, rounded, glabrous. Anthers 1(–3), 0·4–0·7(–1·8) mm, usually included at anthesis. Ovary glabrous. $2n=14$. *Dry, open habitats. S., W. & C. Europe, northwards to 59° in Scotland, but doubtfully native in much of E.C. Europe.* All except Cr Fa Fe Is No Rs (N, B, C, K, E) Sb.

9. V. muralis (Kunth) Nees, *Linnaea* **19**: 694 (1847) (*V. broteri* Boiss. & Reuter, *V. dertonensis* var. *broteri* (Boiss. & Reuter) Hegi, *V. sciuroides* var. *longearistata* Willk., *V. dertonensis* var. *longearistata* (Willk.) Aznav.). Stems 10–60 cm, usually erect. Inflorescence a sparingly branched, usually erect panicle or rarely a raceme 3–15 cm, usually well exserted from uppermost leaf-sheath; pedicels 0·5–3·5 mm. Spikelets 5–10 mm (excluding awns), disarticulating below each fertile floret; most florets fertile; distal 1–2(–3) florets gradually reduced and male or sterile. Lower glume 1–3(–6) mm, ¼–½ as long as upper; upper glume 4–8(–10) mm (including awn up to 2 mm). Lemma 4–7 (–10) mm, with an awn usually 2–3 times as long, 0·8–1·3 mm wide, finely 5-veined; callus *c.* 0·2 mm, rounded, glabrous. Anthers 1(–3), 0·3–0·7 mm, usually included at anthesis. Ovary glabrous. $2n=14$. *Dry, open habitats. S. Europe.* Az Bl Co Ga Gr Hs It Ju Lu Sa Si Tu.

10. V. myuros (L.) C. C. Gmelin, *Fl. Bad.* **1**: 8 (1805) (incl. *V. megalura* (Nutt.) Rydb.). Stems 8–65 cm, usually erect. Inflorescence a sparingly branched panicle or a raceme 5–35 cm, erect or slightly nodding, usually partly included in uppermost leaf-sheath; pedicels 0·4–2 mm. Spikelets 6–10·5 mm (excluding awns), disarticulating below each fertile floret; most florets fertile; distal 1–2(–3) florets gradually reduced and male or sterile. Lower glume 0·4–2·5 mm, $\frac{1}{10}$–$\frac{2}{5}$ as long as upper; upper glume 2·5–6·5 mm (including awn up to 1 mm). Lemma 4·5–7·5 mm, with an awn usually 1–2 times as long, 0·8–1·3 mm wide, finely 5-veined; callus *c.* 0·2 mm, rounded, glabrous. Anthers 1(–3), 0·4–0·8(–1·3) mm, usually included at anthesis. Ovary glabrous. $2n=42$. *Dry, open habitats. W., C. & S. Europe, northwards to Ireland, S.W. Poland and W. Kazakhstan; casual further north.* All except Da Fa Fe Is No Rs (N, B, C) Sb Su.

Often casual or naturalized outside its native area of distribution, the precise limits of which are obscure.

Variants with ciliate lemmas have usually been recognized as **V. megalura** (Nutt.) Rydb., *Bull. Torrey Bot. Club* **36**: 538 (1909), but they should be treated only as formae, as should plants with pubescent lemmas.

11. V. ciliata Dumort., *Obs. Gram. Belg.* 100 (1824) (*Festuca ciliata* Danth. ex DC., non Gouan). Stems 3–45 cm, usually erect. Inflorescence a sparingly branched, erect or sometimes slightly nodding panicle or raceme 3–20 cm; pedicels 0·2–2 mm. Spikelets 5–10·5 mm (excluding awns), disarticulating below each fertile floret; proximal 1–3 florets fertile; distal 3–7 florets sterile, usually with longer and wider lemmas with shorter awns. Lower glume 0·1–1 mm, less than ¼ as long as upper; upper glume 1·5–4 mm, acute, but apex often breaking off and appearing truncate or obtuse. Fertile lemma 4–6·5 mm, with an awn usually 1–2 times as long, finely 3-veined or with 2 extra short veins, glabrous to pubescent; callus *c.* 0·1 mm, rounded, glabrous. Anthers 1(–3), 0·4–0·6(–1·6) mm, included at anthesis. Ovary glabrous. *Dry, open habitats. W. & S. Europe, northwards to 53° in E. England.* Al Be Bl Br Bu Co Cr Ga Gr Hs It Ju Lu Rs (K) Rm Sa Si Tu.

(a) Subsp. **ciliata**: Spikelets mostly 7–10·5 mm. Fertile lemma 5–6·5 mm, usually pubescent on the dorsal midline and sparsely ciliate; sterile lemma up to 8 mm (excluding awn), usually densely ciliate. $2n=28$. *Throughout the range of the species except the north-west.*

(b) Subsp. **ambigua** (Le Gall) Stace & Auquier, *Bot. Jour. Linn. Soc.* **76**: 384 (1978) (*Festuca ambigua* Le Gall, *V. ambigua* (Le Gall) More): Spikelets mostly 5–7 mm. Fertile lemma 4–5 mm, glabrous; sterile lemma up to 6 mm (excluding awn), glabrous. $2n=28$. *Maritime and submaritime sand and shingle. From S. England and Belgium to N.W. France.*

The two subspecies are largely allopatric, but overlap in N.W. France; subsp. (a) is naturalized in S.E. England. Glabrous or subglabrous variants of subsp. (a) occur scattered throughout its range; these can usually be distinguished from subsp. (b) by the slightly larger size of their floral parts.

Sect. NARDURUS (Reichenb.) Stace (*Nardurus* Reichenb.). Annual. Anthers 3, 0·7–1·3(–1·9) mm, slightly exserted at anthesis. Inflorescence racemose or with a few branches near base. Spikelets disarticulating below each fertile floret; pedicels not or scarcely dilated; most florets fertile.

12. V. unilateralis (L.) Stace, *Bot. Jour. Linn. Soc.* **76**: 350 (1978) (*Triticum unilaterale* L., *Festuca maritima* L., *Nardurus maritimus* (L.) Murb., *N. unilateralis* (L.) Boiss., *N. tenuiflorus* (Schrader) Boiss., *N. tenellus* Reichenb. ex Godron; incl. *N. montanus* Boiss. & Reuter, *N. krausei* (Regel) V. Krecz. & Bobrov). Stems 3–45 cm, usually erect. Inflorescence a rather rigid, secund raceme 1–16 cm, sometimes with short branches at lower nodes; pedicels 0·7–1·6 mm, usually erect. Spikelets 4–8 mm (excluding awns). Lower glume 1·5–3·5 mm, ½–¾ as long as upper; upper glume 3–5 mm. Lemma 3–5 mm, usually with an awn about as long or longer, sometimes more or less unawned, finely 5-veined, glabrous to pubescent; callus *c.* 0·1 mm, rounded, glabrous. Ovary glabrous. $2n=14$. *Dry, open habitats. S. & W. Europe, northwards to 52° 45′ N. in C. England.* Be Br Bu Co Ga He Hs It Ju †Lu Sa Rs (K).

7. Ctenopsis De Not.[1]

Annuals. Leaves narrow, convolute. Inflorescence a secund raceme or sometimes sparingly branched. Spikelets with 3–14 florets, disarticulating below each floret. Glumes very unequal, the lower very short, the upper 1- to 3-veined, rounded on back. Lemma 5-veined, rounded on back, short- to long-awned, chartaceous, with narrow hyaline margin. Palea equalling or nearly equalling lemma, 2-veined, 2-fid. Anthers 3. Grain narrowly ellipsoid, more or less free from palea, glabrous; hilum oblong, sub-basal, less than ½ as long as grain.

Ligule of upper cauline leaves not more than 0·5 mm; anthers 1·5–2·5 mm; lower glume acuminate to subulate **1. delicatula**
Ligule of upper cauline leaves 0·5–1·5 mm; anthers 0·5–1·5 mm; lower glume acute to obtuse **2. gypsophila**

1. C. delicatula (Lag.) Paunero, *Anal. Inst. Bot. Cavanilles* **21**: 365 (1963) (*Vulpia delicatula* (Lag.) Dumort.). Stems up to 40

[1] By C. A. Stace.

cm, slender, erect or geniculate at base. Ligule of upper cauline leaves 0·1–0·5 mm. Inflorescence 1–7 × 0·5–1 cm, racemose or with a few branches below; pedicels 0·4–1 mm, at an angle of 45–90° after anthesis. Spikelets 5·5–9·5 mm (excluding awns), with 3–7 florets. Lower glume 0·4–1 mm, finely pointed, hyaline throughout or with a very narrow central band of parenchyma, veinless or rarely shortly 1-veined, entire; upper glume 4–6·5 mm, lanceolate, subulate to acuminate at apex, with 3 veins. Lemma 3·2–5·5 mm, gradually acuminate, with awn usually about as long as lemma, scabrid on midrib, otherwise usually glabrous; veins inconspicuous. Rhachilla-segments 0·9–1·3 mm. Anthers 1·5–2·5 mm. $2n=14$. *Dry, open habitats.* ● *W. & C. Spain, N.E. Portugal.* Hs Lu.

2. C. gypsophila (Hackel) Paunero, *op. cit.* 368 (1963) (*Vulpia delicatula* var. *gypsacea* Willk.). Stems up to 35 cm, slender, erect or geniculate at base. Ligule of upper cauline leaves 0·5–1·5 mm. Inflorescence 1–5 × 0·5–2 cm, racemose or with a few branches below; pedicels 0·4–1(–2) mm, at an angle of 45–90° after anthesis. Spikelets 5·5–12 mm (excluding awns), with 4–14 florets. Lower glume 0·7–1·5 mm, acute to obtuse, with wide hyaline margin, 1-veined, spinulose on margins; upper glume 3–5 mm, narrowly lanceolate, subulate at apex, with 1–3 veins. Lemma 3·2–4·2 mm, glabrous to pubescent, rather abruptly acuminate, with awn usually *c.* ½ as long as lemma; veins inconspicuous. Rhachilla-segments 0·6–0·9 mm. Anthers 0·5–1·5 mm. *Dry, open habitats on gypsaceous soils.* ● *C. Spain; W. Sicilia.* Hs Si.

Possibly conspecific with *C. cynosuroides* (Desf.) Paunero from N. Africa.

C. pectinella (Delile) De Not., *Ind. Sem. Horti Bot. Genuensis* **1847**: 26 (1847), from N. Africa and W. Asia, with sessile spikelets 3·5–5·5 mm, has been recorded from S.W. Spain, probably in error or as a casual, and as a casual elsewhere in S. Europe.

8. Wangenheimia Moench[1]

Annuals. Leaves convolute. Inflorescence a secund spike. Spikelets with 4–11 florets, tardily disarticulating below each floret. Glumes equal or subequal, the lower twisted to lie parallel to the rhachilla on the flattened face of the spikelet, coriaceous, with thickened midrib. Lemma 5-veined, more or less keeled. Palea almost equalling lemma, 2-veined, very shortly 2-fid. Anthers 3. Grain ellipsoid, free from palea, glabrous; hilum oblong, sub-basal, less than ¼ as long as grain.

1. W. lima (L.) Trin., *Fund. Agrost.* 132 (1820) (*Desmazeria castellana* Willk.). Stems up to 30 cm, rather rigid, erect. Inflorescence 0·8–3·5 × 0·4–1·4 cm, straight; pedicels 0·2–0·6 mm, at an angle of 45–90° after anthesis. Spikelets 3·5–8 mm. Lower glume 3·5–5·8 mm, linear, subulate, with 1 vein, more or less keeled; upper glume 3·5–6·1 mm, lanceolate, acute, with 2–3 veins, rounded on back at base but keeled for most of its length. Lemma 2·7–4·5 mm, acuminate or acute to obtuse and apiculate, the lowest pubescent at base to all pubescent throughout. Anthers 2–2·5 mm. *Dry, open habitats.* *C. & E. Spain, N.E. Portugal.* Hs Lu.

9. Micropyrum Link[1]

Annuals. Leaves flat, convolute when dry. Inflorescence a distichous, spiciform raceme or sparingly branched panicle. Spikelets with 3–9(–14) florets, disarticulating below each floret. Glumes subequal, not keeled, acute to rounded. Lemma 5-veined, rounded on back, obtuse to emarginate, apiculate to long-awned, chartaceous, with hyaline margin. Palea almost equalling lemma, 2-veined, shortly 2-fid. Anthers 3, slightly exserted at anthesis. Grain 2·5–3·2 mm, ellipsoid, adherent to palea, glabrous; hilum linear, nearly as long as grain.

Spikelets ± appressed at anthesis; anthers 0.5–1.3 mm	**1. tenellum**
Spikelets erecto-patent at anthesis; anthers 2–3.2 mm	**2. patens**

1. M. tenellum (L.) Link, *Linnaea* **17**: 398 (1843) (*Festuca festucoides* (Bertol.) Becherer, *Nardurus tenellus* (L.) Duval-Jouve, non Reichenb. ex Godron, *Nardurus lachenalii* (C. C. Gmelin) Godron). Stems up to 60 cm, slender, erect, rather rigid. Inflorescence 1–20 cm, rigid, unbranched or with very few branches; pedicels 0·5–1·5 mm. Spikelets (3–)4–9(–14) mm (excluding awns), more or less appressed at anthesis. Lower glume 2·1–5 mm, acute to obtuse, with (1–)3 veins, more than ¾ as long as upper; upper glume 2·4–6 mm, obtuse to rounded, with 3(–5) veins. Lemma 2·7–5 mm, aculeolate near margins proximally, otherwise glabrous, scarcely cucullate, unawned or with awn up to as long as lemma. Rhachilla-segments 0·6–0·9 mm. Anthers 0·5–1·3 mm. $2n=14$. *Dry places. S. Europe, extending northwards to c.* 49° *N. in France.* Bu Co Ga Ge ?Gr He Hs It Ju Lu Sa Si Tu.

2. M. patens (Brot.) Rothm. ex Pilger, *Bot. Jahrb.* **74**: 567 (1949). Like **1** but stems up to 100 cm; inflorescence up to 30 cm; spikelets (7–)9–15 mm, erecto-patent at anthesis; lemma 3·5–5·5 mm, cucullate, unawned or rarely with awn up to 2 mm; rhachilla-segments 1–1·6 mm; anthers 2–3·2 mm. $2n=14$. ● *Portugal, W. & C. Spain.* Hs Lu.

10. Castellia Tineo[1]

Annuals. Leaves flat. Inflorescence a spike or raceme or with few, simple, racemose branches below. Spikelets with 6–12 florets, disarticulating below each floret. Glumes more or less keeled, acute to obtuse. Lemma with 5 prominent, thin veins, not keeled, subacute to obtuse, membranous, densely tuberculate. Palea almost equalling lemma, 2-veined, truncate to slightly 2-fid. Anthers 3, with deeply separated anther-lobes, included or slightly exserted at anthesis. Grain 3·5–4 mm, oblong-ellipsoid, strongly adherent to palea, glabrous; hilum linear, ¾ as long as grain.

1. C. tuberculosa (Moris) Bor, *Ind. Forest.* **74**: 90 (1948) (*Nardurus tuberculosus* (Moris) Hayek, *Castellia tuberculata* Tineo). Stems up to 75(–100) cm, erect. Inflorescence 4–26 cm, with spikelets on 2 sides, unbranched or with few branches below; pedicels absent or stout, up to 0·5 mm. Spikelets 9–15 mm, ovate, distant. Glumes glabrous, the lower 2·8–3·5 mm, acute, 3-veined, the upper 3·5–5 mm, subacute to obtuse, 3- to 5-veined. Lemma 4·2–5·7 mm, glabrous but with dense minute tubercles on dorsal surface. Anthers 0·3–0·5 mm. Rhachilla-segments 0·5–0·7 mm, minutely aculeolate. *Dry places. Mediterranean region from S.E. Spain to S.E. Greece; very local.* Cr Gr Hs Sa Si. (*N. Africa, S.W. Asia.*)

11. Narduroides Rouy[1]

Annuals. Leaves flat, convolute when dry. Inflorescence spicate, rarely branched. Spikelets with 4–6 florets, disarticulating below each floret. Glumes subequal, (1–)3- to 5-veined, not keeled, emarginate; midrib prominent. Lemma 5-veined, rounded or very slightly keeled on back, chartaceous, with hyaline margin. Palea almost equalling lemma, 2-veined, shortly 2-fid. Anthers 3, slightly exserted at anthesis. Grain 1–1·8 mm, ellipsoid, slightly adherent to palea, glabrous; hilum punctiform, sub-basal.

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1. N. salzmannii (Boiss.) Rouy, *Fl. Fr.* **14**: 301 (1913) (*Nardurus salzmannii* Boiss.). Stems up to 40 cm, slender, erect, rather rigid. Inflorescence 2–23 cm, rigid, rarely with a few branches; pedicels up to 0·5 mm. Spikelets (2·2–)4–7 mm, appressed, set in depressions in rhachis. Glumes broadly hyaline at margin; lower 1·5–2·7 mm, with (1–)3(–5) veins; upper 1·8–3·2 mm, with 3–5 veins. Lemma 2·2–3·2 mm, emarginate to shortly 2-fid, unawned but sometimes apiculate, glabrous. Rhachilla-segments 0·8–1·2 mm. $2n=14$. *Dry places. S. & C. Spain; S.E. France.* Ga Hs.

12. Desmazeria Dumort.[1]

(incl. *Catapodium* Link, *Scleropoa* Griseb.)

Annuals. Leaves flat, convolute when dry. Inflorescence a raceme or sparingly branched panicle. Spikelets with 5–25 florets, disarticulating below each floret. Glumes subequal, weakly to strongly keeled, acute to obtuse. Lemma 5-veined, with 1–5 of the veins prominent, keeled to rounded on back, often with a short apiculum, coriaceous, acute to shortly 2-fid. Anthers 3, slightly exserted at anthesis. Grain 1·5–2 mm, ellipsoid-oblong, strongly adherent to palea, glabrous; hilum punctiform, sub-basal.

The three species placed in *Desmazeria* in this account are the type-species of the genera *Desmazeria*, *Catapodium* and *Scleropoa* respectively, but they differ only in small, mainly quantitative characters which are not sufficient for generic separation.

1 Lemma 3·5–4·5 mm, strongly keeled **1. sicula**
1 Lemma 2–3 mm, rounded on back or keeled only near apex
2 Lower glume 2–3 mm; upper glume 2·3–3·3 mm **2. marina**
2 Lower glume 1·3–2 mm; upper glume 1·5–2·3 mm **3. rigida**

1. D. sicula (Jacq.) Dumort., *Comment. Bot.* 27 (1822). Stems up to 25 cm, erect. Inflorescence 1·5–6 cm, not rigid, with spikelets on 2 sides, unbranched; pedicels 0·5–1 mm, appressed, stout. Spikelets 10–22 mm, ovate, crowded, with (5–)12–25 florets, tardily disarticulating. Glumes slightly unequal, keeled, obtuse to subacute, glabrous or aculeolate on midrib; lower glume 2·5–3 mm, 3-veined; upper glume 3–4 mm, 3- to 5-veined. Lemma 3·5–4·5 mm, strongly keeled, subacute to obtuse, not or very shortly apiculate, more or less cucullate, glabrous to sparsely aculeolate on keel, with minute capitate hairs near base. Rhachilla-segments *c.* 0·7 mm, with minute capitate hairs. Anthers 0·8–1·4 mm. *Dry places. S. Spain, Sardegna, S. Italy, Sicilia.* Hs It Sa Si.

2. D. marina (L.) Druce, *Scott. Bot. Rev.* **1**: 156 (1912) *Catapodium loliaceum* (Hudson) Link, *Desmazeria loliacea* (Hudson) Nyman, *Scleropoa loliacea* (Hudson) Gren. & Godron). Stems up to 25 cm, procumbent to erect. Inflorescence 1–12 cm, rigid, with spikelets on 2 sides, usually unbranched but sometimes with few, simple branches below; pedicels 0·7–2 mm, appressed, stout. Spikelets 4–10 mm, ovate, with 5–14 florets, tardily disarticulating. Glumes subequal, obtuse to acute, glabrous, more or less keeled, with prominent veins; lower glume 2–3 mm, (1–)3-veined; upper glume 2·3–3·3 mm, 3(–5)-veined. Lemma 2·2–3 mm, rounded on back proximally, keeled distally, acute to obtuse, often shortly apiculate, glabrous. Rhachilla-segments 0·3–0·6 mm, sparsely aculeolate. Anthers 0·4–0·6 mm. $2n=14$, 28. *Dry, open habitats near the sea. S. & W. coasts of Europe, northwards to 59° N. in Scotland (Orkney).* Az Be Bl Br Co Cr Ga Gr Hb Ho Hs It Ju Lu Sa Si Tu.

3. D. rigida (L.) Tutin in Clapham, Tutin & E. F. Warburg, *Fl. Brit. Is.* 1434 (1952) (*Scleropoa rigida* (L.) Griseb.). Stems up to 35(–60) cm, procumbent to erect. Inflorescence 1–12(–18) cm, rigid, usually with 1 or 2 branches at lower nodes; branches and pedicels with weak pulvini and often somewhat divaricate at maturity; branches bearing spikelets from near base or devoid of spikelets for up to ½ of their length, the axis or branches bearing spikelets on two sides or spikelets spreading in 3 dimensions; pedicels 0·5–3 mm, appressed to patent. Spikelets 4–10 mm, narrowly ovate, with 5–12 florets, rather readily disarticulating. Glumes subequal, acute, glabrous or aculeolate on veins, more or less keeled, with prominent veins; lower glume 1·3–2 mm, (1–)3-veined; upper glume 1·5–2·3 mm, 3-veined. Lemma 2–2·6(–3) mm, rounded on back or keeled distally, acute to obtuse, often shortly apiculate, glabrous. Rhachilla-segments 0·5–1 mm, sparsely aculeolate. Anthers 0·4–0·6 mm. $2n=14$. *Dry places. S. & W. Europe, northwards to 56° 30′ N. in Scotland.* Al Az Be Bl Br Bu Co Cr Ga Ge Gr Hb He Ho Hs It Ju Lu ?Rm Rs (K) Sa Si Tu.

A very variable species, particularly in inflorescence-characters. The following two subspecies seem worthy of recognition.

(a) Subsp. **rigida**: Stems not more than 15(–35) cm. Inflorescence 1–8(–12) cm, with branches bearing spikelets from near base. Pedicels mostly 1–2 mm, relatively long and narrow. Lemmas strongly convolute after anthesis, becoming well-separated from each other. *Throughout the range of the species.*

(b) Subsp. **hemipoa** (Delile ex Sprengel) Stace, *Bot. Jour. Linn. Soc.* **76**: 352 (1978) (*Festuca hemipoa* Delile ex Sprengel, *Scleropoa hemipoa* (Delile ex Sprengel) Parl.; incl. *Catapodium occidentale* Paunero): Stems up to 35(–60) cm. Inflorescence 2–12(–18) cm, with lower branches devoid of spikelets for at least the lower ⅓. Pedicels mostly 0·5–1 mm, relatively short and thick. Lemmas not convolute near apex and partially imbricate after anthesis. *Usually on maritime sands. Mediterranean region, from S.E. Spain to Greece; Atlantic coasts of S.W. France and N. Spain.*

Catapodium rigidum subsp. **majus** (C. Presl) F. H. Perring & P. D. Sell, *Watsonia* **6**: 317 (1967), differs from subsp. (a) only in its well-branched inflorescence spreading in 3 dimensions, but all degrees of intermediates occur and it is best regarded as only a variety.

13. Cutandia Willk.[1]

Annuals. Leaves flat or more or less convolute. Inflorescence a panicle or rarely a raceme, the branches divaricate at maturity. Spikelets disarticulating variously below each floret, at the base of the pedicel and at the base of the branches. Glumes slightly to very unequal, more or less keeled, acuminate to rounded or emarginate, not or shortly awned. Lemma with 3 thick veins, strongly keeled on all 3 veins, acuminate to rounded, with hyaline margin, usually emarginate or 2-fid at apex, unawned or with an awn from the sinus up to 1·2 mm. Palea equalling or almost equalling lemma, 2-veined, acute to truncate or 2-fid. Anthers 3, exserted at anthesis. Grain narrowly ellipsoid, trigonous, more or less free, glabrous; hilum usually elongated, sub-basal, up to ¼ as long as grain.

1 Lower glume ½–¾ as long as upper; lemma not more than 4 mm **2. stenostachya**
1 Lower glume more than ¾ as long as upper; lemma more than 4·5 mm
2 Spikelets with 2–3(–4) florets **4. memphitica**
2 Spikelets with 5–9(–12) florets
3 Glumes 3- to 5-veined; lemma 5·5–7 mm, obtuse to acute **1. maritima**

[1] By C. A. Stace.

3 Glumes 1-veined; lemma 4·7–5·5 mm, obtuse to emarginate **3. divaricata**

1. C. maritima (L.) W. Barbey, *Fl. Sard. Comp.* 72 (1885) (*Scleropoa maritima* (L.) Parl.). Stems up to 35 cm, procumbent to erect, rigid. Inflorescence a sparingly branched panicle 1·5–12 cm, mostly with 1 spikelet and 1–2 branches at each node; branches and pedicels pulvinate, more or less divaricate at maturity; pedicels 0·5–2 mm, smooth, terete. Spikelets 8–16(–22) mm, narrowly ovate, with 5–9(–12) florets. Glumes obtuse to acute, sometimes mucronate, smooth, with thick, prominent veins; lower 4·5–5·5 mm, 3-veined; upper 5·5–6·5 mm, 3- to 5-veined. Lemma 5·5–7 mm, smooth, obtuse to acute, apiculate, with a wide insertion and partly enfolding the next higher rhachilla-segment and lemma. Rhachilla-segments 1–1·5 mm, smooth. $2n=14$. *Maritime sands. Mediterranean region and Iberian peninsula.* Bl Co Cr Ga Gr Hs It Lu Sa Si.

2. C. stenostachya (Boiss.) Stace, *Bot. Jour. Linn. Soc.* **76**: 352 (1978) (*Scleropoa stenostachya* Boiss.). Stems up to 38 cm, ascending to erect, somewhat rigid. Inflorescence a sparingly branched panicle 3–12 cm, mostly with 1–2 spikelets or short branches and 1 longer branch at each node; branches and pedicels pulvinate, divaricate at maturity; pedicels 0·4–2 mm, aculeolate, sharply angular. Spikelets 5–14 mm, narrowly linear, with 2–5 florets. Glumes obtuse to emarginate or somewhat laciniate, sometimes mucronate, smooth or slightly scabrid; lower 1·3–2·6 mm, ½–¾ as long as upper, 1-veined; upper 2·3–4 mm, 3-veined. Lemma 2·7–4 mm, aculeolate on veins distally, obtuse to emarginate or somewhat laciniate, not enfolding the next higher rhachilla-segment, sometimes mucronate. Rhachilla-segments 2·4–2·9 mm, pubescent. *Rocky places on hills. Aegean region (Samothraki and Karpathos).* Cr Gr.

3. C. divaricata (Desf.) Ascherson ex W. Barbey, *Fl. Sard. Comp.* (1885) (*Scleropoa divaricata* (Desf.) Parl.). Stems up to 35 cm, procumbent to erect, somewhat rigid. Inflorescence a rather sparingly branched panicle 3–10 cm, mostly with 1 spikelet and 1–2 branches at each node; branches and pedicels pulvinate, divaricate at maturity; pedicels 0·3–1 mm, aculeolate, sharply angular. Spikelets 9–17 mm, linear-oblong, with 5–9(–12) florets. Glumes obtuse to rounded, rarely subacute, not mucronate, smooth or slightly scabrid, with 1 thick, prominent vein; lower 2·8–4·3 mm; upper 3·5–5 mm. Lemma 4·7–5·5(–7) mm, glabrous, obtuse or rounded to emarginate, apiculate, not enfolding next higher rhachilla-segment. Rhachilla-segments 1·2–2 mm, aculeolate. *Maritime sands. W. Mediterranean region.* Hs It ?Ju Sa Si.

4. C. memphitica (Sprengel) K. Richter, *Pl. Eur.* **1**: 77 (1890) (*C. scleropoides* Willk.). Stems up to 35 cm, procumbent to erect, somewhat rigid. Inflorescence a sparingly branched panicle 3–15 cm, mostly with 1 spikelet and 1(–2) branches at each node; branches and pedicels pulvinate, strongly divaricate at maturity; pedicels 0·3–0·6(–1·5) mm, aculeolate, sharply angular. Spikelets 7–10·5 mm, oblanceolate, with 2–3(–4) florets. Glumes acute to acuminate, apiculate, glabrous, with 1 thick, prominent vein; lower 3·5–4·3 mm; upper 4·5–5·5 mm. Lemma 5·8–7·5 mm (excluding awn), glabrous, acuminate, not enfolding the next higher rhachilla-segment, with an awn 0·5–1·2 mm. Rhachilla-segments 1·5–2·5 mm, aculeolate. *Maritime sands. S.E. Spain (Almería to Cabo de Gata).* Hs. (*Morocco to Pakistan.*)

14. Sphenopus Trin.[1]

Slender, more or less glabrous annuals. Leaves flat or almost filiform. Inflorescence a spreading, much-branched panicle; branches filiform, divaricate after anthesis. Spikelets 2–3 mm, with 2–5 florets, disarticulating below each floret. Glumes very unequal, largely hyaline, rounded to emarginate, much shorter than lemmas. Lemma 3-veined, keeled on all 3 veins and enclosing palea, rounded to subacute, unawned. Palea shorter than lemma, 2-veined, 2-fid. Anthers 3, *c.* 0·4 mm, slightly exserted at anthesis. Grain oblong-ellipsoid; hilum short, basal.

1. S. divaricatus (Gouan) Reichenb., *Fl. Germ. Excurs.* 45 (1830) (*S. gouanii* Trin.). Stems 1–several, up to 30 cm. Inflorescence up to 10 cm; branches mostly 2 at each node, naked for more than ½ their length; pedicels mostly 2 at each branch-node, mostly 2–4 mm, filiform but gradually thickened distally. Lower glume 0·1–0·4 mm, veinless; upper glume 0·6–1 mm, usually 1-veined. Rhachilla-segments *c.* 0·5 mm, glabrous or minutely aculeolate. Lemma 1·5–2 mm, glabrous. $2n=12$. *Maritime sands and rocks and saline marshes. Mediterranean region, S. Portugal.* Bl Ga Gr Hs It Lu Sa Si.

15. Vulpiella (Trabut) Burollet[1]

Like *Cutandia* but inflorescence not divaricate at maturity; spikelets with 5–12(–18) florets; glumes acuminate, shortly awned; lemma acuminate, with long awns; grain strongly adherent to palea, with rounded edges and inrolled adaxial surface; hilum oblong-linear, sub-basal.

1. V. tenuis (Tineo) Kerguélen, *Bull. Soc. Bot. Fr.* **124**: 347 (1977) (*V. incrassata* (Salzm. ex Loisel.) Burollet, *Vulpia incrassata* (Salzm. ex Loisel.) Parl., *Vulpia tenuis* (Tineo) Parl., *Bromus tenuis* Tineo). Stems up to 40 cm, erect. Inflorescence a panicle 2–10 cm, with up to 4 branches at each node; branches and pedicels with a pulvinus but not divaricate; pedicels 0·7–4 mm, aculeolate, sharply angular. Spikelets 8–25(–40) mm (excluding awns), obovate. Glumes acuminate, shortly awned, scabrid on midrib, with inconspicuous veins; lower glume 3–4·7 mm, 1-veined, the upper 4–6·6 mm, 1- to 3-veined. Lemma 6–8 mm. aculeolate, acuminate, with awn up to 8 mm. *Dry, sandy places. W. Mediterranean region, from Mallorca to S.W. Italy.* Bl Co Ga It Sa Si.

16. Poa L.[2]

Annuals or perennials. Inflorescence a panicle. Spikelets laterally compressed, with (1–)2–10 florets. Glumes keeled, membranous, usually 3-veined or the lower 1-veined. Lemma 5-veined, keeled, membranous, awnless or rarely with a short terminal awn. Palea 2-keeled, the keels aculeolate or ciliate. Grain ellipsoid; hilum basal, punctiform.

Measurements of ligules refer to those of the leaves of the flowering stems unless otherwise stated. Measurements of the panicle refer to well-grown panicles from the middle of the flowering season. Anthers are measured when mature but undehisced.

Literature: A. Buschmann, *Österr. Bot. Zeitschr.* **91**: 81–130 (1942). J. Chrtek, *Folia Phytotax. Geobot. (Praha)* **4**: 197–203 (1969). J. Chrtek & V. Jirásek, *Preslia* **34**: 40–68 (1962). F. Hermann, *Hercynia* **1**: 451–461 (1939). J. Nannfeldt, *Symb. Bot. Upsal.* **1(5)**: 1–113 (1935). N. N. Tzvelev, *Nov. Syst. Pl. Vasc. (Leningrad)* **9**: 47–54 (1972).

1 Spikelets proliferating
2 Caespitose
3 Base of stem bulbous
4 Stem 15–40 cm; ligule not more than 3 mm, hyaline; propagules bulb-like **35. bulbosa**
4 Stem 12–20 cm; ligule 3–6·5 mm, milky-white; propagules leaf-like **38. timoleontis**

[1] By C. A. Stace. [2] By J. R. Edmondson.

3 Base of stem not bulbous
5 Leaves 1–2 mm wide, flat to folded, gradually tapering to apex; uppermost leaf-blade arising more than half-way up the stem **47. ×jemtlandica**
5 Leaves 2–4·5 mm wide, flat with cucullate apex; uppermost leaf-blade arising less than halfway up the stem **43. alpina**

2 Rhizomatous
6 Ligule not more than 1 mm
7 Base of stem enclosed by thickened leaf-sheaths **(6×43). herjedalica**
7 Base of stem not enclosed by conspicuously thickened leaf-sheaths **(6–9). pratensis** group
6 Ligule 1–5 mm
8 Stem (20–)25–50(–70) cm; ligule 2–5 mm; spikelets with the lower floret usually not proliferating
9 Leaves 2–3 mm wide; glumes unequal **48. ×nobilis**
9 Leaves 3–5 mm wide; glumes subequal **11. granitica**
8 Stem 10–20 cm; ligule 1–3·5 mm; spikelets with all florets usually proliferating
10 Leaves (1–)1·5–2·5 mm wide, flat, with a slightly cucullate apex **10. arctica**
10 Leaves 1–2 mm wide, flat or folded, tapering gradually to the apex **47. ×jemtlandica**

1 Spikelets not proliferating
11 Lemma with a short terminal awn **45. flabellata**
11 Lemma unawned
12 Annual or rarely perennial; keels of palea with flexuous, curved or crispate hairs along their whole length
13 Stems solitary or few, purple-tinged at base; marginal veins of lemma densely tomentose with crispate hairs **44. jubata**
13 Stems ±numerous, though sometimes somewhat isolated, greenish; marginal veins of lemma with short straight hairs
14 Lower panicle-branches erecto-patent after anthesis; spikelets with rather distant florets; anthers 0·2–0·5 mm, scarcely longer than wide **2. infirma**
14 Lower panicle-branches patent or deflexed after anthesis; spikelets with crowded florets; anthers 0·6–2 mm, at least twice as long as wide
15 Spikelets not crowded towards the ends of the panicle-branches; anthers 0·6–0·8(–1) mm, 2-3 times as long as wide **1. annua**
15 Spikelets crowded towards the ends of the panicle-branches; anthers 1·6–2 mm, 5–8 times as long as wide **3. supina**
12 Perennial; keels of palea aculeolate, or ciliate only in the lower half
16 Leaves 0·3–0·5 mm wide, tightly convolute to filiform
17 Base of stem bulbous **35. bulbosa**
17 Base of stem not bulbous
18 Stem (30–)50–80(–100) cm; panicle 4–18 cm; branches strongly scabrid **18. stiriaca**
18 Stem 6–30 cm; panicle not more than 2·5 cm; branches smooth
19 Stem 6–10 cm; ligule 1·5–2 mm, acute; glumes obtuse **34. trichophylla**
19 Stem 5–30 cm; ligule 0·4–0·6 mm, truncate; glumes acute, distinctly keeled **21. pirinica**
16 Leaves more than 0·5 mm wide, flat or folded
20 Stem stout, strongly compressed towards the base
21 Rhizomatous; leaves 1–2 mm wide **13. longifolia**
21 Caespitose; leaves (4–)7–12(–15) mm wide
22 Leaves flat, tapering gradually to an acute apex; ligule 3–5 mm, acute to rounded **16. hybrida**
22 Leaves flat to canaliculate, abruptly contracted to a cucullate apex; ligule 1–3 mm, rounded to truncate
23 Panicle-branches long, arcuate-patent; glumes subequal; lemma sparsely lanate at base **17. remota**
23 Panicle-branches short, erecto-patent; glumes unequal; lemma usually not lanate at base **15. chaixii**
20 Stem ±slender, terete or compressed, especially above
24 Stem bulbous at base; glumes widest below the middle, with a distinctly curved keel
25 Leaves (0·5–)1–2 mm wide; stem 15–40 cm; lemma lanate at base; spikelets with 2–6 florets **35. bulbosa**
25 Leaves 0·5–1 mm wide; stem 5–10(–20) cm; lemma not lanate at base; spikelets with 5–10 florets **36. perconcinna**
24 Stem not bulbous at base; glumes usually widest at or near the middle, with a ±weakly curved keel
26 Base of stem enclosed by thickened leaf-sheaths; lateral shoots intravaginal; lower panicle-branches 1–3 together
27 Ligule *c.* 1 mm, inconspicuous, rounded to truncate; anthers up to 0·7 mm **33. abbreviata**
27 Ligule 1–7 mm, ±conspicuous, acute to truncate; anthers at least 1 mm
28 Lemma hairy between the veins
29 Leaves 4–10 cm, green; lower cauline and basal leaves with a short, ±truncate ligule; panicle ± pyramidal **43. alpina**
29 Leaves (1·5–)2·5–6 cm, glaucous; cauline and basal leaves with an elongate, acute ligule; panicle ±ovoid
30 Leaves 2–4·5 mm wide, flat to weakly folded **42. badensis**
30 Leaves 1·5–2·5 mm wide, canaliculate to strongly folded **41. molinerii**
28 Lemma glabrous between the veins
31 Stem (15–)20–30(–40) cm; panicle 3·5–5 cm, ellipsoid-oblong **39. media**
31 Stem 6–20(–30) cm; panicle 1–5 cm, ovoid to pyramidal
32 Ligule 1–2 mm, hyaline; glumes subequal **40. pumila**
32 Ligule 2·5–6·5 mm, milky-white; glumes unequal
33 Leaves 1·2–1·8 mm wide, flat **37. ligulata**
33 Leaves 0·5–1 mm wide, folded **38. timoleontis**
26 Base of stem not enclosed by conspicuously thickened leaf-sheaths; lateral shoots extravaginal; lower panicle-branches 2–7 together
34 Panicle-branches smooth; plant ±densely caespitose
35 Panicle-branches terete; uppermost leaf without a distinct sheath **22. minor**
35 Panicle-branches sulcate; uppermost leaf with a distinct sheath
36 Panicle rather compact; marginal veins of lemma hairy for most of their length; hairs obtuse **20. laxa**
36 Panicle lax; marginal veins of lemma hairy for *c.* ¼ of their length; hairs acute **19. flexuosa**
34 Panicle-branches ±scabrid
37 Not rhizomatous
38 Ligule of uppermost leaf 5–10 mm
39 Spikelets with 2 florets; lowest panicle-branches in pairs **5. feratiana**
39 Spikelets usually with 3 or more florets; lowest panicle-branches 3–5 together **4. trivialis**
38 Ligule of uppermost leaf not more than 3·5 mm
40 Ligule not more than 0·5 mm; stem smooth
41 Sheaths of cauline leaves compressed, with a distinctly raised keel; stem compressed; leaves (3–)4–5 mm wide **28. rehmannii**
41 Sheaths of cauline leaves terete, without a prominent keel; stem terete; leaves 1·5–2(–3) mm wide **27. nemoralis**
40 Ligule at least 1 mm; stem smooth or scabrid
42 Stem (10–)17–35(–55) cm, stiffly erect; stem usually very glaucous **26. glauca**
42 Stem 30–80(–120) cm, geniculate-ascending to erect; stem not or slightly glaucous
43 Ligule 2·5–3·5 mm, acute; panicle-branches in pairs at lower nodes; lemma appressed-hairy between the veins **24. flaccidula**

43 Ligule up to 3 mm, acute to truncate; panicle-branches up to 5 at lower nodes; lemma hairy on keel and marginal veins, glabrous between the veins
44 Plant ± laxly caespitose; stems (15–)40–80 cm, smooth; panicle (8–)12–20(–30) cm **25. palustris**
44 Plant ± densely caespitose; stems 20–45(–65) cm, scabrid; panicle 3–12(–17) cm **(29–32). sterilis** group
37 Rhizomatous
45 Stem strongly compressed, especially above, often purple-tinged at the nodes; lemma glabrous or sparsely hairy **23. compressa**
45 Stem terete, without purple-tinged nodes; lemma usually hairy on the veins
46 Stem leafy for ⅓ or more of its length; ligule usually less than 1 mm, truncate
47 Lemma glabrous, not lanate at base **14. sibirica**
47 Lemma hairy on keel and marginal veins, lanate at base **(6–9). pratensis** group
46 Stem leafy for about half its length; ligule 1·5–9 mm, acute to rounded
48 Stem 10–15(–20) cm; panicle 3–5 cm, rather open, with few spikelets; glumes unequal, the upper wider and longer than the lower **10. arctica**
48 Stem (20–)25–40 cm; panicle 5–10 cm, open or contracted, with ± numerous spikelets; glumes subequal
49 Ligule (3–)5–9 mm, acute; spikelets greenish; lemma shortly hairy on keel and marginal veins; anthers (1·2–)1·5–2 mm **12. cenisia**
49 Ligule 2–5 mm, rounded to truncate; spikelets variegated with brownish, golden or violet bands; lemma ± long-hairy on keel and marginal veins; anthers 2–2·4 mm **11. granitica**

Sect. OCHLOPOA Ascherson & Graebner. Annuals or short-lived perennials. Stems erect to procumbent or shortly creeping. Branches extravaginal. Leaves flat. Panicle-branches smooth. Lemma not lanate at base, more or less hairy on the veins.

1. P. annua L., *Sp. Pl.* 68 (1753). Usually annual, erect to shortly creeping. Stems 5–30 cm, slightly compressed. Leaves (1–)2–3 mm wide, thin, flaccid, often transversely wrinkled. Panicle (1–)3–8 cm, more or less pyramidal; lower branches in pairs, patent or deflexed after anthesis. Spikelets not crowded towards the ends of the panicle-branches, with 3–5 closely spaced florets. Glumes unequal. Lemma usually sparsely hairy on veins. Palea ciliate along the whole length of keels. Anthers 0·6–0·8(–1) mm, 2–3 times as long as wide. Flowering throughout the year. $2n=28$. *Disturbed ground. Throughout Europe.* All except Sb.

An allotetraploid formed from the hybrid **2** × **3** and producing sterile hybrids with both; a successful, almost cosmopolitan weed.

2. P. infirma Kunth in Humb., Bonpl. & Kunth, *Nov. Gen. Sp.* **1**: 158 (1817) (*P. annua* subsp. *exilis* (Tommasini) Murb.). Like **1** but stems more strongly compressed; leaves 1–2 mm wide; panicle elongate-ovoid, the branches erecto-patent after anthesis; spikelets with 5–6 relatively widely spaced florets; anthers 0·2–0·5 mm, scarcely longer than wide. Flowering in spring. $2n=14$. *Sandy, usually coastal places. S. & W. Europe northwards to S.W. England.* Au Br Co Cr Ga Gr Hs It Lu Sa Tu.

P. maroccana Nannf., *Svensk Bot. Tidskr.* **32**: 296 (1938), which is like **2** but with anthers 0·7–0·9 mm, is probably a local autotetraploid variant; it has been recorded from S. & S.E. Spain.

3. P. supina Schrader, *Fl. Germ.* 289 (1806) (*P. annua* subsp. *supina* (Schrader) Link, *P. foucaudii* Hackel). Like **1** but stouter, creeping and always perennial; panicle laxly pyramidal, the lower panicle-branches patent; lemma glabrous on keel, hairy on marginal veins; anthers 1·5–2·5 mm, 5–8 times as long as wide. Flowering in spring. $2n=14$. *Pastures and damp places. Mountains of C. & S.W. Europe; Appennini; Fennoscandia; N.E. Russia.* Au Co Cz Da Fe Ga Ge He Hs ?Hu It Ju No Po Rm Rs (N, C, ?W) Su [Rs (B)].

Sect. COENOPOA Hyl. (Sect. *Triviales* Nannf.). Perennial; laxly caespitose, shortly stoloniferous, with numerous extravaginal non-flowering shoots arising from the base. Leaves flat. Panicle-branches densely scabrid. Lemma hairy on the keel, not or scarcely lanate at base.

4. P. trivialis L., *Sp. Pl.* 67 (1753). Stems (30–)50–90 cm, smooth or slightly scabrid near the apex. Leaves 2–4·5 mm wide, rather thin and soft; ligule 3·5–10 mm, acute. Panicle (9–)15–25 cm, ovoid-pyramidal; lower branches 3–5 together. Spikelets usually with 3 or more florets. Lemma shortly hairy on the keel, lanate at base. Keels of the palea aculeolate. $2n=14+0$–5B, 28. *Damp places and disturbed ground. Throughout Europe.* All except Sb.

(a) Subsp. **trivialis**: Stolons slender, terete. Leaves pale green; ligule 3·5–10 mm. Panicle pyramidal, rather open. *Throughout most of the range of the species, but rare in the south.*

(b) Subsp. **sylvicola** (Guss.) H. Lindb. fil., *Öfvers. Finska Vet.-Soc. Förhandl.* **48(13)**: 9 (1906) (*P. sylvicola* Guss.): Stolons moniliform, fleshy. Leaves bright green; ligule 5–10 mm. Panicle narrowly ovoid, somewhat contracted. *S. Europe.*

5. P. feratiana Boiss. & Reuter, *Pugillus* 128 (1852). Like **4** but leaves 1–2 mm wide; ligule 3·5–6·5 mm; lower panicle-branches mostly in pairs; spikelets always with 2 florets; lemma not lanate at base. ● *N.W. Spain, W. Pyrenees.* Ga Hs.

Sect. POA. Perennial, with long-creeping rhizomes; laxly to densely caespitose, with extravaginal branches. Leaves flat to folded. Panicle-branches terete, sparsely scabrid. Lemma hairy on the keel and marginal veins, copiously lanate at base.

(6–9). P. pratensis group. Usually more or less caespitose. Leaves 0·8–3(–4) mm wide. Panicle more or less lax, ovoid to pyramidal, the lower branches 2–5 together. Spikelets usually not proliferating.

The members of this group are highly variable and largely apomictic; specific limits are therefore difficult to define. The four taxa treated here as species may be considered ecotypic variants of *P. pratensis* in its broadest sense. These taxa have probably arisen on more than one occasion, as a result of hybridization of various ancestral species followed by increase in chromosome number and disruption of the sexual breeding system. Intercrossing is now probably a rare event; within the limits imposed by their predominantly agamospermous breeding system, they can therefore be regarded as species.

Literature: G. Almgård, *Ann. Agric. Coll. Sweden* **26**: 77–119 (1960). J. Clausen, *Euphytica* **10**: 87–94 (1961). V. Jirásek, *Acta Horti Bot. Prag.* **1963**: 60–68 (1964). E. Åkerberg, *Hereditas* **28**: 1–126 (1942).

1 Leaves 2–3·5(–4) mm wide, abruptly cucullate at apex; lower panicle-branches usually in pairs **6. alpigena**
1 Leaves 0·8–3 mm wide, gradually narrowed to a scarcely cucullate apex; lower panicle-branches (2–)3–5 together

2 Stems ±solitary, with few dead leaf-sheaths at base; glumes subequal, acuminate, usually both 3-veined **7. subcaerulea**

2 Stems clustered, often forming distinct tussocks, with numerous remains of leaf-sheaths at base; glumes unequal, acute, the lower usually 1-veined

3 Plant laxly caespitose; basal leaves flat or canaliculate, much shorter than stem; ligule decurrent on sheath-margins **8. pratensis**

3 Plant densely caespitose; basal sheaths strongly folded, wiry, nearly as long as stem; ligule not decurrent **9. angustifolia**

6. P. alpigena (Fries) Lindman, *Svensk Fanerogamfl.* 91 (1918) (*P. pratensis* subsp. *alpigena* (Fries) Hiit.). Plant 20–30(–50) cm, with long rhizomes, not forming compact tussocks; non-flowering shoots distichously leafy. Leaves 2–3(–4) mm wide, abruptly contracted into a cucullate apex. Panicle 6–8 cm, compact, ovoid to pyramidal, the lower branches usually in pairs. Spikelets with 3–5 florets, sometimes proliferating; keels of the palea ciliate below. $2n=35$, 43, 56, 70–72, 84. *Heaths and pastures. N. Europe, southwards to S. Norway.* Fa Fe Is No Rs (N, C) Sb Su.

Plants from the arctic with proliferating spikelets have been named **P. pratensis** subsp. **colpodea** (Th. Fries) Tzvelev, *Nov. Syst. Pl. Vasc.* (*Leningrad*) **9**: 47 (1972); they have sometimes been confused with **10**, and with *P.* × *herjedalica*, which usually has a proliferating inflorescence.

P. × **herjedalica** H. Sm., *Veg. Utveckl. Centralsvenska Högfjälls.* 159 (1920) (**6** × **43**), is frequent in those parts of Fennoscandia where the parent species grow together. It is like **6** but with short rhizomes, the stem-base enclosed by conspicuously thickened leaf-sheaths, and the inflorescence usually proliferating.

7. P. subcaerulea Sm. in Sowerby, *Engl. Bot.* **14**: t. 1004 (1802) (*P. irrigata* Lindman, *P. pratensis* L. subsp. *irrigata* (Lindman) Lindb. fil., *P. athroostachya* Oett.). Somewhat glaucous, with usually solitary stems (15–)20–30(–45) cm. Leaves 1·5–2·5 mm wide, fringed with hairs at the mouth of the sheath. Ligule *c.* 1 mm, hairy on the adaxial surface. Panicle (3–)4–6·5 cm, the branches mostly in pairs. Glumes subequal, 3-veined, acuminate. $2n=38$–117. *N. & C. Europe.* Au Br Cz Da Fa Fe Ga Ge Hb ?Ho Hu Is No Rs (N, B, C, W) Su.

8. P. pratensis L., *Sp. Pl.* 67 (1753) (incl. *P. pinegensis* Roshev., *P. turfosa* Litv.). Bright green, rather laxly caespitose; stems (15–)20–50(–70) cm. Leaves 2–3 mm wide, flat or canaliculate, shorter than the stem. Ligule *c.* 1 mm, decurrent on sheath-margins. Panicle 6–15 cm, the lower branches mostly 3–5 together. Glumes unequal, acute, the lower 1-veined. $2n=42$, 50–78, 91, 98. *Throughout Europe.* All except Bl; introduced in Az.

9. P. angustifolia L., *Sp. Pl.* 67 (1753) (*P. pratensis* subsp. *angustifolia* (L.) Gaudin). Greyish-green, densely caespitose; stems (30–)50–70 cm. Leaves up to 40 cm × 0·8–1·5(–2) mm, the basal wiry, strongly folded, the upper shorter, sometimes flat. Ligule 1–3 mm, not decurrent. Panicle 6–10 cm, the lower branches 3–5 together. Glumes unequal, acute, the lower 1-veined. $2n=46$–63. *Most of Europe.* Au Az Be Bl Br Bu Co Cz Da Fe Ga Ge Gr He Ho Hs Hu It Ju Lu No Po Rm Rs (N, B, C, W, K, E) Sa Su Tu [Is].

Sect. CENISIA Ascherson & Graebner (Sect. *Stoloniferae* Nannf. pro parte). Perennial; rhizomatous. Branches extravaginal; distichously leafy non-flowering shoots usually present. Leaves flat. Panicle-branches terete, sparsely to densely scabrid. Lemma hairy on the keel and marginal veins, somewhat lanate at base. Keels of the palea aculeolate or ciliate below.

10. P. arctica R. Br. in Parry, *Jour. Voy. N.W. Pass., Suppl. App.* 288 (1824) (incl. *P. petschorica* Roshev.). Laxly caespitose; stems 10–15(–20) cm. Leaves (1–)1·5–2·5 mm wide, dark green. Ligule 1·5–2(–3·5) mm, rounded or sometimes acute. Panicle 3–5 cm, more or less pyramidal, rather open, with few spikelets; spikelets with (2–)3–4 florets, tinged blackish-purple, sometimes proliferating. Glumes unequal. Lemma appressed-hairy on abaxial surface, hairy on keel and marginal veins, lanate at base. Keels of the palea aculeolate or shortly ciliate in lower half. Anthers 1·8–2 mm. $2n=38$, 56, 72, 76. *Heaths and dry grassland. Arctic and subarctic Europe, southwards to S. Norway and C. Ural.* Fe ?Is No Rs (N, C) Sb Su.

Very variable.

11. P. granitica Br.-Bl., *Arch. Bot. Bull.* (*Caen*) **3**: 46 (1929). Laxly caespitose; stem 25–50(–70) cm, rather leafy. Leaves (2–)3–5 mm wide, bright green. Ligule 2–5 mm, rounded to truncate, often lacerate. Panicle 5–10 cm, ovoid, somewhat contracted. Spikelets with 2–5 florets. Glumes subequal. Lemma short- to long-hairy on keel and marginal veins, lanate at base. Keels of the palea ciliate in lower half. Anthers 2–2·4 mm. *Alpine meadows; calcifuge.* ● *Carpathians.* Cz Po Rm Rs (W).

(a) Subsp. **granitica**: Stems 25–40 cm, robust. Leaves 3–4 mm wide. Panicle 7–10 cm; spikelets sometimes proliferating, strongly violet-tinged. Lemma abundantly crispate-hairy on keel and marginal veins, densely lanate at base. $2n=64$, 67, 71, 72, 94. *W. Carpathians.*

(b) Subsp. **disparilis** (E. I. Nyárády) E. I. Nyárády, *Rev. Roum. Biol.* (*Bot.*) **10**: 355 (1965): Stems 30–50(–70) cm, rather slender. Leaves 2–3 mm wide. Panicle 5–7(–9) cm; spikelets never proliferating, tinged bronze or golden-brown or occasionally violet. Lemma with short, straight hairs on keel and marginal veins, sparsely lanate at base. *E. & S. Carpathians.*

12. P. cenisia All., *Auct. Fl. Pedem.* 40 (1789). Laxly caespitose; stems 24–40 cm, with distichously leafy non-flowering shoots. Leaves 2–3 mm wide, slightly glaucous. Ligule of cauline leaves 3–9 mm, acute; ligule of basal leaves very short and truncate or absent. Panicle (2–)4·5–10 cm; spikelets with 3–5 florets, greenish or weakly violet-tinged. Glumes subequal. Lemma shortly hairy on keel and marginal veins, lanate at base. *Rocks, screes and stony pastures. Mountains of C. & S. Europe.* Al Au Bu Co Cr Ga Ge Gr He Hs It Ju Rm Sa.

1 Panicle open, with patent branches; marginal veins of lemma hairy in lower ⅓; keels of the palea aculeolate **(b) subsp. cenisia**

1 Panicle contracted, spicate; marginal veins of lemma hairy in lower ½; keels of the palea ±ciliate in lower half or occasionally aculeolate

2 Lemma with long, appressed hairs on marginal veins; panicle-branches sparsely scabrid for most of their length **(c) subsp. contracta**

2 Lemma with short, patent hairs on marginal veins; panicle-branches sparsely scabrid towards the apex, smooth below **(a) subsp. sardoa**

(a) Subsp. **sardoa** E. Schmid, *Viert. Naturf. Ges. Zürich* **78**: 239 (1933): Stem leafy to above the middle. Panicle (2–)3–5(–9) cm, narrow, contracted, the branches sparsely scabrid in upper ½. Marginal veins of lemma hairy in lower ½. Keels of the palea ciliate in lower ½, or occasionally aculeolate. Anthers 1·8–2 mm. $2n=56$. ● *Pyrenees, Corse, Sardegna, Alpes Maritimes.*

(b) Subsp. **cenisia**: Stem usually leafy only in lower ½. Panicle 5–10 cm, lax, rather open, the branches more or less patent, sparsely to densely scabrid. Marginal veins of lemma hairy in lower ⅓. Keels of the palea aculeolate. Anthers 1·5–1·7 mm. $2n=28$, 49, 50–56. *Calcicole* ● *Alps.*

(c) Subsp. **contracta** (E. I. Nyárády) E. I. Nyárády, *Bul. Grăd. Bot. Univ. Cluj* **11**: 8 (1931): Stems leafy to about the middle. Panicle 4–7 cm, narrow, somewhat contracted, the branches moderately scabrid for most of their length. Marginal veins of lemma hairy in lower ½. Keels of the palea ciliate in lower half. Anthers 1·7–2 mm. *S. Carpathians, mountains of Balkan peninsula and Kriti.*

Sect. MACROPOA F. Hermann ex Tzvelev. Perennial, rhizomatous; stem geniculate-ascending, slightly compressed at base. Branches intra- or extravaginal. Leaves 2–5 mm wide, canaliculate; ligule 1–2 mm, obtuse. Panicle-branches weakly scabrid. Lemma glabrous, not lanate at base. Keels of the palea aculeolate.

13. P. longifolia Trin., *Mém. Acad. Sci. Pétersb.* ser. 6, **4(2)** *Bot.*: 61 (1836). Stem 30–50(–60) cm, stout, somewhat compressed and with greyish remains of leaf-sheaths at base. Leaves 1–2 mm wide, tapering gradually to an abruptly mucronate apex. Ligule 1–2 mm, truncate. Panicle 6–9 cm, narrow; branches short, more or less erect. Spikelets with 2–4 florets. Glumes unequal. Lemma glabrous. Anthers 2·5–3·7 mm. *Meadows and open woods. Mountains of Krym.* Rs (K). (*Caucasus, N.E. Turkey, W. Iran.*)

Represented in Europe by the endemic subsp. **fagetorum** (P. Smirnov) Tzvelev in Fedorov, *Fl. Part. Eur. URSS* **1**: 285 (1974) (*P. fagetorum* P. Smirnov).

14. P. sibirica Roshev., *Bull. Jard. Bot. Pétersb.* **12**: 121 (1912). Stems (20–)50–120 cm, slender, somewhat compressed at base. Leaves 2–5 mm wide, tapering gradually to the apex. Ligule *c.* 1 mm, obtuse. Panicle 6–18 cm, pyramidal; branches elongate, more or less patent. Spikelets with (2–)3–4(–5) florets. Glumes unequal. Lemma glabrous. Anthers 1·5–2·5 mm. *Meadows and wood-margins. N.E. Russia.* Rs (N, C). (*N. & N.C. Asia.*)

Sect. HOMALOPOA Dumort. Densely caespitose perennials; stems compressed in lower half, especially where enclosed by strongly folded leaf-sheaths; branches extravaginal. Leaves flat or folded. Panicle-branches terete, sparsely to densely scabrid. Lemma glabrous or hairy only on the keel, lanate or not at base. Keels of the palea aculeolate.

15. P. chaixii Vill. in L., *Syst. Pl. Eur.* **1**, *Fl. Delph.* 7 (1786). Stems 50–120(–150) cm, stout. Leaves 6–10(–15) mm wide, abruptly contracted to the cucullate apex. Ligule 1–2 mm, truncate. Panicle 10–15 cm, ovoid, compact; branches short, erecto-patent, densely scabrid. Spikelets with 4–5 florets. Glumes unequal; keel scabrid at the apex. Lemma glabrous, with a scabrid keel, usually not lanate at base. $2n=14$. *Woods, mainly in mountain districts. C. & S. Europe; introduced elsewhere with grass-seed, and naturalized in lawns and pastures.* Al Au Be Bu Cz Ga Ge Gr He Hs It Ju Po Rm Rs (W) [Br Da Fe Ho No *Rs (B, C) Su].

16. P. hybrida Gaudin, *Alpina* (*Winterthur*) **3**: 46 (1808). Sometimes shortly creeping; stems 50–150 cm, stout. Leaves (4–)5–8 mm wide, flat, tapering gradually to the apex. Ligule 3–5 mm, rounded. Panicle 15–20 cm, conical; branches somewhat elongate, patent, sparsely scabrid. Glumes unequal; keel smooth or scabrid near the apex. Lemma hairy on the keel, sparsely lanate at base $2n=14$. *Moist woods and pastures. Alps, Jura, E. & S. Carpathians, mountains of Jugoslavia.* Au Ga Ge Gr He It Ju Rm Rs (W).

17. P. remota Forselles, *Linn. Inst. Skr.* **1**: 6 (1807). Like **16** but often with short epigeal stolons; lower leaves abruptly contracted to the cucullate apex; ligule 2–3 mm; panicle-branches very long, arcuate-patent; glumes subequal, scabrid on keel and lateral veins. $2n=14$. *Moist woods. N., C. & E. Europe, southwards to Switzerland, C. Romania and S. Ukraine.* Au Cz Da Fe Ge He Hu No Po Rm Rs (N, B, C, W, E) Su.

Sect. LEPTOPHYLLAE J. R. Edmondson. Densely caespitose, shortly stoloniferous perennials, with numerous non-flowering shoots arising near the base; branches extravaginal. Leaves very slender, strongly folded. Panicle-branches sulcate, densely scabrid. Lemma sparsely hairy on the keel and marginal veins, very sparsely lanate at base. Keels of the palea weakly aculeolate.

18. P. stiriaca Fritsch & Hayek, *Jahreskat. Wien. Bot. Tauschanstalt* **1904**: 226 (1904) (*P. pratensis* var. *stiriaca* (Dörfler) Suess.). Slightly glaucous; stems (30–)50–80(–100) cm. Leaves (10–)30–40 cm × 0·2–0·3 mm, mostly arising from near the base of the stem, strongly folded, shortly hairy between the veins on the adaxial surface. Ligule 1–2 mm, rounded. Panicle (4–)7–11 (–18) cm, rather lax; branches erect. Spikelets with (2–)4–6 florets. $2n=14$. *Rocks, screes and wood-margins.* ● *E.C. Europe, extending southwards to Crna Gora.* Au Cz Ju Po Rm.

Sect. OREINOS Ascherson & Graebner. Laxly to densely caespitose perennials; branches extravaginal; short stolons sometimes present. Leaves flat or folded. Panicle-branches slender, terete to sulcate, smooth. Lemma hairy on the keel and marginal veins, lanate at base. Keels of the palea aculeolate to ciliate.

19. P. flexuosa Sm., *Fl. Brit.* **1**: 101 (1800) (*P. laxa* subsp. *flexuosa* (Sm.) Hyl.). Laxly caespitose; stems 10–20(–30) cm, mostly leafy only at the base. Leaves 1–2 mm wide; ligule up to 3·5 mm, rounded-lacerate. Cauline leaves with a distinct sheath. Panicle 2·5–5·5 cm, ovoid; branches sulcate. Spikelets with 2–3 florets. Lemma hairy on keel and for *c.* ⅓ of the length of the marginal veins; hairs acute. Keels of the palea aculeolate. $2n=42$. *Rocks and screes.* ● *Mountains of N.W. Europe.* Br Is No Su.

20. P. laxa Haenke in J. Jirasek et al., *Beob. Reis. Riesengeb.* 118 (1791). Densely caespitose; stems (10–)13–20 cm, mostly leafy only at the base. Leaves 0·8–1·5(–2·5) mm wide; ligule up to 3 mm, acute, rounded-lacerate, or truncate. Cauline leaves with a distinct sheath. Panicle (2–)2·8–3·5(–7) cm; branches sulcate. Spikelets with 3–4 florets. Lemma hairy on keel and for *c.* ⅔ of the length of the marginal veins; hairs obtuse. Anthers 1–1·3 mm. $2n=21$, 28. *Mountain rocks and grassy slopes; calcifuge.* ● *From S.W. Germany and the Carpathians southwards to the Sierra Nevada, C. Appennini and S.W. Bulgaria.* Au Bu Co Cz Ga Ge He Hs It Ju Po Rm.

P. nyaradyana Nannf., *Symb. Bot. Upsal.* **1(5)**: 38 (1935), a glaucous variant of **20** from the Carpathians, has longer, acute ligules and rather longer anthers (up to 1·7 mm).

21. P. pirinica Stoj. & Acht., *Bull. Inst. Roy. Hist. Nat.* (*Sofia*) **12**: 181 (1939). Densely caespitose; stems 5–30 cm. Leaves 0·2–0·4 mm wide, filiform, mostly basal; ligule 0·4–0·6 mm, truncate. Cauline leaves with a distinct sheath. Panicle (1·8–)3–5·5(–6·5) cm, elongate-ellipsoid to narrow and subspicate; branches rather flexuous, terete, with relatively few spikelets. Spikelets with 3–6 florets. Lemma hairy on keel and for *c.* ½ of

the length of the marginal veins; hairs acute. Keels of the palea sparsely long-ciliate for most of their length. $2n=14$. *Screes and stony slopes; calcicole.* ● *S.W. Bulgaria (Pirin Planina); E.C. Greece (Olimbos).* Bu Gr.

22. P. minor Gaudin, *Alpina* (*Winterthur*) **3**: 44 (1808). Densely caespitose; stems 5–30 cm, leafy for most of their length. Leaves 1–1·5(–2) mm wide; ligule 2–2·5 mm, subacute. Uppermost leaf without a distinct sheath. Panicle 2·5–3 cm, ovoid; branches terete. Spikelets with 4–6 florets. Lemma hairy for *c.* ½ of the length of the keel and marginal veins. Keels of the palea aculeolate. $2n=28$. *Stony slopes and screes; calcicole.* ● *Pyrenees; Sierra Nevada; Alps; mountains of Jugoslavia and Romania.* Au Ga Ge He Hs It Ju Rm.

Sect. TICHOPOA Ascherson & Graebner. Perennial, rhizomatous, with stems strongly compressed above. Branches extravaginal. Leaves flat. Panicle-branches very short, moderately scabrid. Lemma glabrous, or shortly appressed-hairy on the keel and marginal veins, lanate at base. Keels of the palea aculeolate.

23. P. compressa L., *Sp. Pl.* 69 (1753). Stems 20–40 cm, geniculate-ascending, smooth, strongly compressed in upper part, arising obliquely from the rhizome. Leaves 2–4(–5) mm wide, smooth, flat. Panicle 2–7(–10) cm, rather narrow to pyramidal; branches moderately scabrid. Spikelets with (2–)4–8 florets. Lemma glabrous, or shortly appressed-hairy below on keel and marginal veins. Anthers 1–1·2 mm. $2n=42, 45, 49, 56$. *Walls, rocks and other dry places; somewhat calcicole. Most of Europe except the extreme north and west and some Mediterranean islands.* All except Az Bl Cr Fa Is Lu Sb; not native in Hb.

Sect. STENOPOA Dumort. (Sect. *Hylopoa* Ascherson & Graebner). Laxly to densely caespitose perennials, never rhizomatous. Branches extravaginal. Leaves flat or somewhat convolute, tapering gradually to the apex. Panicle-branches terete, scabrid. Glumes subequal to unequal. Lemma hairy on the keel and marginal veins, not or sparsely lanate at base. Keels of the palea aculeolate to ciliate.

24. P. flaccidula Boiss. & Reuter, *Pugillus* 128 (1852). Laxly caespitose. Stems 30–60 cm, smooth. Leaves 1–2 mm wide, flaccid; margins smooth or weakly scabrid. Ligule 2·5–3·5 mm, acute. Panicle 8–12 cm, lax, pyramidal; branches scabrid, in pairs at the lower nodes, patent, bearing spikelets only on the upper part of each branch. Spikelets 3·5–4 mm, mostly with 3 florets. Glumes subequal. Lemma appressed-hairy on the abaxial surface between keel and marginal veins, sparsely lanate at base. *Shady places. Mountains of S. & E. Spain and Mallorca.* Bl Hs.

25. P. palustris L., *Syst. Nat.* ed. 10, **2**: 874 (1759) (incl. *P. tanfiljewii* Roshev.). Rather laxly caespitose. Stems (15–)40–80 cm, smooth. Leaves 1–2(–3) mm wide; margins smooth. Ligule 1–2·5 mm, rounded. Panicle (8–)12–20(–30) cm, narrowly pyramidal; branches scabrid, up to 5 at the lower nodes, erecto-patent. Spikelets 3–5 mm, with 2–5 florets; glumes subequal. Lemma hairy on keel and marginal veins, sparsely lanate at base. $2n=28$. *Wet grassland, marshes and forest-margins. Much of Europe, but absent from most of the west and parts of the south.* Au Be Br Bu Cr Cz Da Fe Ga Ge Gr He Ho Hu It Ju No Po Rs (N, B, C, W, K, E) Su [Hb].

26. P. glauca Vahl, *Fl. Dan.* **6(17)**: 3 (1790) (*P. caesia* Sm.; incl. *P. ganeschinii* Roshev.). Densely caespitose; stem (10–)17–35(–55) cm, stiffly erect, usually very glaucous, smooth to somewhat scabrid at apex. Leaves rather short and tapering, 2·5–3 mm wide. Ligule 1·2–2 mm, truncate. Panicle 3·5–7(–10) cm, ovoid, compact; branches 2–3(–4) at the lower nodes. Spikelets 4–6 mm, with 2–4(–5) florets; glumes subequal. Lemma hairy on keel and marginal veins, lanate at base. $2n=42, 44, 49, 56, 63, 65$, *c.* 70. *Rocks, screes and other dry, open habitats. N. Europe; mountains of Europe southwards to the Pyrenees, S. Alps and N. Greece.* Au Br Cz Fa Fe Ga Gr He Is It Ju No Po Rs (N, C) Sb Su.

27. P. nemoralis L., *Sp. Pl.* 69 (1753). Laxly caespitose; stem 30–70 cm, smooth, rather leafy. Leaves 1·5–2(–3) mm wide; margins smooth; sheaths terete. Ligule up to 0·5 mm. Panicle 5–8(–10) cm, lax, elongate-ovoid; branches 2–5 at the lower nodes. Spikelets up to 4 mm, numerous, with 2–4 florets. Glumes unequal, the lower glume narrow, more or less subulate. Lemma hairy on keel and lower part of marginal veins, lanate at base. $2n=28, 33, 42, 56$. *Woods. Almost throughout Europe.* All except Az Bl Cr Sb.

P. balbisii Parl., *Fl. Ital.* **1**: 360 (1850) (*P. capitata* Balbis), a poorly understood variant described from Sardegna and occurring also in Corse, probably does not warrant separation from **27.**

28. P. rehmannii (Ascherson & Graebner) Wołoszczak, *Fl. Polon. Exsicc.* **10–11**: 1020 (1904) (*P. anceps* Rehmann, non Forster). Moderately densely caespitose; stem 30–40 cm, compressed, smooth. Leaves (3–)4–5 mm wide, slightly glaucous, with scabrid margins; sheaths of cauline leaves compressed, with a distinct raised keel. Ligule 0·3–0·5 mm, truncate. Panicle 10–12 cm, linear-triangular in outline, often drooping at the apex; branches 3–5 at the lower nodes. Spikelets 4–5 mm, with 3–5 florets; glumes subequal. Lemma hairy on keel and lower part of marginal veins, not lanate at base. Anthers 1·6–1·9 mm. $2n=14$. ● *S. & E. Carpathians.* Rm Rs (W).

(29–32). P. sterilis group. Densely caespitose. Leaves flat or slightly folded or canaliculate, especially when dry, more or less scabrid on margins. Stems usually rather leafy. Spikelets narrow. Glumes subequal to equal.

A biosystematic investigation of the whole range of variants in this group is required, as the plants are extremely variable in both macroscopic and microscopic characters. They occur in a wide range of habitats from near sea-level to 2200 m.

Literature: G. Dihoru, *Studii Cerc. Biol.* (*Ser. Bot.*) **20**: 95–106 (1968). G. Şerbănescu, *op. cit.* **19**: 23–31, 227–237 (1967).

1 Panicle narrow, subspicate, with short, erect, ±sparsely scabrid branches; palea glabrous on surface between keels; plant often glaucous
2 Stems not leafy; leaves 0·5–1·3 mm wide; rhachilla scabrid, not hirsute **32. stepposa**
2 Stems leafy; leaves (0·8–)1·2–2 mm wide; rhachilla finely papillose to hirsute **31. sterilis**
1 Panicle narrow to wide, ovoid to pyramidal; branches patent to erect, sparsely to densely scabrid; palea glabrous or hairy on surface between keels; plant not or scarcely glaucous
3 Stems smooth or slightly scabrid below the panicle; uppermost node concealed by sheath of the leaf below; glumes rather narrow, the upper (3·5–)4–5 mm; lemma often violet- and gold-tinged **30. versicolor**
3 Stems ±densely scabrid below the panicle; uppermost node usually not concealed by sheath of the leaf below; glumes ovate-lanceolate, the upper (3–)3·5–3·8 mm; lemma usually not variegated **29. pannonica**

29. P. pannonica A. Kerner, *Österr. Bot. Zeitschr.* **14**: 84 (1864). Stems 25–45 cm. Leaves 1·5–2·5 mm wide. Ligule up

to 3 mm, oblong, rounded or somewhat lacerate. Panicle 3–6(–10) cm, the branches rigid, very scabrid, 2–4 at lower nodes. Spikelets greenish, with 2–4 florets; rhachilla finely papillose. Lemma densely long-hairy on marginal veins, densely lanate at base. ● *E.C. Europe, extending to S.W. Ukraine.* Cz Ju Rm Rs (W).

(a) Subsp. **pannonica** (*P. podolica* Błocki): Stems 35–45 cm. Panicle rather wide, more or less pyramidal, with elongate, somewhat patent branches. Palea with tangled hairs between the keels. *S.W. Ukraine, Moldavia, Romania.*

(b) Subsp. **scabra** (Ascherson & Graebner) Soó, *Acta Bot. Acad. Sci. Hung.* **5**: 483 (1959) (*P. scabra* Kit. ex Steudel, non Ehrh.): Stems 25–30(–35) cm. Panicle narrow, spicate to ovoid, with short, more or less erect, branches. Palea glabrous to sparsely hairy between the keels. *E.C. Europe.*

30. P. versicolor Besser, *Enum. Pl. Volhyn.* 41 (1821) (*P. romanica* Prodan). Stems (20–)25–40(–65) cm. Leaves 1–2 mm wide. Ligule up to 2·5 mm, oblong, obtuse to acute. Panicle 6–17 cm; branches sparsely to densely scabrid, up to 5 together at lowest nodes. Spikelets violet- and gold-tinged, with 2–4(–5) florets. Lemma *c.* 3·3 mm, sparsely long-hairy on keel and marginal veins, densely lanate at base. Palea glabrous, or rarely sparsely hairy between the keels. Rhachilla finely papillose. ● *S.W. Ukraine, Moldavia, E. Romania; mountains of C. part of Balkan peninsula.* Al Gr Ju Rm Rs (W).

31. P. sterilis Bieb., *Fl. Taur.-Cauc.* **1**: 62 (1805). Stems 25–35 cm, smooth or sparsely to densely scabrid above. Leaves up to 2 mm wide. Ligule up to 1 mm, truncate. Panicle 8–12 cm, narrow, subspicate. Spikelets greenish, with (2–)3–4 florets. Lemma *c.* 2·5 mm, usually not lanate at base. Rhachilla with a line of hairs or finely papillose. *S. Ukraine, S.E. Russia.* Rs (W, K, E). (*S.W. & S.C. Asia.*)

32. P. stepposa (Krylov) Roshev. in Komarov, *Fl. URSS* **2**: 754 (1934). Like **31** but stems (15–)25–30 cm, smooth, often leafless above; leaves 0·5–1·3 mm wide. *S.C. & S.E. Russia.* Rs (C, E) [Rs (N)]. (*Siberia.*)

Sect. ABBREVIATAE Nannf. ex Tzvelev. Densely caespitose perennials, without rhizomes. Branches intravaginal. Leaves folded. Panicle-branches sulcate, smooth. Lemma glabrous, or shortly appressed-hairy between the veins, not lanate at base. Keels of palea aculeolate in upper part.

33. P. abbreviata R.Br. in Parry, *Jour. Voy. N.W. Pass., Suppl. App.* 287 (1824). Densely caespitose; stems 5–15 cm, smooth. Leaves mostly basal, numerous, tending to curve upwards especially when dry. Ligule 0·5–1 mm, rounded. Uppermost cauline leaf more or less appressed to the stem, without a distinct sheath. Panicle up to 1·5 × 0·8 cm, compact, ellipsoid. Spikelets rather few, purple-tinged. Lemma shortly appressed-hairy to sericeous on the abaxial surface. Anthers 0·6–0·8 mm. *Dry, stony ground. Svalbard; arctic Russia (near Anderma).* Rs (N) Sb. (*Circumpolar-arctic.*)

Sect. NANOPOA J. R. Edmondson. Densely pulvinate perennials. Branches intravaginal. Leaves setaceous, convolute. Panicle-branches terete, smooth. Lemma glabrous, not lanate at base. Keels of the palea aculeolate.

34. P. trichophylla Heldr. & Sart. ex Boiss., *Diagn. Pl. Or. Nov.* **3(4)**: 136 (1859). Stems 6–10 cm, smooth, almost leafless. Leaves 1–2 cm × 0·3–0·5 mm, setaceous, convolute; ligule 1·5–2 mm, prominent, milky-white, finely tapering, acute. Panicle 1·5–2·5 × 0·8–1 cm, narrowly ellipsoid; branches 1–2 at each node. Spikelets *c.* 2·5 mm, with 2–3 florets, strongly tinged with purple. Glumes unequal, obtuse, with a distinct hyaline margin. Lemma not strongly keeled, glabrous, obtuse; lateral veins indistinct. $2n = 14$. ● *C. Greece (Parnassos).* Gr.

Records from Pindhos and Kiona are erroneous.

Sect. BOLBOPHORUM Ascherson & Graebner. Laxly to densely caespitose perennials; branches intravaginal. Stems smooth, bulbous at base or clothed with remains of old leaf-sheaths. Leaves flat to folded, usually abruptly contracted into a cucullate apex. Panicle-branches smooth to scabrid, terete. Lemma hairy on keel and marginal veins, with obtuse, often long hairs, and sometimes shortly appressed-hairy on abaxial surface Keels of the palea aculeolate to ciliate.

35. P. bulbosa L., *Sp. Pl.* 70 (1753). Usually caespitose; stems 15–40 cm. Leaves somewhat glaucous, mostly basal, the basal leaves 2–10 cm × (0·5–)1–2 mm, folded or flat; margins not cartilaginous. Ligule up to 3 mm, acute. Panicle 2–6 cm, compact, ovoid; branches in pairs at the lower nodes, scabrid. Spikelets more or less purple-tinged, often proliferating, with 2–6 florets. Glumes broadly ovate, subequal; lemma densely lanate at base. $2n = 21, 28, 39, 42$. *Dry places. Most of Europe except the extreme west and parts of the north.* All except Az Fa Hb Is Rs (N) Sb.

36. P. perconcinna J. R. Edmondson, *Bot. Jour. Linn. Soc.* **76**: 330 (1978) (*P. concinna* Gaudin, non R.Br., *P. bulbosa* subsp. *concinna* (Gaudin) Hayek, *P. molinerii* Lam. & DC., non Balbis). Like **35** but stems 5–10(–25) cm; leaves 1–6 cm × 0·5–1·5 mm; ligule 0·8–2·2 mm; panicle narrowly elliptical; spikelets greenish, with 6–10 florets, never proliferating; lemma not lanate at base. $2n = 14$. *Dry places, mainly in mountain districts.* ● *From S.E. France to the Balkan peninsula.* ?Bu Ga ?Gr He It Ju Sa.

37. P. ligulata Boiss., *Voy. Bot. Midi Esp.* **2**: 659 (1842). Densely caespitose; stems (8–)12–20 cm. Leaves 1·2–5 cm × 1·2–1·8 mm, glaucous, flat; margins not cartilaginous. Ligule 2·5–6 mm, prominent, milky-white, acute, lacerate. Panicle (1–)1·8–3 cm, compact, ovoid to pyramidal; branches 1–2 at the lower nodes. Spikelets more or less purple-tinged, never proliferating, with 5–10 florets. Glumes unequal. Lemma shortly hairy on keel and marginal veins, not lanate at base. Keels of the palea aculeolate. Anthers 1·4–1·6 mm. $2n = 14$. *Mountain rocks and screes. Spain.* Hs.

38. P. timoleontis Heldr. ex Boiss., *Fl. Or.* **5**: 607 (1884) (*P. bulbosa* subsp. *timoleontis* (Heldr. ex Boiss.) Hayek). Like **37** but leaves 0·5–1 mm wide, folded; ligule 3–6·5 mm; panicle ovoid; spikelets sometimes proliferating; anthers 1–1·2 mm. $2n = 14$. *Dry pastures. Balkan peninsula and Aegean region.* Al Bu Cr Gr Ju Tu.

The stem-base of **38** tends to be bulbous; this character, together with the sometimes proliferating spikelets, leads to confusion with **35**, from which it can easily be distinguished by its densely caespitose habit, short leaves with prominent milky-white ligules, and by the lemma not being lanate at the base.

39. P. media Schur, *Verh. Mitt. Siebenb. Ver. Naturw.* **4** (*Sert. Fl. Transs.*): 87 (1853) (incl. *P. ursina* Velen.). Laxly caespitose, glaucous; stems (15–)20–30(–40) cm. Leaves 4–9 cm × 1–1·5(–2) mm, flat or folded, mostly basal; margins not cartilaginous. Ligule 1–2·5 mm, rounded, more or less lacerate. Panicle 3·5–5 cm, compact, ellipsoid-oblong; branches (1–)2 at the lower nodes. Spikelets violet-tinged, never proliferating, with

3–5 florets. Glumes unequal. Lemma moderately hairy on keel and marginal veins, not or sparsely lanate at base. Keels of the palea ciliate in lower half. Anthers *c.* 1·6 mm. $2n=14+0$–2B. *Mountain pastures.* ● *Balkan peninsula, S. & E. Carpathians.* Al Bu Gr Ju Rm Rs (W).

40. P. pumila Host, *Fl. Austr.* **1**: 146 (1827) (*P. thessala* Boiss. & Orph.). Densely caespitose; stems 6–18(–30) cm. Leaves 2–5 cm × (0·2–)0·5–1·5 mm, mostly basal, folded or flat; margin not cartilaginous. Ligule 1–2 mm, truncate in the basal leaves, longer and acute in the cauline. Panicle 2·5–5 cm, rather open, ellipsoid to ovoid, with 2–3 slender branches. Spikelets greenish to violet-tinged, with 4–6 florets; glumes subequal. Lemma shortly hairy on keel and marginal veins, glabrous between the veins, sparsely lanate at base. Keels of the palea finely aculeolate or with a few short hairs below. Anthers 1·4–1·8(–2) mm. $2n=14$. *Mountain pastures and rocks.* ● *E. Alps; mountains of Balkan peninsula and Romania.* Al ?Au Gr It Ju Rm.

41. P. molinerii Balbis, *Elenco* 85 (1801) (*P. badensis* var. *xerophila* (Br.-Bl.) Suess.). Densely caespitose; stems (8–)12–18 cm. Leaves 2–6 cm × 1–2·5 mm, glaucous, mostly basal, usually tightly folded but sometimes flat to canaliculate; margin often more or less cartilaginous. Ligule of lowest leaves up to 1 mm, obtuse, often lacerate, the cauline with ligule 1–2 mm. Panicle 1·5–4 cm, compact, narrowly ellipsoid to ovoid; branches rather rigid, mostly in pairs at the lower nodes. Spikelets more or less violet-tinged, with (2–)3–5 florets; glumes subequal. Lemma more or less long-hairy on keel and marginal veins, sparsely hairy between the veins. Keels of the palea ciliate below or aculeolate throughout. Anthers (1·3–)1·5–2 mm. $2n=14$. ● *Mountains of S. & C. Europe.* Al Au Bu Cz Ga Gr He Hs It Ju Rm.

Closely related to **40** and **42**; transitional forms occur occasionally and further work is needed to clarify their relationships.

42. P. badensis Haenke ex Willd., *Sp. Pl.* **1**: 392 (1797) (*P. alpina* subsp. *badensis* (Haenke ex Willd.) G. Beck). Densely caespitose; stems (15–)20–35 cm. Leaves mostly basal, glaucous; margin cartilaginous. Basal leaves (1·5–)2·5–6 cm × 2–3(–4·5) mm, flat to canaliculate; ligule up to 2 mm, rounded to truncate, lacerate. Cauline leaves folded, short; ligule 2–6 mm, acute. Panicle 4–7 cm, compact, ovoid; spikelets greenish or occasionally purple-tinged, densely clustered, with 5–9 florets. Glumes unequal. Lemma moderately hairy on and sparsely hairy between keel and marginal veins, usually sparsely lanate at base. Keels of the palea aculeolate. $2n=14+0$–8B, 18, 21, 28. *Dry rocks or sandy ground.* ● *C. Europe and N. part of Balkan peninsula.* Al Au Bu Cz Ga Ge He Hu ?It Ju Rm.

43. P. alpina L., *Sp. Pl.* 67 (1753) (*P. borisii* Stefanov). Laxly caespitose; stems 15–30(–40) cm. Leaves 4–10 cm × 2–4·5 mm, flat; margin not cartilaginous. Ligule of basal leaves 1–2(–3) mm, truncate; ligule of cauline leaves 3–5 mm, often lacerate. Panicle compact to patent, more or less pyramidal; branches in pairs at the lower nodes. Spikelets purple-tinged, with 4–6(–9) florets, often proliferating. Glumes unequal. Lemma densely hairy on keel and marginal veins, sparsely hairy on the surface between the veins, usually sparsely lanate at base. Keels of the palea ciliate below. $2n=22, 26, 28, 33$–$35, 37$–$40, 42$–$46, 56$. *Mountain pastures and exposed grassland. Mountains of Europe and locally at low altitudes in the north.* Al Au Br Bu Co Cz Fa Fe Ga Ge Gr Hb He Hs Is It Ju No Po Rm Rs (N, B, C, W) Sb Si Su.

Subsp. **insularis** (Parl.) Hayek, *Prodr. Fl. Penins. Balcan.* **3**: 264 (1933) (*P. bivonae* Parl. ex Guss.), a seldom collected and rather poorly understood variant of **43**, differs in having elongate leaves 4–7 mm wide, and shortly branched panicle with 2–5 branches at the lower nodes, glabrous lemma or lemma hairy on veins only, and keels of palea aculeolate. It occurs in the mountains of Sicilia and N.C. Greece.

INCERTAE SEDIS.

44. P. jubata A. Kerner, *Österr. Bot. Zeitschr.* **23**: 6 (1873) (*P. grimburgii* Hackel). Annual. Stems 12–27 cm, solitary, slender, smooth, purple-tinged at the base. Leaves up to 3 cm × 0·3–0·6 mm, folded. Ligule up to 2·5 mm, acute. Panicle up to 5 cm, lax, ellipsoid, with few spikelets; branches weakly scabrid, arising singly at the lower nodes. Spikelets with 4–11 florets, tinged with purple. Glumes unequal, the upper broadly ovate, subacute, wider than the lower. Lemma very densely long-hairy on keel and marginal veins, ciliate on intermediate veins, sparsely lanate at base. Keels of the palea ciliate along their whole length. Rhachilla smooth, glabrous. Anthers 0·6–0·7 mm. *Sandy ground, usually by the sea.* ● *W. coast of Balkan peninsula; one station in Turkey.* Al Gr Ju Tu.

45. P. flabellata (Lam.) Hooker fil., *Philos. Trans. Roy. Soc. London* **168**: 22 (1879). Densely caespitose perennial. Stems stout, 45–55(–150) cm × 4–12(–15) mm, flat to canaliculate; ligule 8–12 mm, acute or obtuse, usually lacerate. Panicle 8–21 × 1–4 cm, narrow, spike-like, dense. Spikelets with 1–4 florets. Glumes subequal, the lower 1-, the upper 3-veined. Lemma scabrid on the veins, with a scabrid terminal awn up to 2 mm. Keels of the palea aculeolate. Anthers 2·8–4 mm. *Naturalized in the Shetland Is.* [Br.] (*Southernmost South America.*)

APPARENTLY STABILIZED HYBRIDS.

46. P. × hartzii Gand., *Bull. Soc. Bot. Fr.* **66**: 302 (1920) (Probably **26 × 33**). Densely caespitose; shoots extravaginal. Stems (10–)15–25(–30) cm; leaves mostly basal, folded, *c.* 2·5 mm wide. Uppermost leaf with a distinct, elongate sheath. Ligule 2–3(–4) mm, acute. Panicle 3–5 cm, narrow, contracted; branches scabrid. Spikelets with 3–5 florets; lemma hairy on keel and marginal veins and between the veins. *Svalbard.* Sb. (*Greenland, arctic Canada.*)

47. P. × jemtlandica (Almq.) K. Richter, *Pl. Eur.* **1**: 84 (1890) (Probably **19 × 43**). Densely caespitose; shoots intra- and extravaginal. Stem 10–20 cm, with the remains of leaf-sheaths at the base. Leaves 1–2 mm wide, flat or folded, tapering gradually to the apex; ligule 1–2·5 mm, acute. Panicle 2–5 cm, lax, more or less ovoid. Spikelets rather few towards the apex of the panicle-branches, with 2–4 proliferating florets; lemma hairy on keel and marginal veins. $2n=c.\ 36$. *N. & W. Fennoscandia; Scotland.* Br ?Is No Rs (N) Su.

48. P. × nobilis Skalińska, *Acta Soc. Bot. Polon.* **24**: 751 (1955) (Probably **11 × 43**). Rhizomatous, with intra- and extravaginal shoots. Stem 30–40 cm, with few leaves. Leaves 2–3 mm wide; ligule *c.* 3 mm, subacute, sometimes lacerate. Panicle 4·5–8·5 cm, nodding at apex. Spikelets with 2 florets, the upper proliferating. Glumes unequal. Lemma densely crispate-hairy on keel and marginal veins. Keels of palea ciliate in lower half. $2n=c.\ 80$. ● *S. Poland (Tatra).* Po.

49. P. × taurica H. Pojark., *Nov. Syst. Pl. Vasc.* (*Leningrad*) **1965**: 51 (1965) (Probably **23 × 29**). Perennial, rhizomatous, laxly caespitose. Stem 25–40(–80) cm, geniculate-ascending, scabrid, distinctly compressed in upper part. Leaves 1–2·5 mm

wide, scabrid, flat to folded; ligule *c.* 1 mm, truncate. Panicle 3–7(–12) cm, with few spikelets; branches very scabrid. Spikelets with 2–4 florets. Lemma shortly hairy below on keel and marginal veins, not lanate at base. Keels of palea aculeolate. Anthers 1·4–1·5 mm. ● *Krym.* Rs (K).

17. **Bellardiochloa** Chiov.[1]

Perennial. Inflorescence a panicle. Spikelets laterally compressed, with 3–4 florets. Glumes 3-veined, keeled. Lemma 5-veined, keeled, with a short apical awn. Rhachilla and base of lemma with a ring of short, stiff hairs. Grain oblong; hilum basal, linear.

1. B. violacea (Bellardi) Chiov., *Stud. Veg. Piemonte* 60 (1929) (*Poa violacea* Bellardi, *Festuca rhaetica* Suter). Densely caespitose perennial (12–)20–50 cm. Leaves up to 0·8 mm wide, convolute-setaceous, glaucous; ligule 3–7 mm, acute, lacerate. Panicle 5–12 cm, oblong, contracted; branches scabrid, 3–7 together at lowest nodes. Spikelets violet-tinged, with 3–4 florets; glumes subequal. Lemma obscurely 5-veined, scabrid on the keel, shortly hairy at base of keel and on marginal veins, not lanate at base; awn up to *c.* 1 mm. Palea hairy on surface between the keels. $2n=14$. *Rocks, screes and dry grassland. Mountains of S. & C. Europe, from the Carpathians southwards to N. Spain, Sicilia and S. Greece.* ?Al Au Bu Co Cz Ga Gr He Hs It Ju Po Rm Rs (W) Si.

18. **Eremopoa** Roshev.[2]

Annuals. Leaves flat. Inflorescence a panicle. Spikelets terete or slightly compressed laterally, with (1–)2–many florets. Glumes unequal, membranous, shorter than the florets, the lower 1-veined, the upper 3-veined. Lemma indistinctly 5-veined. Palea shorter than lemma, 2-keeled.

1. E. altaica (Trin.) Roshev. in Komarov, *Fl. URSS* **2**: 431 (1934). Stems 10–40 cm, slender, usually simple. Leaves 1–3 mm wide, scabridulous above; ligule 1–2·5 mm. Panicle 4–10(–15) cm, lax, with branches in half whorls. Spikelets 3–5 mm. Glumes narrowly lanceolate, the lower 1 mm, the upper 1·5–2 mm. Lemma gradually narrowed to the acute apex. Anthers 0·3–0·5 mm. *S. Ural.* Rs (C). (*C. & S.W. Asia.*)

The European plant is subsp. **songorica** (Schrenk) Tzvelev, *Bot. Žur.* **51**: 1104 (1966) (*E. songorica* (Schrenk) Roshev.). The typical subspecies occurs in C. Asia.

19. **Catabrosella** (Tzvelev) Tzvelev[2]

Perennials, with tuberous, thickened stem-base. Leaves usually flat. Inflorescence a panicle. Spikelets laterally compressed, with 2–4 florets. Glumes unequal, the lower 1-veined, the upper 3-veined, shorter than the florets. Lemma 5-veined, scarious and erose above. Palea about as long as lemma, 2-keeled.

1. C. humilis (Bieb.) Tzvelev, *Bot. Žur.* **50**: 1320 (1965) (*Colpodium humile* (Bieb.) Griseb.). Caespitose; stems 5–15 cm, invested with dead sheaths at base. Leaves 0·6–2 mm wide, usually glabrous, smooth; ligule 0·8–3·5 mm. Panicle 2·5–7·5 cm, lax, with 2–5 smooth branches at a node. Spikelets 1·8–4 mm. Glumes lanceolate to ovate. Lemma oblong-ovate, shortly hairy on the back in the lower half. Anthers 1–1·7 mm. *S.E. part of U.S.S.R.* Rs (E). (*Temperate Asia.*)

[1] By J. R. Edmondson. [2] By T. G. Tutin.
[3] By W. E. Hughes and G. Halliday.

20. **Arctophila** Rupr. ex N. J. Andersson[2]

Perennials. Leaves flat. Inflorescence a usually lax panicle. Spikelets somewhat compressed laterally, with 2–7 florets. Glumes subequal, membranous, shorter than the spikelet, 1- to 3-veined. Lemma herbaceous, obtuse, obscurely 3- to 5-veined, shortly hairy at base. Rhachilla glabrous, usually prolonged, with a vestigial floret at the apex.

1. A. fulva (Trin.) N. J. Andersson, *Gram. Scand.* 49 (1852). Robust, with a thick brittle rhizome. Stems 15–80 cm, erect. Leaves 2–5(–10) mm wide, distichous on non-flowering shoots, purplish, smooth, long-acute, the upper usually much longer than the lower; sheaths smooth, usually imbricate; ligule up to 5 mm, truncate, usually lacerate. Panicle up to 17 cm; branches usually long, the lower often deflexed, smooth. Spikelets 2·5–7 mm. Glumes ovate, with a broadly scarious apex. Lemma with a broadly scarious apex. Anthers *c.* 1·3 mm. $2n=42$. *Wet places. Arctic and subarctic Europe, southwards to* 64° 50′ *N. in Finland.* Fe Rs (N) Sb Su.

21. **Puccinellia** Parl.[3]

(*Atropis* Rupr.)

Perennials, biennials or annuals. Leaf-sheaths open. Inflorescence a panicle. Spikelets with (2–)3–10 imbricate florets. Glumes usually unequal, oblong, obtuse, shorter than lemma; lower glume 1(–3)-veined; upper glumes 3-veined. Lemma 5-veined, usually oblong, obtuse, often ciliolate to erose at apex, rounded, rarely keeled, on back. Palea equalling or almost equalling lemma, 2-keeled. Grain glabrous, with a sub-basal, punctiform hilum, falling with lemma and palea.

Evidence for the existence of the numerous hybrids which have been reported is slight.

1 Stolons present, rooting at nodes
 2 Leaves usually more than 3 cm; veins of lemma hairy; keels of palea scabrid; stolons extravaginal **4. maritima**
 2 Leaves not more than 3 cm; veins of lemma glabrous; keels of palea smooth; stolons intravaginal **5. phryganodes**
1 Stolons usually absent
 3 Lower glume ⅔ as long as lemma; lemma with straight, divergent veins **13. vahliana**
 3 Lower glume less than ⅔ as long as lemma; lemma with curved, convergent veins
  4 Leaves flat
   5 Lemma 2·75–4 mm, with conspicuous veins **12. rupestris**
   5 Lemma 1·5–2·5 mm
    6 Lemma with inconspicuous veins **1. distans**
    6 Lemma with conspicuous veins **3. fasciculata**
  4 Leaves plicate or convolute
   7 Anthers (0·8–)1·2–3·5(–4) mm
    8 Lemma 1·5–2·5 mm **3. fasciculata**
    8 Lemma (2–)2·5–3·5(–4) mm **(6–10). festuciformis group**
   7 Anthers 0·3–1 mm
    9 Lemma conspicuously hairy in lower half, especially on the veins **11. angustata**
    9 Lemma glabrous to minutely hairy
     10 Lemma glabrous or very sparsely hairy at base **2. tenella**
     10 Lemma minutely hairy at base
      11 Inflorescence-branches usually all long and lacking spikelets for up to half their length; mid-vein of lemma not reaching apex **1. distans**
      11 Inflorescence-branches, at least the short ones, with spikelets to base; mid-vein of lemma reaching apex **3. fasciculata**

Subgen. **Puccinellia**. Leaf-epidermis differentiated into long and short cells. Rhachilla stout, not thickened at insertion of

florets. Glumes very unequal in length. Lemma longer than glumes, usually with not very prominent convergent veins.

1. P. distans (L.) Parl., *Fl. Ital.* **1**: 367 (1850) (*Glyceria distans* (L.) Wahlenb., *Atropis distans* (L.) Griseb.). Caespitose perennial; stems 4–65 cm, erect to decumbent. Leaves up to 10 cm. Inflorescence up to 18 cm, narrowly lanceolate to broadly pyramidal, contracted or spreading; branches 2–6 at each node, smooth to coarsely scabrid, lacking spikelets for up to half their length, usually becoming deflexed after anthesis. Spikelets with 3–9 florets, green or purple-tinged. Glumes acute or subacute, the lower 0·5–1·5 mm, the upper 1–2·5 mm. Lemma exceeding glumes, minutely hairy at base. *Saline habitats; occasionally as a weed inland. Almost throughout Europe.* All except ?Al Az Co Cr Sa Sb Si.

1 Lemma 2·2–4 mm — (d) subsp. **borealis**
1 Lemma 1·5–2·8 mm
2 Anthers 0·3–0·6 mm — (c) subsp. **hauptiana**
2 Anthers 0·5–1 mm
3 Leaves conduplicate; spikelets usually purplish — (b) subsp. **limosa**
3 Leaves ±flat; spikelets usually greenish-yellow — (a) subsp. **distans**

(a) Subsp. **distans** (*P. retroflexa* (Curtis) Holmberg): Leaves flat. Inflorescence-branches long, scabrid. Spikelets green. Lower glume 1–1·5 mm, the upper 1·5–2·5 mm. Lemma 1·5–2·8 mm, greenish-yellow. Palea equalling lemma. $2n=42$. *Almost throughout the range of the species.*

(b) Subsp. **limosa** (Schur) Jáv. in Soó & Jáv., *Magyar Növ. Kéz.* **2**: 928 (1951) (*P. limosa* (Schur) Holmberg): Like subsp. (a) but leaves less than 2 mm wide, more or less conduplicate; spikelets usually purplish. $2n=28$. ● *S.E. & C. Europe, from C. Germany to Moldavia.*

(c) Subsp. **hauptiana** (Trin. ex V. Krecz.) W. E. Hughes, *Bot. Jour. Linn. Soc.* **76**: 363 (1978) (*Atropis hauptiana* Trin. ex V. Krecz.): Like subsp. (a) but lower glume 0·5–1 mm, the upper 1–2·2 mm; palea shorter than lemma; anthers 0·3–0·6 mm. $2n=28, 42$. *N. & E. Russia.*

(d) Subsp. **borealis** (Holmberg) W. E. Hughes, *loc. cit.* (1978) (*P. retroflexa* subsp. *borealis* Holmberg, *P. capillaris* (Liljeblad) Jansen, *P. retroflexa* sensu Holmberg, non *Poa retroflexa* Curtis): Like subsp. (a) but leaves often plicate; inflorescence-branches usually short; lemma 2·2–4 mm. $2n=42$. *Coasts of N. & W. Europe, southwards to the Netherlands.*

2. P. tenella (Lange) Holmberg, *Meddel. Grønl.* **58**: 45 (1926) (*Atropis tenella* (Lange) V. Krecz.). Caespitose; stems up to 11 cm, procumbent to ascending. Leaves 2–4 cm, conduplicate. Inflorescence up to 7 cm, scarcely exserted, narrow; branches smooth or scabrid above. Spikelets with 2–6 florets. Lower glume 0·9–1·4 mm, the upper 1·3–1·8 mm. Lemma 1·9–2·5 mm, glabrous or very sparsely hairy at base. Keels of palea usually smooth. Anthers 0·5 mm. $2n=42$. *Seashores. Arctic Europe* (*Vajgač, Svalbard*). Rs (N) Sb. (*Circumpolar.*)

The plants from Svalbard, with the keels of the palea spinulose, have been distinguished as **P. svalbardensis** Rönning, *Kong. Norske Vid. Selsk. Skr.* (*Trondhjem*) **1961(4)**: 9 (1963). They probably do not merit specific rank.

3. P. fasciculata (Torrey) E. P. Bicknell, *Bull. Torrey Bot. Club* **35**: 197 (1907) (*P. borreri* (Bab.) Hayek, *Glyceria borreri* Bab.). More or less caespitose perennial, rarely biennial. Leaves up to 20 cm, somewhat glaucous, flat or plicate. Inflorescence 2–18 cm, lanceolate to ovate; branches 2–4 at each node, somewhat scabrid, at least the short ones with spikelets to the base. Spikelets with 3–8 florets. Lower glume 1–2 mm; upper glume 1·5–2 mm. Lemma 1·5–2·5 mm, minutely hairy at base. *Salt-marshes. W. Europe, northwards to the Netherlands; N.E. Italy and N.W. Jugoslavia.* Be Br Ga Hb Ho Hs It Ju Lu Sa Si.

(a) Subsp. **fasciculata**: Stems up to 85 cm. Ligule 1–2·5 mm. Inflorescence-branches patent. Lemma with entire margins. Palea as long as lemma. Anthers 0·4–0·8 mm. Grain 1–1·5 mm. $2n=28$. *Throughout the range of the species.*

(b) Subsp. **pungens** (Pau) W. E. Hughes, *Bot. Jour. Linn. Soc.* **76**: 363 (1978) (*P. pungens* (Pau) Paunero, *Glyceria pungens* Pau): Stems 6–25(–30) cm. Ligule 0·5 mm. Inflorescence-branches more or less erect. Lemma with erose-ciliolate margins. Palea slightly shorter than lemma. Anthers 1·25–1·75 mm. Grain *c.* 2 mm. ● *E. Spain* (*Laguna de Gallocanta, S. of Calatayud*).

4. P. maritima (Hudson) Parl., *Fl. Ital.* **1**: 370 (1850) (*Atropis maritima* (Hudson) Griseb., *Glyceria maritima* (Hudson) Wahlenb., *G. foucaudii* (Hackel) Coste). Robust perennial with extravaginal stolons; stems up to 30(–80) cm, erect or ascending. Leaves more than 3 cm, flat or plicate. Inflorescence up to 25 cm, rather narrow; branches smooth or scabrid above. Spikelets with 4–10 imbricate florets. Lower glume 1·5–2·8 mm, the upper 2–4·2 mm. Lemma 2·7–4·6 mm, usually hairy in the lower half, at least on the veins. Keels of palea spinulose. Anthers 1·5–2·5 mm. $2n=56$ (14, 42, 49, 60, 63, 70, 77). *Salt-marshes. Coasts of W. Europe and the Baltic region; probably introduced in arctic Russia.* Be Br ?Co Da Fa Ga Ge Hb Ho Hs Is ?It Lu No Po Rs (*N, B) ?Sa Su.

All records from the Mediterranean region require confirmation.

5. P. phryganodes (Trin.) Scribner & Merr., *Contr. U.S. Nat. Herb.* **13**: 78 (1910) (*Atropis phryganodes* (Trin.) V. Krecz.). Like **4** but stolons intravaginal; leaves rarely more than 3 cm; flowering stems up to 7 cm, rarely present; spikelets with not more than 4 florets; lower glume 1·2–1·7 mm, the upper 1·5–2·5 mm; lemma 1·5–2·5 mm; keels of palea smooth; anthers indehiscent. $2n=28$. *Salt-marshes. Arctic Europe; Gulf of Bothnia* (*near Oulu*). Fe No Rs (N) Sb.

(6–10). P. festuciformis group. Caespitose, often glaucous perennials. Leaves folded; ligule ovate, acute. Panicle-branches 2–6 at each node; panicle more or less contracted. Spikelets often purple- or violet-tinged.

A group of closely related species requiring further study.

1 Inflorescence-branches smooth
2 Keels of palea ciliolate only towards apex — **10. tenuissima**
2 Keels of palea ciliolate only at base — **8. gigantea**
1 Inflorescence-branches scabrid
3 Glumes ±acute — **7. dolicholepis**
3 Glumes obtuse
4 Upper glume 1·5–2 mm — **9. poecilantha**
4 Upper glume 2·8–3·5 mm — **6. festuciformis**

6. P. festuciformis (Host) Parl., *Fl. Ital.* **1**: 368 (1850). Stems up to 60 cm. Leaves up to 2·5 mm wide. Inflorescence up to 15 cm, the branches scabrid, often deflexed after anthesis. Spikelets with 5–11 florets. Glumes obtuse, the upper 2·8–3·5 mm. Lemma 2–4 mm, with a wide scarious margin. Anthers 0·8–2·5 mm. $2n=35$. *Salt-marshes. S. & S.C. Europe.* Au Bu Co Ga Gr Hs Hu It Ju Lu Rm Rs (W, K, E) Sa Si Tu.

1 Inflorescence not secund
2 Anthers 0·8–1·2 mm — (d) subsp. **tenuifolia**
2 Anthers 1·2–2·3 mm — (b) subsp. **convoluta**
1 Inflorescence secund
3 Lower glume 2·5–3 mm; anthers 2–2·5 mm — (a) subsp. **festuciformis**

3 Lower glume 1·5–2·5 mm; anthers 1·5–2 mm
(c) subsp. **intermedia**

(a) Subsp. **festuciformis** (*P. teyberi* Hayek, *P. palustris* (Seenus) Hayek): Leaves setaceous, scabrid towards the apex. Inflorescence secund, the branches deflexed after anthesis. Spikelets ovate-lanceolate. Glumes ovate, the lower 2·5–3 mm. Lemma 3–3·5 mm. Anthers 2–2·5 mm. *From Portugal to E. Bulgaria.*

(b) Subsp. **convoluta** (Hornem.) W. E. Hughes, *Bot. Jour. Linn. Soc.* **76**: 363 (1978) (*P. convoluta* (Hornem.) Hayek, *Atropis convoluta* (Hornem.) Griseb., *Glyceria convoluta* (Hornem.) Fries, *Poa convoluta* Hornem.). Like subsp. (a) but leaves wider, smooth; glumes ovate-lanceolate to lanceolate; lemma 2–3·5 mm; anthers 1·2–2·3 mm. *Throughout most of the range of the species.*

(c) Subsp. **intermedia** (Schur) W. E. Hughes, *loc. cit.* (1978) (*P. salinaria* (Simonkai) Holmberg; *Atropis intermedia* Schur): Like subsp. (a) but leaves smooth above, more or less scabrid below; inflorescence secund; spikelets linear-lanceolate; lower glume 1·5–2·5 mm; lemma 2–2·5 mm; anthers 1·5–2 mm. ● *From E. Austria to E. Romania.*

(d) Subsp. **tenuifolia** (Boiss. & Reuter) W. E. Hughes, *Bot. Jour. Linn. Soc.* **76**: 364 (1978) (*Glyceria tenuifolia* Boiss. & Reuter): Like subsp. (a) but leaves filiform, scabrid beneath; inflorescence not secund, the branches erect, becoming slightly patent after anthesis; spikelets oblong; lower glume 1–1·2 mm; lemma 2–2·3 mm; anthers 0·8–1·2 mm. *S.W. Europe.*

7. P. dolicholepis (V. Krecz.) V. Krecz. ex Pavlov, *Fl. Kazakhstana* **1**: 243 (1956) (*Atropis dolicholepis* V. Krecz.). Stems up to 60 cm. Inflorescence up to 20 cm, the branches scabrid, patent after anthesis. Spikelets linear to linear-lanceolate, with 3–5 florets. Lower glume 1·5–2·5 mm, lanceolate, more or less acute, the upper 2·5–3 mm. Lemma 3–3·5 mm. Keels of palea ciliolate towards the base. Anthers 1–1·5 mm. *Saline habitats. S. & S.E. Russia, W. Kazakhstan.* Rs (C, E).

8. P. gigantea (Grossh.) Grossh., *Fl. Kavk.* **1**: 114 (1928) (*Atropis chilochloa* V. Krecz. pro parte, *A. sclerodes* V. Krecz.). Stems up to 80 cm. Inflorescence up to 20 cm, the branches smooth, erect, somewhat spreading after anthesis. Spikelets narrowly oblong, with 4–7 florets. Lower glume 1–1·7 mm, the upper 1·5–2·5 mm. Lemma 2·5–3 mm, hairy on the veins in the lower half. Keels of palea more or less ciliolate towards the base. Anthers 1·2–1·6 mm. *Saline habitats. S. & S.E. parts of U.S.S.R.* Rs (C, W, K, E).

9. P. poecilantha (C. Koch) Grossh., *Opred. Rast. Kavk.* 706 (1949) (*Atropis poecilantha* (C. Koch) V. Krecz., *A. chilochloa* V. Krecz. pro parte). Stems up to 40 cm. Inflorescence 10–15 cm, the branches scabrid, deflexed after anthesis. Spikelets oblong, with 6–9 florets. Glumes obtuse, the lower 1–1·5 mm, oblong-ovate, the upper 1·5–2 mm. Lemma 2·5–3 mm. Keels of palea ciliolate towards the top. Anthers 1·5–2 mm. *Saline habitats. S.E. Russia, W. Kazakhstan.* Rs (E).

10. P. tenuissima (V. Krecz.) V. Krecz. ex Pavlov, *Fl. Kazakhstana* **1**: 242 (1956) (*Atropis tenuissima* V. Krecz.). Stems up to 50 cm. Leaves filiform. Inflorescence 5–15 cm, contracted, the branches smooth. Spikelets elliptical, with 3–5 florets. Lower glume 0·7–1 mm, the upper 1·5–1·7 mm. Lemma 2 mm. Keels of palea ciliolate towards the apex. Anthers 1·2–1·5 mm. *Saline habitats. S.E. Russia.* Rs (C, E).

11. P. angustata (R. Br.) Rand & Redf., *Fl. Mount Desert Is. Maine* 181 (1894) (*Atropis angustata* (R. Br.) Griseb.). Caespitose; stems up to 15(–25) cm, usually erect. Inflorescence purplish, well-exserted; branches sometimes patent, scabrid at least above. Spikelets with (2–)3–5 florets. Lower glume (0·9–)1·1–1·9(–2·4) mm, the upper (1·8–)2·1–3·1 mm. Lemma 2·8–3·6 (–3·9) mm, conspicuously hairy in the lower half, especially on the veins. Keels of palea strongly spinulose-hairy. Anthers 0·5–0·8 mm. $2n=42$. *Open habitats, especially on saline clay. N.E. Russia; Svalbard.* Rs (N) Sb. (*Circumpolar.*)

12. P. rupestris (With.) Fernald & Weatherby, *Rhodora* **18**: 10 (1916) (*Glyceria procumbens* (Curtis) Dumort.). Annual or biennial. Stems 4–40 cm, erect or ascending. Inflorescence 2–10 cm, rigid, usually dense, strongly secund; branches erecto-patent, scabridulous. Spikelets narrowly oblong, subsessile, with 3–5 florets. Lower glume 1·25–3 mm, 1- to 3-veined. Anthers 0·75–1 mm. $2n=42$. *Damp places near the sea; inland on damp sands in Spain.* ● *W. Europe, from England and the Netherlands to C. Spain.* Be Br Ga Ho Hs.

Subgen. **Pseudocolpodium** (Tzvelev) W. E. Hughes. Leaf-epidermis not differentiated into long and short cells. Rhachilla slender, abruptly thickened at insertion of florets. Glumes subequal. Lemma about as long as glumes, with straight, divergent veins.

13. P. vahliana (Liebm.) Scribner & Merr., *Contr. U.S. Nat. Herb.* **13**: 78 (1910) (*Colpodium vahlianum* (Liebm.) Nevski). Caespitose perennial; stems up to 12(–15) cm, erect. Leaves erect, usually bright green. Inflorescence *c.* 2 cm, compact, usually purple; branches smooth, the pedicels conspicuously thickened apically. Spikelets with 2–5 florets. Glumes strongly veined, the lower 2·1–3 mm, ⅔ as long as the adjacent lemma, the upper 2·3–3·5 mm. Lemma 3·4–4·3 mm, with 5 straight, divergent veins, densely hairy in lower half, especially on the veins. Keels of palea strongly spinulose-hairy. Anthers 0·8–1·2 mm. $2n=14$. *Damp, open habitats. Svalbard.* Sb. (*Circumpolar.*)

× Pucciphippsia Tzvelev[1]
(*Phippsia* × *Puccinellia*)

Like *Puccinellia* but with a small compact panicle and usually 2 florets in a spikelet. Sterile.

Literature: O. Hedberg, *Bot. Tidsskr.* **58**: 157–162 (1962).

1. × P. vacillans (Th. Fries) Tzvelev, *Nov. Syst. Pl. Vasc. (Leningrad)* **8**: 76 (1971). Caespitose perennial. Stems up to 10(–15) cm. Leaves flat. Inflorescence-branches 5–8 at each node, smooth; panicle contracted before and after anthesis. Spikelets with (1–)2 florets and rarely with up to 2 vestigial florets. Glumes persistent, the lower 0·4–0·7 mm, the upper 0·8–1·3 mm. Lemma 1·8–2·4 mm, strongly keeled, stiffly hairy in the lower half, especially on the veins. Keels of palea spinulose. Anthers *c.* 0·75 mm, sterile. $2n=21$. *Damp, open habitats. Svalbard.* Sb. (*Novaja Zemlja; arctic Canada.*)

The parentage and hybrid status of this taxon have been much disputed but it is probably *Phippsia algida* × *Puccinellia vahliana.*

22. Phippsia R. Br.[2]

Perennials. Leaves flat. Inflorescence a panicle. Spikelets usually with 1 floret. Glumes less than ¼ as long as the floret, often caducous. Lemma 3-veined, keeled. Palea distinctly 2-keeled. Stamens 1 or 2.

Lemma glabrous or weakly hairy in lower half; panicle 1–2 cm, spike-like **1. algida**

[1] By G. Halliday and W. E. Hughes. [2] By G. Halliday.

Lemma densely and stiffly hairy in lower half; panicle 1·5–4 cm, usually pyramidal **2. concinna**

1. P. algida (Solander) R. Br. in Parry, *Jour. Voy. N.W. Pass., Suppl. App.* 284 (1824). Caespitose. Stems 2·5–8 cm, usually scarcely exceeding the leaves, often procumbent. Leaves 1–2 mm wide, rounded at apex; ligule 1·2–1·6 mm, triangular. Panicle 1–2 cm × 3–5 mm, dense; branches smooth. Glumes 0·3–0·6 mm, the lower smaller, usually caducous, the upper sometimes so. Lemma 1·3–1·6(–1·8) mm, broadly ovate, glabrous or somewhat hairy in the lower half, especially on the veins, often violet, with a wide, purplish-brown, hyaline margin and apex. Palea almost equalling lemma, glabrous or spinulose on the keels. Stamens (1–)2; anthers 0·3–0·5 mm. Grain dark brown, equalling the palea, widest at or just above the middle. $2n=28$. *Damp, open habitats; nitrophilous. Arctic Europe, Iceland and mountains of Fennoscandia.* Fe Is No Rs (N) Sb Su.

2. P. concinna (Th. Fries) Lindeb., *Bot. Not.* **1898**: 155 (1898). Like **1** but stems up to 15(–25) cm, well-exserted from the leaves; panicle 1·5–4 cm × 10–30 mm, usually pyramidal with patent branches; both glumes usually caducous; lemma and keels of palea densely and stiffly hairy; stamens usually 1; grain widest below the middle. $2n=28$. *Damp, open habitats. Svalbard and arctic Russia; mountains of Fennoscandia from* 62° *to* 63° 15′ *N.* No Rs (N) Sb Su.

Plants from Fennoscandia are generally smaller than those from Svalbard and have narrower panicles. They have been described as var. *algidiformis* (H. Sm.) Holmberg. In Russia this name has been applied to similar plants intermediate between **1** and **2**, of supposed hybrid origin and occurring with the putative parents. The status of such plants requires investigation as do also the occasional reports of sterile hybrids between **1** and **2**.

23. Sclerochloa Beauv.[1]

Annuals. Leaves flat. Inflorescence a raceme or with few, usually simple, racemose branches near the middle. Spikelets with 3–5 florets, the lower 2–3 fertile and the upper 1–3 male or sterile, disarticulating tardily below each floret or pedicel. Glumes strongly keeled. Lemma with 5–7 prominent, thick veins, strongly keeled, rounded to emarginate, chartaceous, with broad hyaline margin. Palea almost equalling lemma, 2-veined, very strongly 2-keeled, tapering to apex. Anthers slightly exserted at anthesis. Grain 2·5–3·5 mm including a stylopodium 0·7–1 mm, narrowly triangular-ovoid, more or less trigonous, free, glabrous; hilum punctiform, basal.

1. S. dura (L.) Beauv., *Agrost.* 98, 177 (1812). Stems up to 16 cm, procumbent to erect. Inflorescence 1–4 cm, rigid, more or less secund; pedicels stout, up to 1 mm. Spikelets 6–10 mm, narrowly oblong, crowded. Glumes somewhat asymmetrical, glabrous, oblong-ovate, with wide hyaline margins; lower glume 2–3 mm, obtuse to emarginate, with (1–)3(–5) veins; upper glume 3·5–5 mm, rounded to emarginate, with (5–)7–9 veins. Lowest lemma 4·8–6 mm, the upper much shorter, glabrous, rounded to emarginate, sometimes very shortly mucronate. Anthers 0·8–1·5 mm. Lowest rhachilla-segments 2–2·5 mm, the upper shorter. $2n=14$. *Dry places. S. & S.C. Europe, but absent from the islands; S. part of U.S.S.R.; casual and perhaps locally naturalized further north.* Au Bu Cz Ga Ge Gr He Hs Hu It Ju Po Rm Rs (*C, W, K, E) Tu [Po].

[1] By C. A. Stace. [2] By T. G. Tutin. [3] By G. Halliday.

24. Dupontia R. Br.[2]

Perennials. Leaves folded or flat. Inflorescence a panicle. Spikelets somewhat compressed laterally, with 1–4(–5) florets. Glumes subequal, about as long as the spikelet, membranous, with a wide hyaline margin. Lemma finely 3(5)-veined, the lateral veins extending to about the middle, the middle vein sometimes excurrent as a mucro or short awn, scarious, usually hairy in the lower part, bearded at base. Palea shorter than lemma.

Glumes truncate, obtuse; lemma with long hairs at base and short hairs on the whole surface; stamens *c.* 2 mm **1. fisheri**
Glumes acuminate; lemma with long hairs at base, otherwise glabrous; stamens *c.* 3 mm **2. psilosantha**

1. D. fisheri R. Br. in Parry, *Jour. Voy. N.W. Pass., Suppl. App.* 291 (1824). Rhizomatous. Stems 10–25(–40) cm, rather stout. Leaves 1–4 mm wide, smooth and glabrous, longitudinally folded; sheaths often purplish; ligule *c.* 1 mm, truncate. Panicle 2–5(–12) cm; branches erect or sometimes patent or the lower deflexed. Spikelets *c.* 4 mm, usually with 2 florets. Glumes and lemma purple, with golden hyaline margins. Glumes ovate-lanceolate to ovate, truncate, obtuse. Lemma with long hairs at base and short hairs on the surface, unawned. Stamens *c.* 2 mm. $2n=88$. *Wet tundra. Svalbard, Arctic Russia.* Rs (N) Sb. (*Circumpolar.*)

2. D. psilosantha (Rupr.) Griseb. in Ledeb., *Fl. Ross.* **4**: 386 (1852). Like **1** but spikelets 5–8 mm, usually with 1 floret; glumes acuminate; lemma with long hairs at base, otherwise glabrous, usually mucronate or awned; stamens *c.* 3 mm. $2n=44$. *Wet tundra. Svalbard, Arctic Russia.* Rs (N) Sb. (*Circumpolar.*)

Plants intermediate between **1** and **2** are of fairly frequent occurrence and further work may show that **2** should be regarded as a variety of **1**.

25. Arctagrostis Griseb.[3]

Robust, rhizomatous perennials. Leaves flat. Inflorescence a narrow panicle. Spikelets with 1 floret. Glumes subequal, the upper up to ¾ as long as the floret. Lemma 3-veined, the midvein occasionally excurrent from the back as a short mucro. Palea similar to the lemma, indistinctly 2-keeled.

1. A. latifolia (R. Br.) Griseb. in Ledeb., *Fl. Ross.* **4**: 434 (1852). Stems 10–70 cm, rigid, with persistent yellowish-brown sheaths below and on the rhizome. Leaves up to 18 cm × 2–7 mm, acute, finely scabrid; ligule 3–5 mm, broadly rounded, entire. Inflorescence 4–13 cm × 6–20 mm, dense, often somewhat interrupted below; branches scabrid. Spikelets purplish. Glumes ovate-lanceolate, usually glabrous. Lemma 3·5–5·5 mm, lanceolate, acute, scabrid, with a scarious, entire or slightly erose apex; lateral veins indistinct. Palea almost equalling the lemma. Anthers 1·5–2·5 mm. $2n=56$, ?62. *Wet tundra. Arctic Europe, extending southwards to c.* 65° *N. in N. Ural.* Fe No Rs (N) Sb.

26. Dactylis L.[2]

Perennials. Leaves flat or involute. Inflorescence a panicle with spikelets in dense clusters on the patent to erect branches. Spikelets laterally compressed, with 2–5 florets. Glumes subequal, keeled, somewhat curved, the lower 1-, the upper 3-veined. Lemma 5-veined, chartaceous, mucronate or shortly awned at apex. Palea about as long as lemma.

Literature: K. Domin, *Acta Bot. Bohem.* **14**: 3–147 (1943).

G. L. Stebbins & M. Zohary, *Univ. Calif. Publ. Bot.* **31(1)**: 1–39 (1959).

1. D. glomerata L., *Sp. Pl.* 71 (1753). Caespitose, often glaucous. Stems up to 100(–200) cm, erect or decumbent; non-flowering shoots usually strongly compressed. Leaves scabrid; ligule 2–10 mm, acute or lacerate. Panicle 1–15(–26) cm. Spikelets 5–9 mm. Glumes lanceolate to ovate, long-acute, scabrid or ciliate on the keel. Lemma lanceolate, scabrid or ciliate on the keel, the lowest 3–7 mm. Anthers 3–4 mm. $2n=14$, $28+0$–$4B$. *Meadows, roadsides, open woodland and stony hillsides. Almost throughout Europe, though probably introduced in parts of the north.* All except Sb.

A very variable species which, owing to its agricultural importance, has been studied intensively in some parts of its range. It includes diploids and tetraploids, which can usually be distinguished from one another by the size of their stomata and pollen-grains; in other characters there seems to be largely parallel variation.

Several of these variants have been given specific or subspecific rank but most of them do not seem to be clearly distinguishable except by chromosome number, average characteristics of populations and behaviour in cultivation. In the present state of knowledge a formal taxonomic treatment of these populations at specific or subspecific rank does not seem possible.

The most widespread of the diploids in Europe is **D. glomerata** subsp. **aschersoniana** (Graebner) Thell., *Allgem. Bot. Zeitschr.* **17**: 34 (1911) (*D. polygama* Horvátovszky, *D. aschersoniana* Graebner), which occurs mainly in W. & C. Europe. More local are subsp. **woronowii** (Ovcz.) Stebbins & Zohary, *Univ. Calif. Publ. Bot.* **31(1)**: 9 (1959) (*D. woronowii* Ovcz.), which is doubtfully recorded from Krym, subsp. **reichenbachii** (Hausm. ex Dalla Torre & Sarnth.) Stebbins & Zohary, *loc. cit.* (1959), from the mountains of N. Italy, subsp. **ibizensis** Stebbins & Zohary, *op. cit.* 12 (1959), from Islas Baleares (Ibiza), subsp. **juncinella** (Bory) Stebbins & Zohary, *op. cit.* 13 (1959), from S. Spain (Sierra Nevada, 2200–2900 m) and subsp. **lusitanica** Stebbins & Zohary, *loc. cit.* (1959), from C. Portugal.

Tetraploid populations have been divided into subsp. **glomerata**, which occurs throughout the range of the species, except the south, subsp. **hispanica** (Roth) Nyman, *Consp.* 819 (1882) (incl. subsp. *rigida* (Boiss. & Heldr.) Hayek), in the southern and western parts of the range of the species, and **D. marina** Borrill, *Jour. Linn. Soc. London* (*Bot.*) **56**: 437 (1961), from coastal habitats in Portugal and the Mediterranean region.

D. glomerata subsp. **slovenica** Domin in Domin & Podp., *Klíč Úplné Květeně Rep. Česk.* 903 (1928), from the W. Carpathians, has stems 100–200 cm, with a swollen tuberous base, and a panicle 20–26 cm. It probably represents another tetraploid population.

27. Beckmannia Host[1]

Inflorescence of racemosely arranged, simple or sparingly branched, dense unilateral spikes. Spikelets somewhat laterally compressed, obovate in outline, subsessile, in 2 rows on the rhachis. Glumes a little shorter than lemma, navicular, more or less inflated, deciduous. Lemma lanceolate. Palea 2-keeled. Lodicules acuminate. Ovary glabrous; styles short.

Flowering stems usually tuberous at base; spikelets with 2 fertile florets; glumes strongly inflated; anthers *c.* 1·8 mm **1. eruciformis**
Flowering stems not tuberous at base; spikelets with 1 fertile floret; glumes slightly inflated; anthers *c.* 0·8 mm **2. syzigachne**

[1] By T. G. Tutin.

1. B. eruciformis (L.) Host, *Gram. Austr.* **3**: 5 (1805). Perennial; flowering stems 30–150 cm, usually tuberous at base. Leaves 4–10 mm wide, flat, scabrid; sheaths ribbed; ligule 5–8 mm, acute. Inflorescence usually 18–25 cm; spikes 1–3 cm, erect to erecto-patent. Spikelets 2·5–3 mm, obovate in outline, with 2 fertile florets. Glumes equal, strongly inflated, with a green or rarely purplish keel, whitish coriaceous sides and scarious margin. Lemma usually shortly mucronate, puberulent on the back. Anthers *c.* 1·8 mm. $2n=14$. *Damp ground and in shallow water. E. & E.C. Europe, extending westwards to Italy.* Al Bu Cz Gr Hu It Ju Rm Rs (N, B, C, W, K, E) Tu [Ge].

(a) Subsp. **eruciformis**: Laxly caespitose, with creeping rhizomes. Basal internode of stems tuberous. *Throughout most of the range of the species.*

(b) Subsp. **borealis** Tzvelev, *Nov. Syst. Pl. Vasc.* (*Leningrad*) **10**: 81 (1973): Densely caespitose, without creeping rhizomes. Basal internode of stems not tuberous. *N. & E. Russia.*

2. B. syzigachne (Steudel) Fernald, *Rhodora* **30**: 27 (1928). Like **1** but annual; stems 30–120 cm, never tuberous at base; spikes up to 2 cm; spikelets with 1 fertile and sometimes 1 sterile floret; glumes slightly inflated; lemma glabrous on the back. Anthers *c.* 0·8 mm. *Wet places. S. Ural* (*near Bajmak*). Rs (C). (*Temperate Asia and North America.*)

28. Cynosurus L.[1]

Perennials or annuals. Leaves flat. Inflorescence a more or less unilateral condensed panicle. Spikelets dimorphic, the fertile laterally compressed, with 1–5 florets, the sterile below the fertile and consisting of narrow, rigid glumes and lemmas. Glumes of fertile spikelets thin, subequal, acute. Lemma chartaceous, with an apical awn. Palea 2-keeled, shortly 2-fid at apex, about as long as lemma.

1 Perennial; lemma of fertile spikelet with awn shorter than the lemma **1. cristatus**
1 Annual; lemma of fertile spikelet with awn longer than the lemma
2 Awns of glumes and lemmas of sterile spikelet 15–20 mm, pink at base; uppermost sheath usually reaching or enclosing base of inflorescence at anthesis **4. callitrichus**
2 Awns of glumes and lemmas of sterile spikelet 6–15 mm; uppermost sheath far below the inflorescence at anthesis
3 Leaves 3–9 mm wide; panicle dense; upper lemmas of sterile spikelets not much shorter and wider than lower **2. echinatus**
3 Leaves 1–3 mm wide; panicle rather lax; upper lemmas of sterile spikelets much shorter and wider than lower **3. elegans**

1. C. cristatus L., *Sp. Pl.* 72 (1753). Perennial. Stems 15–75 (–90) cm, wiry. Leaves 0·5–2 mm wide; sheaths smooth, the uppermost far below the inflorescence at anthesis; ligule *c.* 1 mm. Panicle up to $7(-8·5)\times 0·7$ cm, narrowly oblong, with flat, zig-zag axis. Spikelets 3–5 mm, distichous. Glumes and lemmas of sterile spikelets linear-lanceolate, shortly awned, membranous, with green, ciliate keel, the upper lemmas similar to but shorter than the lower. Lemmas of fertile spikelets lanceolate, obscurely veined, shortly awned, more or less hairy. $2n=14$. *Meadows and pastures. Most of Europe.* All except Bl Cr Fa Is Sb.

2. C. echinatus L., *Sp. Pl.* 72 (1753). Annual. Stems (10–) 20–60 cm, smooth. Leaves 3–9 mm wide; sheaths smooth, the uppermost not reaching the inflorescence at anthesis; ligule 2–4 mm. Panicle $1–4\times 0·7–1·5$ cm (excluding awns), ovoid to oblong, unilateral, dense. Spikelets 8–10 mm. Glumes and lemmas of

sterile spikelets narrow, the upper not much shorter and wider than the lower, all with awns 6–15 mm. Lemmas of fertile spikelets lanceolate, 5-veined, bidentate at apex, with a long awn from the sinus. $2n=14$. *Cultivated fields and dry, open habitats. S. Europe; naturalized in C. Europe and casual further north.* Al Az Bl Bu Co Cr Ga Gr He Hs It Ju Lu Rm Rs (W, K) Sa Si Tu [Au Cz Ge Hu].

3. C. elegans Desf., *Fl. Atl.* **1**: 82 (1798) (incl. *C. polybracteatus* auct., non Poiret). Like **2** but usually smaller; leaves 1–3 mm wide; panicle usually rather lax and lobed; upper lemmas of sterile spikelets much shorter and wider than the lower, resembling the lemmas of the fertile spikelets. $2n=14$. *Mediterranean region, Portugal.* Bl Co Cr Ga Gr Hs It Lu Sa Si.

4. C. callitrichus W. Barbey, *Herb. Levant.* 165 (1882). Like **2** but uppermost leaf-sheath usually enclosing base of panicle; panicle ovoid to subglobose; awns of glumes and lemmas of sterile spikelets 15–20 mm. *E. Kriti.* Cr. (*N. Africa, S.W. Asia.*)

29. Lamarckia Moench[1]

Annual. Leaves flat. Inflorescence a rather condensed secund panicle. Spikelets dimorphic, somewhat laterally compressed, falling in groups of 3–5; fertile spikelets with 1 floret and a sterile rudiment, surrounded by 2–4 sterile spikelets with many florets. Glumes thin, subequal, acute. Lemma of fertile spikelets chartaceous, awned, of the sterile spikelets membranous, unawned. Palea 2-keeled.

1. L. aurea (L.) Moench, *Meth.* 201 (1794) (*Cynosurus aureus* L.). Stems 7–15(–20) cm. Leaves 2–6 mm wide; sheaths scabridulous on the ribs, the uppermost somewhat inflated; ligule 5–10 mm. Panicle up to $6\times2{\cdot}5$ cm, oblong. Spikelets pedicellate, in groups of 3–5 at the ends of branches; pedicels villous. Sterile spikelets 5–8 mm; glumes linear-lanceolate; lemmas numerous, ovate, distichous, imbricate. Fertile spikelets with linear-lanceolate glumes and ovate lemma, 2-fid at apex, with a long awn from the sinus; sterile rudiment with a long awn. $2n=14$. *Open habitats. Mediterranean region, Portugal.* Bl Co Cr Ga Gr Hs It Ju Lu Sa Si.

30. Catabrosa Beauv.[1]

Perennials. Leaves flat; sheaths with connate margins. Inflorescence a lax panicle. Spikelets subterete, usually with 2 florets. Glumes unequal, shorter than spikelet, thin, the lower with no apparent vein, the upper prominently 3-veined. Lemma oblong when flattened, rounded on the back, membranous with a scarious apex, prominently 3-veined. Palea 2-keeled, similar in texture to the lemma.

1. C. aquatica (L.) Beauv., *Agrost.* 97, 157 (1812). Stoloniferous; stems 5–70 cm. Leaves up to 10 mm wide, smooth, soft, obtuse; ligule *c.* 5 mm, obtuse. Panicle up to 30 cm; branches in half whorls of 3–5, successive whorls alternating. Spikelets 3–4 mm. Glumes obovate, often purplish. Lemma $2{\cdot}5$–$3{\cdot}5$ mm. $2n=20$. *In shallow water and wet, sandy or muddy places. Most of Europe.* All except Az Bl Cr Lu Sb.

31. Cinna L.[1]

Perennials. Leaves flat. Inflorescence a lax panicle. Spikelets hermaphrodite, laterally compressed, with 1 floret. Glumes subequal, longer than lemma, 1-veined, herbaceous, with wide scarious margin. Lemma indistinctly 3-veined, herbaceous, with wide scarious margin and dorsal awn. Palea somewhat shorter than lemma. Stamen 1.

1. C. latifolia (Trev.) Griseb. in Ledeb., *Fl. Ross.* **4**: 435 (1852). Laxly caespitose; stems 60–130 cm. Leaves up to 20 mm wide, scabrid; ligule up to 6 mm, lacerate. Panicle 15–30 cm. Spikelets *c.* 2 mm. Glumes lanceolate, acute. Lemma with a short, slender awn inserted a little below the apex. *Damp woods. N. Europe, from* 53° *N. in C. Russia to* 65° *N. in Finland.* Fe No Rs (N, B, C) Su.

32. Apera Adanson[1]

Annuals. Leaves flat or convolute. Inflorescence a panicle. Spikelets laterally compressed, with 1 floret, rarely more. Glumes unequal, membranous, the lower 1-veined, the upper 3-veined, about as long as the lemma. Lemma obscurely 5-veined, chartaceous, rounded on the back, with a long, subapical awn. Palea about equalling lemma. Rhachilla shortly prolonged.

1 Panicle-branches long, patent	**1. spica-venti**
1 Panicle-branches short, erect	
2 Upper glume unawned; anthers 0·3–0·4 mm	**2. interrupta**
2 Upper glume shortly awned; anthers *c.* 1·5 mm	**3. intermedia**

1. A. spica-venti (L.) Beauv., *Agrost.* 31, 151 (1812) (*Agrostis spica-venti* L.). Stems 20–100(–120) cm. Leaves (1–)3–10 mm wide, flat, glabrous, scabrid above or on both surfaces; sheaths smooth or scabrid above, often purplish; ligule 3–12 mm. Panicle (7–)10–25(–32) × 3–15 cm; branches patent. Spikelets $2{\cdot}5$–3 mm, often purplish. Glumes lanceolate, acute, scabrid on the keel in the upper half. Lemma oblong-lanceolate, scabridulous above the middle, shortly bearded at base; awn 5–12 mm. Anthers 1–2 mm. $2n=14$. *Sandy places and cultivated ground. Most of Europe, but rare in the extreme south and probably only introduced in the north.* Al Au Be Br Bu Cz *Da Ga Ge Gr He Ho Hs Hu It Ju Po Rm Rs (C, W, K, E) Sa Tu [Co Fe No Rs (N, B) Su].

(a) Subsp. **spica-venti**: Stems up to 120 cm; sheaths smooth or weakly scabrid above. Lower glume distinctly shorter than upper; lemma about as long as lower glume. *Throughout most of the range of the species.*

(b) Subsp. **maritima** (Klokov) Tzvelev, *Nov. Syst. Pl. Vasc. (Leningrad)* **1968**: 23 (1968): Stems not more than 50 cm; sheaths scabrid. Lower glume almost as long as upper; lemma usually somewhat shorter than lower glume. *Saline, sandy soils. S. Ukraine, S.E. Russia.*

2. A. interrupta (L.) Beauv., *Agrost.* 31, 151 (1812) (*Agrostis interrupta* L.). Stems 10–70 cm. Leaves 1–4 mm wide, convolute when dry, scabrid or puberulent above; sheaths smooth, often purplish; ligule 2–5 mm. Panicle 3–20 × 0·4–1·5 cm, more or less interrupted below, dense above; branches erect. Spikelets 2–$2{\cdot}5$ mm, green or purplish. Glumes lanceolate, acute, scabrid on the keel in the upper half. Lemma oblong-lanceolate, scabridulous above the middle, shortly bearded at base; awn 4–10 mm. Anthers 0·3–0·4 mm. $2n=14$. *Sandy, usually open habitats. W. & C. Europe, extending to S. Italy and discontinuously to S.E. Russia; S.E. Sweden (Öland and Gotland).* ?Al Au *Br ?Bu Cz Ga Ge He Hs Hu It Ju ?Lu Rm Rs (K, E) Su Tu.

Local over much of its range, and in some regions doubtfully native.

3. A. intermedia Hackel, *Ann. Naturh. Mus. (Wien)* **20**: 430 (1905). Like **2** but upper glume shortly awned; lemma glabrous at base; anthers *c.* 1·5 mm. *Turkey-in-Europe.* Tu. (*S.W. Asia.*)

[1] By T. G. Tutin.

33. **Psilurus** Trin.[1]

Annuals. Leaves filiform. Inflorescence a slender, flexuous spike with widely spaced, distichously arranged spikelets sunk in the joints of the tardily disarticulating angular rhachis. Spikelets laterally compressed, sessile, with 1 hermaphrodite floret. Terminal spikelet with 2 small, 1-veined glumes, the lower glume absent in the other spikelets. Lemma linear-lanceolate, much longer than the glumes, membranous, with an apical awn. Palea 2-veined, as long as the lemma. Rhachilla sometimes prolonged, with a terminal sterile floret. Stamen 1.

1. P. incurvus (Gouan) Schinz & Thell., *Viert. Naturf. Ges. Zürich* **58**: 40 (1913) (*P. aristatus* (L.) Duval-Jouve, *P. nardoides* Trin.). Stems up to 35 cm, numerous, slender, smooth, glabrous. Leaves 1–5 cm × *c.* 0·5 mm; ligule very short, truncate. Lemma *c.* 4 mm; awn 3–5 mm. Anthers 0·4 mm. Caryopsis *c.* 4 mm. $2n=28$. *Dry, open habitats. S. Europe.* Al Bl Bu Co Cr Ga Gr Hs It Ju Lu Rm Rs (K) Sa Si Tu.

34. **Mibora** Adanson[1]

Annuals. Leaves flat. Inflorescence spike-like, unilateral. Spikelets laterally compressed, with 1 floret. Glumes subequal, membranous, longer than the floret, 1-veined, persistent. Lemma 5-veined, truncate, densely hairy, thinner than the glumes. Palea as long as lemma, hairy.

1. M. minima (L.) Desv., *Obs. Pl. Angers* 45 (1818). Stems 2–15 cm, filiform, tufted. Leaves up to 2(–4) cm, mostly at the base of the plant, glabrous, with an obtuse, cartilaginous apex; sheaths with a wide scarious margin, glabrous, the lower without lamina; ligule up to 1 mm, truncate. Inflorescence 0·5–2 cm, usually purplish, very slender. Spikelets 1·8–3 mm, subsessile, in 2 rows along one side of the rhachis. Glumes oblong to elliptic-oblong, obtuse to slightly emarginate, rounded on the back. Lemma often denticulate at apex. Anthers 1–1·7 mm. $2n=14$. *Sandy and other light soils, damp in winter. S., W. & W.C. Europe, northwards to c. 53° N. in Wales; an occasional casual elsewhere.* Be Br ?Bu Ga Ge Gr Ho Hs †It Lu.

35. **Briza** L.[1]

Subglabrous annuals or perennials. Inflorescence usually much-branched. Spikelets ovoid or broadly triangular, laterally compressed; florets 4–20. Glumes ovate-orbicular, cordate, 3- to 9-veined, with wide scarious margin. Lemma suborbicular, cordate, 7- to 9-veined, closely imbricate. Palea ovate to obovate, obtuse, shorter than to almost equalling the lemma, with 2 narrowly winged keels. Ovary glabrous; styles terminal. Grain rounded dorsally, flattened ventrally.

1 Perennial, with non-flowering shoots; ligule 0·5–1·5 mm **1. media**

1 Annual, without non-flowering shoots; ligule at least 2 mm
2 Spikelets (10–)14–25 mm, not more than 12 **2. maxima**
2 Spikelets 3–5(–7) mm, usually numerous
3 Leaves at least 2 mm wide; panicle-branches patent; pedicels mostly longer than spikelets **3. minor**
3 Leaves not more than 1 mm wide; panicle-branches erect; pedicels shorter than spikelets **4. humilis**

1. B. media L., *Sp. Pl.* 70 (1753). Laxly caespitose perennial 15–100 cm. Stems erect. Leaves 2–7 mm wide, flat, scabridulous on the margin; sheaths smooth; ligule 0·5–1·5 mm. Panicle 4–18 cm, erect, much-branched, lax; lower branches (1–)2 together; pedicels mostly longer than spikelets, very slender. Spikelets 4–7(–12) mm, numerous, pendent, usually purplish; florets 4–12. Glumes 2·5–3·5 mm, concave, cucullate, suborbicular, 3- to 5-veined, subcoriaceous. Lemma *c.* 4 mm, like the glumes, 7- to 9-veined. Palea somewhat shorter than lemma. $2n=14, 28$. *Grassland. Most of Europe, but only as a casual in the extreme north.* All except Az Bl Cr Fa Is Sb.

(a) Subsp. **media**: Usually 15–60 cm. Leaves 2–4 mm wide. Panicle-branches patent. *Throughout the range of the species.*

(b) Subsp. **elatior** (Sibth. & Sm.) Rohlena, *Sitz.-Ber. Böhm. Ges. Wiss.* **1912(1)**: 130 (1912) (*B. elatior* Sibth. & Sm.): Usually 50–100 cm. Leaves 4–7 mm wide. Panicle-branches erect. *S.E. Europe.*

2. B. maxima L., *Sp. Pl.* 70 (1753). Annual 10–60 cm. Stems erect or geniculate below. Leaves 3–8 mm wide, flat, scabridulous on the margin; sheaths smooth; ligule 2–5 mm. Panicle 2–10 cm, secund, drooping at apex; branches usually solitary, each with 1–3 spikelets; pedicels very slender. Spikelets (10–)14–25 mm, 1–12, pendent, glabrous or appressed-pubescent, often reddish-brown; florets 7–20. Glumes 5–7 mm, concave, suborbicular, 5- to 9-veined, subcoriaceous. Lemma 6–8 mm, like the glumes, 7- to 9-veined. Palea up to ⅔ as long as lemma. $2n=14$. *Open habitats. S. Europe; cultivated for ornament elsewhere and frequent as a casual and occasionally naturalized.* Al Az Bl Bu Co Cr Ga Gr Hs It Ju Lu Sa Si Tu [Br Rs (E)].

3. B. minor L., *Sp. Pl.* 70 (1753). Annual (5–)10–60 cm. Stems erect. Leaves 3–10 mm wide, flat, scabridulous above and on margin; sheaths smooth; ligule 3–6 mm. Panicle 3–20 cm, erect, much-branched, lax; lower branches 1–2 together, patent; pedicels mostly longer than the spikelets, very slender. Spikelets 3–5 mm, numerous, usually pale green; florets 4–8. Glumes 2–3·5 mm, concave, cucullate, suborbicular, 3- to 5-veined, subcoriaceous. Lemma 1·5–2 mm, like the glumes, but papillose on the back, 7- to 9-veined. Palea somewhat shorter than lemma. $2n=10$. *Open habitats. S. & W. Europe, northwards to S. England.* Al Az Bl *Br Co Cr Ga Gr Hs It Ju Lu Sa Si Tu [Be].

4. B. humilis Bieb., *Fl. Taur.-Cauc.* **1**: 66 (1808) (*B. spicata* Sibth. & Sm., non Burm. fil.). Like **3** but rarely more than 20 cm; leaves up to 1 mm wide; panicle-branches short, erect; pedicels mostly shorter than spikelets; glumes and lemma acute, smooth, not cucullate. $2n=14$. *Rocky slopes and dry, open places. S.E. Europe.* Al Bu Cr Gr Rs (K) Tu.

Tribe **Seslerieae** Koch

Like *Poeae* but silica-bodies elliptical or saddle-shaped; inflorescence a dense, cylindrical to globose panicle, subtended by glume-like bracts; lemma membranous, often hairy or scabrid, 4- to 5-dentate and often shortly awned at apex; ovary hairy or glabrous at apex; grain with basal, punctiform hilum.

36. **Sesleria** Scop.[2]

More or less caespitose perennials. Leaves flat, plicate or involute; ligule short, truncate or obtuse. Inflorescence spike-like, cylindrical to globose, often bluish, greyish or whitish; bracts at base of inflorescence well-developed. Spikelets laterally compressed, with 2–5 florets. Glumes unequal, membranous, 1- to 3-veined. Lemma 5-veined, membranous, with 2–5 usually aristulate teeth at apex. Palea as long as or longer than lemma.

[1] By T. G. Tutin. [2] By M. Deyl.

The species are very variable and often only weakly differentiated, frequently hybridizing. The following key makes no allowance for extreme variants or for hybrids.

Literature: M. Deyl, *Op. Bot. Čech.* 3: 1–257 (1946).

1 Stems not more than 15 cm at anthesis; ligule more than 0·5 mm; sheaths open
2 Bracts ovate to lanceolate; spikelets with 2–3 florets; lemma with 5 awns, the middle 1·8–2·5 mm **1. ovata**
2 Bracts suborbicular; spikelets often with 4 florets; lemma with awns not more than 1 mm
3 Inflorescence 8–13 × 8–12 mm, silvery, rarely greyish; lemma unawned or with awns less than 0·05 mm **2. leucocephala**
3 Inflorescence 5–7 × 5–7 mm, blue-grey; lemma with awns 0·5–1 mm **3. sphaerocephala**
1 Stems usually more than 15 cm at anthesis; ligule usually less than 0·5 mm; sheaths closed, or open at the top only
4 Basal sheaths reticulate **4. tenuifolia**
4 Basal sheaths not reticulate
5 Lemma hirsute or villous on and between the veins
6 Middle awn of lemma at least as long as the lemma **5. comosa**
6 Middle awn of lemma shorter than the lemma
7 Leaves 1–1·5 mm wide **6. tenerrima**
7 Leaves at least 1·5 mm wide
8 Lemma sparsely hairy between the veins
9 Young leaves not pruinose; spikelets with 2–3 florets; lemma 4–5 mm **7. sadlerana**
9 Young leaves whitish-pruinose above; spikelets with 3–4 florets; lemma 3–4 mm **8. heuflerana**
8 Lemma densely hirsute between the veins
10 Sheaths glabrous; inflorescence (11–)16(–30) × 7–10 mm, subcylindrical **9. bielzii**
10 Sheaths hirsute or villous; inflorescence globose or ovoid
11 Inflorescence 15–20 × 8–12 mm; leaves glabrous; lemma 4·5–5 mm **10. coerulans**
11 Inflorescence 9–15 × 7–9 mm; leaves hirsute above; lemma 3–4·5 mm **11. korabensis**
5 Lemma glabrous or pubescent only between the veins
12 Lemma densely pubescent between the veins
13 Inflorescence 7–11 mm wide
14 Spikelets with 3–4 florets; glumes 3·5–4·5(–6) mm; young leaves pruinose above, the uppermost usually less than 3 cm **8. heuflerana**
14 Spikelets with 2–3 florets; glumes 5·5–6 mm; leaves glaucescent, the uppermost more than 3 cm **12. vaginalis**
13 Inflorescence 11–15 mm wide
15 Inflorescence 15 mm wide; glumes *c.* 6 mm, the awn 2–4 mm; lemma 4·5–5·5 mm, the middle awn up to 5 mm; palea 5–6·5 mm, with awns 2–3 mm **13. doerfleri**
15 Inflorescence 11–14 mm wide; glumes *c.* 4 mm, the awn 1–2 mm; lemma 4–4·5 mm, the middle awn 1·5–2·5 mm; palea *c.* 4·5 mm, with awns up to 0·5 mm **14. wettsteinii**
12 Lemma sparsely pubescent to glabrous between the veins
16 Lemma sparsely pubescent between the veins
17 Leaves hirsute above **25. rigida**
17 Leaves glabrous or subglabrous on both surfaces
18 Very densely caespitose; stem more than 1 mm in diameter at apex; lemma 3·5–4·5 mm, shiny, puberulent **15. robusta**
18 Laxly caespitose; stem less than 1 mm in diameter at apex; lemma 4·5–6 mm, pubescent **26. insularis**
16 Lemma glabrous between the veins
19 Uppermost leaf more than 3 cm
20 Inflorescence not more than 30 mm
21 Inflorescence 9–14 mm wide, very dense; lemma 5–6 mm, with 3–5 awns **16. nitida**
21 Inflorescence 6–7 mm wide, rather lax; lemma 3–4 mm, with 3–5 teeth **17. alba**
20 Inflorescence more than 30 mm
22 Inflorescence lax
23 Inflorescence 30–40 × 7–9 mm, usually bluish; uppermost leaf in the middle of the stem **18. latifolia**
23 Inflorescence (35–)40–100 mm, usually whitish
24 Inflorescence 45–100 × 5–7 mm; uppermost leaf above the middle of the stem; glumes 5–6 mm; lemma 3–4·5 mm, with middle awn 0·5–1·5 mm **19. autumnalis**
24 Inflorescence 35–70 × 6–8 mm; uppermost leaf below the middle of the stem; glumes 7–10 mm; lemma 5–6 mm, with middle awn 1·5–2 mm **20. anatolica**
22 Inflorescence dense
25 Laxly caespitose; inflorescence usually 6–8 mm wide; uppermost leaf about the middle of the stem; lemma 4·5–5·5 mm **21. argentea**
25 Usually densely caespitose; inflorescence usually 6–9 mm wide; uppermost leaf in the lower ⅓ of the stem; lemma 3·5–4·5 mm **15. robusta**
19 Uppermost leaf not more than 3 cm
26 Palea shortly awned
27 Leaves mostly with 7–13 veins, usually hairy above **25. rigida**
27 Leaves mostly with 13 or more veins, usually glabrous **26. insularis**
26 Palea 2-fid, unawned
28 Middle awn of lemma not more than 0·5 mm **22. albicans**
28 Middle awn of lemma 1–2 mm
29 Bracts at base of inflorescence up to 11 × 5 mm, very conspicuous, spathe-like, silvery **24. taygetea**
29 Bracts at base of inflorescence small, inconspicuous, not spathe-like
30 Young leaves pruinose above; inflorescence 10–14 × 7–9 mm, dense **23. caerulea**
30 Young leaves not pruinose; inflorescence 10–30 mm
31 Leaves (1·5–)2·5–3(–5) mm wide; inflorescence 5–7(–9) mm wide, lax; lemma up to 6 mm **22. albicans**
31 Leaves (3–)4–5 mm wide; inflorescence 9–12 mm wide, dense; lemma 4–5 mm **7. sadlerana**

1. S. ovata (Hoppe) A. Kerner, *Sched. Fl. Exsicc. Austro-Hung.* 1: 109 (1881) (*S. tenella* Host, *S. microcephala* DC.). Stems 3–10 cm, elongating after anthesis. Leaves 1–1·5 mm wide, flat or convolute, flaccid, hairy or subglabrous above; sheaths shiny. Inflorescence 6–10 × 4–6 mm, the bracts at its base ovate to lanceolate. Glumes 2 mm, ovate, abruptly contracted into an awn 1–2 mm. Lemma *c.* 2 mm, broadly ovate, dark blue, glabrous or ciliate, with 5 awns, the middle 1·8–2·5 mm, the lateral *c.* 1 mm. Palea longer than lemma, with awns 1–1·5 mm. *Rocks and screes above* 2000 *m.; calcicole.* ● *Alps, mainly in the east.* Au Ga Ge It Ju.

2. S. leucocephala DC. in Lam. & DC., *Fl. Fr.* ed. 3, 3: 76 (1805) (*S. sphaerocephala* auct., non Ard.). Stems *c.* 15 cm, elongating after anthesis. Leaves 1–2 mm wide, convolute or flat; sheaths subglabrous. Inflorescence 8–13 × 8–12 mm, the bracts at its base suborbicular, with acuminate apex. Glumes ovate, very shortly awned. Lemma 4–4·5 mm, broadly ovate, silvery, hairy in the proximal ⅓, usually unawned. Palea shorter than the lemma. *Rock-crevices and screes; calcicole.* ● *S.E. Alps.* Au He It Ju.

3. S. sphaerocephala Ard., *Animadv. Bot. Spec. Alt.* 20 (1764). Stems up to 12 cm, elongating after anthesis. Leaves *c.* 1 mm wide, flat or convolute, glabrous but ciliate; sheaths glabrous. Inflorescence 5–7 × 5–7 mm, globose. Glumes ovate-lanceolate,

with an awn 1·5 mm. Lemma 3·5–4 mm, blue-grey, hairy and long-ciliate in the proximal ½, with awns 0·5–1 mm. Palea as long as or longer than lemma. $2n=14$. *Rock-crevices and screes; calcicole.* ● *E. Alps.* Au It Ju.

Records from the S.W. Alps (Mont Cenis) are erroneous.

4. S. tenuifolia Schrader, *Fl. Germ.* 272 (1806). Stems usually 20–30 cm. Leaves 0·4–0·6(–3) mm wide, usually junciform or setaceous, pruinose and more or less hairy above; sheaths usually glabrous, the basal reticulate. Inflorescence (10–)15(–30) mm. Glumes *c.* 4 mm, lanceolate to ovate, acute or acuminate. Lemma 4–5 mm, blue or grey, sparsely ciliate, with 1–3 awns up to 1·5 mm. Palea longer than lemma, ciliate on the keels. *Limestone rocks.* ● *Italy, W. Jugoslavia, N. Albania.* Al It Ju.

(a) Subsp. **tenuifolia**: Leaves *c.* 0·6 mm wide, rarely wider (var. *juncifolia* (Suffren) Marchesetti). Inflorescence usually 15–20 mm, lax. $2n=28, 42$. *Throughout the range of the species.*

(b) Subsp. **kalnikensis** (Jáv.) Deyl, *Bot. Jour. Linn. Soc.* **76**: 364 (1978) (*S. kalnikensis* Jáv.): Leaves 1–3 mm wide. Inflorescence 20–25 mm, often dense. $2n=56$. *N.W. Jugoslavia.*

5. S. comosa Velen., *Abh. Böhm. Ges. Wiss.* **7(1, 8)**: 44 (1886). Stems up to 50 cm, *c.* 1 mm in diameter at apex. Leaves 2–3(–4) mm wide, glabrous, flat or convolute, the uppermost 1·5–4 cm, flat; sheaths glabrous. Inflorescence 7–17 × 7–12 mm, the bracts at its base ovate to lanceolate. Glumes 2–3 mm, lanceolate, long-ciliate. Lemma *c.* 3 mm, densely villous; middle awn 3–4·5 mm, the lateral 2–3 mm. Palea as long as lemma, villous; awns 2–3 mm. $2n=28$. *Mountain rocks; calcifuge.* ● *C. part of Balkan peninsula.* Al Bu Ju.

6. S. tenerrima (Fritsch) Hayek, *Denkschr. Akad. Wiss. Math.-Nat. Kl.* (*Wien*) **94**: 206 (1918). Stems 10–30 cm, slender. Leaves 1–1·5 mm wide, usually convolute, subglabrous, the uppermost 0·5–1·2 cm. Inflorescence usually 9–14 × 7–8 mm, the bracts at its base broadly ovate. Glumes 2–3 mm, lanceolate, with awns 1–4 mm. Lemma 3–4 mm, densely hirsute; middle awn 2–3 mm, the lateral 0–1 mm. Palea usually longer than lemma; awns 1–2 mm. $2n=28$. *Mountain rocks.* ● *S. half of Balkan peninsula.* Al Gr Ju.

7. S. sadlerana Janka, *Term. Füz.* **8**: 28 (1884) (*S. budensis* Ascherson & Graebner). Leaves (3–)4–5 mm wide, flat or folded, usually with more than17 veins; sheaths hairy or glabrous. Inflorescence 18–25 × (7–)9–12 mm, dense. Glumes 4–5 mm, with awn *c.* 1 mm. Lemma 4–5 mm, ciliate on margin and veins, glabrous or sparsely hairy between the veins; middle awn 1–2 mm. Palea as long as or longer than lemma. *Calcicole.* ● *E.C. Europe.* Au Hu Ju Po.

(a) Subsp. **sadlerana**: Leaves rigid, with stout marginal veins, the uppermost 0·8–1·5 cm; sheaths often hairy. Lemma usually glabrous between the veins. $2n=56$. *Hungary, E. Austria, S.E. Czechoslovakia.*

(b) Subsp. **tatrae** (Degen) Deyl, *Bot. Jour. Linn. Soc.* **76**: 364 (1978) (*S. tatrae* (Degen) Deyl, *S. bielzii* forma *tatrae* Degen): Leaves soft, the uppermost usually 2–3 cm; sheaths glabrous. Lemma usually hairy between the veins. $2n=56$. *W. Carpathians and S.E. Alps.*

8. S. heuflerana Schur, *Verh. Zool.-Bot. Ges. Wien* **6**: 203 (1856). Stems up to 70 cm. Leaves 2–3(–7) mm wide, strongly pruinose above when young, the uppermost 1·5–3(–5) cm; sheaths glabrous. Inflorescence usually 10–30 × 7–11 mm. Glumes usually 3·5–4·5 mm, narrowly lanceolate, sparsely ciliate; awn 0·5–2·5 mm. Lemma pubescent; awns (1–)2(–4) mm. Palea with awns up to 2 mm. *Woods and rocks; calcicole.* ● *E.C. Europe.* Cz Hu Rm Rs (W).

(a) Subsp. **heuflerana**: Laxly caespitose. Leaves flat or convolute, rarely folded. Glumes up to 4·5 mm. Lemma and palea up to 4·5 mm. $2n=28$. *Throughout the range of the species.*

(b) Subsp. **hungarica** (Ujhelyi) Deyl, *Bot. Jour. Linn. Soc.* **76**: 364 (1978) (*S. hungarica* Ujhelyi): Densely caespitose. Leaves flat or folded. Glumes up to 6 mm. Lemma 5 mm. Palea 5–6 mm. $2n=56$. *Czechoslovakia and Hungary.*

9. S. bielzii Schur, *Verh. Mitt. Siebenb. Ver. Naturw.* **1**: 109 (1850). Stems rather stout. Leaves 1·5–2·5 mm wide, flat or convolute, the uppermost 2–3 cm; sheaths glabrous. Inflorescence (11–)16(–30) × 7–10 mm, the bracts at its base ovate to lanceolate. Glumes 4–10 mm, ovate-lanceolate, ciliate; awn up to 4 mm. Lemma 4–5 mm, hairy; middle awn 2–3 mm, the laterals 0·5–1 mm. Palea (3–)4(–6) mm, hairy, unawned or with awns up to 0·5 mm. $2n=56$. *Stony or grassy slopes.* ● *Carpathians and mountains of Balkan peninsula.* Bu Gr Ju Rm Rs (W).

10. S. coerulans Friv., *Flora* (*Regensb.*) **19**: 438 (1836) (incl. *S. orbelica* (Velen.) Hayek). Stems up to 25 cm, stout. Leaves 2–4 mm wide, glabrous, usually plicate, the uppermost 1–3 cm; sheaths densely villous. Inflorescence 15–20 × 8–12 mm, dense, the bracts at its base conspicuous, rounded. Glumes 4–7 mm, ciliate; awn (1–)2(–3) mm. Lemma 4·5–5 mm, villous; middle awn 3–4 mm, the laterals 1–2 mm. Palea longer than lemma; awns 1–2 mm. $2n=56$. *Stony or grassy slopes.* ● *Mountains of Balkan peninsula; S. Carpathians.* Al Bu Gr Ju Rm.

11. S. korabensis (Kümmerle & Jáv.) Deyl, *Op. Bot. Čech.* **3**: 141 (1946). Like **10** but leaves usually hairy above, often with a continuous subepidermal layer of sclerenchyma; inflorescence 9–15 × 7–9 mm; glumes 3–4·5 mm; lemma 3–4·5 mm, densely appressed-hairy between the veins, the middle awn 2–3 mm, the lateral 0·5–1·5 mm. ● *Mountains of C. part of Balkan peninsula.* Al Bu Gr Ju.

S. klasterskyi Deyl, *op. cit.* 144 (1946), from Bulgaria, is a related taxon requiring further investigation.

12. S. vaginalis Boiss. & Orph. in Boiss., *Diagn. Pl. Or. Nov.* **3(4)**: 130 (1859). Stems 30–40 cm, slender. Leaves 3–4 mm wide, folded, falcate, with pale setaceous apex up to 2 mm, the uppermost 3–6 cm, rarely less; sheaths pubescent or glabrous. Inflorescence 30–40 × 7–10 mm, rather dense. Glumes 5·5–6 mm, with stout awns 1–2 mm. Lemma 4–5·5 mm, ciliate and sericeous between the veins; middle awn 1–2 mm, the laterals 0·5–1 mm. Palea 4·5–6 mm, ciliate on the keels, unawned. *Mountain rocks.* ● *S. Greece* (*N. Peloponnisos*). Gr.

13. S. doerfleri Hayek, *Österr. Bot. Zeitschr.* **64**: 360 (1914). Stems up to 70 cm. Leaves up to 5·5 mm wide, with scabrid margins near the pungent apex, the uppermost more than 6 cm; sheaths glabrous. Inflorescence 25–30 × 15 mm, very dense. Glumes *c.* 6 mm, narrowly lanceolate, gradually narrowed into an awn 2–4 mm. Lemma 4·5–5·5 mm, narrowly lanceolate, sericeous; middle awn up to 5 mm, the laterals 2–3 mm. Palea longer than lemma, with awn 2–3 mm. *Rock-crevices.* ● *W. Kriti.* Cr.

14. S. wettsteinii Dörfler & Hayek, *Denkschr. Akad. Wiss. Math.-Nat. Kl.* (*Wien*) **94**: 206 (1918) (incl. *S. gigantea* Dörfler &

Hayek). Like **13** but the uppermost leaf 4–8 cm; inflorescence 20–25 × 11–14 mm; glumes *c.* 4 mm, ovate-lanceolate; awn 1–2 mm; lemma 4–4·5 mm, long-ciliate, pubescent between the veins; middle awn 1·5–2·5 mm, the laterals up to 0·5 mm; palea about as long as lemma, 2-dentate or shortly awned. $2n = 56$. *Mountain rocks.* ● *Albania and S.W. Jugoslavia.* Al Ju.

15. S. robusta Schott, Nyman & Kotschy, *Analecta Bot.* **1** (1854) (*S. nitida* auct. balcan., non Ten.). Stems up to 60 cm. Leaves up to 4·5 mm wide, flat or plicate, glabrous or sparsely pubescent, the uppermost 3–10 cm, in the lower ¼ of the stem; sheaths glabrous. Inflorescence 6–9 mm wide, the bracts at its base lacerate, ciliate. Glumes 5–6 mm, lanceolate, ciliate; awn 1–2 mm. Lemma 3·5–4·5 mm; middle awn 1–1·5 mm, the lateral minute. Palea 3·5–4·5 mm, shortly awned. *Calcicole.* ● *W. Jugoslavia and Albania.* Al ?Bu Ju.

(a) Subsp. **robusta**: Stems more than 1 mm in diameter at apex. Inflorescence usually 30–40 × 9–14 mm. Lemma shiny, puberulent. $2n = 56$. *W. Jugoslavia.*

(b) Subsp. **skanderbeggii** (Ujhelyi) Deyl, *Bot. Jour. Linn. Soc.* **76**: 364 (1978) (*S. skanderbeggii* Ujhelyi): Stems less than 1 mm in diameter at apex. Inflorescence usually 25–30 × 6–9 mm. Lemma glabrous. *Throughout the range of the species.*

16. S. nitida Ten., *Fl. Nap.* **1**: 322 *& Prodr.* 10 (1811). Stems up to 70 cm. Leaves 3·5–6 mm wide, flat, rarely convolute, glabrous, glaucescent, with scabrid margins, the uppermost 3·5–7·5 cm, above the middle of the stem; sheaths glabrous or sparsely pubescent. Inflorescence 20–30 × 9–14 mm, dense. Glumes 5–5·5 mm, lanceolate, ciliate on the veins, with 3–5 awns, the middle 1–2 mm, the laterals 0·5 mm. Lemma 5–6 mm, ovate-lanceolate, usually glabrous; middle awn 1–2 mm, the laterals 0·5 mm. Palea 5·5–6·5 mm, shortly awned. $2n = 28$. ● *Mountains of C. & S. Italy and Sicilia.* It Si.

17. S. alba Sibth. & Sm., *Fl. Graec. Prodr.* **1**: 52 (1806). Stems up to 50 cm. Leaves 3–5 mm wide, flat, soft, glaucescent, the uppermost 3–10 cm; sheaths sparsely pubescent. Inflorescence 20–30 × 6–7 mm, lax, whitish. Glumes up to 7 mm, narrowly lanceolate, ciliate on the veins; awn 1 mm. Lemma 3–4 mm, glabrous, 3- to 5-dentate, the middle tooth with an awn 1–1·5 mm. Palea 4·5–5 mm, ciliate on the keels. *Woods and scrub. S.E. Bulgaria and Turkey-in-Europe.* Bu Tu. (*Caucasus to Lebanon.*)

18. S. latifolia (Adamović) Degen, *Magyar Bot. Lapok* **4**: 133 (1905). Stems up to 40 cm, glabrous, slender. Leaves 3–4 mm wide, flat or plicate, the uppermost 3–6 cm, at about the middle of the stem; sheaths glabrous. Inflorescence usually 30–40 × 7–9 mm, dark bluish or grey, lax. Lemma 3–4·5 mm, the middle awn 1–2 mm, the laterals up to 0·7 mm. Palea *c.* 5 mm, 2-dentate, ciliate. $2n = 28$. ● *Bulgaria, C. & E. Jugoslavia.* Bu ?Gr Ju.

19. S. autumnalis (Scop.) F. W. Schultz, *Arch. Fl. Jour. Bot.* 296 (1861) (*S. elongata* Host). Stems up to 40 cm, slender. Leaves up to 4 mm wide, usually flat, glabrous, glaucescent, strongly scabrid, the uppermost 4–8 cm or more, above the middle of the stem; sheaths glabrous. Inflorescence 45–100 × 5–7 mm, lax, greyish or whitish. Glumes 5–6 mm, narrowly lanceolate; awn 1–5 mm, stout. Lemma 3–4·5 mm, lanceolate, sparsely ciliate at base; middle awn 0·5–1·5 mm, the laterals 0·5 mm. Palea 4–5 mm. $2n = 28$. *Calcicole.* ● *From N. & E. Italy to C. Albania.* Al It Ju.

20. S. anatolica Deyl, *Op. Bot. Čech.* **3**: 104 (1946). Stems up to 70 cm, often scabrid at apex. Leaves up to 4 mm wide, flat or plicate, glabrous, the uppermost 3–12 cm, below the middle of the stem; sheaths glabrous. Inflorescence (35–)40–70 × 6–8 mm, often lax, usually whitish. Glumes 7–10 mm, narrowly lanceolate; awn 1·5–2 mm. Leaves 5–6 mm, lanceolate, glabrous or ciliate at base, the middle awn 1·5–2 mm. Palea 5·5–6·5 mm, ciliate, with awns up to 0·6 mm. *Krym.* Rs (K). (*Anatolia and Caucasian region.*)

21. S. argentea (Savi) Savi, *Bot. Etrusc.* **1**: 66 (1808) (*S. cylindrica* DC.). Stems up to 50 cm, leafy at least to the middle. Leaves 3–5 mm wide, glabrous, scabrid on margins, the uppermost 3–10 cm; sheaths glabrous. Inflorescence 35–55(–120) × 6–8(–10) mm, whitish, rarely greyish. Glumes 5–7 mm, narrowly lanceolate, ciliate on the keel; awn 1–2·5 mm. Lemma 4·5–5·5 mm, glabrous; middle awn 1–1·5 mm. Palea little longer than lemma, shortly awned. $2n = 28$. *Limestone rocks.* ● *Italy and S.E. France; N. & E. Spain.* Ga Hs It.

Variable, especially in Italy, where plants apparently intermediate between **16** and **19** are found. Experimental investigation is required.

22. S. albicans Kit. ex Schultes, *Österreichs Fl.* ed. 2, **1**: 216 (1814) (*S. caerulea* subsp. *varia* (Jacq.) Hayek, *S. caerulea* subsp. *calcarea* (Čelak.) Hegi). Stems 10–45 cm, slender. Leaves (1·5–)2·5–3(–5) mm wide, flat or plicate, the uppermost not more than 1 cm; sheaths glabrous. Inflorescence 10–30 × 5–7(–9) mm, rather lax, bluish. Glumes 4–7 mm, ovate-lanceolate, acuminate, usually unawned, glabrous, rarely ciliate. Lemma 4–6 mm, ovate-lanceolate, sparsely ciliate on margins and veins, up to 5-dentate, the middle tooth with an awn. Palea 2-dentate, ciliate. $2n = 28$. *Dry, calcareous grassland.* ● *W. & C. Europe, extending southwards to the N. Appennini and Crna Gora.* Au Be Br Cz Ga Ge Hb He †Ho Hs Hu Is It Ju Po ?Rs (W).

(a) Subsp. **albicans**: Leaves 2·5–3(–5) mm wide, with 17–19 veins. Glumes 4–6 mm. Lemma 4–5 mm, the middle awn not more than 0·5 mm. *Throughout the range of the species except C. & S.W. Jugoslavia.*

(b) Subsp. **angustifolia** (Hackel & G. Beck) Deyl, *Bot. Jour. Linn. Soc.* **76**: 364 (1978) (*S. caerulea* var. *angustifolia* Hackel & G. Beck): Leaves 1·5–2 mm wide, with usually 15 veins. Glumes 5–7 mm. Lemma up to 6 mm, the middle awn 1–2 mm. *C. & S.W. Jugoslavia.*

23. S. caerulea (L.) Ard., *Animadv. Bot. Spec. Alt.* 18 (1764) (*S. uliginosa* Opiz, *S. caerulea* subsp. *uliginosa* (Opiz) Hayek). Like **22a** but stems stouter; leaves pruinose above, often convolute, the uppermost 1–2 cm; inflorescence 10–14 × 7–9 mm, dense; glumes ciliate on margin and veins; lemma with an awn up to 1 mm. $2n = 28$. *Usually in damp, calcareous habitats. From C. Sweden and N.W. Russia southwards to Crna Gora and C. Bulgaria.* Au Bu Cz Fe Ge He Hu ?It Ju Po Rm Rs (B, C) Su.

24. S. taygetea Hayek, *Denkschr. Akad. Wiss. Math.-Nat. Kl. (Wien)* **94**: 207 (1918). Stems 15–25 cm, leafy up to the middle. Leaves 0·5 mm wide, setaceous, with long hairs beneath, the uppermost up to 3 cm; sheaths glabrous. Inflorescence up to 15 × 11 mm, with silvery bracts up to 11 × 5 mm at base. Glumes 6–7 mm, acuminate or awned. Lemma 5–6 mm, with middle awn *c.* 1 mm. Palea longer than lemma, 2-dentate. $2n = 28$. ● *S. Greece (Taïyetos).* Gr.

25. S. rigida Heuffel ex Reichenb., *Fl. Germ. Excurs.* 140 (3) (1831) (*S. filifolia* Hoppe, *S. haynaldiana* Schur). Stems *c.* 15 cm. Leaves 1–2(–3) mm wide, plicate, pruinose above, the upper-

most 0·5–1(–2) cm. Inflorescence 15–20 × 7–8 mm, greyish or whitish. Glumes 5–6 mm, acute or shortly awned. Lemma (3–)4–5 mm, ovate-lanceolate, usually glabrous between the veins, sparsely ciliate; middle awn 0·5–1 mm. Palea longer than lemma, shortly awned. *Usually calcicole.* ● *Mountains of Romania and N. & C. parts of Balkan peninsula.* Bu Gr Ju Rm.

(a) Subsp. **rigida**: Mature leaves with 7–13 veins, usually with a continuous subepidermal layer of sclerenchyma, hairy above. Stems shorter than leaves. Sheaths usually hairy. *Throughout the range of the species, except the extreme south.*

(b) Subsp. **achtarovii** (Deyl) Deyl, *Bot. Jour. Linn. Soc.* **76**: 364 (1978) (*S. achtarovii* Deyl): Mature leaves with at least 13 veins, without a continuous subepidermal layer of sclerenchyma, glabrous or subglabrous above. Stems longer than leaves. Sheaths glabrous. *S. Bulgaria; Thasos.*

S. serbica (Adamović) Ujhelyi, *Feddes Repert.* **62**: 64 (1959), from serpentine soils in C. & E. Jugoslavia, appears to be an ecotypic variant of **25**. It has $2n=28$.

26. S. insularis Sommier, *Bull. Soc. Bot. Ital.* **1905**: 126 (1905) (*S. corsica* (Hackel) Ujhelyi). Stems up to 65 cm, slender. Leaves 1·5–5 mm wide, flat or convolute, usually with 13–21 veins, glabrous or sparsely pubescent, the uppermost 1–3(–10) cm; sheaths glabrous. Inflorescence 15–45 × 7–8(–12) mm, usually dense. Glumes 4–6(–9) mm, ciliate, with awn (1–)2–3 mm. Lemma (4–)5–6 mm, shortly pubescent between the veins, ciliate. Palea 4–5·5 mm, ciliate and shortly awned. $2n=28$. ● *W. & C. Mediterranean region.* Al Bl Co It Ju Sa.

1 Uppermost leaf at least 8 cm; awn of lemma not more than 1 mm **(b) subsp. italica**
1 Uppermost leaf not more than 3 cm; awn of lemma at least 1 mm
2 Leaves not more than 2 mm wide; inflorescence 25–40 mm **(a) subsp. insularis**
2 Leaves at least 2·5 mm wide; inflorescence 15–25 mm **(c) subsp. sillingeri**

(a) Subsp. **insularis**: Leaves 1·5–2 mm wide, the uppermost up to 3 cm. Inflorescence 25–40 × 7–8 mm. Lemma 5–6 mm, with awn (1–)2–4 mm. $2n=28$. *Islands of W. Mediterranean region.*

(b) Subsp. **italica** (Pamp.) Deyl, *Bot. Jour. Linn. Soc.* **76**: 364 (1978) (*S. caerulea* var. *italica* Pamp.): Leaves 3–5 mm wide, the uppermost 8–10 cm. Inflorescence 40–45 × 8–10 mm. Lemma 4–4·5 mm, with awn 0·5–1 mm. *N. Appennini.*

(c) Subsp. **sillingeri** (Deyl) Deyl, *loc. cit.* (1978) (*S. sillingeri* Deyl): Leaves 2·5–4 mm wide, the uppermost 1–3 cm. Inflorescence 15–25 × 7–12 mm. Lemma 4·5–5 mm, with awn 1–2 mm. *From Bosna to Albania.*

37. Oreochloa Link[1]

Rhizomatous perennials. Leaves linear or setaceous. Inflorescence a distichous or unilateral spike-like panicle; bracts at base of inflorescence absent, or very small. Spikelets laterally compressed, with 3–7 florets. Glumes unequal, membranous, obscurely 1- to 3-veined. Lemma obscurely 5- to 7-veined, membranous, usually unawned. Palea shorter than lemma.

All species grow on exposed mountain grassland, rocks or screes, and are calcifuge.

1 Plant caespitose; rhizomes short; leaves rigid
2 Transverse section of leaf with sclerenchyma beneath the veins only; ligule 3–6 mm; rhachis often sparsely hirsute **1. disticha**
2 Transverse section of leaf with a continuous subepidermal layer of sclerenchyma; ligule 0·2–1 mm; rhachis glabrous **2. blanka**
1 Plant not caespitose; rhizomes long, slender; leaves soft
3 Sheaths not covering the nodes of the flowering stem **3. seslerioides**
3 Sheaths covering the nodes of the flowering stem **4. confusa**

1. O. disticha (Wulfen) Link, *Hort. Berol.* **1**: 44 (1827) (*Sesleria disticha* (Wulfen) Pers.). Densely caespitose; stems up to 25 cm, glabrous or puberulent above. Leaves up to 15 cm × 0·6 mm, involute, rigid, setaceous, with bands of sclerenchyma beneath the veins only; sheaths usually densely hairy, overlapping; ligule 3–6 mm. Inflorescence 9–14 × 7–9 mm; rhachis often sparsely hirsute. Glumes 3·5–4 mm, ovate-lanceolate. Lemma 4–5 mm, broadly ovate-lanceolate, shortly hairy in the lower ⅔, acute or shortly aristate, brownish, with a slate-coloured band below the apex and wide hyaline margin. Palea long-ciliate on the keels. $2n=14$. ● *Alps and Carpathians.* Au Cz Ga Ge He It Ju Po Rm Rs (W).

2. O. blanka Deyl, *Op. Bot. Čech.* **3**: 244 (1946). Like **1** but leaves with a continuous subepidermal layer of sclerenchyma; sheaths usually glabrous; ligule 0·2–1 mm; rhachis glabrous; glumes 2·5–3·5 mm, broadly ovate; lemma 3·5–4 mm, with hairs up to 0·8 mm. $2n=14$. ● *Pyrenees.* Ga Hs.

3. O. seslerioides (All.) K. Richter, *Pl. Eur.* **1**: 70 (1890) (*O. pedemontana* Reuter). Not or scarcely caespitose, with long, slender rhizomes; stems 15–40 cm. Leaves up to 10 cm × 1–2 mm, smooth, soft, flat or convolute; sheaths glabrous, not covering the nodes of the flowering stem; ligule 1–1·5 mm. Inflorescence 5–15 × 5–12 mm; rhachis glabrous. Glumes 2–3 mm, broadly ovate. Lemma 4–4·5 mm, broadly ovate. Palea long-ciliate on the keels. $2n=14$. ● *S.W. Alps.* Ga It.

4. O. confusa (Coincy) Rouy, *Fl. Fr.* **14**: 168 (1913) (*O. pedemontana* sensu Willk., non Reuter). Like **3** but smaller; leaves usually scabrid on the veins; ligule of upper leaves up to 4 mm; sheaths overlapping and covering the nodes of the flowering stems. ● *Mountains of N.W. Spain.* Hs.

38. Ammochloa Boiss.[2]

Annuals. Leaves flat. Inflorescence a head of spikelets. Spikelets laterally compressed, with many florets. Glumes subequal, broadly membranous, coriaceous in the middle, 1-veined. Lemma broadly ovate, mucronate, becoming coriaceous, 5-veined. Palea 2-keeled. Lodicules absent.

1. A. palaestina Boiss., *Diagn. Pl. Or. Nov.* **2(13)**: 52 (1853) (*A. subacaulis* Balansa). Stems up to 5 cm, stout, smooth, glabrous. Leaves up to 6 cm × 3 mm; sheaths whitish below; ligule 1–2 mm, lacerate. Inflorescence of 2–6 spikelets. Spikelets *c.* 10 mm, greenish-white. Glumes asymmetrically obovate. Lemma somewhat asymmetrical, scabrid or shortly ciliate on the keel. *Dry, sandy places. E. Spain.* Hs. (*N. Africa, S.W. Asia.*)

39. Echinaria Desf.[2]

Annual. Leaves usually flat. Inflorescence a dense, ovoid or globose, prickly head. Spikelets subsessile, somewhat compressed laterally, with (1–)3–4 florets. Glumes subequal, membranous, the lower with 2(–5) strong, excurrent veins, the upper with an excurrent midrib. Lemma coriaceous, with 5(–7) very strong veins, produced as flattened awns, which are deflexed at

[1] By M. Deyl. [2] By T. G. Tutin.

maturity. Palea as long as lemma, the 2, rarely 5, veins produced as flattened awns. Lodicules absent. Styles connate near base.

1. E. capitata (L.) Desf., *Fl. Atl.* **2**: 385 (1799). Stems 1·5–25 cm, erect or ascending, smooth. Leaves up to 2 mm wide, puberulent; ligules very short, ciliolate. Inflorescence 5–15 mm. Lemma *c.* 2 mm, the middle awn 4–6 mm, longer than the laterals. $2n=18$. *Open habitats. S. Europe.* Al Bu Co Cr Ga Gr Hs It Ju Lu Rs (K) Sa Si Tu.

Tribe **Meliceae** Reichenb.

Like *Poeae* but silica-bodies elongate, with rounded ends; leaf-sheaths closed to the mouth; inflorescence a panicle; spikelets slightly compressed laterally, with 1–several fertile florets and (1–)2–3 sterile lemmas; glumes about equalling florets; lemma more or less coriaceous, rounded on the back; lodicules truncate, connate laterally; grain with a linear hilum; chromosomes small or medium-sized; basic number 9.

40. Melica L.[1]

Perennials. Leaves flat or convolute; sheaths entire. Inflorescence a usually rather lax, often simple panicle. Spikelets slightly compressed laterally, with 1–several hermaphrodite florets and 2–3 sterile lemmas forming a terminal, clavate structure. Glumes more or less unequal, firmly membranous, 3- to 5-veined. Fertile lemma rounded on the back, coriaceous in fruit; veins 5–9(–13), sometimes obscure. Palea membranous, 2-keeled, 2-dentate. Lodicules 2, connate laterally.

Literature: W. Hempel, *Feddes Repert.* **81**: 131–145 (1970); 657–712 (1971).

1 Lemma hairy
2 Lemma elliptical, obtuse, glabrous in distal ½ **10. bauhinii**
2 Lemma lanceolate, acute, hairy to apex
3 Lemma hairy all over the back **9. cupanii**
3 Lemma with a glabrous band on the back
4 Panicle usually rather lax and secund; leaves convolute, without a prominent midrib **7. ciliata**
4 Panicle dense, not secund; leaves usually flat, with a prominent midrib **8. transsilvanica**
1 Lemma glabrous
5 Panicle dense, cylindrical; spikelets numerous; leaves 5-15 mm wide **6. altissima**
5 Panicle lax, racemose or with patent branches; spikelets mostly fewer than 20; leaves 1–6(–7) mm wide
6 Glumes unequal, the lower scarious in the distal ½ **5. minuta**
6 Glumes subequal, the lower scarious in the distal ⅓
7 Spikelets eventually nodding, with 2–3 fertile florets
8 Ligule not more than 0·5 mm, truncate **1. nutans**
8 Ligule 1–2·5 mm, ovate **2. picta**
7 Spikelets always erect, with 1 fertile floret
9 Panicle with erecto-patent branches; pedicels of lower spikelets mostly much longer than the spikelets **3. uniflora**
9 Panicle simple or sparingly branched; pedicels not longer than the spikelets **4. rectiflora**

1. M. nutans L., *Sp. Pl.* 66 (1753). Rhizomatous; stems 20–60 cm, slender, scabridulous near apex. Leaves 2–6 mm wide, flat, puberulent above; sheaths scabridulous, the lower purplish; ligule very short, truncate. Panicle 4–20 cm, lax, secund, simple or sparingly branched below. Spikelets 6–8 mm, eventually nodding, with 2–3 fertile florets, falling together when ripe. Glumes ovate to elliptical, obtuse, rounded on the back, persistent. Lemma of fertile florets elliptical to elliptic-oblong, obtuse, strongly veined, slightly longer than glumes, not shining. $2n=18$. *Shady and often rocky places. Most of Europe, but rare in the Mediterranean region and the islands.* Au Be Br Bu Cz Da Fe Ga Ge He Hs Hu It Ju No Po Rm Rs (N, B, C, W, K, E) Su Tu [Ho].

2. M. picta C. Koch, *Linnaea* **21**: 395 (1848). Like **1** but rhizomes short; ligule 1–2·5 mm, ovate; lemma of fertile florets rather obscurely veined, shining. $2n=18$. *C. & E. Europe, northwards to S.E. Finland.* Au Bu Cz Fe Ge Hu Ju Po Rm Rs (C, W, E).

3. M. uniflora Retz., *Obs. Bot.* **1**: 10 (1779). Rhizomatous; stems 20–60 cm, slender, smooth. Leaves 3–7 mm wide, flat, puberulent above; sheaths deflexed-hairy or glabrous, with a bristle 1–4 mm at the mouth on the side opposite to the lamina; ligule very short. Panicle 6–22 cm, lax, sparingly branched; pedicels of lower spikelets mostly much longer than the spikelets. Spikelets 4–7 mm, erect, with 1 fertile floret. Glumes elliptical, subacute, rounded on the back, persistent. Lemma of fertile floret elliptical, obtuse, slightly shorter than the glumes. $2n=18$. *Shady places. Europe, northwards to Scotland and S.W. Finland and eastwards to Moldavia.* All except Az Bl Cr Fa Is Rs (N, C, K, E) Sb.

4. M. rectiflora Boiss. & Heldr. in Boiss., *Diagn. Pl. Or. Nov.* **2(13)**: 56 (1853). Like **3** but rhizomes short; leaves 2–3 mm wide, glabrous; sheaths without a bristle at the mouth on the side opposite to the lamina; panicle simple or sparingly branched; pedicels not much longer than the spikelets; glumes oblong. *Rocks.* ● *S. Greece, Kriti and Karpathos.* Cr Gr.

5. M. minuta L., *Mantissa* 32 (1767). Laxly caespitose; stems 10–60(–100) cm, slender, smooth. Leaves 1–4 mm wide, when convolute, up to 8 mm wide when flat, glabrous or sparsely hairy above; sheaths glabrous; ligule up to 5 mm, truncate or lacerate. Panicle 4–20 cm, lax, with often patent branches or sometimes simple. Spikelets 5–9 mm, eventually nodding, with 2 fertile florets. Glumes ovate-lanceolate, unequal, deciduous, the upper acuminate. Lemma of fertile florets ovate-oblong, with scarious apex, strongly 9- to 11-veined. $2n=18, 36$. *Dry, rocky places. Mediterranean region, Portugal.* Al Bl Co Cr Ga Gr Hs It Ju Lu Sa Si.

Very variable. A number of taxa have been described at specific or subspecific level, but they seem poorly defined morphologically and also lacking in ecological or geographical distinction.

6. M. altissima L., *Sp. Pl.* 66 (1753). Laxly caespitose; stems 60–250 cm, stout, retrorsely scabrid. Leaves 5–15 mm wide, flat, retrorsely scabrid beneath; sheaths retrorsely scabrid; ligule up to 5 mm, ovate. Panicle 10–20 cm, dense, often interrupted below, with short, erect branches. Spikelets 7–10 mm, eventually nodding, with 2 fertile florets. Glumes ovate, obtuse to subobtuse, subequal, deciduous. Lemma of fertile florets ovate, acute, with wide scarious margin, strongly 9- to 13-veined. $2n=18$. *Woods and scrub. From S.C. Czechoslovakia and C. Russia southwards to N.W. Bulgaria.* *Au Bu Cz Hu Ju Rm Rs (C, W, E).

7. M. ciliata L., *Sp. Pl.* 66 (1753). Caespitose to shortly creeping; stems 20–60(–100) cm, slender. Leaves 1–4 mm wide, usually convolute and rigid, without a prominent midrib; sheaths sometimes shortly and sparsely hairy; ligule up to 4 mm, oblong, lacerate. Panicle 4–8(–25) cm, erect, usually rather lax, with usually short, erect (rarely erecto-patent) branches. Spikelets 4–8 mm, with 1 fertile floret. Glumes subequal, ovate, acute,

[1] By T. G. Tutin.

deciduous. Lemma of fertile floret lanceolate, acute, long-ciliate on margin and marginal veins, otherwise papillose, 7- to 9-veined. *Dry, stony places. S., C. & S.E. Europe; S. Sweden, S.W. Finland.* Al Au Be Bl Bu Co Cr Cz Fe Ga Ge Gr He Hs Hu It Ju Lu Po Rm Rs (*B, W, K, E) Sa Si Su Tu.

Very variable. Four subspecies may be recognized and it is possible that **M. cretica** Boiss. & Heldr. in Boiss., *Diagn. Pl. Or. Nov.* **2(13)**: 54 (1853), from Kriti, may represent a further subspecies.

1 Panicle usually 12–25 cm, usually lobed; stem with 1 internode below the panicle **(d)** subsp. **magnolii**
1 Panicle usually not more than 8 cm, usually unlobed; stem with 2–4 internodes below the panicle
2 Upper leaf-sheaths smooth, the lamina smooth or almost so beneath **(a)** subsp. **ciliata**
2 All leaf-sheaths scabrid, the lamina scabrid beneath
3 Spikelets greenish-white at anthesis; panicle usually with more than 50 spikelets, not or weakly secund **(b)** subsp. **taurica**
3 Spikelets purplish at anthesis; panicle usually with fewer than 50 spikelets, secund after anthesis **(c)** subsp. **monticola**

(a) Subsp. **ciliata** (incl. *M. flavescens* (Schur) Simonkai, *M. glauca* F. W. Schultz): Stem with 2–3 internodes below the panicle. Sheaths of upper leaves smooth, the lamina smooth or almost so beneath. Panicle usually not more than 8 cm, secund. Spikelets 5–7 mm. $2n=18$. *Throughout the range of the species, except for much of the south.*

(b) Subsp. **taurica** (C. Koch) Tzvelev, *Sched. Herb. Fl. URSS* **19**: 53 (1972) (*M. taurica* C. Koch): Stem with 3–4 internodes below the panicle. Sheaths of all leaves scabrid, the lamina scabrid beneath. Panicle usually not more than 8 cm, not or weakly secund, usually with more than 50 spikelets. Spikelets (3–)4–6 mm, greenish-white at anthesis. $2n=18$. *Aegean region; Krym.*

(c) Subsp. **monticola** (Prokudin) Tzvelev, *loc. cit.* (1972) (*M. monticola* Prokudin): Like subsp. **(b)** but panicle secund after anthesis, usually with fewer than 50 spikelets; spikelets 5·2–6·5 mm, purplish at anthesis. *S. Ukraine.*

(d) Subsp. **magnolii** (Gren. & Godron) Husnot, *Gram.* 56 (1898) (*M. magnolii* Gren. & Godron): Stem with 1 internode below the panicle. Panicle usually 12–25 cm, usually lobed, not secund. Spikelets (6–)7–9 mm. *W. Mediterranean region, Portugal.*

8. M. transsilvanica Schur, *Enum. Pl. Transs.* 764 (1866). Like **7(a)** but leaves 2–6 mm wide, usually flat, with a prominent midrib; panicle dense, not secund; spikelets 5–9(–11) mm, the lower glume usually distinctly shorter than the upper. $2n=18$. *Dry scrub and wood-margins. E.C. & E. Europe, extending locally westwards to E.C. France.* Al Au Bu Cz Ga Ge Gr He Hu It Ju Po Rm Rs (C, W, K, E).

(a) Subsp. **transsilvanica**: Leaf-sheaths usually hairy; stem with 3(–4) internodes below the panicle. Spikelets purplish at anthesis. *Throughout most of the range of the species.*

(b) Subsp. **klokovii** Tzvelev, *Sched. Herb. Fl. URSS* **19**: 53 (1972): Leaf-sheaths often glabrous; stem with 2(–3) internodes below the panicle. Spikelets greenish-white, becoming golden after anthesis. *Moldavia, S. & E. Ukraine.*

9. M. cupanii Guss., *Fl. Sic. Prodr., Suppl.* 17 (1832). Like **7(a)** but panicle not more than 8 cm, usually lax; glumes unequal, the lower *c.* 2 mm shorter than the upper; lemma with all the veins long-ciliate. *S. Italy and Sicilia; S.E. Spain.* Hs It Si. (*N. Africa, S.W. Asia.*)

10. M. bauhinii All., *Auct. Fl. Pedem.* 43 (1789). Like **7(a)** but panicle lax; spikelets 8–10 mm, with 2 fertile florets; lemma glabrous in the distal ⅓. *Dry places.* ● *W. Mediterranean region.* Bl Co Ga It ?Ju.

41. Schizachne Hackel[1]

Perennials. Leaves flat or convolute; sheaths entire. Inflorescence a lax, secund panicle. Spikelets laterally compressed, with 3–5 hermaphrodite florets. Glumes somewhat unequal, membranous, the lower 3-, the upper 5-veined. Fertile lemma rounded on the back, coriaceous in fruit, 2-fid at apex and awned from just below the sinus; veins 7–9; callus with long hairs. Palea membranous, 2-keeled, shorter than the lemma. Lodicules 2, connate laterally.

1. S. callosa (Turcz. ex Griseb.) Ohwi, *Acta Phytotax. Geobot. (Kyoto)* **2**: 279 (1933). Shortly rhizomatous; stems 40–60 cm, glabrous, smooth below, scabrid near apex. Leaves 1–4 mm wide, glabrous beneath, with sparse, fine, soft hairs above; ligule 1–1·5 mm. Panicle up to 10 cm, with few, long-pedicellate spikelets 10–12 mm. Glumes ovate-lanceolate, acute. Lemma 2-fid for *c.* ¼ its length; awn *c.* 12 mm, eventually divergent. *Shady places. E. Russia, from c.* 55° *to* 62° *N.* Rs (N, C).

Tribe Glycerieae Endl.

Leaves linear, flat; sheaths usually closed to the mouth; silica-bodies oblong, with several constrictions; 2-celled micro-hairs absent; ligule membranous. Inflorescence a panicle. Spikelets all hermaphrodite, laterally compressed or terete, with few to many florets. Rhachilla disarticulating above the glumes and between the florets. Glumes shorter than the spikelet, unequal. Lemmas rounded on the back, herbaceous to chartaceous, usually scarious at apex, with 5–7 more or less parallel veins, unawned. Palea 2-keeled, membranous, about as long as lemma. Lodicules 2, truncate, connate, at least below, fleshy. Stamens 3, rarely 2. Ovary glabrous; styles 2. Grain with a linear hilum as long as the grain; embryo small; starch-grains compound. Chromosomes small; basic number 5.

42. Glyceria R. Br.[2]

Glabrous perennials. Leaves flat; sheaths often entire; ligule membranous. Inflorescence a panicle, with trigonous main axis. Spikelets ovate to linear in outline, with 3–many florets. Glumes unequal, hyaline, 1-veined, shorter than the lowest lemma. Lemma unawned, ovate to oblong-lanceolate, rounded on the back, 5- to 11-veined. Palea about as long as lemma. Lodicules 2, more or less connate, fleshy, glabrous.

All species grow in marshy ground or shallow water.

1 Spikelets 2–10 mm, with 3–11 florets, ovate to oblong-lanceolate in outline; keels of palea unwinged
2 Spikelets 2–4 mm; lemma 1·4–2 mm; lower glume 0·4–0·9 mm, the upper 0·7–1·3 mm **5. striata**
2 Spikelets 4–10 mm; lemma 2·3–4 mm; lower glume 1–3 mm, the upper 1·4–4 mm
3 Stamens 2; anthers 0·5–0·8 mm; rhachilla densely covered with slender pricklets; stems 4–5 mm in diameter **4. lithuanica**
3 Stamens 3; anthers (0·8–)0·9–1·8(–2) mm; rhachilla smooth or with few short, thick pricklets; stems 5–10 mm in diameter

[1] By T. G. Tutin. [2] By J. Holub.

4 Lower glume 2–3 mm, the upper 3–4 mm; leaves grass-green; stems very robust, up to 10(–12) mm in diameter; panicle rather dense, the branches suberect to patent **3. maxima**

4 Lower glume 1–2 mm, the upper 1·5–3 mm; leaves greyish-green; stems 5–7 mm in diameter; panicle lax, the branches patent to pendent

5 Panicle-branches densely aculeolate; leaves scabrid above, smooth beneath; lower glume 1–1·5 mm, the upper 1·5–2 mm **2. arundinacea**

5 Panicle-branches sparsely aculeolate or smooth; leaves smooth above, scabridulous beneath; lower glume 1·5–2 mm, the upper 2–3 mm **1. triflora**

1 Spikelets 8–30(–40) mm, with 6–16 florets, oblong to linear in outline; keels of palea winged in the upper part

6 Spikelets persisting after anthesis; plants sterile; anthers indehiscent, with imperfect pollen **11. × pedicellata**

6 Spikelets disarticulating in fruit; plants fertile; anthers dehiscent, with good pollen

7 Lemma with 3–5 distinct acute teeth at apex; palea deeply 2-fid at apex, with aristate teeth, distinctly exceeding lemma; leaves abruptly contracted at apex; anthers 0·6–1·1 mm **7. declinata**

7 Lemma without distinct acute teeth at apex; palea rounded at apex and 2-denticulate, or shallowly 2-fid with teeth not or only slightly exceeding the lemma; leaves acuminate; anthers 0·7–2·5(–3) mm

8 Lemma 5–7·5 mm; panicle ± secund, with 1–2(–3) branches at central panicle-nodes; longer branches with 1–4, the shorter with 1(–2) spikelets

9 Lemma 5·5–7·5 mm, acute or subacute, strongly veined; spikelets of shorter branches and lateral spikelets of longer branches with distinct pedicels; anthers 1·5–2·5(–3) mm **8. fluitans**

9 Lemma 5–6 mm, rounded-truncate, weakly veined; spikelets of shorter branches and lateral spikelets of longer branches subsessile; anthers 1·1–1·6 mm **9. spicata**

8 Lemma 3–4·5 mm; panicle not secund, with 3–5 branches at central panicle-nodes; longer branches with 5–16, the shorter with 1–6 spikelets

10 Veins of the lemma equal; lemma 3·5–4·5 mm, scabridulous; spikelets 10–20 mm; palea shorter than to as long as the lemma; plant dark- to bluish-green **10. plicata**

10 Veins of the lemma very unequal, 3 longer and very prominent, 4 shorter and indistinct; lemma 3–3·5 mm, smooth; spikelets 8–14 mm; palea as long as or longer than the lemma; plant pale green **6. nemoralis**

Sect. HYDROPOA Dumort. Stock long, thick. Stems robust, erect. Leaf-sheaths terete. Panicle wide, much-branched, with many spikelets. Spikelets 4–10 mm, moderately compressed before anthesis. Palea unwinged on the keels. Stamens 3.

1. G. triflora (Korsh.) Komarov, *Fl. URSS* **2**: 758 (1934). Stems 80–140 cm × 5–7 mm. Leaves 5–10(–12) mm wide, smooth above, scabrid beneath, with two violet-brown spots at the base beneath; cross-veins indistinct in upper leaves; sheaths smooth. Panicle 20–30 cm, lax; branches patent to pendent, scabridulous to smooth. Spikelets tinged with violet. Glumes obtuse or subacute, the lower 1·5–2 mm, the upper 2–3 mm. Lemma 2·6–3·2 mm, 7-veined. Palea 2·5–3 mm, with two short, obtuse teeth at apex. Anthers (0·8–)0·9–1·2(–1·4) mm. *C. Ural.* Rs (C). (*N. Asia.*)

The closely related species **G. grandis** S. Watson in A. Gray, *Man. Bot.* ed. 6, 667 (1890), from North America, with filiform, smooth panicle-branches, acute glumes, lemma 2–2·5 mm and anthers 0·8 mm, is perhaps becoming naturalized in Norway.

2. G. arundinacea Kunth, *Révis. Gram.* **1**: 118 (1929). Stems (50–)80–140(–200) cm × 5–7 mm. Leaves 5–10(–12) mm wide, greyish-green, scabrid above, smooth beneath, with two dark violet spots at the base beneath, strongly cross-veined; sheaths smooth to scabridulous. Panicle 15–50 cm, very lax; main axis smooth; branches filiform, scabrid, patent to pendent. Spikelets tinged with violet and bronze. Glumes subacute, the lower 1–1·5 mm, the upper 1·5–2 mm. Lemma 3 mm, subacute, very narrowly hyaline at apex, 5- to 7-veined. Palea 2·5–2·8 mm, narrowed upwards, with two very short obtuse teeth at apex. Anthers (1–)1·2–1·4(–1·6) mm. *S.E. Europe, from Bulgaria to the lower Volga, and extending northwards to c.* 51° *N. in S. Russia.* Bu ?Hu Rm Rs (W, ?C, E).

3. G. maxima (Hartman) Holmberg, *Bot. Not.* **1919**: 97 (1919) (*G. aquatica* (L.) Wahlenb., non (L.) J. & C. Presl). Stock with numerous long shoots. Stems (60–)80–200(–250) cm × up to 10(–12) mm. Leaves 30–60 cm × 8–18 mm, grass-green, smooth above, scabrid beneath, with two pale brown triangular spots at the base beneath; upper leaves indistinctly cross-veined; sheaths scabridulous. Panicle 10–40 cm, rather dense, with 4–10 branches at central panicle-nodes; main axis scabrid; branches relatively thick, suberect to patent, scabrid. Spikelets green or tinged with yellow or violet. Glumes subacute, the lower 2–3 mm, the upper 3–4 mm. Lemma 3–4 mm, obtuse. Palea 3–4 mm, obtuse. Anthers (1–)1·2–1·8(–2) mm. $2n=60$. *Most of Europe but absent from the extreme north and most of the south-west.* Au Be Br Bu Cz Da *Fe Ga Ge Gr Hb He Ho Hu It Ju No Po Rm Rs (N, B, C, W, E) Sa Si Su Tu.

Sect. STRIATAE Church. Stock long, relatively thick. Stems slender, erect. Leaf-sheaths somewhat compressed. Panicle wide, diffuse, with many spikelets. Spikelets 2–10 mm, moderately compressed before anthesis. Palea unwinged on the keels. Stamens 2.

4. G. lithuanica (Gorski) Gorski, *Icon. Pot. Char. Cyper. Gram. Lithuan.* t. 20 (1849) (*G. remota* Fries). Stock creeping. Stems 50–150 cm × 4–5 mm. Leaves (4–)5–9 mm wide, green, scabrid, flaccid; sheaths open above. Panicle 15–30 cm, very diffuse, much-branched; main axis scabrid; branches filiform, scabrid, almost pendent. Spikelets often tinged with violet. Glumes obtuse, the lower 1·5 mm, the upper 2–2·5 mm. Lemma 3–4 mm, oblong-lanceolate, soft, subacute, hyaline at the top only, scabrid. Palea 3–3·8 mm, narrowly elliptical, with two short teeth at apex. Anthers 0·5–0·8 mm. *Usually in wet woods. N.E. Europe, extending westwards to Norway and southwards to c.* 53° *N. in C. Russia.* Fe No Po Rs (N, B, C) Su.

5. G. striata (Lam.) A. S. Hitchc., *Proc. Biol. Soc. Washington* **41**: 157 (1928) (*G. nervata* (Willd.) Trin.). Stems (20–)30–90 (–100) cm. Leaves 2–6 mm wide, acuminate, more or less in 2 rows, grass-green, flaccid, scabridulous; sheaths closed to the top; ligule closed in front when young. Panicle 5–20 cm, lax, the main axis scabrid; branches 2–3 at central panicle-nodes, slender, scabrid, suberect, later divergent. Spikelets (2–)3–4 mm. Glumes obtuse, tinged with violet, the lower 0·4–0·9 mm, the upper 0·7–1·3 mm. Lemma 1·4–2 mm, elliptical, obtuse, prominently 7-veined. Palea 1·3–2 mm, obovate, subobtuse. Anthers 0·4–0·6 mm. *Naturalized locally in various parts of Europe.* [Au Ga He Rs (W) Su.] (*North America.*)

The above description refers to subsp. **stricta** (Scribner) Hultén, *Lunds Univ. Årsskr.* nov. ser., **38**: 232 (1942), to which all European plants most probably belong. The plants of the typical subspecies have taller stems, wider leaves, more diffuse panicles, the leaf-sheaths not closed to the top, and ligule open in front.

A related North American species, **G. canadensis** (Michx) Trin., *Mém. Acad. Sci. Pétersb.* ser. 6, **1**: 366 (1830), naturalized

in Germany, differs from **5** in having spikelets 5–7 × 5 mm, the lemma not prominently veined, the palea 2·5–3 mm, firmer, and the leaf-sheaths open to the top.

Sect. GLYCERIA. Stock short. Stems slender, often decumbent and ascending. Leaf-sheaths compressed. Panicle wide to narrow, sometimes with few spikelets only. Spikelets 8–30 mm, terete before anthesis. Palea winged on the keels. Stamens 3.

6. G. nemoralis (Uechtr.) Uechtr. & Koernicke, *Bot. Zeit.* **24**: 121 (1866). Stems 40–100 cm. Leaves acute to acuminate, pale green. Panicle 15–28 cm, not secund, broadly oblong, with many spikelets; branches suberect, patent in fruit, 3–5 at central panicle-nodes, nearly smooth, the longer with 5–16, the shorter with 1–6 spikelets. Spikelets pale green, sometimes partly tinged with violet, becoming yellowish to brownish. Glumes obtuse, the lower 1·5–2·5 mm, the upper 2·5–3 mm. Lemma 3–3·5 mm, broadly elliptical to obovate, very obtuse, smooth, with 3 long, very prominent veins alternating with 4 shorter indistinct veins, the hyaline apex long-decurrent. Palea narrowly obovate, firm, as long as or longer than the lemma, with very narrowly winged keels and two small teeth at apex. Anthers 1–1·5 mm, yellow. $2n=20$. *Wet woods. E., E.C. & S.E. Europe.* Bu Cz Ge Hu Ju Po Rm Rs (B, C, W, ?E).

7. G. declinata Bréb., *Fl. Normand.* ed. 3, 354 (1859). Stems 10–50(–65) cm, often arcuately ascending. Leaves 3–18 cm, abruptly contracted at the top, greyish- to bluish-green. Panicle 5–25 cm, narrow, with few spikelets only, often spiciform, secund, contracted in fruit; branches 1–3 at central panicle-nodes, smooth, the longer with 1–6, the shorter with 1(–2) spikelets. Spikelets narrowly oblong, rather lax, greyish-green or purplish. Lower glume 1·5–2·5 mm, ovate, subacute to acute, the upper 2·5–4 mm, elliptical, subobtuse. Lemma 3·5–4·5 mm, oblong-ovate, prominently 7-veined, scabrid, narrowly hyaline and with 3–5 distinct obtuse or acute teeth at apex. Palea oblong-lanceolate, deeply divided into 2 somewhat divergent aristate teeth at apex, distinctly exceeding the lemma. Anthers 0·6–1·1 mm, usually violet. $2n=20$. *W. & C. Europe, extending eastwards to White Russia and northwards to S. Fennoscandia.* Au Az Be Br Co Cz Da Ga Ge Hb He Ho Hs ?Hu It Lu No Po Rm Rs (?B, C, W) Su.

8. G. fluitans (L.) R. Br., *Prodr. Fl. Nov. Holl.* 179 (1810). Stems (20–)40–120(–150) cm. Leaves acuminate, dark to greyish-green. Panicle 10–40(–50) cm, secund, lax, linear, often interrupted, contracted after anthesis; branches 1–2(–3) at central panicle-nodes, the longer with 1-4 spikelets, the shorter with 1(–2) spikelets. Spikelets oblong-linear, lax. Glumes oblong, 1(–3)-veined, the lower 2–3 mm, acute, the upper 3–4·5 mm, obtuse to subacute. Lemma 5·5–7·5 mm, oblong, prominently 7-veined, narrowly hyaline at apex, entire, acute or subacute, scabridulous. Palea oblong-lanceolate, shallowly 2-fid, with 2 short teeth, equalling the lemma. Anthers 1·5–2·5(–3) mm, usually violet. $2n=40$. *Most of Europe.* All except ?Az Bl Cr Rs (K) Sb.

Plants from Iceland with shorter, more obtuse and undulate-crenulate lemmas were described as var. *islandica* A. Löve; they require further investigation. Plants with shorter and more obtuse lemmas named by C. European authors subsp. **poiformis** Fries, *Nov. Fl. Suec., Mantissa* **2**: 7 (1839), belong at least partly to **11.**

9. G. spicata (Biv.) Guss., *Fl. Sic. Syn.* **2**: 784 (1845). Like **8** but spikelets of shorter branches and lateral spikelets of longer branches subsessile; glumes obtuse; lemma 5–6 mm, rounded to truncate, slightly crenulate and broadly hyaline at apex, weakly veined; anthers 1·1–1·6 mm. *E. & C. Mediterranean region.* Co Gr It Ju Sa Si.

The status of this taxon is uncertain and further investigation is required.

10. G. plicata (Fries) Fries, *Nov. Fl. Suec., Mantissa* **3**: 176 (1842). Stems (30–)40–80(–100) cm. Leaves acuminate, dark- to bluish-green. Panicle 10–40 cm, not secund, compound, much-branched, broadly oblong; branches suberect, patent in fruit, 3–5 at central panicle-nodes, the longer with 5–15(–19), the shorter with 1–5 spikelets. Spikelets greyish-green. Glumes very obtuse, the lower 1·5–2·3 mm, ovate, the upper 2·5–4 mm, obovate. Lemma 3·5–4·5 mm, broadly elliptical, very obtuse, usually slightly crenulate and broadly hyaline at apex, with 7 equally prominent veins, scabridulous. Palea oblong-ovate, rounded above, with 2 small teeth at apex, shorter than or as long as the lemma. Anthers 0·7–1·3 mm, yellow. $2n=40$. *Most of Europe, northwards to* 62° 30′ *N. in N.W. Russia.* All except Az Bl Cr Fa Is ?Lu Sb.

11. G. × pedicellata Townsend, *Ann. Nat. Hist.* ser. 2, **5**: 105 (1850) (*G. fluitans* × *plicata*). Stems 50–130 cm, ascending from a creeping, branched base. Leaves acuminate, green. Panicle 10–50 cm, lanceolate to oblong, lax; branches erect, later patent, smooth, 2–3 at central panicle-nodes, the longer with up to 9 spikelets, the shorter with 1–2 spikelets. Spikelets persistent after anthesis, lax, subacute at apex, pale greyish-green. Glumes obtuse, smooth, the lower 2–3 mm, the upper 3–4·5 mm. Lemma (4·4–)5–5·5(–6·6) mm, oblong-elliptical, obtuse, broadly hyaline at apex, prominently veined, scabridulous. Palea equalling lemma, oblong-ovate, with 2 short teeth at apex. Anthers 1–1·8 mm, pale yellow, indehiscent, with imperfect pollen. *N., W. & C. Europe.* Au Be Br Cz Da Ga Ge Hb He Ho Hu Ju No Po Rs (B) Su.

This luxuriant sterile hybrid is nearer to *G. plicata* in habit; it spreads vegetatively and may often occur without the parents.

43. Pleuropogon R. Br.[1]

Perennials. Leaves flat. Inflorescence a unilateral raceme, with solitary, remote, pedicellate, drooping spikelets. Spikelets somewhat compressed laterally, with 3–6 florets. Glumes unequal, shorter than the lowest floret. Lemma widest in upper half, scabrid with short, appressed hairs, with 7 parallel or slightly diverging veins extending beyond the middle, the middle vein occasionally excurrent from the back as a short mucro. Palea nearly equalling lemma, the two prominent keels each with one scabrid awn from just above the base and as long as the palea, another shorter one from the middle and sometimes one or more small teeth above this.

1. P. sabinei R. Br. in Parry, *Jour. Voy. N.W. Pass., Suppl. App.* 289 (1824). Rhizomatous. Stems 8–20 cm. Leaves 2–10 cm, those of the non-flowering shoots, especially when floating, up to 30 cm × 1·5–3 mm, acute, smooth; ligule 2–3·5 mm, triangular, rounded. Panicle up to 8 cm. Spikelets 8–15 mm, purple. Glumes broadly ovate, the upper less than half as long as the lowest floret. Lemma 3–4 mm, oblanceolate, with a scarious, rounded or slightly erose apex, not keeled. Anthers 2 mm. *Shallow pools in tundra. Arctic Europe* (*N. Ural, Vajgač, Svalbard*). Rs (N) Sb. (*Circumpolar.*)

[1] By G. Halliday.

Tribe **Bromeae** Dumort.

Leaves linear, flat; sheaths closed to the mouth, soon splitting; silica-bodies oblong; 2-celled micro-hairs absent; ligule membranous. Inflorescence a panicle. Spikelets all hermaphrodite, laterally compressed or terete, with several to many florets, with distinct, often long pedicels. Rhachilla disarticulating above the glumes and below each floret. Glumes shorter than the spikelet, unequal. Lemma herbaceous to coriaceous, with a scarious margin, with 5–13 veins, 2-fid at apex, usually awned from below the sinus, rounded or keeled on the back. Palea 2-keeled. Lodicules 2, entire, connate below, glabrous. Stamens 3 or 2. Ovary with a terminal, fleshy, hairy appendage; styles 2, inserted laterally. Grain with a linear hilum as long as the grain. Starch-grains simple. Chromosomes large; basic number 7.

44. **Bromus** L.[1]

Annual, biennial or perennial. Leaves flat, or somewhat involute; ligule membranous, often jagged. Inflorescence a panicle. Spikelets with 1–many florets; glumes 1- to 9-veined, persistent at maturity, the upper usually the larger; lemma few- to many-veined, unawned or with a subterminal awn. Grain normally adherent to the palea, and tightly enclosed within the lemma; hilum narrow, elongate.

All the annual species (**1–7** and **20–35**) commonly occur as ruderals and as weeds of cultivated ground, though most of them are also found in dry grassland, especially in the southern part of their range. This range of habitat may be presumed, unless other information is given. On account of their ruderal and weedy habit it is almost impossible to delimit with any confidence the boundaries between native and naturalized and between naturalized and casual occurrence for these species, and many of them are fairly frequent casuals outside the countries listed for them here.

Literature: H. Scholz, *Willdenowia* **6**: 139–159 (1970). P. M. Smith, *Notes Roy. Bot. Gard. Edinb.* **30**: 361–375 (1970). R. Tournay, *Bull. Jard. Bot. Bruxelles* **31**: 289–299 (1961).

1 Lower glume 1-veined; upper glume 3-veined; spikelets parallel-sided or cuneiform and wider at the top
2 Annual; awn usually longer than lemma; spikelets cuneate, wider at the top
3 Lemma at least 20 mm
4 Panicle usually lax, spreading; callus-scar almost circular **1. diandrus**
4 Panicle usually dense, stiffly erect; callus-scar ±elliptical **2. rigidus**
3 Lemma not more than 20 mm
5 Panicle drooping, usually lax; most panicle-branches as long as or longer than the spikelets
6 Panicle simple, the branches each bearing 1(–3) spikelets; lemma 14–20 mm **3. sterilis**
6 Panicle always compound, usually secund, with the longer branches bearing at least 4 spikelets; lemma 9–13 mm **4. tectorum**
5 Panicle erect, often dense; most panicle-branches shorter than the spikelets, or spikelets subsessile
7 Panicle lax, the spikelets not densely crowded; panicle-branches 10 mm or more; lemma at least 3 mm wide **5. madritensis**
7 Panicle very dense, the spikelets densely crowded on branches 1–10 mm; lemma less than 3 mm wide
8 Lemma 1–1·5 mm wide; panicle 4–5 cm, with 1–2 spikelets on each branch; awns often somewhat curved outwards at maturity **6. fasciculatus**
8 Lemma at least 2 mm wide; panicle usually more than 4 cm, the branches each with 4–5 spikelets; awns straight at maturity **7. rubens**
2 Perennial; awn not longer than the lemma, rarely absent; spikelets parallel-sided
9 Lemma unawned or with an awn not more than 3 mm; leaves flat; plant with long, creeping rhizomes, not caespitose
10 Awn absent or not more than 1·5 mm; lemma glabrous, or scabrid only at the margin, very rarely pubescent at base **8. inermis**
10 Awn 1·5–3 mm; lemma with long hairs on the marginal veins and at base, glabrous elsewhere **9. sibiricus**
9 Lemma with an awn more than 3 mm; leaves flat or folded and appearing setaceous; rhizomes present or absent; plant usually caespitose
11 Panicle wide, lax; branches patent or nodding; spikelets pendent or patent
12 Panicle large, very lax; branches long, nodding, with pendent spikelets; lowest panicle-node with 2 branches, each with several spikelets; scale at lowest panicle-node ciliate **10. ramosus**
12 Panicle lax; branches and spikelets patent; lowest panicle-node with 3–5 branches, some with one spikelet; scale at lowest panicle-node not ciliate **11. benekenii**
11 Panicle erect, usually narrow; branches erect or patent; spikelets erect
13 Basal sheaths decaying into a persistent fibrous reticulum
14 Leaves and sheaths tomentose-ciliate with short dense silky hairs and sparse long cilia; leaves flat, narrow
15 Upper glume unawned; lemma 12–14 mm; lowest panicle-node with 2–3 branches; spikelets greenish-yellow **16. tomentellus**
15 Upper glume shortly awned; lemma 6–7 mm; lowest panicle-node with 4–5 branches; spikelets usually purplish-green **17. moesiacus**
14 Leaves and sheaths glabrous, or somewhat hairy but not tomentose-ciliate
16 Basal leaves more than 10 cm, 2–3 mm wide, flaccid, flat except sometimes near the apex; lemma 11–13 mm; spikelets not flecked with purple **18. riparius**
16 Basal leaves rarely more than 10 cm × 1·5 mm, somewhat rigid and involute throughout their length; lemma 8–12 mm; spikelets often flecked with purple **19. cappadocicus**
13 Basal sheaths remaining intact, or decaying into persistent, parallel fibres, not forming a reticulum
17 Rhizome long; leaf-sheaths usually with dense, grey-white hairs; lemma *c.* 9 mm, scabrid on the veins **13. pannonicus**
17 Not with the above combination of characters
18 Upper leaves often wider than the lower, flat or somewhat convolute; plant caespitose, not rhizomatous **12. erectus**
18 Leaves all of similar width; plant rhizomatous
19 Lemma *c.* 20 mm; leaves flat, or slightly convolute at the apex; rhizome short **15. pindicus**
19 Lemma 8–10 mm; leaves setaceous-complicate; rhizome long **14. moellendorffianus**
1 Lower glume 3- to 7- veined, the upper 5- to 9-veined; spikelets ovate or lanceolate, tapering towards the top
20 Perennial; spikelets strongly compressed; lemma strongly keeled; awn shorter than the lemma or absent, always straight, arising very near the apex
21 Spikelets lanceolate to ovate; glumes cucullate; lemma mucronate, or with a short, slender awn up to 1 mm; palea *c.* ½ as long as lemma **36. willdenowii**
21 Spikelets linear-lanceolate; glumes acute; lemma with an awn 4–10 mm; palea about equalling the lemma **37. carinatus**
20 Annual; spikelets subterete; lemma rounded on the back; awn about as long as the lemma, arising well below the apex, often curved, rarely short or absent

[1] By P. M. Smith.

22 Grain thick, longitudinally inrolled; margins of lemma inrolled, not or scarcely overlapping in fruit; rhachilla disarticulating tardily; panicle lax
23 Lemma not more than 6·5 mm; lower sheaths softly hairy
24 Lemma 6–6·5 mm; panicle very lax, patent or drooping; stems 80–110 cm **20. arvensis**
24 Lemma 5–6 mm; panicle narrow, contracted; stems not more than 60 cm **21. pseudosecalinus**
23 Lemma at least 6·5 mm; sheaths often glabrous
25 Lemma 6·5–9(–10) mm; anthers 1–2 mm **22. secalinus**
25 Lemma (8–)10–14(–16) mm; anthers 2–3 mm
26 Apical sinus of lemma very deep, the teeth 1–3 mm, awn-like, the lemma usually appearing 3-awned; margin of lemma with a lateral tooth or lobe **23. bromoideus**
26 Apical sinus of lemma shallow, the teeth short and wide; lateral teeth or lobes absent **24. grossus**
22 Grain thin, flat or feebly rolled; margins of lemma gaping and overlapping in fruit; rhachilla fragile, soon disarticulating; panicle lax or dense
27 Palea split almost to the base **28. interruptus**
27 Palea entire or shallowly emarginate
28 Lemma 4·5–6·5 mm, with wide, hyaline, sharply angled margin; ripe grain exceeding palea **29. lepidus**
28 Lemma usually more than 6·5 mm, with narrow, hyaline, rounded or bluntly angled margin; grain not exceeding palea
29 Awn terete, arising not more than 1·5 mm from apex of lemma, straight or only weakly divaricate in fruit, sometimes absent
30 Panicle usually dense; most pedicels shorter than their spikelets; lemma papery, with prominent veins; anthers rarely more than 1 mm, usually much less **27. hordeaceus**
30 Panicle lax; most pedicels longer than their spikelets; lemma corneous, with obscure veins; anthers more than 1 mm
31 Anthers(3–)4–5 mm; panicle up to 30 cm; palea about equalling the lemma **20. arvensis**
31 Anthers not more than 3 mm; panicle usually not more than 15 cm; palea shorter than lemma
32 Lemma 6·5–8 mm, with rounded margins; lowest rhachilla-segment 0·5–1 mm **26. racemosus**
32 Lemma 8–11·5 mm, with bluntly angled margins; lowest rhachilla-segment 1·5–1·75 mm **25. commutatus**
29 Awn flattened at base, arising more than 1·5 mm from apex of lemma, markedly divaricate, patent or deflexed at maturity, sometimes twisted at base
33 Panicle dense, erect, sometimes interrupted or verticillate; panicle-branches and pedicels much shorter than their spikelets
34 Spikelets (20–)25–50 mm (excluding awns); lemma 12–15 mm; awn 12–15 mm, usually twisted at the base and patent **31. alopecuros**
34 Spikelets (8–)12–20(–25) mm (excluding awns); lemma 6·5–9(–11) mm; awn 6·5–9(–12) mm, usually only slightly twisted
35 Lemma not more than 2 mm wide; grain narrowly elliptical, *c.* 1 mm wide; panicle obovoid-cuneate or branches verticillate **30. scoparius**
35 Lemma 3–5 mm wide; grain oblanceolate, more than 1 mm wide; panicle ovoid to ovoid-oblong, often with few spikelets **27. hordeaceus**
33 Panicle lax, erect or nodding, somewhat contracted only when young or depauperate; at least some panicle-branches and pedicels as long as or longer than their spikelets
36 Panicle lax, nodding; pedicels mostly longer than spikelets, or panicle racemose
37 Panicle usually secund, racemose, with few, somewhat laterally compressed spikelets; spikelets up to 70 mm; lemma up to 7 mm wide **35. squarrosus**
37 Panicle usually compound, with numerous, terete spikelets; spikelets not more than 40 mm; lemma not more than 4 mm wide **34. japonicus**
36 Panicle lax, erect; pedicels mostly equalling or shorter than spikelets
38 Lemma 6–9 mm; panicle with slender, flexuous branches and pedicels; spikelets 15–25 mm, often tangled, usually with short, crispate hairs **33. intermedius**
38 Lemma 12–20 mm; panicle with stout, usually rigid branches and pedicels; spikelets 20–50 mm, usually not tangled, usually with dense, long hairs **32. lanceolatus**

Sect. GENEA Dumort. Annuals or rarely biennials. Spikelets lanceolate only when young, soon becoming cuneate, wider at the top. Lower glume 1-veined, the upper 3-veined. Awn longer than the lemma, usually flattened and scabrid.

1. B. diandrus Roth, *Bot. Abh.* 44 (1787) (*B. gussonii* Parl.). Stems 35–90 cm, erect or decumbent, hairy below the panicle. Leaves rough, with scattered hairs; sheaths with patent hairs. Panicle often up to 25 cm, very lax, nodding, the branches 2–4 at a node, patent, very rough, mostly bearing a single spikelet; spikelets 50–70 mm, narrowly cuneate when mature. Lower glume 15–25 mm, subulate, the upper 20–35 mm, linear-lanceolate. Lemma 20–35 mm, lanceolate, gradually tapering to a deeply emarginate apex; awn 35–65 mm, straight, flat and very scabrid; callus-scar almost circular. Palea shorter than lemma. Stamens 2–3; anthers 1–5 mm. $2n=56$. *Mediterranean region and S.W. Europe.* Bl Co Cr Ga Gr Hs It Ju Lu Sa Si Tu [*Az Be Br Rs (K)].

2. B. rigidus Roth, *Bot. Mag.* (*Zürich*) **4(10)**: 21 (1790) (*B. maximus* Desf., *B. villosus* Forskål). Stems 20–40 cm, erect, pubescent at least near the inflorescence. Leaves 10–25 cm × 4–6 mm, covered with dense, short hairs; sheaths with patent hairs. Panicle 15–20 cm, dense, erect; branches shorter than the spikelets, often hairy; spikelets 25–35 mm, erect, glabrous or hairy. Glumes mostly hyaline except for the veins, the lower 15–18 mm, linear-lanceolate, the upper 20–25 mm, narrowly lanceolate. Lemma 22–25 mm, linear-lanceolate, deeply 2-fid at the apex; awn 30–50 mm, straight, flattened, very stout and rough; callus-scar more or less elliptical. Palea distinctly shorter than lemma. Stamens 2; anthers *c.* 1 mm. $2n=42$. *S. & W. Europe, northwards to N.W. France and Hungary.* Az Bl Co Cr Ga Gr Hs Hu It Ju Lu Rm Sa Si Tu [Cz].

B. hispanicus Rivas Ponce, *Lagascalia* **3**: 53 (1973), described from Spain, is closely related to or conspecific with **2**. It appears to differ mainly in the somewhat laxer panicle.

3. B. sterilis L., *Sp. Pl.* 77 (1753). Stems 5–100 cm, glabrous, erect or geniculately ascending. Leaves 5–20 cm × 2–6 mm, flaccid, softly hairy; sheaths pubescent. Panicle 10–20 × 7–12 cm, very lax; branches mostly much longer than the spikelets, patent or nodding, with 1(–3) spikelets; spikelets 20–35 × 4–8 mm, scabrid, compressed, hairy or glabrous, cuneate, with 5–9 florets. Lower glume 6–14 mm, subulate, the upper 10–20 mm, linear-lanceolate. Lemma 14–20 × 2–4 mm, narrowly lanceolate, with acute apical teeth 1–3 mm; awn 15–30 mm, slender, straight, usually longer than lemma. Palea almost equalling lemma. Stamens 3; anthers 1 mm. $2n=14$. *S., W. & C. Europe, extending to S. Sweden.* All except Az Fa Is Rs (N, C) Sb, but only as an alien in Fe and Rs (B).

4. B. tectorum L., *Sp. Pl.* 77 (1753). Stems 5–90 cm, erect, slender, glabrous or slightly puberulent. Leaves 4–16 cm × 2–4 mm, softly hairy; lower sheaths hairy, the upper sometimes glabrous. Panicle 5–20 cm, lax or rather dense, at first erect, then nodding and mostly secund, often pale green tinged with purple, shining when glabrous; branches slender, hairy, flexuous, with up to 8 spikelets; spikelets 10–20 × 3–4 mm, nodding, narrow at first, becoming cuneate when ripe, with 4–8 florets, hairy or glabrous. Glumes with hyaline margins, the lower 5–8(–9) mm, the upper 7–11(–13) mm. Lemma 9–12 × 2–3 mm, lanceolate; awn 10–18 mm, slender, straight. Palea distinctly shorter than lemma. Stamens 3; anthers 0·5–1 mm. $2n=14$. *Europe, northwards to N. France, S. Fennoscandia and C. Russia.* ?Al Au Be Bu Co Cr Cz Da Ga Ge Gr He Ho Hs Hu It Ju Lu No Po Rm Rs (C, W, K, E) Sa Si Su Tu [Br Fe Rs (B)].

5. B. madritensis L., *Cent. Pl.* **1**: 5 (1755). Stems up to 60 cm, erect or ascending, glabrous except sometimes near the panicle. Leaves up to 20 cm × 2–4 mm, linear, acute, flat, glabrous or pubescent; lower sheaths hairy, the upper often glabrous. Panicle 3–15 × 2–6 cm, erect; branches 2–3 at a node, up to 3 cm; spikelets 30–50 × 7–12 mm, cuneate, wider at the top, lax, with 6–10 florets, hairy or glabrous. Lower glume 5–10 mm, the upper 10–15 mm, both very narrow. Lemma 12–20 × 3–3·5 mm, narrowly oblong-lanceolate, with apical teeth 2–3 mm, the margins somewhat inrolled at maturity; awn 12–20 mm, straight or weakly divaricate. Palea shorter than lemma. Stamens 2; anthers 0·5–1 mm. $2n=28$, 42. *S. & W. Europe, northwards to N.W. France.* Al Az Bl Bu Co Cr Ga Gr Hs It Ju Lu Rs (K) Sa Si Tu [Br Hb].

6. B. fasciculatus C. Presl, *Cyper. Gram. Sic.* 39 (1820). Stems 4–25 cm, erect or geniculate at base, sometimes hairy below the panicle. Leaves and sheaths softly hairy, the lamina 2–10 cm × 1–2 mm. Panicle 4–5 × 0·7–1·2 cm, stiffly erect; branches rigid, shorter than the spikelets, glabrous or hairy; spikelets 20–30 mm (excluding awns), broadly cuneate. Lower glume 7–8 mm, subulate, the upper 12–14 mm, narrowly lanceolate. Lemma 13–15 × 1–1·5 mm, with somewhat incurved margins, glabrous or hairy, gently curved outwards at maturity, deeply emarginate at the apex; awn 13–18 mm, about equalling the lemma, rough, straight or slightly divaricate. Palea shorter than lemma. Stamens 3; anthers 0·5–4 mm. $2n=14$. *S. Greece, S. Italy and islands of the Mediterranean region.* Bl Co Cr Gr It Sa Si.

7. B. rubens L., *Cent. Pl.* **1**: 5 (1755). Stems 10–40 cm, erect or ascending, glabrous below, often hairy below the inflorescence. Leaves up to 12 cm × 5 mm, flat, hairy; sheaths softly pubescent. Panicle 2–10 × 2–5 cm, erect, very dense, cuneate at base, often reddish-brown; branches and pedicels much shorter than the spikelets, pubescent; spikelets 18–25 × 2–6 mm, cuneate, hairy or glabrous, subsessile, with 4–8 florets. Lower glume 5–7 mm, subulate, the upper 8–10 mm, lanceolate, both with wide, hyaline margins. Lemma 10–13 × 2–3 mm, oblong-elliptical, strongly veined and 2-fid for *c.* 4 mm; awn 8–12 mm, straight, reddish. Palea shorter than lemma, very narrow. Stamens 2 or 3; anthers 0·5–1 mm. $2n=28$. *Mediterranean region and S.W. Europe.* ?Az Bl Co Cr Ga Gr Hs It Lu Sa Si Tu.

Depauperate plants of **5** and **7** are hard to separate.

Sect. PNIGMA Dumort. Perennials. Spikelets narrow, more or less parallel-sided when mature, terete. Lower glume 1(–3)-veined, the upper 3(–5)-veined. Lemma rounded or weakly keeled on the back. Awn usually shorter than the lemma, rarely absent.

8. B. inermis Leysser, *Fl. Hal.* 16 (1761). Strongly rhizomatous; usually glabrous; stems 30–150 cm, erect, glabrous or rarely hairy below the nodes. Leaves up to 9 mm wide, flat, usually glabrous; sheaths glabrous, or rarely the lower pubescent. Panicle 10–25 cm, erect, spreading, the branches 3–7 at a node; spikelets 15–30 × 3–5 mm, usually glabrous, lanceolate or linear-oblong, with 5–10 florets. Glumes unequal, at least the upper with an obtuse hyaline apex. Lemma 8–10 mm, glabrous or scabrid only at the margin, very rarely pubescent at base, obtuse or shallowly emarginate, usually unawned, but sometimes with a weak awn up to 1·5 mm. Palea somewhat shorter than lemma. Anthers 4–5 mm. $2n=56$. *Europe, westwards to the Netherlands and N.W. Italy; cultivated for fodder in parts of E. & E.C. Europe.* Au ?Be Bu Cz Ga Ge Ho *Hs Hu It Ju Po Rm Rs (N, B, C, W, K, E) Tu [Br Da Fe He Is No Su].

There are numerous agricultural varieties. Considerable natural variation exists, and many varieties or forms have been recognized on minor characters of indumentum distribution or awn development.

9. B. sibiricus Drobov, *Trav. Mus. Bot. Acad. Pétersb.* **12**: 229 (1914) (*Zerna occidentalis* Nevski, ?*B. vogulicus* Soczava). Creeping, rhizomatous; stems 20–100 cm, covered at the base by pale brown, entire, usually glabrous leaf-sheaths. Leaves flat, glabrous or sparsely hairy. Panicle 3–15 cm, erect, narrow and rather dense, the branches often shorter than the spikelets, each bearing 1–2 spikelets. Spikelets 12–25 mm, narrowly oblong, often dark purple, with 4–8 florets. Lower glume 5–8 mm, the upper 7–10 mm. Lemma lanceolate, hairy at the base and on margins only, with a short, straight awn 1·5–3 mm. Palea shorter than lemma. Anthers 2–4 mm. *Meadows, screes and maritime sands. N.E. Russia.* Rs (N, C). (*Temperate Asia, N. America.*)

10. B. ramosus Hudson, *Fl. Angl.* 40 (1762) (*B. asper* Murray). Erect, laxly caespitose; stems 40–190 cm, puberulent. Leaves 10–60 cm × 6–15 mm, flaccid, flat, sparsely hairy, the lower wider than the upper; sheaths auriculate at apex, with long, rigid, retrorse hairs. Panicle 15–40 cm, very wide and lax, nodding, green or sometimes purplish; branches 2 at a node, longer than the spikelets, each with 1–9 spikelets, the lowest pair with a ciliate scale at the base; pedicels 5–40 mm; spikelets 20–40 × 4–6 mm, lax, pendent, linear-oblong, with 4–12 florets. Lower glume 6–8 mm, subulate, the upper 9–11 mm, lanceolate, mucronate or very shortly awned. Lemma 10–13 mm, lanceolate, with an obscure marginal angle, hairy on the margins and veins; awn 4–7 mm, straight. Palea distinctly shorter than lemma. Anthers 2·5–4 mm. $2n=14$, 28, 42. *Woods, hedges and shady roadsides. W., C. & S. Europe, extending eastwards to Gotland and E. Romania.* Al Au Be Br Bu Cz Da Ga Ge Gr Hb He Ho Hs Hu It Ju No Po Rm Rs (?B, W) ?Sa Si Su Tu [Lu].

11. B. benekenii (Lange) Trimen, *Jour. Bot.* (*London*) **10**: 333 (1872). Caespitose; stems 50–120 cm, erect, minutely hairy. Leaves 10–25 cm × 5–12 mm, flat, sparsely hairy especially on the margins; sheaths densely and shortly hairy, the upper sometimes glabrous. Panicle 12–20 × 10–15 cm, nodding above; branches 2–5 at a node, slender, each with 1–5 spikelets, the lowest pair with a glabrous or rarely pubescent scale at the base; spikelets 15–30 cm, lanceolate-acuminate, with 3–6 florets. Glumes scabrid, the lower 7–8 mm, linear-lanceolate, the upper 9–11 mm, oblong-lanceolate. Lemma 11–14 mm, narrowly lanceolate, with appressed hairs; awn 5–8 mm, straight, erect. Palea distinctly shorter than lemma. Anthers *c.* 3 mm. $2n=28$. *Woods and hedges. Much of Europe, but absent from most of the north-east, much of the extreme west and many of the islands.* Al Au Be

Br Bu Cz Da Fe Ga Ge Gr He Ho Hs Hu It Ju No Po Rm Rs (B, C, W, K, E) Si Su Tu.

12. B. erectus Hudson, *Fl. Angl.* 39 (1762). Caespitose; stems 15–120 cm, erect, slender or stout and rigid, usually glabrous. Leaves up to 35 cm, linear-acuminate, tough, glabrous or sparingly hairy, the lower often involute, 2–3 mm wide, the upper flat, 4–6 mm wide; sheaths glabrous or hairy. Panicle erect, the branches ascending or rarely patent, each with 1–4 spikelets; spikelets linear-lanceolate when young, becoming oblong. Glumes acuminate. Lemma narrowly lanceolate, with somewhat inrolled margins at maturity; awn slender. $2n=42, 56$. *Meadows, dry banks, roadsides and waste places; calcicole. S., W. & C. Europe, northwards to N. England; naturalized in Fennoscandia and W. part of U.S.S.R.* Al Au Be Br Bu Co Cz Ga Ge Gr He Ho Hs Hu It Ju ?Lu Po Rm Rs (W) Sa Si [Da Fe Hb No Rs (B, C) Su].

1 Leaf-sheaths lanate, the lower eventually decaying into parallel fibres; panicle dense; lemma 8–9 mm **(b)** subsp. **condensatus**

1 Leaf-sheaths not lanate, the lower remaining intact when dead; panicle lax; lemma more than 9 mm

2 Glumes subequal; panicle short, contracted; pedicel equalling or shorter than the spikelet; florets overlapped for ¾ of their length by the floret below; lemma hairy or glabrous **(a)** subsp. **erectus**

2 Glumes markedly unequal; panicle elongate, lax; pedicel often longer than the spikelet; florets overlapped only by the apex of the floret below; lemma glabrous

3 Plant up to 100 cm; lemma 13–18 mm, distinctly longer than the upper glume; lower sheaths with dense, short hairs **(c)** subsp. **stenophyllus**

3 Plant not more than 40 cm; lemma *c.* 10 mm, about equalling the upper glume; lower sheaths glabrous or with scattered, long hairs **(d)** subsp. **transsilvanicus**

(a) Subsp. **erectus**: Stems up to 100 cm. Leaves and sheaths glabrous or with scattered long hairs, the sheaths remaining intact when dead. Panicle 10–20 cm, erect, elliptical, the pedicels equalling or shorter than the spikelets; spikelets 15–25 mm, with rhachilla-segments up to 2·5 mm. Lower glume 7–12 mm, the upper 8–14 mm. Lemma 10–15 mm, glabrous or sometimes hairy; awn 2–8 mm, straight. Palea scarcely shorter than lemma. Anthers 4–7 mm. *Throughout the range of the species.*

(b) Subsp. **condensatus** (Hackel) Ascherson & Graebner, *Syn. Mitteleur. Fl.* **2(1)**: 580 (1901): Stems up to 60 cm, densely caespitose. Leaf-sheaths lanate, eventually decaying into persistent, parallel fibres. Panicle 8–11 cm, erect, narrow, with densely crowded spikelets, the pedicels usually much shorter than the spikelets; spikelets up to 18 mm, with 5–6 crowded florets, the rhachilla-segments *c.* 1·5 mm. Lower glume 6–8 mm, the upper 7–10 mm. Lemma 8–9 mm, usually glabrous; awn 3–5 mm. ● *S. Alps and adjacent lowlands, N.W. part of Balkan peninsula.*

(c) Subsp. **stenophyllus** (Link) Ascherson & Graebner, *op. cit.* 583 (1901): Stems up to 100 cm, densely caespitose. Leaves glabrous, the lower sheaths remaining intact when dead, shortly hairy. Panicle 15–25 cm, lax, the pedicels often much longer than the very lax spikelets; spikelets 35–40(–50) mm, with 7–10 florets; rhachilla-segments up to 6 mm. Lower glume 7–9 mm, the upper 9–11 mm. Lemma 13–18 mm, glabrous; awn 6–9 mm, straight. Palea shorter than lemma. Anthers 4–6 mm. ● *N. Italy and N. Jugoslavia.*

(d) Subsp. **transsilvanicus** (Steudel) Ascherson & Graebner, *loc. cit.* (1901): Stems up to 40 cm, caespitose. Leaves glabrous or hairy; lower sheaths with sparse, long hairs or glabrous, remaining intact when dead. Panicle 15–20 cm, lax, with long, slender branches often with 1 spikelet, mostly longer than the very lax spikelets; spikelets 30–40 mm, with 7–10 florets; rhachilla-segments 4–5 mm. Lower glume 6–8 mm, the upper 8–10 mm. Lemma *c.* 10 mm, glabrous; awn up to 8 mm, curving slightly outwards when mature. Palea shorter than lemma. Anthers *c.* 3 mm. ● *From N. Italy to S. Bulgaria and C Romania.*

13. B. pannonicus Kummer & Sendtner, *Flora* (*Regensb.*) **32**: 757 (1849). Rhizomatous; stems up to 70(–130) cm, erect, sometimes laxly caespitose. Leaves linear, flat. Panicle 8–12 cm, erect, lax; branches erect, 3–5 at lowest panicle-node, each with 1 spikelet; spikelets usually glabrous, with 5–7 florets. Glumes 6–7 mm, narrowly lanceolate. Lemma *c.* 9 mm, scabrid on the veins; awn 7–8 mm, slender, straight. Anthers 3–4 mm. *Dry grassland and stony slopes.* ● *E.C. Europe, extending southwards to C. Jugoslavia.* Cz Hu Ju Rm.

(a) Subsp. **pannonicus**: Leaves and sheaths with numerous, long greyish hairs; basal sheaths remaining intact. Spikelets 14–17(–25) mm, remaining erect. *Throughout the range of the species.*

(b) Subsp. **monocladus** (Domin) P.M. Sm., *Bot. Jour. Linn. Soc.* **76**: 360 (1978) (*B. monocladus* Domin): Leaves and sheaths glabrous, rarely sparsely hairy, basal sheaths breaking down into fibres. Spikelets *c.* 20 mm, sometimes drooping at maturity. $2n=28$. *On dolomitic soils. S. Czechoslovakia, N. Hungary.*

14. B. moellendorffianus (Ascherson & Graebner) Hayek, *Prodr. Fl. Penins. Balcan.* **3**: 208 (1932). Rhizomatous; stems up to 40 cm, erect, slender, fragile. Leaves setaceous-complicate; sheaths glabrous, or hairy only at apex. Panicle up to 5 cm, lax; branches with 1 spikelet, often much shorter than the spikelets; spikelets 15–23 mm, glabrous, glossy, with 5–6 closely imbricate florets. Lower glume *c.* 7 mm, the upper *c.* 11 mm. Lemma 8–10 mm, about equalling the upper glume, with wide hyaline margins distally; awn straight, almost as long as lemma. Palea shorter than lemma. *Rocky ground.* ● *W.C. Jugoslavia (near Sarajevo and Travnik).* Ju.

15. B. pindicus Hausskn., *Mitt. Thür. Bot. Ver.* nov. ser., **13–14**: 53 (1897). Laxly caespitose, rhizomatous; stems up to 100 cm, glabrous. Leaves flat throughout, occasionally somewhat convolute at the apex, all *c.* 3 mm wide, rather tough and rigid; dead basal sheaths remaining intact or decaying into parallel fibres. Panicle 12–28 cm, erect, dense; branches 1–2 at the lower nodes, as long as or often shorter than the spikelets, often with 1 spikelet; spikelets 40–50 mm, lax, erect, becoming 10–12 mm wide at maturity, glabrous, with 6–7 florets. Lower glume 10–11 mm, the upper 11–12 mm, acuminate. Lemma 16–20 mm, linear-lanceolate, with wide, hyaline margins and long, acute apical teeth; awn *c.* 10 mm, straight. Anthers 4–5 mm. *Damp schistose rocks.* ● *N.C. Greece (Pindhos, above Metsovon).* Gr.

16. B. tomentellus Boiss., *Diagn. Pl. Or. Nov.* **1(7)**: 126 (1846). Caespitose; stems up to 60 cm, glabrous, rigid, erect or geniculately ascending. Leaves 10–20 cm × 3–7 mm, flat, tomentose; sheaths tomentose, with dense, short white hairs and sparse, longer hairs, decaying into a whitish reticulum of persistent, anastomosing fibres. Panicle up to 10 × 4 cm, compact, erect or rarely nodding, rarely with more than 10 spikelets; branches short, glabrous or shortly hairy, the lower 2–3 at a node; spikelets 25–35 × 5–7 mm, lax, oblong, becoming cuneiform when mature, usually hairy, pale greenish-yellow, with 6–10 florets. Lower glume 10–14 mm, the upper 10–16 mm, acute, unawned.

Lemma 12–14 mm, oblong-lanceolate, with short apical teeth; awn somewhat shorter than lemma, straight or weakly divaricate. Anthers *c.* 3 mm. *Mountain pastures. Kriti.* Cr. (*S.W. Asia.*)

17. B. moesiacus Velen., *Fl. Bulg.* 616 (1891). Caespitose; stems 20–40 cm. Leaves 3–5 cm, flat, the lower 1–1·5 mm wide, the upper up to 4 mm wide, tomentose, lanate and with sparse long hairs; lower sheaths decaying into persistent, reticulate fibres. Panicle *c.* 8 × 4 cm, erect, rather lax, the lower branches 4–5 at a node, about as long as the spikelets; spikelets up to 20 × 4 mm, linear-oblong, with 6–9 florets, usually hairy. Glumes 4–5 mm, the upper with an awn *c.* 1 mm, from near the apex. Lemma 6–7 mm, broadly lanceolate, often tinged with purple, the apical teeth short; awn straight, erect, about as long as the lemma. Palea slightly shorter than lemma. Anthers *c.* 2 mm. *Dry hillsides; calcicole.* ● *S.W. Bulgaria.* Bu.

18. B. riparius Rehmann, *Notizbl. Veg. Gest. Schwarz. Meer* 83 (1872) (*B. fibrosus* Hackel, *B. erectus* auct. ross., non Hudson). Densely caespitose, sometimes with very short rhizomes; stems 30–90 cm, slender, erect or decumbent at the base. Leaves 10–20 cm × 2–3 mm, flaccid, scabrid, the margins sometimes with brittle cilia; sheaths with long, patent or retrorse hairs, the basal decaying into persistent, reticulate fibres. Panicle 10–20 × 3–7 cm, erect, rather lax, the branches scabrid, each with 1–2 spikelets; spikelets 20–30 mm, lanceolate, usually pale green, with 5–7 florets. Lower glume 8–10 mm, the upper 9–12 mm. Lemma 11–13 mm, oblong-lanceolate, usually glabrous, sometimes appressed-hairy; awn 5–8 mm, straight or slightly curved. Palea shorter than lemma. Anthers 2·5–3·5 mm. $2n=70$. *Meadows, scrub and rocky hillsides. S.E. Europe, extending northwards to C. Russia.* Bu Gr Ju Rm Rs (C, W, K, E).

Robust variants with hairy inflorescences from Romania and Bulgaria have been distinguished as **B. barcensis** Simonkai, *Enum. Fl. Transs.* 584 (1887) (*B. fibrosus* subsp. *barcensis* (Simonkai) Hayek), but the status of this taxon is very doubtful.

19. B. cappadocicus Boiss. & Balansa, *Bull. Soc. Bot. Fr.* **4**: 306 (1857). Densely caespitose, sometimes with very short rhizomes; stems 25–45 cm, slender, erect. Leaves up to 10 cm × 1·5 mm, the cauline often only 1–2 cm, rather tough, sparsely hairy, flat or weakly involute, acuminate; basal sheaths decaying into persistent, reticulate fibres, eventually enveloping the lower part of the stems in a spongy mass. Panicle erect, with slender, flexuous branches, each with 1–2 spikelets; spikelets often greenish-purple. Lower glume 5–7 mm, the upper 7–8 mm. Lemma 8–10 mm, lanceolate, shortly hairy; awn straight or curving slightly outwards. Palea shorter than lemma. Anthers 2–2·5 mm. $2n=42$. *Rocky ground. S. half of Balkan peninsula.* Al Bu Gr Ju.

(a) Subsp. **cappadocicus**: Leaf-sheaths glabrous or shortly pubescent. Panicle 5–9 cm, with 2–3 nodding branches at lowest node. Spikelets 14–20 mm, with 5–8 florets, glabrous; awn 4–6 mm. *S. Albania and Macedonia.* (*S.W. Asia.*)

(b) Subsp. **lacmonicus** (Hausskn.) P.M.Sm., *Bot. Jour. Linn. Soc.* **76**: 360 (1978) (*B. lacmonicus* Hausskn.): Leaf-sheaths with long, patent hairs. Panicle 5–6 cm, with 5 erect or ascending branches at lowest node. Spikelets 11–15 mm, with 3–5 florets, densely hairy; awn 5–8 mm. ● *S. Bulgaria to C. Greece.*

Sect. BROMUS. Annuals or rarely biennials. Spikelets lanceolate or ovate-lanceolate, terete or slightly compressed. Lower glume 3- to 5-veined, the upper 5- to 7-veined. Lemma rounded on the back, usually shallowly emarginate and with 2 apical teeth, rarely entire. Awn straight, patent or recurved, about as long as lemma, rarely absent.

20. B. arvensis L., *Sp. Pl.* 77 (1753). Stems 80–110 cm, erect, glabrous. Leaves 10–20 cm × 2–6 mm, flat, linear-acuminate, sparsely hairy; sheaths with scattered hairs. Panicle up to 30 × 20 cm, very lax, erect at first, finally patent or nodding; branches long, slender, rough, with up to 10 spikelets; spikelets 10–25 mm, oblong-lanceolate, with 4–10 florets. Lower glume 4–6 mm, the upper 6–8 mm. Lemma 7–9 mm, broadly elliptical or obovate, shallowly 2-dentate; awn 6–10 mm, straight, slender. Palea about equalling the lemma. Anthers up to 5 mm, never less than half as long as lemma. Grain 7–9 mm, flat, thin. $2n=14$. *S. & S.C. Europe; widely naturalized further north.* Al Bl Bu Ga Gr Hs Hu It Ju Rm Rs (*C, W) Tu [Au Be Br Cz Da Fe Ge Ho No Po Rs (N, B) Su].

Subsp. **segetalis** H. Scholz, *Willdenowia* **6**: 145 (1970) (*B. secalinus* subsp. *billotii* (F. W. Schultz) Ascherson & Graebner), has been recorded from C. Europe as a weed in crops of *Secale*. It has the lemma *c.* 6 mm, divaricate in fruit, and a rather thick, weakly incurved grain.

21. B. pseudosecalinus P.M. Sm., *Feddes Repert.* **77**: 63 (1968). Stems 30–60 cm, erect, slender; sheaths hairy. Panicle 5–10 cm, lax, contracted and somewhat nodding after flowering; spikelets 8–12 mm, lanceolate at first, becoming ovate, glabrous, disarticulating tardily at maturity; florets imbricate at first, erecto-patent after anthesis. Glumes and lemmas corneous, obscurely veined; lemma 5–6 mm, the bluntly angled margins becoming inrolled, revealing the rhachilla; awn 2–6 mm, straight or slightly flexuous. Palea shorter than lemma. Anthers 1·25–1·75 mm. Grain 4–4·5 mm, longitudinally incurved at maturity. $2n=14$. ● *Britain and Ireland.* Br Hb.

The distribution is imperfectly known.

22. B. secalinus L., *Sp. Pl.* 76 (1753). Stems 20–120 cm, erect, usually stout. Leaf-sheaths usually glabrous or the lower very obscurely hairy, rarely with uniform, fine, stiff hairs. Panicle 5–20 cm, lax, often secund and nodding after flowering; spikelets 12–20 mm, glabrous or hairy, lanceolate at first, later ovate; florets imbricate at first, erecto-patent after anthesis. Glumes and lemma corneous, obscurely veined. Lemma 6·5–9(–10) mm, shallowly emarginate at the apex, or entire, the inrolled margins revealing the rhachilla; awn up to 8 mm, straight or flexuous, sometimes absent. Palea equalling lemma. Anthers 1–2 mm. Grain 6–9 mm, longitudinally inrolled at maturity. $2n=28$. *S. & S.C. Europe; widely naturalized further north.* *Az Bu Co ?Cr Ga Gr Hs Hu It Ju *Lu Rm Rs (W) Sa Si [Au Be Br Cz Da Fe Ge He Ho No Po Rs (N, B, C) Su].

23. B. bromoideus (Lej.) Crépin, *Bull. Soc. Bot. Belg.* **6**: 399 (1867) (*B. arduennensis* Dumort.). Stems 60–130 cm, erect, stout. Leaf-sheaths glabrous. Panicle 18–20 cm, lax, erect at first, often secund later; spikelets 25–30 mm, ovate-lanceolate, glabrous or hairy; florets imbricate at first, erecto-patent after anthesis. Glumes and lemmas corneous, with prominent veins; glumes often shortly awned below the apex. Lemma (11–)12–14 (–16) mm, deeply emarginate, with 2 apical setae 1–3 mm, and a prominent triangular or rounded tooth on each margin, with the margins inrolling somewhat at maturity; awn 8–12 mm, stout, straight, arising below the apical sinus of the lemma, which may hence appear 3-awned. Palea shorter than lemma. Anthers 2–3 mm. Grain 8 mm, inrolled at maturity. $2n=28$. *Formerly in S.E. Belgium, just extending into France, among crops of* Triticum spelta; *now extinct except in Botanic Gardens.* ● †Be †Ga.

24. B. grossus Desf. ex DC. in Lam. & DC., *Fl. Fr.* ed. 3, **3**: 68 (1805). Stems 60–130 cm, erect, stout. Leaf-sheaths hairy or

glabrous. Panicle 14–18 cm, lax, erect, often secund later; spikelets 18–50 mm, ovate-lanceolate, glabrous or hairy. Glumes and lemmas corneous, but with the veins sometimes prominent below; glumes sometimes shortly awned below the apex. Lemma (8–)10–12(–14) mm, bluntly angled, with a shallow apical sinus; awn 8–12 mm, stout, straight, arising below the sinus. Palea about equalling lemma. Anthers 2–3 mm. Grain 10–12 mm, a little shorter than lemma, inrolled at maturity. $2n=28$. *Among crops of* Triticum spelta. ● *Belgium; an occasional casual elsewhere.* Be.

For a full account of the origins, taxonomy and relationships of *B. grossus*, *B. bromoideus* and their varieties see R. Tournay, *Bull. Jard. Bot. Bruxelles* **38**: 295–380 (1968).

25. B. commutatus Schrader, *Fl. Germ.* 353 (1806). Stems 40–120 cm, erect or ascending, glabrous. Lower leaf-sheaths softly hairy, the upper usually glabrous or nearly so. Panicle-branches and pedicels slender, mostly longer than the spikelets; spikelets oblong-lanceolate, soon disarticulating. Lower glume 5–7 mm, the upper 6–9 mm. Lemma 8–11·5 mm, obovate-oblanceolate, bluntly angled on the margins, acute, with overlapping margins; awn 3–10 mm. Palea shorter than lemma. Grain thin, flat, slightly shorter than the palea. $2n=28$. *Most of Europe except Fennoscandia and the N. & E. parts of the U.S.S.R.* Al Au Be Br Bu Co Cz Ga Ge Gr Hb He Ho Hs Hu It Ju Po Rm Rs (*B, C, W, K) Si [Da Su].

(a) Subsp. **commutatus**: Panicle 6–25 cm, soon nodding, lax; spikelets 15–25 × 4–6 mm, usually glabrous; lowest rhachilla-segment 1·5 mm, awn straight. Anthers *c.* 1·5 mm. *Throughout the range of the species.*

(b) Subsp. **neglectus** (Parl.) P.M. Sm., *Bot. Jour. Linn. Soc.* **76**: 360 (1978) (*Serrafalcus neglectus* Parl.): Panicle 10–15 cm, erect, somewhat contracted at first; spikelets 18–25 × 5–7 mm, hairy; lowest rhachilla-segment 1·5–1·75 mm; awn weakly divaricate. Anthers 2–3 mm. ● *Italy and Sicilia; once recorded from E. Greece.*

26. B. racemosus L., *Sp. Pl.* ed. 2, 114 (1762). Stems 20–110 cm, erect or ascending, glabrous or rarely shortly pubescent. Lower leaf-sheaths hairy, the upper glabrous or with scattered hairs. Panicle 4–15 × 1–5 cm, erect, narrow, sometimes nodding in fruit; branches and pedicels slender, at least some longer than the spikelets; spikelets 10–15 × 3–5 mm, lanceolate, glabrous, soon disarticulating; lowest rhachilla-segment 0·5–1 mm. Lower glume 4–6 mm, the upper 4–7 mm. Lemma 6·5–8 mm, elliptical or narrowly oblanceolate, rounded to a cucullate apex; awn 5–9 mm, straight. Palea shorter than lemma. Anthers 1·5–3 mm. Grain thin, flat, slightly shorter than palea. $2n=28$. *Much of Europe, northwards to S. Fennoscandia, but absent from most of the U.S.S.R.* Al Au Be Br Bu Cr Cz Da Ga Ge Hb He Ho Hs Hu It Ju Lu Po Rs (E) Si Su.

27. B. hordeaceus L., *Sp. Pl.* 77 (1753). Stems erect, procumbent or ascending. Leaf-sheaths hairy. Panicle erect, usually dense, sometimes reduced to 1 spikelet; pedicels mostly shorter than the spikelets. Glumes usually unequal. Lemma chartaceous, with prominent veins, the margin narrowly hyaline. Palea shorter than lemma. Anthers usually less than 1 mm. Grain shorter than palea. $2n=28$. *Almost throughout Europe.* All except Sb, but only casual in Fa and Is.

1 Awns stout, flattened at the base, divaricate, patent or recurved in fruit; panicle very dense; spikelets hairy
2 Panicle with few spikelets; leaf-sheaths and spikelets densely hairy; stems rarely more than 15 cm, stout; lemma 6·5–8·5 mm, bluntly angled **(c)** subsp. **ferronii**
2 Panicle with many spikelets; leaf-sheaths and spikelets shortly pubescent; stems usually 15–25 cm, sometimes longer; lemma 8–11 mm, rounded at the margin **(b)** subsp. **molliformis**
1 Awns terete at the base, straight or curving slightly outwards in fruit; panicle usually open at first, sometimes contracted in fruit; spikelets hairy or glabrous
3 Stems 1–8(–12) cm, procumbent or ascending; lemma 6·5–7·5 mm; awn straight or curving slightly outwards in fruit **(d)** subsp. **thominii**
3 Stems 3–80 cm, usually erect; lemma 8–11 mm; awn straight, erect **(a)** subsp. **hordeaceus**

(a) Subsp. **hordeaceus** (*B. mollis* L.): Sometimes biennial; stems 3–80 cm, usually erect. Leaf-sheaths strongly hairy. Panicle (3–)5–10 cm; spikelets 12–25 × 4–6 mm, lanceolate, with 6–12 florets, usually hairy. Lemma 8–11 mm, bluntly angled; awn 4–11 mm, stout, straight, erect. Anthers 0·2–2 mm. *Throughout the range of the species.*

(b) Subsp. **molliformis** (Lloyd) Maire & Weiller in Maire, *Fl. Afr. Nord* **3**: 255 (1955) (*B. molliformis* Lloyd): Stems 15–25(–60) cm, erect. Leaves and sheaths shortly pubescent. Panicle up to 10 cm, very dense, with numerous spikelets; branches and pedicels very short and stiff; spikelets 12–17 × 6 mm, ovate-lanceolate with 6–10 florets, softly hairy, often reddish. Glumes more or less equal. Lemma 8–11 mm, obovate-oblanceolate, rounded at the margins; awn 6–10 mm, stout, patent or recurved at maturity, often twisted below. Anthers up to 1·5 mm, usually much less. *S. Europe.*

(c) Subsp. **ferronii** (Mabille) P.M. Sm., *Watsonia* **6**: 330 (1968) (*B. ferronii* Mabille): Sometimes biennial; stems 2–15(–20) cm, usually erect; leaf-sheaths densely hairy. Panicle 2–5 cm, very dense; spikelets 8–18 × 3–6 mm, ovate-oblong, with 4–7 florets, densely hairy. Lemma 6·5–8·5 mm, broadly lanceolate, bluntly angled; awn 2–5·5 mm, stout, flattened at base, recurved or patent in fruit. Anthers 0·2–1·5 mm. *On cliff-tops.* ● *N.W. Europe.*

(d) Subsp. **thominii** (Hard.) Maire & Weiller, *Fl. Afr. Nord* **3**: 256 (1955) (*B. thominii* Hard.): Stems 1–8(–12) cm, procumbent or ascending. Leaf-sheaths shortly hairy. Panicle 1–3 cm, erect, dense, often simple; spikelets 8–12 × 2–3 mm, lanceolate, with 3–5 florets, hairy or glabrous. Lemma 6·5–7·5 mm, ovate-lanceolate, bluntly angled; awn 3–7 mm, slender, terete, sometimes weakly divaricate in fruit. Anthers *c.* 1 mm. *Mainly on maritime sands.* ● *W. Europe.*

Hybrids between **27(a)** and **29** (**B. × pseudothominii** P.M. Sm., *Watsonia* **6**: 330 (1968) (*B. thominii* auct., non Hard.)), occur frequently; they are fertile and segregate. They tend to resemble **27(a)** more than **29** but usually have glabrous lemmas, often with a wider and more distinctly angled margin and the grain usually equals the palea. They are particularly common in ruderal habitats.

28. B. interruptus (Hackel) Druce, *Jour. Bot.* (*London*) **33**: 344 (1895). Sometimes biennial; stems 20–100 cm, erect. Leaf-sheaths hairy. Panicle 2–8 cm, narrow, stiffly erect, usually interrupted; spikelets 10–17 mm, broadly ovoid, with 5–10 florets, hairy, subsessile, often densely clustered in threes, the florets crowded and closely imbricate. Lemma 7·5–9 mm, chartaceous, with prominent veins, rounded or very bluntly angled on the margins; awn 3–8 mm, straight or flexuous. Palea shorter than lemma, 2-fid almost to the base. Anthers 1–1·5 mm. Grain shorter than palea. $2n=28$. *Formerly among crops of* Onobrychis *and* Trifolium *spp. in S. & E. England; now apparently extinct.* ● †Br.

29. B. lepidus Holmberg, *Bot. Not.* **1924**: 326 (1924). Sometimes biennial; stems 4–70 cm, erect, usually slender. Panicle

2–10 cm, erect, rather narrow, lax or dense. Spikelets 5–15 × 2–4 mm, lanceolate, usually glabrous and shiny; florets closely imbricate at first, later a little divaricate. Glumes unequal. Lemma (4·5–)5·5–6·5 mm, broadly ovate, with sharply angled, wide hyaline margins; awn 2–5·5 mm, straight. Palea shorter than lemma. Anthers 0·5–2 mm. Grain exceeding the palea. $2n=28$. *Established in N.W. & N.C. Europe and in S. Scandinavia; casual elsewhere in C. Europe. Of unknown origin and nowhere certainly native.* [*Be *Br Cz Da ?Ga *Ge Hb Ho Su.]

B. oostachys Bornm., *Feddes Repert.* **20**: 69 (1924), is probably a pathological variant of *B. lepidus*.

B. brachystachys Hornung, *Flora* (*Regensb.*) **16**: 417 (1833), formerly occurred in C. Germany, but has not been seen since 1936. It appears to have affinities with **29** and with **20**. It differs from the former in its large panicle *c.* 20 cm and from the latter in the short lemma (4–5 mm) and in the grain being longer than the palea.

30. B. scoparius L., *Cent. Pl.* **1**: 6 (1755) (*B. rigens* L.). Stems 10–50 cm, erect or ascending, often tillering abundantly. Leaves 5–20 cm × 2–5 mm, with long, patent hairs on the upper surface; sheaths glabrous or sparsely hairy. Panicle 1–7 × 0·5–3 cm, erect, very dense, cuneate at the base, sometimes interrupted and appearing verticillate; branches and pedicels very short, usually much shorter than the spikelets; spikelets 10–20(–25) × 2–3 mm, oblong-lanceolate, densely crowded, subsessile, hairy or glabrous, with 5–10 florets. Glumes narrow, the lower 3–4 mm, the upper 5–7 mm. Lemma 7–8(–10) mm, oblong-lanceolate, the margin not angled, shortly 2-fid at the apex, often concave on the back when fully ripe; awn 7–9(–12) mm, equalling or exceeding lemma, flattened and twisted at the base, patent or recurved at maturity. Palea slightly shorter than lemma. Anthers 0·25–0·5 mm. $2n=14$. *S. Europe.* Al Bu Cr Gr Hs It Ju Lu Rs (K, E) Sa Si Tu.

31. B. alopecuros Poiret, *Voy. Barb.* **2**: 100 (1789) (*B. alopecuroides* Poiret). Stems stout, erect or decumbent at the base, glabrous. Leaves flat, softly hairy; sheaths, especially the lower, softly hairy. Panicle 10–15 × 1–3 cm, narrow, dense, erect; branches and pedicels rigid, shorter than the spikelets; spikelets 20–50 × 4–7 mm, erect, crowded, hairy or glabrous, narrowly lanceolate, with 8–15 florets. Glumes unequal. Lemma narrowly lanceolate; awn at least as long as lemma, stout, twisted below and patent at maturity, arising up to 5 mm below the apex of the lemma. Palea somewhat shorter than lemma. $2n=14$. *Mediterranean region, westwards to Sicilia.* Cr Gr It Si.

(a) Subsp. **alopecuros**: Stems 20–80 cm. Spikelets often 3 at each node; lemma 10–15 mm, with broadly triangular teeth at the apex. Anthers 0·5–1 mm. *Throughout the range of the species.*

(b) Subsp. **caroli-henrici** (W. Greuter) P.M. Sm., *Bot. Jour. Linn. Soc.* **76**: 360 (1978) (*B. caroli-henrici* W. Greuter): Stems up to 40 cm. Spikelets usually borne singly at the nodes, even in robust plants; lemma 11–15(–17) mm, with acuminate teeth at the apex. Anthers 0·75–1·5 mm. *Kriti.*

32. B. lanceolatus Roth, *Catalecta Bot.* **1**: 18 (1797) (*B. macrostachys* Desf.). Stems up to 70 cm, erect or geniculately ascending, glabrous or rarely puberulent near the panicle, sometimes hairy at the nodes. Leaves up to 30 cm × 3–5 mm, acute or acuminate, flat, flaccid, glabrous or softly hairy; sheaths hairy, sometimes densely so, with soft white hairs. Panicle 5–10(–15) cm, erect, dense when immature or depauperate, becoming laxer with age; panicle-branches and pedicels scabrid or hairy, rather rigid and tough, mostly shorter than the spikelets; spikelets 20–50 × 6–10 mm, lanceolate to oblong-lanceolate, with 8–20 florets, usually with dense, long hairs. Lower glume 5–9 mm, the upper 8–12 mm. Lemma 11–20 mm, oblanceolate with a bluntly angled margin, often deeply 2-fid at apex; awn 6–12 mm, flat, often twisted at the base, patent at maturity. Palea much shorter than lemma. Anthers *c.* 1 mm. $2n=28$. *S. Europe.* Bu Co Cr Ga Gr Hs It Ju Lu Sa Si Tu.

Very variable.

33. B. intermedius Guss., *Fl. Sic. Prodr.* **1**: 114 (1827). Stems up to 60 cm, erect or ascending, usually glabrous. Leaves up to 25 cm × 2–4 mm, flat, often ciliate; sheaths hairy. Panicle 5–10 (–20) cm, lax, erect or nodding; branches 1–2(–5) at a node, with 1–3 spikelets, at least some longer than the spikelets, slender, flexuous or coiled, often producing a tangled panicle; spikelets 10–15 mm, lanceolate, with short, often crispate hairs. Lower glume 4–6 mm, the upper 6–8 mm. Lemma 6–9 mm, oblong-lanceolate, deeply emarginate at the apex; awn usually as long as lemma, slightly flattened and twisted at the base, patent or recurved at maturity. Palea shorter than lemma. Anthers 0·75–1 mm. $2n=14$. *Mediterranean region, Bulgaria.* Al Bu Co Cr Ga Gr Hs It Ju Sa Si Tu.

34. B. japonicus Thunb., *Fl. Jap.* 52 (1784) (*B. patulus* Mert. & Koch). Stems erect or ascending, glabrous. Leaves 10–20 cm × 2–4 mm, softly hairy; sheaths hairy. Panicle usually large, effuse; branches mostly longer than the spikelets, 2–5 at lower nodes, slender and flexuous, with 1–3 spikelets; spikelets 20–40 mm, with 6–12 florets, glabrous or hairy. Lower glume 4–5 mm, the upper 6–7 mm. Lemma broadly lanceolate, shortly 2-dentate at the apex; awn flattened at base. Palea much shorter than lemma. Anthers *c.* 1 mm. $2n=14$. *C. & S.E. Europe, extending to C. Russia, C. Italy and C. France; doubtfully native in the west and north.* Au Bu Cz Ga Ge Gr He Hu It Ju Po Rm Rs (C, W, K, E) Tu.

(a) Subsp. **japonicus**: Stems 20–80 cm. Panicle 10–18 cm, the branches patent or nodding; spikelets ovate-lanceolate. Lemma 8–9 mm, not or obscurely angled; awn 6–10 mm, usually shorter than the lemma, divaricate. *Throughout the range of the species.*

(b) Subsp. **anatolicus** (Boiss. & Heldr.) Pénzes, *Bot. Közl.* **33**: 118 (1936): Stems 15–60 cm; panicle 10–12 cm, nodding; spikelets oblong-lanceolate. Lemma 10–12 mm, conspicuously angled; awn 10–18 mm, usually longer than the lemma, recurved in fruit. *S. Krym.* (*C. & S.W. Asia.*)

35. B. squarrosus L., *Sp. Pl.* 76 (1753) (*B. wolgensis* Fischer ex Jacq.). Stems 20–60 cm, erect or geniculately ascending, glabrous. Leaves 5–15 cm × 4–6 mm, flat or slightly infolded, hairy; sheaths hairy, often with dense, long cilia. Panicle up to 20 cm, very lax, often with few spikelets, racemose or subracemose, secund; panicle-branches mostly equalling or shorter than the spikelets, slender, often simple; spikelets 15–70 × 7–15 mm, broadly oblong or broadly ovate-lanceolate, hairy or glabrous, with 8–30 florets. Lower glume 5–7 mm, the upper 6–9 mm. Lemma 8–11 × 6–8 mm, with an angled margin, and an apical sinus, rarely entire; awn up to 10 mm, longer on the upper lemmas, flattened and sometimes twisted at the base, divaricate at maturity. Palea much shorter than lemma. Anthers 1–1·25 mm. $2n=14$. *Europe, northwards to C. France, S. Czechoslovakia and C. Russia.* Al Au Bl Bu Cr Cz Ga Gr He Hs Hu It Ju Rm Rs (C, W, K, E) Tu.

B. briziformis Fischer & C. A. Meyer in Fischer, C. A. Meyer & Trautv., *Ind. Sem. Horti Petrop.* **3**: 30 (1837), from S.W. Asia, is a frequent casual in parts of C. Europe. It is an annual

with a lax panicle, spikelets 15–25 × 10–15 mm and an inflated, rhombic lemma which is unawned or with an awn not more than 1 mm.

Sect. CERATOCHLOA (Beauv.) Griseb. Short-lived perennials. Spikelets ovate or ovate-lanceolate, strongly compressed. Lower glume 3- to 5-veined, the upper 5- to 7-veined. Lemma and glumes strongly keeled on the back. Awn usually much shorter than the lemma, often absent.

36. B. willdenowii Kunth, *Révis. Gram.* 134 (1829) (*B. catharticus* Vahl). Laxly caespitose; stems (15–)20–100(–150) cm, erect or ascending. Leaves 10–20(–50) cm × 3–12 mm, glabrous or thinly hairy; upper sheaths glabrous, the lower shortly hairy. Panicle 5–30 cm, lax, with patent or nodding branches, often longer than the spikelets; spikelets 20–40 × 5–10 mm, lanceolate to ovate, very strongly compressed, glabrous or scabrid, with 6–12 closely imbricate florets. Glumes acuminate, unequal, sharply keeled on the back. Lemma 14–18 × 5–7 mm, broadly lanceolate, keeled on the back, rather corneous; awn usually absent or up to 1 mm and weak. Palea about half as long as lemma. Anthers up to 4 mm, shorter in cleistogamous florets. $2n=42$. *Occasionally cultivated for fodder and locally naturalized in S. Europe; casual elsewhere.* [Az Ga Lu Rs (C, W, E).]

37. B. carinatus Hooker & Arnott, *Bot. Beech. Voy.* 403 (1840). Stems 30–80 cm, erect, glabrous. Leaves 20–30 cm × 5–10 mm, flat, acuminate; sheaths glabrous but puberulent near the mouth. Panicle 15–30 cm, with long, patent or nodding branches; spikelets 25–30 mm, linear-lanceolate, with 5–9 lax florets. Glumes lanceolate, acute. Lemma 15–17 mm, lanceolate, scabrid on the back; awn 4–10 mm, almost terminal. Palea slightly shorter than lemma. Anthers *c.* 5 mm, shorter in cleistogamous florets. $2n=56$. *Naturalized in parts of N.W. Europe.* [Br Ho.] (*North America.*)

Tribe **Brachypodieae** C. O. Harz

Like *Bromeae* but leaf-sheaths open or closed; silica-bodies variable; inflorescence spike-like; spikelets subsessile, terete, with the side of the lemma next to the rhachis; lemma with 5–7 veins and entire apex, rounded on the back; lodicules ciliate; ovary with the outermost layer of nucellus cells becoming thick-walled in fruit; chromosomes small; basic number 5, 7, 9.

45. **Brachypodium** Beauv.[1]

Perennials or annuals, rarely woody below, with often extensively branched rhizomes. Inflorescence a raceme of distichous, alternate, shortly pedicellate spikelets, inserted with the back of the lemmas to the rhachis. Spikelets 1(–3) at each node, usually with numerous florets. Glumes unequal, shorter than the lowest floret. Glumes and lemmas acuminate, mucronate or with a straight or weakly flexuous apical awn. Palea equalling or a little shorter than the lemma, emarginate or truncate, the keels ciliate or scabrid. Ovary hairy at apex. Grain narrowly elliptical to oblanceolate; hilum linear.

Literature: A. St-Yves, *Candollea* **5**: 427–493 (1934). T. Tateoka, *Bol. Soc. Argent. Bot.* **12**: 44–56 (1968).

1 Annual; anthers not more than 1 mm; spikelets laterally compressed; stems usually less than 25 cm **5. distachyon**
1 Perennial; anthers at least 2·5 mm; spikelets terete or subterete; stems usually more than 25 cm
2 Awn equalling or exceeding lemma; plant caespitose or very shortly rhizomatous **1. sylvaticum**
2 Awn not more than half as long as lemma, sometimes absent; plant with obvious creeping rhizomes
3 Leaves flat or somewhat convolute even when dry, usually flaccid; veins unequally spaced, some more prominent than others; rhizomes sparingly branched **2. pinnatum**
3 Leaves usually convolute and appearing setaceous at least when dry, tough; veins evenly spaced, equally prominent; rhizomes much-branched
4 Leaves up to 10 cm, patent, obviously distichous, glaucous, tightly convolute; raceme short, of 1–7 crowded spikelets, each up to 30 mm **3. retusum**
4 Leaves 10–40 cm, flat or convolute, not patent, not distichous; raceme long, of 5–12 spikelets, each up to 80 mm **4. phoenicoides**

Sect. BRACHYPODIUM (incl. *Brevipodium* A. & D. Löve, *Leptorachis* Nevski). Perennials. Leaves flat or convolute, flaccid or rigid. Raceme usually elongate and nodding or drooping. Spikelets terete or subterete, rarely fewer than 5. Glumes and lemmas chartaceous. Anthers at least 2·5 mm.

1. B. sylvaticum (Hudson) Beauv., *Agrost.* 101, 155 (1812). Caespitose; stems erect or ascending, hairy at and sometimes near the nodes. Leaves 10–35 × 6–12 mm, usually flaccid and drooping, rough, with scattered hairs above; veins pale, prominent beneath; ligule 1–5 mm, obtuse. Raceme 7–20 cm, with (3–)8–12 rather distant spikelets. Spikelets terete, linear, hairy or glabrous, somewhat patent especially before maturity. Glumes acute, the lower 6–9 mm, the upper 8–11 mm, shortly aristate. Lemma lanceolate; awn 7–14 mm, straight or weakly flexuous. Anthers 3·5–5·5 mm. $2n=18$, 28, 42 + 2B, 56. *Woods and other shady places. Europe, northwards to* 64° *N. in Norway.* All except Fa Is Rs (N) Sb.

(a) Subsp. **sylvaticum**: Stems 50–100 cm. Leaves flat, bright or yellowish-green, the sheaths usually with patent or deflexed hairs. Raceme nodding. Spikelets 17–25(–30) mm, with 6–15 florets. Lemma 7–12 mm, hairy. *Throughout the range of the species.*

(b) Subsp. **glaucovirens** Murb., *Beitr. Fl. Südbosn.* 22 (1891): Stems up to 200 cm. Leaves often convolute, glaucous and rigid, the sheaths glabrous. Raceme erect. Spikelets up to 55 mm, with 14–22 florets. Lemma 10–11 mm, glaucous, usually glabrous. $2n=16$. *Mediterranean region.*

2. B. pinnatum (L.) Beauv., *Agrost.* 101, 155 (1812). Rhizomatous, sometimes subcaespitose; stems 40–120 cm, erect, pubescent at the nodes. Leaves 10–40 cm × 3–6(–8) mm, flat or somewhat convolute, sparsely hairy on the upper surface, scabrid beneath; ligule *c.* 2 mm, truncate. Raceme 7–20 cm, erect, with up to 15 spikelets. Spikelets terete, linear, somewhat patent especially before maturity, with 8–24 florets. Lower glume 3–6 mm, the upper 5–8 mm. Lemma oblong-lanceolate; awn erect. Anthers 3·5–5·5 mm. $2n=14$, 16, 28. *Dry grassland and woods; usually calcicole. Europe, northwards to* 62° 30′ *in N.W. Russia.* All except Az Bl Fa Is Sb.

(a) Subsp. **pinnatum**: Leaves green. Spikelets 18–40 mm, usually straight. Lemma 7–11 mm, usually with some short hairs; awn 1–6 mm. $2n=28$. *Throughout the range of the species.*

(b) Subsp. **rupestre** (Host) Schübler & Martens, *Fl. Würtemberg* 48 (1834) (*B. rupestre* (Host) Roemer & Schultes): Leaves somewhat glaucous. Spikelets 30–50 mm, usually falcate. Lemma 9–11 mm, glabrous; awn not more than 3 mm. $2n=14$. *W., C. & S. Europe.*

[1] By P. M. Smith.

3. B. retusum (Pers.) Beauv., *Agrost.* 101, 155 (1812) (*B. ramosum* Roemer & Schultes). Occasionally woody at base; rhizomes partly or wholly above ground, extensively branched; stems 15–50 cm, erect or geniculately ascending, slender, glabrous. Leaves up to 10 cm × 2–4 mm, often less, with prominent, equally spaced veins, flat, tough, becoming convolute when dry, acute, the cauline patent, distichous; ligule *c.* 1 mm. Raceme 4–9 cm, dense, stiffly erect, with 1–5(–7) spikelets. Spikelets (12–)20–30 mm, linear, overlapping considerably, glabrous, glaucous, with (6–)10–15 florets. Glumes acute, the lower 4–5 mm, the upper 6–7 mm. Lemma 7–8 mm, ovate-lanceolate, abruptly narrowed to the apex; awn 2–4 mm, straight, sometimes absent on lower lemmas. Anthers 3·5–5 mm. $2n=18$. *Dry, rocky places. Mediterranean region and S.W. Europe.* Al Bl Co Cr Ga Gr Hs It Ju Lu Sa Si.

4. B. phoenicoides (L.) Roemer & Schultes, *Syst. Veg.* **2**: 740 (1817). Rhizomes branched; stems (40–)50–80(–100) cm, erect. Leaves 10–40 cm × 3–5 mm, flat, more or less flaccid, or convolute and somewhat rigid, appearing 1–1·5 mm wide, some veins more prominent than others; ligule 1–1·5 mm. Raceme 15–20(–30) cm, narrow, erect, of 6–9(–13) somewhat remote spikelets. Spikelets (20–)30–60(–80) mm, linear, often falcate. Lower glume 4–6 mm, the upper 5–7·5 mm, mucronate or very shortly awned. Lemma 8–10 mm, ovate-lanceolate, abruptly narrowed to the apex, mucronate or very shortly awned. Lemma 8–10 mm, ovate-lanceolate, abruptly narrowed to the apex, mucronate or awned; awns, when present, 1–2·5 mm. Anthers 4–6 mm. $2n=28$. *Dry, usually open habitats. Mediterranean region and S.W. Europe.* Bl Co Ga Gr Hs It Ju Lu Sa Si.

Sect. TRACHYNIA (Link) Nyman (*Trachynia* Link). Annuals. Leaves flat, usually flaccid. Raceme short, stiffly erect, of 1–2(–6) spikelets. Spikelets laterally compressed. Glumes and lemmas coriaceous. Anthers not more than 1 mm.

5. B. distachyon (L.) Beauv., *Agrost.* 101, 155 (1812) (*Trachynia distachya* (L.) Link). Stems 2–15(–45) cm, geniculately ascending or stiffly erect, glabrous. Leaves 1–12 cm × 3–4 mm, glaucous, hairy; ligule *c.* 1 mm or vestigial. Raceme 2–4 cm. Spikelets 20–30 mm, oblong-lanceolate, dull green or glaucous, glabrous or hairy, diverging from the raceme-axis, with 6–16(–30) florets. Lower glume 5–6 mm, the upper 7–8 mm, acute, prominently veined. Lemma 8–10 mm, lanceolate, prominently veined; awn 7–15 mm, straight. $2n=10$, 28, ?30. *Dry, usually open habitats. S. Europe; an occasional casual elsewhere.* Al Az Bl Bu Co Cr Ga Gr Hs It Ju Lu Rs (W, K) Sa Si Tu.

Tribe **Triticeae** Dumort.

Leaves linear, flat or convolute; silica-bodies oblong to elliptical; 2-celled micro-hairs absent; ligule membranous. Inflorescence a spike or spike-like raceme. Spikelets all hermaphrodite, or some male or sterile, solitary or in groups of 2–6, sessile or subsessile on alternate sides of the rhachis; florets 1–many. Glumes coriaceous, strongly veined, half as long to almost as long as the spikelet, inserted laterally. Lemma chartaceous to coriaceous, unawned or awned from the apex, keeled or rounded on the back. Palea 2-keeled. Lodicules 2, entire or more or less toothed, ciliate. Stamens 3. Ovary hairy at apex; styles 2, short. Grain with a linear hilum as long as the grain. Starch-grains simple. Chromosomes large; basic number 7.

[1] By A. Melderis.

46. **Festucopsis** (C. E. Hubbard) Melderis[1]
(*Brachypodium* Sect. *Festucopsis* C. E. Hubbard)

Caespitose perennials with intravaginal non-flowering shoots. Leaves tightly inrolled, rarely conduplicate; leaf-sheaths of the non-flowering shoots closed; ligule very short. Inflorescence spike-like. Spikelets cylindrical, slightly compressed laterally, erect, with 5–8 florets, smooth and glabrous. Glumes subequal, somewhat asymmetrical, coriaceous, with a narrow membranous margin, shorter than the lower floret, the lower 1- to 3-veined, the upper 3- to 6-veined. Lemmas closely imbricate, coriaceous, usually 5-veined, awned or unawned. Palea 2-keeled, stiffly ciliolate on the keels in the upper part. Ovary hairy at the top.

Literature: C. E. Hubbard, *Hook. Ic.* ser. 5, **3**: t. 3280 (1935). F. Markgraf, *Bot. Jahrb.* **74**: 268–270 (1948).

Stems not more than 40 cm; basal leaf-sheaths disintegrating into ± parallel fibres; glumes unawned; lower lemmas with an awn up to 4·5 mm, the upper unawned **1. serpentini**
Stems more than 40 cm; basal leaf-sheaths disintegrating into a mass of reticulate fibres; glumes usually shortly awned; all lemmas with an awn more than 4·5 mm **2. sancta**

1. F. serpentini (C. E. Hubbard) Melderis, *Bot. Jour. Linn. Soc.* **76**: 317 (1978) (*Brachypodium serpentini* C. E. Hubbard). Stems up to 40 cm. Leaves up to 12 cm × 0·5 mm, filiform-setaceous, inrolled or conduplicate, minutely puberulent on the inside, smooth and glabrous on the outside; leaf-sheaths disintegrating into more or less parallel fibres. Spikes 4·5–6·5 cm, with 6–14 spikelets. Spikelets 1·6–2·4 cm, whitish-green. Glumes elliptic-oblong, acute, the lower 7–9 mm, 3-veined, the upper 8–10 mm, 3- to 5-veined. Lower lemmas 9–12 mm, 5- to 6-veined, with an awn 2·5–4·5 mm, the upper usually unawned. Palea shorter than the lemma. Anthers 3–3·5 mm. $2n=14$. *Serpentine rocks.* ● *S.E. Albania.* Al.

2. F. sancta (Janka) Melderis, *op. cit.* 319 (1978) (*Festuca sancta* Janka, *Brachypodium sanctum* (Janka) Janka, *Agropyron sanctum* (Janka) Hackel). Stems 45–110 cm. Leaves 7–30 cm × 2–3 mm, usually inrolled, minutely scabridulous on the inside, smooth and glabrous on the outside; leaf-sheaths disintegrating into a mass of reticulate fibres. Spikes 7–9 cm, with 5–8 spikelets. Spikelets 1–1·2(–1·5) cm, green. Glumes lanceolate, usually with an awn up to 1·5 mm, the lower 6–7 mm, 1- to 3-veined, the upper 8–9 mm, 3- to 5-veined. Lemmas 9–10 mm, 5-veined, with an awn 4·5–9 mm. Palea nearly as long as or slightly longer than the lemma. Anthers 4 mm. *Calcareous rocks.* ● *Mountains of N. Greece and S.W. Bulgaria.* Bu Gr.

47. **Leymus** Hochst.[1]

Rhizomatous perennials. Leaves flat or convolute, glaucous, scabrid, rarely shortly hairy on veins above, glabrous beneath; ligule short. Inflorescence a spike; rhachis tough. Spikelets subsessile, usually imbricate, with 3–5(–7) florets; rhachilla disarticulating above the glumes and beneath each floret. Glumes narrowly lanceolate to linear-subulate, covering the sides of the lower florets, 1- to 5-veined, glabrous or hairy, not or shortly awned. Lemma lanceolate, 5- to 7-veined, not or shortly awned. Palea nearly as long as the lemma, 2-keeled.

1 Glumes 2·2–3·2 mm wide, with 3–5 distinct veins; spikelets in pairs at each node of the rhachis **1. arenarius**
1 Glumes not more than 2 mm wide, with 1–3 obscure veins
2 Spikelets solitary at each node of the rhachis **7. ramosus**
2 Spikelets in groups of 2–4(–7) at each node of the rhachis
3 Keels of the palea glabrous, or aculeolate only near the apex; spike robust; spikelets usually in groups of 3–4(–6) at each node of the rhachis **2. racemosus**

3 Keels of the palea spinose-ciliate at least in the upper half; spikes not robust; spikelets in groups of 2–3 at each node of the rhachis
4 Basal part of glumes narrowly lanceolate, the lower glume with its basal part enfolding that of the upper; lemma 10–15 mm **3. karelinii**
4 Basal part of glumes linear, the lower glume with its basal part not enfolding that of the upper; lemma 4–9 mm
5 Plant with long, creeping rhizomes, not forming tufts; leaves usually flat, with thin, distant veins **6. multicaulis**
5 Plant with shortly creeping rhizomes, forming small tufts connected by a rhizome; leaves flat or convolute, with prominent, approximate veins
6 Lemma glabrous on the back, with an awn 1–2 mm; glumes scabrid on the margins and on the mid-vein towards the apex **4. akmolensis**
6 Lemma more or less hairy on the back, with an awn 0·5–1 mm; glumes usually hairy **5. paboanus**

1. L. arenarius (L.) Hochst., *Flora* (*Regensb.*) **31**: 118 (1848) (*Elymus arenarius* L.). Glaucous perennial with long, creeping rhizomes. Stems usually 50–150 cm, robust, glabrous. Leaves 8–15 mm wide, flat, with convolute margins, densely and minutely scabrid or hairy on veins above, glabrous beneath. Spikes 15–35 cm × 10–25 mm, dense; rhachis glabrous except for spinose-ciliate main angles. Spikelets 20–32 mm, with 3–4(–5) florets, in pairs at each node of the rhachis. Glumes 15–25 × 2·2–3·2 mm, narrowly lanceolate, tapering to an acuminate-subulate point, with 3–4 distinct veins, keeled, glabrous or shortly hairy, especially on the keel. Lemma 12–25 mm, 5- to 7-veined, densely hairy, with short, soft hairs. Palea sparsely ciliate on keels near the apex. Anthers 7–8 mm. $2n=56$. *Maritime sands and sandy shores of large lakes. N. & W. Europe, from the Arctic to N.W. Spain; an occasional casual elsewhere.* Be Br Da Fa Fe Ga Ge Hb Hs Ho Is No Rs (N, B, C) Su.

A sterile hybrid between **1** and *Elymus farctus* occurs in the Baltic region.

L. mollis (Trin.) Hara, *Bot. Mag.* (*Tokyo*) **52**: 232 (1938) (*Elymus mollis* Trin.), from North America and N.E. Asia, was planted in Iceland to stabilize sand-dunes but is now very rare or extinct. It is like **1** but has the upper part of the stem and the rhachis densely pubescent; it has $2n=28$.

2. L. racemosus (Lam.) Tzvelev, *Not. Syst.* (*Leningrad*) **20**: 429 (1960) (*Elymus giganteus* Vahl). Perennial with long, creeping rhizomes. Stems 50–100 cm, up to 10 mm in diameter in the basal part. Leaves up to 15 mm wide, scabrid on the veins above and on the margins, glabrous beneath. Spikes 15–35 cm × 10–20 mm, gradually tapering towards the apex. Spikelets 15–20 mm, with 4–6 florets, compressed, in groups of 3–6. Glumes 15–25 mm, linear-lanceolate, acuminate-subulate above, glabrous. Lemma 10–14 mm, 7-veined, acute, softly hairy in the lower part, glabrous towards the apex. Anthers *c.* 5 mm. *Dry, sandy soils. S.E. Europe.* Bu Rm Rs (C, W, K, E) Tu.

1 Stems nearly always shortly hairy below the spikes; spikes very dense, with spikelets in groups of 3–5(–6); glumes 1-veined **(a)** subsp. **racemosus**
1 Stems nearly always glabrous below the spikes; spikes rather lax, with spikelets in groups of 3
2 Glumes 2- to 3-veined; keels of the palea glabrous or with a few cilia in the upper part **(b)** subsp. **sabulosus**
2 Glumes 1-veined; keels of the palea with numerous cilia in the upper part **(c)** subsp. **klokovii**

(a) Subsp. **racemosus**: Stems nearly always shortly hairy below spikes. Spikes dense, with spikelets in groups of 3–5(–6) at each node of the rhachis. Glumes 1-veined. Keels of the palea glabrous or with a few cilia in the upper part. $2n=28$. *S.E. Russia.* (*Caucasus to C. Asia.*)

(b) Subsp. **sabulosus** (Bieb.) Tzvelev, *Nov. Syst. Pl. Vasc.* (*Leningrad*) **8**: 65 (1971) (*Elymus sabulosus* Bieb., *Leymus sabulosus* (Bieb.) Tzvelev): Stems nearly always glabrous below the spikes. Spikes rather lax, with spikelets in groups of 3 at each node of the rhachis. Glumes 2- to 3-veined. Keels of the palea glabrous or with a few cilia in the upper part. $2n=28$. *Throughout the range of the species.*

(c) Subsp. **klokovii** Tzvelev, *loc. cit.* (1971): Stems glabrous below the spikes. Spikes rather lax, with spikelets usually in groups of 3 at each node of the rhachis. Glumes 1-veined. Keels of the palea with numerous cilia in the upper part. *S.E. part of U.S.S.R.*

3. L. karelinii (Turcz.) Tzvelev, *op. cit.* **9**: 59 (1972) (*Aneurolepidium angustum* (Trin.) Nevski pro parte, *A. karelinii* (Turcz.) Nevski, quoad nom.). Perennial with shortly creeping rhizomes, forming small tufts. Stems 50–100 cm, scabrid below the spikes, otherwise glabrous. Leaves up to 6 mm wide, flat, with convolute margins, scabrid above, glabrous beneath. Spikes 10–20 cm × 5–10 mm, linear, fairly dense; rhachis with appressed, rigid, short hairs. Spikelets 12–15 mm, with 2–3 florets, in groups of 2–3. Glumes 10–15 mm, narrowly lanceolate below, the lower with its basal part enfolding that of the upper, acuminate-subulate above, obscurely 2- to 3-veined, scabrid on the back, spinose-ciliate on margins. Lemma 10–15 mm, with short appressed hairs, tapering into a short awn-like point. Keels of the palea spinose-ciliate in the upper part. $2n=56$. *Saline meadows and river-gravels. S. Ural and adjacent lowlands.* Rs (C, E). (*Siberia, C. Asia.*)

4. L. akmolinensis (Drobov) Tzvelev, *Not. Syst.* (*Leningrad*) **20**: 430 (1960) (*Aneurolepidium akmolinense* (Drobov) Nevski). Perennial with shortly creeping rhizomes, forming small tufts. Stems 45–80 cm. Leaves up to 5 mm wide, flat or convolute, with prominent approximate veins, scabrid above and on the margins, glabrous beneath. Spikes 6–10 cm × 5–7 mm, linear, dense; rhachis hairy or spinose-ciliate only on main angles. Spikelets 8–13 mm, pruinose, with 3–5 florets, usually in pairs at each node of the rhachis. Glumes 7–10 mm, linear-subulate, obscurely 1-veined, scabrid on margins and on the mid-vein towards the apex. Lemma 6–8·5 mm, glabrous, tapering into an awn up to 1·2 mm. $2n=28$. *Saline soils. S.E. Russia.* Rs (E). (*Temperate Asia.*)

5. L. paboanus (Claus) Pilger, *Bot. Jahrb.* **74**: 7 (1947) (*Aneurolepidium paboanum* (Claus) Nevski). Perennial with shortly creeping rhizomes, forming small tufts. Stems 45–90 cm. Leaves 3–5 mm wide, flat or with convolute margins, with prominent approximate veins, scabrid above, glabrous beneath. Spikes 8–15 cm × 5–10 mm, dense, narrowing towards the apex; rhachis with appressed hairs. Spikelets 7–12 mm, with 4–6 florets, usually in pairs at each node of the rhachis. Glumes 7–9 mm, linear-subulate, usually hairy, without veins or obscurely 1-veined. Lemma 6–8·5 mm, broadly lanceolate, abruptly tapering into an awn 0·5–1 mm, more or less densely white-hairy, tinged with purple at the base. Palea usually longer than the lemma. *Saline meadows and river-gravels. S.E. part of U.S.S.R.* Rs (E). (*Siberia, C. Asia.*)

6. L. multicaulis (Kar. & Kir.) Tzvelev, *Not. Syst.* (*Leningrad*) **20**: 430 (1960) (*Aneurolepidium multicaule* (Kar. & Kir.) Nevski). Perennial with long, creeping rhizomes. Stems 50–70 cm. Leaves 3–8 mm wide, flat, sometimes with convolute margins, with thin, distant veins, scabrid above, glabrous, sometimes scabrid beneath. Spikes 5–12 cm × 6–12 mm; rhachis spinose-ciliate on main angles. Spikelets 8–13 mm, with 3–6 florets, often tinged with

purple, in groups of 2–3 at each node of the rhachis. Glumes 4–8 mm, subulate, 1-veined, scabrid on the vein and on margins. Lemma 4–6 mm, broadly lanceolate, glabrous, shining, with an awn 2–3 mm. *Saline meadows. W. Kazakhstan and Volga delta.* Rs (E). (*Siberia, C. Asia.*)

7. L. ramosus (Trin.) Tzvelev, *loc. cit.* (1960) (*Aneurolepidium ramosum* (Trin.) Nevski). Perennial with long, creeping rhizomes. Stems 20–40 cm, branched at the base, fasciculate. Leaves 2–6 mm wide, convolute or flat, scabrid above and on margins, smooth beneath. Spikes 3·5–8 cm × 4–9 mm, linear, fairly lax; rhachis spinulose-ciliate on the main angles. Spikelets 10–13 mm, usually with 5–7 florets, solitary at each node of the rhachis. Glumes 5–8 mm, unequal, linear-subulate, without veins or obscurely 1-veined, the lower often rudimentary. Lemma 6–8 mm, glabrous, unawned or with an awn up to 2 mm. *Steppes, disturbed ground and saline soils. E. Ukraine, S.E. Russia.* Rs (W, K, E).

48. Elymus L.[1]

(*Roegneria* Koch, *Elytrigia* Desv., *Clinelymus* (Griseb.) Nevski)

Caespitose or rhizomatous perennials. Leaves flat or more or less convolute; ligule short. Inflorescence a spike; rhachis usually tough. Spikelets solitary or in groups of 2–3 at each node, nearly sessile, usually imbricate, with 2–11 florets; rhachilla disarticulating above the glumes and beneath each floret or sometimes spikelets falling entire at maturity. Glumes 1- to 11-veined, unawned or with a short awn. Lemma lanceolate, 5-veined. Palea 2-keeled.

Hybrids occur between many of the species and are usually intermediate between the parents and male-sterile. Only the commonest and most widespread are mentioned in the following account.

E. canadensis L., *Sp. Pl.* 83 (1753), **E. smithii** (Rydb.) Gould, *Madroño* **9**: 127 (1947), **E. subsecundus** (Link) Á. & D. Löve, *Taxon* **13**: 201 (1964) (*Triticum subsecundum* Link), **E. villosus** Muhl. ex Willd., *Enum. Pl. Horti Berol.* 131 (1809) and **E. virginicus** L., *Sp. Pl.* 84 (1753), all native of North America, and **E. dahuricus** Turcz. ex Griseb. in Ledeb., *Fl. Ross.* **4**: 331 (1852) (*Clinelymus dahuricus* (Turcz. ex Griseb.) Nevski), widespread in temperate Asia, have been recorded, mainly from N. Europe, but do not at present seem to be naturalized.

Literature: S. A. Nevski, *Acta Inst. Bot. Acad. Sci. URSS* (*Ser.* 1) **2**: 43–56, 75–85 (1936). P. F. A. Ascherson & K. O. P. P. Graebner, *Synopsis der mitteleuropäischen Flora* **2(1)**: 640–667. Leipzig. 1901. Y. Cauderon, *Étude cytogénétique des* Agropyrum *français et de leurs Hybrides avec les Blés.* Paris. 1958.

1 Spikelets in pairs in the middle part of the spike; glumes 4–5 mm **1. sibiricus**
1 Spikelets solitary at each node of the rhachis; glumes usually more than 5 mm
2 Plant with long rhizomes, not forming dense tufts
3 Rhachis fragile, disarticulating at maturity, glabrous on the main angles **22. farctus**
3 Rhachis tough, not disarticulating at maturity, spinose-ciliate on the main angles
4 Glumes acute, mucronate or shortly awned
5 Leaves usually tightly convolute, with prominent, closely crowded, flattened veins bearing rigid spinules on the upper surface; lower sheaths ciliate; rhachis glabrous **17. pycnanthus**
5 Leaves usually flat, with fine or prominent, not closely crowded, rounded, often sparsely long-hairy veins on the upper surface; lower sheaths usually not ciliate; rhachis sometimes shortly hairy **18. repens**
4 Glumes muticous but sometimes subacute
6 Glumes usually oblong, obtuse to obliquely truncate, indurate-coriaceous; leaves with conspicuously indurate margins; sheaths ciliate **20. hispidus**
6 Glumes usually lanceolate or oblong-lanceolate, subacute, coriaceous; leaves without conspicuously indurate margins; sheaths usually not ciliate
7 Leaves flat, with convolute margins, prominently veined; glumes 6·5–9·6 mm, 4- to 7-veined **19. pungens**
7 Leaves usually convolute, not prominently veined; glumes 4–6 mm, 3- to 5-veined **21. lolioides**
2 Plant caespitose, without rhizomes
8 Glumes smooth, only the mid-vein sometimes with a few spinules towards the apex; anthers 4–7 mm; leaves usually convolute
9 Internodes of the rhachis on the side facing spikelets nearly flat; glumes obtuse or obliquely truncate to truncate, sometimes slightly emarginate or apiculate
10 Rhachis tough, usually spinose-ciliate on the main angles **(13–16). elongatus group**
10 Rhachis fragile, glabrous on the main angles **22. farctus**
9 Internodes of the rhachis on the side facing spikelets concave; glumes subacute to acuminate
11 Lemma with an awn 8–25 mm, divergent at nearly a right angle at maturity; glumes subacute to acuminate; sheaths usually not ciliate **10. reflexiaristatus**
11 Lemma unawned; glumes subacute; sheaths usually ciliate
12 Lower glume usually 7–9 mm, 1–2 mm shorter than the lower floret, 5- to 7-veined; rhachis densely spinose-ciliate on the main angles **11. stipifolius**
12 Lower glume usually 5–7 mm, 2–3 mm shorter than the lower floret, 3- to 5-veined; rhachis glabrous or sparsely spinose-ciliate on the main angles **12. bungeanus**
8 Glumes more or less scabrid on the veins; anthers usually 1–3·5 mm; leaves usually flat
13 Glumes nearly as long as or longer than the lower floret, with a narrow hyaline margin, not widened below the apex, with crowded, nearly parallel veins
14 Glumes 14–20 mm, usually exceeding the lower floret, widest in the lower half, 7- to 9-veined; anthers *c.* 5 mm **2. panormitanus**
14 Glumes less than 14 mm, usually slightly shorter than the lower floret, widest in the middle, 4- to 7-veined; anthers less than 2·5 mm
15 Glumes thin, membranous, 4- to 5-veined, very scabrid on and between the veins; lemma strigose; awn 2–4 mm; anthers 2–2·5 mm **4. mutabilis**
15 Glumes thick, firm, 4- to 7-veined, scabrid on the veins, glabrous between them; lemma glabrous below, scabrid towards the apex; awn not more than 1·5 mm; anthers 1–1·5 mm **3. trachycaulus**
13 Glumes distinctly shorter than the lower floret, with veins not crowded
16 Glumes widest above the middle, asymmetrical near the apex, usually abruptly tapering into a short awn, with a hyaline margin 0·7–1 mm wide **9. alaskanus**
16 Glumes widest below the middle, nearly symmetrical at the apex, more or less gradually or abruptly tapering into a short awn or unawned, with a hyaline margin 0·2–0·4 mm wide
17 Lemma with scattered short spinules only in the upper part and mainly on the veins
18 Nodes usually hairy; glumes 6–10 mm, 3- to 5-veined, ±abruptly tapering into a short awn; lemma usually long-awned **5. caninus**
18 Nodes glabrous; glumes 5–7 mm, usually 3-veined, acute; lemma unawned, acuminate **7. fibrosus**
17 Lemma strigose or shortly hairy

[1] By A. Melderis.

19 Lemma strigose on the back, sometimes shortly hairy towards the apex **6. uralensis**
19 Lemma densely and shortly hairy in the lower part, ±scabrid towards the apex **8. macrourus**

Sect. ELYMUS. Caespitose perennials. Spikes lax to dense; rhachis tough, spinose-ciliate on the main angles. Spikelets usually in groups of 2–3, usually with 3–5 florets. Glumes usually 2- to 4-veined, scabrid on veins, gradually tapering into an awn. Callus shortly hairy.

1. E. sibiricus L., *Sp. Pl.* 83 (1753) (*Clinelymus sibiricus* (L.) Nevski). Stems 45–80 cm. Leaves 5–10 mm wide, flat, scabridulous on the upper surface, usually glabrous beneath; sheaths usually strigose or hairy. Spikes 7–20 cm, lax, drooping. Spikelets 10–12 mm (excluding awns), in pairs in the middle part of the rhachis, solitary in the basal and terminal parts. Glumes 4–5 mm, linear-subulate or narrowly lanceolate, 3-veined, gradually tapering into an awn 1–5 mm. Lemma *c.* 8 mm, strigulose, with an awn 15–20 mm. Palea spinose-ciliate on keels. Anthers *c.* 1 mm. $2n=28$. *Dry meadows and scrub. Casual in E. & E.C. Europe and locally naturalized in E. Russia.* [Rs (C).] (*Temperate Asia.*)

Sect. GOULARDIA (Husnot) Tzvelev. Caespitose. Spikes dense or lax, erect to drooping; rhachis tough, spinose-ciliate on the main angles. Spikelets solitary on the rhachis, usually with 3–5 florets. Glumes 3- to 9-veined, scabrid on the veins, acute or acuminate or with a mucro or a short awn. Callus shortly hairy.

2. E. panormitanus (Parl.) Tzvelev, *Sched. Herb. Fl. URSS* **18**: 27 (1970) (*Agropyron panormitanum* Parl.). Stems 80–100 cm. Leaves 5–10 mm wide, flat, scabrid and often sparsely long-hairy on the upper surface, glabrous beneath; sheaths glabrous. Spikes 10–20 cm, rather lax. Spikelets 15–20 mm (excluding awns). Glumes 15–20 mm, exceeding the lower floret, 7- to 9-veined, gradually tapering into a short mucro. Lemma 12–15 mm, scabridulous towards the apex, with an awn 20–30 mm. Palea shortly ciliate on keels. Anthers *c.* 5 mm. $2n=28$. *Mountain woods. Mediterranean region and S.E. Europe.* ?Cr Gr Hs It Ju Rm Rs (K) Si.

A variant with 4- to 6-veined glumes and awns of the lemma 4–8 mm occurs in S.W. Spain (Prov. Cádiz).

3. E. trachycaulus (Link) Gould ex Shinners, *Rhodora* **56**: 28 (1954) (*Roegneria pauciflora* (Schweinitz) Hyl.). Stems 50–100 cm. Leaves 2–4 mm wide, flat or with convolute margins, scabrid on the upper surface, glabrous beneath; sheaths usually glabrous. Spikes 9–20 cm, dense, usually erect, not secund; rhachilla glabrous. Spikelets 9–17 mm. Glumes 7–14 mm, nearly as long as the lower floret, lanceolate, sometimes with a tooth near the apex, 4- to 7-veined, acute or tapering into an awn up to 2 mm. Lemma 7–12 mm, glabrous below, strigulose towards the apex, acuminate or with an awn up to 1·5 mm. Palea shortly ciliate on keels. Anthers 1–1·5 mm. $2n=28$. *Widely cultivated for fodder in the U.S.S.R. and locally naturalized.* [Rs (B, C, W, E).] (*North America.*)

The plant here described is subsp. **novae-angliae** (Scribner) Tzvelev, *Nov. Syst. Pl. Vasc.* (*Leningrad*) **10**: 23 (1973). Subsp. **trachycaulus**, which has laxer spikes with usually strigulose rhachilla, is a frequent casual in N. Europe.

4. E. mutabilis (Drobov) Tzvelev in Grubov, *Pl. As. Centr.* **4**: 217 (1968) (*Agropyron mutabile* Drobov, *Roegneria mutabilis* (Drobov) Hyl.). Stems 70–120 cm, glabrous, rarely shortly hairy at the nodes. Leaves 8–12 mm wide, flat, scabrid, sometimes sparsely long-hairy on the upper surface, glabrous beneath; sheaths glabrous or the lower more or less shortly hairy. Spikes 6–15 cm, dense, erect, sometimes secund. Spikelets 6–15 mm; rhachilla hairy. Glumes 7–10 mm, 4- to 5-veined, very scabrid on the veins and strigulose between them, sometimes with a tooth near the apex, gradually tapering into a mucro or an awn up to 2 mm. Lemma 9–12 mm, strigulose, rarely nearly glabrous, with an awn 2–4 mm. Palea spinose-ciliate on keels. Anthers 2–2·5 mm. $2n=28$. *Woods and scrub. Arctic Fennoscandia, N. & E. Russia.* Fe No Rs (N, C, E) Su.

5. E. caninus (L.) L., *Fl. Suec.* ed. 2, 39 (1755) (*Agropyron caninum* (L.) Beauv., *Roegneria canina* (L.) Nevski, *R. behmii* Melderis). Stems 30–110 cm, usually shortly hairy at and below the nodes. Leaves 4–10 mm wide, flat, finely veined, scabrid and usually sparsely long-hairy on the upper surface, glabrous beneath; sheaths glabrous or the lower shortly hairy. Spikes 5–20 cm, slender, usually nodding. Spikelets usually 10–15 mm; rhachilla hairy. Glumes 6–10 mm, 3- to 5-veined, scabrid on the veins, with a hyaline margin 0·2–0·4 mm wide which is widened below the apex, more or less gradually tapering into an awn up to 4 mm. Lemma 9–11 mm, glabrous below, often with minute scattered hairs towards the apex, with a flexuous awn 7–18 mm. Palea spinose-ciliate on keels. Anthers 2·5–3 mm. $2n=28$. *Woods; rarely in more exposed situations. Almost throughout Europe.* All except Az Bl Cr Fa Sb Tu.

A variable species, especially in the appearance of spike, presence of hairs on leaves and sheaths, number of florets in spikelet, size and shape of glumes and in length of awns on lemma. Shortly awned and unawned variants occur in very restricted areas of N., W. & C. Europe, and probably have originated through mutation from local populations. They have been described as species or varieties or forms, but are not well enough defined to merit subspecific rank. In addition, the hybrids between these variants and the typical variant prove to be highly fertile.

Hybrids between **5** and **4** and between **5** and **9(b)** are rather frequent in Scandinavia.

6. E. uralensis (Nevski) Tzvelev, *Nov. Syst. Pl. Vasc.* (*Leningrad*) **8**: 63 (1971). Stems *c.* 100 cm, shortly hairy at or below the nodes. Leaves flat, with convolute margins. Spikes 8·5–17 cm, Spikelets *c.* 15 mm (excluding awns); rhachilla with short, appressed hairs. Glumes 8–10 mm, sometimes with a tooth at the apex, usually 5-veined, gradually tapering into an awn 3–7 mm. Lemma 8–11 mm, with an erect or slightly flexuous awn 8–18 mm. Palea shortly ciliate on keels. Anthers 2·5 mm. *Open woods and scrub; usually calcicole. E. Russia.* Rs (N, C, E).

(a) Subsp. **uralensis** (*Roegneria uralensis* (Nevski) Nevski): At least the lower leaves and sheaths shortly hairy. Spikes dense, erect, secund. Glumes often shortly hairy on the veins. Lemma strigose on the back, with short hairs towards the apex. ● *S. Ural* (*S.W. of Magnitogorsk*).

(b) Subsp. **viridiglumis** (Nevski) Tzvelev, *Nov. Syst. Pl. Vasc.* (*Leningrad*) **8**: 63 (1971) (*Roegneria viridiglumis* Nevski, *R. taigae* Nevski): Leaves sparsely hairy above, glabrous beneath, the sheaths glabrous or the lowest shortly hairy. Spikes rather lax, slightly nodding, not secund. Glumes scabridulous or scabrid on the veins. Lemma sparsely strigose all over. *Scattered localities in E. Russia, from c.* 53° 30′ *to* 68° *N.*

7. E. fibrosus (Schrenk) Tzvelev, *Sched. Herb. Fl. URSS* **18**: 29 (1970) (*Roegneria fibrosa* (Schrenk) Nevski). Stems usually 40–70 cm. Leaves 3–7 mm wide, flat, glabrous on both surfaces

or scabridulous on the upper; sheaths glabrous or the lower shortly hairy. Spikes 6–15 cm, narrow, lax, drooping, usually purplish; rhachis spinose-ciliate on the main angles. Spikelets 10–13 mm, with 2–3 florets; rhachilla hairy. Glumes 5–7 mm, 3-veined, acuminate. Lemma 9–11 mm, glabrous below, scabridulous towards the apex, acuminate-subulate. Palea ciliate on keels. Anthers *c.* 2 mm. $2n=28$. *Meadows, scrub and river-gravels. N. Finland and N. & C. Russia, southwards to c.* 51° 30′ *N.* Fe Rs (N, C, E).

8. E. macrourus (Turcz.) Tzvelev, *op. cit.* 30 (1970). Stems 25–100 cm. Leaves 3–7 mm wide, flat; sheaths glabrous. Spikes narrow, erect; rhachis spinose-ciliate on the main angles. Spikelets pale green or purplish; rhachilla villous. Glumes $\frac{1}{2}$–$\frac{2}{3}$ as long as the lower floret, elliptic-lanceolate, scabrid on the veins, with a narrow hyaline margin, unawned or with an awn up to 1 mm. Lemma *c.* 10 mm, densely hairy below, sparsely strigose or nearly glabrous towards the apex, acute or with an awn up to 1·5 mm. Palea densely and shortly ciliate on keels. *River-sands and gravels. E. part of arctic and subarctic Russia.* Rs (N). (*Siberia to Canada.*)

(a) Subsp. **macrourus** (*Roegneria macroura* (Turcz.) Nevski): Laxly caespitose. Leaves scabridulous above, smooth beneath. Spikes usually 15–30 cm, with distinctly spaced spikelets especially in the lower part of the rhachis. Spikelets *c.* 20 mm, with 5–7 florets. Glumes usually 7–10 mm, acute. Anthers 2 mm. $2n=28$. *Near Vorkuta.*

(b) Subsp. **turuchanensis** (Reverdatto) Tzvelev, *Nov. Syst. Pl. Vasc.* (*Leningrad*) **8**: 63 (1971) (*Roegneria turuchanensis* (Reverdatto) Nevski): Densely caespitose. Leaves shortly hairy at least above. Spikes 5–10 cm, fairly dense, with approximate spikelets. Spikelets usually 10–15 mm, with 3–5 florets. Glumes 4–6 mm, more or less obtuse, finely toothed at apex. Anthers 1·5 mm. $2n=28$. *Throughout the range of the species.*

9. E. alaskanus (Scribner & Merrill) Á. Löve, *Taxon* **19**: 299 (1970) (*E. kronokensis* (Komarov) Tzelev). Stems usually 45–60 cm, shortly hairy at the nodes. Leaves flat; sheaths glabrous or the lower long-hairy. Spikes 4–8 cm, erect, usually dense, pale green or purplish, pruinose. Spikelets usually 10–12 mm; rhachilla densely strigulose. Glumes 5–10 mm, with a wide hyaline margin, wider and asymmetrical near the apex, usually abruptly narrowed into a short awn, usually scabridulous on the veins. Lemma 7–9 mm, usually glabrous below, scabridulous towards the apex, with an awn 2–4 mm. Palea shortly ciliate on keels. Anthers 1·6–2 mm. *River-banks, rocks and stony slopes. Iceland, N & W. Fennoscandia, N. Russia.* Fe Is No Rs (N) Su.

A polymorphic circumpolar species with several subspecies, 3 of which occur in Europe. The typical subspecies occurs in N.E. Asia.

1 Leaves 1·5–2·5 mm wide, shortly hairy on the upper surface; spikes 2–4 mm wide, fairly lax; glumes 4–7 × 1·5–2 mm **(a)** subsp. **borealis**

1 Leaves 3–4 mm wide, scabrid, often sparsely long-hairy on the veins of the upper surface; spikes usually 4–6 mm wide, dense; glumes 5–10 × 2–2·5 mm

2 Glumes 5–8 mm, obovate to oblong-obovate, abruptly narrowed at the apex into an awn not more than 1 mm and with a hyaline margin 0·7–1 mm wide **(b)** subsp. **scandicus**

2 Glumes 7–10 mm, oblong lanceolate, gradually narrowed at the apex into an awn up to 2 mm and with a hyaline margin 0·5–0·8 mm wide **(c)** subsp. **subalpinus**

(a) Subsp. **borealis** (Turcz.) Melderis, *Bot. Jour. Linn. Soc.* **76**: 374 (1978) (*Triticum boreale* Turcz., non *Elymus borealis* Scribner, *Roegneria borealis* (Turcz.) Nevski): Stems 20–60 cm, slender. Spikelets 9–10 mm, usually with 2, rarely 3 florets. Glumes 4–7 mm, 3- to 5-veined, scabridulous on the veins. Lemma 7–8 mm, glabrous below, scabridulous towards the apex. $2n=28$. *N.E. Russia.*

(b) Subsp. **scandicus** (Nevski) Melderis, *op. cit.* 375 (1978) (*Roegneria scandica* Nevski): Stems 30–45 cm, slender. Spikelets 10–12 mm, with 2–4 florets. Glumes 5–8 mm usually 5-veined, scabridulous on the veins, rarely shortly hairy. Lemma 8–9 mm, glabrous below, scabridulous towards the apex, rarely shortly hairy. $2n=28$. ● *Iceland, N. Fennoscandia, N. Russia.*

(c) Subsp. **subalpinus** (Neuman) Melderis, *loc. cit.* (1978) (*Triticum violaceum* forma *subalpinum* Neuman): Stems 40–65 cm, fairly robust. Spikelets 12–15 mm, with 3–5 florets. Glumes 7–10 mm, 5-veined, scabridulus on veins. Lemma 8–10 mm, glabrous below, scabridulous towards the apex. ● *Mountains of S. & C. Fennoscandia.*

Sect. CAESPITOSAE (Rouy) Melderis. Caespitose. Spikes rather lax, erect; rhachis tough, spinose-ciliate or nearly glabrous on the main angles. Spikelets solitary on the rhachis, usually with 3–5 florets. Glumes 5–8 mm, lanceolate or narrowly lanceolate, 5- to 9(–11)-veined, usually glabrous on the veins, acuminate to subacute or obtuse to truncate. Callus glabrous.

10. E. reflexiaristatus (Nevski) Melderis, *Bot. Jour. Linn. Soc.* **76**: 375 (1978) (*Agrophyron reflexiaristatum* Nevski). Glaucous-green. Stems slender. Leaves usually convolute, densely and minutely hairy on the upper surface, glabrous beneath; sheaths usually not ciliate. Spikes 7·5–15 cm (excluding awns), narrow. Spikelets nearly as long as the internodes of the rhachis; rhachilla glabrous. Glumes usually 6–9 mm, slightly shorter than the lower floret, glabrous, 5- to 7-veined. Lemma 7–10 mm, glabrous, with awn 8–25 mm, divergent at nearly a right angle. *Rocks and stony slopes; calcicole. Ural and adjacent lowlands; Krym.* Rs (N, C, K).

(a) Subsp. **reflexiaristatus**: Stems 45–80 cm. Leaves up to 4 mm wide (when flattened), convolute. Rhachis nearly glabrous on the main angles. Spikelets usually 14–20 mm, with 5 florets. Glumes narrowly lanceolate or lanceolate, subacute. Awn strongly scabrid. Anthers 5·5–6 mm. *Ural and adjacent lowlands.*

(b) Subsp. **strigosus** (Bieb.) Melderis, *op. cit.* 376 (1978) (*Bromus strigosus* Bieb., *Agropyron strigosum* (Bieb.) Boiss. non *Elymus strigosus* Rydb.): Stems 50–60 cm. Leaves up to 3 mm wide (when flattened), convolute, rarely nearly flat. Rhachis slightly spinose-ciliate on the main angles. Spikelets usually 11–13 mm, with 4–5 florets. Glumes narrowly lanceolate, acuminate. Awn scabridulous. Anthers *c.* 5 mm. $2n=14$ (28). ● *Mountains of Krym.*

11. E. stipifolius (Czern. ex Nevski) Melderis, *loc. cit.* (1978) (*Agropyron stipifolium* Czern. ex Nevski). Stems 40–90 cm. Leaves 2–3 mm wide (when flattened), convolute or flat with convolute margins, rather rigid, pungent, scabridulous on the upper surface, smooth beneath, scabrid on the indurate margins; at least the lower sheaths glabrous or shortly hairy, ciliate. Spikes 7–15 cm, slender, lax; rhachis rather densely spinose-ciliate on the main angles. Spikelets 12–17 mm, usually with 4–5 florets; rhachilla glabrous. Glumes 7–11 × 2–2·2 mm, lanceolate, glabrous, 5- to 6-veined, subacute, the lower 7–9 mm, 1–2 mm shorter than the lower floret. Lemma 10–11 mm, glabrous, unawned. Palea shortly ciliate on keels in the upper part. Anthers 5–6 mm. $2n=28$. *Steppes and rocky slopes. S. & E. Ukraine and adjacent regions of S. Russia.* Rs (C, W, K, E).

12. E. bungeanus (Trin.) Melderis, *loc. cit.* (1978) (*Triticum bungeanum* Trin., *Agropyron geniculatum* (Trin.) C. Koch, *Elytrigia geniculata* (Trin.) Nevski). Stems 30–70 cm. Leaves narrow, usually convolute, shortly hairy on the upper surface, glabrous beneath; sheaths usually ciliate. Spike 6·5–15 cm, slender, lax; rhachis glabrous or sparsely spinose-ciliate on the main angles. Spikelets 11–17 mm, with 3–5 florets; rhachilla glabrous. Glumes lanceolate, glabrous, 3- to 6-veined, subacute; the lower usually 5–7 mm, 2–3 mm shorter than the lower floret, 3- to 5-veined. Anthers 5–6 mm. *Rocks and stony slopes. S. Ural; Krym; one station on the middle Volga.* Rs (C, K).

(a) Subsp. **scythicus** (Nevski) Melderis, *loc. cit.* (1978) (*Agropyron scythicum* Nevski): Glaucous-green. Leaves 2·5–4 mm wide (when flattened), convolute or flat with convolute margins. Spikelets 12–17 mm. Glumes 6–10 × 1·8–2 mm. Lemma 9–10 mm, subacute at the apex, unawned. ● *Mountains of Krym.*

(b) Subsp. **pruiniferus** (Nevski) Melderis, *loc. cit.* (1978) (*Agropyron pruiniferum* Nevski): Glaucous and pruinose. Stems sometimes strigose below the nodes. Leaves 2–2·5 mm wide (when flattened), convolute. Spikelets 11–14 mm. Glumes 5–7 × up to 1·5 mm, usually with wide hyaline margins. Lemma 8–8·5 mm, acuminate, unawned. *S. Ural; middle Volga.*

Subsp. *bungeanus* occurs in Siberia.

(13–16). E. elongatus group. Leaves flat or convolute. Rhachis of spike with internodes nearly flat on the side facing the spikelets, usually spinose-ciliate on the main angles. Glumes indurate-coriaceous, obtuse or truncate. Lemma obtuse, unawned.

1 Stems slender; upper leaves convolute, the lower flat, 1–2 mm wide, sparsely ciliate, minutely hairy beneath; glumes usually 3- to 5-veined
2 Spikelets slightly compressed; lower sheaths usually ciliate; glumes truncate or emarginate **13. nodosus**
2 Spikelets strongly compressed; lower sheaths not ciliate; glumes truncate and apiculate **14. flaccidifolius**
1 Stems robust; leaves flat or convolute, usually 3–5 mm wide, usually scabrid on the margin, glabrous beneath; glumes usually 5- to 9-veined
3 Lower glume nearly as long as lower floret, 5- to 7-veined, obtuse; lemma sometimes sparsely hairy; stems usually strigulose below the nodes **15. curvifolius**
3 Lower glume not more than ¾ as long as lower floret, 5- to 9(–11)-veined, ± truncate; lemma glabrous; stems glabrous **16. elongatus**

13. E. nodosus (Nevski) Melderis, *loc. cit.* (1978) (*Agropyron nodosum* Nevski). Leaves 1–2 mm wide, glaucous-green, convolute, with rather fine veins, densely covered with delicate spinules or very short hairs on the upper surface, sparsely ciliate, usually glabrous beneath; lower sheaths often ciliate. Spikelets with few florets; rhachilla densely strigulose. Glumes unequal, glabrous. Lemma glabrous. *Rocks and stony slopes. Krym; Corse.* Co Rs (K). (*Caucasus to Lebanon.*)

(a) Subsp. **nodosus**: Stems 30–80 cm, often conspicuously swollen at base. Lower sheaths minutely hairy on the surface, ciliate. Spikes 4–11 cm, lax. Spikelets 10–12 mm, with 3–5 florets. Glumes 5- to 6-veined, often ½ the length of the lower floret, the lower 4–6 mm, the upper 5–7 mm. Lemma 7·5–8·5 mm. Anthers *c.* 4·5 mm. $2n=28$. ● *S. Krym.*

(b) Subsp. **corsicus** (Hackel) Melderis, *op. cit.* 377 (1978) (*Agropyron caespitosum* var. *corsicum* Hackel): Stems 50–80 cm, not conspicuously swollen at base. Lower sheaths glabrous on the surface, but ciliate. Spikes 10–15 cm, lax. Spikelets 10–11 mm, with 3 florets. Glumes usually 5-veined, about ⅔ as long as the lower floret, the lower 6–7 mm, the upper 7–8 mm. Lemma 9–9·5 mm. Anthers *c.* 5 mm. $2n=28$. ● *Corse* (*Sant'Angelo, N. of Corte.*)

14. E. flaccidifolius (Boiss. & Heldr.) Melderis, *loc. cit.* (1978) (*Agropyron elongatum* var. *flaccidifolium* Boiss. & Heldr.). Stems 35–65 cm. Lower leaves 1–2 mm wide, flat, soft, finely veined, densely and shortly hairy on the upper surface, sparsely ciliate, minutely hairy beneath; lower sheaths strigulose. Spikes 7–15 cm, lax. Spikelets 10–11 mm, conspicuously compressed, with 6–9 florets. Glumes usually 4–6 mm, usually 5-veined. Lemma usually 6 mm, emarginate, with a short mucro in the sinus. Palea ciliolate on keels near the apex. Anthers *c.* 4 mm. *Coastal marshes. Mediterranean region, westwards to Sicilia.* Al Cr Gr Si Tu.

15. E. curvifolius (Lange) Melderis, *loc. cit.* (1978) (*Agropyron curvifolium* Lange). Stems 60–100 cm, robust, usually strigulose below the nodes. Leaves up to 3 mm wide (when flattened), glaucous-green, usually convolute, rigid, sometimes recurved, prominently and closely veined, scabrid and shortly hairy on the veins above, scabrid on the margins, smooth beneath, subulate-pungent. Spikes 13–15 cm, erect, lax. Spikelets 10–15 mm, with 5–7 florets, strongly compressed laterally; rhachilla strigulose. Glumes 6–8 mm, nearly as long as the lower floret, usually 5-veined. Lemma 7–8 mm, glabrous, or sparsely hairy. Palea ciliolate on keels. Anthers 4 mm. *Gypsaceous, saline or calcareous soils.* ● *S.C. Spain.* Hs.

16. E. elongatus (Host) Runemark, *Hereditas* **70**: 156 (1972) (*Triticum elongatum* Host, *Agropyron elongatum* (Host) Beauv.). Stems robust, glabrous. Leaves 2·5–5 mm wide (when flattened), flat or convolute, coriaceous, prominently and closely veined, with sparse spinules, sometimes also with short setae. Spikes erect, lax. Spikelets strongly compressed laterally; rhachilla strigulose. Glumes often hyaline and emarginate at the apex, the lower ⅔–¾ as long as the lower floret. Lemma glabrous. *S. & S.E. Europe.* Bl Bu Co Ga Gr Hs It Ju Lu Rm Rs (W, K, E) Sa Tu.

Several variants have been described by various authors as separate species or as subordinate taxa; only the following seem to merit subspecific status.

(a) Subsp. **elongatus**: Stems 50–80 cm. Lower sheaths glabrous on the margins. Spikes 10–25 cm; lower internodes usually as long as the spikelets. Spikelets usually 10–17 mm, with 7–8 florets. Glumes 7–10 mm, 5–9(–11)-veined. Lemma 9–10 mm. Palea with cilia less than 0·1 mm on keels in the upper part. Anthers 4–4·5 mm. $2n=14$. *Maritime sands and salt-marshes. Throughout the range of the species.*

(b) Subsp. **ponticus** (Podp.) Melderis, *Bot. Jour. Linn. Soc.* **76**: 377 (1978) (*Triticum ponticum* Podp.): Stems 50–100 cm. Lower sheaths usually ciliate. Spikes 10–35 cm; lower internodes usually much longer than the spikelets. Spikelets usually 17–25 mm, with 8–13 florets. Glumes 9–11 mm, usually 5- to 7-veined. Lemma 10–13 mm, glabrous, sometimes minutely hairy along the margins. Palea with cilia 0·1–0·3 mm on the whole length of keels. $2n=70$ (56). *Dry or saline habitats. S.E. Europe.*

Sect. ELYTRIGIA (Desv.) Melderis. Rhizomatous. Spikes dense or lax, erect; rhachis tough, spinose-ciliate on the main angles. Spikelets solitary on the rhachis, usually with 5–10 florets, often falling entire at maturity. Glumes usually glabrous on the veins, acute or with a short mucro or awn, or obtuse or obliquely truncate to truncate. Callus glabrous.

17. E. pycnanthus (Godron) Melderis, *op. cit.* 378 (1978) (*Triticum pycnanthum* Godron, *Agropyron litorale* Dumort., nom. illeg., *A. pycnanthum* (Godron) Godron & Gren., *A. pungens* auct., non (Pers.) Roemer & Schultes). Stems 10–120 cm, rigid. Leaves up to 35 cm × 2–6 mm, flat or convolute, glaucous-green, rigid, with prominent, crowded, flattened, scabrid veins on the upper surface, glabrous beneath, pungent; lower sheaths ciliate. Spikes 4–20 cm. Spikelets 10–20 mm, with 3–10 florets; rhachilla strigulose. Glumes 8–10 mm, lanceolate-oblong, coriaceous, prominently 4- to 7-veined, asymmetrically keeled, scabridulous on the keel, acute. Lemma 7–11 mm, keeled above, subobtuse, unawned, mucronate or with an awn up to 10 mm. Palea spinose-ciliate on keels. Anthers 5–7 mm. $2n=42$. *Maritime sands and shingle.* ● *Coasts of W. & S. Europe.* Al Au Az Be Bl Br Bu Co Da Ga Ge Gr Hb He Ho It Ju Lu ?Rm.

E. pycnanthus × repens (*Agropyron × oliveri* Druce, *A. campestre* auct., non Godron & Gren.) is like *E. repens* but always has a dense spike, the veins on the upper surface of leaves are more prominent and flattened, with short spinules or sparse long hairs, the margins of the leaf-sheaths are usually glabrous, sometimes shortly ciliate, the glumes asymmetrically keeled, acute, and the lemma acute or obtuse with an excurrent mid-vein. It occurs commonly on the west coast of Europe and as an occasional casual in the Baltic region and C. Russia.

18. E. repens (L.) Gould, *Madroño* **9**: 127 (1947) (*Triticum repens* L., *Agropyron repens* (L.) Beauv., *Elytrigia repens* (L.) Nevski). Stems 30–120 cm. Leaves 3–10 mm wide, usually flat. Spikes usually 5–15 cm, dense or lax. Spikelets 8–17 mm, usually with 5–7 florets; rhachilla strigulose. Glumes 5–15 mm, lanceolate, usually 5- to 7-veined, acute to subobtuse, mucronate or shortly awned, with a hyaline margin widest near the apex. Lemma 6–11 mm, keeled distally, glabrous, unawned or subulate. *Almost throughout Europe, but doubtfully native in parts of the north.* All except Az Cr Sb.

Very variable. The correlation between the characters is poor and most of the variants do not show any ecological or geographical differentiation. At least 5 subspecies may, however, be recognized in Europe.

1 Spikelets strongly compressed; lemma emarginate, with mid-vein prolonged into a short, thick, obtuse point, not projecting beyond the apex; palea minutely spinose-ciliate on keels in the upper part **(d) subsp. elongatiformis**
1 Spikelets slightly compressed; lemma usually acute, mucronate; palea spinose-ciliate throughout most of the length of the keels
2 Stems geniculate at the base; leaves with prominent, crowded veins; glumes usually 3-veined **(c) subsp. arenosus**
2 Stems erect; leaves with rather fine, distant veins; glumes 5- to 9-veined
3 Plant dull green; leaves flat, soft; spikes usually dense; glumes 5- to 7-veined; lemma mucronate or with an awn up to 8 mm **(a) subsp. repens**
3 Plant glaucous-green or glaucous; leaves ± convolute, rigid; spikes lax
4 Rhizomes long-creeping; stems sometimes rooting at the lower nodes; leaves sometimes hairy; glumes 6- to 9-veined; lemma usually subobtuse or acuminate-subulate **(b) subsp. pseudocaesius**
4 Rhizomes short; stems not rooting at the lower nodes; leaves scabrid above; glumes 5- to 6-veined; lemma with an awn 8–15 mm **(e) subsp. calcareus**

(a) Subsp. **repens**: Leaves often with sparse long hairs on the upper surface; lower sheaths sparsely or densely hairy. Spikes sometimes with a hairy rhachis. Glumes 7–12 mm. Lemma 8–11 mm. Anthers 5–5·5 mm. $2n=42$ (28, 56). *Waste places and as a persistent weed of cultivated land. Throughout the range of the species.*

(b) Subsp. **pseudocaesius** (Pacz.) Melderis, *Bot. Jour. Linn. Soc.* **76**: 379 (1978) (*Agropyron repens* var. *pseudocaesium* Pacz.): Leaves usually scabrid on the upper surface. Glumes 10–13 mm, nearly as long as the lower floret, often with mucro up to 0·2 mm. Lemma 9·5–13 mm, usually emarginate, with a mucro up to 0·2 mm in the sinus. Anthers 6–7 mm. $2n=42$. *Steppes and saline soils. S. Ukraine and S.E. Russia.*

(c) Subsp. **arenosus** (Petif) Melderis, *loc. cit.* (1978) (*T. repens* var. *arenosum* Petif, *Elytrigia repens* var. *maritima* Hyl.): Plants glaucous-green, forming small, dense tufts. Leaves narrow, convolute, usually glabrous on both surfaces. Spikes *c.* 5 cm, with small spikelets with 2–6 florets. Glumes 5–6 mm, often 3-veined. Lemma 6–7 mm, subobtuse or acuminate-subulate. Anthers *c.* 4 mm. *Maritime sands. Coasts of N.W. Europe.*

(d) Subsp. **elongatiformis** (Drobov) Melderis, *loc. cit.* (1978) (*Agropyron elongatiforme* Drobov): Leaves with prominent veins; sheaths sometimes ciliate. Spikelets 9–15 mm, often divergent from the rhachis in their upper part. Glumes 4–8 mm. Lemma 6–10 mm. Anthers *c.* 4 mm. $2n=42$. *Grassland and disturbed ground. S. & E. Ukraine, S.E. Russia.*

(e) Subsp. **calcareus** (Černjavski) Melderis, *op. cit.* 380 (1978) (*Agropyron calcareum* Černjavski): Leaves with rather conspicuous veins. Glumes 7–8 mm, more or less abruptly tapering into a short awn 3–4 mm. Lemma *c.* 10 mm, with an awn 8–15 mm. Anthers 4·5–5 mm. *Dolomitic rocks.* ● *S. Makedonija (Mt Petrinja).*

E. repens × hispidus (*Agropyron × mucronatum* Opiz) occurs frequently in C. & E. Europe. It is like *E. hispidus* but the leaves are softer, with the veins rather prominent and crowded in the basal part, becoming thinner and less crowded distally. The glumes are rather prominently veined, with a wide hyaline margin and are abruptly narrowed at the mucronate apex. $2n=42$.

E. repens × Hordeum secalinum has been recorded, though rarely, from meadows and disturbed ground in England, Denmark and S. France. It is morphologically intermediate between the parents and is usually male-sterile. It has $2n=49$.

19. E. pungens (Pers.) Melderis, *loc. cit.* (1978) (*Triticum pungens* Pers., *Agropyron pungens* (Pers.) Roemer & Schultes, *Elytrigia pungens* (Pers.) Tutin). Stems slender. Leaves flat or convolute, with prominent, somewhat distant, scabrid veins on the upper surface, glabrous beneath, pungent. Spikes erect, rather lax. Spikelets laterally compressed, usually with 5–7 florets; rhachilla densely strigulose. Glumes 6·5–9·6 mm, keeled, prominently veined, subobtuse to acute, often mucronate. Lemma obtuse, with a short mucro. *Dry places.* ● *S.W. Europe, extending to N.W. France.* Bl Ga Hs Lu.

The name *Triticum pungens* Pers. has been misapplied to **17** (which differs from *E. pungens* mainly in having leaves with prominent, crowded, flattened veins on the upper surface) and to *E. pycnanthus × repens*.

1 Stems, rhachis and spikelets densely and shortly hairy **(c) subsp. fontqueri**
1 Stems, rhachis and spikelets glabrous
2 Leaves usually convolute, scabrid on the upper surface, the lower sometimes also with sparse long hairs on the veins, glabrous beneath; sheaths not ciliate; glumes subobtuse **(a) subsp. pungens**
2 Leaves usually flat, scabrid on both surfaces, without sparse long hairs; sheaths sometimes ciliate; glumes usually acute **(b) subsp. campestris**

(a) Subsp. **pungens**: Stems 40–50 cm. Leaves *c.* 2·5 mm wide; lower sheaths minutely hairy, not ciliate. Spikes *c.* 8·5 cm. Spikelets 14–18 mm. Glumes oblong, coriaceous, slightly scabrid on the keel near the apex. Lemma 8·5–10 mm, subobtuse, with a very short mucro. Palea with rather long, spinose cilia on keels. Anthers 4 mm. *N. & C. Spain, N. Portugal.*

(b) Subsp. **campestris** (Godron & Gren.) Melderis, *loc. cit.* (1978) (*Agropyron campestre* Godron & Gren.): Stems 50–100 cm. Leaves up to 10 mm wide; sheaths sometimes ciliate. Spikes 15–25 cm. Spikelets 13–17 mm, with 5–9 florets. Glumes lanceolate or elliptical, acute or subacute, with a very short mucro. Palea spinose-ciliate on keels. Anthers 4–4·5 mm. $2n=56$. *From N.W. France to Portugal.*

(c) Subsp. **fontqueri** Melderis, *loc. cit.* (1978): Stems 40–65 cm. Leaves up to 5 mm wide; sheaths pubescent, nearly always ciliate. Spikes 7–15 cm. Spikelets 10–13 mm, with 4–7 florets. Glumes oblong, usually shortly pubescent on and between the veins, acute or subobtuse. Lemma 9·5–11 mm, minutely pubescent or sometimes with few short hairs on the surface, especially near the apex. Palea sometimes with rather long cilia on keels. Anthers 3–3·5 mm. *S. & S.E. Spain, Islas Baleares, ?E.C. Portugal.*

20. E. hispidus (Opiz) Melderis, *loc. cit.* (1978) (*Agropyron hispidum* Opiz, *A. intermedium* (Host) Beauv., non *Elymus intermedius* Bieb.): Stems 40–115 cm. Leaves 2–7 mm wide, flat or more or less convolute, glaucous-green, scabrid and with sparse long hairs on the upper surface, glabrous beneath; sheaths usually ciliate. Spikes erect, rather dense to lax. Spikelets laterally compressed, usually with 4–5 florets, usually glabrous; rhachilla shortly strigulose. Glumes slightly unequal, oblong or lanceolate-oblong, keeled, somewhat scabrid on the keel near the apex, obtuse or obliquely truncate to truncate. Lemma keeled towards the apex, subobtuse. Palea spinose-ciliate on keels. *Dry, usually sandy or stony ground. Europe, northwards to C. France and to c.* 56° *N. in C. Russia.* Al Au Bu ?Cr Cz Ga Ge Gr He Hs Hu It Ju Po Rm Rs (C, W, K, E) Tu.

Extremely variable in characters of leaf, spike and spikelet. Several species and a large number of minor taxa have been described within this complex, of which at least 5 seem to be worth subspecific rank.

1 Spikes linear; spikelets with 1–3 florets, very closely appressed to and partly embedded in the rhachis (e) subsp. **pouzolzii**
1 Spikes broadly linear; spikelets with 4–many florets, not very closely appressed to the rhachis
2 Leaves densely and shortly hairy on the upper surface (d) subsp. **varnensis**
2 Leaves scabrid, sometimes with sparse long hairs on the upper surface
3 Leaves scabrid on the upper surface; spikes 20–30 cm, lax; spikelets usually 15–20 mm, conspicuously shorter than the internodes in the lower part of the rhachis (c) subsp. **graecus**
3 Leaves scabrid and with sparse long hairs on the upper surface; spikes 10–25 cm, rather dense; spikelets usually 10–15 mm, nearly as long as the internodes in the lower part of the rhachis
4 Spikelets glabrous (a) subsp. **hispidus**
4 Spikelets hairy (b) subsp. **barbulatus**

(a) Subsp. **hispidus**: Stems 60–100 cm. Leaves with prominent veins and conspicuously indurate margins, scabrid and usually also with sparse long hairs on the upper surface, glabrous beneath. Spikes 10–20 cm, fairly dense. Spikelets usually 10–15 mm, glabrous. Glumes 5–8 × 2–3 mm. Lemma 8–11 mm, sometimes mucronate or shortly awned. Anthers 5–6·5 mm. $2n=42$ (28, 43). *Almost throughout the range of the species.*

(b) Subsp. **barbulatus** (Schur) Melderis, *op. cit.* 381 (1978) (*Agropyron barbulatum* Schur, *A. intermedium* subsp. *trichophorum* (Link) Ascherson & Graebner): Stems 60–100 cm. Leaves long-hairy and scabrid on the upper surface, scabrid and sometimes hairy beneath; lower sheaths sometimes hairy on the surface. Spikes 10–25 cm; rhachis more or less hairy. Spikelets 9–18 mm, hairy. Glumes 5–8·5 × 2–2·5 mm. Lemma 8–11 mm, sometimes with an awn 1–10 mm, glabrous on the back below, rarely villous. Anthers up to 8 mm. $2n=42$ (28). *Almost throughout the range of the species.*

(c) Subsp. **graecus** Melderis, *loc. cit.* (1978) (*Agropyron litorale* auct. graec. pro parte, non Dumort.): Stems 80–100 cm. Leaves with close, prominent, often flattened scabrid veins on the upper surface. Spikes 20–30 cm, lax. Spikelets 15–20 mm, conspicuously shorter than the internodes in the lower part of the rhachis. Glumes 6·5–8·5 mm, lanceolate-oblong, obliquely truncate or obtuse, abruptly contracted into an apiculum. Lemma 9–12 mm. Anthers *c.* 7·5 mm. ● *S.E. Greece (Attiki)*

(d) Subsp **varnensis** (Velen.) Melderis, *op. cit.* 382 (1978) (*Triticum varnense* Velen., *Agropyron varnense* (Velen.) Hayek): Stems 60–100 cm. Leaves rigid, rather prominently veined, densely and minutely hairy on the veins of the upper surface. Spikes up to 30 cm, lax. Spikelets 15–20 mm, shorter than the internodes in the lower part of the rhachis. Glumes 7–10 mm, 5- to 7-veined, firm, obtuse. Lemma 9–11 mm, obtuse or with a very short mucro. *Maritime sands.* ● *E. part of Balkan peninsula.*

(e) Subsp. **pouzolzii** (Godron) Melderis, *loc. cit.* (1978) (*Triticum pouzolzii* Godron, *T. rottboellioides* (Mandon ex Husnot) Duval-Jouve ex Ascherson & Graebner): Stems 40–115 cm. Leaves with prominent scabridulous veins on the upper surface. Spikes 6–14 cm, linear, lax. Spikelets 8–10 mm, with 1–3 florets, distant, closely appressed to and partly embedded in the rhachis. Glumes 5–7 mm, usually 4- to 5-veined, strongly keeled, glabrous, obtuse, with a very short mucro. Lemma *c.* 6 mm, subobtuse. *Field-margins.* ● *S. & W. France.*

A striking variant, var. *epiroticus* Melderis, with spikes 23–26 cm, rhachis of the spike densely and minutely hairy, glumes 8·5–11 mm, gradually tapering into a short awn, with a dense indumentum of short, appressed hairs on and between the veins, has been found in N.W. Greece. It might be given a higher status if more complete material were available for investigation.

21. E. lolioides (Kar. & Kir.) Melderis, *loc. cit.* (1978) (*Triticum lolioides* Kar. & Kir., *Agropyron lolioides* (Kar. & Kir.) P. Candargy). Stems 30–70 cm. Leaves convolute or rarely flat, 5–6 mm wide, with convolute margins, prominently but rather finely veined, densely and shortly hairy, often also with sparse long hairs on veins of the upper surface, glabrous beneath; sheaths glabrous. Spikes 7–15 cm, rather lax Spikelets 10–15 mm, usually with 5–7 florets, glabrous; rhachilla strigulose. Glumes 4–6 mm, ¾–¾ as long as the lower floret, elliptical, 3- to 5-veined, obtuse, with conspicuous scarious-hyaline margins. Lemma 7–8·5 mm, subobtuse, often with a very short mucro. Palea spinose-ciliate on keels. Anthers *c.* 3·5 mm. $2n=$?58. *Dry places. C. & S. Russia.* Rs (C, W, E).

Sect. JUNCEAE (Prat) Melderis. Rhizomatous or caespitose. Spikes usually lax, erect or somewhat curved; rhachis fragile, disarticulating at maturity, glabrous on the main angles. Spikelets solitary on the rhachis, with 2–9 florets. Glumes 5–18 mm, keeled, lanceolate to narrowly oblong, glabrous on the veins, obtuse to truncate, 4- to 12-veined. Callus glabrous.

22. E. farctus (Viv.) Runemark ex Melderis, *loc. cit.* (1978) (*Triticum junceum* L., non *Elymus junceus* Fischer, *T. farctum* Viv., *Agropyron junceum* (L.) Beauv.). Stems rigid. Leaves

convolute, or flat with convolute margins, rigid, glaucous-green, prominently veined, densely and minutely hairy on the upper surface, glabrous beneath. Spikes erect or slightly curved; rhachis readily breaking just above each spikelet, glabrous on the surface and main angles. Spikelets glabrous, usually appressed to the rhachis, laterally compressed; rhachilla densely strigulose. Glumes asymmetrically keeled, unawned. Lemma keeled towards the apex, unawned. *Maritime sands; rarely on maritime rocks. Coasts of Europe, northwards to S. Norway and eastwards to Estonia and Krym.* All except Au Az Cz He Hu Is Rs (N, C, E).

A polyploid complex, ranging from diploid to octoploid, the members of which have been variously treated as species or subspecies. Since the correlation between chromosome number and morphology is imperfect, subspecific rank seems the most appropriate.

1 Plant with long-creeping rhizomes; palea spinose-ciliate nearly throughout the length of the keels
2 Spikes erect, with 8–12(–15) spikelets, usually longer than the leaves; rhachis not very fragile; anthers 10–12 mm **(a) subsp. farctus**
2 Spikes usually slightly curved, with 4–8(–12) spikelets, often shorter or slightly longer than the leaves; rhachis very fragile; anthers 6–8 mm **(b) subsp. boreali-atlanticus**
1 Plant caespitose; rhizomes very short or absent; palea spinose-ciliate only in upper half of keels
3 Rhizomes short; spikes 10–40 cm, lax; spikelets shorter than the internodes in the lower part of the rhachis; ligule up to 2·5 mm **(c) subsp. bessarabicus**
3 Rhizomes absent; spikes 2–10 cm; spikelets longer than the internodes in the lower part of the rhachis; ligule not more than 0·5 mm **(d) subsp. rechingeri**

(a) Subsp. farctus: Rhizomes long-creeping. Stems usually 50–80 cm, rather thick. Leaves up to 5 mm wide, convolute, rarely flat with convolute margins; sheaths sometimes densely and shortly hairy; ligule not more than 1 mm. Spikes 15–35 cm. Spikelets 10–25 mm, usually with 5–9 florets. Glumes 10–18 mm, narrowly lanceolate or oblong, 6- to 12-veined, obtuse. Lemma 10–18 mm, obtuse. Palea spinose-ciliate throughout the length of the keels. Anthers 10–12 mm. $2n=42, 56$. *S. Europe.*

(b) Subsp. boreali-atlanticus (Simonet & Guinochet) Melderis, *Bot. Jour. Linn. Soc.* **76**: 383 (1978) (*Agropyron junceum* subsp. *boreali-atlanticum* Simonet & Guinochet, *A. junceiforme* (Á. & D. Löve) Á. & D. Löve, *Elytrigia juncea* subsp. *boreoatlantica* Hyl.): Rhizomes long-creeping. Stems 20–60 cm, rather fragile. Leaves 2–6 mm wide, flat or often convolute; ligule not more than 1 mm. Spikes 4–20 cm, erect, or slightly curved. Spikelets 15–25 mm, with 3–8 florets. Glumes 9–15 mm, prominently 7- to 11-veined, narrowly oblong, obtuse. Lemma 11–18 mm, obtuse or emarginate, with a very short mucro in the sinus. Palea spinose-ciliate throughout the length of the keels. Anthers 6–8 mm. $2n=28$. *N. & W. Europe.*

(c) Subsp. bessarabicus (Săvul. & Rayss) Melderis, *loc. cit.* (1978) (*Agropyron bessarabicum* Săvul. & Rayss, *Elytrigia juncea* subsp. *bessarabicum* (Săvul. & Rayss) Tzvelev): Rhizomes few, shortly creeping, forming tufts. Stems 30–80 cm. Leaves 2–5 mm wide, flat or with convolute margins; ligule up to 2·5 mm. Spikes 14–40 cm. Spikelets usually 18–25 mm, the lower shorter than the internodes of the rhachis, with 2–3 florets. Glumes 15–20 mm, narrowly oblong, 7- to 9-veined, obtuse. Lemma usually 13–17 mm, obtuse. Palea spinose-ciliate on keels in the upper half. Anthers 4·5–6 mm. $2n=14$. ● *Black Sea coast, from Bulgaria to Krym.*

(d) Subsp. rechingeri (Runemark) Melderis, *loc. cit.* (1978) (*Agropyron rechingeri* Runemark, *Elymus rechingeri* (Runemark) Runemark): Caespitose. Stems 15–45 cm, usually conspicuously swollen at the base. Leaves 1–1·5 mm wide (when flattened), convolute; lower sheaths rarely shortly hairy; ligule not more than 0·5 mm. Spikes 2–10 cm, erect or slightly curved. Spikelets 9–16 mm, with 2–6 florets. Glumes 5–12 mm, narrowly lanceolate to narrowly oblong, 4- to 5-veined, mucronulate or obtuse. Lemma 7–12 mm, lanceolate, usually with a very short mucro. Palea spinose-ciliate in upper half of keels. Anthers 4·5–5·5 mm. $2n=28$. *Maritime rocks. Aegean region.*

E. farctus subsp. *farctus* × *E. pycnanthus* and × *E. repens* are widespread in the Mediterranean region; subsp. *boreali-atlanticus* × *E. pycnanthus* ($2n=35$) and subsp. *boreali-atlanticus* × *E. repens* ($2n=35, 49$) occur commonly on the west coast of Europe.

E. farctus subsp. *boreali-atlanticus* × *Leymus arenarius* occurs occasionally on maritime sands in the Baltic region. It is morphologically intermediate between the parents and is sterile. *E. repens* × *Leymus arenarius* has also been recorded from maritime sands in arctic Russia.

49. Agropyron Gaertner[1]

Perennials. Leaves flat or more or less convolute; ligule short. Inflorescence a spike; rhachis tough. Spikelets solitary at each node of the rhachis, pectinate or imbricate, with 3–10 florets, strongly compressed laterally; rhachilla disarticulating above the glumes and beneath the florets. Glumes narrowly lanceolate to ovate-lanceolate, with a wide scarious margin, prominently keeled, with 1–2 inconspicuous lateral veins. Lemma membranous, 5-veined, keeled, with or without a short awn. Palea as long as or slightly shorter than the lemma, 2-dentate at the apex, 2-keeled, coarsely ciliate on keels.

1 Plants with long-creeping rhizomes; glumes lanceolate-subulate, gradually tapering to a subulate apex; palea with not more than 10 cilia on each keel
2 Spikes 5–7 mm wide, linear; spikelets imbricate, ascending **3. tanaiticum**
2 Spikes 7–18 mm wide, broadly linear; spikelets ± pectinate, divergent from the rhachis at a wide angle
3 Spikes dense; lower internodes of the rhachis 2–5 mm; lemma acute or with an awn up to 2 mm **1. cimmericum**
3 Spikes lax; lower internodes of the rhachis 3–10 mm; lemma unawned **2. dasyanthum**
1 Plant without creeping rhizomes; glumes lanceolate or ovate-lanceolate, more or less abruptly tapering above, acuminate or shortly awned; palea with at least 10 cilia on each keel
4 Spikes 1·5–7 cm × 8–23 mm, ovate, oblong or broadly linear; spikelets pectinate, divergent from the rhachis at a wide angle **6. cristatum**
4 Spikes 2·5–15 cm × 5–12 mm, linear; spikelets imbricate, ascending
5 Spikes 5–15 cm; glumes acuminate or with an awn not more than 1·5 mm; lemma 6–8·5 mm, acute or with an awn not more than 1 mm **4. fragile**
5 Spikes 2·5–7·5 cm; glumes with an awn up to 3 mm; lemma 5–6 mm, with an awn 1–3 mm **5. desertorum**

1. A. cimmericum Nevski, *Acta Univ. As. Med.* ser. 8 b (Bot.), **17**: 56 (1934). Rhizomatous perennial. Stems 25–50 cm. Leaves 2–4 mm wide, convolute, minutely hairy on the upper surface, glabrous beneath; sheaths usually glabrous; ligule *c.* 1 mm. Spikes 6–11 cm × 8–15 mm, linear, dense; rhachis more or less shortly hairy. Spikelets 7–9 mm, pectinate, divergent from the rhachis at a wide angle. Glumes 3·5–6 mm, narrowly lanceolate-subulate, usually glabrous, with an awn 1–2 mm. Lemma 6–7 mm, with long white hairs, acute or with an awn 0·5–2 mm. Palea with 1–10 cilia on each keel. Anthers 3·5–4 mm. *Sandy and*

[1] By A. Melderis.

gravelly steppes. ● *S.E. Ukraine (N. & W. shores of Azovskoe More).* Rs (W, K).

2. A. dasyanthum Ledeb., *Ind. Sem. Horti Dorpat.* 3 (1820). Rhizomatous perennial. Stems 40–75 cm. Leaves up to 4 mm wide, convolute, prominently veined and minutely hairy on the upper surface, glabrous beneath; sheaths usually glabrous; ligule up to 1·5 mm. Spikes 6–15 cm × 7–18 mm, linear, lax, with distinct gaps between spikelets; rhachis more or less shortly hairy. Spikelets 7–12 mm, more or less pectinate, divergent from the rhachis at a wide angle. Glumes 5–8 mm, narrowly lanceolate-subulate, with a short mucro, glabrous or ciliate on the keel. Lemma 7–8 mm, densely villous, with long white hairs, rarely glabrous, unawned. Palea usually glabrous on the keels, rarely with 1–3 cilia on each keel. Anthers 5 mm. $2n=28$. *Sandy ground.* ● *C. & S. Ukraine.* Rs (W).

3. A. tanaiticum Nevski, *Acta Univ. As. Med.* ser. 8b (Bot.), **17**: 56 (1934). Rhizomatous perennial. Stems 30–80 cm, glabrous. Leaves usually 2–5 mm wide, flat, with convolute margins, rarely convolute, minutely hairy on the upper surface, glabrous beneath; sheaths glabrous, rarely the lower hairy; ligule up to 5 mm. Spikes usually 5–16 cm × 5–7 mm, linear, fairly lax; rhachis glabrous or shortly hairy. Spikelets 7–12 mm, ascending, more or less imbricate. Glumes 3–7 mm, narrowly lanceolate-subulate, acuminate, glabrous, rarely ciliate on the keel. Lemma 6–8 mm, with long white hairs, sometimes nearly glabrous, acute, unawned. Palea with 1–10 cilia on each keel. Anthers 4·5–5 mm. *Sandy river-banks.* ● *E. Ukraine and S.E. Russia (basins of Don and Donets rivers).* Rs (C, W, E).

Probably of hybrid origin involving **2** and **4**.

4. A. fragile (Roth) P. Candargy, *Arch. Biol. Vég.* (*Athènes*) **1**: 58 (1901). Caespitose perennial. Stems 30–80 cm. Leaves convolute or flat. Spikes 5–15 cm × 5–12 mm, linear, fairly dense. Spikelets ascending, imbricate. Glumes 5–7 mm, lanceolate, more or less abruptly tapering above, acuminate or shortly awned with an awn up to 1·5 mm, glabrous or scabridulous, rarely with a few cilia on the keel towards the apex. Lemma 6–8·5 mm, acute or with an awn not more than 1 mm. Palea with 12–40 cilia on each keel. Anthers 3·5–4 mm. $2n=28$ (14). *Dry sandy ground. S.E. part of U.S.S.R.* Rs (E). (*Caucasus and C. Asia.*)

Represented in Europe by subsp. **sibiricum** (Willd.) Melderis, *Bot. Jour. Linn. Soc.* **76**: 384 (1978) (*Triticum sibiricum* Willd.).

5. A. desertorum (Fischer ex Link) Schultes in Schultes & Schultes fil., *Mantissa* **2**: 412 (1824). Caespitose perennial. Stems 25–50 cm, glabrous or scabridulous below the spike. Leaves 2–3 mm wide, convolute, rigid, scabridulous on the upper surface, glabrous beneath; sheaths of the lower leaves with long patent hairs or glabrous. Spikes 2·5–7·5 cm × 5–9 mm, linear, more or less cylindrical. Spikelets ascending, imbricate. Glumes 3–4 mm, lanceolate, more or less abruptly tapering above, with an awn up to 3 mm, glabrous. Lemma 5–6 mm, glabrous, with an awn 1–3 mm. Palea with 10–20 cilia on each keel. Anthers 4 mm. $2n=28$ (29, 32). *Steppes and saline soils. S.E. Russia, Krym.* Rs (C, K, E). (*Caucasus, C. Asia.*)

6. A. cristatum (L.) Gaertner, *Novi Comment. Acad. Sci. Petrop.* **14(1)**: 540 (1770) (*Eremopyrum cristatum* (L.) Willk.). Caespitose perennial. Stems 25–75 cm. Leaves 1·5–5 mm wide, convolute or flat with convolute margins, rarely conduplicate, usually more or less hairy on the upper surface, glabrous beneath. Spikes usually 1·5–5 cm × 10–23 mm, pectinate, dense. Spikelets 8–15 mm, divergent from the rhachis at a wide angle. Glumes 3–5 mm, ovate-lanceolate, abruptly tapering into a short awn 2–3 mm. Lemma 5–7 mm, shortly awned. Palea with more than 10 cilia on each keel. *Steppes, sandy soils, stony slopes and other dry habitats. S., C. & E. Europe.* Au Bu Cz ?Gr Hs Hu It Ju Rm Rs (C, W, K, E) Tu.

A polymorphic species varying much in indumentum of floral and vegetative parts, presence or absence of swollen basal internodes of the stem, density of spike, size of spikes and spikelets, and shape and structure of the cauline leaves and those of the non-flowering shoots.

1 Basal internodes not conspicuously swollen (a) subsp. **pectinatum**
1 Basal internodes conspicuously swollen
2 Leaves of non-flowering shoots flat, fairly soft, shortly pubescent on both surfaces, not pungent (b) subsp. **sabulosum**
2 Leaves of non-flowering shoots convolute or flat with convolute margins, rigid, not shortly pubescent on both surfaces, pungent
3 Plant pruinose; leaf-sheaths glabrous and not ciliate; spikelets usually with 5–7 florets; lemma with an awn *c.* 4 mm (c) subsp. **brandzae**
3 Plant green or greenish-glaucous, not pruinose; sheaths of the lower leaves more or less sparsely long-hairy and ciliate; spikelets usually with 3–5 florets; lemma with an awn up to 3 mm
4 Stems often hairy below the spikes and nodes; leaves convolute or conduplicate, densely and shortly hairy, not prominently veined on the upper surface, with scattered short spinules and short rigid bristles beneath (d) subsp. **ponticum**
4 Stems glabrous; leaves thick, flat, with convolute margins, prominently veined, with scattered short spinules on veins, not densely and shortly hairy on the upper surface, usually glabrous beneath (e) subsp. **sclerophyllum**

(a) Subsp. **pectinatum** (Bieb.) Tzvelev, *Sched. Herb. Fl. URSS* **18**: 25 (1970) (*A. pectiniforme* Roemer & Schultes): Stems usually softly hairy below the spike, not swollen at the base; non-flowering shoots short. Leaves usually scabridulous or more or less hairy above, glabrous beneath; sheaths densely hairy or glabrous. Spikes oblong-ovate, conspicuously narrowed towards the apex, with distinct gaps between the spikelets; rhachis scabridulous or shortly hairy. Glumes scabridulous or ciliate on the keel and more or less hairy on the sides. Lemma glabrous or sparsely long-hairy. Anthers 4–5 mm. $2n=14$, 28 (42). *Throughout the range of the species.*

(b) Subsp. **sabulosum** Lavrenko, *Bull. Jard. Bot. Kieff* **12–13**: 148 (1931): Like subsp. (a) but basal internodes swollen; leaves sometimes glabrous above; rhachis and lemma usually glabrous. ● *S. & E. Ukraine, S.E. Russia.*

(c) Subsp. **brandzae** (Panţu & Solac.) Melderis, *Bot. Jour. Linn. Soc.* **76**: 384 (1978) (*Agropyron brandzae* Panţu & Solac.): Stems swollen at the base. Leaves inrolled, setaceous, rigid, pungent at the apex, glabrous. Spikes narrowed towards the apex, fairly lax, slightly pectinate, with distinct gaps between the spikelets. Spikelets with 5–7 florets. Glumes scabrid on the keel, otherwise glabrous. Lemma 6–6·5 mm, glabrous, with an awn 4–6 mm. ● *E. Bulgaria, E. Romania.*

(d) Subsp. **ponticum** (Nevski) Tzvelev, *Nov. Syst. Pl. Vasc.* (*Leningrad*) **9**: 58 (1972) (*Agropyron ponticum* Nevski): Stems swollen at the base, often pubescent below the nodes. Leaves convolute or conduplicate, rigid, more or less pungent at the apex, densely and shortly hairy above. Spikes narrowed towards the apex, fairly dense, with distinct gaps between the spikelets. Spikelets usually with 3 florets. Glumes usually glabrous. Lemma 7 mm, glabrous or more or less hairy, with an awn 2–3 mm. ● *Krym.*

(e) Subsp. **sclerophyllum** Novopokr. ex Tzvelev, *op. cit.* 58 (1972) (*A. pinifolium* Nevski): Stems swollen at the base. Leaves short,

thick, rigid, pungent at the apex, with scattered spinules above, glabrous beneath, the cauline flat, with convolute margins. Spikes narrowed towards the apex, dense, with distinct gaps between the spikelets. Spikelets with 3–5 florets. Glumes with tangled cilia on the keel. Lemma 6 mm, glabrous or more or less hairy, with an awn 2 mm. *Krym.*

Subsp. **cristatum**, from E. & C. Asia, with spikes without distinct gaps between the spikelets, has recently been reported from S. Ural, but it is probably introduced and perhaps only casual.

A. imbricatum Roemer & Schultes, *Syst. Veg.* **2**: 757 (1817) (*Triticum imbricatum* Bieb., non Lam.) is a variant of subsp. (a) with more or less hairy spikelets.

50. Eremopyrum (Ledeb.) Jaub. & Spach[1]

Annuals. Leaves flat; ligule short. Inflorescence a dense, compressed spike. Spikelets solitary at each node of the rhachis, arranged alternately and pectinately, sessile, with 3–6 florets, strongly compressed laterally; rhachilla disarticulating above the glumes and below the florets. Glumes equal, coriaceous, becoming very hard at maturity, with a prominent keel, connate at the base, unawned or shortly awned. Lemma coriaceous, 5-veined, keeled, acute or awned. Palea shorter than the lemma, membranous, 2-keeled, ciliate on the keels in the upper part.

Literature: N. L. Bor in K. H. Rechinger, *Flora Iranica* **70**: 185–191. Graz. 1970.

1 Glumes 1-veined, conspicuously canaliculate along each side of the keel; lower lemmas shortly hairy below, the others glabrous **1. triticeum**
1 Glumes 3- to 5-veined, not conspicuously canaliculate along each side of the keel; all lemmas hairy
2 Spike elliptic-ovate; glumes lanceolate, with 2–3 conspicuous marginal veins, strongly curved; lemma hispidulous **2. orientale**
2 Spike oblong; glumes linear-lanceolate, with obscure marginal veins, slightly curved; lemma villous **3. distans**

1. E. triticeum (Gaertner) Nevski, *Acta Univ. As. Med.* ser. 8b (Bot.), **17**: 52 (1934). Stems up to 30 cm. Leaves up to 4 cm × 1–2 mm, scabrid or shortly hairy on the upper surface. Spike 1–1·7 cm × 6–10 mm, very dense, elliptic-ovate or orbicular in outline, often breaking off whole at maturity; rhachis fairly tough. Spikelets 6–10 mm, divergent at a wide angle from the rhachis, usually with 2–3 florets. Glumes 4–6 mm, ½–⅔ as long as the spikelet, broadly lanceolate, prominently inflated at the base, 1-veined, conspicuously canaliculate along each side of the keel, glabrous, with a spinose-subulate apex. Lemma 5–6 mm, shortly awned, the lower shortly hairy below, glabrous above, the others glabrous. Palea rounded or emarginate at the apex. $2n=14$. *Steppes and other dry habitats. S.E. Europe, from E. Romania to W. Kazakhstan, and extending northwards to C. Russia; an occasional casual elsewhere.* Rm Rs (C, W, K, E).

2. E. orientale (L.) Jaub. & Spach, *Ill. Pl. Or.* **4**: 26 (1851). Stems up to 25 cm. Leaves 3–6 cm × 2–3 mm, scabridulous, sometimes puberulent on the upper surface. Spike up to 2·5 cm × 9–15 mm, dense, elliptic-ovate; rhachis fragile. Spikelets 10–15 mm, divergent from the rhachis, usually with 2–3 florets. Glumes 10–15 mm (including awns), lanceolate, asymmetrical, with 2–3 conspicuous marginal veins, strongly curved, hispid on the sides, with an awn 2–5 mm. Lemma as long as or slightly longer than the glumes, hispidulous, with an awn 4–5 mm. Keels of the palea prolonged into 2 tooth-like appendages. $2n=28$. *Steppes and semi-deserts. S.E. Europe, from E. Romania to W. Kazakhstan.* Rm Rs (C, W, K, E).

3. E. distans (C. Koch) Nevski, *Acta Univ. As. Med.* ser. 8b (Bot.), **17**: 52 (1934). Stems up to 25 cm. Leaves 6–8 cm × 2–3 mm, scabrid, sometimes sparsely hairy on the upper surface, glabrous beneath. Spike 2·5–5 cm × 8–15 mm, dense; rhachis very fragile. Spikelets 15–17 mm, more or less suberect, with 3–5(–6) florets. Glumes 13–17 mm (including awns), narrowly lanceolate, with 2–3 obscure marginal veins, slightly curved, villous on sides; awn 6–7 mm. Lemma as long as or slightly longer than the glumes, densely villous, with an awn 5–7 mm. Keels of the palea prolonged into 2 tooth-like appendages. $2n=14, 28$. *Stony, sandy or clayey slopes. S.E. Russia.* Rs (E). (*S.W. & S.C. Asia; Algeria.*)

51. Crithopsis Jaub. & Spach[1]

Annuals. Leaves flat; ligule very short. Inflorescence a short, dense spike; rhachis compressed, very fragile, densely hairy. Spikelets in pairs at each node of the rhachis, with 2 florets, the lower bisexual, the upper sterile, rudimentary; rhachilla flattened, disarticulating below the florets. Glumes equal, coriaceous, strap-shaped, longer than the florets, scabrid. Lemma of the lower floret flattened dorsally, 5-veined, scabrid and often somewhat verrucose below, scabrid and more or less hirsute above, awned. Palea nearly as long as the lemma, 2-keeled, ciliate on the keels.

1. C. delileana (Schultes) Roshev., *Zlaki* 319 (1937) (*Agropyron cretense* Coust. & Gand.). Stems up to 35 cm, usually fasciculate, geniculate at the base, smooth and glabrous. Leaves up to 6 cm × 3 mm, linear-acuminate, scabrid and sparsely long-hairy on the upper surface and margins, smooth and glabrous beneath. Spike 2·5–3·5 cm (excluding awns). Glumes 15–21 mm (including awns), narrow, flattened, 3-veined. Lemma *c.* 7 mm, oblong-lanceolate, with a flattened awn 4–7 mm. *Sandy calcareous soils. Kriti.* Cr. (*N. Africa, S.W. Asia.*)

52. Aegilops L.[2]

Annuals. Leaves usually flat. Inflorescence a spike. Spikelets solitary at the nodes of the rhachis, all hermaphrodite or the upper sterile and the lower vestigial. Florets 2–8, the upper usually male or vestigial. Glumes equal, coriaceous, truncate, often with 1 or more teeth or awns, usually rounded on the back. Lemma thin below, coriaceous and strongly veined towards the toothed or awned apex. Palea with 2 keels.

Closely related to and sometimes united with *Triticum*. In spite of the occurrence of hybrids and the close genetic connection between the two genera they are sufficiently distinct morphologically to make it convenient to maintain them both.

All species occur in dry, open habitats.

Literature: A. Eig, *Feddes Repert.* (*Beih.*) **55**: 1–228 (1929). N. L. Bor in C. C. Townsend & E. Guest, *Flora of Iraq* **9**: 173–194. Baghdad. 1968.

1 Spike (excluding awns) more than 10 times as long as wide, ± cylindrical
2 Spikelets ventricose; spike moniliform **2. ventricosa**
2 Spikelets not or scarcely ventricose; spike not moniliform
3 Glumes truncate, with a tooth or short awn **1. speltoides**
3 Glumes not truncate, those of the terminal spikelet long-awned
4 Awns longer than the spike **4. dischasians**
4 Awns shorter than the spike **3. cylindrica**
1 Spike (excluding awns) *c.* 5 times as long as wide or less, tapering markedly towards the apex

[1] By A. Melderis. [2] By T. G. Tutin and C. J. Humphries.

5 Glumes of terminal spikelet long-awned, those of the lateral spikelets dentate or shortly awned **5. comosa**
5 Glumes of all spikelets long-awned
6 Awns of lemma about as long as those of glumes; glumes with (3–)4–5 long awns **9. geniculata**
6 Awns of lemma distinctly shorter than those of glumes, or lemma merely toothed; lower glumes with 1–3 long awns
7 Glumes usually with 1 long awn; lower glume with all veins narrow and ± equal in width **6. uniaristata**
7 Glumes with 2–3 long awns; lower glume with some narrow and some wide veins
8 Upper 1–2 spikelets sterile; spike abruptly contracted above the fertile spikelets **10. neglecta**
8 All spikelets fertile; spike gradually tapering upwards
9 Awns of glumes of terminal spikelet distinctly longer than those of lateral spikelets; spikes with (3–)4–6 spikelets **7. triuncialis**
9 Awns of glumes of terminal and lateral spikelets equal; spikes with 2–3(–4) spikelets **8. lorentii**

1. A. speltoides Tausch, *Flora* (*Regensb.*) **20**: 108 (1837) (*A. bicornis* auct., non (Forskål) Jaub. & Spach, *Triticum speltoides* (Tausch) Godron). Stems numerous, up to 60 cm. Leaves sparsely hairy; upper sheaths glabrous, the lower sparsely hairy, not inflated. Spike 8–11 × 0·3 cm (excluding awns), cylindrical, without vestigial basal spikelets; rhachis not disarticulating at maturity. Spikelets usually 9–12. Glumes 6–7 mm, truncate, with a short tooth. Lemma narrowed upwards, truncate, with a tooth or short awn at apex, the lower 2 of the terminal spikelet with an awn up to 12 cm. $2n=14$. *S.E. part of Balkan peninsula.* Bu Gr Tu [Ga ?It].

2. A. ventricosa Tausch, *loc. cit.* (1837). Stems numerous, 20–40 cm. Leaves glabrous or villous; upper sheaths glabrous but ciliate, the lower patent-villous, not or scarcely inflated. Spike 4–6(–12) × up to 0·5 cm (excluding awns), moniliform, with 0–2 vestigial basal spikelets; rhachis disarticulating at maturity. Spikelets 5–10, usually strongly ventricose. Glumes of lateral spikelets truncate, with 2 teeth, the outer long and narrow, sometimes forming an awn, the inner short and wide, obtuse; glumes of terminal spikelet usually 3-dentate. Lemmas usually with 1 awn. $2n=28$. *W. Mediterranean region.* Bl Hs *It Sa [Ga].

3. A. cylindrica Host, *Gram. Austr.* **2**: 6 (1802) (*Triticum cylindricum* (Host) Cesati, Passer. & Gibelli). Stems numerous, up to 40 cm. Leaves glabrous or sparsely hairy; lower sheaths sparsely hairy, the upper glabrous, slightly inflated. Spike 6–11 cm (excluding awns), more than 10 times as long as wide, cylindrical, with 1–2 vestigial basal spikelets; rhachis usually disarticulating at maturity. Fertile spikelets 4–6, closely appressed to the rhachis and as long as the internodes. Glumes of terminal spikelet with an awn distinctly shorter than the rest of the spike. Lower glume of lateral spikelets usually with a short awn. $2n=28$. *S.E. & E.C. Europe, northwards to S. Czechoslovakia; casual and locally naturalized elsewhere in S. & C. Europe.* Bu Cz Gr Hu Ju Rm Rs (W, K, E) Tu [Ga *It].

4. A. dichasians (Zhuk.) Humphries, *Bot. Jour. Linn. Soc.* **78**: 236 (1979) *A. caudata* subsp. *dichasians* Zhuk., *A. caudata* L. pro parte, *Triticum caudatum* (L.) Raspail, *T. dichasians* (Zhuk.) Bowden, *T. markgrafii* W. Greuter). Like **3** but leaves hairy; spike up to 7 cm (excluding awns); rhachis not disarticulating at maturity; glumes of terminal spikelet with an awn somewhat longer than the rest of the spike; lower glume of lateral spikelets with 1–2 acute teeth, rarely with a short awn. $2n=14$. *S. part of Balkan peninsula and Aegean region.* Bu Cr Gr Ju.

5. A. comosa Sibth. & Sm., *Fl. Graec. Prodr.* **1**: 72 (1806) (*Triticum comosum* (Sibth. & Sm.) K. Richter). Stems usually several, up to 45 cm. Leaves glabrous or sparsely hairy; upper sheaths glabrous, the lower patent-villous, slightly inflated. Spike 2–7 × 0·2–0·4 cm (excluding awns), gradually narrowed upwards, with 1–2 vestigial basal spikelets; rhachis not disarticulating at maturity. Spikelets 3–4. Glumes of lateral spikelets 9–10 mm, scabrid or hispidulous, 2-dentate or sometimes with a short awn. Glumes of terminal spikelet with 1–3 long awns, the middle longer than the lateral. $2n=14$. *S. & E. Greece.* Gr.

(a) Subsp. **comosa**: Spikes very slender. Glumes not ventricose. *S. & S.E. Greece.*

(b) Subsp. **heldreichii** (Boiss.) Eig, *Feddes Repert.* (*Beih.*) **55**: 109 (1929) (*Triticum heldreichii* (Boiss.) K. Richter): Spikes relatively stout. Glumes distinctly ventricose. *N.E. Greece.*

6. A. uniaristata Vis., *Fl. Dalm.* **3**: 345 (1852) (*A. peregrina* (Hackel) Maire & Weiller, *Triticum uniaristatum* (Vis.) K. Richter, *T. variabile* Markgraf). Stems numerous, up to 40 cm. Leaves glabrous or shortly hairy; sheaths glabrous or the lower patent-hairy. Spike 1·5–3·5 cm (excluding awns), usually with 3 vestigial basal spikelets; rhachis not disarticulating at maturity. Spikelets 2–7, all fertile, subglobose to almost linear. Lower glume of lowest spikelets 6–8 × 4–6 mm, awned or toothed, the awns variable in number and length, often patent at maturity; veins all narrow and of equal width. $2n=28$. *E. Mediterranean region.* Al Cr Gr It Ju Tu.

7. A. triuncialis L., *Sp. Pl.* 1051 (1753) (*Triticum triunciale* (L.) Raspail). Glaucous; stems several, up to 45 cm. Leaves sparsely hairy or glabrous; upper sheaths glabrous, the lower often hairy, slightly inflated. Spike 3–6 × 0·5–0·9 cm (excluding awns), gradually narrowed upwards, with 1–2 vestigial basal spikelets; rhachis sometimes disarticulating at maturity. Spikelets (3–)4–6, all fertile. Glumes of the lowest spikelet 7–10 mm, appressed-hairy or scabrid, usually with 3 teeth 2–3 of which form awns; awns of the terminal spikelet 3–6 cm, distinctly longer than those of the lateral spikelets. $2n=28$. *S. Europe.* Al Bu Co Ga Gr Hs It Ju Lu Rs (K) Sa Si Tu.

A. umbellulata Zhuk., *Bull. Appl. Bot. Pl.-Breed.* (*Leningrad*) **18(1)**: 447 (1928), from S.W. Asia, has recently been reported from a roadside in E. Kriti. It has short spikes with 2 fertile spikelets, (2–)3(–4) basal rudimentary and 1–3 sterile upper spikelets; the lower glume of the fertile spikelets has 4–7 often divaricate awns.

8. A. lorentii Hochst., *Flora* (*Regensb.*) **28**: 25 (1845) (*A. biuncialis* Vis., *A. macrochaeta* R. J. Shuttlew. & Huet ex Duval-Jouve, *Triticum ovatum* var. *macrochaetum* (R. J. Shuttlew. & Huet ex Duval-Jouve) Hayek). Stems numerous, 5–10(–30) cm. Leaves ciliate; sheaths sparsely hairy below, somewhat inflated above. Spike 2–3 cm (excluding awns), *c.* 5 times as long as wide, tapering markedly towards the apex, with 1(–2) vestigial basal spikelets; rhachis not disarticulating at maturity. Fertile spikelets 2–3(–4). Lower glumes of lower spikelet 8–9 × 5–6 mm; upper glume with (2–)3 awns, distinctly longer than the 1 or more awns of the lemma; awns of glumes of terminal spikelet as long as those of the lateral. $2n=28$. *S. Europe.* Bu Cr Ga Gr Hs It Ju Rm Rs (K).

9. A. geniculata Roth, *Bot. Abh.* 45 (1787) (*A. ovata* L. pro parte, *Triticum ovatum* (L.) Gren. & Godron). Stems numerous, up to 30(–40) cm. Leaves hairy or glabrous; sheaths glabrous, somewhat inflated. Spike 1–2 cm (excluding awns), about twice as long as wide, with 1(–2) vestigial basal spikelets; rhachis not

disarticulating at maturity. Fertile spikelets (1–)2(–3), somewhat ventricose. Lower glume of lowest spikelet 7–8 × 5–6 mm, with (3–)4–5 long awns; awns of the lemma about as long as those of the glumes. Terminal spikelet sterile. $2n=28$. *S. Europe.* Al Bl Bu Co Cr Ga Gr Hs It Ju Lu Rm Rs (K) Sa Si ?Tu.

10. A. neglecta Req. ex Bertol., *Fl. Ital.* **1**: 787 (1834) (*A. triaristata* Willd., nom illegit., *A. ovata* L. pro parte, *Triticum ovatum* var. *triaristatum* Ascherson & Graebner). Stems several, up to 45 cm. Leaves hairy; sheaths glabrous or the lower sparsely villous, somewhat inflated. Spike 1–3 × 0·8–1·3 cm (excluding awns), abruptly contracted above the second spikelet, with 2(–3) vestigial basal spikelets; rhachis not disarticulating at maturity. Spikelets 3–4, the lower 2 fertile, crowded, the upper 1–2 sterile, remote. Lower glume of fertile spikelets 8–11 × 5–7 mm, with 2–3 long awns; awns of lemma distinctly shorter than those of glumes. $2n=28$, 42. *S. Europe.* Al Bu Co Cr Ga Gr Hs It Ju Lu Rm Rs (K) Sa Si Tu.

53. Triticum L.[1]

Annuals. Leaves flat. Inflorescence a distichous spike. Spikelets solitary at each node of the rhachis, each with 2–6(–9) florets, the upper 1 or 2 of which are usually sterile. Glumes equal, chartaceous (rarely membranous), truncate, with 1–2 teeth, or awned. Lemma coriaceous, ventricose, scabrid. Palea membranous, with 2 keels.

Literature: F. Körnicke, *Die Arten und Varietäten des Getreides. Handbuch des Getreidbaues* **1**. Bonn. 1885. J. Percival, *The Wheat Plant.* London. 1921. C. A. Flaksberger, *Kulturnaya Flora SSSR.* (1) *Khlebnye Zlaki. Pšenica.* Moskva & Leningrad. 1935. R. F. Peterson, *Wheat. Botany, Cultivation and Utilization.* London & New York. 1965. N. L. Bor in C. C. Townsend & E. Guest, *Flora of Iraq* **9**: 194–208. Baghdad. 1968.

Triticum consists of a polyploid series in which there are diploid, tetraploid and hexaploid representatives, with chromosome numbers of 14, 28 and 42. Genome analysis of the karyotypes has shown that the diploids have one *Triticum* genome, the tetraploids have this genome and another derived from *Aegilops speltoides* Tausch, and the hexaploids have both these and a third derived from *Aegilops squarrosa* L.

The cultivation of **2**, **3**, **5**, **6** and **7** is declining almost everywhere, giving way to **4** and **8**.

1 Glumes 25–35(–40) mm, membranous, often concealing the lemma **6. polonicum**
1 Glumes 15 mm or less, chartaceous, not concealing the lemma
2 Rhachis fragile, disarticulating at maturity
3 Spikelets with 2 florets, one fertile
4 Rhachis densely hairy, disarticulating readily at maturity **1. baeoticum**
4 Rhachis sparsely ciliate, disarticulating only with pressure at maturity **2. monococcum**
3 Spikelets usually with 3–5 florets, usually 2 fertile
5 Rhachis disarticulating above the spikelet **3. dicoccon**
5 Rhachis disarticulating below the spikelet **7. spelta**
2 Rhachis tough, not disarticulating at maturity
6 Glumes strongly keeled throughout
7 Glumes nearly as long as lowest floret; endosperm flinty; spike slender, laterally compressed **4. durum**
7 Glumes *c.* ⅔ as long as lowest floret; endosperm mealy; spike stout, nearly square in section **5. turgidum**
6 Glumes keeled in the upper half only
8 Spikes lax, more than 3 times as long as wide; upper internodes of the rhachis 4–8 mm **8. aestivum**
8 Spikes dense, not more than 3 times as long as wide; upper internodes of the rhachis (0·5–)1–3 mm **9. compactum**

[1] By C. J. Humphries.

1. T. baeoticum Boiss., *Diagn. Pl. Or. Nov.* **2(13)**: 69 (1853) (*T. monococcum* subsp. *baeoticum* (Boiss.) Hayek). Stems 60–100 cm, solid or thick-walled, pubescent at the nodes. Leaves 2–4 mm wide, scabrid, ciliate and hairy on the veins. Spike 4–9 cm (excluding awns), slender, lax, laterally compressed. Rhachis densely hairy at the nodes and margin, brittle, disarticulating below the spikelet at maturity. Spikelets with 2 florets, one fertile. Glumes (4–)6–9(–10) mm, coriaceous, with two dentate keels, one of which is prominent. Fertile lemma with awn up to 10 cm. *Grassland. Balkan peninsula and Krym.* Al Bu Gr Ju Rs (K) Tu.

The plants from Krym, with two fertile florets in a spikelet and long awns on each fertile lemma, have been regarded as conspecific with **T. thaoudar** Reuter ex Hausskn., *Mitt. Thür. Bot. Ver.* nov. ser., **13–14**: 66 (1899), from S.E. Asia, which is doubtfully distinct from **1.**

2. T. monococcum L., *Sp. Pl.* 86 (1753). Like **1** but leaves up to 10 mm wide and glabrous, the rhachis sparsely ciliate at the nodes and less brittle and the spike shorter and more compact. $2n=14$. *Cultivated as a cereal (einkorn) on a small scale in the Balkan peninsula and Romania; a rare weed elsewhere.*

3. T. dicoccon Schrank, *Baier. Fl.* **1**: 389 (1789) (*T. volgense* (Flaksberger) Nevski). Stems 80–130 cm, solid or thick-walled and hollow, glabrous to sparsely pubescent at the nodes. Leaves up to 20 mm wide, scabrid. Spike (2–)3–7(–11) cm (excluding awns), lax, laterally compressed. Rhachis glabrous or hairy at the nodes and margin, brittle, disarticulating above the spikelet at maturity. Spikelets with 3(–4) florets. Glumes (6–)7–10(–13) mm, coriaceous, persistent, with a single prominent, veined keel. Lemma usually with a scabrid awn up to 15 cm. $2n=28$. *Cultivated as a cereal (emmer) locally in S.E. Europe and E.C. Russia.*

4. T. durum Desf., *Fl. Atl.* **1**: 114 (1798). Stems 70–140 cm, solid or thick-walled and hollow, glabrous at the nodes. Leaves 7–16 mm wide, puberulent. Spike 4–11 cm (excluding awns), dense, laterally compressed. Rhachis hairy at the nodes and margin, tough. Spikelets with 5(–7) florets. Glumes (8–)10–12 mm, coriaceous, with a prominent, veined, crested keel and a secondary weak, dentate keel, sometimes pubescent towards the apex. Fertile lemma with a stout, scabrid awn up to 20 cm. Caryopsis extremely hard; endosperm flinty. $2n=28$. *Cultivated as a cereal (durum wheat) widely in the Mediterranean region, and rarely elsewhere in S. & S.C. Europe, mainly for use in macaroni and similar products.*

5. T. turgidum L., *Sp. Pl.* 86 (1753). Stems 120–170 cm, thick-walled, more or less solid. Leaves up to 18 mm wide, softly pubescent, at least when young. Spikes 7–12 cm, cylindrical, dense, sometimes branched below. Rhachis hairy at the nodes and margin, tough. Spikelets with 5–7 florets. Glumes 9–10 mm, broadly ovate, coriaceous, with prominent, 1-veined keel, terminating in an acute, curved, apical tooth. Awn of fertile lemma 8–12(–16) cm. Endosperm mealy. $2n=28$. *Cultivated as a cereal (rivet wheat) locally throughout a large part of Europe, but mainly in the south.*

6. T. polonicum L., *Sp. Pl.* ed. 2, 127 (1762). Stems 100–160 cm, thick-walled, filled with pith, glabrous or rarely pubescent at

the nodes. Leaves up to 20 mm wide, glabrous to sparsely pubescent. Spike (5–)10–16 cm (excluding awns), dense, more or less square in cross section or compressed. Rhachis subglabrous to sparsely hairy at the nodes and margin, tough. Spikelets with 4–5 florets. Glumes 25–35(–40) mm, lanceolate, membranous, with a prominent, veined keel, hairy or subglabrous. Fertile lemma awnless, or with a stout awn up to 15 cm. Endosperm flinty. $2n=28$. *Cultivated in N. Spain and Islas Baleares; occasional elsewhere as a weed or minor crop.*

The specific epithet derives from a confusion between the 'Galicia' of Spain and the 'Galicia' of E.C. Europe.

7. T. spelta L., *Sp. Pl.* 86 (1753). Stems 80–120 cm, thin-walled, hollow, glabrous at the nodes. Leaves 13–20 mm wide, glabrous to sparsely pubescent. Spike 10–15 cm (excluding awns), slender, lax, laterally compressed, with 1–4 vestigial basal spikelets. Rhachis glabrous to sparsely hairy at the nodes and margin, brittle, disarticulating readily below the spikelet at maturity. Spikelets with (2–)3–5 florets. Glumes (5–)7–10 mm, truncate, with a prominent, veined, dentate keel and a second, smaller dentate crest. Fertile lemma with a stout divergent awn up to 10 cm. $2n=42$. *Cultivated as a cereal (spelt wheat) in C. & N.W. Europe, mainly in hill-country.*

8. T. aestivum L., *Sp. Pl.* 85 (1753) (*T. sativum* Lam.). Stems 40–150 cm, thin-walled and hollow, rarely partially filled with pith, glabrous at the nodes. Leaves 6–16 mm wide, scabrid, pubescent when young. Spike 4–18 cm (excluding awns), lax to dense, more or less 4-angled in section. Rhachis glabrous, tough, the upper internodes 4–8 mm. Spikelets with 3–6(–9) florets. Glumes *c.* 10 mm, truncate, with a single crested keel prominent at the apex only, indistinct below, sometimes pubescent towards the apex. Fertile lemma awnless, or with an awn up to 16 cm. Endosperm mealy to flinty. $2n=42$. *Cultivated as a cereal (bread wheat) throughout Europe except the extreme north.*

9. T. compactum Host, *Gram. Austr.* **4**: 4 (1809). Stems up to 140 cm, thin-walled, hollow, glabrous at the nodes. Leaves 7–15 mm wide, scabrid to sometimes sparsely pubescent. Spike 4–5 (–6) cm, strongly compressed, with more or less patent spikelets, terete. Rhachis hairy at the nodes and margin, tough, the upper internodes (0·5–)1–3 mm. Spikelets with 2–5(–6) florets. Glumes 8–9 mm, truncate, with a crested keel, prominent in the upper half, rounded below. Fertile lemma awnless, or with awns up to 9 cm. Endosperm mealy. *Cultivated as a cereal (club wheat) in parts of S. & S.C. Europe, but mainly as a minor constituent of crops consisting mainly of* **4** *or* **8.**

54. Dasypyrum (Cosson & Durieu) T. Durand[1] (*Haynaldia* Schur)

Annual or perennial. Leaves flat. Inflorescence a compressed, dense, distichous spike. Rhachis bearded at the margin, disarticulating readily at the nodes below the spikelet at maturity. Spikelets of 2–4 florets, arranged singly at the nodes of the rhachis; upper floret sterile, long-pedicellate. Glumes equal, truncate, with membranous margin and with two prominent, coriaceous, ciliate keels, abruptly tapered into a long, scabrid awn. Lemma broadly ovate, strongly keeled, long-awned when fertile, or acuminate; awn scabrid and sometimes ciliate towards the base of the dorsal edge. Palea narrowly lanceolate, membranous.

Annual, without rhizome — **1. villosum**
Perennial, with creeping rhizome — **2. hordeaceum**

[1] By C. J. Humphries.

1. D. villosum (L.) P. Candargy, *Arch. Biol. Vég.* (*Athènes*) **1**: 35, 62 (1901) (*Secale villosum* L., *Triticum villosum* (L.) Bieb., *Haynaldia villosa* (L.) Schur). Annual. Stems 20–100 cm, glabrous. Leaves 1–5 mm wide, smooth, scabrid or hirsute on the veins and margin; ligule membranous, truncate. Spike 4–12 × 0·6–2 cm (including awns). Spikelets 0·7–2·2 cm (excluding awns). Glumes 3·5–7·5 mm, attenuate towards the base; awns 1·4–3·5(–5·4) cm. Lemma 6–14 mm; awn 0·7–6 cm. Palea up to 14 mm. Anthers 5–7 mm. $2n=14$. *Dry grassland; calcicole. Mediterranean region and S.E. Europe.* Al Bl Bu Co Cr *Ga Gr It Ju Rm Rs (K) Sa Si Tu.

2. D. hordeaceum (Cosson & Durieu) P. Candargy, *loc. cit.* (1901) (*Triticum hordeaceum* Cosson & Durieu). Like **1** but perennial with shortly creeping rhizome; awns of the glumes and lemmas not exceeding 1·5 cm. *Mountain rocks. S. Greece (Taïyetos).* Gr. (*N. Africa.*)

55. Secale L.[2]

Annuals, biennials or perennials. Leaves flat or involute; ligule short, truncate. Inflorescence usually a simple, laterally compressed, dense, distichous spike. Spikelets solitary at each node of the rhachis, sessile, with 2, rarely 3, hermaphrodite florets. Glumes linear-subulate, 1-veined, keeled, scabrid. Lemma lanceolate, 5-veined, keeled, with rigid, pectinate cilia on the keel, with a long, straight, scabrid awn. Palea hyaline, membranous, 2-keeled.

Literature: R. I. Roshevitz, *Acta Inst. Bot. Acad. Sci. URSS* (*Ser.* 1) **6**: 105–163 (1947).

1 Glumes with awn at least twice as long as remainder of glume — **1. sylvestre**
1 Glumes with awn short or absent
 2 Rhachis fragile, disarticulating below the spikelets at maturity; spike 4–11 cm; perennial — **2. montanum**
 2 Rhachis tough, not disarticulating at maturity; spike 5–15 cm; annual — **3. cereale**

1. S. sylvestre Host, *Gram. Austr.* **4**: 7 (1809). Annual. Stems 20–50 cm, usually pubescent below the spike. Leaves 2–3 mm wide, flat or involute, glabrous or sparsely and shortly hairy. Spike usually 4–8 cm (excluding awns), usually wider in the upper part. Rhachis very fragile, densely bearded at the nodes and margin. Glumes 8–12 mm, scabrid or shortly pubescent on the keel and in the upper part towards the apex, tapering into a scabrid awn 1·5–3(–5) cm. Lemma *c.* 10 mm; awn 4–8 cm. *Sandy soils. S.E. & E.C. Europe, extending northwards to c.* 53° *N. in E.C. Russia.* Bu Hu Ju Rm Rs (C, W, K, E).

2. S. montanum Guss., *Fl. Sic. Prodr.* **1**: 145 (1827). Caespitose, greyish-green perennial. Stems up to 100 cm, usually glabrous below the spike. Leaves usually 2–8 mm wide, flat or involute, glabrous or scabridulous. Spike 4–8(–11) cm (excluding awns), linear; rhachis very fragile, bearded at the nodes and margin. Glumes 8–10 mm, densely scabrid on the keel, acuminate or shortly awned. Lemma 8–13 mm; awn 0·2–2·5 cm. *Dry, stony or rocky mountain-sides. S. Europe.* Al Bu Gr Hs It Ju Rm Si.

3. S. cereale L., *Sp. Pl.* 84 (1753). Caespitose annual. Stems up to 150 cm, glabrous or pubescent below the spike. Leaves 5–10 mm wide, flat, usually scabridulous on the upper surface. Spike 5–15 cm (excluding awns), linear; rhachis tough, glabrous or sparsely bearded at the nodes and margin. Glumes 6–15 mm, densely scabrid on the keel, awnless or shortly awned. Lemma

[2] By S. A. Heathcote.

7–15 mm; awn usually 2–5·5 cm. *Cultivated as a cereal (rye) throughout most of Europe, but principally in the north-east.*

56. Psathyrostachys Nevski[1]

Perennial with short, creeping rhizomes. Leaves flat, with convolute margins. Inflorescence a compressed, oblong spike, disarticulating readily between the groups of spikelets at maturity. Spikelets 2–3 together, arranged distichously on the rhachis. Florets 2–3, rarely 1. Glumes subulate, equal, densely hairy to scabrid, obscurely 1-veined. Lemma 5- to 7-veined, elliptical, acute, mucronate.

1. P. juncea (Fischer) Nevski in Komarov, *Fl. URSS* **2**: 714 (1934). Stems (20–)30–70(–80) cm, erect, decumbent at base. Leaves 2–10 cm × 1–4 mm, linear-acuminate; old sheaths forming dense, fibrous tufts at the base of the plant. Spike (3–)5–11 cm; rhachis-segments 3·5 mm, ciliate at the margins. Spikelets 7–8 mm. Glumes 6–7 mm. Lemma 7–8 mm, tapering into an awn up to 2 mm long. $2n=14$. *Dry places. E.C. & S.E. Russia, W. Kazakhstan.* Rs (C, E). (*S.W. & C. Asia.*)

57. Hordeum L.[1]

Annuals or perennials. Leaves usually flat. Inflorescence a compressed, linear to oblong spike. Spikelets 3 at each node, dispersed together at maturity, the triplets arranged in 2 longitudinal rows, the fertile florets in 2, 4 or 6 longitudinal rows, each triplet with a central hermaphrodite spikelet and 2 lateral hermaphrodite, male or sterile spikelets. Florets 1, rarely 2. Glumes linear-subulate to lanceolate and awned, free to the base. Lemma 5-veined, ovate. Palea narrowly ovate, keeled. Rhachilla usually prolonged in central spikelets.

Literature: S. A. Nevski, *Acta Inst. Bot. Acad. Sci. URSS* (*Ser.* 1) **5**: 64–256 (1941). G. Covas, *Madroño* **10**: 1–21 (1949). N. L. Bor in C. C. Townsend & E. Guest, *Flora of Iraq* **9**: 244–257. Baghdad. 1968.

Most of the annual species described below occur as casuals outside their native or established range. Several other species from America and Asia have also been recorded as casuals in Europe.

1 Stem swollen at the base **7. bulbosum**
1 Stem not swollen at the base
2 Annual
3 Rhachis tough, not disarticulating at maturity
4 Spikes with 4–6 longitudinal rows of fertile spikelets **3. vulgare**
4 Spikes with 2 rows of fertile spikelets **2. distichon**
3 Rhachis fragile, disarticulating at maturity
5 Awn of fertile lemma 4–14 cm, stout **1. spontaneum**
5 Awn of fertile lemma not more than 3 cm, slender
6 Glumes of central spikelet long-ciliate **4. murinum**
6 Glumes of central spikelet scabrid or smooth, not ciliate
7 Glumes of lateral spikelets dissimilar, the outer subulate or awn-like, the inner lanceolate or winged below; lower leaf-sheaths glabrous or with hairs not more than 0·25 mm **5. marinum**
7 Glumes of lateral spikelets similar, subulate or rarely linear-lanceolate; lower leaf-sheaths with hairs at least 0·5 mm **6. hystrix**
2 Perennial
8 Glumes 3–8 cm, patent at maturity; lemma of lateral spikelets awn-like **11. jubatum**
8 Glumes 0·4–2 cm, erect or slightly patent at maturity; lemma of lateral spikelets linear-lanceolate
9 Lemma glabrous
10 Spike 5–15 cm; spikelets 8–15 mm (excluding awns) **7. bulbosum**
10 Spike 2–5 cm; spikelets 4–7 mm (excluding awns) **10. secalinum**
9 Lemma densely scabrid-puberulent
11 Awn of central lemma 0·6–1·5 (–2·5) cm **8. bogdanii**
11 Awn of central lemma 0·1–0·5 cm **9. brevisubulatum**

Sect. HORDEUM. Annuals. Spikes linear to broadly oblong. Lateral spikelets vestigial, male, or hermaphrodite and fertile. Glumes narrowly linear-lanceolate, erect to widely divergent. Fertile lemma with a long stout awn.

1. H. spontaneum C. Koch, *Linnaea* **21**: 430 (1848). Stems up to 70 cm, erect. Leaves 5–16 cm × 4–8 mm, glabrous or scabrid and sometimes sparsely hairy. Spike 4–9 cm (excluding awns), laterally compressed. Rhachis densely hairy at the margin, disarticulating readily at maturity. Lateral spikelets sterile, male or vestigial. Awn of lemma of central floret up to 14 mm. *Dry places. Kriti.* Cr. (*S.W. & S.C. Asia, N. Africa.*)

2. H. distichon L., *Sp. Pl.* 85 (1753). Stems up to 90 cm, erect. Leaves 5–24(–30) cm × 4–15 mm, glabrous to scabrid. Spike 6–12 cm (excluding awns), compressed, with 2 rows of fertile spikelets. Rhachis tough, hairy at the margin. Awn of lemma of central spikelet up to 15 cm; lemma of lateral spikelets truncate, sometimes mucronate, slender. $2n=14$. *Cultivated as a cereal (two-rowed barley) in most of Europe.*

Cultivars with short, pyramidal spikes 4–6 cm and divaricate awns are called **H. zeocriton** L., *Sp. Pl.* 85 (1753).

3. H. vulgare L., *Sp. Pl.* 84 (1753) (*H. polystichon* Haller fil.). Like **2** but stems up to 130 cm; spike 4–12 cm, oblong, square or hexagonal in cross section, with 4 or 6 rows of fertile spikelets; all lemmas with stout awns up to 18 cm. $2n=14$. *Cultivated as a cereal (six-rowed barley) in most of Europe.*

Sect. TRICHOSTACHYS Dumort. Annuals. Spikes linear to oblong. Lateral spikelets vestigial or male. Outer glume of lateral spikelets setaceous or subulate, the inner narrowly lanceolate or winged. Glumes of central spikelet narrowly lanceolate to setaceous.

4. H. murinum L., *Sp. Pl.* 85 (1753). Stems 5–50 cm, erect or ascending. Leaves 2–8 mm wide, glabrous or sparsely pubescent; sheaths somewhat inflated above. Spike 2–7(–12) cm, oblong, strongly compressed. Rhachis sparsely ciliate at the nodes and margin, disarticulating readily at maturity. Glumes of central spikelet and inner glume of lateral spikelets lanceolate, ciliate; outer glumes of lateral spikelets subulate. *Disturbed ground and dry grassland. Much of Europe, but absent from most of the U.S.S.R. and not native in Fennoscandia.* Al Au Az Be Bl Br Bu Co Cr Cz Ga Ge Gr He Ho Hs Hu It Ju Lu Po Rm Rs (W, K, E) Sz Si Tu [Da Hb No Su].

1 Anthers of central spikelet 0·2–0·5 mm; prolongation of rhachilla of lateral spikelets stout, orange-brown **(b) subsp. glaucum**
1 Anthers of central spikelet 0·7–1·4 mm; prolongation of rhachilla of lateral spikelets slender, green
2 Central spikelet sessile or with a pedicel not more than 0·6 mm; lateral spikelets not longer than the central **(a) subsp. murinum**
2 Central spikelet with pedicel (0·7–)0·9–1·8 mm; lateral spikelets longer than the central **(c) subsp. leporinum**

(a) Subsp. **murinum**: Leaves not glaucous. Palea of central spikelet 1–1·4 times as long as palea of lateral spikelets. $2n=28$. *Almost throughout the range of the species.*

[1] By C. J. Humphries.

(b) Subsp. **glaucum** (Steudel) Tzvelev, *Nov. Syst. Pl. Vasc.* (*Leningrad*) **8**: 67 (1971) (*H. glaucum* Steudel): Leaves glaucous. Palea of central spikelet 0·7–0·8 times as long as palea of lateral spikelets. $2n=14$. *Mediterranean region and S.W. Europe.*

(c) Subsp. **leporinum** (Link) Arcangeli, *Comp. Fl. Ital.* 805 (1882) (*H. leporinum* Link): Leaves green. Palea of central spikelet 0·7–0·9 times as long as palea of lateral spikelets. $2n=28$. *S. Europe, extending northwards to N.W. France and C. Ukraine.*

Covas considers subsp. (c) to be an allotetraploid arising from hybridization between subspp. (a) and (b).

5. H. marinum Hudson, *Fl. Angl.* ed. 2, **1**: 57 (1778) (*H. maritimum* Stokes). Stems 5–60 cm, erect or geniculately ascending. Leaves 1·5–4 mm wide, puberulent; basal leaf-sheaths glabrous or pubescent, with dense short hairs 0·1–0·25 mm. Spike (1–)1·5–5 cm (excluding awns), oblong, tapered towards the apex. Glumes subulate, scabridulous; inner glume of lateral spikelets expanded into a wing 0·6–1·4 mm wide at the base. $2n=14, 28$. *Maritime sands and disturbed ground. S. Europe, and coasts of W. Europe, northwards to N.E. England.* Al Be Bl Br Bu Co Cr †Da Ga Ge Gr Hs Ho It Ju Lu Rm Sa Si.

6. H. hystrix Roth, *Catalecta Bot.* **1**: 23 (1797) (*H. maritimum* subsp. *gussonianum* (Parl.) Ascherson & Graebner). Like **5** but basal leaf-sheaths with hairs 0·5–1(–1·2) mm; inner glumes of lateral spikelets 0·2–0·6(–0·7) mm wide, subulate or slightly swollen, but not winged. $2n=14, 28$. *Dry, grassy places and disturbed ground. S., S.E. & E.C. Europe.* Al Au Bl Bu Co Cr Cz Gr Hs Hu It Ju Lu Rm Rs (K, E) Sa Si Tu.

Sect. BULBOHORDEUM Nevski. Perennials; stems swollen at the base. Spikes linear. Lateral spikelets male. Outer glume of lateral spikelets setaceous, the inner linear-lanceolate. Glumes of central spikelet linear-lanceolate.

7. H. bulbosum L., *Cent. Pl.* **2**: 8 (1756). Stems up to 100 cm, erect. Leaves 1–7 mm wide, scabridulous, sometimes covered with long, white hairs on the upper surface. Spike 5–15 cm, dense, compressed. Rhachis disarticulating readily at maturity. $2n=14, 28$. *Dry grassland. Mediterranean region and S.E. Europe.* Al Bu Cr Gr Hs It Ju Rm Rs (K) Sa Si Tu [Ga Lu].

Diploid plants occur mainly in the W. & C. Mediterranean region; they are more delicate than the tetraploid plants, with more numerous tillers and narrower leaves.

Sect. STENOSTACHYS Nevski. Densely caespitose perennials. Spikes dense, linear, compressed, slender. Lateral spikelets sterile or male. Glumes of lateral spikelets more or less erect at maturity, subulate, scabridulous.

8. H. bogdanii Wilensky, *Izv. Saratovsk. Opyt. Stan.* **12**: 13 (1918). Stems (40–)50–100 cm, erect; nodes pubescent. Leaves 2–10 mm wide, scabrid; walls of epidermal cells straight; sheaths smooth, sometimes hairy below. Spike 3–10 cm. Rhachis slightly scabrid on the angles, tough below but disarticulating readily above at maturity. Pedicels of lateral spikelets 1–1·5 mm; central spikelet sessile. Lemma of central spikelet 5–8 mm, lanceolate, scabrid-appressed-puberulent; awn 0·6–1·5(–2·5) cm; anthers 1·25–1·5 mm. *Wet meadows. S.E. Russia, W. Kazakhstan.* Rs (E). (*C. Asia.*)

9. H. brevisubulatum (Trin.) Link, *Linnaea* **17**: 391 (1843). Stems 20–50 cm, slender, erect or geniculately ascending; nodes pubescent. Leaves 1–4 mm wide, scabridulous; walls of epidermal cells straight. Spike 4·5–7 cm. Rhachis ciliate on the angles, tough below, disarticulating at maturity above. Pedicels of lateral spikelets up to 1 mm; central spikelet sessile. Lemma of central spikelet 4–5·5 mm, lanceolate, sparsely scabrid-puberulent; awn 0·1–0·5 cm; anthers 2·5–4 mm. *Saline meadows. S.E. Russia, W. Kazakhstan.* Rs (C, E). (*Siberia and C. Asia.*)

10. H. secalinum Schreber, *Spicil. Fl. Lips.* 148 (1771) (*H. pratense* Hudson). Stems 15–70 cm, slender, erect; nodes glabrous. Leaves 0·2–0·5 cm wide, glabrous below, sparsely pubescent above; walls of epidermal cells sinuate; sheaths hairy below. Spike 2–5(–6) cm. Rhachis ciliate, disarticulating at maturity. Pedicels of lateral spikelets up to 1·5 mm; central spikelet sessile. Lemma of central spikelet 3–6 mm, lanceolate, glabrous, shortly awned. $2n=14, 28$. *Meadows. From S. Sweden southwards to C. Spain, Sicilia and Bulgaria, but absent from a large part of C. Europe.* Be Br Bu Co Cz Da Ga Ge Hb He Hs Ho ?Hu Ju Lu It Po Rm Si Su.

Occasionally produces male-sterile hybrids with *Elymus repens* (L.) Gould (× *Agrohordeum langei* (K. Richter) Camus).

Sect. CRITESION (Rafin.) Nevski. Caespitose perennials. Spikes narrowly linear, dense, slender. Lateral spikelets sterile. Glumes equal, long, slender, scabridulous, divaricate.

11. H. jubatum L., *Sp. Pl.* 85 (1753) (*Critesion jubatum* (L.) Nevski). Stems 20–60 cm, erect or geniculately ascending. Leaves 2–4 mm wide, scabridulous above, pubescent below; sheaths more or less patent-hairy. Spike 3–8(–11) cm. Rhachis ciliate, disarticulating readily at maturity. Pedicels of lateral spikelets up to 3 mm; florets linear-subulate, awned, sterile; central spikelet with pedicel up to 1 mm. Glumes 3–8 cm, patent at maturity. Lemma of central spikelet smooth, lanceolate, with a slender awn 2–10 cm. $2n=28$. *Naturalized in N. & W.C. Europe.* [Be Da Fe Ge He Ho No Su.] (*N. America, E. Asia.*)

58. Hordelymus (Jessen) C. O. Harz[1]

Like *Hordeum* but the rhachis always tough; lateral spikelets hermaphrodite; central spikelet usually hermaphrodite; glumes connate at the base.

1. H. europaeus (L.) C. O. Harz, *Samenk.* 114 (1885) (*Cuviera europaea* (L.) Koeler, *Elymus europaeus* L., *Hordeum europaeum* (L.) All.). Caespitose perennial with a short, creeping rhizome. Stems 40–110 cm, scabridulous below the spike and pubescent at the nodes. Leaves 4–14 mm wide, green, usually scabridulous, at least towards the apex; sheaths hairy, sometimes glabrous above. Spike 4–12 cm, erect, dense. Glumes linear-lanceolate, stiff, glabrous to scabridulous, awned; lemma 8–10 mm, lanceolate, scabridulous to sparsely pubescent towards the apex, with an awn 1·5–2·5 cm. $2n=28$. *Woods and shady places. From N. Ireland and S.C. Sweden southwards to C. Spain, Sicilia and Krym.* Au Be Br Bu Co Cz Da Ga Ge Hb He Hs Hu It Ju Po Rm Rs (B, C, W, K) Si Su.

59. Taeniatherum Nevski[1]

Annual. Leaves flat or involute. Inflorescence a dense, distichous spike, disarticulating at the nodes below the spikelets at maturity. Spikelets arranged in pairs at the nodes of the rhachis; florets 2, the lower hermaphrodite, the upper rudimentary and sterile. Glumes connate at the base, narrowly subulate, rigid. Lemma lanceolate, with a flattened callus and a long, flexuous, scabrid awn.

[1] By C. J. Humphries.

1. T. caput-medusae (L.) Nevski, *Acta Univ. As. Med.* ser. 8b, (Bot.) **17**: 38 (1934) (*Elymus caput-medusae* L., *Hordeum asperum* (Simonkai) Degen, *H. crinitum* (Schreber) Desf., *Taeniatherum asperum* (Simonkai) Nevski, *T. crinitum* (Schreber) Nevski). Stems 5–55 cm, glabrous. Leaves 0·2–0·6 mm wide, glabrous to scabrid and sparsely hairy on the veins and margin. Spike 5–15 (–18) cm (including awns). Glumes 1·5–6 cm, erect or ascending from near the base. Lemma 4–12 mm; awn 5–12 cm. $2n=14$. *Dry fields and rocky places. S. Europe.* Al Bu Ga Gr Hs It Ju Lu Rm Rs (W, K) Sa Si Tu.

T. crinitum (Schreber) Nevski in Komarov, *Fl. URSS* **2**: 719 (1934), is a variant from Krym with the spike almost as long as the stem and with erect glumes. It does not seem to merit specific rank.

Tribe **Aveneae** Dumort.

Leaves linear; silica-bodies oblong or elliptical; 2-celled micro-hairs absent; ligule membranous. Inflorescence usually a panicle. Spikelets hermaphrodite, somewhat compressed laterally, with 1–many florets. Rhachilla disarticulating above or rarely below the glumes and between the florets. Glumes often longer than the florets, often shiny and with a silvery-hyaline margin. Lemma membranous or cartilaginous, often with a dorsal, often geniculate awn. Palea 2-keeled, rarely very short. Lodicules 2(–3), 2-dentate or entire. Stamens 3. Ovary hairy all over or glabrous; styles 2. Grain with linear or ovate hilum; starch-grains compound. Chromosomes large; basic number 7.

60. Avena L.[1]

Annuals. Leaves flat (rarely convolute); ligule membranous. Inflorescence a panicle. Spikelets large, with (1–)2–5(–7) florets. Glumes lanceolate, acuminate, usually subequal, thinly chartaceous, with a shiny, scarious margin, and several veins. Lemma usually coriaceous, 2-dentate to 2-aristulate (rarely subentire), usually with a dorsal awn; awn usually with a thick, twisted lower part (*column*) and a thinner, straight upper part (*seta*), usually geniculate. Palea tough, shorter than the lemma, with hyaline margin and 2 ciliate keels.

Measurements of the lemma exclude the aristulae, if present.

Hybrids sometimes occur in and around cultivated fields; these are not allowed for in the key.

Literature: A. I. Malzev, *Bull. Appl. Bot. Pl.-Breed.* (*Leningrad*), *Suppl.* **38**: 1–522 (1930). A. Taborda de Morais, *Bol. Soc. Brot.* ser. 2, **11**: 49–72 (1936); **13**: 573–709 (1939).

1 Lower glume *c.* ½ as long as upper
2 Rhachilla disarticulating above the glumes and between the florets at maturity; spikelets with 3–5 florets **1. clauda**
2 Rhachilla disarticulating above the glumes but not between the florets at maturity; spikelets with 1–3 florets **2. eriantha**
1 Glumes subequal
3 Lemma 2-aristulate
4 Rhachilla not disarticulating at maturity **7. strigosa**
4 Rhachilla disarticulating at maturity
5 Glumes 30–45 mm, conspicuously longer than the florets; callus-scar linear **3. longiglumis**
5 Glumes 12–30 mm, about equalling the florets; callus-scar oblong-ovate
6 Glumes 20–30 mm; stems 30–100 cm, ± erect **4. barbata**
6 Glumes 12–18 mm; stems 7–30 cm, or longer and procumbent
7 Glumes 15–18 mm; leaves 0·5–1·5 mm wide **5. saxatilis**
7 Glumes 12–15 mm; leaves 2–4 mm wide **6. prostrata**
3 Lemma 2-dentate, 2-fid or 2-mucronulate
8 Glumes conspicuously shorter than the florets **9. nuda**
8 Glumes as long as or longer than the florets
9 Rhachilla disarticulating at maturity
10 Rhachilla disarticulating above the glumes and between the florets at maturity; spikelets 18–25 mm **10. fatua**
10 Rhachilla disarticulating above the glumes but not between the florets at maturity; spikelets 25–45 mm
11 Awn arising *c.* ⅓ of the way from base to apex of lemma, the geniculation 3–8 mm below the apex of the glumes **13. sterilis**
11 Awn arising in the lower ¼ of lemma, the geniculation 8–12 mm below the apex of the glumes **14. murphyi**
9 Rhachilla not disarticulating at maturity
12 Spikelets 10–12 mm **8. brevis**
12 Spikelets 17–35 mm
13 Awn (when present) with a distinct column; rhachilla-segments breaking at their apex and falling attached to the lower floret **11. sativa**
13 Awn without a distinct column; rhachilla-segments breaking at their base and falling attached to the upper floret **12. byzantina**

1. A. clauda Durieu in Duchartre, *Rev. Bot.* **1**: 360 (1845) (*A. pilosa* sensu Hayek, non Bieb.). Stems 20–70 cm, glabrous. Leaves up to 10 cm × 1·5–5 mm, with sparse patent hairs; ligule 1·5–3 mm. Panicle up to 15 cm, subsecund. Spikelets 18–24 mm, with 3–5 florets. Lower glume *c.* ½ as long as upper, 3- to 5-veined, the upper 5- to 7-veined. Lemma 12–14 mm, narrowly lanceolate, glabrous; aristulae 3–6 mm; awn 30–45 mm. Palea ⅗ as long as lemma. Callus-scar oblong-linear. Rhachilla disarticulating above the glumes and between the florets at maturity. *Dry, rocky places. E. part of Balkan peninsula.* Bu Gr Tu.

2. A. eriantha Durieu, *loc. cit.* (1845). Like **1** but spikelets 15–20 mm, with 1–3 florets; lemma shortly hirsute in the distal half and minutely verruculose proximally; rhachilla disarticulating above the glumes but not between the florets at maturity. *Dry, rocky places. Krym.* ?Gr Rs (K). (*N. Africa, W. Asia.*)

3. A. longiglumis Durieu, *op. cit.* 359 (1845). Stems 25–140 cm, glabrous. Leaves up to 40 cm × 2–10 mm, sparsely hairy to scabridulous; ligule 2–6 mm. Panicle up to 30(–40) cm, secund. Spikelets 30–45 mm, with 2–3 florets. Glumes subequal, (7–)9- to 11-veined. Lemma 20–25 mm, narrowly lanceolate, villous in the proximal half; aristulae 10–15 mm, each with a small lateral seta; awn 50–70 mm. Palea ⅚ as long as lemma. Callus-scar linear. Rhachilla disarticulating above the glumes and between the florets at maturity. $2n=14$. *Sandy or rocky places near the sea. S. Portugal, S.W. Spain.* Hs Lu.

4. A. barbata Pott ex Link in Schrader, *Jour. für die Bot.* **1799(2)**: 315 (1800). Stems 30–100 cm, glabrous. Leaves up to 30 cm, usually 3–8 mm wide, usually sparsely hairy or ciliate; ligule 2–5 mm. Panicle up to 30(–50) cm, subsecund. Spikelets 18–30 mm, with 2–3 florets. Glumes subequal, 5- to 7(–9)-veined. Lemma 12–18 mm, narrowly lanceolate, villous up to the insertion of the awn; aristulae 3–12 mm; awn 30–60 mm. Palea ⅘ as long as lemma. Callus-scar oblong-ovate. Rhachilla disarticulating between the florets at maturity. *Dry, waste places, roadsides and cultivated ground. S. Europe.* Al Bl Bu Co Cr Ga Gr Hs It Ju Lu Rm Rs (K) Sa Si Tu [Au Az Ge].

(*a*) Subsp. **barbata**: Lemma with aristulae 3–5 mm, without lateral setae. $2n=14$, 28. *Throughout most of the range of the species.*

(*b*) Subsp. **atherantha** (C. Presl) Rocha Afonso, *Bot. Jour. Linn. Soc.* **76**: 358 (1978) (*A. atherantha* C. Presl): Lemma with

[1] By M. L. Rocha Afonso.

aristulae 6–12 mm, usually with a short lateral seta on one side. $2n=14$. *S. part of Mediterranean region.*

5. A. saxatilis (Lojac.) Rocha Afonso, *op. cit.* 359 (1978) (*A. barbata* var. *saxatilis* Lojac.). Like **4(a)** but stems 7–25 cm, densely caespitose; leaves not more than 6 cm × 0·5–1·5 mm, scabridulous; ligule 0·3–1 mm; panicle not more than 10 cm, with spikelets 15–18 mm; glumes not more than 7-veined; lemma 9–10 mm, with aristulae 3–4 mm; awn 15–30 mm. *Dry, open habitats on basalt.* ● *Islands near Sicilia (Isole Lipari, Marettimo, Linosa).* Si.

6. A. prostrata Ladizinsky, *Israel Jour. Bot.* **20**: 297 (1971). Like **4(a)** but stems 15–50 cm, usually procumbent; basal leaves up to 6 cm × 1·5–4 mm, the cauline very short; ligule 0·5–1 mm; spikelets 12–15 mm; lemma 8–10 mm, with aristulae 2–4 mm; awn 20–30 mm. $2n=14$. *Dry, rocky places. S.E. Spain (prov. Murcia.).* Hs.

7. A. strigosa Schreber, *Spicil. Fl. Lips.* 52 (1771). Stems 35–100(–180) cm, glabrous. Leaves up to 25(–40) cm × 3–12 mm, scabridulous; ligule 2–5 mm. Panicle up to 25(–35) cm, more or less contracted. Spikelets 14–20(–22) mm, with (1–)2–3 florets. Glumes subequal, 7- to 9-veined. Lemma 13–16 mm, narrowly lanceolate, glabrous or hairy; aristulae 1–9 mm; awn 20–35 mm. Palea $\frac{4}{5}$ as long as lemma. Rhachilla not disarticulating at maturity. *Cultivated locally on a small scale, but occurring mainly as a weed among other cereal crops. N., W. & C. Europe.* [Au Az Be Br Cz Da Fe Ga Ge ?Gr Hb He Ho Hs Hu It Ju Lu No Po Rs (N, B, C) Su.]

Probably derived from **3** in cultivation.

(a) Subsp. **strigosa**: Spikelets up to 20(–22) mm. Lemma glabrous or more or less hairy; aristulae 5–9 mm, with a lateral seta up to 1 mm; awn inserted about the middle of the lemma. $2n=14$. *Throughout the range of the species.*

(b) Subsp. **agraria** (Brot.) Tab. Mor., *Bol. Soc. Brot.* ser. 2, **12**: 240 (1937): Spikelets not more than 16 mm. Lemma glabrous; aristulae 1–3 mm, with 1 or 2 shorter lateral setae; awn inserted in distal $\frac{1}{3}$ of lemma. *W. Europe.*

8. A. brevis Roth, *Bot. Abh.* 42 (1787). Stems 35–100(–130) cm, glabrous. Leaves up to 25(–35) cm × 2–8(–12) mm, scabridulous; ligule 1–3(–4) mm. Panicle up to 20 cm, somewhat contracted. Spikelets 10–12 mm, with 1–2 florets. Glumes subequal, 5- to 7-veined. Lemma 6–9 mm, lanceolate, more or less ventricose, glabrous except for some rigid hairs in the distal $\frac{1}{3}$; apex with 2 triangular-acuminate teeth 0·5–1 mm, usually produced into aristulae 0·2–1 mm; awn 10–25 mm, deciduous in fruit. Palea $\frac{3}{4}$ as long as lemma. Rhachilla not disarticulating at maturity. $2n=14$. *Cultivated locally in sandy fields in N.W. Europe and rarely naturalized.*

9. A. nuda L., *Demonstr. Pl.* 3 (1753) (*A. sativa* subsp. *nuda* (L.) Rouy). Stems 45–90 cm, glabrous, with a waxy bloom. Leaves up to 20 cm × 3–7 mm, scabridulous; ligule 2–4 mm. Panicle up to 25 cm, rather contracted. Spikelets 20–30(–35) mm, with 2–4 florets. Glumes subequal, 7- to 9-veined. Lemma 15–20 mm, lanceolate, acuminate, glabrous; apex with 2 acuminate teeth 1–3(–4) mm; awn 15–20 mm, inserted about the middle of the lemma, not twisted below. Palea $\frac{1}{2}$ as long as lemma. Rhachilla not disarticulating at maturity. $2n=14$. *Cultivated on a small scale, mainly in C. Europe, and rarely naturalized.*

A. chinensis (Fischer ex Roemer & Schultes) Metzger, *Eur. Cereal.* 53 (1824), is cultivated in parts of W. & C. Europe. It is like **9** but is larger, with spikelets 25–35(–45) mm, with 3–7 florets, the lowest of which is sometimes awned, the others unawned. The lemma is 18–25 mm and entire or 2-denticulate at the apex.

10. A. fatua L., *Sp. Pl.* 80 (1753). Stems 30–100(–150) cm, glabrous. Leaves up to 45 cm × 5–15 mm, scabridulous, ciliolate at base; ligule 3–6 mm. Panicle up to 40 cm, the branches more or less patent. Spikelets 18–25 mm, with 2–3 florets. Glumes subequal, 7- to 9-veined. Lemma 14–20 mm, ovate-lanceolate, glabrous or hairy below; apex with teeth 0·2–0·5 mm; awn 25–40 mm. Palea $\frac{5}{6}$ as long as lemma. Callus-scar ovate. Rhachilla disarticulating between the florets at maturity. Grain *c.* 15 × 4 mm, oblong. *Cultivated fields and waste ground. Most of Europe, but native only in the south.* All except ?Cr Fa ?Gr Is Sb.

A. septentrionalis Malzev, *Bull. Angew. Bot.* **6**: 915 (1913), from N. & C. Russia, **A. cultiformis** (Malzev) Malzev et al., *Sorn. Rast. SSSR* **1**: 208 (1934) (*A. fatua* subsp. *cultiformis* Malzev), from W. & C. Russia, and **A. aemulans** Nevski, *Acta Univ. As. Med.* ser. 8b, (Bot.) **17**: 5 (1934), from E. Russia, closely resemble **10**; the first is distinguished by the pubescent nodes, the second by the shorter and wider, subovoid to oblong grain, and the third by the rhachilla disarticulating above the glumes but not between the florets at maturity.

11. A. sativa L., *Sp. Pl.* 79 (1753). Stems 40–140(–200) cm, glabrous. Leaves up to 45 cm × 3–15(–20) mm, scabridulous; ligule 3–5 mm. Panicle up to 25(–40) cm, patent or contracted and unilateral. Spikelets 17–30 mm, with 2–3 florets. Glumes subequal, 7- to 9-veined. Lemma 12–25 mm; apex emarginate or with very short teeth; lowest lemma usually awned, the others unawned; awn 15–40 mm, usually almost straight. Palea $\frac{5}{6}$ as long as lemma. Rhachilla not disarticulating at maturity but breaking immediately below each floret; segments 2·5–3 mm. *Cultivated as a cereal (oats) in much of Europe.*

Many of the records of **11** from the Mediterranean region refer to **12.**

1 Spikelets 25–30 mm; lemma usually sparsely hairy — (c) subsp. **macrantha**

1 Spikelets 17–25 mm; lemma glabrous
- 2 Lemma 15–20 mm — (a) subsp. **sativa**
- 2 Lemma 12–15 mm — (b) subsp. **praegravis**

(a) Subsp. **sativa** (incl. *A. orientalis* Schreber, *A. sativa* subsp. *orientalis* (Schreber) Werner, *A. nodipilosa* Malzev): Spikelets 17–20 mm. Lemma 15–20 mm, narrowly lanceolate, glabrous, usually unawned. Grain 8–9 mm. *Throughout the range of the species.*

(b) Subsp. **praegravis** (Krause) Tab. Mor., *Bol. Soc. Brot.* ser. 2, **13**: 604 (1939) (*A. praegravis* (Krause) Roshev.): Spikelets 20–25 mm. Lemma 12–15 mm, ovate-lanceolate, glabrous. Grain 11–12 mm. *Mainly in the eastern part of the range of the species.*

(c) Subsp. **macrantha** (Hackel) Rocha Afonso, *Bot. Jour. Linn. Soc.* **76**: 359 (1978) (*A. fatua* subsp. *macrantha* (Hackel) Malzev, *A. sativa* var. *macrantha* Hackel): Spikelets 25–30 mm. Lemma 20–25 mm, narrowly lanceolate, usually sparsely hairy. Grain *c.* 10 mm. *S. Europe.*

A. volgensis (Vavilov) Nevski, *Acta Univ. As. Med.* ser. 8b (Bot.), **17**: 5 (1934), from C. Russia, is like **11(a)** but the rhachilla has segments *c.* 1·5 mm, which break at their base and fall attached to the upper floret.

12. A. byzantina C. Koch, *Linnaea* **21**: 392 (1848). Stems 60–100(–180) cm, glabrous. Leaves up to 30 cm × 1·5–6(–12) mm,

scabridulous; ligule 3–7 mm. Panicle up to 25 cm, more or less patent. Spikelets 25–35 mm, with 3(–4) florets. Glumes subequal, 7- to 9-veined. Lemma 15–20 mm, narrowly lanceolate, glabrous except for a basal tuft of long hairs; apex with teeth 0·5–1·5 mm; awn 25–35 mm, without a distinct column, flexuous but never geniculate, the lowest 1(–2) lemmas awned, the others unawned. Palea ¾ as long as lemma. Rhachilla not disarticulating at maturity, but breaking at the base of the segment below each floret. *Cultivated as a cereal in S. Europe, mainly on dry or saline soils.*

Derived from **11** by selection under cultivation.

13. A. sterilis L., *Sp. Pl.* ed. 2, 118 (1762). Stems 50–150 cm, glabrous. Leaves up to 60 cm × 4–13 mm, scabridulous, sometimes ciliate below. Panicle up to 40 cm, usually patent. Spikelets 25–45 mm. Glumes subequal, 7- to 11-veined. Lemma 18–33 mm, narrowly lanceolate, with rigid hairs in the proximal ⅔; apex with teeth 1–1·5 mm; awn 30–90 mm. Palea ⅘ as long as lemma. Callus-scar ovate to ovate-oblong. Rhachilla disarticulating above the glumes but not between the florets. *Dry, waste places and cultivated fields. S. Europe.* ?Al Bl Bu Co Cr Ga Gr Hs It Ju Lu *Rm Rs (W, K, E) Sa Si Tu [Az Be Br Cz Hu].

(a) Subsp. **sterilis**: Ligule 6–8 mm. Spikelets (32–)35–45 mm, with 3–5 florets, the 2(–3) lower usually awned. Glumes 9- to 11-veined. Lemma 25–33 mm; awn 60–90 mm, stout. $2n=42$. *Throughout most of the range of the species.*

(b) Subsp. **ludoviciana** (Durieu) Nyman, *Consp.* 810 (1882) (*A. ludoviciana* Durieu): Ligule 3–4 mm. Spikelets 25–30(–32) mm, with 2–3 florets, the one or two lower awned. Glumes 7- to 9-veined. Lemma 18–25 mm; awn 30–60 mm, slender. $2n=42$. *Throughout most of the range of the species.*

14. A. murphyi Ladizinsky, *Israel Jour. Bot.* **20**: 24 (1971). Like **13(a)** but ligule 2–4 mm; panicle not more than 25 cm; spikelets with 2–4 florets; lemma glabrous, with slightly divergent teeth; rhachilla-segments with a tuft of hairs below each lemma; callus-scar elliptical. $2n=28$. *Roadsides and waste places. S.W. Spain.* Hs.

61. Helictotrichon Besser[1]

Caespitose perennials. Leaves distinctly ribbed above, the basal without distinct bulliform cells above, or with several rows of small bulliform cells between the ribs; ligule of cauline leaves usually truncate-dentate; sheaths of basal leaves usually open to the base. Inflorescence a compound panicle. Spikelets usually numerous, erect or patent, slightly compressed laterally, with 2–4 fertile and 1(–2) sterile florets; all fertile florets usually awned. Glumes lanceolate, unequal, membranous, acute, the lower 1-veined, the upper 3-veined. Lemma lanceolate, 5- to 7-veined, glabrous, slightly 2-dentate; awn geniculate, arising at about the middle of the lemma, more or less terete in lower part. Palea more or less 2-fid at apex, shortly ciliate on keels. Ovary densely hairy. Grain deeply sulcate.

Literature: C. Gervais, *Denkschr. Schweiz. Naturf. Ges.* **88**: 3–166 (1973). J. Holub in I. Klášterský, *Philip Maximilian Opiz und seine Bedeutung für die Pflanzentaxonomie*, 101–133. Praha, 1958. E. Paunero, *Anal. Inst. Bot. Cavanilles* **17(1)**: 259–267 (1959). E. Potztal, *Bot. Jahrb.* **75**: 321–332 (1951). A. St-Yves, *Candollea* **4**: 376–423 (1931).

1 Ligules, at least of basal leaves, 3–8 mm, longer than wide, acute, not ciliate on the upper margin

[1] By J. Holub.

2 Basal leaves at least 1 mm wide; all ligules 3–6 mm, oblong; panicle with 15–45 spikelets **4. parlatorei**

2 Basal leaves not more than 0·7 mm wide, setaceous; ligules of basal leaves 3–8 mm, lanceolate, of cauline leaves 1–3 mm, truncate; panicle with 7–17 spikelets **13. desertorum**

1 Ligules 0·2–1·5 mm, wider than long, truncate, ciliate on the upper margin

3 Sheaths of inner basal leaves always dark violet-brown

4 Lower glume 13–15 mm, the upper 15–20 mm; callus-hairs 4·5–6 mm; basal leaves at least 1 mm in diameter **10. filifolium**

4 Lower glume *c.* 10 mm, the upper *c.* 12 mm; callus-hairs 3–3·5 mm; basal leaves not more than 0·9 mm in diameter **11. murcicum**

3 Sheaths of inner basal leaves whitish or brownish, sometimes suffused with violet when young

5 Basal leaves 0·5–0·9 mm in diameter, never flat; callus-hairs nearly ½ as long as lemma; panicle 4–9 cm

6 Stem glabrous below the panicle; panicle-axis smooth; spikelets 8–12 mm; awn 12–18 mm **5. setaceum**

6 Stem pubescent below the panicle; panicle-axis scabrid; spikelets 12–15 mm; awn 18–22 mm **6. petzense**

5 Basal leaves 0·7–4 mm wide, sometimes ±flat; callus-hairs ¼–⅓ as long as lemma; panicle 6–25 cm

7 Basal leaves without a conspicuous subepidermal layer of sclerenchyma; non-flowering shoots extravaginal

8 Sheaths of basal leaves open to the base; pedicels scarcely clavate; leaves glaucous above, dark green beneath **1. decorum**

8 Sheaths of basal leaves open only in the upper half; pedicels clavate; leaves greyish-green on both surfaces

9 Leaves (1–)2(–4) mm wide, often convolute; spikelets with 2–3 fertile florets; anthers 3–4·5 mm **2. sedenense**

9 Leaves (2–)3–4(–7) mm wide, usually flat; spikelets with 3–4 fertile florets; anthers *c.* 5 mm **3. planifolium**

7 Basal leaves with a continuous subepidermal layer of sclerenchyma; at least some non-flowering shoots intravaginal

10 Dead leaves soon deciduous; rhachilla disarticulating only above the glumes **7. sempervirens**

10 Dead leaves ±persistent; rhachilla disarticulating below each floret

11 Basal leaves pubescent beneath **9. sarracenorum**

11 Basal leaves glabrous beneath, though sometimes ciliate

12 Stem 1–3 mm in diameter; panicle 10–15 cm; hairs of rhachilla 2·5–3·5 mm; lemma 9–11 mm **8. convolutum**

12 Stem 3–6 mm in diameter; panicle 12–25 cm; hairs of rhachilla 4·5–5 mm; lemma 10–13 mm **12. cantabricum**

1. H. decorum (Janka) Henrard, *Blumea* **3**: 430 (1940). Non-flowering shoots extravaginal, sometimes elongated. Stems 40–80(–100) cm. Basal leaves 20–50 cm × 2·5–4 mm when flat, or 1–1·4 mm in diameter when convolute, dull, glaucous and scabrid above, shiny, dark green and smooth beneath, without a continuous subepidermal layer of sclerenchyma, long-persistent when dead; sheaths of basal leaves open to base; ligule *c.* 0·5 mm, truncate, ciliate. Panicle 10–15 cm; primary branches with 4–10 spikelets; pedicels not distinctly clavate. Spikelets (8–)10–14 mm, with 2–3 fertile florets. Rhachilla disarticulating below each floret; segments 2–3 mm, with hairs 2·5–3 mm; callus-hairs 2–2·5 mm. Lower glume 7–9 mm, the upper 9–11 mm. Lemma 7–10 mm. Palea 6–9 mm. $2n=14$. *Calcareous rocks.* ● *E. & S. Carpathians and mountains of Transilvania.* Rm.

2. H. sedenense (DC.) J. Holub, *Folia Geobot. Phytotax. (Praha)* **5**: 436 (1970) (*Avena montana* Vill., *A. sedenensis* DC.). Non-flowering shoots extravaginal. Stems (30–)40–80(–90) cm. Basal leaves 10–25 cm × (1–)2(–4) mm when flat, or 0·5–0·9 mm in diameter when convolute, greyish-green, without a continuous subepidermal layer of sclerenchyma, more or less persistent when

dead; sheaths of basal leaves open only in the upper half; ligule *c.* 0·5 mm, truncate, ciliate. Panicle 6–15 cm; primary branches with 1–5 spikelets; pedicels subclavate. Spikelets (7–)9–12(–13) mm, with 2–3 fertile florets. Rhachilla disarticulating below each floret; segments 1·5–2·5 mm, with hairs 2·5–4 mm; callus-hairs 2–2·5 mm. Lower glume 7–9 mm, the upper 8–11 mm. Lemma 7–10 mm. Palea 6–9 mm. $2n=14+0$–$2B$, $28+0$–$2B$. *Rocky slopes; calcicole. Mountains of S.W. Europe.* Ga Hs It.

3. H. planifolium (Willk.) J. Holub, *op. cit.* **9**: 273 (1974) (*Avena montana* var. *planifolia* Willk.). Like **2** but plant more robust; leaves longer and more or less flaccid, mostly flat, (2–)3–4(–7) mm wide; branches of panicle more rigid; spikelets 11–14 mm, with 3–4 fertile florets; segments of rhachilla with hairs 3·5–5 mm; callus-hairs 2·5–3 mm. $2n=28+0$–$2B$. *Rocky slopes and pastures.* ● *C. Pyrenees.* Ga Hs.

4. H. parlatorei (J. Woods) Pilger, *Feddes Repert.* **45**: 7 (1938) (*Avena parlatorei* J. Woods). Rhizome sometimes shortly creeping and with short stolons. Stem 40–80(–100) cm. Leaves 20–40 (–60) cm × 2–4 mm when flat, or 1–1·3 mm in diameter when convolute, persistent when dead; ligule 3–6 mm, oblong, acute, lacerate later, glabrous. Panicle (8–)10–13(–15) cm, rather lax, with 15–45 spikelets; main axis scabridulous; primary branches with 3–5(–8) spikelets. Spikelets (8–)10–11(–12) mm, with 2–3 fertile florets. Rhachilla disarticulating only above the glumes; segments 2–3 mm, with hairs 2–3 mm; callus-hairs 1·5–2 mm; pedicel of sterile floret 3–4 mm, glabrous. Lower glume 7–10 mm, the upper 9–12 mm. Lemma 7–10(–11) mm, 2-fid. Palea 7–9 mm. $2n=14$. *Rocky slopes and screes; calcicole.* ● *S.W. & E. Alps.* Au Ga Ge It Ju.

The above description refers to diploid plants. Tetraploid plants ($2n=28$), known only from one locality in N.W. Italy, have spikelets (12–)14–15(–16) mm; their status needs further investigation.

5. H. setaceum (Vill.) Henrard, *Blumea* **3**: 430 (1940) (*Avena setacea* Vill.). Non-flowering shoots intravaginal. Stems (15–)20–60(–70) cm, slender, glabrous, smooth. Basal leaves 10–40(–60) cm × 0·5–0·8 mm, setaceous, tough, puberulent above, smooth beneath, soon deciduous; sheaths of basal leaves more or less equal in length, tough, stramineous to greyish, long-persistent; ligule 0·2–0·5 mm, truncate, ciliate, or reduced to a row of cilia. Panicle 4–10 cm, with 8–25 spikelets, dense; main axis smooth; primary branches with 2–5 spikelets; pedicels not clavate. Spikelets 8–12 mm, with 2–3 fertile florets; rhachilla disarticulating only above the glumes; segments 1·5–2 mm, with hairs 4–6 mm; callus-hairs 3–3·5 mm; pedicel of the sterile floret 3–4 mm, hairy. Lower glume 7–10 mm, the upper 10–12 mm. Lemma (7–)8–11 mm. Palea 7–8 mm. $2n=14$. *Rocky slopes; calcicole.* ● *S.W. Alps and mountains of Provence.* Ga It.

6. H. petzense Melzer, *Österr. Bot. Zeitschr.* **114**: 308 (1968). Like **5** but stems pubescent above; basal leaves 0·7–0·9 mm in diameter; ligule of cauline leaves up to 0·7 mm; panicle-axis densely scabrid, spikelets 12–15 mm; lower glume up to 12 mm, the upper up to 14(–15) mm. $2n=14$. *Calcareous mountain rocks.* ● *S.E. Alps* (*Karawanken*). Au Ju.

7. H. sempervirens (Vill.) Pilger, *Feddes Repert.* **45**: 7 (1938) (*Avena sempervirens* Vill.). Non-flowering shoots intravaginal. Stems (30–)40–100(–150) cm. Basal leaves 15–60 cm × 0·9–1·5 mm, rigid, convolute, or flat and 2–4 mm wide, glaucous, sometimes pruinose, scabridulous, soon deciduous when dead; sheaths of basal leaves tough, long-persistent; ligule 0·5–1·5 mm, truncate, ciliate. Panicle 8–20 cm, with 30–55 spikelets; primary branches scabrid, with 3–7(–10) spikelets. Spikelets 10–14 mm, with 2(–3) fertile florets, the upper unawned. Rhachilla disarticulating only above the glumes; segments 2·5–4 mm, with hairs 4–5 mm; callus-hairs 3–4 mm; pedicel of the sterile floret 4–6 mm, sparsely hairy to glabrous. Lower glume 7–10 mm, the upper 10–12 mm. Lemma (8–)9–12 mm. Palea 8–9 mm. $2n=42+0$–$5B$. *Rocks and stony pastures; calcicole.* ● *S.W. Alps.* Ga It.

8. H. convolutum (C. Presl) Henrard, *Blumea* **3**: 430 (1940) (*Avena convoluta* C. Presl). Basal leaves 20–40 cm × (0·5–)0·7–1·5 mm, convolute, or more or less flat and 1·5–3 mm wide, glaucous, smooth beneath, more or less persistent when dead; sheaths tough, dilated to the base, ligule 0·3–0·6 mm, truncate, ciliate and hairy. Panicle with 15–50 spikelets; primary branches flexuous, with 5–12 spikelets; pedicels clavate. Rhachilla disarticulating below each floret; segments 3 mm; callus-hairs 2–3·5 mm. Lemma 9–11 mm. Palea 8–9 mm. *Rocky slopes; calcicole. Mediterranean region from Sicilia eastwards.* Al Gr It Ju Si.

(a) Subsp. **convolutum**: Stems (40–)50–80 cm. Convolute leaves (0·5–)0·7–1·2 mm in diameter. Panicle 8–13 cm. Spikelets 10–12 mm, with 2–3 fertile florets. Lower glume 9–10 mm, 1-veined, the upper 10–11 mm; rhachilla-segments with hairs 2·5–3 mm. $2n=14$. *Throughout the range of the species.*

(b) Subsp. **heldreichii** (Parl.) Gervais, *Denkschr. Schweiz. Naturf. Ges.* **88**: 58 (1973): Stems 80–100 cm. Leaves 1–1·5 mm in diameter and convolute, or often more or less flat. Panicle 11–16 cm. Spikelets 12–17 mm, with 3–4 fertile florets. Lower glume 10–12 mm, usually 3-veined, the upper 12–14 mm; rhachilla-segments with hairs 3·5 mm. *S. & S.E. Greece.*

Further investigation of the taxonomy and distribution of these subspecies is needed.

9. H. sarracenorum (Gand.) J. Holub, *Preslia* **31**: 50 (1959) (*Avena sarracenorum* Gand.). Stems 40–90 cm. Basal leaves 15–25 cm × 2–4 mm, erect, pungent, pubescent beneath, subglaucous above, persistent when dead; sheaths pale brownish, tough; ligule 0·2–0·5 mm, densely hairy. Panicle 6–10 cm, with 25–35 spikelets; pedicels clavate. Spikelets 10–14 mm, with 3–4 fertile florets. Rhachilla disarticulating below each floret; segments 3 mm, with hairs 4–5 mm; callus-hairs 3–4 mm. Lower glume 10 mm, the upper 11–12 mm. Lemma 9–12 mm, smooth, deeply 2-fid. Palea 9 mm. Grain hispid. $2n=14$, 28, 70. *Dry, rocky slopes and wood-clearings.* ● *S. & S.E. Spain.* Hs.

Plants from S. Spain (Ronda) which resemble **10** in their glabrous leaves, but are closer to **9** in the colour of the sheaths, require further investigation.

10. H. filifolium (Lag.) Henrard, *Blumea* **3**: 430 (1940) (*Avena filifolia* Lag.). Non-flowering shoots intra- and extravaginal. Stems (40–)60–120 cm. Basal leaves 20–60 cm × 1–1·3 mm, convolute, erect, pungent, subglaucous and scabrid above, glabrous and smooth beneath, more or less persistent when dead; sheaths indurate, dilated to the base, persistently violet-brown, long-ciliate at the mouth, with a continuous subepidermal layer of sclerenchyma; ligule very short or nearly absent, densely hairy. Panicle 12–25 cm, with 15–40 spikelets; main axis scabridulous; primary branches with 2–5 spikelets. Spikelets 15–20 mm, with 2–3 fertile florets. Rhachilla disarticulating below each floret; segments 3·5 mm, with hairs 5–6 mm; callus-hairs 4·5–6 mm; pedicel of the sterile floret 4 mm, hairy. Lower glume 13–15 mm, the upper 15–20 mm. Lemma 13–15 mm, 2-fid, mucronate, shiny. Palea 10–11 mm. $2n=70$, $84+0$–$1B$. *Rocky slopes, dry pastures and wood-clearings. S. Spain.* Hs.

11. H. murcicum J. Holub, *Preslia* **49**: 218 (1977). Like **10** but smaller and more slender; stems 40–60 cm; basal leaves 0·7–

0·9 mm in diameter; lower glume *c.* 10 mm, the upper *c.* 12 mm; callus-hairs 3–3·5 mm. *Rocky slopes.* ● *S.E. Spain* (*Prov. Murcia*). Hs.

12. H. cantabricum (Lag.) Gervais, *Denkschr. Schweiz. Naturf. Ges.* **88**: 69 (1973). Sometimes with short stolons; non-flowering shoots intra- and extravaginal. Stems 60–125 cm, 3–6 mm in diameter. Basal leaves 20–50(–80) cm × 2–3 mm, rigid, erect, acute, glabrous beneath, subglaucous above, more or less persistent when dead; sheaths rather soft, stramineous, sometimes suffused with violet when young, without a continuous subepidermal layer of sclerenchyma; ligule 0·2–0·5 mm, ciliate. Panicle (10–) 13–25 cm, with 20–60 spikelets, pale; pedicels clavate. Spikelets 11–14(–15) mm, with 2–3 fertile florets. Rhachilla disarticulating below each floret; segments 3 mm, with hairs 4·5–5 mm; callus-hairs 3 mm. Lower glume 8–9 mm, the upper 11–12 mm. Lemma 10–13 mm, 2-fid. Palea 9–11 mm. $2n = 84, 98$. *Mountain pastures and wood-clearings.* ● *Pyrenees, Cordillera Cantábrica.* Ga Hs.

The species includes various taxa needing further investigation. Plants with $2n = 84$ occur in the Pyrenees, plants with $2n = 98$ in the Cordillera Cantábrica.

13. H. desertorum (Less.) Nevski, *Sovetsk. Bot.* **1937(4)**: 41 (1937) (*Avena desertorum* Less., *Avenastrum desertorum* (Less.) Podp.). Non-flowering shoots intravaginal. Stems 30–60 cm, slender. Basal leaves 20–50 cm × 0·5–0·7 mm, setaceous, greyish-green, soon deciduous when dead; sheaths of basal leaves pale grey or stramineous, rather tough, persistent, the inner more or less shiny; ligule of basal leaves 3–8 mm, acute, of cauline leaves 1–3 mm, truncate, lacerate, usually glabrous. Panicle (4–)5–8 (–10) cm, with 7–17 spikelets; primary branches with 2–3 spikelets; pedicels not clavate. Spikelets 9–12(–14) mm, with 2(–3) fertile florets. Rhachilla disarticulating below each floret; segments 2–2·5 mm, with hairs 2·5–3 mm; callus-hairs 2 mm; pedicel of the sterile floret up to 4 mm, hairy. Lower glume 6·5–9 mm, the upper 10–11 mm. Lemma 8–10 mm. Palea 8–9 mm. *Steppes and stony slopes. From W. Czechoslovakia to S. Ural, northwards to* 55° *N. in C. Russia.* Au Cz Rs (W, C, E).

(a) Subsp. **desertorum**: Sheaths of cauline leaves glabrous. Lemma usually 2-fid. *S.E. Russia.*

(b) Subsp. **basalticum** (Podp.) J. Holub, *Folia Geobot. Phytotax.* (*Praha*) **5**: 436 (1970) (*Avenastrum desertorum* var. *basalticum* Podp.): Sheaths of cauline leaves puberulent. Lemma usually 3- to 4-dentate. $2n = 14$. *Throughout the range of the species.*

62. Avenula (Dumort.) Dumort.[1]

Like *Helictotrichon* but roots without a ring of sclerenchyma surrounding the endodermis; basal leaves without ribs above, with 2 distinct lines of bulliform cells along the mid-vein above; ligule of cauline leaves acute; spikelets erect, with 2–7 fertile florets; lower glume (1–)3-veined, the upper 3(–5)-veined; awn twisted and usually compressed in lower part.

Measurements of the width of the stem refer to its thickness in the lower ¼ and the length of the ligule of cauline leaves refers to the uppermost leaf, unless this leaf is exceptionally short. Spikelet-length excludes the awns, the number of florets includes sterile rudimentary florets and the length of rhachilla-segments and of their hairs refers to the segment between the first and second florets. Glume-length is measured on a lateral spikelet and characters of the lemma refer to the first and second florets at anthesis.

[1] By J. Holub.

The treatment of species from S. Europe and particularly from Spain is provisional and further investigation is required.

Literature: C. Gervais, *Denkschr. Schweiz. Naturf. Ges.* **88**: 3–166 (1973). J. Holub, *Acta Horti Bot. Prag.* **1962**: 75–86 (1962); *Acta Mus. Nation. Prag.* **17(B), 1961(5)**: 189–244 (1962). E. Paunero, *Anal. Inst. Bot. Cavanilles* **17(1)**: 267–283 (1959). W. Sauer & H. Chmelitschek, *Mitt. Bot. Staatssamm.* (*München*) **12**: 513–607 (1976). A. St-Yves, *Candollea* **4**: 423–490 (1931).

1 Lower part of awn terete, of uniform thickness when viewed from the side; keels of palea glabrous and smooth; veins not reaching upper margin of lemma **1. pubescens**
1 Lower part of awn flattened, alternately thick and thin when viewed from the side; keels of palea shortly ciliate or aculeolate; veins reaching upper margin of lemma
2 Basal leaves in cross-section with a continuous subepidermal layer of sclerenchyma beneath; rhachilla-segments with hairs 2·5–4 mm **27. hackelii**
2 Basal leaves in cross-section without a continuous subepidermal layer of sclerenchyma beneath; rhachilla-segments glabrous or with hairs not more than 3 mm
3 Rhachilla-segments glabrous or with sparse hairs near apex, the hairs shorter than those of the callus
4 Lemma sericeous or hairy on the back in the lower ½
5 Basal leaves deeply sulcate beneath; uppermost cauline leaf 3–8 cm, patent; lower glume 10–12 mm, the upper 12–16 mm **24. gervaisii**
5 Basal leaves not sulcate beneath; uppermost cauline leaf not more than 1·5 cm, appressed to stem; lower glume 6–9 mm, the upper 8–11 mm
6 Basal leaves 1·5–3 mm wide, V-shaped in cross-section, spirally twisted when dead, ±smooth; cartilaginous margin and mid-vein distinct beneath **19. bromoides**
6 Basal leaves 0·3–0·4 mm wide, orbicular in cross-section, not spirally twisted when dead, scabrid; cartilaginous margin and mid-vein not distinct beneath **20. murcica**
4 Lemma not sericeous or hairy on the back in the lower ½
7 Lateral veins of basal leaves connected by sclerenchyma and colourless parenchyma with at least 1 leaf-surface
8 Lemma reddish-brown, longitudinally sulcate in the lower half
9 Basal leaves 2–5 mm wide, not sulcate beneath, and with 4–6 sclerenchyma-strands on each side of mid-vein; callus-hairs 0·5–1 mm **9. compressa**
9 Basal leaves 0·3–2(–2·5) mm wide, sulcate beneath, and with 1(–3) sclerenchyma-strands on each side of mid-vein; callus-hairs 1·5–2·5 mm **12. mirandana**
8 Lemma greenish-yellow, not longitudinally sulcate
10 Basal leaves not sulcate beneath; callus-hairs *c.* 1 mm; panicle with 7–17 spikelets **13. gonzaloi**
10 Basal leaves sulcate beneath; callus-hairs 1·5–2·5 mm; panicle with 3–10 spikelets **12. mirandana**
7 Lateral veins of basal leaves separated from subepidermal sclerenchyma by chlorenchyma
11 Basal leaves flat or conduplicate, the cross-section oblong in outline
12 Basal leaves not sulcate beneath; subepidermal sclerenchyma groups small or almost absent; callus-hairs 0·4–0·8 mm **19. bromoides**
12 Basal leaves sulcate beneath; subepidermal sclerenchyma groups present opposite all veins; callus-hairs *c.* 1·5 mm
13 Spikelets 18–24 mm, with 5–7 florets; lemma narrowed from the middle, acute; anthers 5–6 mm **21. cincinnata**
13 Spikelets (20–)25–30 mm, with 7–9 florets; lemma narrowed in the upper ⅓, subtruncate; anthers 6–8 mm **22. peloponnesiaca**
11 Basal leaves usually setaceous or junciform, the cross-section elliptical to orbicular in outline
14 Basal leaves 1–2 mm in diameter, junciform; lemma narrowed from the middle

15 Basal leaves 1–1·5 mm in diameter, deeply sulcate; panicle 7–15 cm **25. pruinosa**
15 Basal leaves 1·5–2 mm in diameter, smooth or slightly sulcate; panicle 15–22 cm **26. crassifolia**
14 Basal leaves 0·3–0·8 mm in diameter, setaceous; lemma narrowed in the upper $\frac{1}{3}$
16 Basal leaves 10–40 cm, deeply sulcate, the upper cauline at least 3 cm; panicle with 13–21 spikelets; lower glume 10–12 mm **24. gervaisii**
16 Basal leaves 2–7 cm, not sulcate, the upper cauline not more than 1 cm; panicle with 2–8 spikelets; lower glume 7–8 mm **20. murcica**
3 Rhachilla-segments hairy at least in the upper $\frac{1}{2}$, the hairs longer than or about as long as those of the callus
17 Ligules of basal and cauline leaves of about the same length
18 Densely caespitose; lateral veins of basal leaves not connected with the epidermis by sclerenchyma; ligule of basal leaves 2–3 mm **23. cycladum**
18 Stoloniferous; lateral veins of basal leaves connected with the epidermis by sclerenchyma; ligule of basal leaves 4–6 mm **10. aetolica**
17 Ligule of cauline leaves usually at least twice as long as that of the basal leaves
19 Lateral veins of basal leaves not connected with the epidermis by sclerenchyma (S. Aegean region) **23. cycladum**
19 Lateral veins of basal leaves connected with the epidermis by sclerenchyma and colourless parenchyma
20 Lemma reddish-brown in lower $\frac{1}{2}$
21 Basal leaves 4–12 mm wide, their sheaths very strongly compressed **18. planiculmis**
21 Basal leaves 0·4–6 mm wide, their sheaths terete to slightly compressed
22 Veins of lemma not excurrent; hairs of rhachilla-segments 1–1·5 mm **3. schelliana**
22 Veins of lemma excurrent, forming 2(4) setae; hairs of rhachilla-segments 1·5–2·5 mm
23 Sheaths of basal leaves closed in the lower $\frac{1}{3}(-\frac{1}{2})$; lemma not longitudinally sulcate in the lower $\frac{1}{2}$; upper cauline leaf 2–7 cm, ± patent **2. versicolor**
23 Sheaths of basal leaves closed at the base only; lemma longitudinally sulcate in the lower $\frac{1}{2}$; upper cauline leaf not more than 2 cm, appressed to stem **(4–7). marginata** group
20 Lemma not reddish-brown in the lower $\frac{1}{2}$
24 Basal leaves 2–12 mm wide, their sheaths very strongly compressed
25 Basal leaves 4–12 mm wide, with 8–16 lateral veins on each side of the mid-vein; panicle often interrupted in the lower part **18. planiculmis**
25 Basal leaves 2–6 mm wide, with 6–10 lateral veins on each side of the mid-vein; panicle usually not interrupted in the lower part **17. praeusta**
24 Basal leaves 0·4–6 mm wide, their sheaths terete or slightly compressed
26 Basal leaves convolute, setaceous to junciform, the cross-section elliptical to orbicular in outline
27 Basal leaves not more than $\frac{1}{4}$ as long as stem, 1·5–2 mm in diameter, very pungent, slightly sulcate; pedicels ± smooth; plant without stolons **15. pungens**
27 Basal leaves $\frac{1}{3}$–$\frac{1}{2}$ as long as stem, 0·4–1·3 mm in diameter, not or only slightly pungent, not sulcate; pedicels scabrid; plant with short stolons
28 Stems 30–60 cm, slender; ligule of upper cauline leaves 2–4 mm; basal leaves setaceous, 0·4–0·6 mm in diameter, with *c.* 3 lateral veins on each side of the mid-vein; panicle 4–13 cm, with 4–9 spikelets **11. blavii**
28 Stems 60–100 cm, robust; ligule of upper cauline leaves 6–10 mm; basal leaves junciform, 1·2–1·3 mm in diameter; panicle 15–20 cm with 14–17 spikelets **14. requienii**
26 Basal leaves flat or conduplicate, the cross-section oblong to oblong-elliptical in outline
29 Basal leaves 2–7 cm
30 Basal leaves *c.* $\frac{1}{5}$ as long as stem, 2–4 mm wide; spikelets 14–18 mm, with 5–7 florets; rhachilla-segments with hairs 1·5–2·5 mm; upper glume 12–14 mm **8. levis**
30 Basal leaves $\frac{1}{12}$–$\frac{1}{10}$ as long as stem, 0·8–2 mm wide; spikelets 10–12 mm, with 3–5 florets; rhachilla-segments with hairs 0·4–1 mm; upper glume 9–10 mm **(4–7). marginata** group
29 Basal leaves 5–40 cm
31 Lemma longitudinally sulcate, at least at base, with 2(4) setae at apex; upper cauline leaf not more than 2 cm, appressed to stem **(4–7). marginata** group
31 Lemma not longitudinally sulcate in lower $\frac{1}{2}$, without distinct setae at apex; upper cauline leaf usually more than 2 cm, patent
32 Spikelets 10–16 mm; rhachilla-segments 1·5–2 mm, with hairs 1–1·5 mm; upper glume 9–13 mm; anthers 3·5–4·5 mm **3. schelliana**
32 Spikelets 12–23 mm; rhachilla-segments 2–3 mm, with hairs 2–3 mm; upper glume 12–18 mm; anthers 5–8 mm
33 Basal leaves 1–3 mm wide, usually conduplicate, with subterete sheaths; plant densely caespitose, usually without stolons; panicle with 5–18 spikelets **16. pratensis**
33 Basal leaves 2–6 mm wide, usually flat, with compressed sheaths; plant laxly caespitose to ± creeping, with stolons; panicle with 12–30 spikelets **17. praeusta**

Subgen. **Pubavenastrum** (Vierh.) J. Holub. Cartilaginous margin of basal leaves not serrulate; ligule of basal leaves truncate-dentate. Lower glume 1- to 3-veined. Veins of lemma not reaching the upper margin. Lower part of awn terete, twisted, of uniform thickness when viewed from the side. Keels of palea glabrous and smooth. Lodicules thick, shortly 2-dentate at apex, usually shorter than ovary.

1. A. pubescens (Hudson) Dumort., *Bull. Soc. Bot. Belg.* **7**: 68 (1868) (*Avena pubescens* Hudson, *Avenastrum pubescens* (Hudson) Opiz, *Arrhenatherum pubescens* (Hudson) Samp.). Laxly caespitose, with short extravaginal stolons. Stems 30–100 cm. Basal leaves 10–30 cm × 2–6 mm, flat or conduplicate, soft, green, subobtuse, usually with long hairs, the margin very narrowly cartilaginous and smooth; sheaths of basal leaves closed nearly to the mouth, usually shortly hairy; ligule 0·5–1 mm and more or less truncate in basal, 5–8 mm and acute in cauline leaves. Panicle (6–)8–15(–20) cm; branches slender, more or less flexuous, 2–6(–9) at lower nodes. Spikelets usually pale green and white, with 2–4 florets; rhachilla-segments 2·5 mm, villous with hairs 3–6 mm; callus-hairs 2–3 mm. Lower glume 1(–3)-veined. Lemma soft, weakly veined, denticulate at apex. $2n = 14 + 0$–2B. *Meadows, pastures and wood-clearings. From arctic Norway southwards to N. Portugal, C. Appennini and Bulgaria.* Al Au Be Br Bu Cz Da Fe Ga Ge Hb He Ho Hs Hu Is It Ju Lu No Po Rm Rs (?N, B, C, W, E) Su.

(a) Subsp. **pubescens**: Spikelets 10–17 mm, usually with 2–3 florets. Lower glume 7–13 mm, the upper 10–18 mm and about as long as florets. Lemma 9–13 mm; awn 12–22 mm. *Throughout the range of the species.*

(b) Subsp. **laevigata** (Schur) J. Holub, *Folia Geobot. Phytotax. (Praha)* **11**: 295 (1976) (*Avena laevigata* Schur): Spikelets 15–20(–26) mm, with 3–4 florets. Lower glume 10–17(–20) mm, the upper 14–21(–26) mm and longer than florets. Lemma 11–16 (–20) mm; awn 16–26 mm. *W. & S. Alps, S. & E. Carpathians.*

Plants from mountain regions, with bronze and violet variegated spikelets, 3-veined lower glume, upper glume 13–18 mm and lemma 11–15 mm, have been given specific status as **Avena amethystina** Clarion ex DC. in Lam. & DC., *Fl. Fr.* ed. 3, **3**: 56 (1805) and **Avena lucida** Bertol., *Fl. Ital.* **1**: 701 (1835); their status is uncertain and requires further investigation.

Subgen. **Avenula**. Cartilaginous margin of basal leaves serrate. Glumes 3(–5)-veined. Veins of lemma reaching the upper margin. Lower part of the awn flattened, twisted, alternately thick and thin when viewed from the side. Keels of palea shortly ciliate or aculeolate. Lodicules thin, long-acuminate, with a lateral tooth, longer than ovary.

Sect. AVENULA. Basal leaves in cross-section without a continuous subepidermal layer of sclerenchyma beneath. Rhachilla-segments glabrous or with hairs not more than 3 mm.

2. A. versicolor (Vill.) Laínz, *Comun. Inst. Nac. Invest. Agrar., Ser. Recurs. Nat.* (*Madrid*) **1974(2)**: 23 (1974) (*Avena versicolor* Vill., *Avenastrum versicolor* (Vill.) Fritsch). Laxly caespitose, with extravaginal shoots. Stems 15–40(–50) cm, slender. Basal leaves 5–20 cm × 2–4·5 mm, glaucescent, smooth, with 3–4 lateral veins on each side of mid-vein; upper cauline leaf (1–)2–7(–12) cm, more or less patent; sheaths of basal leaves entire in the lower $\frac{1}{3}$(–$\frac{1}{2}$); ligule 1–2 mm in basal, 3–5 mm in cauline leaves. Panicle (2–)3–8(–10) cm, with 1–2 branches at lower nodes. Spikelets 10–15 mm, with 4–6 florets, shiny, brown; rhachilla-segments 1·5–2 mm, with dense hairs 2 mm; callus-hairs *c.* 1 mm. Lemma 8–11 mm, indurate, brown and distinctly veined in the lower $\frac{1}{2}$, 2-fid and shortly 2-setose at apex. *Alpine meadows and pastures; calcifuge.* ● *Mountains of C. & S. Europe from the Carpathians to the Pyrenees, C. Appennini and S.W. Bulgaria.* Au Bu Cz Ga Ge He Hs It Ju Po Rm Rs (W).

(a) Subsp. **versicolor**: Basal leaves usually flat, rather soft. Upper cauline leaf (1–)2–7(–12) cm. Panicle oblong-ovate, with 5–14 spikelets; branches scabridulous. Spikelets variegated with brown and violet. Lower glume 6–10 mm, the upper 8–12 mm. $2n=14+0$–3B. *Throughout the range of the species except the Appennini and Alpi Apuane.*

(b) Subsp. **pretutiana** (Parl. ex Arcangeli) J. Holub, *Folia Geobot. Phytotax* (*Praha*) **11**: 295 (1976) (*Avena scheuchzeri* subsp. *pretutiana* Parl. ex Arcangeli): Basal leaves usually conduplicate, rather stiff. Upper cauline leaf very short. Panicle linear-oblong, with 12–18 spikelets; branches scabrid. Spikelets brown, not variegated with violet. Lower glume 9–11 mm, the upper 11–13 mm. $2n=14$. *N. & C. Appennini, Alpi Apuane.*

3. A. schelliana (Hackel) W. Sauer & Chmelitschek, *Mitt. Bot. Staatssamm.* (*München*) **12**: 582 (1976) (*Avena schelliana* (Hackel) Roshev.). Laxly caespitose, with extravaginal shoots. Stems 40–80 cm. Basal leaves 10–20 cm × 2–4 mm, usually flat, glaucescent, with 5–6 lateral veins on each side of mid-vein; upper cauline leaf 2–4 cm; sheaths of basal leaves slightly compressed; ligule 0·5–3 mm in basal, 3–5 mm in cauline leaves. Panicle 5–15 cm, with 12–30(–40) spikelets; branches scabridulous, 1–2 (–3) at the lower nodes. Spikelets 10–16(–17) mm, pale brown, with (3–)4–6 florets; rhachilla-segments 1·5–2 mm, with hairs 1–1·5 mm. Lower glume 7–10 mm, the upper 9–13 mm. Lemma 8–12 mm, brownish, greenish and whitish, slightly indurate, veined, subobtuse. $2n=14$. *Steppes and dry meadows. S. & C. parts of U.S.S.R., from C. Ural to W. Ukraine.* Rs (C, W, K, E).

The relationship of this species with **A. hookeri** (Scribner) J. Holub, *Folia Geobot. Phytotax.* (*Praha*) **11**: 295 (1976), described from North America, requires further investigation. Relationships between plants from Europe and from East Asia (whence **3** was described) also require investigation.

(4–7). A. marginata group. Basal leaves usually laxly spirally twisted when dead; upper cauline leaf not more than 2 cm, appressed to stem; sheaths of basal leaves slightly compressed. Panicle often brownish. Spikelets 10–20 mm, with (3–)4–6(–8) florets. Lemma indurate, often brown in the lower half, longitudinally sulcate at least at base, the veins prominent, excurrent in 2(4) setae at apex.

1 Ligule of upper cauline leaf 2–3·5 mm; basal leaves $\frac{1}{12}$–$\frac{1}{10}$ as long as stem; spikelets 10–12 mm, with 3–5 florets **7. delicatula**

1 Ligule of upper cauline leaf 3–10 mm; basal leaves $\frac{1}{10}$–$\frac{1}{2}$ as long as stems; spikelets 10–20 mm, with 4–6 florets
2 Lemma glabrous, distinctly sulcate along the veins in the lower $\frac{1}{2}$; basal leaves flat or loosely conduplicate; plant caespitose **4. marginata**
2 Lemma usually sericeous in the lower part, distinctly sulcate along the veins only at the glabrous base; basal leaves ± conduplicate; plant stoloniferous
3 Basal leaves ± smooth, 2–4 mm wide, with 7–11 lateral veins on each side of mid-vein; callus-hairs 2–3 mm, reddish-brown **5. albinervis**
3 Basal leaves distinctly papillose, 1·5–2·5 mm wide, with 4–6 lateral veins on each side of mid-vein; callus-hairs 1–2 mm, whitish **6. occidentalis**

4. A. marginata (Lowe) J. Holub, *Preslia* **49**: 219 (1977) (*Avena marginata* Lowe). Caespitose. Basal leaves flat or loosely conduplicate, subobtuse; ligule 1–3(–7) mm in basal, 4–10 mm in cauline leaves. Panicle 6–15(–20) cm, greyish-violet-brown or greenish; branches 2–5 cm, slender, scabrid, 1–3 at lower nodes, the primary with 1–3(–5) spikelets. Spikelets 10–20 mm; rhachilla-segments 1·5–2·5 mm, with often brownish hairs towards apex. Lemma glabrous, longitudinally sulcate in the lower $\frac{1}{2}$. $2n=14$. *Dry meadows and wood-margins; usually calcifuge. W. Europe, northwards to N.W. France.* Ga Hs Lu.

1 Upper glume not more than 11 mm (c) subsp. **pyrenaica**
1 Upper glume at least 12 mm
2 Lemma 13–16 mm, yellowish-green throughout (a) subsp. **marginata**
2 Lemma 10–13 mm, reddish-brown in lower half (b) subsp. **sulcata**

(a) Subsp. **marginata**: Stems 40–100 cm × 2–3 mm. Basal leaves 8–15 cm × 2–5 mm, $\frac{1}{7}$–$\frac{1}{5}$ as long as stem, with 10–14 lateral veins on each side of mid-vein. Upper cauline leaf 0·5–1 cm, longer than its ligule. Panicle 10–15(–20) cm, with 12–36 spikelets. Rhachilla-segments with hairs 2–3 mm. Lower glume 12–14 mm, the upper 15–17 mm. Lemma 13–16 mm, uniformly yellowish-green, with 2 apical setae 1·5–2 mm. Anthers 4–5 mm. *W.C. Portugal* (*Serra de Sintra*). (*Madeira.*)

(b) Subsp. **sulcata** (Gay ex Delastre) Franco, *Bot. Jour. Linn. Soc.* **78**: 236 (1979) (*Avena sulcata* Gay ex Delastre): Like subsp. (a) but basal leaves up to 25(–40) cm × 6(–8) mm, $\frac{1}{5}$–$\frac{2}{5}$ as long as stem; upper cauline leaf up to 2 cm; lower glume 9–12 mm, the upper 12–15 mm; lemma 10–13 mm, deeply sulcate, reddish-brown in lower $\frac{1}{2}$, lighter above, with 2 apical setae 0·8–1·2 mm. *Throughout most of the range of the species.*

(c) Subsp. **pyrenaica** J. Holub, *Preslia* **49**: 208 (1977): Stems 20–40(–80) cm × 1–1·5 mm. Basal leaves (2–)6–10(–15) cm × (0·4–)0·8–2(–3) mm, $\frac{1}{10}$–$\frac{1}{6}$ as long as stem, with 7–11 lateral veins on each side of mid-vein. Upper cauline leaf 0·2–0·7 cm, sometimes shorter than its ligule. Panicle 6–12(–15) cm, with 3–16 (–25) spikelets. Rhachilla-segments with hairs 1·5–2 mm. Lower glume 7–9 mm, the upper 10–11 mm. Lemma 9–10 mm,

moderately sulcate. Anthers 3·5–4 mm. ● *Pyrenees, N.E. Portugal.*

Plants from Portugal are usually taller and have narrower leaves than those from the Pyrenees and the lemma is uniformly yellowish-green. They may represent an additional subspecies, but require further investigation.

5. A. albinervis (Boiss.) Laínz, *Comun. Inst. Nac. Invest. Agrar., Ser. Recurs. Nat. (Madrid)* **1974(2)**: 23 (1974) (*Avena albinervis* Boiss.). Stoloniferous. Stems 30–60 cm. Basal leaves 7–20(–25) cm × (2–)3–5(–7) mm, ¼–½ as long as stem, usually flat, greyish-green, more or less smooth on both surfaces, with 7–11 lateral veins on each side of mid-vein, laxly spirally twisted when dead; upper cauline leaf 0·5–1·5 cm, appressed to stem; ligule 0·5–2 mm in basal, 3–5 mm in cauline leaves. Panicle 7–16 cm, brownish, with 11–40 spikelets; branches scabrid, 2(–3) at lower nodes. Spikelets 12–16(–20) mm; hairs of rhachilla-segments 1·5–2 mm; callus-hairs 2–3 mm, reddish-brown. Lower glume 10–12 mm, the upper 11–14 mm. Lemma 10–14 mm, brown and sericeous in the lower ½, sulcate along the veins only at the glabrous base of the lemma, with inner setae 0·5–1 mm. Palea with keels ciliolate almost throughout. Anthers 3–5 mm. $2n=28$. *Pine-woods and other dry places.* ● *N.W. Portugal, W. & S. Spain.* ?Ga Hs Lu.

6. A. occidentalis (Gervais) J. Holub, *Folia Geobot. Phytotax. (Praha)* **11**: 295 (1976) (*Avenochloa albinervis* subsp. *occidentalis* Gervais). Like **5** but stems 50–100 cm; basal leaves 0·4–3·5 mm wide, usually conduplicate, with 4–6(–7) lateral veins on each side of mid-vein, distinctly papillose beneath; callus-hairs 1–2 mm, whitish. *Dry scrub.* ● *C. & S.W. Portugal.* Lu.

(a) Subsp. **occidentalis**: Basal leaves (0·7–)1·5–2·5(–3·5) mm wide, linear, usually conduplicate, more or less papillose above, strongly spirally twisted when dead; setae of lemma 0·5–1 mm; palea with keels ciliolate only in the median ½. $2n=42$. *C. Portugal.*

(b) Subsp. **stenophylla** Franco, *Bot. Jour. Linn. Soc.* **76**: 359 (1978): Basal leaves 0·4–1 mm wide, linear-filiform, strongly conduplicate, smooth and pruinose above, not or only very laxly twisted when dead; setae of lemma 1–2 mm; palea with keels distinctly ciliolate nearly throughout. *S.W. Portugal.*

7. A. delicatula Franco, *loc. cit.* (1978). Densely caespitose. Stems 20–40 cm × 0·5–1 mm, very slender. Basal leaves 1·5–4 cm × (0·4–)0·8–2 mm, $\frac{1}{12}$–$\frac{1}{10}$ as long as stem, flat or conduplicate, greyish-green, with 3–5 lateral veins on each side of mid-vein, subacute, spirally twisted when dead; upper cauline leaf 0·1–0·7 cm, appressed to stem; ligule 1–3 mm in basal, 2–3·5 mm in cauline leaves. Panicle 2–6 cm, greenish or suffused with violet, with 3–10 spikelets. Spikelets 10–12 mm, with 3–5 florets; rhachilla-segments 1·5–2 mm, with white hairs 0·4–1 mm. Lower glume 7–9 mm, the upper 9–10 mm. Lemma 9–10 mm, uniformly yellowish-green, glabrous, moderately sulcate in lower ½, with 2 apical setae 0·2–0·5 mm. Anthers 3·5–4 mm. *Dry mountain slopes* ● *N.E. Portugal, ?N. Spain.* ?Hs Lu.

8. A. levis (Hackel) J. Holub, *Folia Geobot. Phytotax. (Praha)* **11**: 295 (1976) (*Avena levis* Hackel). Densely caespitose. Stems 20–50(–60) cm. Basal leaves 3–7(–12) cm × 2–4 mm, ½ as long as stem, conduplicate or flat, rigid, laxly spirally twisted, glaucous, pruinose; upper cauline leaf 0·2–1·2 cm; sheaths of basal leaves short, slightly compressed, ciliate at the mouth; ligule 1–1·5 mm in basal, 3–7 mm in cauline leaves. Panicle 6–13 cm, with 6–8 spikelets; branches 0·5–1·5 cm, more or less smooth, 1–2 at lower nodes. Spikelets 14–18(–22) mm, deep or yellowish-green, shiny, with 5–7 florets; rhachilla-segments *c.* 2 mm, with hairs 1·5–2·5 mm. Glumes smooth, the lower 9–11 mm, the upper 12–14(–15) mm. Lemma 9–12(–14) mm, indurate in the lower part, narrowed in the upper ¼, subobtuse. $2n=14$. *Alpine meadows and pastures, on schistose rocks.* ● *S. Spain (Sierra Nevada).* Hs.

The occurrence of this species in Morocco is doubtful.

9. A. compressa (Heuffel) W. Sauer & Chmelitschek, *Mitt. Bot. Staatssamm. (München)* **12**: 582 (1976) (*Avena compressa* Heuffel). Caespitose. Stems 30–70(–100) cm, slightly compressed at the base. Basal leaves 5–15 cm × 2–5 mm, flat or loosely conduplicate, glaucescent, with *c.* 6 lateral veins on each side of mid-vein; upper cauline leaf 1–4(–6) cm, appressed to stem; sheaths of basal leaves compressed; ligule 1·5–3 mm in basal, 4–10 mm in cauline leaves. Panicle 7–15 cm, brownish, with (5–)10–24(–27) spikelets; branches scabridulous, 1–2(–3) at lower nodes. Spikelets 14–21 mm, with 4–9 florets; rhachilla-segments 1·5–2·5 mm, glabrous; callus-hairs 0·5–1 mm, about reaching the base of the lemma. Lower glume 8–12 mm, the upper 10–15 mm. Lemma 9–14 mm, indurate, reddish-brown and sulcate in the lower ½, prominently veined, scabrid, narrowed in the upper ¼, subobtuse and 2-fid. $2n=14$. *Dry, stony slopes, wood-margins and -clearings. S.E. & E.C. Europe, northwards to N. Hungary and eastwards to Krym.* Bu Gr Hu Ju Rm Rs (K) Tu.

10. A. aetolica (Rech. fil.) J. Holub, *Folia Geobot. Phytotax. (Praha)* **11**: 294 (1976) (*Avenastrum aetolicum* Rech. fil.). Laxly caespitose, with short stolons. Stems 20–60 cm, slender. Basal leaves 4–8 cm × 1·5–2 mm, conduplicate, obtuse, smooth except for margins; ligule 4–6 mm in both basal and cauline leaves. Panicle 5–10 cm; branches 6–10 mm, slender, scabrid, usually solitary. Spikelets *c.* 20 mm, with 5–7 florets, shiny; rhachilla-segments 2–2·5 mm, with hairs *c.* 1·5 mm. Glumes acute, the lower *c.* 11 mm, the upper 14 mm. Lemma 12–14 mm, pale green, weakly veined, 2-fid. *Calcareous mountain screes.* ● *C. Greece.* Gr.

11. A. blavii (Ascherson & Janka) W. Sauer & Chmelitschek, *Mitt. Bot. Staatssamm. (München)* **12**: 582 (1976) (*Avena blavii* Ascherson & Janka). Densely caespitose, shortly stoloniferous. Stems 30–60 cm, slender. Basal leaves 15–30 cm, ⅓(–½) as long as stem, closely convolute, setaceous, 0·4–0·6 mm in diameter, with 3 lateral veins on each side of mid-vein; cross section suborbicular in outline; cartilaginous margin and mid-vein not distinct beneath; cauline leaves 5–7 cm, setaceous, very acute; ligule 1–2 mm in basal, 2–4 mm in cauline leaves. Panicle 4–13 cm, simple, with 4–9(–17) spikelets. Spikelets 15–30(–35) mm, with 4–7 florets; rhachilla-segments 2–3 mm, with hairs 1·5–2·5 mm. Lower glume 10–15 mm, the upper 14–20 mm. Lemma 12–18 mm, slightly veined, narrowed upwards from the middle. *Stony slopes and rocks; calcicole.* ● *Mountains of C. & S.W. Jugoslavia.* ?Al Ju.

12. A. mirandana (Sennen) J. Holub, *Folia Geobot. Phytotax. (Praha)* **11**: 295 (1976) (*Avena mirandana* Sennen). Stoloniferous. Stems 30–60(–80) cm × 1–2 mm. Basal leaves 6–15 cm × (0·3–)0·5–2(–2·5) mm, conduplicate, convex and deeply striate outside; ligule 0·5–3 mm in basal, 3–7(–10) mm in cauline leaves. Panicle 8–14 cm, more or less simple, with 3–12 spikelets; branches scabridulous. Spikelets 15–20 mm, with 4–6 florets; rhachilla-segments 2–3 mm, glabrous or with hairs 1–1·5 mm in the upper part; callus-hairs 1·5–2·5(–3) mm. Glumes very acute, the lower 9–12 mm, the upper 11–15 mm. Lemma 10–14 mm, stramineous or brown in the lower ½, narrowed in the upper ⅓, subobtuse,

shortly 2-fid at apex. $2n=98$. *Dry slopes. N. Spain.* Hs. (*N.W. Africa.*)

13. A. gonzaloi (Sennen) J. Holub, *loc. cit.* (1976) (*Avena pratensis* subsp. *iberica* var. *gonzaloi* Sennen). Caespitose, stoloniferous. Stems 50–90(–100) cm. Basal leaves 10–20 cm, 0·8–1 mm wide when conduplicate, usually closely conduplicate below and flat above, up to $\frac{1}{4}(-\frac{1}{3})$ as long as stem, scabrid beneath, acute, with *c.* 6 lateral veins on each side of mid-vein, the cross-section ovate-orbicular in outline; ligule 1–2·5 mm in basal, 3–6(–10) mm in cauline leaves. Panicle 10–20 cm, with 7–17 spikelets; branches scabrid, 2(–3) at lower nodes. Spikelets 6–21 mm, with 5–6 florets; rhachilla-segments 2–3 mm, glabrous; callus-hairs *c.* 1 mm. Lower glume 10–12 mm, the upper 13–14 mm. Lemma 12–13 mm, narrowed in the upper $\frac{1}{3}$, denticulate at apex. *Dry places.* ● *E. & C. Spain.* Hs.

Plants with basal leaves 3–4 mm wide, sulcate beneath, up to half as long as stem, panicle 18–26 cm, and spikelets 20–25 mm, with 6–8 florets, were described from N.E. Spain as **Avena bromoides** subsp. **iberica** var. **sennenii** St-Yves, *Candollea* **4**: 457 (1931); they may represent a further species, related to **12** or **13.**

14. A. requienii (Mutel) J. Holub, *Folia Geobot. Phytotax. (Praha)* **11**: 295 (1976) (*Avena requienii* Mutel). Caespitose, with short stolons. Stems 60–100 cm, robust. Basal leaves 30–50 cm × 1·2–1·3 mm, more or less junciform, rigid, up to $\frac{1}{2}$ as long as stem, acute, with 4–5 lateral veins on each side of mid-vein, the cross-section orbicular in outline; sheaths of cauline leaves deeply sulcate; ligule 1·5–4·5 mm and hairy in basal leaves, 6–10 mm in cauline leaves. Panicle 15–20 cm, with 14–17 spikelets; branches scabrid, the primary with 2–3 remote spikelets. Spikelets 16–23 mm, with 4–7 florets; rhachilla-segments 2·5–3 mm, with hairs 2–2·5 mm. Lower glume *c.* 13 mm, the upper *c.* 17 mm. Lemma 14–16 mm. $2n=112, 126, 133, 147$. *Dry places.* ● *S.W. France, N.E. & C. Spain.* Ga Hs.

The varied chromosome-numbers suggest that **14** probably includes several taxa of hybrid origin. Further investigation is required.

15. A. pungens (Sennen ex St-Yves) J. Holub, *Preslia* **49**: 219 (1977) (*Avena pratensis* subsp. *pratensis* var. *pungens* Sennen ex St-Yves). Densely caespitose. Stems 50–80 cm, robust, shortly hairy above. Basal leaves 1·5–2 mm in diameter, closely convolute, subcylindrical, up to $\frac{1}{4}$ as long as stem, slightly sulcate beneath, attenuate into a long, pungent apex; ligule 2–2·5 mm in basal, 8–10 mm in cauline leaves. Panicle 12–17 cm; branches more or less smooth, 2 at lower nodes, the primary with (1–)2–3 spikelets. Spikelets *c.* 20 mm, with *c.* 5 florets, suffused with violet; rhachilla-segments 3 mm, with hairs 2–3 mm in the upper part only. Lower glume *c.* 10 mm, the upper *c.* 14 mm. Lemma *c.* 14 mm, more or less violet at base, narrowed in the upper $\frac{1}{3}$, acute and entire at apex. Palea *c.* 10 mm. *Dry places.* ● *E. Pyrenees.* ?Ga Hs.

Apparently known only from Llivia, a small Spanish enclave N.E. of Puigcerdá, surrounded by French territory.

16. A. pratensis (L.) Dumort., *Bull. Soc. Bot. Belg.* **7**: 68 (1868) (*Avena pratensis* L., *Avenastrum pratense* (L.) Opiz, *Arrhenatherum pratense* (L.) Samp.). Caespitose. Stems 30–80(–100) cm. Basal leaves 5–25 cm × 1–3(–4) mm, usually conduplicate, greyish-green, pruinose above, with 3–8 lateral veins on each side of mid-vein, the cross-section usually elliptical in outline; upper cauline leaf 0·5–3 cm, obtuse; sheaths of basal leaves subterete; ligule 0·5–1 mm in basal, 3–5(–7) mm in cauline leaves. Panicle 5–16(–20) cm, spiciform, with 5–18 spikelets; branches scabrid, 1–2 at lower nodes, the primary with 1–2 spikelets. Spikelets 12–23(–28) mm, with (3–)4–6(–8) florets; rhachilla-segments 2–3 mm, with hairs 2–3 mm; callus-hairs 1–2 mm. Lower glume 10–15 mm, the upper 12–18(–20) mm. Lemma (10–)12–16 mm. $2n=126$. *Dry grassland and open woods.* ● *W. & C. Europe and W. & S. Fennoscandia, extending southwards to N.E. Spain.* Au Be Br Cz Da Fe Ga Ge He Ho Hs It ?Ju No Po ?Rm Rs (B, C, ?W) Su.

(a) Subsp. **pratensis**: All basal leaves glabrous. *Throughout the range of the species.*

(b) Subsp. **hirtifolia** (Podp.) J. Holub, *Folia Geobot. Phytotax. (Praha)* **11**: 295 (1976) (*Avenastrum pratense* var. *hirtifolium* Podp.): At least the youngest basal leaves sparsely hairy beneath. *C. Czechoslovakia, N.E. Austria.*

The occurrence of **16** in S.E. Europe needs confirmation, as most records refer to **17.** Plants from the mountains of Scotland and N. England, with larger and more strongly coloured spikelets, described as **Avena alpina** Sm., *Trans. Linn. Soc. London* **10**: 335 (1811), may represent a distinct taxon.

17. A. praeusta (Reichenb.) J. Holub, *Folia Geobot. Phytotax. (Praha)* **11**: 295 (1976) (*Avena praeusta* Reichenb., *A. alpina* auct., non Sm.). Laxly caespitose, with short stolons. Stems 60–110 (–130) cm, compressed below. Basal leaves 15–40(–60) cm × 2–6 mm, completely or partly flat, glaucous and scabrid above, with 6–10 lateral veins on each side of mid-vein; upper cauline leaf 1–5 cm. Sheaths of basal leaves compressed. Ligule *c.* 1 mm in basal, 4–7 mm in cauline leaves. Panicle 8–21 cm, with 12–30 (–40) spikelets; branches scabrid, (1–)2 at lower nodes, the primary with (1–)2–3(–4) spikelets. Spikelets 16–22(–25) mm, greenish, only slightly suffused with violet; rhachilla-segments 2·5–3 mm, with hairs 2–3 mm; callus-hairs 2 mm. Lower glume 8–13 mm, the upper 13–18 mm. Lemma 11–16 mm, narrowed upwards from the middle. $2n=126$. *Dry slopes and wood-clearings.* ● *C. & S.E. Europe.* Au Cz Hu It Ju Rm Rs (W).

17 is morphologically intermediate between **16** and **18.** Some populations of robust plants with flat basal leaves 3–7 mm wide, strongly compressed basal sheaths and a large panicle with 10–40 spikelets are similar to **18**; they have been called **Avena planiculmis** var. **taurinensis** Belli, *Malpighia* **4**: 363 (1890) or **A. adsurgens** Schur ex Simonkai, *Enum. Fl. Transs.* 547 (1887). Their taxonomic status is uncertain, as is that of **Avena pseudoviolacea** A. Kerner ex Dalla Torre, *Anleit. Beob. Bestimm. Alpenpfl.* 228 (1882), and **A. ausserdorferi** (Ascherson & Graebner) Dalla Torre & Sarnth., *Fl. Tirol* **6(1)**: 199 (1906), both from high mountains in the C. Alps. The former has the panicle with few, deep violet spikelets and the panicle-branches more or less smooth. The latter differs mainly in the completely smooth panicle-branches and greenish spikelets.

18. A. planiculmis (Schrader) W. Sauer & Chmelitschek, *Mitt. Bot. Staatssamm. (München)* **12**: 533 (1976) (*Avena planiculmis* Schrader). Laxly caespitose, with stolons up to 10 cm. Stems robust, scabrid above. Basal leaves flat or loosely conduplicate, with long whitish cilia towards the base, with 8–16 lateral veins on each side of mid-vein; sheaths of basal leaves strongly compressed, scabrid; ligule 1–2(–4) mm in basal, 3–10 mm in cauline leaves. Panicle dense, compound, often interrupted below. Spikelets with (4–)5–8 florets, usually variegated with brown, violet and white; rhachilla-segments *c.* 3 mm, with hairs 1·5–2·5 mm. Lower glume 10–12 mm, the upper 13–17 mm. Lemma 13–17 mm, indurate and distinctly veined in the lower $\frac{1}{2}$. $2n=126$. *Mountain grassland and scrub. E. Sudeten Mts, Carpathians and mountains of Balkan peninsula.* Bu Cz Ju Po Rm Rs (W).

(a) Subsp. **planiculmis**: Stems 60–120 cm × *c.* 3 mm. Basal leaves 6–12 mm wide, deep green. Panicle 13–26(–30) cm, with 15–40(–55) spikelets; branches 2–3 at lower nodes, the primary with 2–5 spikelets. Spikelets 20–28(–35) mm. ● *E. Sudeten Mts, N. Carpathians.*

(b) Subsp. **angustior** J. Holub, *Preslia* **49**: 209 (1977): Stems 30–80(–100) cm × 1·5–2·5 mm. Basal leaves 4–7 mm wide, greyish-green. Panicle 7–23(–30) cm, with (6–)10–35 spikelets; branches usually 2 at lower nodes, the primary with 1–3 spikelets. Spikelets 15–25 mm. *Carpathians and mountains of Balkan peninsula.*

19. A. bromoides (Gouan) H. Scholz, *Willdenowia* **7**: 420 (1974) (*Avena bromoides* Gouan). Caespitose. Stems 25–50(–70) cm, smooth. Basal leaves 3–15 cm × 1·5–3(–4) mm, up to $\frac{1}{6}$–$\frac{1}{3}$ as long as stem, flat or conduplicate, glaucous, pruinose, smooth except for the distinct cartilaginous margin, spirally twisted when dead, flat beneath, with vascular bundles separated from subepidermal sclerenchyma by chlorenchyma; upper cauline leaf 0·2–1·5 cm; ligule 0·5–1(–2) mm in basal, 2–6 (–10) mm in cauline leaves. Panicle 6–15(–20) cm, with 5–15 spikelets. Spikelets (10–)12–20(–22) mm, with 7–8 florets; rhachilla-segments 1·5–3 mm, glabrous; callus-hairs 0·4–0·8 mm, not reaching beyond the base of the lemma. Glumes obtuse, the lower 6–9 mm, the upper 8–11 mm. Lemma 8–13 mm, soft, sometimes sericeous in the lower $\frac{1}{3}$, narrowed in the upper $\frac{1}{4}$–$\frac{1}{3}$ and irregularly denticulate at apex; awns divaricate. $2n = 14 + 0$–2B. *Dry meadows and stony ground. S.W. Europe.* Bl Ga Hs It Lu.

Tetraploid and hexaploid chromosome-numbers recorded for material from S. Spain refer to **24** or **25**.

20. A. murcica J. Holub, *Preslia* **49**: 206 (1977). Caespitose. Stems 30–45 cm × 0·5–1 mm; nodes dark violet. Basal leaves 2–7 cm × 0·3–0·4 mm, setaceous, $\frac{1}{10}$–$\frac{1}{6}$ as long as stem, not spirally twisted when dead, strongly scabrid, convex beneath; cartilaginous margin and main vein not distinct; upper cauline leaf 0·3–0·9 cm; ligule of cauline leaves 1–2 mm. Panicle simple, with 2–8 more or less sessile spikelets. Spikelets 14–15 mm, punctulate-scabrid; rhachilla-segments 1·5–2 mm, glabrous; callus-hairs 0·8–1 mm. Lower glume 7–8 mm, the upper *c.* 9 mm. Lemma 9–10 mm, usually hairy below, narrowed in the upper $\frac{1}{3}$, rounded-truncate and irregularly denticulate at apex. *Dry places.* ● *S. Spain, S.E. Portugal.* Hs Lu.

21. A. cincinnata (Ten.) J. Holub, *Folia Geobot. Phytotax. (Praha)* **11**: 294 (1976) (*Bromus cincinnatus* Ten., *Avena australis* Parl.). Caespitose. Stems 40–80 cm × *c.*1 mm. Basal leaves 10–15 cm × 2–3 mm, more or less flat to loosely conduplicate, glaucous, with a distinct cartilaginous margin, sulcate beneath, twisted into a lax spiral when dead, the cross-section oblong in outline; vascular bundles separated from the distinct groups of subepidermal sclerenchyma by chlorenchyma; upper cauline leaf 0·5–3 cm; ligule 1–1·5 mm in basal, 4–5 mm in cauline leaves. Panicle 6–12(–15) cm, with 6–17 spikelets. Spikelets 18–24 mm, with 5–7 florets; rhachilla-segments 2–3 mm, more or less glabrous; callus-hairs *c.* 1·5 mm, exceeding base of lemma. Glumes narrowly lanceolate, acute, the lower 10–14 mm, the upper 13–18 mm. Lemma 12–16 mm, narrowed upwards from middle, acute, 2-fid, glabrous. $2n = 14$. *Dry places. S. Italy, Sicilia.* ?Bl ?Hs It Si.

Records from Spain and Islas Baleares need confirmation.

22. A. peloponnesiaca J. Holub, *Preslia* **49**: 207 (1977). Like **21** but with long stolons; stems 1·5–2 mm in diameter; spikelets (20–)25–30 mm, with 7–9 florets; lemma narrowed in the upper $\frac{1}{3}$, subtruncate, shortly 2-fid or irregularly denticulate at apex. *Stony mountainsides.* ● *S. Greece (S. Peloponnisos).* Gr.

A. agropyroides (Boiss.) J. Holub, *Folia Geobot. Phytotax. (Praha)* **11**: 294 (1976) (*Avena agropyroides* Boiss., *Avenastrum agropyroides* (Boiss.) Halácsy), collected in S.E. Greece (Argolis) in 1841, has not been refound since. It is like **21** but has 8–9 spikelets 15–18 mm, in a simple panicle, with the branches solitary at the nodes. The lemma has silky hairs in the lower half.

23. A. cycladum (Rech. fil. & Scheffer) W. Greuter, *Ann. Mus. Goulandris* **1**: 75 (1973) (*Avenastrum cycladum* Rech. fil. & Scheffer, ?*Avena sibthorpii* Nyman). Densely caespitose. Stem 20–30(–50) cm, slender, rigid, erect. Basal leaves 2–5 cm × 1·5–2 mm, conduplicate, rigid, recurved, pruinose, smooth except for margin, the lateral veins not connected with the epidermis by sclerenchyma; upper cauline leaf very short; sheaths of basal leaves smooth, keeled; ligule 2–3 mm in basal, 3–4 mm in cauline leaves. Panicle 5–7 cm, with (2–)4–7 spikelets; branches 1–2 at lower nodes, rigid, very short; some spikelets subsessile. Spikelets 15–22 mm, with 3–5 florets; rhachilla-segments hairy, glabrous in the lower $\frac{1}{3}$. Lower glume *c.* 12 mm, the upper *c.* 17 mm, 3- to 5-veined. *Dry, stony places.* ● *Kikladhes, Kriti.* Cr Gr.

24. A. gervaisii J. Holub, *Preslia* **49**: 205 (1977). Caespitose. Stems 50–80 cm × 1–2 mm, moderately scabrid; nodes violet. Basal leaves 10–40 cm × *c.* 0·6 mm, usually convolute, greyish-green, sulcate outside; upper cauline leaf 3–8 cm, patent; sheaths greyish-violet, scabrid; ligule 1·5–3·5 mm in basal, 4–7 mm in cauline leaves. Panicle 10–22 cm, with (6–)13–21(–27) spikelets. Spikelets 18–30 mm, with 7–9 florets, greenish-stramineous; rhachilla-segments 1·5–2·5 mm, glabrous; callus-hairs 0·5–1 mm. Lower glume 10–12 mm, the upper 12–16 mm. Lemma 12–15 mm, pale greenish, broadly hyaline at apex, slightly sericeous in the lower $\frac{1}{3}$, narrowed in the upper $\frac{1}{3}$, shortly 2-fid and 2-setose at apex. *Dry hillsides.* ● *S. Spain.* Hs.

25. A. pruinosa (Batt. & Trabut) J. Holub, *Folia Geobot. Phytotax. (Praha)* **11**: 295 (1976) (*Avena pruinosa* Batt. & Trabut). Stoloniferous. Stems 50–80 cm, Basal leaves 20–25 cm × 1·1–1·5 mm, usually convolute, more or less rigid, glaucous, with distinctly cartilaginous margin and mid-vein, strongly scabrid, sulcate beneath, somewhat spirally twisted when dead, the cross-section broadly elliptical to suborbicular in outline; vascular bundles separated from the subepidermal sclerenchyma by chlorenchyma; upper cauline leaf *c.* 1·5 cm; sheaths of basal leaves glabrous or ciliate; ligule 1–2 mm in basal, 3–4 mm in cauline leaves. Panicle 7–13(–15) cm, with 10–16 spikelets; branches 1–2 at lower nodes, with 1 spikelet. Spikelets (18–)22–30(–35) mm, with 5–7 florets; rhachilla-segments 3 mm, with hairs 0·6 mm; callus-hairs 1 mm. Lower glume 14–17 mm, the upper 17–20 mm. Lemma 14–18 mm, narrowed upwards from the middle. *Dry places. S. Spain.* Hs. (*N.W. Africa.*)

26. A. crassifolia (Font Quer) J. Holub, *loc. cit.* (1976) (*Avena crassifolia* Font Quer). Like **25** but basal leaves thicker, conduplicate and 1·5–2 mm in diameter or more or less flat and *c.* 4 mm wide, not or scarcely sulcate; sheaths of basal leaves densely sericeous; panicle 15–22 cm; primary branches with 1–2 spikelets; lemma often with 2 setae at apex. *Dry places.* ● *Islas Baleares.* Bl.

Sect. SCLERAVENASTRUM (J. Holub) J. Holub. Basal leaves with a continuous layer of subepidermal sclerenchyma. Hairs of rhachilla-segments 2·5–4 mm.

27. A. hackelii (Henriq.) J. Holub, *loc. cit.* (1976) (*Avena hackelii* Henriq.). Densely caespitose, with intravaginal shoots. Stems 40–80 cm. Basal leaves 20–45 cm × 0·5–0·7 mm, narrowly junciform, rigid, scabrid, pungent, with indistinct cartilaginous margin and mid-vein, the cross-section more or less orbicular in outline; upper cauline leaf 0·7–2·5(–3·5) cm; sheaths of basal leaves greyish-violet, ciliate at mouth; ligule 1–1·5 mm in basal, 5–8 mm in cauline leaves. Panicle 7–20 cm, with 7–17 spikelets; branches scabrid, 2 at lower nodes. Spikelets 15–21 mm, with 4–7 florets; rhachilla-segments 2–2·5 mm, with hairs 2·5–4 mm; callus hairs 2–3 mm. Lower glume 10–14 mm, the upper 12–18 mm. Lemma 11–17 mm, indurate and slightly sulcate in the lower ⅓, acuminate, 2- to 4-denticulate to -setose at apex. *Dry places.* ● *S.W. Portugal.* Lu.

63. Danthoniastrum (J. Holub) J. Holub[1]

Like *Helictotrichon* but panicle spicate, with few spikelets; lower glume (3–)5-veined, the upper 5- to 7-veined; lemma deeply 2-dentate, with long, soft hairs below; awn arising from the sinus, geniculate, the basal part compressed and 3-veined; lodicules 3, hairy.

Literature: B. R. Baum, *Österr. Bot. Zeitschr.* **122**: 51–57 (1973).

1. D. compactum (Boiss. & Heldr.) J. Holub, *Folia Geobot. Phytotax. (Praha)* **5**: 436 (1970) (*Avena compacta* Boiss. & Heldr.). Stems 10–30(–50) cm, erect, slender, glabrous, smooth. Leaves 5–18 cm × 0·5–0·8 mm, setaceous, convolute, rigid, somewhat pungent, glabrous, smooth, with caducous lamina; ligule 1–1·5 mm, shortly ciliate at apex; basal sheaths persistent. Panicle 3–6 cm, with (2–)3–6(–7) spikelets; branches up to 6 mm, erect, usually with 1 spikelet. Spikelets 14–20(–25) mm, with (3–)4–7 (–9) florets, yellowish-green, shining. Glumes lanceolate, acuminate, glabrous, the lower (8–)10–14(–15) mm, the upper (9–)11–15(–17) mm. Lemma 8–14 mm, ovate-lanceolate; awn 11–20 mm. Palea 6–11 mm, linear-lanceolate. Anthers 3–4·5 mm. *Mountain rocks and stony pastures; calcicole. S., W. & C. parts of Balkan peninsula.* Al Bu Gr Ju.

64. Arrhenatherum Beauv.[1]

Perennials; basal internodes often swollen and globose. Leaves flat, convolute when young, not strongly ribbed above. Inflorescence a panicle. Spikelets slightly compressed laterally, usually with 2 florets and one rudiment. Lower floret male, with a geniculate dorsal awn arising from the lower ⅓ of lemma, the upper female or hermaphrodite, usually with a short, slender, straight seta, rarely both florets hermaphrodite and awned. Glumes unequal, hyaline, the lower 1- to 3-veined, the upper about as long as florets, 3(–5)-veined. Lemma 5- to 9-veined. Palea shorter than lemma, shortly 2-dentate at apex, ciliate on keels. Lodicules 2. Stamens 3. Florets falling together at maturity. Grain more or less terete, with hilum ½–⅔ its length.

Literature: R. B. Fernandes, *Mem. Soc. Brot.* **6**: 6–11 (1950). B. Kitanov, *Izv. Bot. Inst. (Sofia)* **2**: 195–208 (1951).

1 Lemma of second floret glabrous or with sparse hairs not more than 1 mm; awn of lower floret 10–20 mm, arising in the lower ⅓ of the lemma; rhachilla between first and second florets not more than 0·6 mm **1. elatius**

1 Lemma of second floret with hairs 2–3 mm; awn of lower floret 15–27 mm, arising at the base of the lemma; rhachilla between first and second florets 1–2 mm

2 Spikelets 11–13 mm; grain 4·5–5 mm; lemma 8–11 mm; anthers 4–5 mm **2. palaestinum**

2 Spikelets 7–10 mm; grain 3·5–4 mm; lemma *c.* 8 mm; anthers *c.* 3 mm **3. album**

1. A. elatius (L.) Beauv. ex J. & C. Presl, *Fl. Čechica* 17 (1819). Laxly caespitose. Stems 50–150(–180) cm, smooth, shining. Leaves 10–40 cm × 1–8(–10) mm, green, usually glabrous or subglabrous, more or less scabrid; ligule 1–3 mm, obtuse, usually ciliate. Panicle (5–)10–25(–30) cm, oblong or lanceolate, lax to rather dense. Spikelets 7–10 mm, oblong; rhachilla between first and second florets not more than 0·6 mm. Glumes acute, the lower 4–6 mm, oblong-lanceolate, the upper 7–10 mm, ovate-lanceolate. Lemma 7–10 mm, oblong-lanceolate, subacute, often shortly 2-dentate, glabrous or with sparse hairs up to 1 mm. Awn of the lower floret 10–20 mm, arising in the lower ⅓ of the lemma. Anthers 4–5 mm. Grain 4–5 mm. *Meadows and roadsides. Most of Europe, but absent from much of the north-east.* All except ?Al Cr Rs (N) Sb.

(a) Subsp. **elatius**: Basal internodes not swollen; nodes usually glabrous. $2n=28$. *Throughout the range of the species, but rarer in the south-west.*

(b) Subsp. **bulbosum** (Willd.) Schübler & Martens, *Fl. Würtemberg* 70 (1834): Stems with (1–)2–6(–8) swollen, globose basal internodes 6–10 mm in diameter; nodes often hairy. $2n=28$. *Mainly in S. & W. Europe.*

A. almijarense Gand., *Bull. Soc. Bot. Fr.* **55**: 159 (1908), with smaller tubers, more slender and shorter stems, glaucous leaves, shorter glumes and spiciform panicle was described from S. Spain. It needs further investigation.

Diploid plants ($2n=14$) from S.W. Europe, have been described as **A. elatius** subsp. **sardoum** (E. Schmid) Gamisans, *Candollea* **29**: 46 (1974) (subsp. *braun-blanquetii* P. Monts. & L. Villar, *A. murcicum* Sennen). They are like subsp. (a) but are densely caespitose, with numerous stems 30–65(–80) cm, leaves shorter and not more than 3 mm wide and panicle (3–)6–12 cm, subspicate, with few spikelets; grain 3·5–4 mm. They are recorded from Corse, Sardegna, Pyrenees and S.E. Spain and may be worth specific rank, but further investigation is needed.

2. A. palaestinum Boiss., *Diagn. Pl. Or. Nov.* **2(13)**: 51 (1853) (*A. erianthum* auct. balcan., non Boiss. & Reuter). Caespitose. Stems (40–)50–100(–120) cm × 1–3 mm, with the lower internodes swollen and globose; nodes and swollen internodes glabrous. Leaves usually glabrous, scabrid; ligule short, entire to lacerate, ciliate. Panicle 10–20 cm, oblong, lax. Spikelets 11–13 mm; rhachilla between first and second florets 1–1·5(–2) mm. Glumes more or less acute, the lower 5–6 mm, lanceolate, the upper 9–10 mm, lanceolate-ovate. Lemma 8–11 mm, oblong-lanceolate, shortly 2-dentate, that of the lower floret glabrous, that of the upper floret long-hirsute, except at apex; hairs 2–3 mm; awn of the lower floret 20–27 mm, stout, arising from near the base; seta of the upper floret 4–8 mm, arising in the upper ⅓, or absent. Anthers 4–5 mm. Grain 4·5–5 mm. *Dry grassland. S. part of Balkan peninsula, S. Aegean region.* Bu Cr Gr Ju.

3. A. album (Vahl) W. D. Clayton, *Kew Bull.* **16**: 250 (1962) (*A. erianthum* Boiss. & Reuter). Laxly caespitose. Stems 50–100 cm, with the lower internodes swollen and globose; nodes and swollen internodes hairy or glabrous. Leaves glabrous or hirsute, more or less scabrid; ligule shortly ovate, lacerate. Panicle 10–20(–30) cm, narrow, rather dense. Spikelets 7–10 mm; rhachilla between first and second florets 1–2 mm. Glumes acute, the lower 4–6 mm, the upper *c.* 8 mm. Lemma *c.* 8 mm, that of the lower floret usually long-ciliate in the lower half, with an awn

[1] By J. Holub.

15–25 mm, arising from near the base; lemma of the upper floret hirsute except at apex, and with a seta 3–5 mm; hairs 2–3 mm. Anthers *c.* 3 mm. Grain 3·5–4 mm. $2n=28$. *Dry grassland. C. & S. Spain, Portugal.* Hs Lu.

Intermediates between **1** and **3**, presumably of hybrid origin, occur in Spain and Portugal.

65. **Pseudarrhenatherum** Rouy[1]

Like *Arrhenatherum* but basal internodes never swollen and globose; leaves with prominent ribs on upper surface; awn of the lower floret arising at or above the middle of the lemma; rhachilla disarticulating above the glumes only; grain dorsally compressed, deeply sulcate, with hilum ⅓ its length.

Sheaths, leaves and nodes usually hairy; leaves flat, later convolute; lower glume 3-veined; awn arising in the upper ⅓ of the lemma; spikelets 5–7 mm, yellowish-green, often tinged with violet **1. longifolium**

Sheaths, leaves and nodes usually glabrous; leaves filiform, convolute; lower glume usually 1-veined; awn arising in the lower half of the lemma; spikelets 9–10 mm, pale green **2. pallens**

1. P. longifolium (Thore) Rouy, *Bull. Soc. Bot. Fr.* **68**: 401 (1922) (*Avena longifolia* Thore). Stems (30–)40–120(–150) cm, scabridulous above, hairy at the nodes. Leaves flat, later convolute, 1–4 mm wide, scabrid above, hairy to subglabrous beneath; sheaths of cauline leaves usually with dense deflexed hairs; ligule finely ciliate at apex. Panicle (5–)8–20 cm, elliptical, rather dense. Spikelets 5–7 mm, yellowish-green or tinged with violet. Glumes lanceolate-ovate, acuminate, 3-veined, the lower 4–6 mm, with very short lateral veins, the upper 5–7 mm. Lemma 5–6·5 mm, elliptical, that of the lower floret more or less 2-fid, that of the upper floret acute; awn 7–9 mm, arising in the upper ⅓ of the lemma and the lower twisted part distinctly overtopping it. Palea 4–5 mm, lanceolate. Anthers 2·5–4 mm. Grain 2·5–3 mm. $2n=14$. *Pine-woods and heaths; calcifuge.* ● *W. Europe, from N.W. France to C. Portugal and S. Spain.* Ga Hs Lu.

2. P. pallens (Link) J. Holub, *Taxon* **15**: 167 (1966) (*Avena pallens* Link). Like **1** but stems 30–70 cm, smooth, usually with glabrous nodes; leaves filiform, convolute, 0·6–0·8 mm in diameter, usually glabrous; sheaths of cauline leaves glabrous; panicle 5–12 cm; spikelets 9–10 mm, pale green; lower glume 7–8 mm, usually 1-veined, the upper 9–10 mm, 3-veined; awn 12–15 mm, arising in the lower half of the lemma; palea 6–7 mm; anthers 4–5 mm. *Dry grassland; calcicole.* ● *C. Portugal.* Lu.

66. **Gaudinia** Beauv.[2]

Annuals or biennials. Leaves flat. Inflorescence a distichous spike. Rhachis fragile, disarticulating above the insertion of the spikelet. Spikelets laterally compressed, sessile, more or less appressed to the concave rhachis, with 3–11 florets. Glumes unequal, shorter than to about as long as the spikelet, the lower with 3(–5), the upper with 5–7(–11) strong veins. Lemma obscurely 7- to 9-veined, coriaceous, often with a dorsal awn. Palea shorter than lemma.

1 Lower glume more than ¾ the length of the upper **3. coarctata**

1 Lower glume less than ¾ the length of the upper
2 Upper glume (7–)8–10(–12) mm; lemma with a geniculate awn **1. fragilis**
2 Upper glume 4·5–5 mm; lemma unawned **2. hispanica**

[1] By J. Holub. [2] By T. G. Tutin.

1. G. fragilis (L.) Beauv., *Agrost.* 95, 164 (1812). Stems 15–120 cm, usually several, erect or ascending, glabrous, smooth, shiny. Leaves and sheaths more or less villous; ligule very short, truncate. Inflorescence up to 35 cm. Spikelets 10–18 mm. Glumes shorter than the spikelets, glabrous and scabrid on the veins or sometimes villous, the lower 3–6 mm, lanceolate, acute, the upper (7–)8–10(–12) mm, oblong, obtuse. Lemma *c.* 7 mm, lanceolate, glabrous or sometimes villous, with a geniculate awn *c.* 10 mm. Anthers 4–5 mm. Grain 2·5 × 0·5 mm. $2n=14+0$–2B. *Grassy, usually damp habitats. S. Europe; a frequent casual in N.W. & E. Europe and occasionally persisting.* Al Bl Bu Co Cr Ga He Hs It Ju Lu Rs (K) Sa Si Tu [*Az Br Hb].

2. G. hispanica Stace & Tutin, *Bot. Jour. Linn. Soc.* **76**: 353 (1978). Like **1** but stems not more than 25 cm; inflorescence *c.* 10 cm, very slender; spikelets 6–9 mm; lower glume *c.* 2·5 mm, the upper 4·5–5 mm; lemma 5·5–6·5 mm, unawned. Anthers *c.* 3 mm. $2n=14$. *Sandy soil.* ● *S.W. Spain* (*Prov. Huelva*). Hs.

3. G. coarctata (Link) T. Durand & Schinz, *Consp. Fl. Afr.* **5**: 845 (1894). Like **1** but stems rarely more than 30 cm; spikelets not more than 10 mm, usually with 3–5 florets; glumes usually nearly as long as the spikelet, the lower 5·5–7 mm, the upper 6·5–9 mm; anthers 2·5–2·75 mm; grain 1·5 × 0·75 mm. *Rocks and sandy ground, usually near the sea.* ● *Açores.* Az.

67. **Ventenata** Koeler[2] (incl. *Gaudiniopsis* Eig)

Annuals. Leaves convolute or plicate. Spikelets laterally compressed, with 2–7 florets. Glumes somewhat unequal, with a wide, scarious margin, the lower 3- to 7-veined, the upper 3- to 9-veined. Lemma 5-veined, chartaceous, with a scarious margin, the lowest shorter than the others, unawned, the uppermost with a dorsal awn.

Inflorescence a lax panicle; lowest lemma with an apical seta up to 4 mm **1. dubia**

Inflorescence spike-like; lowest lemma without an apical seta **2. macra**

1. V. dubia (Leers) Cosson in Durieu, *Expl. Sci. Algérie* **2**: 104 (1855) (*V. avenacea* Koeler). Stems 15–70 cm, slender, erect, puberulent below the nodes. Leaves and sheaths glabrous or sparsely hairy; ligule 6–9 mm, acute or lacerate. Panicle up to 20 cm, lax, pyramidal, with few spikelets borne near the ends of the long, minutely hispidulous branches. Spikelets 10–15 mm (excluding awns), usually with 2–3 florets. Glumes lanceolate, acuminate, minutely hispidulous on the veins, the lowest 5- to 7-, the upper 7- to 9-veined. Lemma lanceolate, the lowest with an apical seta up to 4 mm, the others 2-fid, with 2 apical setae 1·5–2 mm; awn 10–15 mm, geniculate. Anthers *c.* 1 mm. $2n=14$. *Dry places. S. & C. Europe.* Al Au †Be Bu Cz Ga Ge Gr Hs Hu It Ju Lu Po Rm Rs (W, K, E) Sa Tu.

2. V. macra (Bieb.) Boiss., *Fl. Or.* **5**: 540 (1884) (*Gaudiniopsis macra* (Bieb.) Eig). Stems 10–50 cm, glabrous, erect or ascending. Leaves somewhat hairy above; ligule 3–6 mm, lacerate. Inflorescence 4–10 cm, spike-like. Spikelets *c.* 10 mm (excluding awns), usually with 4–7 florets; pedicels 1–3·5 mm, stout, erect. Glumes lanceolate, acute, the lower 3-, the upper 3- to 5-veined. Lowest lemma acute, the others shortly 2-dentate; awn *c.* 10 mm, geniculate. Anthers 2·5 mm. *Dry, rocky places. Krym; once recorded from S. Greece.* ?Gr Rs (K). (*S.W. & C. Asia.*)

68. **Koeleria** Pers.[1]

Caespitose perennials. Leaves flat or convolute. Inflorescence a spicate or lax panicle. Spikelets laterally compressed, with (1–)2–5 florets. Glumes equal or unequal, the upper the longer and usually equalling the first floret, the lower *c.* ⅔ as long as the first floret, distinctly keeled, 1- to 5-veined. Lemma lanceolate to ovate-lanceolate, keeled, mostly longer than the glumes, usually obtuse, with or without an awn. Palea as long as or shorter than the lemma, 2-keeled, 2-fid at the apex. Grain oblong-fusiform.

Literature: K. Domin, *Biblioth. Bot.* (*Stuttgart*) **65**: 1–354 (1907). J. Ujhelyi in G. Vida (ed.), *Evolution in Plants* (*Symposia biologica hungarica* **12**) 163–176. Budapest. 1972.

1 Basal leaf-sheaths reticulately fibrous
 2 Old leaf-sheaths breaking down into a tight mass of veins **1. vallesiana**
 2 Old leaf-sheaths persistent, laxly imbricate **(5–13). macrantha** group
1 Basal leaf-sheaths not reticulately fibrous
 3 Glumes of central spikelets ± equal
  4 Spikelets glabrous, sometimes scabrid **2. cenisia**
  4 Spikelets hirsute
   5 Plant densely caespitose, without creeping rhizomes; old leaf-sheaths tightly imbricate, forming a tuberous base to the stem **3. hirsuta**
   5 Plant laxly caespitose, with short, creeping rhizomes; old leaf-sheaths loosely imbricate, not forming a tuberous base to the stem **4. asiatica**
 3 Glumes of central spikelets distinctly unequal
  6 Lemma unawned, glabrous to slightly pubescent **(5–13). macrantha** group
  6 Lemma awned, densely hirsute
   7 Plants densely caespitose; stems tuberous at the base **3. hirsuta**
   7 Plants laxly caespitose, with creeping rhizomes; stems slender at the base **4. asiatica**

1. K. vallesiana (Honckeny) Gaudin, *Alpina* (*Winterthur*) **3**: 47 (1808) (*K. setacea* Pers.). Densely caespitose; stems 10–50 cm, woody and conspicuously tuberous at the base, glabrous to pubescent especially towards the inflorescence. Leaves of non-flowering shoots 3–12 cm, convolute and setaceous or flat and up to 3 mm wide, greyish-green, the margins minutely serrulate; sheaths tightly imbricate, breaking down into a persistent, reticulate-fibrous mass of veins. Panicle 15–70 × 6–12 mm, ovoid-spiciform. Spikelets 4–6 mm. Glumes unequal, acuminate to shortly aristate, shining green or pale brown, with a wide hyaline and somewhat silvery margin. Lemma acuminate to mucronate. $2n = 14 + 0–2B$, 28, 40, 42, 43, 112, 126. *Dry grassland and rocky places; calcicole. W. Europe, northwards to S.W. England; N. Appennini.* Br Ga ?Ge He Hs It Lu.

(a) Subsp. **vallesiana** (*K. aurata* Bubani): Stems, rhachis and spikelets glabrous to sparsely hairy. *Limestone rocks. Throughout the range of the species.*

(b) Subsp. **castellana** (Boiss. & Reuter) Domin, *Magyar Bot. Lapok* **3**: 342 (1904) (*K. castellana* Boiss. & Reuter): Stems, rhachis and spikelets densely puberulent. *Gypsaceous soils. C. & S.E. Spain.*

Subsp. **(a)** occasionally hybridizes with **5.**

2. K. cenisia Reuter ex Reverchon, *Bull. Soc. Étud. Sci. Angers* **3**: 139 (1874) (*K. brevifolia* Reuter). Densely caespitose. Stems 10–25 cm, slender, somewhat tuberous at the base, glabrous. Leaves of non-flowering shoots 2–5(–7) cm × 0·5–1 mm, flat or plicate, somewhat soft, glabrous to pruinose or velutinous; sheaths tightly imbricate, persistent and undivided, markedly dilated, glabrous or hairy, sometimes corrugated. Panicle 10–50 × *c.* 8 mm, cylindrical-oblong, spiciform. Spikelets 4–7 mm. Glumes more or less equal, acuminate to shortly aristate, brown or violet, variegated with white, with a wide hyaline margin. Lemma acuminate, with a scabridulous, subapical, dorsal awn. $2n = 14 + 0–2B$. *Dry grassland and rocks*, 1200–2500 *m.* ● *S. Alps, eastwards to* 8° *E.* Ga He It.

3. K. hirsuta Gaudin, *Alpina* (*Winterthur*) **3**: 48 (1808). Densely caespitose. Stems 10–35 cm, slender, somewhat tuberous at the base, glabrous to densely hirsute above. Leaves of non-flowering shoots 3–15 cm × 0·5–2 mm, carinate-convolute, hard, acute, minutely pubescent; sheaths tightly imbricate, persistent and entire, somewhat dilated, densely and softly pubescent to more or less glabrous, sometimes slightly corrugated. Panicle 10 × 2–5 mm, compact, ovoid-spiciform. Glumes equal or subequal, shortly aristate, greenish-violet, with a silvery hyaline margin. Lemma acuminate, with a scabrid, subapical, dorsal awn up to 3 mm. $2n = 14 + 0–5B$. *Dry grassland, rocks and screes*, 1700–3100 *m.* ● *S. & E. Alps.* Au He It.

4. K. asiatica Domin, *Bull. Herb. Boiss.* ser. 2, **5**: 947 (1905). Laxly caespitose, with short creeping rhizomes. Stems 5–20 cm, slender, pubescent. Leaves of non-flowering shoots 4–10 cm × 1–2 mm, convolute or flat, soft; sheaths loosely imbricate, persistent, slightly dilated, glabrous, with parallel veins. Panicle 10–40 × 7–12 mm, compact-spiciform. Spikelets 3–4 mm. Glumes equal to subequal, acute, green or purplish, with a silvery hyaline margin, glabrous. Lemma shortly awned, densely pubescent. $2n = 28$. *Dry tundra, rocky slopes and screes. Ural and N.E. Russia.* Rs (N, C). (*N. & C. Asia.*)

(5–13). K. macrantha group. Laxly or densely caespitose. Stems bulbous or rhizomatous at the base. Old leaf-sheaths loosely imbricate, usually corrugated, with parallel or rarely reticulate venation.

This group is a complex that is very imperfectly understood; a great deal of variation occurs as a result of polyploidy and adaptation to a wide range of ecological conditions. Many populations, which may represent only ecotypes and variants of different ploidy-levels, have variously and inconsistently been given specific, subspecific and varietal rank. From the limited data available there is little evidence to uphold these taxa and correlate chromosome-number with morphology. Consequently, the species recognized in this aggregate are based entirely on morphology, and therefore may still only represent minor taxa. Until their true relationships can be worked out from detailed population-studies and cytogenetic analyses the treatment must remain provisional.

1 Laxly caespitose; stems slender at the base; leaves usually not glaucous
 2 Spikelets 6–8 mm
  3 Spikelets glabrous **13. pyramidata**
  3 Spikelets pubescent **12. eriostachya**
 2 Spikelets less than 6 mm
  4 Leaves of non-flowering shoots usually convolute, densely silvery-scabrid **6. glauca**
  4 Leaves of non-flowering shoots flat or plicate, slightly scabrid or smooth above
   5 Upper glume ovate to ovate-lanceolate, with narrow hyaline margin; lemma herbaceous **5. macrantha**
   5 Upper glume lanceolate, with wide hyaline margin; lemma membranous **11. nitidula**

[1] By C. J. Humphries.

1 Densely caespitose; stems somewhat bulbous at the base; leaves usually glaucous
6 Leaves flaccid **11. nitidula**
6 Leaves rigid
7 Panicle not more than 25 mm
8 Lemma with an awn up to 0·5 mm; glumes acuminate **7. lobata**
8 Lemma unawned; glumes acute **10. crassipes**
7 Panicle more than 25 mm
9 Spikelets (4–)6–8 mm **8. splendens**
9 Spikelets 3–5·5 mm
10 Spikelets distinctly pedicellate; glumes linear-lanceolate **6. glauca**
10 Spikelets ±sessile; glumes obovate
11 Stems at least 45 cm; inflorescence usually more than 80 mm, interrupted below; anthers 1·2–1·6 mm **9. caudata**
11 Stems usually less than 30 cm; inflorescence usually less than 50 mm, not interrupted; anthers 1·5–2·5 mm **10. crassipes**

5. K. macrantha (Ledeb.) Schultes in Schultes & Schultes fil., *Mantissa* **2**: 345 (1824) (*K. alpigena* Domin, *K. cristata* (L.) Pers. pro parte, *K. gracilis* Pers., *K. sclerophylla* P. Smirnov). Laxly caespitose, sometimes with creeping rhizomes. Stems 10–40 cm, usually glabrous or puberulent. Leaves of non-flowering shoots up to 15 cm × 1–2 mm, usually flat or plicate, green or sometimes glaucous; sheaths persistent, glabrous or hairy, with parallel veins. Panicle 20–80(–100) × *c.* 10 mm, narrowly oblong, more or less lobed especially below. Spikelets 2–5(–6) mm. Glumes unequal, acuminate, mucronate or shortly aristate, green, brown or purplish, with silvery hyaline margin. Lemma acuminate, glabrous. $2n = 14$, 28 + 0–6B, 42, 70. *Europe northwards to N. Scotland and Lithuania; casual in Fennoscandia.* Al Au Be Bl Br Bu Cz Ga Ge Gr Hb He Ho Hs Hu It Ju Po Rm Rs (B, C, W, K, E) Tu.

Very variable in habit, leaf-size and indumentum. Populations with apparently distinctive combinations of these characters have been described as separate taxa, but it is generally not possible to distinguish them from the remainder by any single character. Laxly caespitose rhizomatous plants with slender somewhat glaucous leaves, from C. Russia and N. Ukraine, separated as **K. delavignei** Czern. ex Domin, *Biblioth. Bot.* (*Stuttgart*) **65**: 247 (1907) (incl. *K. incerta* Domin), are perhaps worth specific status.

6. K. glauca (Schrader) DC., *Cat. Pl. Horti Monsp.* 116 (1813) (*K. maritima* Lange, *K. pohleana* (Domin) Gontsch.). Densely caespitose. Stems 10–45(–60) cm, robust, thickened towards the base, glabrous below, puberulent above. Leaves of non-flowering shoots 2–5 cm, convolute or rarely flat, stiff, glaucous, silvery-scabrid; sheaths persistent, glabrous or pubescent to densely hairy, breaking down into filaments when old. Panicle 20–110 × *c.* 8 mm, spiciform, interrupted below; rhachis densely puberulent. Spikelets 4–5 mm. Glumes unequal, obtuse when flat, pale green or brown, glabrous to minutely puberulent. Lemma subobtuse or mucronulate, minutely puberulent at least below. $2n = 14$ (28, 42, 70). *Sandy soils. Europe, from N. Spain, Hungary and Krym northwards to N. Scotland and to* 61° 30′ *in N. Russia.* Au Be Br Cz Da Ga Ge Ho Hs Hu Po Rm Rs (N, B, C, W, K, E) Su.

7. K. lobata (Bieb.) Roemer & Schultes, *Syst. Veg.* **2**: 620 (1817) (*K. brevis* Steven, *K. degenii* Domin). Densely caespitose, forming small, compact tufts. Stems 20–35 cm, with enlarged bulbous bases. Leaves of non-flowering shoots 2–5 cm × 1–1·5 mm, convolute, glaucous, glabrous; sheaths persistent, dilated, with parallel or corrugated veins, glabrous. Panicle a short dense spike 20–25 × *c.* 8 mm. Spikelets 5–7 mm, sessile or shortly pedicellate. Glumes unequal, acuminate, pale green or purplish, scabrid or hairy. Lemma glabrous to slightly hairy, with an apical awn up to 1 mm. $2n = 28$. *Dry places. S.E. Europe, from Turkey to S.E. Russia.* Bu Rm Rs (W, K, E) Tu.

8. K. splendens C. Presl, *Cyper. Gram. Sic.* 34 (1820) (*K. bivestita* Schur, *K. dasyphylla* Willk., *K. subaristata* (Pančić) Domin). Densely caespitose, forming large compact tufts with short, intravaginal creeping rhizomes. Stems 20–45 cm, somewhat bulbous at the base. Leaves of non-flowering shoots 3–5(–12) cm × *c.* 1 (–2) mm, flat to convolute, glaucous, scabrid above, pubescent or glabrous beneath, ciliate at the margin, the veins and margins whitish; sheaths persistent, inflated, pubescent and ciliate at the margin or glabrous. Panicle 30–80 × *c.* 12 mm, ovate-oblong, robust, dense, sometimes interrupted below, with a puberulent rhachis. Spikelets (4–)6–8 mm, shortly pedicellate. Glumes unequal, acuminate to shortly aristate, glabrous to densely pubescent above. Lemma acuminate to shortly aristate, usually glabrous. $2n = 28$. *Dry habitats; usually calcicole. S. Europe.* Al ?Au Bu Co Ga Gr Hs It Ju Rm Rs (W, K) Sa Si Tu.

9. K. caudata (Link) Steudel, *Syn. Pl. Glum.* **1**: 293 (1854). Densely caespitose, with hard, intravaginal, shortly creeping rhizomes. Stems (45–)60–95 cm, distinctly bulbous at base, glabrous but puberulent near apex. Leaves scabrid, plicate or flat, glaucous; leaves of non-flowering shoots 5–12 cm × 1–2 mm, flaccid, not or very sparsely ciliate; lower sheaths retrorsely pubescent. Panicle (45–)80–170 × 5–13 mm, spiciform, narrowly oblong, interrupted below. Spikelets 3·5–5·5 mm, subsessile. Glumes unequal, subobtuse, mucronate, ciliate on the keel. Anthers 1·2–1·6 mm. *Open woods and mountain grassland.* ● *E.C. Portugal.* ?Hs Lu.

10. K. crassipes Lange, *Vid. Meddel. Dansk Naturh. Foren. Kjøbenhavn* **1860**: 43 (1861). Like **9** but stems 10–30 cm, glabrous or slightly papillose near apex; leaves convolute or rarely flat, those of non-flowering shoots 2–5(–8) cm × 0·5–1 mm, rigid, ciliate at least in the lower half; lower sheaths glabrous; panicle (20–)25–50(–80) × 4–8 mm, not interrupted; spikelets 3–4·5 mm; glumes acute; anthers 1·5–2·5 mm. $2n = 14$. *Dry places.* ● *Spain, N.E. Portugal.* Hs Lu.

11. K. nitidula Velen., *Fl. Bulg.* 611 (1891). Laxly or densely caespitose, with short, creeping rhizomes. Stems 30–40(–65) cm, very slender. Leaves of non-flowering shoots 15–25 cm × *c.* 1 mm, plicate or flat, glabrous, soft, green or greyish-green; sheaths occasionally breaking down into ribbons when mature, slightly pubescent. Panicle 60–80 × 15–30 mm, narrowly lanceolate and dense when young, ovoid and lax when mature. Spikelets 4–4·5 mm, with long pedicels. Glumes unequal, acute, narrowly lanceolate, bright green and shining, glabrous. Lemma acute or aristate, narrowly lanceolate, hyaline. *Rocky places and dry grassland. C. & E. parts of Balkan peninsula.* ?Au Bu ?Hu Ju Tu.

Variants with a densely caespitose habit and short, glaucous, somewhat convolute leaves, with an appearance similar to **12**, are sometimes distinguished as **K. glaucovirens** Domin, *Magyar Bot. Lapok* **3**: 273 (1904).

12. K. eriostachya Pančić, *Verh. Zool.-Bot. Ges. Wien* **6**: 591 (1856) (*K. pyramidata* subsp. *eriostachya* (Pančić) Schinz & R. Keller). Densely caespitose, with short, creeping rhizomes. Stems up to 45 cm, glabrous. Leaves of non-flowering shoots 5–10 cm × 2–3 mm, convolute or plicate, slightly pubescent; sheaths persistent, smooth to scabrid. Panicle 20–80 × 10–15 mm,

spiciform. Spikelets 6–8 mm. Glumes subequal, acute, sparsely pubescent, greenish-purple. Lemma acute, glabrous or rarely pubescent. *Dry grassland or rocks; usually calcicole. E. Alps, S. Carpathians and mountains of the Balkan peninsula.* Au Bu He It Ju Rm.

13. K. pyramidata (Lam.) Beauv., *Agrost.* 84, 166 (1812) (*K. cristata* (L.) Pers. pro parte, *K. genevensis* Domin). Laxly caespitose, sometimes with long, creeping extravaginal rhizomes. Stems (30–)45–90 cm, robust, glabrous to puberulent above. Leaves of non-flowering shoots 4–23 cm × 1–3·5 mm, flat, green or glaucescent, glabrous, or with sparse, long white hairs at the margins; sheaths persistent, sparsely sericeous to densely pubescent. Panicle (50–)100–220 × 13–30 mm, pyramidal, robust, with a pubescent rhachis. Spikelets (5–)6–8 mm. Glumes unequal, acute, glabrous and smooth or scabrid, green or pale brown. Lemma acuminate to shortly aristate, glabrous, puberulent or rarely ciliate. $2n=42$, 56, 70, 84. *Meadows and wood-margins. From N. Russia and the Netherlands southwards to N. Italy and Macedonia.* Au Be Bu Cz Da Ga Ge He Ho Hu It Ju Po Rm Rs (N, B, C, W) [Su].

Plants from Russia and the Baltic region, with long, creeping rhizomes and hairy sheaths, have usually been considered as a separate species, **K. grandis** Besser ex Gorski, *Icon. Pot. Char. Cyper. Gram. Lithuan.* t. 19 (1849) (*K. polonica* Domin), but the correlation between these characters often breaks down.

69. Lophochloa Reichenb.[1]

Annuals. Inflorescence a panicle. Spikelets laterally compressed, with (1–)2–5(–10) florets. Glumes keeled, cartilaginous at the base. Lemma 2-fid, usually prominently 5-veined, keeled, with a straight or slightly curved awn inserted near the apex. Palea 2-keeled, 2-fid. Rhachilla and callus glabrous or with short hairs.

1 Glumes subequal, with pectinately arranged hairs, the lower 3-veined; anthers elongate
2 Awn less than 1·3 mm; keels of each pair of glumes parallel or slightly convergent **4. pubescens**
2 Awn more than 1·3 mm; keels of each pair of glumes divergent **5. salzmannii**
1 Glumes unequal, glabrous or with irregularly arranged hairs, the lower 1-veined; anthers ovoid to ellipsoid
3 Panicle ovoid; awn of lower lemmas 3–5 mm **2. hispida**
3 Panicle oblong to pyramidal or spike-like; awn of lower lemmas not more than 2·5 mm
4 Lower glume *c.* ¾ as long as and much narrower than the upper; rhachilla-hairs not more than 0·5 mm **1. cristata**
4 Glumes subequal; rhachilla-hairs *c.* 1 mm **3. pumila**

Subgen. **Lophochloa**. Glumes unequal, the lower 1-veined. Anthers ovoid to ellipsoid.

1. L. cristata (L.) Hyl., *Bot. Not.* **1953**: 355 (1953) (*Koeleria phleoides* (Vill.) Pers.). Caespitose, with erect or geniculate, glabrous stems 5–60 cm. Leaves up to 18 cm × 8 mm; leaves and sheaths villous to pubescent, greenish when dry. Panicle 1–12 × 0·5–1(–2) cm, cylindrical and dense, or pyramidal, lax and more or less lobed. Pedicels scabridulous. Spikelets 3–7·5 mm. Glumes acute, pubescent or glabrous, the lower *c.* ¾ as long as the upper. Rhachilla-hairs not more than 0·5 mm. Lemma with 5 usually distinct veins, shortly 2-fid; awn 1–3 mm, arising near apex, usually straight. Anthers 0·2–0·5 mm. $2n=26$. *Cultivated ground and dry, sandy grassland. Mediterranean region and S.W. Europe, extending northwards to* 47° 30′ *N. in W. France and to E. Bulgaria.* Al Az Bl Bu Co Cr Ga Gr Hs It Ju Lu Rs (K) Sa Si Tu.

2. L. hispida (Savi) Jonsell, *Bot. Jour. Linn. Soc.* **76**: 321 (1978) (*Koeleria hispida* (Savi) DC., *Festuca hispida* Savi). Stems 5–30 cm, more or less geniculate, glabrous. Leaves up to 10 cm × 7 mm, acuminate; leaves and sheaths more or less villous. Panicle 1–6 × 0·7–1·5 cm, ovoid, very dense. Pedicels smooth, very rigid. Spikelets 4–5 mm. Glumes acuminate, glabrous or ciliate on the keel, the lower *c.* ¾ as long as and much narrower than the upper. Rhachilla glabrous. Lemma with 5 prominent veins; awn of lower lemmas 3–5 mm, arising near apex, slightly curved. Anthers 0·7–1 mm. *Mediterranean region, from Sardegna to W. Greece.* Gr It Sa Si.

3. L. pumila (Desf.) Bor, *Grasses Burma Ceylon India Pakist.* 445 (1960) (*Trisetum pumilum* (Desf.) Kunth). Caespitose, with erect or geniculate, glabrous stems 5–35 cm. Leaves up to 7 cm × 3 mm; leaves and sheaths villous to pubescent, light purplish when dry. Sheaths somewhat inflated. Panicle 1–6 × *c.* 0·5 cm, spike-like, tapered towards the ends. Pedicels pubescent. Spikelets 2·7–3·6 mm. Upper glume densely pubescent; lower glume ciliate on the keel, almost as long as the upper. Rhachilla-hairs *c.* 1 mm. Lemma with 5 distinct veins, scabridulous, acute or minutely 2-fid; awn 1·5–2·5 mm, arising slightly below apex, straight or slightly curved. Anthers *c.* 0·4 mm. *Sandy places. C. & S. Spain.* Hs.

Subgen. **Aegialina** (Schultes & Schultes fil.) Jonsell. Glumes subequal, the lower 3-veined. Anthers elongate.

4. L. pubescens (Lam.) H. Scholz, *Willdenowia* **6**: 291 (1971) (*Koeleria pubescens* (Lam.) Beauv., *K. villosa* Pers., *Phalaris pubescens* Lam.). Stems 10–40 cm, geniculate to erect, sparsely pubescent to glabrous. Leaves up to 6 cm × 7 mm, tapering from the base. Leaves and sheaths densely pubescent. Panicle 5–12 × 0·5 cm, very dense, cylindrical. Spikelets 3·5–6 mm, with 1–2 florets nearly enclosed by the glumes. Lower glume as long and wide as the upper, both with pectinately arranged hairs along veins, more or less prickly between the veins. Rhachilla and callus glabrous. Lemma nearly smooth; awn usually 0·5–1 mm, straight. Anthers 1·5–2 mm. *Maritime sands. Mediterranean region.* Co ?Cr Ga Gr Hs It Ju Sa Si.

5. L. salzmannii (Boiss. & Reuter) H. Scholz, *op. cit.* 292 (1971) (*Koeleria salzmannii* Boiss. & Reuter). Like **4** but leaves and sheaths with longer hairs; panicle somewhat laxer, cylindrical to narrowly pyramidal (lobed in large specimens); spikelets with 2–5 florets, not enclosed by the divaricate, often villous glumes; rhachilla and callus finely pubescent; awn 1·7–2·5 mm, straight to slightly curved. *Sandy soil. S. Spain.* Hs. (*N. Africa.*)

70. Trisetum Pers.[1]

Annuals or perennials. Inflorescence a panicle, sometimes spike-like. Spikelets laterally compressed, with 2 to several florets. Glumes keeled, more or less unequal, the lower 1(–3)-veined, the upper 3-veined. Lemma 2-fid or with 2 setae, 5-veined, with a straight or curved, often twisted awn nearly always inserted in the distal half. Palea 2-keeled, 2-fid, not enclosed by lemma at maturity, thus making the spikelets silvery. Rhachilla and callus with short or long hairs. Anthers usually long and narrow.

Literature: J. Chrtek & V. Jirásek, *Webbia* **17**: 569–580 (1963). E. Paunero, *Anal. Inst. Bot. Cavanilles* **9**: 503–582 (1950).

[1] By B. Jonsell.

1 Annual, without non-flowering shoots
2 Pedicels very rigid and tough; glumes cartilaginous with rigid hairs; basal part of awn twice as wide as distal part **22. ovatum**
2 Pedicels not very rigid, brittle; glumes membranous, glabrous or with soft hairs; awn of about equal width throughout
3 Lemma with two setae more than half as long as the undivided part
4 Anthers less than 1 mm; lemma smooth **23. loeflingianum**
4 Anthers more than 1 mm; lemma scabridulous **24. macrochaetum**
3 Lemma with setae less than half as long as the undivided part
5 Spikelets in an elongate, usually lax panicle; lower glume ½ as long as upper **20. parviflorum**
5 Spikelets crowded, sometimes in a spike-like panicle; lower glume at least ¾ as long as upper
6 Panicle narrowly cylindrical; glumes subequal **21. scabriusculum**
6 Panicle pyramidal, broadly cylindrical or ovoid; lower glume shorter and narrower than the upper
7 Awn inserted not more than ¼ of the way from apex to base of lemma, straight or weakly curved, greyish; palea divided to *c.* ⅛ of its total length **18. paniceum**
7 Awn inserted at about ½ of the way from apex to base of lemma, twisted and obtusely angled, brownish; palea divided to less than ⅛ of its total length **19. aureum**
1 Perennial, with non-flowering shoots
8 Leaves of non-flowering shoots and those of basal parts of stem distichous, often bluish-green
9 Sheaths velutinous; rhachilla-hairs less than 2 mm **1. velutinum**
9 Sheaths glabrous or hairy but not velutinous; rhachilla-hairs more than 2 mm
10 Leaves more than 6 mm wide **2. macrotrichum**
10 Leaves less than 6 mm wide
11 Hairs at base of lemma reaching half-way to the point of insertion of the awn; panicle narrowly ovoid to lanceolate **5. argenteum**
11 Hairs at base of lemma reaching more than half-way to the point of insertion of the awn; panicle ovoid **4. distichophyllum**
8 Leaves not distichous, green or greyish-green
12 Stems less than 20 cm; plant densely caespitose; leaves rigid; old sheaths long-persistent
13 Leaves flat, tomentose beneath, with cartilaginous margins **6. glaciale**
13 Leaves involute or canaliculate, glabrous beneath; margins not cartilaginous
14 Awn less than 7 mm; glumes subequal **7. gracile**
14 Awn more than 7 mm; lower glume *c.* ¾ as long as the upper **8. bertolonii**
12 Stems usually more than 20 cm; plant caespitose or rhizomatous; leaves membranous; old sheaths evanescent
15 Pedicels and upper part of stem densely pubescent to villous; plant caespitose
16 Ligule 2–3 mm; stems usually more than 30 cm; leaves *c.* 4 mm wide **9. hispidum**
16 Ligule less than 1 mm; stems not more than 40 cm; leaves not more than 3 mm wide **10. spicatum**
15 Pedicels and upper part of stem usually scabridulous to glabrous; plant laxly caespitose to rhizomatous
17 Many rhachilla-hairs more than 2 mm; plant rhizomatous
18 Leaves tomentose **3. laconicum**
18 Leaves ciliate, otherwise nearly glabrous **2. macrotrichum**
17 All rhachilla-hairs less than 2 mm; plant laxly caespitose
19 Anthers less than 1 mm **11. subalpestre**
19 Anthers more than 1 mm
20 All rhachilla-hairs less than 1 mm **15. tenuiforme**
20 At least some rhachilla-hairs 1 mm or more
21 Hairs at base of awn longer than width of awn **16. fuscum**
21 Pricklets at base of awn shorter than width of awn
22 Lower sheaths glabrous or with very short appressed hairs; awn strongly curved but not geniculate **17. sibiricum**
22 Lower sheaths with at least some longer hairs; awn usually sharply geniculate
23 Panicle nearly always more than 6 cm, with more than 50 spikelets; flowering stem with more than 2 nodes **13. flavescens**
23 Panicle not more than 6 cm, with usually not more than 50 spikelets; flowering stem with 2 nodes
24 Upper glume almost entirely colourless, broadly obovate; ovary glabrous; panicle contracted **12. baregense**
24 Upper glume strongly pigmented towards the base, obovate; ovary with an apical tuft of short hairs; panicle usually diffuse **14. alpestre**

1. T. velutinum Boiss., *Elenchus* 88 (1838). Rhizomatous perennial with stolons. Stems 25–40 cm, puberulent to glabrous. Leaves up to 8 cm × 0·4 mm (usually much shorter), mostly involute, crowded near the base, patent and strikingly distichous. Leaves and sheaths velutinous. Panicle 5–11 × 1–3 cm, cylindrical or narrowly pyramidal, rather open. Spikelets 4·8–8 mm, shining, the florets equalling or exceeding the upper glume. Glumes smooth, the lower distinctly shorter than the upper. Rhachilla with rather soft, dense hairs 1·2–2 mm. Lemma 4·5–6·4 mm, very shortly 2-fid, smooth; awn 4·5–7·5 mm, inserted *c.* ¼ of way from apex to base of lemma, geniculate and somewhat twisted. Anthers *c.* 3 mm. *Calcareous mountain rocks.* ● *S. Spain.* Hs.

T. rigidum (Bieb.) Roemer & Schultes, *Syst. Veg.* **2**: 662 (1817), has been recorded rather doubtfully from Krym. It is like **1** but has finely pubescent sheaths and rhachilla-hairs 4–5 mm and occurs in S.W. Asia.

2. T. macrotrichum Hackel, *Magyar Bot. Lapok* **2**: 110 (1903). Stoloniferous perennial. Stems 40–50 cm, scabridulous above, otherwise glabrous. Leaves up to 15 cm × 10 mm, flat, scabrid, ciliate, otherwise nearly glabrous. Sheaths with scattered hairs, scabridulous. Panicle 6–10 × 2–3 cm, rather lax, erect or nodding, yellowish. Spikelets 5–8 mm. Glumes smooth or sparsely scabridulous along the keel, the lower acute, *c.* ⅔ as long as the upper and much narrower. Rhachilla and callus with dense, soft hairs 2·5–4 mm. Lemma 4–6·5 mm, slightly 2-fid, minutely scabridulous; awn 3·5–5·5 mm, inserted between ⅓ and ½ of way from apex to base of lemma, scabridulous, curved or geniculate. Anthers *c.* 2 mm. *Rocky mountain slopes.* ● *S. & E. Carpathians.* Rm ?Rs (W).

3. T. laconicum Boiss. & Orph. in Boiss., *Diagn. Pl. Or. Nov.* **3(4)**: 129 (1859). Stoloniferous perennial. Stems 50–60 cm, glabrous. Leaves up to 12 cm × 4 mm, erect; leaves and basal sheaths tomentose. Panicle 6–15 × 2–3 cm, cylindrical, not very dense. Spikelets 6–9 mm. Upper glume hyaline and shining, scabridulous along the keel; lower glume ⅔ as long as upper. Rhachilla with hairs up to 2·5 mm. Lemma 4·5–7·5 mm, very shortly 2-aristate, scabridulous; awn 5–10 mm, inserted above the middle, bent near the point of insertion, minutely scabridulous. Anthers 2·7–4 mm. ● *S. Greece* (*Parnon Oros; Evvoia*). Gr.

The plant from Evvoia has been separated as **T. rechingeri** Chrtek, *Acta Univ. Carol.* (*Biol.*) **1966**: 92 (1967), differing from

that from Parnon Oros chiefly by its shorter rhachilla-hairs. Until more material is available it seems preferable to regard them as conspecific.

4. T. distichophyllum (Vill.) Beauv., *Agrost.* 88, 180 (1812). Extensively creeping, stoloniferous perennial with ascending stems 10–30 cm, glabrous to hairy. Leaves up to 6 cm × 3 mm, flat or canaliculate, puberulent, more or less patent, crowded and markedly distichous below. Sheaths glabrous to densely pubescent with scattered longer hairs. Panicle 3–6 × 1–3 cm, ovoid, rather lax, with 20–50 usually silvery-brownish to violet spikelets. Spikelets 5·5–8·5 mm. Glumes almost smooth, broadly hyaline, the lower $\frac{3}{4}$–$\frac{5}{6}$ as long as the upper, narrower, usually with 2 shorter lateral veins. Rhachilla with dense hairs *c.* 3 mm; hairs at base of lemma about reaching the base of awn. Lemma 4–5·5 mm, with 2 short setae; awn 4·5–6·8 mm, inserted *c.* $\frac{1}{3}$ of the way from apex to base of lemma, geniculate near the base, twisted. Anthers 2–3 mm. $2n=28$, 56. *Rocks and screes; calcicole.* ● *Alps; E. Pyrenees; mountains of Crna Gora and N. Albania.* Al Au Ga Ge He Hs It Ju.

5. T. argenteum (Willd.) Roemer & Schultes, *Syst. Veg.* **2**: 665 (1817). Like **4** but up to 35 cm and more slender; leaves usually canaliculate, narrower and more slender, scabridulous only beneath; panicle up to 8 cm, lanceolate to narrowly ovoid, lax, with spikelets 4–6·5 mm; lower glume *c.* $\frac{3}{4}$ as long as upper, always 1-veined; rhachilla-hairs 2–2·5 mm; hairs at base of lemma reaching up to half-way to base of awn; lemma 3·7–5 mm; anthers 2–2·5 mm. $2n=28$. *Rocks and screes; calcicole.* ● *E. Alps.* Au ?He It Ju.

6. T. glaciale (Bory) Boiss., *Elenchus* 87 (1838). Densely caespitose perennial with glabrous stems 8–20 cm. Shoots surrounded by a dense layer of old fibrous sheaths. Basal leaves up to 5 cm × 1·5 mm, tomentose, especially beneath, rigid, distinctly veined; midvein and margins thickened, cartilaginous. Cauline leaves less than 1 cm, almost scale-like. Sheaths distinctly veined, velutinous-tomentose. Panicle 2·5–3 × 0·7–1 cm, cylindrical, dense. Spikelets *c.* 5 mm, with 1–2 florets. Glumes subequal, equalling the florets, smooth. Rhachilla densely hairy, the hairs *c.* 1 mm. Lemma 3·5–4·5 mm, slightly 2-fid, glabrous; awn 4–5 mm, inserted slightly above the middle, geniculate. Anthers *c.* 2 mm. $2n=14$. *Alpine screes.* ● *S. Spain (Sierra Nevada).* Hs.

7. T. gracile (Moris) Boiss., *Voy. Bot. Midi Esp.* **2**: 654 (1842). Densely caespitose perennial with nearly glabrous stems 4–15 cm. Non-flowering shoots surrounded by papery, pubescent sheaths and numerous older leaves. Basal leaves 0·8–3 cm, curved and rigid, canaliculate, prominently veined, greyish-green when young, finely pubescent above. Cauline leaves few, up to 1·2 cm; sheaths glabrous, distinctly veined, somewhat inflated. Panicle *c.* 2 × 1·2 cm, ovoid, rather dense, with 15–25 spikelets. Spikelets 4–7 mm. Glumes subequal, equalling the florets, smooth. Rhachilla with erecto-patent hairs *c.* 1 mm. Lemma 3·5–5 mm, 2-fid for *c.* $\frac{1}{6}$ of its length, glabrous or hairy between the awn and the base; awn *c.* 5 mm, inserted below middle of lemma, geniculate. Anthers *c.* 2·5 mm. $2n=14$. *Mountain grassland.* ● *Corse, Sardegna.* Co Sa.

T. conradiae Gamisans, *Candollea* **26**: 322 (1971), from high altitudes in Corse, does not seem to warrant recognition at specific level, as it differs from **7** only in having a hairy lemma.

8. T. bertolonii Jonsell, *Bot. Jour. Linn. Soc.* **76**: 320 (1978) (*T. villosum* (Bertol.) Schultes, non Pers.). Caespitose perennial, with villous (rarely glabrous) stems 10–25 cm. Leaves greyish-green, involute and setaceous, *c.* 1 mm wide, curved, finely pubescent above; basal leaves up to 12 cm, the cauline much shorter. Sheaths rather persistent, glabrous. Panicle 2–6 × 1–1·5 cm, narrowly ovoid, rather lax, with 20–40 spikelets. Spikelets 6·5–9 mm. Glumes smooth, the upper equalling or slightly shorter than the florets, the lower *c.* $\frac{2}{3}$ as long as the upper, much narrower. Rhachilla and callus with hairs 1·5–2·5 mm. Lemma 4·8–7·5 mm, smooth, with 2 setae *c.* $\frac{1}{4}$ as long as undivided part; awn 9–13 mm, inserted above middle of lemma, angled. Anthers 2–2·5 mm. *Mountain cliffs.* ● *C. & S. Appennini.* It.

9. T. hispidum Lange, *Vid. Meddel. Dansk Naturh. Foren. Kjøbenhavn* **1860**: 42 (1861). Densely caespitose perennial with vigorous non-flowering shoots. Old sheaths rather persistent, 3–5 mm wide, stramineous, with purplish bases, densely villous. Stems 30–80 cm, tomentose and with numerous patent or deflexed long hairs. Leaves up to 25 cm × 5 mm, erect, tomentose to villous like the young sheaths. Panicle 6–12 × 1–2·5 cm, narrowly cylindrical, tapered towards the apex, with erecto-patent, very crowded branches. Spikelets 4·5–6 mm. Glumes equalling the florets, hairy, the lower slightly shorter than the upper. Rhachilla with hairs *c.* 0·5 mm. Lemma 3–3·8 mm, shortly 2-aristate, densely hairy; awn 2·5–4·5 mm, inserted *c.* $\frac{1}{4}$ of the way from apex to base of lemma, bent near the point of insertion. Anthers 1·6–2·4 mm. *Rock-crevices.* ● *Mountains of N.W. Spain and N. Portugal.* Hs Lu.

10. T. spicatum (L.) K. Richter, *Pl. Eur.* **1**: 59 (1890) (*T. subspicatum* (L.) Beauv.). Caespitose perennial. Stems 8–40 cm, erect, more or less villous with retrorse hairs. Leaves flat or somewhat involute, villous to finely scabridulous, usually 1–3 mm wide; basal leaves up to 10 cm, the upper up to 5 cm. Panicle 1·5–5 × 0·5–1·5 cm, narrowly cylindrical to ovoid, dense but sometimes interrupted. Spikelets 4·2–7·5 mm. Glumes subequal or the lower *c.* $\frac{1}{3}$ as long as the upper. Rhachilla with hairs *c.* 0·5 mm. Lemma 3–5·2 mm, 2-fid; awn 2·5–4 mm, inserted in upper third of lemma, strongly curved. Anthers 0·6–1 mm. *Tundra, meadows, stony slopes and mountain rocks. Arctic and subarctic Europe, extending southwards in the mountains to S. Norway and N.C. Ural; Alps; Pyrenees.* Au Fe Ga Ge He Hs Is It No Rs (N) Sb Su.

1 Sheaths almost glabrous **(b)** subsp. **ovatipaniculatum**
1 Sheaths villous
2 Upper glume distinctly shorter than florets, abruptly tapered; panicle nearly always purplish-brown **(a)** subsp. **spicatum**
2 Upper glume equalling or slightly shorter than florets, gradually tapered; panicle greenish to pale violet **(c)** subsp. **pilosiglume**

(a) Subsp. **spicatum**: Usually 15–30 cm. Leaves moderately pubescent. Sheaths villous. Panicle usually 2–4 × 1 cm, purplish to brownish (very rarely greenish). Glumes scabridulous along the keels, otherwise smooth; upper glume broadly ovate, usually abruptly tapered, distinctly shorter than florets. Lemma finely scabridulous or smooth. $2n=28$. *N. Europe.*

(b) Subsp. **ovatipaniculatum** Hultén ex Jonsell, *Svensk Bot. Tidskr.* **69**: 132 (1975): Up to *c.* 20 cm. Leaves and sheaths almost glabrous. Panicle 1·5–3 × *c.* 1 cm, ovoid, brownish to purplish. Glumes scabridulous on the keel, otherwise smooth; upper glume ovate, gradually tapered, slightly shorter than florets. Lemma nearly smooth. $2n=28$. *Alps and Pyrenees.*

(c) Subp. **pilosiglume** (Fernald) Hultén, *op. cit.* **53**: 215 (1959): Up to 40 cm. Leaves moderately to densely pubescent. Sheaths villous. Panicle 3–6 × 0·5–1 cm, often narrowly cylindrical, sometimes interrupted, greenish to pale violet (very seldom dark).

Glumes scabridulous to densely pubescent; upper glume gradually tapered, equalling or slightly shorter than florets Lemma scabridulous to pubescent. $2n=42$. *Iceland.* (*Greenland, North America.*)

11. T. subalpestre (Hartman) Neuman, *Sver. Fl.* 755 (1901) (*T. agrostideum* (Laest.) Fries). Laxly caespitose perennial with glabrous stems 20–40 cm. Leaves up to *c.* 15 cm × 1–3 mm, flat or somewhat convolute, pubescent above or subglabrous, shortly ciliate. Sheaths rather densely retrorsely pubescent. Panicle 3–7 × 0·5–1 cm, rather lax, lanceolate to narrowly oblong, often brownish. Spikelets 4·2–5·7 mm. Glumes broadly hyaline, almost smooth, the lower *c.* ¾ as long as the upper. Rhachilla-hairs *c.* 0·7 mm; callus-hairs very short. Lemma 3·5–4·5 mm, 2-fid; awn 4·5–7 mm, inserted *c.* ⅓ of way from apex to base of lemma, strongly curved. Anthers *c.* 0·7 mm. $2n=28$. *Along streams and rivers. Arctic Fennoscandia.* Fe No Su.

12. T. baregense Laffitte & Miégeville, *Bull. Soc. Bot. Fr.* **21**: 46 (1874) (*T. agrostideum* auct., non (Laest.) Fries). Like **11**, but sheaths with longer hairs; spikelets 4·2–5·5 mm; glumes almost entirely hyaline, thin; rhachilla-hairs up to 1 mm; callus-hairs up to 0·5 mm; awn straight or angled; anthers 1·5–2 mm. $2n=14$. *Subalpine meadows.* ● *Pyrenees.* Ga Hs.

13. T. flavescens (L.) Beauv., *Agrost.* 88, 180 (1812) (*T. pratense* Pers.). Laxly caespitose perennial with erect or geniculate stems 25–80 cm, glabrous or hairy at the nodes. Leaves flat or somewhat involute, 2–5(–10) mm wide, very attenuate, moderately villous; basal leaves up to 20 cm, the upper up to 10 cm. Basal sheaths more or less villous, the upper often glabrous. Panicle 5–16 × 1–4 cm, usually rather lax, shining yellowish, rarely purplish. Spikelets 5–7·5 mm, very numerous. Glumes broadly hyaline, somewhat scabridulous, the lower ⅔–¾ as long as upper, much narrower. Rhachilla and callus with hairs up to 1·2 mm. Lemma 4–5·3 mm, 2-fid or bicuspidate; awn 4·5–6·5 mm, inserted *c.* ⅓ of way from apex to base of lemma, angled, scabridulous. Anthers 1·5–2·5 mm. Ovary glabrous. *Grassland, roadsides and open woods. Most of Europe but only as an alien in much of the north.* All except Bl Fa Is Sb Rs (N, K, E), but only naturalized in Fe No Rs (B) Su.

13 is a very complex species, even in the rather narrow sense taken here, with some close allies (**12, 14, 15**) being treated as separate species. The division into subspecies is tentative. Variants from the Alps and Carpathians resemble one another and are here united in subsp. (**c**), but further investigation is needed.

1 Leaves usually more than 5 mm wide — (**c**) subsp. **purpurascens**
1 Leaves usually less than 5 mm wide
2 Panicle strongly contracted, golden at maturity — (**b**) subsp. **splendens**
2 Panicle lax, ±stramineous at maturity — (**a**) subsp. **flavescens**

(**a**) Subsp. **flavescens**: Leaves usually less than 5 mm wide. Panicle more or less lax, yellowish at maturity. Spikelets up to 7·5 mm, usually with 2–4 florets. $2n=28$. *Throughout the range of the species.*

(**b**) Subsp. **splendens** (C. Presl) Arcangeli, *Comp. Fl. Ital.* 779 (1882): Leaves usually less than 5 mm wide. Panicle contracted, golden. Spikelets up to 6 mm, with usually only 2 well-developed florets. *S. Italy, Sicilia, Sardegna, S. part of Balkan peninsula.*

(**c**) Subsp. **purpurascens** (DC.) Arcangeli, *loc. cit.* (1882) (*T. candollei* (Serres) Verlot): Stems up to *c.* 70 cm. Leaves 5–10 mm wide. Panicle very long and wide, dense, purplish. Spikelets up to 7·5 mm, with 3–4 florets. $2n=12$. *Carpathians and Alps.*

14. T. alpestre (Host) Beauv., *Agrost.* 88, 180 (1812). Like **13(a)** but more densely caespitose and with 2 nodes usually concealed by sheaths; stem 15–35 cm, sometimes pubescent; leaves often convolute, 1–2 mm wide, the basal up to 8 cm, the upper up to 4 cm; panicle 3–6 cm, with up to *c.* 50 spikelets, rather lax and wide, usually brownish; lower glume usually *c.* ¾ as long as the upper; ovary with an apical tuft of short hairs. $2n=14$. *Mountain meadows and screes; calcicole.* ● *Carpathians, E. & S. Alps.* Au Cz Ge ?He It Ju Po Rm Rs (W).

Some plants from the S.W. Alps (Isère) resemble **14** but have more slender stems, shorter rhachilla-hairs and only a few hairs on the ovary. They approach **12** but have much more diffuse and brownish panicles. Their taxonomic status needs further study.

15. T. tenuiforme Jonsell, *Bot. Jour. Linn. Soc.* **76**: 320 (1978) (*T. tenue* (Hackel) Chrtek, non Roemer & Schultes). Laxly caespitose perennial with slender, glabrous stems 15–40 cm. Leaves up to 6 cm × *c.* 1 mm, mostly convolute, somewhat hairy or glabrous. Basal sheaths densely retrorsely puberulent. Panicle 3–6 × 0·5–1·5 cm, lax, with fewer than 50 spikelets, narrowly lanceolate to oblong, light brownish. Spikelets 4–6 mm. Glumes broadly hyaline, the lower *c.* ¾ as long as the upper. Rhachilla-hairs *c.* 0·5 mm; callus-hairs *c.* 0·3 mm. Lemma 4–5·5 mm, 2-fid; awn inserted somewhat above middle of lemma, slightly to strongly curved. Anthers 2–2·5 mm. ● *Mountains of N.W Greece and E. Albania.* Al Gr.

T. burnoufii Req. ex Parl., *Fl. Ital.* **1**: 263 (1850) (*T. flavescens* var. *burnoufii* (Req. ex Parl.) Briq.), described from Corse, has not been collected since 1844. It is like **15** but has densely puberulent stem and spikelets and rhachilla-hairs up to 1 mm. Plants from Corse intermediate between *T. burnoufii* and **13** have been called *T. flavescens* var. *corsicum* (Rouy) Briq. They require further study.

16. T. fuscum (Kit. ex Schultes) Schultes in Roemer & Schultes, *Syst. Veg.* **2**: 664 (1817) (*T. carpathicum* auct., non (Host) Roemer & Schultes. *T. ciliare* (Kit. ex Schultes) Domin). Laxly caespitose perennial with glabrous stems 25–70 cm. Leaves up to 15 cm × 3–5 mm, flat, ciliate and moderately pubescent. Lower sheaths with rather dense retrorse hairs, the upper subglabrous. Panicle 5–13 × 1–4 cm, rather lax, brownish to purplish. Spikelets 4·4–7·5 mm. Glumes broadly hyaline, with scabridulous to ciliate keel, the lower *c.* ¾ as long as the upper. Rhachilla-hairs up to 1·3 mm. Lemma 4·2–5 mm, 2-fid, with ciliate keel; awn 4–7 mm, inserted *c.* ⅓ of way from apex to base of lemma, strongly curved and with hairs 0·1–0·3 mm, especially towards the base. Anthers 2–2·5 mm. Ovary with a few apical hairs. *Mountain meadows and stream-sides.* ● *Carpathians.* Cz Po Rm Rs (W).

17. T. sibiricum Rupr., *Beitr. Pfl. Russ. Reich.* **2**: 65 (1845). Laxly caespitose perennial with glabrous stems 20–100 cm. Leaves 4–16 cm × 0·3–0·8 mm, flat, glabrous or moderately hairy above. Sheaths glabrous or with very short appressed hairs. Panicle 2·5–16 × 1·5–3 cm, lax and elongate to dense and ovoid, brownish. Spikelets 5·2–8·5 mm. Glumes broadly hyaline, sparsely scabridulous, the lower ⅔–¾ as long as the upper. Rhachilla with hairs *c.* 1 mm; callus-hairs very short. Lemma 4·5–5·8 mm, 2-fid; awn 5–10 mm, inserted *c.* ⅓ of way from apex to base of lemma, strongly curved, scabridulous; callus-hairs very short. Anthers 2–2·5 mm. $2n=14$. *Wet meadows, river-gravels and scrub. U.S.S.R., southwards to c. 50° N. in C. Ukraine, and extending to N.E. Poland.* ?Ju Po ?Rm Rs (N, B, C, W).

(a) Subsp. **sibiricum**: Stems usually at least 50 cm. Cauline leaves usually more than 10 cm. Panicle elongate and rather lax. *Throughout most of the range of the species.*

(b) Subsp. **litorale** (Rupr.) Roshev., *Bull. Jard. Bot. URSS* **21**: 90 (1922): Stems not more than 40 cm. Cauline leaves not more than 10 cm. Panicle shorter, more compact and brownish. *Arctic and subarctic Russia.*

18. T. paniceum (Lam.) Pers., *Syn. Pl.* **1**: 97 (1805) (*T. neglectum* (Savi) Roemer & Schultes). Caespitose annual, with basally geniculate to erect, glabrous stems 20–45(–65) cm. Leaves flat and thin, the lower up to 15(–20) cm × 6 mm, moderately villous like the sheaths. Panicle 2–12(–17·5) cm, cylindrical, narrowly ovoid or narrowly pyramidal, usually yellowish, dense but often lobed. Spikelets 3–5·5 mm, with florets slightly exceeding or equalling the glumes. Glumes largely hyaline, villous to glabrous with scabridulous keels, the upper broadly ovate, the lower much narrower, slightly shorter. Rhachilla with very short appressed hairs. Lemma 1·3–3·7 mm, villous to smooth, acute or slightly bicuspidate; callus glabrous; awn 1·5–4 mm, inserted in upper part of lemma, straight or slightly curved, scabridulous. Anthers 0·8–1·6 mm. $2n=14$. *Roadsides, walls and cultivated ground. W. & C. Mediterranean region, Portugal.* Bl Co Ga Hs It Lu Sa Si.

19. T. aureum Ten., *Fl. Nap.* **2**: 378 (1820) (*T. condensatum* (Link) C. Presl). Caespitose annual, with erect, spreading or geniculate glabrous stems 7–30 cm. Leaves up to 10 cm × 3 mm but usually much smaller, flat, subglabrous to villous. Sheaths somewhat inflated, glabrous to villous. Panicle 1–5 × 0·5–3 cm, pyramidal to ovoid, dense but often lobed, shining yellowish to brownish. Spikelets 2·6–3·2 mm. Glumes broadly hyaline, nearly smooth, the upper broadly ovate, the lower narrower and *c.* ¾ as long, Rhachilla and callus with hairs 0·3–0·4 mm. Lemma 1·6–2·7 mm, with hyaline margins, bicuspidate, glabrous or hairy, minutely scabridulous; awn 2–3·5(–6) mm, inserted somewhat above middle of lemma, slightly bent. Anthers 1–1·5 mm. *Sandy ground near the sea.* ● *Mediterranean region; local.* Bl Gr It Ju Si.

Most plants from Malta have awns 4–6 mm (var. *melitense* (Steudel) Lojac.).

20. T. parviflorum (Desf.) Pers., *Syn. Pl.* **1**: 97 (1805). Caespitose annual, with erect or geniculate glabrous stems 20–50 cm. Leaves up to 15 cm × 3 mm, flat, more or less villous like the sheaths. Panicle 4–15 × 1·5–3 cm, dense to fairly lax, rather contracted, diffuse. Spikelets 2·5–4 mm. Upper glume equalling the florets, glabrous, with aculeolate veins and margins; lower glume *c.* ½ as long and ¼ as wide as upper. Rhachilla minutely puberulent; callus glabrous. Lemma 1·8–3 mm, 2-fid, glabrous, with scabridulous margins. Awn 2–5 mm, inserted near apex, straight to slightly curved. Anthers 1–1·5 mm. *Italy, Sardegna, Sicilia.* It Sa Si.

21. T. scabriusculum (Lag.) Cosson ex Willk. in Willk. & Lange, *Prodr. Fl. Hisp.* **1**: 73 (1861). Laxly caespitose annual, with rather slender, glabrous stems 10–30 cm. Leaves rather few, up to 3 cm × 1·5 mm, villous to pubescent like the sheaths. Panicle 5–9 × *c.* 0·5 cm, narrowly cylindrical, contracted, somewhat reddish. Spikelets 3·2–4 mm. Glumes nearly equal, with rigid keels, hairy to subglabrous, but scabridulous. Rhachilla with hairs *c.* 0·3 mm. Lemma 2·5–3·3 mm, minutely 2-fid, scabridulous on the keel. Awn 0·8–2 mm, inserted near apex of lemma, nearly straight or slightly bent. Anthers *c.* 1 mm. ● *N.W., C. & S. Spain, N.E. Portugal.* Hs Lu.

22. T. ovatum (Cav.) Pers., *Syn. Pl.* **1**: 98 (1805). Caespitose annual with erect or spreading, glabrous or retrorsely pubescent stems 4–50 cm. Leaves up to 4 cm × 4 mm, flat, often short but wide and narrowly triangular, moderately villous. Sheaths densely pubescent, somewhat inflated. Panicle 0·5–3 × 0·5–1·5 cm, ovoid, very dense. Spikelets *c.* 5 mm (excluding setae). Glumes subequal, cartilaginous, with rigid cilia on veins and margins. Rhachilla with sparse, short hairs or subglabrous; callus glabrous. Lemma villous, with 2 setae, the undivided part *c.* 3·5 mm, the setae 1–3 mm. Awn 3–6·5 mm, inserted slightly below the sinus, strongly curved, widening towards the base, scabridulous. Anthers *c.* 1·7 mm. $2n=14$. *Dry places.* ● *N.W. & C. Spain, N. Portugal.* Hs Lu.

23. T. loeflingianum (L.) C. Presl, *Cyper. Gram. Sic.* 30 (1820) (incl. *T. cavanillesii* Trin., *T. gaudinianum* Boiss.). More or less caespitose annual with shortly villous stems 6–25 cm. Leaves up to 4 cm × 1 mm, flat or canaliculate, pubescent. Sheaths inflated, with dense retrorse hairs. Panicle 1·5–4 × 0·5–1·5 cm, ovoid to cylindrical, dense. Spikelets *c.* 5 mm. Glumes largely hyaline, almost smooth, the lower *c.* ⅔ as long as upper and narrower. Rhachilla with dense hairs; callus-hairs *c.* 0·5 mm. Lemma nearly smooth, with 2 setae, glabrous or with sparse hairs; undivided part 2·5–3 mm, the setae only slightly shorter. Awn 5·5–7·5 mm, inserted slightly below the sinus, angled. Palea very short and narrow. Anthers *c.* 0·5 mm, broadly linear. *Dry, open habitats, usually on sand or gravel. C. & S. Spain; S.W. Alps; S.E. Russia.* He Hs It Rs (E). (*S.W. & C. Asia.*)

T. cavanillesii Trin., *Mém. Acad. Sci. Pétersb.* ser. 6, **1**: 63 (1830), differs from typical **23** only in having hairs on the rhachilla 1·5–2 mm, instead of *c.* 0·3 mm. Such plants constitute the entire population in the Alps, while in Spain both variants occur. The difference does not seem worthy of taxonomic recognition.

24. T. macrochaetum Boiss., *Diagn. Pl. Or. Nov.* **2(13)**: 48 (1853). Like **23** but stems glabrous; sheaths not inflated; panicle up to 6 cm; rhachilla-hairs *c.* 0·5 mm; lemma scabridulous; anthers *c.* 1·5 mm. *W.C. Spain* (*Navalmoral de la Mata, prov. Cáceres*). Hs. (*N.E. Africa, Israel.*)

71. **Trisetaria** Forskål[1]

Annuals. Inflorescence a contracted panicle; rhachis often tough. Spikelets laterally compressed, with 1–5 florets. Glumes more or less cartilaginous, 3-veined. Lemma usually prominently 2-setose, membranous, 5-veined, with a long, twisted awn inserted above the middle. Palea 2-keeled, 2-fid. Rhachilla and callus with short hairs. Anthers usually long and narrow.

1. T. dufourei (Boiss.) Paunero, *Anal. Inst. Bot. Cavanilles* **9**: 521 (1950) (*Trisetum dufourei* Boiss.). Caespitose annual 15–35 cm, with erect or geniculate, retrorsely villous or glabrous stems. Leaves up to 5 cm × 3 mm, flat, villous. Sheaths slightly inflated, retrorsely villous. Panicle 2–6 × 1–2·5 cm, ovoid to cylindrical, dense but sometimes lobed. Pedicels antrorsely pubescent. Spikelets (excluding setae) 4–7 mm. Glumes with narrow hyaline margin, hairy, acuminate, the upper 4·5–6·5 mm, the lower *c.* ¾ as long. Rhachilla with hairs *c.* 0·5 mm; callus-hairs very short. Lemma scabridulous, with 2 setae, the undivided part 3·2–4·4 mm, the setae *c.* ⅔ as long. Awn 5–6·5 mm, angled and twisted, scabridulous. Anthers *c.* 2 mm. *Sandy soil near the sea.* ● *S. Portugal, S.W. Spain.* Hs Lu.

[1] By B. Jonsell.

72. **Parvotrisetum** Chrtek[1]

Annuals. Inflorescence a panicle. Spikelets small, laterally compressed, with 2–3 florets. Glumes keeled, membranous, the lower 1-veined, the upper 3-veined. Lemma 2-fid or with 2 short setae, membranous, keeled, with an awn inserted near the middle. Palea 2-keeled, 3- to almost 4-fid. Rhachilla glabrous; callus puberulent. Anthers elongate.

1. P. myrianthum (Bertol.) Chrtek, *Preslia* **37**: 201 (1965) (*Trisetum myrianthum* (Bertol.) Parl.). Annual 20–60 cm, with 1–several glabrous stems. Leaves up to 12 cm × 2 mm, involute, puberulent above, glabrous beneath. Sheaths glabrous. Panicle 6–20 × 1–3 cm, fairly lax but usually rather congested. Pedicels scabridulous. Spikelets 2·4–3·3 mm. Glumes glabrous, with sparsely scabridulous keels, the lower slightly shorter. Lemma 1·2–1·7 mm, 2-fid or with 2 short setae, glabrous to somewhat pubescent. Awn 2–3 mm, very slender, angled, minutely scabridulous. Anthers *c.* 1 mm. *Grassland and cultivated ground; usually calcifuge.* ● *N. Italy; S. & W. parts of the Balkan peninsula.* ?Al Gr It Ju Tu.

73. **Lagurus** L.[2]

Annual. Leaves flat. Inflorescence a dense, ovoid or subcylindrical to subglobose panicle. Spikelets laterally compressed, with 1 floret. Glumes subequal, linear, membranous, with a long, densely ciliate, setaceous apex, 1-veined. Lemma 5-veined, membranous, hairy at the base, with 2 long apical setae and a dorsal, geniculate awn. Palea somewhat shorter than lemma. Rhachilla prolonged, ciliate.

1. L. ovatus L., *Sp. Pl.* 81 (1753). More or less greyish-pubescent. Stems 8–50 cm, erect or ascending, simple or branched from the lower nodes. Leaves up to 10 mm wide, soft, long-acute; sheaths inflated; ligule up to 3 mm, obtuse or truncate, more or less lacerate, villous. Panicle 0·5–6 × 0·5–2 cm (excluding awns), very softly and densely hairy. Spikelets 7–9 mm (excluding awns), those at base of panicle mostly sterile. Glumes villous on the back; setaceous apex with hairs *c.* 2 mm. Lemma *c.* 3 mm (excluding awn and apical setae), lanceolate; awn 8–20 mm; apical setae 2–6 mm. Anthers *c.* 1·5 mm. $2n=14$. *Maritime sands; more rarely on dry waste places inland. S. Europe; sometimes cultivated for ornament and a frequent casual in C. Europe.* Al Az Bl Bu Co Cr Ga Gr Hs It Ju Lu Rs (K) Sa Si Tu.

74. **Deschampsia** Beauv.[3]

Perennials, usually caespitose. Leaves flat or setaceous. Inflorescence a panicle. Spikelets laterally compressed, with 2(–3) hermaphrodite florets. Glumes subequal, membranous, somewhat shorter than to almost as long as the florets, 1- to 3-veined. Lemma obscurely 5-veined, truncate and irregularly toothed at apex, with short hairs at the base; awn dorsal, straight or geniculate. Palea as long as the lemma, with 2 scabrid keels. Rhachilla prolonged.

Literature: A. Buschmann, *Phyton (Austria)* **2**: 276–287 (1950). S. Kawano, *Bot. Mag. Tokyo* **79**: 293–307 (1966). E. Paunero, *Anal. Inst. Bot. Cavanilles* **13**: 175–229 (1955). K. von Weihe & G. Reese, *Bot. Jahrb.* **88**: 1–48 (1968).

1 Lemma acute or with truncate, toothed apex with the central teeth at least as long as the outer
2 Leaves less than 1 mm wide, tightly inrolled; awn sharply geniculate **5. flexuosa**
2 Leaves more than 1 mm wide, flat or sometimes inrolled; awn straight **1. cespitosa**
1 Lemma with truncate, toothed apex, the outer teeth much the longest
3 Awn shorter than lemma or not more than 1 mm longer; leaves glaucous **2. media**
3 Awn up to 5 mm longer than lemma; leaves green
4 Upper glume strongly 3-veined in the lower half; leaves arising in 2 ranks **4. foliosa**
4 Lateral veins of upper glume scarcely visible; leaves not 2-ranked **3. setacea**

Sect. DESCHAMPSIA. Palea bifid. Rhachilla prolonged by more than ¼ the length of the upper floret. Anthers less than 2 mm.

1. D. cespitosa (L.) Beauv., *Agrost.* 91, 160 (1812). Caespitose; stems 12–200 cm, erect, smooth. Leaves 3–60 cm × up to 5 mm, flat or convolute, green or glaucous, aculeolate on margin and often on upper surface; ligule 3–15 mm, acute. Panicle 3–50 × up to 20 cm, usually lax, branches smooth or aculeolate. Spikelets 3–9 mm, silvery, purplish or stramineous, sometimes proliferating. Glumes ovate to lanceolate, acute. Lemma usually truncate with a toothed apex, the outer teeth not longer than the inner; awn straight, as long as or exceeding lemma. Rhachilla prolonged by up to ½ the length of the upper floret. *Most of Europe, but rare in the Mediterranean region.* All except Az Bl Co Cr Sa.

A very complex species, with many variants which differ to a greater or lesser degree in ecology, cytology and morphology. The following subspecies represent the most distinct taxa and have more or less discrete areas of distribution, although they appear to hybridize readily.

1 Panicle-branches and keel of lower glume at least sparsely aculeolate
2 Plant slender; basal leaves flat, less than 2 mm wide; awn arising from middle of lemma **(f)** subsp. **orientalis**
2 Plant robust; basal leaves flat and more than 2 mm wide or inrolled; awn arising from base of lemma
3 Plant stoloniferous, laxly caespitose; glumes long-lanceolate **(g)** subsp. **paludosa**
3 Plant not stoloniferous, densely caespitose; glumes ovate-lanceolate **(a)** subsp. **cespitosa**
1 Panicle-branches and keel of lower glume smooth
4 At least some spikelets proliferating; lemma acute, with few small teeth at apex; awn arising from the middle or above **(b)** subsp. **alpina**
4 Spikelets not proliferating; lemma truncate, with large teeth
5 Laxly caespitose; the uppermost leaf-blade not much shorter than the lower **(c)** subsp. **obensis**
5 Densely caespitose; the uppermost leaf-blade much shorter than the lower
6 Stems 50–100 cm; spikelets 6–9 mm, the awn conspicuously longer than lemma **(d)** subsp. **bottnica**
6 Stems 10–30 cm; spikelets 3–5 mm, the awn equalling or shorter than lemma **(e)** subsp. **borealis**

(a) Subsp. **cespitosa**: Densely caespitose; stems usually more than 30 cm. Leaves 10–60 cm × 2–5 mm when flat, rarely inrolled, usually strongly aculeolate on margin and upper surface. Panicle 10–50 cm, usually lax; branches aculeolate. Spikelets 4–6 mm, silvery and purple, rarely proliferating. Glumes ovate-lanceolate, the lower with aculeolate keel. Lemma truncate, with several prominent, subequal teeth at the apex; awn not more than 1 mm longer than the lemma, arising near the base. Rhachilla prolonged by ⅓–½ the length of the upper floret. $2n=24, 26+0–7B$. *Damp grassland. Throughout the range of the species.*

(b) Subsp. **alpina** (L.) Tzvelev in Fedorov, *Fl. Part. Eur. URSS* **1**: 209 (1974) (*D. alpina* (L.) Roemer & Schultes): Densely

[1] By B. Jonsell. [2] By T. G. Tutin. [3] By G. C. S. Clarke.

caespitose; stems 10–40 cm. Leaves 2–15 cm × 2–4 mm, aculeolate on margin and upper surface. Panicle 5–16 cm, usually dense; branches smooth. Spikelets 4–5·5 mm, purple and yellowish, usually proliferating. Glumes ovate-lanceolate; keel smooth. Lemma acute, with slightly toothed apex; awn not more than 1 mm longer than the lemma, arising from the middle or above. Rhachilla prolonged by ¼–⅓ the length of the floret. $2n=52$, 56. *Damp, stony places and rocks, usually on mountains. N. Europe.*

(c) Subsp. **obensis** (Roshev.) Tzvelev, *op. cit.* 210 (1974) (*D. obensis* Roshev.): Laxly caespitose; stems 20–50 cm. Leaves 12–20 cm × 2–3 mm, smooth or weakly aculeolate. Panicle 10–17 × up to 3 cm, lax; branches smooth. Spikelets 6·5–9 mm, stramineous, not proliferating. Glumes narrowly lanceolate; keel smooth. Lemma truncate, with 4 subequal teeth at apex; awn not more than 1 mm longer than lemma, arising from near base. Rhachilla prolonged by ¼–⅓ the length of the upper floret. *Maritime sands. Arctic Russia.* (*N. Siberia.*)

(d) Subsp. **bottnica** (Wahlenb.) G. C. S. Clarke, *Bot. Jour. Linn. Soc.* **76**: 363 (1978) (*Aira bottnica* Wahlenb., *D. bottnica* (Wahlenb.) Trin.): Like subsp. (c) but stems 50–100 cm; leaves 12–20 cm, bluish-green, soon becoming stramineous; panicle 20–30 cm; central teeth at apex of lemma longer than the outer; awn 2–5 mm longer than lemma; rhachilla prolonged by ½ the length of the upper floret. $2n=26$, 26+2B, 28. *Stony sea-shores.* ● *N. & E. parts of Baltic region.*

(e) Subsp. **borealis** (Trautv.) Tzvelev in Fedorov, *Fl. Part. Eur. URSS* **1**: 210 (1974) (*D. borealis* (Trautv.) Roshev.): Densely caespitose; stems 10–30 cm, slender. Leaves 1·5–4 cm × 1 mm, weakly aculeolate, convolute. Panicle 3–8 × up to 3 cm; branches patent, smooth. Spikelets 3–4 mm, not proliferating, brownish-purple. Glumes ovate-lanceolate; keel smooth. Lemma truncate, the apex toothed, with the longest teeth in the centre; awn not exceeding the lemma, arising at the middle or above. Rhachilla prolonged by ¼ the length of the upper floret. $2n=28$. *Damp meadows or by streams and lakes. Arctic Russia.*

(f) Subsp. **orientalis** Hultén, *Kungl. Svenska Vet.-Akad. Handl.* ser. 3, **5(1)**: 109 (1927): Densely caespitose; stems 20–80 cm, slender. Leaves 4–12 cm × less than 2 mm, smooth or weakly aculeolate, flat. Panicle 10–25 × up to 10 cm, lax; branches smooth. Spikelets 3–5 mm, not proliferating, greyish-yellow. Glumes lanceolate; keel smooth. Lemma truncate, the apex with 4 subequal teeth; awn not exceeding lemma by more than 1 mm, arising at the middle. Rhachilla prolonged by ½ the length of the upper floret. *Meadows and river-banks. N. Russia.*

(g) Subsp. **paludosa** (Schübler & Martens) G. C. S. Clarke, *Bot. Jour. Linn. Soc.* **76**: 363 (1978) (*Aira cespitosa* subsp. *paludosa* Schübler & Martens, *A. wibeliana* Sonder, *D. wibeliana* (Sonder) Parl.): Laxly caespitose, stoloniferous; stems erect or slightly decumbent at base, sometimes rooting at lowest nodes. Leaves 10–30 cm × 2–4 mm, sparsely aculeolate on margin and upper surface. Panicle 7–40 × 2·5–25 cm, lax; branches weakly aculeolate. Spikelets 5–6·5 mm, yellowish and purple, not proliferating. Glumes long-lanceolate, the keel of the lower glume aculeolate. Lemma truncate, the apex with 4 subequal teeth; awn up to 1 mm longer than lemma, arising from near the base. Rhachilla prolonged by ¼–⅓ the length of the upper floret. $2n=26+0$–2B. *Estuarine marshes.* ● *N.W. Germany.*

A northern, mainly coastal variant which is usually smaller, has short, involute, glaucous basal leaves and is generally less strongly aculeolate than subsp. (a), has been called subsp. **glauca** (Hartman) Tzvelev in Fedorov, *Fl. Part. Eur. URSS* **1**: 209 (1974). Plants with short ligules, proliferating spikelets, long rhachilla-prolongation and sparse aculeolation, from river- and lake-margins in the C. Alps, have been called **D. littoralis** (Gaudin) Reuter, *Cat. Pl. Vasc. Genève* ed. 2, 236 (1861); they have $2n=56$.

D. brevifolia R. Br. in Parry, *Jour. Voy. N.W. Pass., Suppl. App.* 291 (1824) (*D. arctica* (Sprengel) Ostenf.), which is like subsp. (e) but has an almost spike-like panicle and more robust stems, has been reported from arctic Russia and Svalbard, but its presence there needs confirmation.

2. D. media (Gouan) Roemer & Schultes, *Syst. Veg.* **2**: 687 (1817). Laxly caespitose; stems 8–70 cm, erect, smooth. Leaves 2–20 cm × 1 mm, convolute, setaceous, glaucous; margin aculeolate; ligule 5 mm, acute. Panicle 3–24 × up to 15 cm, usually lax; branches erecto-patent or patent, weakly aculeolate. Spikelets 3–5 mm, often silvery or purplish, not proliferating. Glumes ovate-lanceolate, acute, the lower with weakly aculeolate keel. Lemma 3–4 mm, ovate-oblong; apex truncate, toothed, with the outer teeth much the longest; awn straight, shorter or up to 1 mm longer than the lemma, arising above or near the middle. Rhachilla prolonged by at least ½ the length of the upper floret. $2n=26$. *Wet pastures and river-banks. W. & C. Mediterranean region, extending locally northwards to* 49° 30′ *in W. Germany.* ?Al Ga Ge ?Gr Hs It Ju Lu.

Plants from Spain and N.E. Portugal with folded, rather than convolute, basal leaves which curve downwards towards the ground and have a long ligule have been distinguished as **D. refracta** (Lag.) Roemer & Schultes, *loc. cit.* (1817).

3. D. setacea (Hudson) Hackel, *Cat. Rais. Gram. Port.* 33 (1880) (*D. discolor* (Thuill.) Beauv.). Densely caespitose; stems 20–70 cm, erect, smooth. Leaves 5–20 cm × up to 1 mm, setaceous or rarely flat, rough above, smooth beneath; ligule 3–8 mm, narrowly lanceolate. Panicle 5–15 × up to 10 cm, lax; branches erecto-patent, aculeolate. Spikelets 4–5 mm, purple and yellowish, not proliferating. Glumes ovate-oblong, acute, the upper 1-veined; keel aculeolate above. Lemma 3 mm, ovate-oblong, truncate, the apex toothed, with the marginal teeth much the longest; awn longer than lemma by up to 3 mm, geniculate, twisted, arising near the base. Rhachilla prolonged by at least ½ the length of the upper floret. $2n=14$. *Bogs and wet heaths. W. Europe from N. Spain to S. Norway and extending eastwards to W. Poland.* Be Br Da Ga Ge Hb Ho Hs No Po Su.

Outside Europe this species seems to be known only from the Chilean Andes.

4. D. foliosa Hackel, *loc. cit.* (1880). Caespitose; stems 15–30 cm, erect, slender, smooth, laterally compressed so that the leaves appear 2-ranked. Leaves 5–15 cm × up to 0·6 mm, folded, aculeolate above, smooth on margin and beneath; ligule 4–7 mm, lanceolate. Panicle 4–9 × 1–5 cm, rather lax; branches erecto-patent, weakly aculeolate. Spikelets 3·5–6 mm, stramineous or sometimes purplish, not proliferating. Glumes lanceolate, the upper strongly 3-veined in the lower half; keel smooth. Lemma 2·5–4 mm, truncate, the apex toothed, with the outer teeth the longest; awn longer than lemma by up to 5 mm, straight or weakly geniculate, arising near the base. Rhachilla prolonged by ½ the length of the upper floret. *Mountain pastures. Açores.* Az. (*Madeira*)

Sect. AVENARIA (Reichenb.) Holmberg. Palea not bifid. Rhachilla prolonged by less than ¼ the length of the upper floret. Anthers 2 mm or more.

5. D. flexuosa (L.) Trin., *Bull. Sci. Acad. Imp. Sci. Pétersb.* **1**: 66 (1836) (incl. *D. stricta* Hackel). Caespitose; stems 20–100 cm, erect, smooth, sometimes with slender stolons. Leaves up to

20 cm × 0·3–0·8 mm, setaceous, weakly aculeolate above, smooth beneath; ligule 1–3 mm, obtuse. Panicle 5–15 × up to 8 cm, lax; branches usually patent, smooth or sparsely aculeolate. Spikelets 4–7 mm, purplish or silvery, rarely proliferating. Glumes ovate-lanceolate, acute; keel smooth. Lemma 3–6 mm, ovate-oblong, truncate and minutely toothed at the apex; awn longer than the lemma by up to 5 mm, sharply geniculate, twisted, arising near the base. Rhachilla prolonged by less than ¼ the length of the upper floret. $2n=26, 28, 56$. *Moors, heaths and open woodlands; calcifuge. Much of Europe, but rarer in the south and absent from much of the south-east.* All except Az Bl Cr Rs (K, E) Sb.

75. Vahlodea Fries[1]

Like *Deschampsia* but glumes about twice as long as lemma; lemma with hairs at the base, which reach ½–⅔ of the way to the apex.

1. V. atropurpurea (Wahlenb.) Fries ex Hartman, *Handb. Skand. Fl.* ed. 4, 30 (1843). Laxly caespitose; stems 15–30 cm, slender, smooth. Leaves flat, glabrous, up to 3 mm wide; ligule *c.* 2 mm. Panicle 3–7 cm, lax; branches flexuous, very slender, the lower often deflexed, scabrid especially distally. Spikelets *c.* 5 mm, borne only towards the ends of the branches. Glumes lanceolate, acuminate, shortly and sparsely hairy, purplish, with a wide, brownish, scarious margin. Lemma *c.* 2 mm, obtuse, shortly hairy in the upper half; awn arising about the middle, hairy below, not exserted. Anthers 0·5–0·7 mm. $2n=14$. *Damp, grassy places; calcifuge. N. & W. Fennoscandia, arctic Russia.* Fe No Rs (N) Su.

76. Aira L.[1]

Annuals. Leaves often convolute. Inflorescence a panicle. Spikelets laterally compressed, with 2 hermaphrodite florets, the upper sessile or subsessile. Glumes subequal, membranous, as long as to longer than the florets, 1- to 3-veined. Lemma 5-veined in the basal half, 2-fid at apex, with a dorsal awn from below the middle or sometimes the lower or both florets unawned. Palea shorter than lemma. Rhachilla not prolonged. Grain subfusiform, longitudinally sulcate on the adaxial face, glabrous.

All species occur in dry, open habitats.

1 Panicle narrow, dense, with short, erect branches; pedicels mostly shorter than spikelets **1. praecox**
1 Panicle wide, lax, with erecto-patent to divaricate branches; pedicels 1–8 times as long as spikelets
2 Pedicels 2–8 times as long as spikelets
3 Pedicels 5–8 times as long as spikelets; glumes obtuse **7. tenorii**
3 Pedicels 2–5 times as long as spikelets; glumes acute
4 Both awns long-exserted **6. elegantissima**
4 Awn of lower floret shorter than glumes or absent
5 Spikelets *c.* 3·5 mm **8. provincialis**
5 Spikelets 1·5–2·5 mm **6. elegantissima**
2 Pedicels 1–2 times as long as spikelets
6 Glumes acute to acuminate
7 Spikelets 2·5–3·5 mm; anthers 0·3–0·6 mm; both florets awned **2. caryophyllea**
7 Spikelets 2–2·5 mm; anthers *c.* 1·3 mm; lower floret often unawned **4. uniaristata**
6 Glumes obtuse or subobtuse, usually denticulate and often mucronate
8 Leaf-sheaths not inflated, the uppermost far below the panicle **3. cupaniana**
8 Leaf-sheaths inflated, the uppermost enclosing the base of the panicle **5. scoparia**

[1] By T. G. Tutin.

1. A. praecox L., *Sp. Pl.* 65 (1753). Stems 2–12(–20) cm, erect to procumbent, slender. Leaves up to 5 cm × 0·5 mm, glabrous, convolute; sheaths smooth; ligule up to 3 mm, obtuse. Panicle 0·5–5 cm, narrow, with short, erect branches. Spikelets 2·5–3·5 mm, crowded. Glumes lanceolate, scabridulous on the keel, shining. Lemma as long as glumes, scabridulous towards the apex, with short hairs at base; awn exserted, arising *c.* ½ of the way from base to apex. $2n=14$. *Europe, eastwards to S.W. Finland (Ahvenanmaa), Lithuania, W. Czechoslovakia and N.W. Italy.* Az Be Br Cz Da Fa Fe Ga Ge Hb He Ho Hs It Lu No Po Rs (B) Su.

2. A. caryophyllea L., *Sp. Pl.* 66 (1753). Stems (3–)10–30(–50) cm, erect or erecto-patent, slender. Leaves up to 5 cm × 0·3 mm, glabrous, convolute; sheaths retrorsely scabridulous, not inflated, the uppermost far below the panicle; ligule up to 5 mm, denticulate at apex. Panicle 1–12 × 1–12 cm, lax, with long, erecto-patent branches; pedicels gradually thickened at apex. Spikelets 2–3·5 mm. Glumes ovate, acuminate, scabridulous on the keel, 1- to 3-veined, shining. Lemma ¾ as long as glumes, scabridulous towards the apex, with short hairs at base; awn exserted, arising *c.* ½ of the way from base to apex. Anthers 0·3–0·6 mm. *S., W. & C. Europe, extending to S. Sweden; doubtfully native in north and east parts of its range.* Al Au Az Be Br Bu Co Cz Da Ga Ge ?Gr Hb He Ho Hs Hu It Ju Lu Po Rm Rs (?C, W, K) Sa Si Su Tu.

(a) Subsp. **caryophyllea**: Plant usually 5–35 cm; spikelets 2·5–3·5 mm; longer pedicels usually more than 5 mm. $2n=28$. *Almost throughout the range of the species.*

(b) Subsp. **multiculmis** (Dumort.) Bonnier & Layens, *Fl. Fr.* 358 (1894): Plant usually 20–50 cm; spikelets 2–2·5 mm; longer pedicels usually less than 5 mm. $2n=28$. *Mainly in the south-western part of the range of the species.*

3. A. cupaniana Guss., *Fl. Sic. Syn.* **1**: 148 (1843). Like **2** but pedicels abruptly thickened at apex; glumes subobtuse, denticulate towards the apex, often mucronate; lemma ½–⅔ as long as glumes; lower floret often unawned; anthers 0·2–0·4 mm. $2n=14$. *S. Europe.* Bl Co Cr Ga Gr Hs It Lu Sa Si.

4. A. uniaristata Lag. & Rodr., *Anal. Ci. Nat.* **6**: 148 (1803). Like **2** but ligule not denticulate; panicle-branches flexuous and usually divaricate; spikelets 2–2·5 mm, the lower floret often unawned; anthers *c.* 1·3 mm. $2n=14$. *Spain and S.C. Portugal.* Hs Lu.

5. A. scoparia Adamović, *Denkschr. Akad. Wiss. Math.-Nat. Kl. (Wien)* **74**: 117 (1904). Like **2** but leaf-sheaths inflated, the uppermost enclosing the base of the panicle; spikelets *c.* 2 mm, very numerous, crowded; glumes subobtuse, shortly mucronate; lower florets sometimes unawned. ● *S. Jugoslavia (near Bitola).* Ju.

Apparently known only from the type-collection.

6. A. elegantissima Schur, *Verh. Mitt. Siebenb. Ver. Naturw.* **4** (*Sert. Fl. Transs.*): 85 (1853) (*A. capillaris* Host, non Savi, *A. elegans* Willd. ex Gaudin, nom. illegit.). Stems 10–40 cm, erect or decumbent, slender. Leaves up to 4 cm × 0·8 mm, glabrous, flat or convolute; sheaths scabrid; ligule 2–3 mm, acute. Panicle 4–9 × 2–5 cm, very lax; pedicels mostly 2–5 times as long as spikelets, abruptly thickened at apex. Spikelets 1·5–2·5 mm. Glumes ovate-lanceolate, acute, scabridulous on the keel, 1-veined, shiny. Lemma *c.* ⅔ as long as glumes, scabrid, with short hairs at base; lower floret often unawned, the upper with an exserted awn arising below the middle. Anthers 0·3–0·5 mm.

$2n=14$. *S. & S.C. Europe.* Al Au Bl Bu Co Cr Cz Ga Gr He Hs Hu It Ju Rm Rs (K) Sa Si Tu [Ge].

7. A. tenorii Guss., *Fl. Sic. Prodr.* **1**: 62 (1827) (incl. *A. intermedia* Guss.). Like **6** but panicle often wider than long, with divaricate branches; pedicels 5–8 times as long as spikelets; spikelets 1·5–3 mm; glumes obtuse, often denticulate and sometimes mucronate; lemma glabrous or with a few short hairs at base; awns present or absent; anthers 0·7–1·7 mm. $2n=14$. *Mediterranean region.* Bl Co ?Cr Ga Gr Hs It Sa Si.

8. A. provincialis Jordan, *Pug. Pl. Nov.* 142 (1852). Like **6** but pedicels gradually thickened at apex; spikelets *c.* 3·5 mm; lower floret with an awn shorter than the glumes, the upper with a shortly exserted awn. $2n=28$. ● *S.E. France, Corse.* Co ?Cr Ga.

77. Molineriella Rouy[1]
(*Molineria* Parl., non Colla)

Like *Aira* but glumes shorter than florets; lemma conspicuously 5- to 7-veined throughout, obtuse or almost truncate, unawned or with a short, straight dorsal awn from above the middle.

1. M. minuta (L.) Rouy, *Fl. Fr.* **14**: 102 (1913) (*Molineria minuta* (L.) Parl., *Airopsis minuta* (L.) Desv.). Stems 3–20 cm, slender, smooth, shining. Leaves up to 8 cm × 2 mm, scabrid on the margin, otherwise smooth, flat or longitudinally folded; sheaths smooth, the upper somewhat inflated; ligule up to 2·5 mm, often lacerate. Panicle up to 7 × 7 cm, very lax; pedicels 1–5 times as long as spikelets, gradually thickened towards the apex. Spikelets 1–1·5 mm, usually violet, shining. Glumes ovate to ovate-lanceolate, smooth, the lower 1-veined, the upper 3-veined, with the lateral veins short and obscure. Lemma ovate, scarious at apex, unawned; hairs at base of lemma *c.* ⅔ as long as lemma. Anthers 0·9–1 mm. *Dry, open habitats. S. Europe.* Al Bu Co Ga Gr Hs It Ju Lu Sa Tu.

2. M. laevis (Brot.) Rouy, *op. cit.* 103 (1913) (*Molineria laevis* (Brot.) Hackel, *Aira lendigera* Lag.). Like **1** but stems up to 35 cm; spikelets *c.* 2 mm; lemma oblong, with a short, straight dorsal awn from above the middle; hairs at base of lemma up to ½ as long as lemma. $2n=8$. *Dry, open habitats. Spain and Portugal.* Hs Lu.

An old record from Krym requires confirmation.

78. Airopsis Desv.[1]

Like *Aira* but glumes broadly ovate, ventricose; lemma obscurely 3-veined, 3-dentate at apex, unawned; grain suborbicular, rounded on the abaxial face, flat on the adaxial face.

1. A. tenella (Cav.) Ascherson & Graebner, *Syn. Mitteleur. Fl.* **2(1)**: 298 (1899) (*A. globosa* (Thore) Desv.). Stems 3–20(–30) cm, very slender. Leaves up to 6 cm × 1·5 mm, scabridulous, convolute; sheaths weakly scabridulous, the uppermost somewhat inflated; ligule up to 2 mm, obtuse, more or less lacerate. Panicle up to 5 × 1 cm, usually less, oblong or linear-lanceolate, sometimes spicate, rather dense; pedicels about as long as spikelets, clavate at apex. Spikelets 1·2–1·5 mm. Glumes smooth and shining, longer than the florets. Lemma ovate, puberulent outside. Anthers *c.* 0·3 mm. $2n=8$. *Open, sandy habitats. S.W. Europe, extending eastwards to Sicilia.* Co Ga Hs It Lu Si.

[1] By T. G. Tutin.

79. Periballia Trin.[1]

Like *Aira* but lower 1–3 whorls of panicle-branches almost or entirely without spikelets; glumes herbaceous; lemma weakly 3-veined, rarely with a dorsal awn; grain truncate at base, puberulent.

1. P. involucrata (Cav.) Janka, *Term. Füz.* **1**: 97 (1877) (*P. hispanica* Trin.). Stems usually 15–40 cm, slender. Leaves convolute, scabrid; sheaths scabrid, not inflated; ligule up to 4 mm. Panicle up to 15 × 10 cm, lax; most or all branches in the lower 1–3 whorls short, slender, without spikelets; pedicels 1–2(–5) times as long as spikelets, clavate at apex. Spikelets *c.* 3 mm, greenish-brown. Lower glume lanceolate, the upper ovate, both slightly shorter than florets. Lemma obscurely 3-veined, hairy at base, usually unawned. Rhachilla hairy. $2n=14$. *Dry, sandy places.* ● *W. & C. Spain, E. Portugal.* Hs Lu.

80. Antinoria Parl.[1]

Like *Aira* but sometimes perennial; upper floret distinctly stipitate; lemma 3-veined, widest near apex, truncate, shallowly 3-dentate, unawned; grain obovoid-pyriform, rounded on the abaxial face, flat on the adaxial face.

Usually perennial; glumes 1·5–2 mm; anthers *c.* 1 mm	**1. agrostidea**
Annual; glumes *c.* 1 mm; anthers *c.* 0·5 mm	**2. insularis**

1. A. agrostidea (DC.) Parl., *Fl. Palerm.* **1**: 95 (1845) (*Airopsis agrostidea* (DC.) DC.). Stems 5–30 cm, slender, procumbent and rooting at the nodes below when perennial, ascending when annual. Leaves up to 12 cm × 2·5 mm, scabrid above and on margin, flat; sheaths smooth, the upper somewhat inflated; ligule up to 3 mm, usually lacerate. Panicle up to 10 × 7 cm; branches divaricate; pedicels mostly longer than spikelets, clavate at apex. Spikelets 1·5–2 mm, green and violet, shining. Glumes ovate, subobtuse, scabridulous on the keel, 3-veined, longer than the florets. Lemma and rhachilla glabrous. Anthers *c.* 1 mm. *Damp places. Portugal, C. & N.W. Spain, C. & N.W. France.* Ga Hs Lu.

An aquatic variant with long stems and floating leaves occurs in N.C. Portugal and C. Spain (Serra da Estrêla to Sierra de Guadarrama). It has been called subsp. **natans** (Hackel) Rivas Martínez, *Anal. Inst. Bot. Cavanilles* **21**: 295 (1963), but its taxonomic rank requires further investigation.

2. A. insularis Parl., *Fl. Palerm.* **1**: 94 (1845) (*Airopsis insularis* (Parl.) Nyman). Like **1** but always annual; spikelets *c.* 1 mm; anthers *c.* 0·5 mm. *Seasonally wet places. W.C. Mediterranean region; Kriti.* Co Cr It Sa Si.

81. Hierochloë R. Br.[2]

Perennials, smelling of coumarin. Leaves flat or more or less convolute, those on the flowering stem with a short lamina; ligule truncate, obtuse or acute. Inflorescence a panicle. Spikelets laterally compressed, with 2 male florets and 1 terminal hermaphrodite floret. Glumes membranous, subequal, ovate, about as long as the florets, obscurely 3-veined. Lemmas of male florets membranous, obscurely 3- to 5-veined, obtuse, mucronate or awned. Palea shorter than lemma, membranous, 2-veined. Lemma of hermaphrodite floret obscurely 5-veined, hard and shiny in fruit (except in **6**), hairy towards apex. Palea shorter than lemma, membranous, 1-veined. Stamens 3 in male florets, 2 in hermaphrodite floret.

[1] By G. Weimarck.

Apomixis occurs in the genus. Measurements of leaf-widths refer to the leaves of non-flowering shoots.

Literature: G. Weimarck, *Bot. Not.* **124**: 129–175 (1971).

1 Awn more than 1 mm; plant caespitose
2 Longest awn not more than 3 mm; pedicels with hairs 0·1–0·3 mm long immediately below spikelets **1. australis**
2 Longest awn more than 5 mm; pedicels glabrous or with hairs not more than 0·1 mm long **7. alpina**
1 Awn not more than 1 mm, or absent; plant with creeping rhizomes
3 Spikelets 1–2 at each node; leaves not more than 2 mm wide **6. pauciflora**
3 Spikelets 3 or more at the lower nodes; leaves at least 2·2 mm wide
4 Base of stem without conspicuously numerous greyish leaf-sheaths; leaves green; panicle pyramidal
5 Lemma of hermaphrodite floret with ±appressed hairs; lemmas of male florets sparsely ciliate, unawned, mucronate, or with a very slender awn **2. odorata**
5 Lemma of hermaphrodite floret with patent hairs; lemmas of male florets densely ciliate, with a coarse awn, rarely mucronate **3. hirta**
4 Base of stem with very numerous greyish leaf-sheaths; leaves pruinose; panicle ovoid
6 Spikelets usually more than 120, in dense clusters **4. repens**
6 Spikelets usually fewer than 120, not in dense clusters **5. stepporum**

1. H. australis (Schrader) Roemer & Schultes, *Syst. Veg.* **2**: 514 (1817). Caespitose, 30–60(–80) cm. Leaves (1·5–)3–5·5 (–9) mm wide, often pruinose. Inflorescence (2·5–)3·5–7 cm, pyramidal, with (11–)20–35(–70) spikelets. Lemmas of male florets more or less deeply 2-fid, sparsely ciliate. Awn of lemma of lower male floret 0·1–0·5(–3) mm; awn of lemma of upper male floret 1–3 mm, twisted at base, geniculate. Lemma of hermaphrodite floret with appressed hairs towards apex. Facultatively apomictic. $2n=14$. *Open woods.* ● *From N.W. Russia westwards to S. Germany and N. Italy and southwards to Macedonia.* Au Bu Cz Fe Ge Hu It Ju Po Rm Rs (B, C, W).

2. H. odorata (L.) Beauv., *Agrost.* 62, 164 (1812). Rhizomatous, (10–)25–60(–90) cm. Leaves (2·2–)3–6(–8) mm wide, green. Inflorescence pyramidal. Lemmas of male florets sparsely ciliate. Lemma of hermaphrodite floret with more or less appressed hairs towards apex. *Wet meadows, fens, riversides and lake-margins. N. & C. Europe, southwards to the Alps and N. Moldavia.* Au Br Cz Da Fe Ga Ge Hb He Ho Is It No Po Rs (N, B, C, W) Su.

(a) Subsp. **odorata**: Inflorescence (2·5–)3·5–9(–12·5) cm, with (8–)25–60(–100) spikelets. Lemmas of male florets acute, mucronate or slightly 2-fid, the midveins reaching apex of lemma or base of apical incision; hyaline margin usually 0·1–0·3 mm wide; awn, if present, up to 0·8 mm, slender. Amphimictic. $2n=28, 42$. *Throughout the range of the species except the Baltic region and N.W. Russia.*

(b) Subsp. **baltica** G. Weim., *Bot. Not.* **124**: 141 (1971): Inflorescence (3–)4–7·5(–10) cm, with (14–)20–50(–85) spikelets. Lemmas of male florets slightly 2-fid, the midvein ending below apex of lemma or base of apical incision; hyaline margin usually 0·3–0·5 mm wide; awn almost always absent. Apomictic. $2n=42$. ● *Baltic region and N.W. Russia.*

3. H. hirta (Schrank) Borbás, *Balaton Növényföldr.* 315 (1900). Like **2** but lemma of hermaphrodite floret with patent hairs towards apex; lemma of male florets acute or slightly 2-fid, densely ciliate; awn 0·2–1 mm, stout. Apomictic. $2n=56$. *Wet meadows, fens and lake-shores. Fennoscandia and N.W. Russia, extending locally south-westwards to Austria.* Au Cz Fe Ge ?It No Po Rs (N, B, C) Su.

(a) Subsp. **hirta**: 40–85(–110) cm. Inflorescence (5–)7·5–15 cm, usually with at least 9 nodes, with (19–)50–100(–140) spikelets; lower branches usually drooping. Awn of lemmas of male florets tapering, bent gradually outwards. ● *From c. 64° N. in Finland southwards.*

(b) Subsp. **arctica** (C. Presl) G. Weim., *Bot. Not.* **124**: 146 (1971): (20–)30–75 cm. Inflorescence (3–)4·5–8·5 cm, usually with not more than 8 nodes, with (15–)20–70(–85) spikelets; lower branches usually not drooping. Awn of lemmas of male florets not tapering, straight or slightly bent inwards. *Throughout the range of the species.*

4. H. repens (Host) Simonkai, *Enum. Fl. Transs.* 560 (1886). Rhizomatous, (30–)45–70(–90) cm; base of stem enclosed by numerous greyish sheaths. Leaves (5–)7–9(–11) mm wide, pruinose. Inflorescence (5–)6·5–10(–14) cm, ovoid, with (80–)120–160(–300) densely clustered spikelets. Lemmas of male florets acute or slightly 2-fid, densely ciliate; awn (0·1–)0·2–0·5 (–0·8) mm. Lemma of hermaphrodite floret with more or less appressed hairs toward apex. Amphimictic. $2n=28$, $28+2B$. *Dry, open habitats. E.C. & E. Europe, northwards to c. 56° N. in C. Russia.* Au Bu Cz Hu Rm Rs (C, W, E).

5. H. stepporum P. Smirnov, *Bull. Soc. Nat. Moscou* ser. 2, **63 (5)**: 81 (1958). Like **4** but spikelets usually not more than 120 (–160), not in dense clusters; hairs on lemma of hermaphrodite floret more patent. *Steppes and dry, open habitats. S.E. Russia.* Rs (?C, E).

6. H. pauciflora R. Br. in Parry, *Jour. Voy. N.W. Pass., Suppl. App.* 293 (1824). Rhizomatous, (4–)7–25(–35) cm. Leaves 1–2 mm wide, more or less convolute, green. Inflorescence (0·8–)1·2–3·5(–4·5) cm, contracted, with 3–10(–15) spikelets. Lemmas of male florets acute or slightly 2-fid, very sparsely ciliate. Awn of lemmas of male florets absent or up to 1 mm. Lemma of hermaphrodite floret membranous, with sparse, patent hairs towards apex. *Tundra-bogs. Arctic Ural and adjacent lowlands.* Rs (N). (*Arctic and subarctic Asia and America.*)

7. H. alpina (Willd.) Roemer & Schultes, *Syst. Veg.* **2**: 515 (1817). Caespitose, (5–)20–35(–55) cm. Leaves 1·5–3 mm wide, often more or less convolute, green. Inflorescence (1·2–)2–5(–6) cm, usually contracted, with (3–)10–20(–35) spikelets. Lemmas of male florets deeply 2-fid, moderately ciliate. Awn on lemma of lower male floret 0·6–3·5 mm; awn on lemma of upper male floret 5·5–9(–10) mm, almost always twisted at base, geniculate. Lemma of hermaphrodite floret with appressed or patent hairs towards apex. Facultatively apomictic. $2n=56$, 64, 66, 68, 71, 72, 74–78. *Exposed mountain heaths and tundra. Arctic Europe.* Fe No Rs (N) Sb Su.

82. Anthoxanthum L.[1]

Annuals or perennials, often smelling of coumarin. Leaves flat. Inflorescence a condensed panicle. Spikelets laterally compressed, of 2 sterile florets and a terminal hermaphrodite floret. Glumes membranous, very unequal, the lower 1-, the upper 3-veined. Lemma of sterile florets membranous, toothed or with 2 oblong, obtuse lobes at apex, 3-veined, with a dorsal awn. Lemma of fertile floret somewhat indurated, shorter than the sterile ones, 5- to 7-veined. Palea 1-veined. Stamens 2. Lodicules absent.

[1] By T. G. Tutin.

Literature: H. Teppner, *Phyton* (*Austria*) **13**: 305–312 (1969); *Österr. Bot. Zeitschr.* **118**: 280–292 (1970).

1 Perennial, with non-flowering shoots at anthesis
2 Leaves 6–15 mm wide; stems often tuberous at base; spikelets 10–13 mm **3. amarum**
2 Leaves 2–8 mm wide; stems not tuberous at base; spikelets 5·5–9 mm
3 Stems leafless for some distance below the inflorescence at anthesis; spikelets 7–9 mm **1. odoratum**
3 Stems leafy almost up to the inflorescence; spikelets 5·5–6 mm **2. pauciflorum**
1 Annual, without non-flowering shoots at anthesis
4 Spikelets 10–12 mm **6. gracile**
4 Spikelets (4–)6–8 mm
5 Inflorescence lax, usually lobed, tapering at base; awn of upper sterile floret usually exserted; lower sterile lemma widened conspicuously near apex or middle **4. aristatum**
5 Inflorescence dense, unlobed, truncate at base; awn of upper sterile floret not exserted; lower sterile lemma parallel-sided **5. ovatum**

1. A. odoratum L., *Sp. Pl.* 28 (1753). Caespitose perennial (10–)15–50(–100) cm. Leaves 2–8 mm wide, glabrous to sparsely hairy; sheaths smooth, glabrous or pubescent; ligule up to *c.* 4 mm, truncate. Inflorescence 1–9 cm, cylindrical, dense, very rarely with obvious branches. Spikelets 7–9 mm. Glumes hyaline, with green keel, the upper exceeding the florets and enfolding them. Lemma of sterile florets with brown, sericeous hairs in the lower part; awn of upper sterile floret about as long as or slightly longer than the upper glume. Lemma of fertile floret suborbicular. $2n=10$, 20. *Throughout Europe.* All except Sb.

Diploids, known as **A. alpinum** Á. & D. Löve, *Rep. Dept. Agric. Univ. Inst. Appl. Sci.* (*Reykjavik*) ser. B., 3: 105 (1948), occur mainly in the N. part of the range of the species and on high mountains. In Scandinavia they can often be recognized by the glabrous leaves and glumes, but in the Alps no clear morphological distinction between diploids and tetraploids appears to exist. It therefore seems impossible to recognize subspecies within *A. odoratum*.

2. A. pauciflorum Adamović, *Denkschr. Akad. Wiss. Math.-Nat. Kl.* (*Wien*) **74**: 116 (1904). Like **1** but stems not more than 10 cm, leafy nearly up to the inflorescence; leaves 3–3·5 mm wide; inflorescence 0·8–1·2 cm; spikelets 5·5–6 mm. ● *S. Jugoslavia* (*Babuna Planina*). Ju.

An inadequately known plant which may, perhaps, be an extreme variant of **1**.

3. A. amarum Brot., *Phyt. Lusit.* n. 3 (1800). Like **1** but stems up to 90 cm, often tuberous at base; leaves 6–15 mm wide, glabrous but ciliate; spikelets 10–13 mm; awn of upper sterile floret long-exserted. $2n=90$. *Damp places.* ● *N.W. Spain, N. & C. Portugal.* Hs Lu.

4. A. aristatum Boiss., *Voy. Bot. Midi Esp.* **2**: 638 (1842). Annual. Stems 5–60 cm, often freely branched. Leaves 1–5 mm wide, glabrous or hairy, scabrid; sheaths smooth, often somewhat inflated; ligule 1–2 mm, acute. Inflorescence 1–4 cm, usually lax and lobed, tapering at base. Spikelets (4–)6–7 mm, usually 10 or more. Glumes hyaline, with green keel, the upper exceeding the florets and enfolding them. Lemma of sterile florets with sericeous hairs in lower part; awn of upper sterile floret somewhat longer than the floret. Lemma of fertile floret suborbicular, glabrous. *Dry, open habitats. S. Europe; a frequent casual further north, mainly as a cornfield weed, and locally naturalized.* Al Az Bl Bu Co Ga Hs It Ju Lu Sa [Be Br Da Ge Ho Po Rs (B)].

(a) Subsp. **aristatum**: Awn long-exserted; lower sterile lemma widest near the denticulate and more or less deeply 2-fid apex. $2n=10+0$–2 B. *Throughout most of the range of the species.*

(b) Subsp. **macranthum** Valdés, *Lagascalia* **3**: 130 (1973): Awn not or scarcely exserted; lower sterile lemma widest at or below the middle, with denticulate but scarcely 2-fid apex. $2n=10+0$–1 B. *S.W. Spain; Italy.*

5. A. ovatum Lag., *Elench. Hort. Matrit.* 2 (1816). Like **4** but stems usually simple; leaves usually 5–10 mm wide; inflorescence dense, ovoid-cylindrical, truncate at base; spikelets 7–8·5 mm; awn of upper sterile floret not exserted. $2n=10$. *Dry, open habitats. Mediterranean region.* Co Gr Hs It Ju Sa Si Tu.

6. A. gracile Biv., *Stirp. Rar. Sic. Descr.* **1**: t. 1, fig. 1 (1813). Like **4** but stems simple or branched near the base; inflorescence lax, usually with 4–8 spikelets; spikelets 10–12 mm; awn of upper sterile floret nearly twice as long as spikelet. *Dry, open habitats. C. & E. Mediterranean region.* Al Cr Gr It Sa Si.

83. Holcus L.[1]

Perennials or annuals. Leaves flat. Inflorescence a panicle. Spikelets laterally compressed, with 2–3 florets, the lower hermaphrodite, the upper usually male. Glumes subequal, membranous, longer than the florets, strongly keeled, the lower 1-veined, the upper 3-veined. Lemma obscurely 3- to 5-veined, coriaceous, shiny, the upper or both usually with a dorsal awn. Palea membranous, slightly shorter than the lemma. Rhachilla shortly prolonged.

1 Lemma of both florets awned
2 Stem usually 60–70 cm; spikelets 7–8 mm **7. grandiflorus**
2 Stem usually 8–25 cm; spikelets *c.* 4 mm **8. caespitosus**
1 Lemma of lower floret not awned
3 Awn of lemma uncinate or recurved
4 Perennial; awn of lemma not exserted; glumes not or very shortly awned **1. lanatus**
4 Annual; awn of lemma exserted; glumes awned **2. setiglumis**
3 Awn of lemma not uncinate or recurved
5 Glumes awned, the upper with an awn at least 1·5 mm **3. notarisii**
5 Glumes unawned
6 Nodes bearded **4. mollis**
6 Nodes glabrous
7 Perennial; glumes 4–5 mm **5. rigidus**
7 Annual; glumes 7–8 mm **6. gayanus**

1. H. lanatus L. *Sp. Pl.* 1048 (1753). Softly hairy caespitose perennial, often short-lived; stems 20–100 cm, erect or ascending. Leaves 3–10 mm wide; ligule 1–4 mm. Panicle 3–20 × 1–8 cm, rather lax to very dense, whitish to dark purple. Spikelets 4–6 mm. Glumes lanceolate, acute, ciliate on keel and veins, scabrid or puberulent to villous on the surface, the upper usually somewhat longer and wider than the lower, often with an awn up to 1 mm. Lemma of upper floret with a strongly hooked awn *c.* 2 mm from just below the apex. $2n=14+0$–2 B. *Europe, except the north-east and extreme north, where it is only casual.* All except Rs (N) Sb; naturalized in Fe and Is.

2. H. setiglumis Boiss. & Reuter, *Diagn. Pl. Nov. Hisp.* 27 (1842) (*H. setosus* Trin.). Like **1** but annual; leaves 1–4 mm wide;

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glumes usually villous, both awned, the upper with an awn 1·5–6 mm. $2n=14$. *S. Europe.* Gr Hs It

(a) Subsp. **setiglumis**: Panicle usually with 70–500 spikelets; glumes 3–4 mm; awn of upper glume 1·5–3 mm. *Throughout most of the range of the species.*

(b) Subsp. **duriensis** P. Silva, *Agron. Lusit.* **18**: 11 (1956): Panicle with *c.* 100 spikelets; glumes 5(–6) mm; awn of upper glume 4–6 mm. ● *N.E. Portugal.*

3. H. notarisii Nyman, *Syll.* 411 (1855). Like **1** but glumes awned, the awn of the upper at least 1·5 mm; lemma of upper floret with a long-exserted, geniculate awn. ● *N.W. Italy (near Genova).* It.

4. H. mollis L., *Syst. Nat.* ed. 10, **2**: 1305 (1759). Rhizomatous perennial; stems 20–100(–150) cm, usually decumbent, bearded at the nodes. Leaves 3–12(–16) mm wide; sheaths glabrous or hairy; ligule 1–5 mm. Panicle 4–12(–20) × 1–5 cm, dense to rather lax, whitish to purplish. Spikelets 4–6(–7) mm. Glumes shortly ciliate on veins, scabrid, acute, the lower lanceolate, the upper ovate, the lateral veins usually nearer the keel than the margin. Lemma of upper floret with an exserted awn 3·5–5 mm, from just below the apex. $2n=14$, 28, 35 (42, 49). *Grassland, scrub and open woods; calcifuge except in the north. Most of Europe, but only as a casual in parts of the north.* All except Bl Cr Is Rs (N, K, E) Sa Sb Si; doubtfully native in Az, and only naturalized in Fe.

Very variable. The pentaploid seems to be the commonest, at least in W. Europe; it is sterile but spreads vegetatively very effectively. The hybrid **1** × **4** ($2n=21$) occurs where the parents grow together; it closely resembles **4** and is sterile.

(a) Subsp. **mollis**: Stems not thickened and tuberous at base. Panicle usually rather lax and brownish or purplish. *Throughout the range of the species.*

(b) Subsp. **reuteri** (Boiss.) Tutin, *Bot. Jour. Linn. Soc.* **76**: 363 (1978) (*H. reuteri* Boiss.): Stems thickened and tuberous at base. Panicle usually strict, whitish. *Wet places.* ● *N.W. & C. Spain.*

5. H. rigidus Hochst. in Seub., *Fl. Azor.* 17 (1844). Like **4** but leaves usually short, distichous, rigid, patent; sheaths and nodes glabrous; glumes very shortly ciliate on keel, the lateral veins of the upper glume usually nearer the margin than the keel. ● *Açores.* Az.

6. H. gayanus Boiss., *Voy. Bot. Midi Esp.* **2**: 637 (1842). Slender annual; stems 10–25 cm, with glabrous nodes. Leaves *c.* 1 mm wide, pubescent; sheaths pubescent, somewhat inflated; ligule *c.* 2 mm. Panicle 1·5–4 × 1–2 cm, lax, whitish. Spikelets 3–4 mm. Glumes long-acuminate, scabrid on the keel, glabrous, the upper 3-veined throughout its length. Lemma of upper floret with an exserted awn 3–4 mm, from just below the apex. $2n=8$. *Mountain rocks.* ● *N.W. & C. Spain, N. Portugal.* Hs Lu.

7. H. grandiflorus Boiss. & Reuter, *Pugillus* 119 (1852). Shortly rhizomatous perennial; stems up to 75 cm, glabrous. Leaves up to 7 mm wide, glabrous but sometimes ciliate; sheaths glabrous; ligule 1–2 mm. Panicle 5–15 × 1–3 cm, rather lax, greenish-brown. Spikelets 7–8 mm. Glumes ovate, long-acuminate, ciliolate on the veins, glabrous or sparsely puberulent, the upper 3-veined in the lower ⅓. Lemma of both florets with a geniculate awn about as long as the glumes, arising from near the middle. *Dry, open woods.* ● *S.W. Spain.* Hs.

8. H. caespitosus Boiss., *Biblioth. Univ. Genève* ser. 2, **13**: 410 (1838). Like **7** but densely caespitose; stems usually 8–25 cm; leaves *c.* 1·5 mm wide, greyish-glaucous, velutinous; sheaths puberulent to subglabrous, inflated; panicle 1·5–2 × 0·7–1·5 cm; spikelets *c.* 4 mm; glumes acute; awn arising above the middle of the lemma. $2n=14$. *Stony slopes*, 2900–3100 *m.* ● *S. Spain (Sierra Nevada).* Hs.

84. Corynephorus Beauv.[1]

Perennials or annuals. Leaves flat or setaceous. Inflorescence a lax panicle. Spikelets laterally compressed, with 2 florets. Glumes subequal, membranous, longer than the florets, the lower 1-veined, the upper 3-veined at base. Lemma 1-veined, scarious, with a dorsal awn from near the base; awn articulated near the middle, with a ring of short hairs at the joint, dark brown below, whitish above, clavate. Palea shorter than lemma. Rhachilla prolonged, with sericeous hairs.

All species are found mainly on sandy soils.

1 Perennial with numerous non-flowering shoots; hairs at base of lower floret not more than ⅛ as long as lemma **1. canescens**
1 Annual without non-flowering shoots; hairs at base of lower floret at least ¼ as long as lemma
2 Panicle-branches with spikelets throughout most of their length; anthers 1·5 mm **4. macrantherus**
2 Panicle-branches with spikelets in the distal ½ or less; anthers *c.* 0·5 mm
3 Spikelets *c.* 3 mm; awn usually as long as glumes, scarcely enlarged at apex; hairs at base of floret ⅛–¼ as long as lemma **3. fasciculatus**
3 Spikelets *c.* 4 mm; awn distinctly shorter than glumes, strongly enlarged at apex; hairs at base of floret ¼–½ as long as lemma **2. divaricatus**

1. C. canescens (L.) Beauv., *Agrost.* 90, 159 (1812) (*Weingaertneria canescens* (L.) Bernh.). Caespitose, very glaucous perennial; stems 10–60 cm, slender, often geniculate. Leaves involute, setaceous, rigid, scabrid; sheaths often purplish; nodes blackish; ligule 2–4 mm, acute. Panicle 1·5–10 cm; branches patent at anthesis, appressed before and after. Spikelets 3·5–4 mm. Glumes lanceolate, acute, slightly scabrid on the keel. Lemma scabrid; awn a little shorter than glumes, gradually enlarged at apex. Anthers *c.* 1·5 mm. $2n=14$. *Calcifuge. From England, S. Norway and Latvia southwards to S. Portugal, N. Italy and C. Ukraine, but very local in the eastern part of its range.* Au Be Br ?Co Cz Da Ga Ge Ho Hs Hu It Lu No Po Rm Rs (B, C, W) Sa Su.

2. C. divaricatus (Pourret) Breistr., *Procés-Verb. Soc. Dauph. Étud. Biol. (Grenoble)* ser. 3, **17**: 3 (1950) (*C. articulatus* (Desf.) Beauv.). Glabrous annual, not or scarcely glaucous; stems 20–60 cm. Leaves convolute, scabrid; sheaths often purplish; nodes blackish; ligule up to 8 mm, subacute. Panicle up to 20 cm; branches patent or erecto-patent, branched above the middle and with spikelets in the distal half or less. Spikelets 3·5–4 mm. Glumes lanceolate, acute, scabrid on the keel. Lemma shortly 2-lobed at apex; lobes oblong, subobtuse; awn distinctly shorter than glumes, strongly enlarged at apex; hairs at base of floret ¼–½ as long as lemma. Anthers *c.* 0·5 mm. $2n=14$. *Mediterranean region, extending to N.W. Spain.* Bu Co Cr Ga Gr Hs It Sa Si Tu.

3. C. fasciculatus Boiss. & Reuter, *Pugillus* 123 (1852). Like **2** but spikelets *c.* 3 mm; lobes at apex of lemma setaceous; awn usually about as long as glumes, scarcely enlarged at apex; hairs

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at base of floret $\frac{1}{6}$–$\frac{1}{4}$ as long as lemma. $2n=14$. *W. Mediterranean region, Portugal.* Co Ga Hs Lu Sa Si.

A record from Kriti is almost certainly an error.

4. C. macrantherus Boiss. & Reuter, *op. cit.* 124 (1852). Like **2** but panicle-branches branched below the middle and with spikelets throughout most of their length; spikelets 4·5–5 mm; hairs at base of lemma not more than $\frac{1}{4}$ as long as lemma; anthers *c.* 1·5 mm. *S.W. Spain, S. Portugal.* Hs Lu. (*N.W. Africa.*)

85. Avellinia Parl.[1]

Annuals. Leaves flat or involute. Inflorescence a panicle, contracted after anthesis. Spikelets laterally compressed, with 2–4 rather distant florets. Glumes very unequal, persistent, membranous, the lower 1-veined, the upper 3-veined and almost as long as the florets. Lemma obscurely 3-veined, membranous, 2-fid at apex, with a short awn from the sinus. Palea shorter than lemma, deeply 2-fid.

1. A. michelii (Savi) Parl., *Pl. Nov.* 61 (1842) (*Koeleria michelii* (Savi) Cosson & Durieu, *Vulpia michelii* (Savi) Reichenb.). Stems 7–30 cm, usually numerous, erect or geniculate-ascending, retrorsely puberulent. Leaves up to 5 cm, mostly near the base of the stem, puberulent; sheaths puberulent; ligules less than 1 mm, truncate, hairy on the abaxial surface. Panicle 2–7 cm. Spikelets 3–5 mm. Lower glume *c.* $\frac{1}{4}$ as long as upper, linear-lanceolate with subulate apex, the upper lanceolate, mucronate. Lemma linear-lanceolate. Anthers *c.* 0·5 mm. *Dry, open habitats, usually near the sea. Mediterranean region, Portugal.* Bl Co Cr Ga Gr Hs It Ju Lu Sa Si.

A. tenuicula (Boiss. & Reuter) Nyman, *Consp.* 815 (1882) (*Vulpia tenuicula* Boiss. & Reuter) is said to be like **1** but dwarf, the spikelets with subequal glumes and the lemma of the lower floret scarcely awned. It appears to have been collected once only, in C. Spain (near Aranjuez), and requires further investigation.

86. Triplachne Link[1]

Annuals. Leaves flat. Inflorescence a dense, cylindrical to ovoid panicle. Spikelets laterally compressed, with 1 floret. Glumes subequal, membranous, longer than the floret, 1-veined. Lemma obscurely 5-veined, scarious, with a geniculate dorsal awn from near the base and the 2 outer veins excurrent at the truncate apex. Palea about as long as lemma.

1. T. nitens (Guss.) Link, *Hort. Berol.* **2**: 241 (1833). Stems 5–20(–30) cm, geniculate-ascending, usually branched below. Leaves 1–2(–5) cm × 2–3 mm, long-acute, scabrid; sheaths somewhat inflated; nodes blackish; ligule up to 3 mm, obtuse, scabrid. Panicle 1–5 cm. Spikelets 3·5–4 mm. Glumes lanceolate, acute, shiny, scabrid on the keel. Lemma 1·3–1·5 mm, ovate, denticulate at apex, with long appressed hairs; awn *c.* 4 mm, dark brown below, hyaline above; apical setae about as long as lemma. Anthers *c.* 0·5 mm. *Sandy and rocky places near the sea. S. half of Iberian peninsula; islands of Mediterranean region.* Bl Cr Gr Hs Lu Si.

87. Agrostis L.[1]

Perennials or annuals. Leaves flat or setaceous. Inflorescence a panicle. Spikelets laterally compressed, with 1 floret. Glumes subequal to somewhat unequal, membranous, longer than the floret, usually 1-veined. Lemma membranous or scarious, truncate, 3- to 5-veined, often with the lateral veins excurrent, sometimes with a dorsal, geniculate awn. Palea shorter than the lemma, often very small. Rhachilla prolonged or not. Callus usually hairy.

Hybrids are of rather frequent occurrence; they are usually intermediate between the parents and wholly or largely sterile. Some reproduce vegetatively and may occur in the absence of one or both parents. Probably the commonest of these are **19** × **20** and **19** × **22**.

Literature: S. O. Björkman, *Symb. Bot. Upsal.* **17(1)**: 1–112 (1960). E. Paunero, *Anal. Inst. Bot. Cavanilles* **7**: 561–644 (1948). W. R. Philipson, *Jour. Linn. Soc. London* (*Bot.*) **51**: 73–151 (1937). K.-G. Widén, *Fl. Fenn.* **5**: 1–209 (1971).

1 Palea more than $\frac{2}{5}$ as long as lemma
 2 Rhizomes with more than 3 scale-leaves present; panicle usually lax and not contracted after anthesis
  3 Ligules on non-flowering shoots usually shorter than wide; panicle-branches smooth or nearly so; clavate apex of pedicels smooth **19. capillaris**
  3 Ligules on non-flowering shoots usually longer than wide; panicle-branches strongly aculeolate; clavate apex of pedicels aculeolate in lower part
   4 Leaves (1·5–)2–6(–8) mm wide, usually flat; panicle usually not contracted after anthesis **20. gigantea**
   4 Leaves 0·5–2 mm wide, usually involute; panicle contracted after anthesis **21. salsa**
 2 Rhizomes absent or short and usually with not more than 3 scale-leaves
  5 Pedicels mostly about as long as spikelets; panicle usually contracted after anthesis
   6 Most panicle-branches branched 2–3 times and without spikelets in the lower $\frac{1}{2}$; palea $\frac{1}{2}$–$\frac{3}{5}$ as long as lemma **25. castellana**
   6 Most panicle-branches branched 1–2 times and with spikelets in the lower $\frac{1}{2}$; palea $\frac{3}{5}$–$\frac{4}{5}$ as long as lemma
    7 Lemma unawned or rarely with a short, subapical awn; plant up to 100(–150) cm, stoloniferous **22. stolonifera**
    7 Lemma usually awned in the lower $\frac{1}{5}$–$\frac{1}{2}$; plant up to 35 cm, not stoloniferous
     8 Panicle dense, spicate; all branches with spikelets in the lower $\frac{1}{2}$; lemma awned in the lower $\frac{1}{3}$–$\frac{1}{4}$ **23. congestiflora**
     8 Panicle lax at anthesis; lowest branches sometimes without spikelets in the lower $\frac{1}{2}$; lemma awned in the lower $\frac{1}{5}$ **24. gracililaxa**
  5 Pedicels mostly at least twice as long as spikelets; panicle very lax, the branches patent to erecto-patent at and after anthesis
   9 Glumes entirely smooth
    10 Leaves involute when dry; ligule longer than wide, acute **16. delicatula**
    10 Leaves flat when dry; ligule as long as wide, truncate **17. durieui**
   9 Glumes aculeolate, at least on the keel
    11 Annual; ligule not more than 5 mm; glumes obtuse **15. nebulosa**
    11 Perennial; ligule up to 10 mm; glumes acute **18. reuteri**
1 Palea less than $\frac{1}{5}$ as long as lemma
 12 Annual
  13 Panicle dense, with short, erect branches; glumes puberulent **14. juressi**
  13 Panicle lax, with long, patent to erecto-patent branches; glumes glabrous, but often aculeolate on the keel
   14 Spikelets less than 1 mm **13. tenerrima**
   14 Spikelets more than 1 mm
    15 Leaves not more than 2 mm wide; lemma awned; anthers more than $\frac{1}{2}$ as long as lemma **12. pourretii**
    15 Leaves up to 7 mm wide; lemma unawned; anthers less than $\frac{1}{2}$ as long as lemma **10. clavata**
 12 Perennial; panicle often with ±erect branches, at least after anthesis

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16 Callus with hairs *c.* ½ as long as lemma **9. agrostiflora**
16 Callus glabrous or with hairs not more than ⅕ as long as lemma
17 Most basal leaves less than 0·3 mm wide **3. curtisii**
17 Most basal leaves more than 0·5 mm wide
18 Awn arising near the base of the lemma, always present; spikelets at least 3 mm
19 Panicle-branches smooth; lateral veins of lemma excurrent for not more than 0·1 mm; callus glabrous or with hairs not more than 0·1 mm **7. rupestris**
19 Panicle-branches aculeolate; lateral veins of lemma excurrent for *c.* 0·3 mm; callus with hairs *c.* 0·3 mm
20 Panicle-branches erecto-patent during and after anthesis; spikelets dark, reddish-brown **5. alpina**
20 Panicle-branches ±erect; spikelets pale, yellowish-grey to silvery-violet **6. schleicheri**
18 Awn arising near the middle of the lemma, or sometimes absent; spikelets usually less than 3 mm
21 Anthers less than 1 mm and less than ½ as long as lemma
22 Glumes subequal; panicle not more than 10 cm **4. mertensii**
22 Glumes unequal; panicle usually more than 10 cm **11. scabra**
21 Anthers at least 1 mm and more than ½ as long as lemma
23 Basal leaves setaceous, very rigid **8. nevadensis**
23 Basal leaves mostly flat, at least when young, soft
24 Rhizomes absent; stolons often present **1. canina**
24 Rhizomes present; stolons absent **2. vinealis**

1. A. canina L., *Sp. Pl.* 62 (1753) (*A. canina* subsp. *fascicularis* (Curtis) Hyl.). Laxly caespitose perennial; stems 10–70 cm, smooth, often rooting at the nodes and producing short, leafy axillary stolons. Leaves usually 1–2 mm wide, flat or sometimes involute, widest at the base, soft, usually scabrid; ligule (1–)1·5–4·5 mm, acute to acuminate. Panicle 2–20 cm, lax; branches patent at anthesis, usually erect afterwards, more or less scabrid. Spikelets 1·6–2·5 mm, brownish. Glumes lanceolate, acute, subequal, somewhat scabrid on the keel. Lemma *c.* ¾ as long as glumes, the lateral veins shortly excurrent; awn up to 4·5 mm, arising slightly below the middle, sometimes absent; callus with very short hairs. Palea very short. Anthers 1–1·5 mm, more than ½ as long as the lemma. $2n=14$ (16, 28). *Damp habitats. Most of Europe.* All except Az Bl Cr Rs (E) Sa Sb Si Tu.

2. A. vinealis Schreber, *Spicil. Fl. Lips.* 47 (1771) (*A. canina* subsp. *montana* (Hartman) Hartman, *A. tenuifolia* Bieb., non Curtis). Like **1** but often densely caespitose; subterranean scaly rhizomes present; stolons absent; stems never producing short, leafy axillary shoots; ligule acute to obtuse; panicle often dense; anthers 1–1·8 mm. $2n=28$. *Usually in dry habitats. N.W. & C. Europe; perhaps elsewhere but distribution imperfectly known through confusion with* **1**. Au Be Br Cz Da Ga Ge Ho Hu Ju No Po Rm Rs (C, W) Su.

3. A. curtisii Kerguélen, *Bull. Soc. Bot. Fr.* **123**: 318 (1976) (*A. setacea* Curtis, non Vill.). Densely caespitose perennial; stems 10–60 cm, scabrid near the nodes and below the panicle. Leaves 0·2–0·3 mm wide, grooved above, often greyish-green, scabridulous; ligule 2–4 mm, acute. Panicle 3–10 cm; branches short, erect before and after anthesis. Spikelets 3–4 mm. Glumes lanceolate, acute, scabridulous, the upper ¾ as long to nearly as long as the lower. Lemma *c.* ⅔ as long as the glumes, the marginal veins shortly excurrent; awn up to 5 mm, arising near the base; callus with hairs *c.* 0·5 mm. Palea very small. Anthers 1·5–2 mm, more than ½ as long as the lemma. $2n=14$. *Dry, sandy or peaty heaths.* ● *W. Europe, northwards to S. England.* Br Ga Hs Lu.

4. A. mertensii Trin., *Linnaea* **10**: 302 (1836) (*A. borealis* Hartman). Caespitose perennial; stems (5–)10–30(–50) cm, smooth. Leaves 1–3(–5) mm wide, more or less scabrid; ligule 1·2–3(–4) mm, obtuse or truncate. Panicle 3–10 cm; branches usually erecto-patent after anthesis. Spikelets 2·5–3·5 mm, dark brown or purplish. Glumes ovate-lanceolate, acute, smooth or ciliate on the keel, subequal. Lemma ¾–¼ as long as glumes, the marginal veins shortly excurrent; awn 3–4 mm, arising near the middle; callus with very short hairs. Palea very small. Anthers 0·5–0·8 mm, less than ⅖ as long as the lemma. $2n=56$. *N. & W. Fennoscandia, arctic Russia, N. & C. Ural.* Fe No Rs (N, C) Su.

5. A. alpina Scop., *Fl. Carn.* ed. 2, **1**: 60 (1771). Caespitose, shortly rhizomatous perennial; stems 10–30 cm, smooth. Leaves of non-flowering shoots setaceous, scabrid; cauline leaves up to 1·5 mm wide, flat; ligule up to 4 mm, lanceolate, acute. Panicle 1–6 cm; branches erecto-patent during and after anthesis, aculeolate. Spikelets 3–5 mm, dark, reddish-brown. Glumes lanceolate, long-acute, the upper *c.* ¾ as long as lower glume, the marginal veins shortly excurrent; awn *c.* 5 mm, arising near the base; callus with hairs *c.* 0·3 mm. Palea very small. Anthers 1·5–2 mm. $2n=14$. ● *Mountains of Europe, from the Alps and Carpathians southwards to C. Spain, N. Appennini and C. Jugoslavia.* Au Cz Ga Ge He Hs It Ju Po Rm Rs (W).

6. A. schleicheri Jordan & Verlot in F. W. Schultz, *Arch. Fl. Fr. Allem.* 347 (1855). Like **5** but panicle-branches more or less erect; spikelets pale, yellowish-grey to silvery-violet. $2n=42$. *Mountains of W.C. & S.W. Europe.* Au Ga Ge He Hs It.

7. A. rupestris All., *Fl. Pedem.* **2**: 237 (1785). Like **5** but panicle-branches smooth; glumes subequal; callus with hairs *c.* 0·1 mm, or glabrous. $2n=14+0–3$ B, 21, 28. *Mountains of C. & S. Europe.* Al Au Bu Co Cz Ga Ge He Hs It Ju Po Rm Rs (W).

The sterile hybrid between **7** and **9** (*A. rubra* auct. gall., non L.) occurs in the Alps.

8. A. nevadensis Boiss., *Elenchus* 87 (1838). Like **5** but densely caespitose, not rhizomatous; stems up to 50 cm, scabrid; leaves very rigid, glaucous, all setaceous; ligule scabrid; spikelets 2–3 mm; glumes subequal, usually glabrous, aculeolate on the keel; awn arising near the middle; callus with very short hairs; anthers 1–1·5 mm. $2n=42+0–10$ B. *Mountains of S.E. Spain, usually above* 2000 *m.* Hs. (*N.W. Africa.*)

9. A. agrostiflora (G. Beck) Rauschert, *Feddes Repert.* **73**: 49 (1966) (*Calamagrostis agrostiflora* G. Beck, *C. tenella* (Schrader) Link, non Host). Caespitose, shortly rhizomatous perennial; stems 30–70 cm, smooth. Leaves flat, up to 5 mm wide, more or less scabrid, convolute when young; ligule up to 3 mm. Panicle up to 15 cm; branches usually short, erect to erecto-patent, scabrid-puberulent. Spikelets 2·5–3·5 mm. Glumes lanceolate, subequal, smooth. Lemma *c.* ¾ as long as the lower glume, denticulate and unawned, or with an awn less than 1 mm arising near the apex; callus with hairs *c.* ½ as long as the lemma. Palea *c.* ¼ as long as lemma. Anthers *c.* 1·5 mm. $2n=28$. ● *Alps, N. Appennini, ?Pyrenees.* Au Ga Ge He It Ju.

10. A. clavata Trin. in Sprengel, *Neue Entdeck.* **2**: 55 (1820). Usually annual; stems 30–70 cm, smooth. Leaves flat, up to 4(–7) mm wide, scabrid; ligule 1·5–3 mm. Panicle 8–25 cm; branches long, patent to erecto-patent, scabrid; pedicels clavate. Spikelets 1·6–2·8 mm. Glumes lanceolate, subequal, somewhat aculeolate on the keel. Lemma *c.* ⅔ as long as glumes, smooth, unawned; callus with few, very short hairs. Palea very small or absent. Anthers 0·3–0·5 mm and less than ½ as long as lemma. $2n=42$. *Disturbed ground. Sweden, Finland, N. Russia.* Fe Rs (N, C) Su.

11. A. scabra Willd., *Sp. Pl.* **1**: 370 (1797) (*A. hyemalis* auct., non (Walter) Britton, Sterns & Poggenb.). Like **10** but perennial; spikelets 2–3·5 mm; glumes unequal; lemma scabrid, often with a dorsal awn; anthers up to 0·8 mm. *Naturalized in C. Europe and a frequent casual elsewhere.* [Au Ge.] (*Greenland, North America, N.E. Asia.*)

12. A. pourretii Willd., *Ges. Naturf. Freunde Berlin Mag.* **2**: 290 (1808) (*A. pallida* DC., non With.). Annual; stems 10–50 cm, smooth. Leaves flat, up to 2 mm wide, scabrid; ligule 1·5–4 mm. Panicle up to 13 cm; branches erecto-patent to patent during and after anthesis, aculeolate. Spikelets 2–2·5 mm, usually greenish. Glumes lanceolate, the lower *c.* 1 mm longer than the upper, scabrid on the keel. Lemma less than $\frac{1}{2}$ as long as the lower glume, with long-excurrent lateral veins; awn *c.* 3 mm, arising above the middle; callus with very short hairs. Palea very small. Anthers *c.* 1 mm and more than $\frac{1}{2}$ as long as lemma. $2n=14+0$–2B, 16, 18, 19, 21. *W. Mediterranean region, Portugal.* Co Ga Hs It Lu Sa Si.

13. A. tenerrima Trin., *Gram. Unifl.* 205 (1824) (*A. elegans* Thore ex Loisel., non (Walter) Salisb.). Annual; stems 10–30 cm, scabrid. Leaves flat, up to 1·5 mm wide, scabrid; ligule *c.* 2 mm, obtuse to truncate. Panicle up to 15 cm; branches 2–5 at each node, slender, patent, scabridulous, the pedicels longer than the spikelets, clavate, flexuous, almost smooth. Spikelets *c.* 0·8 mm, purplish. Glumes ovate-lanceolate, subobtuse, subequal, scabrid on the keel. Lemma a little shorter than the glumes, denticulate, unawned; callus glabrous. Palea very small. Anthers *c.* 0·3 mm. $2n=14$. *S.W. Europe.* Ga Hs Lu.

A. litigans Steudel, *Syn. Pl. Glum.* **1**: 162 (1854), described from S. Portugal (Serra da Arrabida), is probably a variant of **13**. It appears to have been collected once only.

14. A. juressi Link in Schrader, *Jour. für die Bot.* **1799 (2)**: 312 (1800). Annual; stems 40–80 cm, soft, smooth. Leaves flat, 3–8 mm wide, long-acute, smooth, except at margin; ligule *c.* 0·5 mm, truncate. Panicle 3–13 cm, dense, lobed; branches short, erect, hairy, with crowded spikelets for most of their length, the pedicels much shorter than the spikelets, not clavate. Spikelets *c.* 3 mm, green. Glumes lanceolate, subobtuse, subequal, puberulent. Lemma little shorter than the glumes, frequently mucronate or shortly awned; callus glabrous. Palea very small. Anthers *c.* 1 mm. $2n=14$. *Damp, shady places. Portugal, W. Spain.* Hs Lu.

15. A. nebulosa Boiss. & Reuter, *Diagn. Pl. Nov. Hisp.* 26 (1842). Annual; stems 6–40(–80) cm, smooth. Leaves flat, 1–4 mm wide, aculeolate on margin and veins; ligule 2–5 mm. Panicle 3–30 cm, very lax; branches 10 or more at each node, slender, erecto-patent at and after anthesis, aculeolate, the pedicels much longer than the spikelets, clavate. Spikelets *c.* 1·5 mm usually purplish. Glumes lanceolate, obtuse, subequal, denticulate at apex, aculeolate at least on the keel. Lemma usually $\frac{1}{4}$–$\frac{1}{3}$ as long as glumes, denticulate, unawned or rarely with a short awn from near the base; callus very small, glabrous. Palea about as long as lemma. Anthers *c.* 1 mm. *Dry, open habitats. C., E. & S. Spain, S.E. Portugal.* Hs Lu.

16. A. delicatula Pourret ex Lapeyr., *Hist. Abr. Pyr., Suppl.* 12 (1818) (*A. truncatula* Parl.). Caespitose perennial; stems 20–40 cm. Leaves involute, at least when dry, glaucous; ligule longer than wide, acute. Panicle with smooth, patent branches, the pedicels longer than the spikelets, the clavate portion twice as long as wide. Spikelets *c.* 1·2 mm. Glumes lanceolate, obtuse, subequal, entirely smooth. Lemma *c.* $\frac{2}{5}$ as long as glumes, with 5 teeth not more than $\frac{1}{8}$ as long as the lemma, unawned. Palea *c.* $\frac{1}{2}$ as long as lemma. $2n=14$. *Dry places.* ● *S.W. Europe, from the Pyrenees to E.C. Portugal.* Hs Lu.

17. A. durieui Boiss. & Reuter ex Willk., *Suppl. Prodr. Fl. Hisp.* 15 (1893). Like **16** but leaves flat, even when dry; ligule about as long as wide, truncate; clavate portion of pedicels 3 times as long as wide; spikelets *c.* 1·7 mm; teeth of lemma *c.* $\frac{1}{4}$ as long as the lemma. *Dry, base-poor habitats.* ● *W. Pyrenees; mountains of N.W. Spain and N. Portugal.* Ga Hs Lu.

18. A. reuteri Boiss., *Voy. Bot. Midi Esp.* **2**: 645 (1844). Like **16** but stoloniferous perennial up to 100 cm; ligule up to 10 mm; glumes acute; lemma *c.* $\frac{3}{4}$ as long as glumes; palea almost as long as lemma. $2n=14$. *Damp, often shady places. C. & S. Portugal, S. Spain, Açores.* Az Hs Lu.

19. A. capillaris L., *Sp. Pl.* 62 (1753) (*A. tenuis* Sibth., *A. vulgaris* With.). Perennial, with rhizomes bearing more than 3 scale-leaves; stems 10–70 cm, smooth. Leaves up to 4 mm wide, flat or involute, long-acute; ligule 0·5–2 mm, usually wider than long. Panicle 1–20 cm; branches patent at and after anthesis, smooth or somewhat aculeolate, subequal, without spikelets in the lower half; clavate apex of pedicels smooth. Spikelets 2–3·5 mm, greenish- to purplish-brown. Glumes lanceolate, acute, equal or subequal, sparsely aculeolate on the keel distally. Lemma $\frac{3}{5}$–$\frac{3}{4}$ as long as glumes, rarely with a short dorsal awn; callus with very short hairs. Palea $\frac{1}{2}$–$\frac{3}{5}$ as long as lemma. Anthers 1–1·5 mm. $2n=28$. *Almost throughout Europe.* All except Az Bl Cr Sa Sb Si Tu.

20. A. gigantea Roth, *Tent. Fl. Germ.* **1**: 31 (1788). Like **19** but up to 150 cm; leaves up to 6(–8) mm wide, usually flat; ligules on non-flowering shoots usually longer than wide; panicle-branches strongly aculeolate; clavate apex of pedicels aculeolate in lower part. $2n=42+0$–4 B. *Most of Europe.* Al Au Be Br Bu ?Cr Cz Da Fe Ga Ge Hb He Ho ?Hs Hu It Ju No Po Rm Rs (N, B, C, W, K, E) Su Tu.

(a) Subsp. **gigantea**: Stems 30–150 cm; panicle-branches usually patent to erecto-patent after anthesis; lemma aculeolate only in the distal part. *Throughout the range of the species.*

(b) Subsp. **maeotica** (Klokov) Tzvelev, *Nov. Syst. Pl. Vasc. (Leningrad)* **8**: 57 (1971): Stems 30–65 cm; panicle-branches erect to erecto-patent after anthesis; lemma aculeolate all over. *S. Ukraine.*

21. A. salsa Korsh., *Trudy Peterb. Obšč. Estestv.* **28(1)**: 8 (1897). Like **19** but leaves 0·5–2 mm wide, usually involute; ligules on non-flowering shoots usually longer than wide; panicle usually contracted after anthesis, the branches strongly aculeolate; clavate apex of pedicels aculeolate in the lower part. *E. Russia.* Rs (C, E).

22. A. stolonifera L., *Sp. Pl.* 62 (1753) (*A. alba* auct., non L.; incl. *A. maritima* Lam., *A. filifolia* Link). Stoloniferous perennial, sometimes with short rhizomes bearing up to 3 scale-leaves; stolons up to 200 cm; stems (5–)15–100(–150) cm, smooth. Leaves flat or involute, long-acute, smooth to scabrid; ligule 1·5–7 mm. Panicle 1–30 cm; branches patent only at anthesis, usually aculeolate, very unequal, often bearing spikelets in the lower $\frac{1}{2}$. Spikelets 2–3 mm, greenish to purplish. Glumes lanceolate, acute, usually aculeolate on the keel. Lemma $\frac{3}{5}$–$\frac{3}{4}$ as long as glumes, rarely with a short awn near the apex; callus with very short hairs. Palea $\frac{1}{2}$–$\frac{3}{5}$ as long as lemma. Anthers 1–1·5 mm. $2n=28$, 30, 32, 35, 42, 44, 46. *Throughout Europe.* All except Sb.

Very variable, but at present no correlation between morphology and chromosome number has been demonstrated, and it does not seem possible to recognize subspecies. Tetraploid plants appear to be much the commonest. Paunero has recognized, but not named, five groups of variants from Spain.

23. A. congestiflora Tutin & E. F. Warburg, *Jour. Bot. (London)* **70**: 43 (1932). Slender perennial, without stolons; stems 5–35 cm, rough or smooth. Leaves flat or involute, scabridulous; ligule 0·5–5 mm. Panicle 2–6(–8·5) cm; branches erecto-patent at anthesis, suberect afterwards, aculeolate, 1–2 times branched, short and unequal; pedicels densely aculeolate. Spikelets 2–3 mm, greenish to purplish. Glumes lanceolate. Lemma *c.* ⅔ as long as glumes, the lateral veins more or less raised in the distal ⅓–½; awn up to 4 mm, arising in the lower ⅓–½, rarely absent; callus with hairs *c.* 0·3 mm or almost absent. Palea ⅗–⅘ as long as lemma. Anthers 0·6–1 mm. ● *Açores.* Az.

(a) Subsp. **congestiflora**: Glumes acute and mucronate, scabridulous. Lemma scabridulous, sometimes hairy, the raised veins excurrent for up to 0·3 mm. *Dry, open or rocky places up to* 500 *m. Throughout the range of the species.*

(b) Subsp. **oreophila** Franco, *Bot. Jour. Linn. Soc.* **76**: 336 (1978): Glumes subacute to subobtuse, not mucronate, smooth. Lemma smooth and glabrous, the faint veins not excurrent, or excurrent for not more than 0·15 mm. *Mountains,* 600–2340 *m. C. & W. parts of the range of the species.*

24. A. gracililaxa Franco, *loc. cit.* (1978). Like **23(a)** but stems up to 20 cm, very slender; ligule 0·5–1·5(–2) mm; panicle 1·5–4·5 cm, very lax at anthesis, more or less contracted afterwards, the lowest branches sometimes without spikelets for more than ½ their length; pedicels nearly smooth; awn arising near base of lemma; anthers 1–1·2 mm. *Dry, open rocky places,* 250–500 *m.* ● *Açores* (*Flores and Terceira*). Az.

25. A. castellana Boiss. & Reuter, *Diagn. Pl. Nov. Hisp.* 26 (1842). Perennial, with short rhizomes and sometimes stolons; stems 20–80 cm, usually smooth. Leaves flat or involute, nearly always aculeolate on the ribs; ligule 1–3 mm. Panicle (6–)8–16 (–25) cm; branches patent at anthesis, rarely afterwards, aculeolate, very unequal, branched 2–3 times. Spikelets 2·5–4 mm, greenish-yellow to purplish. Glumes lanceolate, long-acute, aculeolate on the keel, at least distally, sometimes with appressed hairs. Lemma *c.* ⅔ as long as the glumes, almost always with few to many, usually long hairs, the lateral veins raised in the distal ½–¾ and excurrent for 0·2–0·5 mm, but glabrous and without excurrent veins when unawned; awn up to 5 mm, arising near the base; callus with hairs up to 0·5 mm. Palea ½–⅗ as long as lemma. Anthers 1–1·5 mm. $2n = 28 + 0$–4 B, $42 + 0$–3 B. *S. Europe; more or less naturalized locally in W. & C. Europe.* Al Az Bu Co Ga Gr Hs It Ju Lu.

A variable species whose limits are further obscured by probable hybridization with **19**, **20** and **22**. A number of variants have been given specific rank, among them **A. olivetorum** Godron in Gren. & Godron, *Fl. Fr.* **3**: 483 (1856), which differs from the typical variant in lacking an awn.

A. parlatorei Breistr., *Bull. Soc. Bot. Fr.* **110** (Sess. Extr.): 56 (1966) (*A. frondosa* Ten. ex Sprengel, non Poiret), from S. Italy and some other parts of the Mediterranean region, probably belongs here. It resembles **A. moldavica** Dobrescu & Beldie, *Anal. Şti. Univ. Al. I. Cuza Iaşi* (*Biol.*) **16**: 131 (1970), from E. Romania, in having leaves 3–7 mm wide, scabrid-hairy glumes and growing in damp habitats, but the two differ in the length of the spikelet, which is said to be 2–3 mm in the former and 1·2–1·5 mm in the latter. They may, perhaps, be derived from hybrids between **25** and *Polypogon viridis.*

A biosystematic investigation of the whole complex and of its relationships with **19**–**22** is greatly needed.

88. Gastridium Beauv.[1]

Annuals. Leaves flat. Inflorescence a narrow, cylindrical panicle, rarely lobed, usually tapering towards the apex. Spikelets strongly compressed laterally, with 1 floret. Glumes somewhat unequal, longer than the floret, shiny, swollen and coriaceous below, membranous above, 1-veined. Lemma much shorter than the glumes, elliptical, truncate and more or less dentate at apex, 5-veined, the middle vein usually excurrent as an awn. Palea membranous, 2-keeled. Rhachilla very shortly prolonged.

1. G. ventricosum (Gouan) Schinz & Thell., *Viert. Naturf. Ges. Zürich* **58**: 39 (1913) (*G. lendigerum* (L.) Desv.; incl. *G. scabrum* C. Presl). Stems 10–60 cm, erect or ascending, simple or branched, smooth. Leaves glabrous; ligule 1–3 mm, acute. Panicle 2–12 cm; branches erecto-patent at anthesis, usually appressed before and after. Spikelets (2–)3–4(–5) mm. Glumes scabrid on the keel, constricted above the swollen base, usually with a long, subulate apex. Lemma *c.* 1 mm, usually hirsute; awn slender, geniculate, rarely absent. Anthers *c.* 1 mm. $2n = 14$. *Grassy places and cultivated fields. S. & W. Europe, northwards to S. England.* Al Az Bl Br Bu Co Cr Ga Gr Hs It Ju Lu Rm Sa Si Tu.

G. laxum Boiss. & Reuter, *Pugillus* 126 (1852), is a variant of **1** with a lax panicle and spikelets 2–3 mm; it occurs with typical *G. ventricosum* in S.W. Spain and Portugal.

G. phleoides (Nees & Meyen) C. E. Hubbard, *Kew Bull.* **9**: 375 (1954), native of S.W. Asia and N.E. Africa, has once been recorded from Turkey-in-Europe (near Lüleburgaz) and S. Portugal but probably only as a casual. It is like **1** but the panicle is always very dense, the spikelets are 6–8 mm and the awn 6–8 mm.

89. Polypogon Desf.[1]

Annuals or perennials. Leaves flat. Inflorescence a dense panicle. Spikelets somewhat compressed laterally, with 1 floret. Glumes subequal, 1-veined, chartaceous, scabrid, longer than the floret, usually with an apical awn. Lemma 5-veined, hyaline, truncate. Palea hyaline. Rhachilla not prolonged.

1 Perennial; glumes unawned **3. viridis**
1 Annual; glumes awned
2 Glumes emarginate, shortly ciliate; lemma awned **1. monspeliensis**
2 Glumes 2-fid, long-ciliate; lemma unawned **2. maritimus**

1. P. monspeliensis (L.) Desf., *Fl. Atl.* **1**: 67 (1798). Annual; stems (1·5–)10–90 cm, smooth and glabrous. Leaves scabrid on both surfaces; ligule up to 10 mm. Panicle up to 16 cm, cylindrical or more or less lobed, greenish. Spikelets *c.* 2 mm. Glumes emarginate, shortly ciliate with short, stout hairs on the back in the proximal part; awn 5–7 mm, arising from the sinus. Lemma *c.* 1 mm, denticulate and with an awn 1–1·5 mm at apex. Anthers *c.* 0·4 mm. $2n = 28$. *Damp places, especially near the sea. S. & W. Europe, northwards to S. England.* Al Az Bl Br Bu Co Cr Ga Gr Hs It Ju Lu Rm Sa Si Tu [Cz Rs (W, ?K)].

2. P. maritimus Willd., *Ges. Naturf. Freunde Berlin Neue Schr.* **3**: 442 (1801) (*Chaetopogon creticus* (Coust. & Gand.) Hayek). Like **1** but usually smaller; stems up to 25 cm; ligule up

[1] By T. G. Tutin.

to 6 mm; panicle up to 5(–7) cm, often purple-tinged; glumes 2-fid, long-ciliate; lemma unawned. $2n=14$, 28. *Damp places, especially near the sea. Mediterranean region and W. Europe, northwards to N.W. France; S.E. Russia and W. Kazakhstan.* Az Bl Co Cr Ga Gr Hs It Ju Lu Rs (E) Sa Si Tu.

(a) Subsp. **maritimus**: Callus about as long as wide; glumes not strongly indurate at base at maturity; hairs on the back of the glumes towards the base not strongly inflated, acute. *Throughout the range of the species.*

(b) Subsp. **subspathaceus** (Req.) Bonnier & Layens, *Fl. Fr.* 356 (1894) (*P. subspathaceus* Req.): Callus 3–4 times as long as wide; glumes strongly indurate at base at maturity; hairs on the back of the glumes towards the base strongly inflated, subobtuse. $2n=14$. *Mediterranean region, mainly on the islands.*

3. P. viridis (Gouan) Breistr., *Bull. Soc. Bot. Fr.* **110** (*Sess. Extr.*): 56 (1966) (*P. semiverticillatus* (Forskål) Hyl.). Stoloniferous perennial; stems up to 100 cm, smooth. Leaves scabrid on both surfaces; ligule up to 5 mm. Panicle up to 15 cm, pyramidal, lobed. Spikelets 2–2·5 mm. Glumes obtuse, unawned, scabrid on the back. Lemma *c.* 1 mm, denticulate, unawned. Anthers 0·5–0·7 mm. $2n=28$. *Damp places. S. Europe; casual and sometimes naturalized further north.* Al Az Bl Bu Co Cr Ga Gr He Hs It Ju Lu Rs (K) Sa Si Tu.

P. adscendens Guss. ex Bertol., *Fl. Ital.* **2**: 777 (1836), a rare plant described from S. Italy (near Napoli) and recently found in Kriti, is the hybrid **1 × 3**.

× **Agropogon** P. Fourn.[1]
(*Agrostis* × *Polypogon*)

Like *Polypogon* but spikelets persistent; glumes acute, not emarginate, with an apical awn. Sterile.

1. × A. littoralis (Sm.) C. E. Hubbard, *Jour. Ecol.* **33**: 333 (1946) (*Polypogon littoralis* Sm.; *Agrostis stolonifera* × *Polypogon monspeliensis*). Perennial; stems 8–50 cm. Leaves scabrid; ligule up to 5 mm, obtuse. Panicle up to 12 cm, rather dense, usually lobed. Spikelets 2–3 mm. Glumes acute, not emarginate, scabrid-hairy; awn about as long as the glume. Lemma *c.* 1·5 mm, denticulate and with an awn arising just below the apex. Anthers *c.* 1 mm. $2n=28$. *Damp, often saline habitats. S. & W. Europe, northwards to England.* Br Ga ?Gr Hs It Rm Sa.

90. **Ammophila** Host[1]

Subglabrous, rhizomatous perennials. Leaves convolute. Inflorescence a dense, cylindrical panicle. Spikelets strongly compressed laterally, with 1 floret. Glumes equalling or exceeding the lemma, with wide scarious margin, keeled, persistent, the lower 1-, the upper 3-veined. Lemma linear-lanceolate, coriaceous, 3- to 5-veined, shortly 2-fid at apex, with very short, stout subterminal awn and with hairs less than ½ as long as lemma at base. Palea about as long as lemma, subcoriaceous, the 2 keels close together. Rhachilla prolonged, disarticulating above the glumes. Ovary glabrous; styles short.

1. A. arenaria (L.) Link, *Hort. Berol.* **1**: 105 (1827). Stems 60–120 cm, stout; rhizome far-creeping. Leaves up to *c.* 5 mm wide, rigid, pungent, strongly ribbed and puberulent above, smooth and shiny beneath; sheaths ribbed; ligule 10–30 mm, deeply 2-fid. Panicle 7–20(–30) cm, erect, stramineous. Spikelets 12–14 mm. Glumes somewhat unequal, linear-lanceolate. Lemma 10–14 mm. $2n=14$, 28, 56. *Sand-dunes. Coasts of Europe, northwards to c. 62° N. in Norway.* Al Be Bl Br Bu Co Cr Da Fa *Fe Ga Ge Gr Hb Ho Hs It Ju Lu No Po Rm Rs (B, C) Sa Si Su Tu.

(a) Subsp. **arenaria**: Glumes distinctly exceeding lemma. Hairs at base of lemma *c.* 2 mm. *N. & W. Europe, southwards to N.W. Spain.*

(b) Subsp. **arundinacea** H. Lindb. fil., *Acta Soc. Sci. Fenn.* ser. nov., B, **1(2)**: 10 (1932) (*Psamma australis* Mabille, *A. arenaria* var. *australis* (Mabille) Hayek): Glumes about equalling lemma. Hairs at base of lemma 4–5 mm. *Coasts of S. Europe, from Romania to N. Portugal.*

× **Ammocalamagrostis** P. Fourn.[1]
(*Ammophila* × *Calamagrostis*)

Like *Ammophila* but leaves more or less flat in the living state; panicle less dense; lemma with a slender awn up to 2 mm; hairs at base of lemma from half as long to as long as lemma. Sterile.

Literature: M. Westergaard, *Kong. Danske Vid. Selsk. Biol. Skr.* **2(4)**: 1–66 (1943).

1. × A. baltica (Flügge ex Schrader) P. Fourn., *Monde Pl.* **35**: 28 (1934) (*Ammophila arenaria* × *Calamagrostis epigejos*). Stems usually 74–130 cm, stout; rhizome far-creeping. Leaves up to *c.* 6 mm wide, ribbed on both surfaces, puberulent above; sheaths weakly ribbed; ligule 5–15 mm, shallowly lobed. Panicle 17–22 cm, erect, purplish. Spikelets 12–14 mm. Glumes somewhat unequal, linear-lanceolate, distinctly longer than lemma. Lemma 4·5–9 mm. Palea somewhat shorter than to about as long as lemma. $2n=28$, 42. *Usually on old sand-dunes. Coasts of the Baltic and North Seas, from E. England to Estonia, northwards to c. 59° 30′; isolated stations in N. France and N.W. Scotland.* Br Da Ga Ge Ho No Po Rs (B) Su.

Very variable.

Ammophila arenaria × *Calamagrostis arundinacea* was known from one locality in Sweden, where it is now extinct.

91. **Calamagrostis** Adanson[2]

Perennials. Leaves flat or convolute; ligule membranous. Spikelets narrow, with 1 floret, in dense to rather lax panicles. Lemma membranous, 3- to 5-veined, shorter than the glumes, surrounded by usually long callus-hairs, with an awn arising from the back or apex. Rhachilla disarticulating above the glumes.

Interspecific hybridization is common in this genus and large numbers of supposed hybrids have been recognized, using morphological characters. There seem to be few sterility barriers between the amphimictic species. Interspecific hybridization and subsequent polyploidy has apparently given rise to a number of apomictic species, notably **5**, **10** and **13**. Because of this it is sometimes difficult to classify the material into clear-cut species, and although the cytology of this genus and its effects on speciation have been the subject of a series of papers by Nygren there is still much to be learnt about the status of many of the morphological variants which are traditionally recognized.

Literature: A. Nygren, *Hereditas* **32**: 131–262 (1946); *Symb. Bot. Upsal.* **17(3)**: 1–105 (1962).

1 Lemma scabridulous, longer than callus-hairs
2 Palea about ¾ as long as lemma; awn often slender, straight
3 Glumes smooth or weakly scabrid on keel only **8. holmii**
3 Glumes aculeolate on keel, scabrid elsewhere

[1] By T. G. Tutin. [2] By G. C. S. Clarke.

4 Spikelets 3–4(–4·5) mm; glumes shortly acute **6. stricta**
4 Spikelets 4·5–6 mm; glumes acuminate **7. scotica**
2 Palea about as long as lemma; awn stout, geniculate or twisted
5 Leaves on flowering stems not more than 3 cm; plant small and slender **9. deschampsioides**
5 Leaves on flowering stems more than 3 cm; plant relatively tall and robust
6 Callus-hairs not more than half as long as lemma
7 Upper surface of leaves with long hairs **14. obtusata**
7 Upper surface of leaves scabrid, without hairs **11. arundinacea**
6 Callus-hairs at least half as long as lemma
8 Glumes lanceolate-acuminate, weakly scabrid, golden to reddish-brown, shining; anthers with viable pollen **12. varia**
8 Glumes ovate-lanceolate, strongly scabrid, usually dull purple; anthers without pollen **13. chalybaea**
1 Lemma usually smooth, not longer than callus-hairs
9 Lemma usually 3-veined; glumes narrowly lanceolate, long-acuminate
10 Panicle nodding; glumes distinctly unequal in length; awn exceeding lemma by *c.* 3 mm **2. pseudophragmites**
10 Panicle erect; glumes usually equal in length; awn exceeding lemma by less than 2 mm **1. epigejos**
9 Lemma usually 5-veined, the veins sometimes obscure; glumes ovate-lanceolate to lanceolate-acuminate
11 Stems with 2–3 nodes **10. lapponica**
11 Stems with 4 or more nodes
12 Stems unbranched; lemma deeply 2-fid; awn arising from about middle of lemma **3. villosa**
12 Stems often branched; lemma irregularly notched at apex; awn arising from apical ¼ of lemma
13 Leaves glabrous above; ligule (4–)6–10 mm; anthers without pollen **5. purpurea**
13 Leaves with sometimes sparse, white hairs on upper surface; ligule 1–4 mm; anthers with viable pollen **4. canescens**

Sect. CALAMAGROSTIS. Glumes ovate-lanceolate to narrowly lanceolate. Lemma hyaline, smooth, ½–⅔ as long as glumes. Palea ⅔ as long as lemma. Callus-hairs at least as long as lemma. Rhachilla usually not prolonged.

1. C. epigejos (L.) Roth, *Tent. Fl. Germ.* **1**: 34 (1788) (*C. gigantea* Roshev.). Caespitose, with creeping rhizomes; stems 60–200 cm, erect, usually rather stout, with 2–4 nodes, usually rough beneath panicle, smooth elsewhere. Leaves 4–20 mm wide, flat or weakly convolute; upper surface scabrid, with close-set veins; ligule 4–12 mm, acute, becoming lacerate. Panicle 15–30 × 3–6 cm, erect, dense or more or less patent; branches aculeolate. Spikelets 4–10 mm, silvery-grey to brownish-purple. Glumes subequal or the lower slightly the longer, narrowly lanceolate, aculeolate on keel. Lemma 3-veined, 2-fid; awn short, but exceeding lemma, arising from middle of lemma or above. $2n=28$, 42, 56. *Damp places and disturbed ground. Most of Europe, but rare in the south-west.* All except Az Bl Cr Fa Is Lu Sb.

An amphimictic polyploid complex of which some variants have been recognized as subspecies in the U.S.S.R. These are distinguished on the density of the panicle, smoothness of the stem under the panicle and the degree of inequality in glume-length. As intermediates are frequent, the variants do not seem to merit subspecific status.

C. epigejos hybridizes readily with other amphimictic species; the following are the most frequent hybrids: **1 × 6** (*C.* × *strigosa* (Wahlenb.) Hartman), **1 × 4** (*C.* × *rigens* Lindgren) which are more or less intermediate between their parents, and **1 × 11** (*C.* × *acutiflora* (Schrader) Reichenb.) which is like **12** but has stiff, glaucous leaves. It also hybridizes with *Ammophila* (× *Ammocalamagrostis*, p. 236).

2. C. pseudophragmites (Haller fil.) Koeler, *Descr. Gram.* 106 (1802) (*C. littorea* DC., *C. glauca* (Bieb.) Trin.). Caespitose, with creeping rhizomes; stems 50–150 cm, rather stout, with 2–3 nodes, scabrid beneath panicle, smooth elsewhere. Leaves up to 10 mm wide, flat or slightly convolute, the upper surface scabrid, with prominent, close-set veins; ligule 4–10 mm, acute or lacerate. Panicle 10–40 cm, soon nodding, often rather lax; branches aculeolate. Spikelets 5–9 mm, brownish-purple or rarely light green. Glumes distinctly unequal, the lower distinctly the longer, narrowly lanceolate, smooth or weakly aculeolate on keel only. Lemma 3-veined, 2-fid at apex; awn arising from near apex of lemma, exceeding lemma by *c.* 3 mm. $2n=28$. *Damp places. C. & S.E. Europe, extending to S.E. France, C. Italy and E.C. Russia.* Al Au Bu Cz Ga Ge He Ho ?Hs Hu It Ju Po Rm Rs (C, W, E) Tu.

3. C. villosa (Chaix) J. F. Gmelin, *Syst. Nat.* **2**: 171 (1791). Laxly caespitose, with long rhizomes; stems 50–150 cm, slender, with 4–5 nodes, smooth, unbranched, geniculate at base. Leaves 3–8 mm wide, flat or convolute, the upper surface scabrid and with scattered hairs, the veins relatively prominent but close-set; ligule 3–5 mm, lacerate. Panicle 8–20 × up to 6 cm, rather lax, flexuous or nodding after anthesis; branches weakly aculeolate. Spikelets 4–6 mm, dull brown or purplish. Glumes subequal, lanceolate, weakly scabrid. Lemma 5-veined, 2-fid; awn arising from middle of lemma or a little above, at least as long as lemma. $2n=56$. *Mountain heaths and woods. C. Europe, extending to the S.W. Alps and Bulgaria.* Au Bu Cz Ga Ge He It Ju Po Rm Rs (W).

4. C. canescens (Weber) Roth, *Tent. Fl. Germ.* **2(1)**: 93 (1789) (*C. lanceolata* Roth). Laxly caespitose, with rhizomes; stems 50–150 cm, erect, rather slender, with 4–6 nodes, smooth, often branched. Leaves 3–8 mm wide, flat or convolute, the upper surface with scattered, sometimes sparse, white hairs, the veins slender, close-set; ligule 1–4 mm, obtuse and lacerate. Panicle 5–20 × up to 7 cm, rather lax, flexuous or nodding after anthesis; branches smooth or weakly aculeolate. Spikelets 4–6(–7) mm, dull brown or purplish. Glumes subequal, lanceolate-acuminate, slightly scabrid. Lemma 5-veined, notched at the apex; awn usually very short and slender, arising from the apex or slightly below. Callus-hairs about as long as lemma. Anthers usually purple, with well-developed pollen; thecae separating at maturity. $2n=28$. *Marshes and fens. Europe southwards to N. Spain, N. Italy and Bulgaria.* Au Be Br Bu Cz Da Fe Ga Ge He Ho Hs Hu It Ju No Po Rm Rs (N, B, C, W, E) Su.

(a) Subsp. **canescens**: Awn slender, very short, arising from or near the notch in apex of lemma. Rhachilla-prolongation absent or minute. *Throughout the range of the species.*

(b) Subsp. **vilnensis** (Besser) H. Scholz, *Ber. Deutsch. Bot. Ges.* 77: 145 (1964) (*C. vilnensis* Besser ex Schultes & Schultes fil.): Awn robust, longer, arising distinctly below the apex of lemma. Rhachilla-prolongation present. *Germany and Baltic region.*

The name *C. vilnensis* has sometimes been applied to the hybrid **4 × 6** (*C.* × *gracilescens* (Blytt) Blytt), which is intermediate between its parents in glume-shape, awn-length and the relative lengths of callus-hairs and lemma.

4 × 11 (*C.* × *hartmaniana* Fries) is rather like **11**, but has unbranched stems, long leaves with white hairs on the upper surface, callus-hairs nearly as long as the lemma and a straight awn.

5. C. purpurea (Trin.) Trin., *Gram. Unifl.* 219 (1824). Laxly caespitose, rhizomatous; stems 50–200 cm, rather slender to stout, with (4–)6–8 nodes, often branched. Leaves 3–12 mm wide, flat or sometimes convolute, the upper surface glabrous or weakly scabrid, with rather prominent veins; ligule (4–)6–10 mm. Panicle 5–35 cm, nodding at maturity, often rather dense; branches scabrid to aculeolate. Spikelets 2·5–8 mm, greyish to violet-brown. Glumes subequal, ovate-lanceolate to narrowly lanceolate-acuminate, scabrid. Lemma 5-veined, notched at apex; awn arising from back of lemma, rarely from apex, exceeding or equalling lemma. Callus-hairs at least as long as lemma. Rhachilla sometimes prolonged. Anthers yellow, without pollen; thecae not separating at maturity. $2n=28$, 56–91. *Marshes and fens. N.C. & E. Europe, southwards to N. Switzerland and S.C. Russia, and extending westwards to E. Belgium.* Be Cz Fe Ga Ge He No ?Po Rs (N, B, C) Su.

A complex of apomicts which has arisen from the amphimictic species **4** by autopolyploidy or by hybridization with other species, notably **1**. Morphologically, plants belonging to this complex are extremely variable and their treatment by different authors has varied correspondingly. Although there are intermediates, the following seem to represent the best-delimited series of taxa, which have sometimes been recognized as species, sometimes as subspecies and sometimes as varieties of a single species.

The exact distribution of some subspecies in this group is very imperfectly known.

1 Callus-hairs distinctly longer than lemma; glumes weakly scabrid; rhachilla scarcely prolonged
2 Glumes 6–8 mm, narrowly lanceolate-acuminate; awn arising from notch at apex of lemma (d) subsp. **pseudopurpurea**
2 Glumes 4–6(–7) mm, broadly lanceolate-acuminate; awn arising from back of lemma (b) subsp. **phragmitoides**
1 Callus-hairs about as long as lemma; glumes strongly scabrid; rhachilla distinctly prolonged
3 Plant slender; glumes ovate-lanceolate, violet; leaves green (a) subsp. **purpurea**
3 Plant robust; glumes lanceolate, greenish; leaves glaucous (c) subsp. **langsdorfii**

(a) Subsp. **purpurea**: Stems up to 100 cm, slender, with 6–8 nodes; rhizomes short. Leaves 3–4 mm wide, green; ligule more than 10 mm. Spikelets 2·5–4 mm, violet. Glumes ovate-lanceolate, densely scabridulous; awn arising from upper half of lemma, exceeding lemma by 1–1·5 mm. Callus-hairs about as long as lemma. Rhachilla distinctly prolonged. *E. Russia.*

(b) Subsp. **phragmitoides** (Hartman) Tzvelev, *Nov. Syst. Pl. Vasc. (Leningrad)* **1965**: 36 (1965) (*C. phragmitoides* Hartman, *C. elata* Blytt): Stems usually more than 100 cm, rather stout, with 5–8 nodes; rhizomes long. Leaves 5–10(–15) mm wide, green; ligule 7–10(–13) mm. Spikelets 4–7 mm, brownish-green. Glumes lanceolate-acuminate, sparsely scabridulous. Awn arising from apical $\frac{1}{3}$ of lemma, scarcely exceeding lemma. Callus-hairs distinctly longer than lemma. Rhachilla scarcely prolonged. *Almost throughout the range of the species.*

(c) Subsp. **langsdorfii** (Link) Tzvelev, *op. cit.* 34 (1965) (*C. langsdorfii* (Link) Trin.): Stems usually more than 100 cm, rather stout, with (4–)5–7 nodes; rhizomes long. Leaves 6–12 mm wide, glaucous; ligule 7–10 mm. Spikelets 4–7 mm, greenish or glaucous. Glumes lanceolate-acuminate, scabrid. Awn arising from middle or lower part of lemma, exceeding lemma by 1–1·5 mm. Callus-hairs about as long as lemma. Rhachilla distinctly prolonged. *N.E. Russia.* (*N. Asia, North America.*)

(d) Subsp. **pseudopurpurea** (Gerstlauer ex R. Heine) G. C. S. Clarke, *Bot. Jour. Linn. Soc.* **76**: 361 (1978) (*C. pseudopurpurea* Gerstlauer ex R. Heine): Stems 100–170 cm, robust, with 6–8 nodes; rhizomes long. Leaves 8–12 mm wide, green; ligule 4–6 mm. Spikelets 6–8 mm, greenish-brown. Glumes linear-lanceolate, long-acuminate, slightly scabrid. Awns very slender, arising from notch at apex of lemma or very slightly below. Callus-hairs distinctly longer than lemma. Rhachilla-prolongation minute. ● *E. Germany (S.W. of Dresden).*

Sect. DEYEUXIA (Clarion) Beauv. Glumes ovate-lanceolate to lanceolate. Lemma membranous, scabrid, at least $\frac{3}{4}$ as long as glumes. Palea at least $\frac{2}{3}$ as long as lemma. Callus-hairs usually considerably shorter than lemma. Rhachilla prolonged.

6. C. stricta (Timm) Koeler, *Descr. Gram.* 105 (1802) (*C. neglecta* auct., non (Ehrh.) Beauv.). Laxly caespitose, with long rhizomes; stems 10–100 cm, erect, rather slender, with 2–3 nodes, smooth or slightly rough below panicle. Leaves 10–40(–60) cm × 1·5–5 mm, convolute or flat, the upper surface strongly scabrid; veins close-set, prominent; ligule 1–4 mm, obtuse. Panicle 5–20 cm, cylindrical, dense; branches aculeolate. Spikelets 3–4(–4·5) mm, greyish-brown or purplish. Glumes subequal, ovate-lanceolate, scabrid; keel aculeolate. Lemma 2-fid at apex; awn straight, scarcely exceeding lemma, arising from middle of lemma or slightly below. Callus-hairs $\frac{1}{3}$–$\frac{1}{4}$ as long as lemma, rather sparse. $2n=28$. *Marshes and fens. N. & C. Europe; U.S.S.R., except the south.* Br Cz Da Fe †Ga Ge Hb †He Ho Hu Is No Po Rm Rs (N, B, C, W, E) Sb Su.

Plants from arctic Russia, which have stems up to 40 cm and glumes that are weakly scabrid, have sometimes been separated as **C. groenlandica** (Schrank) Kunth, *Révis. Gram.* **1**: 75 (1829), but do not seem to merit specific status.

7. C. scotica (Druce) Druce, *Brit. Pl. List* ed. 2, 127 (1928). Like **6** but spikelets 4·5–6 mm; glumes lanceolate, acuminate. *Bogs.* ● *N.E. Scotland.* Br.

8. C. holmii Lange in Holm, *Nov.-Zeml. Veg.* 20 (1885). Like **6** but stems less than 40 cm; ligule *c.* 1 mm; panicle 3–7 cm; branches almost smooth; spikelets purplish-black when young; glumes lanceolate, glabrous or very weakly scabrid on keel only. *Arctic Russia.* Rs (N). (*Arctic and subarctic Asia.*)

9. C. deschampsioides Trin., *Sp. Gram. Icon. Descr.* **3**: t. 354 (1836). Stems 15–30(–45) cm, solitary; rhizomes slender, with 2–3 nodes, smooth. Leaves up to 8 cm (not more than 3 cm on flowering stems), 2–3 mm wide, linear, convolute, the upper surface scabrid, with prominent veins; ligule 1–2 mm, truncate. Panicle 2–7 cm, pyramidal; branches more or less smooth. Spikelets 3–4·5 mm, dull purplish-brown. Glumes subequal, ovate-lanceolate, smooth. Lemma 2-fid at apex; awn slightly twisted and bent, slightly exceeding lemma, arising from middle of lemma or below. Callus-hairs up to half as long as lemma. *Marshes and wet meadows. Arctic Russia.* Rs (N). (*Arctic Asia and America.*)

10. C. lapponica (Wahlenb.) Hartman, *Handb. Skand. Fl.* 46 (1820). Laxly caespitose, with long rhizomes; stems 30–130 cm, erect, rather slender, with 2(–3) nodes, scabrid below panicle, smooth elsewhere. Leaves 10–30 cm × 2–6 mm, flat or involute, the upper surface weakly scabrid, often with short hairs; veins prominent but widely spaced; ligule 2–3(–6) mm, obtuse or lacerate. Panicle 5–15 cm, narrow, but often rather lax; branches aculeolate. Spikelets 4–8 mm, purplish or greenish-brown. Glumes subequal, ovate-lanceolate, weakly aculeolate on the

keel, minutely scabrid elsewhere. Lemma irregularly truncate at apex; awn slightly bent and twisted, about as long as lemma, arising from lower ¼ of lemma. Callus-hairs about as long as lemma. $2n=28$, 42–112. *Tundra, dry heaths and woods. N. Europe, southwards to C. Ural and to c.* 62° *N. in Norway.* Fe No Rs (N, C) Su.

11. C. arundinacea (L.) Roth, *Tent. Fl. Germ.* **2(1)**: 89 (1789). Caespitose, with short rhizomes; stems 60–150 cm, erect, rather stout, with 2–3 nodes, smooth. Leaves up to 50 cm × 4–12 mm, flat, hairy at junction of lamina and sheath, the upper surface scabrid, with widely spaced veins; ligule 2–4 mm, obtuse or truncate. Panicle 10–25 × up to 5 cm, often rather dense; branches scabrid or weakly aculeolate. Spikelets 4–6 mm, light brown to purplish. Glumes subequal, lanceolate, scabridulous. Lemma 2-fid at apex; awn bent and twisted, about twice as long as and arising from near base of lemma. Callus-hairs not more than ½ as long as lemma. $2n=28+0$–$2B$. *Open woods and marshes. Most of Europe except the islands, the extreme north and much of the south-west.* Au Be Bu Cz Da Fe Ga Ge Gr He Hs Hu It Ju Lu No Po Rm Rs (N, B, C, W, E) Su.

12. C. varia (Schrader) Host, *Gram. Austr.* **4**: 27 (1809) (*C. montana* Host). Caespitose, with short rhizomes; stems 30–120 cm, rather slender, with 3 nodes, smooth. Leaves 10–25 cm × 4–9 mm, flat, rarely hairy at junction of sheath and lamina, the upper surface smooth, with scarcely raised veins; ligule 2–4 mm, obtuse, lacerate at apex. Panicle 5–20 cm, rather dense; branches weakly scabrid. Spikelets 4–6 mm, golden to reddish-brown. Glumes subequal, lanceolate, acuminate, more or less smooth and shining, smooth or sometimes weakly aculeolate on keel. Lemma 2-fid at apex; awn twisted and bent, up to 1½ times as long as lemma, arising from near base. Callus-hairs ½–¾ as long as lemma. Anthers with thecae separating at maturity; pollen viable. *Open woods and mountain grassland; somewhat calcicole. C. & S. Europe; Gotland.* Au †Be Co Cz Ga Ge Gr He Hu It Ju Po Rm Rs (W) Sa Su.

(a) Subsp. **varia**: Spikelets 4–5 mm. Callus-hairs nearly as long as lemma. $2n=28$. *Throughout the range of the species except Corse.*

(b) Subsp. **corsica** (Hackel) Rouy, *Fl. Fr.* **14**: 88 (1913): Spikelets 5–6 mm. Callus-hairs half as long as lemma. $2n=28$. ● *Corse.*

13. C. chalybaea (Laest.) Fries in Hartman, *Handb. Skand. Fl.* ed. 4, 26 (1843). Caespitose, with short rhizomes; stems 60–150 cm, rather slender, usually with 4 nodes, weakly scabrid beneath panicle, smooth elsewhere. Leaves 20–30 cm × 5–12 mm, flat, hairy at junction of sheath and lamina, the upper surface scabrid; veins widely spaced, not prominent; ligule 3–5 mm, lacerate. Panicle 10–25 cm; branches rather short, aculeolate. Spikelets 3–4 mm, purplish. Glumes subequal, ovate-lanceolate, strongly scabrid and aculeolate on keel. Lemma 2-fid at apex; awn twisted and bent, about as long as lemma, arising from near base. Callus-hairs *c.* ¾ as long as lemma. Anthers with thecae not separating at maturity; pollen absent. $2n=42$. *Open woods and marshes. C. Sweden and C. Norway; N. Russia.* No Rs (N) Su.

Sometimes considered to be the hybrid **4** × **14.**

14. C. obtusata Trin., *Gram. Unifl.* 225 (1824). Like **13** but rhizome long, branched; leaves up to 7 mm wide, with long hairs on the upper surface; glumes weakly scabrid; lemma irregularly toothed at apex; callus-hairs up to ½ as long as lemma. *N. & E. Russia.* Rs (N, C).

92. Chaetopogon Janchen[1]
(*Chaeturus* Link, non Willd.)

Annuals. Leaves setaceous or flat. Inflorescence a narrow panicle. Spikelets laterally compressed, with 1 floret. Glumes subequal, the lower 1-veined, awned, longer than the lemma, the upper 3-veined, unawned. Lemma hyaline, 1-veined. Palea *c.* ½ as long as lemma, without apparent veins.

1. C. fasciculatus (Link) Hayek, *Prodr. Fl. Penins. Balcan.* **3**: 335 (1933). Stems up to 20 cm, slender, ascending. Leaves up to 1 mm wide; ligule up to 5 mm, acute. Panicle 0·5–12 cm. Spikelets *c.* 3 mm (excl. awn), often in groups of 2–3; pedicels short, stout. Glumes lanceolate-subulate, scabrid; awn 1–3 times as long as glume. Lemma somewhat shorter than the glumes. $2n=14$. *Sandy places. Mediterranean region, Portugal.* Hs It Ju Lu.

Subsp. **prostratus** (Hackel & Lange) Laínz, *Anal. Inst. Forest. Invest. Exper.* (*Madrid*) **10**: 327 (1966) (*Chaeturus prostratus* Hackel & Lange), from Portugal and N.W. Spain, is a variant with stems up to 5 cm and awns about as long as the glumes, which does not seem to be clearly distinguishable from **1**.

93. Phleum L.[2]

Annuals or perennials. Leaves flat. Inflorescence a dense spike-like, ovoid or cylindrical panicle. Spikelets strongly compressed laterally, with 1 floret. Glumes membranous, subequal, longer than the lemma, keeled, shortly awned, 3-veined, with the margins overlapping along most of their length. Lemma membranous, truncate or obtuse, 1- to 7-veined, unawned, glabrous to densely ciliate. Palea equalling or almost equalling the lemma, ovate-lanceolate, obtuse, 2-veined. Stamens 2–3.

Literature: H. Nordenskiöld, *Acta Agric. Suec.* **1**: 1–138 (1945). H. Horn af Rantzien, *Bot. Not.* **1946**: 364–386 (1946).

1 Annual, without non-flowering shoots
 2 Glumes gradually tapered to apex
  3 Spikelets oblong-ovate; glumes semi-elliptical, often overlapping at apex; keel usually glabrous **11. subulatum**
  3 Spikelets oblong-lanceolate; glumes linear-lanceolate, parallel or diverging at apex; keel densely ciliate
   4 Panicle narrowed at base; anthers 0·3–1·2 mm **8. arenarium**
   4 Panicle cylindrical; anthers 1·5–2 mm **9. graecum**
 2 Glumes truncate at apex
  5 Stamens 2; lemma 1-veined **10. crypsoides**
  5 Stamens 3; lemma 5- to 7-veined
   6 Glumes flat at apex, with straight keel; awns 2·5–7 mm **3. echinatum**
   6 Glumes swollen towards apex, with curved keel; awns 0·3–0·6 mm **7. paniculatum**
1 Perennial, with non-flowering shoots at anthesis
 7 Glumes gradually tapered at apex
  8 Glumes scabrid or shortly ciliate on the keel; spikelets 2–3·5(–3·7) mm **4. phleoides**
  8 Glumes long-ciliate on the keel; spikelets 3·5–6(–10) mm
   9 Glumes pubescent on the surface; panicle lax and often interrupted below **6. hirsutum**
   9 Glumes hairy only on the keel; panicle compact **5. montanum**
 7 Glumes truncate or obliquely tapered at apex
  10 Panicle broadly cylindrical or ovoid; awns usually more than 2 mm **2. alpinum**
  10 Panicle usually cylindrical; awns 2 mm or less

[1] By T. G. Tutin. [2] By C. J. Humphries.

11 Panicle-branches almost completely adnate to the rhachis **1. pratense**
11 Panicle-branches free
12 Glumes with glabrous, scabrid or shortly ciliate keel **4. phleoides**
12 Glumes with long-ciliate keel **5. montanum**

Sect. PHLEUM. Panicle-branches almost completely adnate to the rhachis. Rhachilla not prolonged. Glumes not winged on the keel. Lemma 3- to 7-veined. Stamens 3. Grain ovoid-oblong, terete.

1. P. pratense L., *Sp. Pl.* 59 (1753). Laxly or densely caespitose perennial 6–150 cm; stems with 1–6 nodes; lower nodes sometimes swollen and tuberous. Leaves up to 45 cm × 10 mm, acuminate, scabrid on both surfaces or at least towards the apex and margins; ligule 1–6 mm; sheath slightly inflated above. Panicle (1–)2–11(–30) × 0·4–1·2 cm, cylindrical, green, often tinged with purple. Spikelets 2–5·5 mm, oblong. Glumes truncate, ciliate on the keel; awn 0·2–2 mm; lower glume softly hairy on the margin. Lemma ⅔–¾ as long as glumes, minutely hairy. Palea as long as the lemma. *Grassland; commonly cultivated as a fodder plant and widely naturalized.* All except Bl Cr Sb.

(a) Subsp. **pratense**: Stems 20–150 cm. Ligule obtuse. Panicle 6–11(–30) cm × 0·6–0·8 cm. Awn 1–2 mm. $2n=42$ (21, 35, 36, 49, 56, 63, 70, 84). *Almost throughout the range of the species.*

(b) Subsp. **bertolonii** (DC.) Bornm., *Bot. Jahrb.* **61**, *Beibl.* **140**: 157 (1928): Stems 6–70(–100) cm. Ligule acute. Panicle 1–8 (–10) × 0·3–0·5 cm. Awn 0·2–1·2 mm. $2n=14$. *Throughout the range of the species, but rare in the north.*

2. P. alpinum L., *Sp. Pl.* 59 (1753). Laxly caespitose perennial 5–50 cm, sometimes shortly rhizomatous; stems with 2–4 nodes. Leaves up to 17 cm × 8 mm, acute, the upper very short; ligule up to 2 mm; leaf-sheaths somewhat inflated above. Panicle 1–5(–6) × (0·3–)0·7–1·5 cm, broadly cylindrical to ovoid, usually purplish. Spikelets 5·5–8·5 mm, oblong. Glumes truncate, ciliate on the keel and scabrid at the margin; awn (1–)1·5–4 mm, glabrous or ciliate; lower glume softly hairy on the margin. Lemma *c.* ¾ as long as glumes, minutely hairy on the veins. Palea slightly shorter than lemma. *Mountains of Europe, and at low altitudes in the north.* Al Au Br Bu Co Cz Fa Fe Ga Ge Gr He Hs Is It Ju No Po Rm Rs (N, C, W) Su.

(a) Subsp. **alpinum** (*P. commutatum* Gaudin, *P. alpinum* subsp. *commutatum* (Gaudin) K. Richter): Awn scabrid. $2n=28$. *Throughout the range of the species.*

(b) Subsp. **rhaeticum** Humphries, *Bot. Jour. Linn. Soc.* **76**: 339 (1978): Awn ciliate. $2n=14$. ● *Mountains of C. & S. Europe.*

3. P. echinatum Host, *Gram. Austr.* **3**: 8 (1805). Laxly caespitose annual 4–35(–45) cm; stems with 1–4 nodes. Leaves up to 14 cm × 7 mm, acuminate; ligule up to 2 mm. Panicle 0·4–3·5 × 0·6–1·6 cm, shortly cylindrical or ovoid, pale or whitish-green. Spikelets 4–10·5 mm (including awn), oblong. Glumes truncate, ciliate on the keel; awn 2·5–7 mm; lower glume softly hairy on the margin. Lemma ⅔ as long as glumes, glabrous or minutely hairy on the veins. Palea slightly shorter than lemma. $2n=10$. *Calcicole. Mediterranean region, westwards to Sicilia.* Al ?Cr Gr It Ju Si.

Sect. CHILOCHLOA. (Beauv.) Griseb. Panicle-branches free. Rhachilla prolonged. Glumes not winged on the keel. Lemma 3- to 7-veined. Stamens 3. Grain ovoid-oblong, terete

4. P. phleoides (L.) Karsten, *Deutsche Fl.* 374 (1881) (*P. boehmeri* Wibel, *P. phalaroides* Koeler). Densely caespitose perennial 6–90 cm; stems with 2–3 nodes, often purple. Leaves up to 20 cm × 6 mm, sometimes convolute, scabrid, acuminate; ligule up to 2 mm. Panicle 3–14(–17) × 0·4–1 cm, narrowly cylindrical, tapered towards the apex, green or purplish. Spikelets 2–3·7 mm, oblong-lanceolate. Glumes abruptly narrowed into a very short awn, with glabrous, scabrid or somewhat irregularly ciliate keel. Lemma ⅔–¾ as long as glumes, minutely pubescent or glabrous. Palea as long as lemma. $2n=14, 28+1$–5 B. *Dry grassland; somewhat calcicole. Most of Europe except the north-east, much of Fennoscandia and the extreme south.* Al Au Be Br Bu Co Cz Da Fe Ga Ge Gr He Hs Hu It Ju Lu No Po Rm Rs (B, C, W, K, E) Su.

5. P. montanum C. Koch, *Linnaea* **21**: 383 (1848). Like **4** but the glumes gradually tapered to a very short awn and pectinate-ciliate on the keel. *Dry mountain grassland. S.E. Europe, S. & E. Carpathians.* Al Bu Gr Ju Rm Rs (W, K).

A very variable species, in need of further investigation, intermediate in most characters between **4** and **6**. Variants with the keel of the glumes shortly ciliate occurring in Greece, called **P. serrulatum** Boiss., *Diagn. Pl. Or. Nov.* **3(4)**: 125 (1859), are closely allied to **4**. Plants from the Carpathians with narrow leaves, long spikelets and densely ciliate glumes approach variants of **6** from S. Italy and Sicilia which have been referred to **5** and have also been called **P. ambiguum** Ten., *Fl. Nap.* **2**: 377 (1820).

6. P. hirsutum Honckeny, *Vollst. Syst. Verz.* 183 (1782) (*P. ambiguum* Ten., *P. michelii* All.). Laxly to densely caespitose perennial 20–90 cm, sometimes shortly rhizomatous; stems with 1–4 nodes. Leaves up to 21 cm × 2–8 mm, acuminate, scabrid on the margin and veins, sometimes glaucous; ligule up to 5 mm. Panicle 2–16 × 0·4–1·6 cm, broadly cylindrical, pale green to purple. Spikelets 3·5–6(–10) mm, lanceolate. Glumes gradually narrowed into a short awn, densely ciliate on the keel; lower glume softly hairy on the margin. Lemma ⅔–¾ as long as glumes, glabrous to pubescent. Palea as long as the lemma. $2n=14$. *Grassland, open woods and stony slopes, usually above* 1000 *m; calcicole. Mountains of C. & S. Europe.* Al Au Bu Cz Ga Ge Gr He It Ju Po Rm Rs (W) Si.

7. P. paniculatum Hudson, *Fl. Angl.* 23 (1762) (*P. asperum* Jacq.). Annual 5–30(–55) cm; stems erect, with 1–6 nodes. Leaves up to 19 cm × 7 mm, obtuse, shortly hairy on the margin; ligule up to 7 mm. Leaf-sheaths slightly inflated; panicle 1–12 × 0·35–0·7 cm, pale green. Spikelets 1·5–2·8 mm, oblanceolate. Glumes truncate, swollen at apex, narrowed at base, scabrid, sometimes slightly ciliate on the keel; lower glume softly hairy on the margin; awn 0·3–0·6 mm. Lemma ¾ as long as glumes, pubescent. Palea slightly shorter than lemma. $2n=28$. *Dry places. S. & S.C. Europe.* Al Au Bu Co ?Cr Ga Ge Gr He Hs Hu It Ju Rm ?Rs (K) Sa Si Tu.

8. P. arenarium L., *Sp. Pl.* 60 (1753). Annual 2–35 cm. Stems with 1–4 nodes. Leaves up to 7 cm × 5 mm, acute, scabrid on the veins; ligule up to 7 mm; leaf-sheaths inflated above. Panicle 0·5–5·5 × 0·3–0·7 cm, narrowly cylindrical to ovoid, tapering at the base, pale to whitish-green, sometimes tinged with purple. Spikelets 2·2–4·4 mm, oblong-lanceolate. Glumes gradually narrowed into a short awn, ciliate on the keel; awn 0·3–1 mm. Lemma ½ as long as glumes, glabrous or pubescent. Anthers 0·3–1 mm. $2n=14$. *Maritime sands and shingle; rarely on sandy soil inland. S. & W. Europe, extending north-eastwards to Gotland; casual in E. & C. Europe.* Be Br Co Da Ga Ge Gr Hb Ho Hs It Ju Lu No Rs (?K) Si Su Tu.

9. P. graecum Boiss. & Heldr. in Boiss., *Diagn. Pl. Or. Nov.* **2(13)**: 42 (1853). Like **8** but stems up to 45 cm; panicle 4–10(–15) cm, rounded at the base; glumes with more finely pointed awns diverging at the apex; awn 0·5–1·5 mm; anthers 1·5–2 mm. *Dry, open habitats. S.E. Europe.* Bu ?Cr Gr It Ju Tu.

(a) Subsp. **graecum**: Spikelets 2·5–3·5 mm. Glumes densely ciliate on the keel, with the hairs about as long as the width of the glume. *Throughout the range of the species.*

(b) Subsp. **aegaeum** (Vierh.) W. Greuter, *Boissiera* **13**: 180 (1967) (*P. arenarium* subsp. *aegaeum* Vierh.): Spikelets 2–2·5(–3) mm. Glumes sparsely ciliate on the keel, the hairs less than half as long as the width of the glume. *Ionioi Nisoi, Kithira, Andekithira and Kikladhes.*

Sect. MAILLEA (Parl.) Horn af Rantzien. Panicle-branches free. Rhachilla prolonged. Glumes winged on the keel. Lemma 1-veined. Stamens 2. Grain ovoid-oblong, terete.

10. P. crypsoides (D'Urv.) Hackel, *Bull. Soc. Bot. Fr.* **39**: 274 (1892). Annual 2–10 cm. Panicle 3–5 × 0·4–0·7 cm, ovoid, rounded at the base, pale or whitish-green. Spikelets 2–4·5 mm, oblong-lanceolate. Glumes abruptly contracted into a very short awn, with a winged, pectinate-ciliate keel. Lemma ⅓ as long as glumes, glabrous. *Sandy places near the sea. C. & E. Mediterranean region.* Cr Gr Sa.

(a) Subsp. **crypsoides**: Hairs on the keel ⅓ as long as the width of the glume. *S. Aegean region.*

(b) Subsp. **sardoum** (Hackel) Horn af Rantzien, *Bot. Not.* **1946**: 370 (1946): Hairs on the keel ½ as long as the width of the glume. ● *Sardegna.*

Sect. ACHNODON Griseb. Panicle-branches free. Rhachilla prolonged. Glumes not winged on the keel. Lemma 5- to 7-veined. Stamens 3. Grain laterally compressed.

11. P. subulatum (Savi) Ascherson & Graebner, *Syn. Mitteleur. Fl.* **2(1)**: 154 (1899) (*P. tenue* (Host) Schrader). Annual 2–30(–40) cm. Stems with 1–6 nodes. Leaves 1·5–12 cm × 1–4 mm, acuminate, sometimes convolute, with scabrid veins; ligule up to 5 mm. Panicle 0·8–11 × 0·2–0·7 cm, pale or whitish-green. Spikelets 2–4 mm. Glumes semi-elliptical, gradually narrowed into a short awn. Lemma ⅔ as long as glumes. *Grassland. S. Europe.* Al Bu Co Cr Ga Gr Hs It Ju Po Rm Rs (K) Si Tu.

(a) Subsp. **subulatum**: Glumes glabrous on the keel. *Throughout the range of the species.*

(b) Subsp. **ciliatum** (Boiss.) Humphries, *Bot. Jour. Linn. Soc.* **76**: 339 (1978) (*P. tenue* var. *ciliatum* Boiss.): Glumes ciliate on the keel. *Jugoslavia, Greece and Kriti.*

94. Alopecurus L.[1]

Usually subglabrous annuals or perennials. Inflorescence a spike-like panicle. Spikelets laterally compressed, with 1 floret. Glumes subequal, often connate below, 3-veined. Lemma hyaline, 3-veined, usually awned from the back; margins often connate below. Palea usually absent or, if present, small. Ovary glabrous; styles usually connate below. Rhachilla disarticulating below the glumes.

Hybrids may occur where two species, especially of Sect. *Alopecurus*, grow together. They are morphologically intermediate between the parents and appear to be sterile, maintaining themselves vegetatively.

[1] By G. C. S. Clarke.

Literature: E. Paunero, *Anal. Inst. Bot. Cavanilles* **10(2)**: 301–346 (1952). N. N. Tzvelev, *Nov. Syst. Pl. Vasc.* (*Leningrad*) **8**: 12–22 (1971).

1 Palea present
 2 Basal leaves flat; rhizome stout **13. gerardii**
 2 Basal leaves setaceous; rhizomes slender **14. vaginatus**
1 Palea absent
 3 Glumes glabrous; keel winged
  4 Glumes connate for not more than ½ their length **10. myosuroides**
  4 Glumes connate for more than ½ their length **11. creticus**
 3 Glumes hairy; keel unwinged
  5 Margins of lemma free or connate only at base
   6 Inflorescence ovoid or broadly cylindrical, conspicuously hairy **7. alpinus**
   6 Inflorescence narrowly cylindrical, not conspicuously hairy
    7 Glumes obtuse; stem not bulbous at base **3. geniculatus**
    7 Glumes acute; stem bulbous at base **5. bulbosus**
  5 Margins of lemma connate for at least ⅓ of their length
   8 Glumes abruptly narrowed above the middle, with stiff hairs in the lower half **12. rendlei**
   8 Glumes not abruptly narrowed, with silky hairs throughout
    9 Glumes aristate, with dense hairs up to 3 mm **6. himalaicus**
    9 Glumes not aristate, with hairs not more than 2 mm on keel and veins only
     10 Glumes obtuse; spikelets not more than 3(–3·5) mm **4. aequalis**
     10 Glumes acute; spikelets (3–)4 mm or more
      11 Slender annual; inflorescence lax
       12 Spikelets in groups of 3–4 per branchlet **8. utriculatus**
       12 Spikelets solitary **9. setarioides**
      11 Robust perennial; inflorescence dense
       13 Glumes parallel or convergent at apex; lemma acute **1. pratensis**
       13 Glumes divergent at apex; lemma obliquely truncate **2. arundinaceus**

Sect. ALOPECURUS. Annual or perennial. Inflorescence cylindrical to ovoid; glumes with silky hairs usually on keel and veins only; palea absent.

1. A. pratensis L., *Sp. Pl.* 60 (1753). Perennial; stems 30–110 cm, erect, not rooting at nodes. Leaves 4–8 mm wide; sheaths scarcely inflated; ligule 1·5–2·5 mm, truncate. Inflorescence 1·8–9 × 0·7–1 cm, cylindrical to ovoid. Spikelets 4–6 mm. Glumes acute, connate for ¼ their length, parallel or convergent at apex; veins and keel with silky hairs. Lemma acute, usually longer than glumes, margins connate for ⅓ their length; awn exserted. Anthers *c.* 5 times as long as wide. *Meadows and pastures. Most of Europe, but rare in the extreme north-east and south-west.* All except Bl Cr ?Gr Lu Sb; not native in Fa or Is.

(a) Subsp. **pratensis**: Inflorescence 3–9 cm, cylindrical. Hairs on glumes less than 2 mm. $2n=28$. *Throughout the range of the species.*

(b) Subsp. **laguriformis** (Schur) Tzvelev in Fedorov, *Fl. Part. Eur. URSS* **1**: 250 (1974): Inflorescence 1·5–4 cm, ovoid. Hairs on glumes 2–3 mm. ● *E. & S. Carpathians.*

2. A. arundinaceus Poiret in Lam., *Encycl. Méth. Bot.* **8**: 776 (1808) (*A. ventricosus* Pers.). Like **1** but leaves up to 12 mm wide; sheaths rather inflated; ligule 2–5 mm; inflorescence 0·8–1·3 cm wide, broadly cylindrical; glumes diverging at apex; lemma usually shorter than glumes, obliquely truncate; awn rarely exserted. $2n=28$. *Damp or saline grassland. E. Europe and Baltic region; Spain and Portugal; a few very isolated stations elsewhere.* Bu Da Fe Ga Ge ?Gr ?He Hs It Ju Lu No Po Rm Rs (N, B, C, W, K, E) Su Tu.

Hybrids with **1** occur frequently in the Baltic region.

Most plants of this species from Portugal are less robust than typical *A. arundinaceus* and have previously been referred to **A. brachystachyus** Bieb., *Fl. Taur.-Cauc.* **3**: 56 (1819). Plants with larger spikelets have been called **A. lasiostachyus** Link, *Hort. Berol.* **1**: 71 (1827), but there seems to be no clear distinction between these and **2**.

3. A. geniculatus L., *Sp. Pl.* 60 (1753). Perennial; stems 10–45 cm, decumbent, rooting at nodes. Leaves 4–8 mm wide; sheaths scarcely inflated; ligule 2–5 mm, obtuse. Inflorescence 2–6·5 × 0·4–0·5 cm, narrowly cylindrical. Spikelets 2–3·5 mm. Glumes obtuse, parallel and hyaline at apex, connate only at base, hairy on keel and veins. Lemma truncate; margins free; awn exserted. Anthers 3–4 times as long as wide, brown at maturity. $2n=28$. *Marshes and damp meadows. Most of Europe, but rare in the extreme south.* Au Be Br Bu Cz Da Fa Fe Ga Ge Hb He Ho Hs Hu Is It Ju Lu No Po Rm Rs (N, B, C, W) Si Su ?Tu.

A. × brachystylus Peterm., *Flora* (*Regensb.*) **27**: 230 (1844) (*A. × hybridus* Wimmer), a hybrid between **1** and **3**, has been recorded widely in N.W. Europe.

4. A. aequalis Sobol., *Fl. Petrop.* 16 (1799) (*A. fulvus* Sm.). Like **3** but annual or short-lived perennial; spikelets 1·5–3 mm; margins of glumes with narrow hyaline band; lemma obtuse, the margins connate for ⅓ to ½ their length; awn not or only slightly exserted; anthers twice as long as wide, orange at maturity. $2n=14$. *Most of Europe, but absent from most of the islands.* Au Be Br Bu Cz Da Fe Ga Ge Gr He Ho Hs Hu Is It Ju Lu No Po Rm Rs (N, B, C, W, K, E) Su.

5. A. bulbosus Gouan, *Hort. Monsp.* 37 (1762). Like **3** but caespitose; stems erect, bulbous at base, not rooting at nodes; glumes acute; anthers not more than 3 times as long as wide. $2n=14$. *Salt-marshes. Coasts of W. & S. Europe, eastwards to N.W. Jugoslavia.* Be Br Co Ga Ge Ho Hs It Ju Sa Si.

6. A. himalaicus Hooker fil., *Fl. Brit. Ind.* **7**: 238 (1896) (*A. brachystachyus* auct. bulg., non Bieb.). Perennial; stems 30–80 cm, erect from short rhizomes. Leaves 3–6 mm wide; upper sheath distinctly inflated; ligule 2–3 mm, obtuse. Inflorescence 1·5–3·2 × 0·8–1·2 cm, ovoid-cylindrical, dense. Spikelets 3–5 mm; glumes densely covered with white hairs up to 3 mm long at apex of keel, contracted into long, slightly divergent apices, connate only at extreme base. Lemma broadly acute, shorter than glumes, margins connate for ⅓ to ½ their length; awn exserted by 5–8 mm. Anthers 3 times as long as wide. *Mountains of Bulgaria.* Bu. (*Himalaya and S.C. Asia.*)

7. A. alpinus Sm. in Sowerby, *Engl. Bot.* **16**: t. 1126 (1803). Perennial; stems 10–60 cm, laxly caespitose. Leaves 2·5–7 mm wide; sheaths scarcely inflated; ligule 1–2 mm, truncate. Inflorescence 1–3 × 0·8–1·4 cm, ovoid or broadly cylindrical, conspicuously hairy. Spikelets 3–5 mm. Glumes broadly acute, more or less parallel at apex, covered with greyish hairs especially on keel, connate at base only. Lemma obtuse; margins connate at extreme base; awn exserted or included, sometimes absent. Anthers 3–4 times as long as wide. *Svalbard, arctic Russia and Ural; Scotland and N. England.* Br Rs (N, C) Sb.

(a) Subsp. **alpinus**: Stems up to 40 cm but often shorter Leaves green. Inflorescence usually ovoid; awn included or exserted by up to 1 mm. $2n=100$, 117, *c.* 120. *Throughout the range of the species except S. Ural.*

(b) Subsp. **glaucus** (Less.) Hultén, *Ark. Bot.* ser. 2, **7**: 10 (1968) (*A. glaucus* Less.): Stems 20–60 cm. Leaves glaucous-green. Inflorescence usually broadly cylindrical; awn exserted by more than 2 mm. *S. Ural.*

8. A. utriculatus Solander in A. Russell, *Nat. Hist. Aleppo* ed. 2, **2**: 243 (1794) (*A. anthoxanthoides* Boiss.). Annual; stems 10–40 cm, erect, slender. Leaves 2–4 mm wide; upper sheaths distinctly inflated; ligule 3–4 mm, broadly acute. Inflorescence 1·5–2·8 × 0·5–1 cm, ovate to broadly cylindrical, lax. Spikelets 4–7 mm, in groups of 3–4 per branchlet. Glumes acute, connate for ¼ their length, parallel or converging at apex; keel and veins sparsely hairy above. Lemma acute, equalling or shorter than glumes; margins connate for ⅓ their length; awn exserted by up to twice the length of the spikelet. *Kikladhes* (*Siros*). Gr. (*S.W. Asia.*)

9. A. setarioides Gren., *Fl. Massil. Adv.* 43 (1857). Like **8** but spikelets 3–4 mm, solitary on branchlets. *Macedonia and Thrace.* Gr Ju Tu.

Sect. PSEUDOPHALARIS Tzvelev. Annual. Inflorescence narrowly cylindrical; glumes glabrous, connate for more than ⅓ their length; keel winged; palea absent.

10. A. myosuroides Hudson, *Fl. Angl.* 23 (1762) (*A. agrestis* L.). Stems 20–85 cm, several, erect. Leaves 2–9 mm wide; upper sheaths somewhat inflated; ligule 2–5 mm, obtuse. Inflorescence 2·5–10(-12) × 0·4–0·7 cm, tapering towards apex. Spikelets 4·5–7·5 mm. Glumes acute, convergent at apex, connate for ⅓ to ½ their length. Lemma acute, margins connate for ⅓–½ their length; awn exserted. Anthers 4–5 times as long as wide. $2n=14$. *Cultivated or disturbed ground. S. & W. Europe; widely naturalized elsewhere as a weed of cultivation, but only casual in the north-east and extreme north.* Al Be Br Bu Co Cr Ga Gr Ho Hs It Ju Lu Rm Rs (K, E) Si Tu [Au Cz Da *Ge He Hu No Po Rs (B, C, W) Su].

11. A. creticus Trin. in Sprengel, *Neue Entdeck.* **2**: 45 (1820). Like **10** but not more than 30 cm; leaves 1·5–3 mm wide; inflorescence 1–2·5 cm; spikelets 3–4·5 mm; glumes obtuse, divergent and mucronate at apex, connate for ½ to ⅔ their length; lemma truncate. $2n=14$. *S. part of Balkan peninsula, Kriti.* Bu Cr Gr Ju.

A. thracicus Penev & Kožuharov, *Notes Roy. Bot. Gard. Edinb.* **28**: 187 (1968), described from S.E. Bulgaria, is taller than typical *A. creticus* but does not seem to warrant specific rank.

Sect. TOZZETTIA (Savi) Endl. Annual. Inflorescence ovoid; glumes abruptly narrowed in the upper half; palea absent.

12. A. rendlei Eig, *Jour. Bot.* (*London*) **75**: 187 (1937) (*A. utriculatus* auct., non Solander). Stems 10–40 cm. Upper leaf-sheaths strongly inflated. Inflorescence 1–2·3 × 0·5–0·9 cm. Spikelets 5–7 mm. Glumes acute, slightly divergent at apex, with stiff hairs only in the lower half, connate for ¼ to ⅓ their length; awn exserted. $2n=14$. *Wet meadows, roadsides and waste places. S. & W. Europe, northwards to Belgium.* Al *Be Bu Cr Ga Ge Gr *He Hs It Ju Sa Si Tu.

Sect. COLOBACHNE (Beauv.) Trin. Perennial. Lamina of uppermost leaf short or absent. Inflorescence ovoid; glumes gradually narrowed into long points; palea present.

13. A. gerardii Vill. in L., *Syst. Pl. Eur.* **1**, *Fl. Delph.* 5 (1786). Stems 12–40 cm, erect from a very stout rhizome. Leaves flat, the upper with inflated sheath and short lamina; ligule 1–2 mm, truncate. Inflorescence 0·9–1·9 × 0·7–1·1 cm. Spikelets 4·5–8·5

mm. Glumes scarcely connate. Lemma truncate, with a fringe of hairs at apex and free margins; awn more or less included. $2n=14$. *Alpine pastures. Mountains of S. Europe, from the S. Alps to the Pyrenees, S. Appennini and S. Greece.* Al Bu Ga Gr Hs It Ju.

14. A. vaginatus (Willd.) Boiss., *Fl. Or.* **5**: 488 (1884). Like **13** but without thickened rhizome; stems from a caespitose base; basal leaves setaceous, the upper with ligule and lamina reduced or absent; awn exserted up to 10 mm. *Dry, stony slopes. Krym.* Rs (K). (*S.W. Asia.*)

95. Cornucopiae L.[1]

Annuals. Leaves flat. Inflorescence a short dense panicle surrounded by an obconical, toothed involucre. Spikelets strongly compressed laterally, with 1 floret. Glumes equal, connate in lower ¼, 3-veined. Lemma equalling the glumes, the margins connate in the lower ½–⅔, 5-veined, the median vein often forming a short, dorsal awn. Palea absent. Lodicules absent.

1. C. cucullatum L., *Sp. Pl.* 54 (1753). Stems up to 40 cm, usually less, numerous, erect. Leaves linear, acuminate, glabrous; sheaths inflated. Inflorescences *c.* 1 cm, numerous; peduncles long, stout, curved, retrorsely scabrid. Spikelets 6–7 mm. Glumes truncate, ciliate on keel in lower ½. Lemma truncate. *Ditches and other damp places. Kriti; Malta (Gozo); W.C. Italy.* *Cr *It *Si. (*S.W. Asia.*)

European records are all relatively recent, and it is possible that the plant is only casual in Europe.

Tribe **Hainardieae** W. Greuter

Leaves linear; silica-bodies orbicular, oblong or elliptical; 2-celled micro-hairs absent; ligule membranous. Inflorescence a slender, cylindrical spike. Spikelets with 1(–2) florets, all hermaphrodite, sessile, alternate, sunk in cavities in the rhachis. Glumes 2, inserted laterally or 1 (except in the terminal spikelet), longer than the lemma, strongly veined, appressed to and completely covering the cavity, except at anthesis, flat, rounded or with an asymmetrical keel on the back. Lemma hyaline, 1- to 3-veined, unawned. Palea 2-veined. Lodicules 2, lanceolate, entire. Stamens 3. Ovary usually with a glabrous apical appendage; styles 2, short. Grain with a linear to elliptical, basal hilum. Starch-grains compound. Chromosomes large; basic number 7, 13, 19.

96. Pholiurus Trin.[1]

Annuals. Leaves flat; ligule membranous. Spikelets laterally compressed, with 2 florets, falling entire at maturity. Glumes 2, equal, strongly veined, coriaceous. Lemma with its side towards the rhachis, membranous, 3-veined, the lateral veins extending to the apex. Rhachis not disarticulating at maturity.

1. P. pannonicus (Host) Trin., *Fund. Agrost.* 132 (1820) (*Lepturus pannonicus* (Host) Kunth). Stems 5–15(–20) cm, geniculate and branching at the base, smooth and glabrous. Leaves up to *c.* 5 cm × 2 mm, scabrid; ligule 3–4 mm, acute. Spike 5–9 cm, straight or slightly curved. Spikelets 4–5 mm, about as long as the internodes. Glumes ovate, obtuse, with membranous margin and apex. $2n=14$. *Damp, saline or gypsaceous soils. S.E. & E.C. Europe.* Au Bu Cz ?Gr Hs Hu Ju Rm Rs (C, W, K, E) Tu.

A record from N.W. Spain requires confirmation.

[1] By T. G. Tutin.

97. Parapholis C. E. Hubbard[1]

Annuals. Leaves flat or convolute when dry; ligule membranous. Spikelets sunk in cavities in the rhachis, with 1 floret. Glumes 2, inserted side by side and covering the cavity except at anthesis, strongly veined, coriaceous. Lemma membranous, with its side towards the rhachis, 3-veined, the lateral veins very short. Rhachis disarticulating at maturity below each spikelet.

The glumes are abruptly inflexed near their outer margin, giving them an asymmetrical keel; this is winged in **2** and **3**, the wing forming the apparent margin of the glume and concealing the infolded true margin.

Literature: H. Runemark, *Bot. Not.* **115**: 1–17 (1962).

1 Keel of glumes distinctly winged
 2 Anthers less than 1 mm; plant usually *c.* 10 cm, stout, with clustered spikes **2. marginata**
 2 Anthers at least 2 mm; plant usually more than 10 cm, slender, with solitary spikes **3. filiformis**
1 Keel of glumes not winged
 3 Anthers less than 1 mm; spikes often strongly curved **1. incurva**
 3 Anthers at least 2 mm; spikes straight or slightly curved
  4 Anthers not more than 2·5 mm; glumes 4–6 mm, not more than 1½ times as long as internode **4. strigosa**
  4 Anthers at least 3·2 mm; glumes 6–9 mm, usually more than 1½ times as long as internode **5. pycnantha**

1. P. incurva (L.) C. E. Hubbard, *Blumea, Suppl.* **3**: 14 (1946) (*Pholiurus incurvatus* A. S. Hitchc., *P. incurvus* (L.) Schinz & Thell., *Lepturus incurvatus* Trin.). Stems 2–25 cm, erect or decumbent, smooth and glabrous. Leaves up to 3(–8) cm × 1–2 mm, scabrid above; ligule up to 1 mm; uppermost sheath inflated. Spikes 1–10 cm, with 10–20 spikelets, usually strongly curved, rigid, solitary. Spikelets 4·5–7 mm, somewhat longer than the internodes. Glumes lanceolate, acuminate, the keel not winged. Anthers 0·5–0·9 mm. Cleistogamous. $2n=38$. *Sandy, clayey or rocky places near the sea. Coasts of S. & W. Europe, northwards to S. England.* Al Bl Br Bu Co Cr Ga Gr Hs It Ju Lu Rs (K) Sa Si Tu [Be].

2. P. marginata Runemark, *Bot. Not.* **115**: 8 (1962). Like **1** but stems not more than 15 cm; leaves smooth above; sheaths often very strongly inflated and reddish; spikes usually straight, with fewer than 10 spikelets, clustered; glumes with winged keel. $2n=14$. *In similar habitats to and often mixed with* **1**. *Islands of Mediterranean region.* Bl Cr Gr Si.

3. P. filiformis (Roth) C. E. Hubbard, *Blumea, Suppl.* **3**: 14 (1946) (*Pholiurus filiformis* (Roth) Schinz & Thell., *Lepturus filiformis* (Roth) Trin.). Stems up to 25 cm, erect or decumbent, usually slender. Leaves up to 8 cm × 0·5–1·5 mm, scabrid above; ligule less than 0·5 mm; uppermost sheath not or scarcely inflated. Spike 3–15 cm, with 10–20 spikelets, straight or nearly so. Spikelets 4–6 mm, not more than 1½ times as long as internodes. Glumes linear-lanceolate, acuminate, with winged keel. Anthers (2–)2·5–3·5 mm. Chasmogamous. $2n=14$. *Salt-marshes. Coasts of S. Europe, from C. Portugal to Turkey.* ?Al Bl Co Cr Ga Gr Hs It Ju Lu Sa Si Tu.

4. P. strigosa (Dumort.) C. E. Hubbard, *loc. cit.* (1946) (*Lepturus filiformis* auct., non (Roth) Trin.). Like **3** but up to 40 cm; spikelets not more than 1¼ times as long as internodes; glumes not winged on the keel; anthers 2–2·5 mm. $2n=28$. *Salt-marshes. Coasts of W. Europe from Scotland and Denmark southwards; locally on the Mediterranean coast, eastwards to N. Jugoslavia.* Be Br Da Ga Ge Hb Ho Hs It Ju Lu Su.

5. P. pycnantha (Hackel) C. E. Hubbard, *loc. cit.* (1946). Like 3 but often taller; spikes usually with 15–30 spikelets; spikelets mostly more than 1½ times as long as internodes; glumes 6–9 mm, not winged on the keel; anthers 3·2–4 mm. *Salt-marshes; rarely on damp, clay soils inland. Mediterranean region; distribution probably incompletely known.* Ga Gr Hs It ?Lu.

98. Hainardia W. Greuter[1]

Annuals. Leaves flat or convolute; ligule membranous. Spikelets sunk in cavities in the rhachis, dorsally compressed, with 1 floret. Glumes 2 in the terminal spikelet, 1 (the upper) in lateral spikelets, covering the cavity except at anthesis, strongly veined, coriaceous. Lemma with its back towards the rhachis, membranous, 3-veined, the lateral veins very short. Rhachis disarticulating at maturity below each spikelet.

1. H. cylindrica (Willd.) W. Greuter, *Boissiera* **13**: 177 (1967) (*Monerma cylindrica* (Willd.) Cosson & Durieu, *Lepturus cylindricus* (Willd.) Trin.). Stems 5–35 cm, erect or ascending, smooth and glabrous. Leaves up to *c.* 7 cm × 2·5 mm, scabrid above; ligule up to *c.* 0·5 mm, truncate, denticulate; uppermost sheath distinctly inflated. Spike up to 25 cm, straight or somewhat curved, rigid. Spikelets 5–8 mm, somewhat longer than the internodes. Glumes ovate-lanceolate, acuminate. Anthers 2·5–3·5 mm. Chasmogamous. $2n=26$. *Saline or gypsaceous soils. S. Europe.* Al Bl Bu Co Cr Ga Gr Hs It Ju Lu Rs (K) Sa Si Tu.

Tribe **Phalarideae** Kunth

Leaves linear; silica-bodies oblong; 2-celled micro-hairs absent; ligule membranous. Inflorescence a panicle, usually dense and cylindrical to ovoid. Spikelets strongly compressed laterally, with usually 3 florets, the lower 2 reduced to the small lemma or 1 or both absent. Rhachilla disarticulating above the glumes but not between the florets. Sometimes spikelets in groups of 5–7, one fertile and sessile, the remainder sterile and pedicellate, the group falling entire. Glumes longer than the florets. Fertile lemma indurate at maturity, unawned. Lodicules 2. Stamens 3. Ovary glabrous; styles 2. Grain with short, oblong hilum; starch-grains compound. Chromosomes large; basic number 5, 6, 7.

99. Phalaris L.[1]

(incl. *Digraphis* Trin., *Typhoides* Moench)

Annuals or perennials. Leaves flat. Inflorescence an ovoid to cylindrical panicle, usually dense and unlobed. Spikelets strongly compressed laterally, with 2–3 florets, the lower (1–)2 reduced to lemmas, the uppermost hermaphrodite. Glumes subequal, chartaceous, longer than the florets, 3- to 5-veined, often winged on the keel. Lower lemmas small, linear to lanceolate; upper lemma 5-veined, coriaceous. Palea coriaceous.

1 Spikelets in groups of 5–7, one hermaphrodite, the rest male or sterile, falling as a group at maturity
2 Annual; pedicels hairy; wing of glumes with 1 prominent tooth near apex **7. paradoxa**
2 Perennial, with tuberous stem-bases; pedicels glabrous; wing of glumes with several small teeth near apex **8. coerulescens**
1 Spikelets all hermaphrodite (except sometimes the basal), persistent
3 Perennial with non-flowering shoots at anthesis
4 Rhizomes long; panicle usually lobed, the branches patent at anthesis; glumes not winged **1. arundinacea**
4 Rhizomes short; panicle not lobed, the branches not patent at anthesis; glumes winged on the keel
5 Glumes subobtuse; wing obliquely truncate; stem-base not tuberous **2. truncata**
5 Glumes acute; wing tapering to apex; stem-base often tuberous **3. aquatica**
3 Annual, without non-flowering shoots at anthesis
6 Glumes with a toothed wing **5. minor**
6 Glumes with an entire wing
7 Sterile lemmas at least ½ as long as the fertile **4. canariensis**
7 Sterile lemmas not more than ⅕ as long as the fertile **6. brachystachys**

1. P. arundinacea L., *Sp. Pl.* 55 (1753) (*Digraphis arundinacea* (L.) Trin., *Typhoides arundinacea* (L.) Moench). Rhizomatous perennial. Stems up to 200 cm, stout, erect, smooth. Leaves 10–35 cm × 6–18 mm, long-acute; sheaths smooth, not inflated; ligule 6–10 mm, lacerate. Panicle 5–25 cm, lanceolate to oblong, lobed, often purplish; branches scabrid, patent at anthesis. Spikelets 5–6·5 mm, very shortly pedicellate. Glumes narrowly lanceolate, 3-veined, keeled but not winged. Sterile lemmas 1–1·5 mm, shortly hairy; upper lemma 3–4 mm, broadly lanceolate, acute, hairy above. Anthers *c.* 3 mm. *Wet places and in shallow water. Most of Europe except the extreme south.* All except Az Bl Cr Is Sb Si.

(a) Subsp. **arundinacea**: Plant robust, dark green. Panicle usually 10–25 cm, with distinct branches, usually lobed. Glumes glabrous. $2n=28, 42+6$ B. *Throughout the range of the species.*

(b) Subsp. **rotgesii** (Fouc. & Mandon ex Husnot) Kerguélen, *Lejeunia* nov. ser., **75**: 226 (1975): Plant slender, pale green. Panicle usually less than 8 cm, with very short branches, usually cylindrical. Glumes often hairy. $2n=14$. *S.W. Europe.*

2. P. truncata Guss. ex Bertol., *Fl. Ital.* **2**: 777 (1836). Shortly rhizomatous perennial. Stems up to 150 cm, not tuberous at base, erect or ascending, smooth. Leaves up to 20 cm × 5 mm, long-acute; sheaths smooth, scarcely inflated; ligule *c.* 3 mm, truncate. Panicle 2·5–8 cm, oblong-cylindrical, not lobed, sometimes purplish; branches smooth. Spikelets *c.* 7 mm. Glumes obovate, subobtuse, winged in the distal ⅔; wing entire, obliquely truncate. Sterile lemmas *c.* $\frac{1}{10}$ as long as the upper; upper lemma *c.* 4 mm, broadly lanceolate, acute, densely appressed-hairy. Anthers *c.* 3 mm. *Damp places. Mediterranean region.* ?Cr Hs It Sa Si Tu [*Ga].

3. P. aquatica L., *Cent. Pl.* **1**: 4 (1755) (*P. tuberosa* L., *P. bulbosa* auct., non L., *P. nodosa* L.). Like **2** but stem-base often tuberous; glumes acute, winged in the distal ¾, the wing tapering to the apex; lowest lemma minute or absent. $2n=28$. *Ditches, grassland, roadsides and cultivated fields. S. Europe.* Al Bl Bu Co Cr Ga Hs It Ju Lu Sa Si.

4. P. canariensis L., *Sp. Pl.* 54 (1753). Annual. Stems 20–120 cm, usually branched, rigid, smooth. Leaves up to 20 cm × 10 mm, long-acute; sheaths slightly scabrid, the upper inflated; ligule 3–8 mm. Panicle 2–5 cm, ovoid to ovoid-oblong, not lobed. Spikelets 7–9 mm. Glumes oblanceolate, acute, winged for most of their length. Sterile lemmas 3–4·5 mm, acute; upper lemma 5–6 mm, hairy. Anthers 3–4 mm. $2n=12$. *Dry, open habitats. Cultivated in parts of S. Europe for bird-seed; widely naturalized in the Mediterranean region; a frequent casual and locally naturalized elsewhere.* [Al Au Az Bl Bu Co ?Cr Cz Ga Ge Gr He *Hs Hu It Ju Lu Rm Rs (C, W, K, E) Sa Si Tu.] (*Islas Canarias, N.W. Africa.*)

5. P. minor Retz., *Obs. Bot.* **3**: 8 (1783). Like **4** but spikelets 4·5–5·5 mm; glumes with a toothed wing; lowest lemma minute,

[1] By T. G. Tutin.

the second *c.* 1 mm, the upper 3 mm; anthers *c.* 1 mm. $2n=28$. *Dry, open habitats. Mediterranean region and W. Europe, northwards to N.W. France.* ?Al Az Bl Co Cr Ga Gr Hs It Ju Lu Sa Si Tu [Rs (K)].

6. P. brachystachys Link in Schrader, *Neues Jour. Bot.* **1(3)**: 134 (1806). Like **4** but sterile lemmas *c.* 0·75 mm, the lowest with long hairs on the margin, the second glabrous. $2n=12$. *Cultivated fields and roadsides. Mediterranean region and S.W. Europe.* Al Az Bl Co ?Cr Ga Gr Hs It Ju Lu Sa Si Tu.

7. P. paradoxa L., *Sp. Pl.* ed. 2, 1665 (1763). Annual. Stems 25–65(–85) cm, usually branched at the base, smooth. Leaves up to 15 cm × 7 mm, long-acute; sheaths smooth or slightly scabrid, the upper inflated; ligule 3–4 mm. Panicle 3–6(–9) cm, widest near the apex. Pedicels (2–)3–4(–5) mm, hairy. Spikelets in groups of 5–7, the central one hermaphrodite and sessile, the rest male or abortive, pedicellate, each group falling entire. Fertile spikelets 6–8 mm; glumes scabrid, with a spinose apex 1–3·5 mm and a wing 0·2–0·5 mm wide at the widest part, projecting from the middle of the keel, with 1 prominent tooth near its apex. Sterile lemmas *c.* 0·3 mm; upper lemma *c.* 3 mm, with sparse long hairs. Anthers *c.* 2 mm. $2n=14$. *Roadsides and cultivated ground. Mediterranean region and S.W. Europe.* Al Bl Cr Ga Gr Hs It Ju Lu Tu.

8. P. coerulescens Desf., *Fl. Atl.* **1**: 56 (1798). Like **7** but perennial, with tuberous stem-bases; stems 70–120 cm; ligule 4–6 mm; panicle (3–)6–12 cm; pedicels 4–7 mm, glabrous; glumes of fertile spikelets smooth, with a mucro 0·3–0·7(–1) mm, the wing 0·5–1 mm wide at the widest part, with several small irregular teeth near the apex. $2n=14$, 42. *Roadsides and cultivated ground. Mediterranean region, Portugal.* Al Bl Co Cr Ga Gr Hs It Ju Lu Sa Si Tu.

Tribe **Coleantheae** Ascherson & Graebner

Leaves linear, flat; sheaths closed at base; silica-bodies absent; 2-celled micro-hairs absent; ligule membranous. Spikelets in small, dense fascicles or whorls on axis and branches of small panicles, somewhat compressed laterally, with 1 floret, continuous with the pedicels. Glumes absent. Lemma caudate- or aristate-acuminate, membranous, 1-veined. Palea 2-keeled, shorter than lemma. Stamens 2. Lodicules absent. Styles 2, very long. Grain exposed between the gaping lemma and palea, terete; pericarp membranous; hilum punctiform. Basic chromosome number 7.

100. **Coleanthus** Seidl[1]

Annuals. Leaves flat. Inflorescence of remote clusters of spikelets. Spikelets laterally compressed, with 1 floret. Glumes absent. Lemma membranous, 1-veined. Palea membranous, 2-keeled, shorter than lemma. Stamens 2. Lodicules absent.

1. C. subtilis (Tratt.) Seidl in Roemer & Schultes, *Syst. Veg.* **2**: 276 (1817). Stems 2–8(–10) cm, filiform, procumbent. Leaves *c.* 1 mm wide, linear, usually recurved; sheaths strongly inflated, the uppermost enclosing the base of the inflorescence at anthesis; ligule *c.* 1 mm, ovate. Spikelets 0·75–1 mm, in clusters of 10–20 (–40); pedicels hairy. Lemma ovate, acuminate, awned, ciliate on keel. *Damp mud at margins of ponds and reservoirs. Scattered localities in N. & C. Europe.* Au Cz Ga Ge †It †No †Rs (C).

A rare grass of wide distribution but very sporadic occurrence.

[1] By T. G. Tutin.

Tribe **Scolochloeae** Tzvelev

Leaves linear; silica-bodies rectangular, with sinuate longitudinal walls; 2-celled micro-hairs absent; ligule membranous. Inflorescence a panicle. Spikelets hermaphrodite, laterally compressed, with (2–)3–4(–5) florets; callus bearded. Rhachilla disarticulating above the glumes and between the florets. Glumes shorter than the spikelets. Lemma somewhat coriaceous, lacerate at apex, rounded on the back, sometimes mucronate, very rarely shortly awned, 7-veined. Palea 2-keeled. Lodicules 2, entire or with a lateral tooth. Stamens 3. Ovary densely hairy at apex. Grain densely hairy at apex, with linear hilum ⅔ as long as grain; embryo nearly ½ as long as grain; starch-grains compound. Chromosomes large; basic number 7.

101. **Scolochloa** Link[1]

Perennials. Leaves flat. Inflorescence a lax panicle. Spikelets laterally compressed, with 3–4 florets. Glumes somewhat unequal, shorter than the spikelets, the lower 3-veined, the upper 5-veined. Lemma 5- to 7-veined, dentate at apex, with 2 tufts of hairs at base. Palea about as long as lemma.

1. S. festucacea (Willd.) Link, *Hort. Berol.* **1**: 137 (1827) (*Graphephorum arundinaceum* (Fries) Ascherson). Robust, rhizomatous perennial; stems up to 200 cm, rooting at the lower nodes. Leaves up to 40 cm × 12 mm, with scabrid margins; ligule up to 6 mm, truncate. Panicle up to 30 cm; branches erect before anthesis, later erecto-patent. Spikelets 9–11 mm. Lower glume 7–8 mm, the upper 8–10 mm. Anthers *c.* 3 mm. $2n=28$. *Lakes or slow-flowing rivers, rarely in wet meadows. N.E. Europe, extending southwards to C. Ukraine and westwards to E. Germany.* Fe Ge Po Rs (N, B, C, W, E) Su.

Tribe **Milieae** Endl.

Leaves linear to narrowly lanceolate, flat; silica-bodies few or none; 2-celled micro-hairs absent; ligule membranous. Inflorescence a panicle. Spikelets all hermaphrodite, dorsally compressed, with 1 floret. Rhachilla disarticulating above the glumes. Glumes longer than the floret. Lemma chartaceous or hyaline, becoming strongly indurate in fruit, unawned. Palea similar in texture to the lemma, becoming chartaceous, 2-keeled. Lodicules 2, acute, entire. Stamens 3. Ovary glabrous; styles 2. Grain with linear or oblong hilum up to ⅔ as long as grain; embryo small; starch-grains compound. Chromosomes large; basic number 2, 7, 9.

102. **Milium** L.[1]

Annuals or perennials. Leaves flat. Inflorescence a panicle. Spikelets slightly compressed dorsally, with 1 floret. Glumes equal, membranous, longer than the floret, 3-veined. Lemma 5-veined, coriaceous and shiny in fruit. Palea as long as the lemma, coriaceous.

Perennial; panicle usually more than 10 cm, with patent to deflexed branches; glumes almost smooth **1. effusum**
Annual; panicle usually less than 10 cm, with erect to erecto-patent branches; glumes scabrid **2. vernale**

1. M. effusum L., *Sp. Pl.* 61 (1753). Shortly rhizomatous perennial. Stems 45–180 cm, smooth, with 3–5 nodes in the lower half. Leaves 10–30 cm × 5–15 mm, glabrous; sheaths smooth; ligule 3–10 mm, obtuse. Panicle 10–40 cm; branches long, slender, smooth, patent or deflexed. Spikelets 3–4 mm. Glumes ovate to elliptic-ovate, acute, green or purplish. Anthers 2–3 mm. $2n=14$, 28. *Woods and scrub, usually on moist, base-rich*

soils. Most of Europe, except for some islands. All except Az Bl Cr Fa Gr Lu Sa Sb.

2. M. vernale Bieb., *Fl. Taur.-Cauc.* **1**: 53 (1808). Annual. Stems 10–50 cm, smooth or scabrid at the nodes, usually with 2 nodes in the lower half. Leaves usually 0·5–4 cm × 1–3 mm, glabrous, scabrid; sheaths scabrid, often purplish, with a wide scarious margin; ligule 2–4 mm, acute. Panicle 1·5–8(–10) cm; branches erect to erecto-patent. Spikelets 2·5–3·5 mm. Glumes ovate, acute, scabrid. Anthers 1·5–1·8 mm. $2n=8$. *Sandy and other light soils, damp in winter. W. & S. Europe.* Be Bu Co Cr Ga Gr Ho Hs It Ju Lu Rm Rs (W, K) Sa Si.

Variable, especially in the branching of the panicle. The following may merit subspecific rank: **M. scabrum** L. C. M. Richard in Merlet, *Herbor. Maine-et-Loire* 131, 220 (1809), from W. Europe, and **M. vernale** subsp. **montianum** (Parl.) Jahandiez & Maire, *Cat. Pl. Maroc* **1**: 36 (1931) (*M. montianum* Parl.), from Sicilia and the Aegean region, but further investigation is needed.

103. Zingeria P. Smirnov[1]

Annuals. Leaves flat or convolute. Inflorescence a lax panicle. Spikelets slightly compressed dorsally, with 1 floret. Glumes subequal, membranous, as long as the floret, the lower 1-veined, the upper 3-veined. Lemma 3-veined, with short, clavate hairs on the dorsal surface, becoming chartaceous in fruit. Palea like the lemma, but 2-veined. Lodicules very small. Rhachilla not prolonged.

Leaves usually convolute; pedicels 4–16 mm; spikelets 1·2-1·5 mm **1. biebersteiniana**
Leaves flat; pedicels 1·5–6 mm; spikelets 1·8–2 mm **2. pisidica**

1. Z. biebersteiniana (Claus) P. Smirnov, *Bull. Soc. Nat. Moscou* ser. 2, **51(2)**: 67 (1946) (*Agrostis biebersteiniana* Claus). Stems 10–35 cm, slender. Leaves up to 7 cm × 1·5 mm, usually convolute; ligule up to 2 mm, obtuse. Panicle 3–12 cm wide, very lax; branches erecto-patent, slender, smooth; pedicels 4–16 mm. Spikelets 1·2–1·5 mm. Glumes ovate, subobtuse, glabrous. Anthers *c.* 0·8 mm. Grain 0·3 mm. $2n=4$. *Damp, grassy places. Krym and S.E. Russia.* Rs (K, E).

2. Z. pisidica (Boiss.) Tutin, *Bot. Jour. Linn. Soc.* **76**: 365 (1978) (*Agrostis pisidica* Boiss.). Like **1** but leaves 1–3 mm wide, flat; panicle 2–6 cm wide, not so lax; pedicels 1·5–6 mm; spikelets 1·8–2 mm; anthers 0·5–0·7 mm; grain 1·7 mm. *Damp, grassy places. S. Romania.* Rm. (*Anatolia and Caucasian region.*)

Tribe **Stipeae** Dumort.

Leaves setaceous to linear, usually convolute or plicate; silica-bodies elliptical or weakly crescentic, oblong, cross- or dumb-bell-shaped; 2-celled micro-hairs probably absent; ligule membranous to scarious. Inflorescence a panicle. Spikelets all hermaphrodite, somewhat compressed laterally or terete, with 1 floret. Rhachilla disarticulating above the glumes. Glumes longer than the floret, membranous or hyaline. Lemma terete, enclosing the palea and strongly indurate in fruit, with a dorsal or terminal, usually 1- to 2-geniculate awn. Palea 2-veined, usually hyaline. Lodicules (2–)3. Stamens 3. Ovary glabrous; styles 2. Grain with linear hilum as long as the grain; embryo small; starch-grains compound. Chromosomes small; basic number 9, 11–17.

[1] By T. G. Tutin.

104. Piptatherum Beauv.[1]
(*Oryzopsis* auct. eur., non Michx)

Perennials. Leaves flat or involute. Inflorescence a lax panicle. Spikelets somewhat compressed dorsally, with 1 floret. Glumes equal, the lower 5-veined, the upper 3- to 5-veined. Lemma obscurely 3- to 5-veined, coriaceous, with a caducous terminal awn. Palea about as long as lemma, coriaceous. Callus very small. Rhachilla not prolonged.

Literature: H. Freitag, *Notes Roy. Bot. Gard. Edinb.* **33**: 341–408 (1975).

1 Panicle-branches 4–8(–20) at a node; spikelets not more than 4 mm; lemma glabrous **1. miliaceum**
1 Panicle-branches 1–3(–4) at a node; spikelets (3–)4–9 mm; lemma ± hairy
 2 Ligule not more than 0·5 mm
  3 Spikelets 3-4(–5) mm; pedicel several times as long as spikelet **2. virescens**
  3 Spikelets 7–8 mm; pedicel about as long as spikelet **3. paradoxum**
 2 Ligule 6–11 mm
  4 Leaves not more than 2·5 mm wide; awn not or scarcely exceeding the glumes **4. coerulescens**
  4 Leaves 5–9 mm wide; awn much exceeding the glumes **5. holciforme**

1. P. miliaceum (L.) Cosson, *Not. Pl. Crit.* 129 (1851) (*P. multiflorum* (Cav.) Beauv., *Oryzopsis miliacea* (L.) Bentham & Hooker ex Ascherson & Graebner). Stems 60–150 cm, erect or ascending, smooth and glabrous. Leaves up to 5 mm wide, scabrid above; ligule *c.* 1 mm, truncate. Panicle up to 40 cm; branches 4–8(–20) at each node, erecto-patent, slender, with spikelets in the distal half, those of the lower nodes sometimes without spikelets. Spikelets 3–4 mm. Glumes ovate-lanceolate, acuminate. Lemma *c.* 2·3 mm, obtuse, glabrous; awn 3–5 mm. Anthers *c.* 1·5 mm. *Dry, open habitats. S. Europe.* Al Az Bl Co Cr Ga Gr Hs It Ju Lu Sa Si Tu.

P. thomasii (Duby) Kunth, *Enum. Pl.* **1**: 177 (1833), recorded from a few localities in S. & S.W. Europe, is doubtfully worth specific rank. It is like **1** but has 20–50 short branches at the lowest node of the panicle; these are sterile or have only a single spikelet.

2. P. virescens (Trin.) Boiss., *Fl. Or.* **5**: 507 (1884) (*Oryzopsis virescens* (Trin.) G. Beck). Stems up to 120 cm, erect. Leaves up to 10 mm wide, scabrid above; ligule not more than 0·5 mm, truncate. Panicle up to 20 cm; branches 1–3 at each node, erecto-patent, slender, flexuous, with few, long-pedicellate spikelets. Spikelets 3–4(–5) mm. Glumes ovate-lanceolate, acute. Lemma 2·5–3 mm, hairy; awn 8–12 mm. Anthers *c.* 1·5 mm. *Scrub and open woods. E.C. & S.E. Europe; some scattered stations in C. Italy and S.C. France.* Au Bu Cz Ga Hu It Ju Rm Rs (W, K, E) Tu.

3. P. paradoxum (L.) Beauv., *Agrost.* 18, 173 (1812) (*Oryzopsis paradoxa* (L.) Nutt.). Stems up to 120 cm, erect. Leaves up to 8 mm wide, smooth except for the scabrid margin; ligule not more than 0·5 mm, truncate. Panicle up to 20 cm; branches 2–3 at each node, suberect, with spikelets in the distal quarter only; pedicels about as long as the spikelet. Spikelets 6–7 mm. Glumes lanceolate, acuminate. Lemma 4–4·5 mm, usually hairy; awn 10–12 mm. Anthers *c.* 2·5 mm. $2n=24$. *Dry places. S.W. Europe.* Ga Hs Lu.

4. P. coerulescens (Desf.) Beauv., *loc. cit.* (1812) (*Oryzopsis coerulescens* (Desf.) Hackel). Stems 30–70 cm, erect. Leaves up

to 2·5 mm wide, scabrid on both surfaces; ligule 6–9 mm, acute; lower sheaths nearly always black when dead. Panicle up to 20 cm; branches 1–2 at each node, patent at anthesis, with spikelets in the distal ¼–½; pedicels mostly shorter than the spikelets. Spikelets 6–8 mm. Glumes ovate-lanceolate, acuminate. Lemma 3·5–4 mm, lanceolate, glabrous; awn *c.* 3 mm. Anthers *c.* 3 mm. *Dry, stony places. Mediterranean region, S. Portugal.* Bl ?Bu Co Cr Ga Gr Hs It ?Ju Lu Sa Si.

5. P. holciforme (Bieb.) Roemer & Schultes, *Syst. Veg.* **2**: 328 (1817) (*Oryzopsis holciformis* (Bieb.) Hackel). Stems up to 100 cm, erect. Leaves up to 9 mm wide, smooth; ligule up to 10 mm, acute. Panicle up to 30 cm; branches 1–4 at each node, erecto-patent, with spikelets in the distal quarter only; pedicels much longer than the spikelets. Spikelets 8–9 mm. Glumes lanceolate, acuminate. Lemma *c.* 5 mm, oblong-lanceolate, hairy; awn *c.* 10 mm. Anthers *c.* 5 mm. *Dry grassland and rocky hillsides. S.E. Europe.* Al Bu Gr Ju Rm Rs (K).

105. Stipa L.[1]

Caespitose perennials, rarely annuals. Leaves usually plicate or convolute, at least when dry, with prominent ribs on the adaxial surface. Inflorescence a panicle. Spikelets somewhat compressed laterally, with 1 floret. Glumes usually subequal, hyaline or membranous, much longer than the lemma, 1- to 3-veined. Lemma usually coriaceous, convolute, terete, entire or shortly 2-fid at apex, hairy, awned from apex or sinus; hairs usually confined to the veins and margins, those of the overlapping margins forming a single line (the *ventral line*). Callus bearded, usually long and pungent; awn usually with a thick, twisted lower part (*column*) and a thinner, straight upper part (*seta*), glabrous or hairy, usually 2-geniculate. Palea hyaline, 2-veined, usually enclosed by the lemma. Rhachilla not prolonged.

All species occur in dry, more or less open habitats.

In the following descriptions the plant is perennial, the glumes subequal, and the lemma coriaceous, entire at the apex and with a 2-geniculate awn, unless the contrary is stated.

Several other species, mainly from South America and Australia, occur from time to time, particularly in the Mediterranean region. The two commonest of these are **S. hyalina** Nees, *Agrost. Brasil.* 378 (1829), and **S. neesiana** Trin. & Rupr., *Mém. Acad. Sci. Pétersb.* ser. 6, **7(2)**: 27 (1843), both from South America. They have a small membranous corona below the insertion of the awn; the former has a callus shorter than or as long as the width of the lemma and the latter a callus much longer than the width of the lemma.

Literature: M. Cynowa-Giełdon, *Rozpr. Uniw. Mik. Kopernika (Toruń)* 1–99 (1975). J. O. Martinovský, *Webbia* **20**: 711–736 (1965); *Anal. Inst. Bot. Cavanilles* **27**: 55–84 (1970); *Preslia* **44**: 7–23 (1972); **47**: 249–261 (1975). H. Scholz, *Willdenovia* **4**: 299–315 (1958). P. A. Smirnov, *Acta Horti Petrop.* **4(2)**: 98–118 (1928); *Feddes Repert.* **36**: 264–271 (1929); *Bull. Soc. Nat. Moscou* **45**: 104–118 (1936). N. N. Tzvelev, *Nov. Syst. Pl. Vasc. (Leningrad)* **11**: 4–21 (1974).

1 Lemma 2 mm, obovate **42. trichotoma**
1 Lemma at least 4 mm, lanceolate
2 Seta glabrous or with hairs not more than 1 mm
3 Awn not geniculate; callus very small, obtuse **41. bromoides**
3 Awn geniculate; callus well-developed, acute
4 Lemma membranous, deeply 2-fid
5 Panicle compact; column hairy **39. tenacissima**
5 Panicle very lax; column glabrous **40. gigantea**
4 Lemma coriaceous, entire, or very shortly 2-fid
6 Awn glabrous to the naked eye
7 Abaxial leaf-surface glabrous, the adaxial hairy; sheaths of lower cauline leaves distinctly longer than the internodes **31. capillata**
7 Abaxial leaf-surface setulose, the adaxial glabrous; sheaths of lower cauline leaves shorter than the internodes **32. sareptana**
6 Awn shortly hairy to the naked eye
8 Glumes unequal, the lower 12–15 mm, the upper 7–10 mm **38. parviflora**
8 Glumes ±equal
9 Ligule of basal leaves at last 3·5 mm, acute; mature lemma brownish **36. offneri**
9 Ligule of basal leaves not more than 1 mm, truncate; mature lemma stramineous
10 Lemma 5–9 mm; awn 6–12 cm
11 Column with hairs *c.* 0·8 mm; seta scabrid **27. capensis**
11 Awn hairy throughout, the column with shorter hairs than the seta **37. korshinskyi**
10 Lemma 14–17 mm; awn 18–25 cm
12 Hairs on seta shorter than those on column; column hairy nearly all round; anthers with a tuft of hairs at apex **33. fontanesii**
12 Hairs on seta longer than those on column; column hairy only on the angles; anthers glabrous
13 Sheaths shortly and densely hairy; leaf ±orbicular in section **34. lagascae**
13 Sheaths glabrous; leaf ±elliptical in section **35. celakovskyi**
2 Seta with hairs 2–7 mm
14 Column densely and uniformly hairy
15 Leaves glabrous on both surfaces; awn at least 20 cm, with hairs at least 4 mm
16 Ventral line of hairs reaching base of awn **10. syreistschikovii**
16 Ventral line of hairs ending well below base of awn **(20–24). joannis** group
15 Leaves hairy, at least on the adaxial surface; awn less than 20 cm, with hairs at most 2 mm
17 Awn not more than 5 cm; seta with much longer hairs near base than near apex **30. orientalis**
17 Awn at least 8 cm; seta with hairs the same length throughout
18 Ligule up to 1·2(–3) mm; lemma usually *c.* 12 mm; awn (13–)13·5–19 cm **28. barbata**
18 Ligule (0·3–)2–5 mm; lemma usually *c.* 10 mm; awn (11·5–)13–15(–16·5) cm **29. arabica**
14 Column glabrous or with scattered soft hairs
19 Lemma with hairs not in distinct lines **26. lessingiana**
19 Lemma with (5)7 lines of hairs at least in lower part
20 Leaf with a setaceous apex **25. tirsa**
20 Leaf with an obtuse or acute apex
21 Abaxial leaf-surface hairy
22 Lower part of basal and lower cauline leaves with dense hairs 0·15–0·3 mm on both surfaces; sides of ribs on adaxial leaf-surfaces with numerous, regularly arranged hairs *c.* 0·08 mm **6. bavarica**
22 Basal and lower cauline leaves with hairs 0·4–1·2 mm throughout their length; sides of ribs on adaxial leaf-surface with at most sparse, irregularly arranged hairs **(16–19). dasyphylla** group
21 Abaxial leaf-surface glabrous
23 Dorsal line of hairs always conspicuously exceeding the neighbouring subdorsal lines; ventral line of hairs usually ending 3–4 mm below the insertion of the awn **(20–24). joannis** group
23 Dorsal line of hairs absent or shorter than (rarely slightly exceeding) the neighbouring subdorsal lines; ventral line of hairs reaching the insertion of the awn, rarely ending 1(–2) mm below it

[1] By J. O. Martinovský.

24 Adaxial leaf-surface hairy
25 Abaxial leaf-surface smooth
26 Stems hairy below the nodes; adaxial leaf-surface very sparsely hairy; leaves with a tuft of hairs at apex **8. endotricha**
26 Stems glabrous below the nodes; adaxial leaf-surface densely hairy; leaves without a tuft of hairs at apex **9. cretacea**
25 Abaxial leaf-surface ±scabrid, at least in the lower part
27 Adaxial leaf-surface with long hairs which protrude between the margins of the convolute leaf; sheaths usually reddish-violet when young; leaf 1–1·5 mm in diameter (C. & E. Europe) **(16–19). dasyphylla group**
27 Adaxial leaf-surface with short hairs not protruding between the margins of the convolute leaf; leaf 0·3–0·85 mm in diameter (Mediterranean region)
28 Sides of ribs with dense, regularly arranged hairs or pricklets *c.* 0·03 mm **14. austroitalica**
28 Sides of ribs glabrous, though sometimes with conical papillae *c.* 0·01 mm
29 Adaxial leaf-surface with sparse long hairs; leaf up to 0·85 mm in diameter; lemma 2-fid at apex **13. rechingeri**
29 Adaxial leaf-surface with dense short hairs; leaf 0·5 mm in diameter; lemma not 2-fid at apex **11. iberica**
24 Adaxial leaf-surface glabrous
30 Sides of ribs glabrous, though sometimes with minute papillae scarcely 0·01–0·015 mm
31 Apex of leaf shortly hairy; column scabrid and with scattered soft hairs **12. apertifolia**
31 Apex of leaf and column glabrous
32 Lemma *c.* 15 mm; sheaths densely setulose **15. novakii**
32 Lemma 18–26 mm; sheaths glabrous or hairy only at the mouth
33 Leaves strongly scabrid; lemma 21–26 mm; awn 34–40 cm **5. crassiculmis**
33 Leaves almost smooth; lemma *c.* 20 mm; awn 26–31 cm **7. epilosa**
30 Sides of ribs with dense, regularly arranged hairs 0·04(–0·08) mm
34 Abaxial leaf-surface glabrous and smooth; column irregularly bent, whitish; lemma (13–)15–20 mm; awn (16–)20–28(–30) cm **1. pennata**
34 Abaxial leaf-surface scabrid to aculeolate; column straight, brown when mature; lemma (18–)21–24(–27) mm; awn (25–)30–35(–39) cm
35 Leaf-sheaths glabrous, except for the margin **2. pulcherrima**
35 Leaf-sheaths densely hairy above
36 Lemma (19–)20–22(–23·5) mm; awn (23–)28–33(–35) cm; palea glabrous **4. dasyvaginata**
36 Lemma 17–19·5 mm; awn (23–)24–27(–28·5) cm; palea hairy **3. mayeri**

1. S. pennata L., *Sp. Pl.* 78 (1753). Stems 25–40 cm, sometimes puberulent. Leaves glabrous and smooth on the abaxial surface, usually puberulent only on the sides of the ribs on the adaxial surface; basal sheaths usually puberulent above; ligule *c.* 4 mm. Panicle *c.* 10 cm, contracted. Glumes *c.* 50 mm. Lemma (13–)15–20 mm, the dorsal line of hairs always shorter than the subdorsal lines; awn (16–)20–28(–30) cm, the column pale, often irregularly bent, the seta plumose. *S. & C. Europe.* Al Au Bu Co Cz Ga Ge ?Gr He Hs Hu It Ju Rm Rs (K) Tu.

1 Ventral line of hairs ending up to 4 mm below base of awn
2 Ventral line of hairs often interrupted; lemma with prominent auricles at the insertion of the awn; column glabrous and smooth **(d) subsp. pennata**
2 Ventral line of hairs not interrupted; auricles absent; column scabrid **(e) subsp. kiemii**
1 Ventral line of hairs reaching base of awn
3 Lemma usually 15–16 mm; awn usually (19–)21–24 cm **(a) subsp. austriaca**
3 Lemma usually 18–19 mm; awn usually 26–28 cm
4 Column scabrid **(b) subsp. lithophila**
4 Column smooth **(c) subsp. eriocaulis**

(a) Subsp. **austriaca** (G. Beck) Martinovský & Skalický, *Preslia* **41**: 331 (1969): Lemma usually 15–16 mm, the ventral line of hairs reaching the base of the awn; awn usually (19–)21–24 cm, the column smooth. ● *C. Europe.*

(b) Subsp. **lithophila** (P. Smirnov) Martinovský, *Preslia* **44**: 18 (1972) (*S. lithophila* P. Smirnov): Lemma usually 18–19 mm, the ventral line of hairs reaching the base of the awn; awn usually 26–28 cm, the column scabrid. ● *Krym.*

(c) Subsp. **eriocaulis** (Borbás) Martinovský & Skalický, *Preslia* **41**: 331 (1969): Like subsp. **(b)** but the column smooth. $2n=44$. *Throughout most of the range of the species.*

(d) Subsp. **pennata**: Lemma usually 18–19 mm, with prominent auricles at the insertion of the awn, the ventral line of hairs ending up to 4 mm below the base of the awn, often interrupted; awn usually 23–28 cm, the column glabrous and smooth. ● *France and Germany.*

(e) Subsp. **kiemii** Martinovský, *Preslia* **44**: 14 (1972): Like subsp. **(d)** but lemma without auricles at the insertion of the awn, the ventral line of hairs not interrupted; column scabrid. ● *Adriatic region.*

2. S. pulcherrima C. Koch, *Linnaea* **21**: 440 (1848) (*S. pennata* subsp. *mediterranea* (Trin. & Rupr.) Ascherson & Graebner). Stems up to 100 cm, glabrous. Leaves scabrid on the abaxial surface, usually with dense hairs 0·04 mm on the sides of the ribs on the adaxial surface, the basal 1(–1·5) mm in diameter; sheaths ciliate, smooth, shining; ligule on non-flowering shoots 0·7–2 mm, on flowering stems 5–7(–9) mm, shortly ciliate. Panicle 10–15 cm, contracted. Glumes 60–80 mm, long-attenuate. Lemma (18–)20–23(–25) mm, the ventral line of hairs reaching the base of the awn; awn up to 50 cm, the column glabrous, the seta plumose, with hairs *c.* 7 mm. Palea usually hairy on the keels. $2n=44$. *Europe, northwards to W.C. France, N. Germany and C. Russia, but not in the Iberian peninsula.* Al Au Bu Co Cz Ga Ge Gr Hu It Ju ?Po Rm Rs (C, W, K, E) Si.

3. S. mayeri Martinovský, *Acta Bot. Croat.* **30**: 145 (1971). Like **2** but stems softly hairy below the panicle and nodes; leaves strongly scabrid on both surfaces; sheaths densely hairy, with hairs 0·1–0·3 mm; ligule with hairs up to 1 mm on back and margin; lemma 17–19·5 mm; awn (23–)24–27(–28·5) cm, the seta with hairs 3–4 mm. ● *S.W. Jugoslavia.* Ju.

4. S. dasyvaginata Martinovský, *Anal. Inst. Bot. Cavanilles* **27**: 61 (1970). Stems up to 50 cm, appressed-setose below the panicle and nodes. Leaves strongly scabrid on the abaxial surface, shortly and densely hairy on the sides of the ribs on the adaxial surface; upper part of sheaths shortly and densely hairy; ligule of basal leaves 2·5–5 mm, ciliate. Panicle contracted. Glumes 45–70 mm. Lemma (19–)20–22(–23·5) mm, the ventral line of hairs reaching the base of the awn; awn *c.* 34 cm, the column glabrous, the seta plumose. Palea glabrous. *S. Spain (Sierra Nevada).* Hs. *(N.W. Africa.)*

5. S. crassiculmis P. Smirnov, *Feddes Repert.* **22**: 375 (1926). Stems 3–4 mm in diameter, glabrous below, hairy near the

panicle. Leaves few, *c.* 2 mm in diameter, junciform, strongly aculeolate-scabrid on the abaxial surface, with minute, acute papillae on the sides of the ribs on the adaxial surface; sheaths hairy near the mouth; ligule of basal leaves 1–2·5 mm, of upper leaves (5–)7–10(–15) mm, ciliate. Panicle contracted. Glumes *c.* 80 mm. Lemma 21–26 mm, the ventral line of hairs reaching the base of the awn; awn 34–40 cm, the column scabrid, the seta plumose, with hairs up to 7 mm. *E.C. Europe and C. part of Balkan peninsula.* Bu Cz Gr Hu Ju Rs (W).

Represented in Europe by subsp. **euroanatolica** Martinovský, *Bot. Jahrb.* **87**: 395 (1967). Subsp. **crassiculmis** occurs in S.C. Asia (Turkmenistan).

6. S. bavarica Martinovský & H. Scholz, *Willdenowia* **4**: 322 (1968). Stems up to 70 cm. Leaves 1–1·3 mm in diameter, the basal softly hairy, at least in part, on the abaxial surface and with short hairs on the ribs on the adaxial surface, the upper leaves strongly scabrid; sheaths of the basal leaves with short, soft, dense hairs, the upper sparsely hairy on the back. Panicle contracted. Glumes long-attenuate. Lemma (21–)23–26 mm, the ventral line of hairs reaching the base of the awn; awn (31–)33–41(–45) cm, the column glabrous, the seta with hairs 3–4 mm. ● *S. Germany* (*near Neuburg*). Ge.

7. S. epilosa Martinovský, *Preslia* **39**: 273 (1967). Leaves 0·5–1 mm in diameter, glabrous and usually smooth on the abaxial surface, scabridulous on the ribs on the adaxial surface; ligule of basal leaves 0·5–1 mm. Lemma 18–21 mm; awn (26–)28–31 cm, the column glabrous, the seta plumose. *S.E. Europe.* Bu Gr ?It Ju Rm.

8. S. endotricha Martinovský, *Preslia* **44**: 12 (1972). Stems shortly hairy below the nodes and throughout the uppermost internodes. Leaves with the abaxial surface glabrous and smooth. Lemma 18–21·5 mm; awn 24·5–27(–30) cm, the column glabrous, the seta plumose. ● *C. & S. Greece.* Gr.

9. S. cretacea P. Smirnov, *Bull. Soc. Nat. Moscou* ser. 2, **49(1)**: 90 (1940). Leaves often flat when fresh, the abaxial surface smooth; sheaths of upper leaves puberulent and ciliate. Lemma 20–23 mm; awn (27–)30–33(–38) cm, the column glabrous, the seta plumose. ● *S.E. Russia* (*by the R. Don, 90 km N.W. of Volgograd*). Rs (E).

10. S. syreistschikovii P. Smirnov, *Del. Sem. Hort. Bot. Univ. Mosq.* **1948**, 36 (1948). Leaves glabrous, tuberculate and scabrid on the abaxial surface and with short hairs only on the sides of the ribs on the adaxial surface; ligule of basal leaves 0·5–1 mm. Lemma (18–)20–21·5 mm; awn (32–)34–36(–37·5) cm, the column with hairs up to 2 mm and the seta with hairs 4(–6) mm. *S.E. Krym.* Rs (K). (*Caucasus.*)

11. S. iberica Martinovský, *Feddes Repert.* **73**: 150 (1966). Leaves strongly scabrid and aculeolate on the abaxial surface and shortly hairy, at least on the marginal ribs, on the adaxial surface; sheaths of basal leaves glabrous, of the upper ciliate and shortly hairy on the back. Glumes aristate. Lemma 18·5–21(–24) mm; awn *c.* 30 cm, the column between the geniculations with short, subappressed setae or only tuberculate and with scattered long, soft hairs. ● *S. France, C. & E. Spain.* Ga Hs.

A variable species requiring further investigation. The following subspecies can be recognized:

(a) Subsp. **iberica**: All ribs on the adaxial surface of the leaves densely hairy. *S. France, N.E. Spain.*

(b) Subsp. **pauneroana** Martinovský, *Anal. Inst. Bot. Cavanilles* **27**: 74 (1970): Only the marginal ribs on the adaxial surface of the leaves sparsely hairy, the remainder glabrous. *C. & E. Spain.*

12. S. apertifolia Martinovský, *Preslia* **39**: 274 (1967). Leaves often flat, even when dry, hairy at apex and for *c.* 1 cm at base, otherwise smooth or scabrid; sheaths hairy near the mouth; ligule of basal leaves 0·5–1 mm, of the upper leaves 2–5 mm. Lemma (19–)20–21·5 mm; awn (20–)22–24(–27) cm; column softly hairy and scabrid here and there; seta plumose. ● *E.C. Spain* (*near Cuenca*). Hs.

13. S. rechingeri Martinovský, *Preslia* **44**: 10 (1972). Leaves *c.* 0·8 mm in diameter, the upper hairy at the apex. Lemma 16–18·5 mm, 2-fid at apex; awn (17–)19·5–21(–23) cm, the column glabrous and smooth below the lower geniculation, sparsely hairy between the geniculations; seta plumose. *Serpentine rocks.* ● *N.W. Greece.* Gr.

14. S. austroitalica Martinovský, *Webbia* **20**: 723 (1965). Upper leaves densely and shortly hairy on the adaxial surface. Lemma (15·5–)17–18·5 mm, sometimes with 2 hairy lobes at apex, the column glabrous, the seta plumose. *Calcareous rocks.* ● *S. Italy, Sicilia.* It Si.

15. S. novakii Martinovský, *Feddes Repert.* **73**: 147 (1966). Leaves setaceous, rigid, glaucescent, strongly scabrid on the abaxial surface, scabridulous on the ribs on the adaxial surface; sheaths densely setulose; ligule of basal leaves *c.* 1 mm, of upper leaves 2·5–4 mm. Lemma 14–15 mm; awn (11–)13–16 cm, the column glabrous, the seta plumose. *Serpentine rocks.* ● *C. Jugoslavia* (*near Kraljevo, c.* 130 *km S. of Beograd*). Ju.

(16–19). S. dasyphylla group. Adaxial leaf-surface densely hairy, the abaxial surface scabrid with conical papillae, often also with hairs 0·5–1 mm.

1 Ventral line of hairs on lemma ending 2–4 mm below the insertion of the awn **18. ucrainica**
1 Ventral line of hairs on lemma ±reaching the insertion of the awn
2 Sheaths glabrous **19. pontica**
2 Sheaths densely puberulent
3 Abaxial leaf-surface with abundant, soft, ±patent hairs *c.* 1 mm **16. dasyphylla**
3 Abaxial leaf-surface with sparse, subappressed, rigid hairs *c.* 0·5 mm **17. zalesskii**

16. S. dasyphylla (Lindem.) Trautv., *Acta Horti Petrop.* **9**: 350 (1884). Stems up to 80 cm. Leaves *c.* 3 mm wide when flat, *c.* 1 mm in diameter when convolute, greyish, with abundant hairs up to 1·2 mm on both surfaces, those on the adaxial surface protruding between the margins of the convolute leaf; basal sheaths puberulent, purplish. Panicle with 5–7 spikelets. Glumes up to 70 mm, aristate, pale violet. Lemma (19–)20–22(–23) mm, with 7 lines of hairs above, 2 of which usually reach the base of the awn; awn 30–45 cm, the column glabrous, the seta with hairs 5–6 mm. *E.C. & S.E. Europe.* Cz Ge Hu Rm Rs (C, W, E).

17. S. zalesskii Wilensky, *Dnevn. Vseross. S'ezda Russk. Bot.* **1**: 41 (1921). Like **16** but leaves always convolute, *c.* 0·5 mm in diameter, the abaxial surface tuberculate and mostly also with subappressed hairs, the hairs on the adaxial surface not protruding between the margins of the leaf; lemma 17–19 mm. ● *S.E. & E.C. Russia, E. Ukraine, W. Kazakhstan; W. Czechoslovakia.* Cz Rs (C, W, ?K, E).

Among the variants included in this species are **S. glabrata** (P. Smirnov) Martinovský, *Preslia* **47**: 260 (1975) and **S. smir-**

novii Martinovský, *loc. cit.* (1975). For details of these taxa see J. O. Martinovský, *op. cit.* 249–261 (1975).

18. S. ucrainica P. Smirnov, *Feddes Repert.* **22**: 374 (1926). Like **16** but leaves always convolute, *c.* 0·5 mm in diameter, the abaxial surface densely aculeolate and with sparse, subappressed hairs, the adaxial surface shortly hairy; basal sheaths not purplish; lemma 17–19 mm, the ventral line of hairs ending 2–4 mm below the base of the awn. $2n=44$. *S. part of U.S.S.R., E. Romania.* Rm Rs (C, W, K, E).

19. S. pontica P. Smirnov, *op. cit.* **26**: 268 (1929). Stems up to 40 cm. Leaves convolute, 0·5–0·9 mm in diameter, the abaxial surface aculeate and with more or less appressed hairs, the adaxial with hairs up to 0·5 mm; sheaths glabrous; ligule of basal leaves 0·5–2 mm, of upper leaves up to 4 mm. Panicle 5–10 cm. Lemma *c.* 17 mm, with 2 marginal lines of hairs reaching the base of the awn, the others shorter; awn up to 40 cm, the column glabrous, the seta with hairs *c.* 5 mm in the middle, becoming shorter upwards. *Krym; Turkey-in-Europe.* ?Bu Rs (K) Tu.

(20–24). S. joannis group. Leaves usually convolute, usually with a tuft of hairs at the apex, at least when young. Glumes long-attenuate. Lemma with the ventral line of hairs usually ending below the base of the awn; awn with plumose seta.

1 Column hairy
2 Young leaves with a tuft of hairs at apex; lemma 17–18 mm; awn 20–25 cm **23. anomala**
2 Young leaves glabrous; lemma 23–25 mm; awn 29–36 cm **24. danubialis**

1 Column glabrous
3 Sheaths of upper leaves scabrid **21. borysthenica**
3 Sheaths of upper leaves smooth
4 Lemma (17–)21–22 mm **22. styriaca**
4 Lemma 15(–20) mm **20. joannis**

20. S. joannis Čelak., *Österr. Bot. Zeitschr.* **34**: 318 (1884) (*S. pennata* auct. scand. et ross., non L.). Leaves 0·5–1 mm in diameter, sometimes flat and 1·5–2·5 mm wide, with hairs up to 3 mm at apex; abaxial surface smooth and glabrous or weakly scabrid; ligule of basal leaves 1(–3) mm, of upper 3(–7) mm. Glumes 40(–70) mm. Awn with glabrous column. *C., S. & E. Europe, westwards to E. France; S.C. Sweden.* Al Au Bu Cz Ga Ge Gr He Hu It Ju Po Rm Rs (C, W, E) Su.

1 Sheaths densely puberulent; adaxial surface of leaf densely hairy **(a)** subsp. **puberula**
1 Sheaths glabrous or sparsely puberulent; adaxial surface of leaf glabrous or with scattered hairs
2 Lemma usually 15–17 mm; awn usually 25–33 cm **(b)** subsp. **joannis**
2 Lemma 17·5–20 mm; awn usually 23–30 cm **(c)** subsp. **balcanica**

(a) Subsp. **puberula** (Podp. & Suza) Martinovský, *Preslia* **48**: 187 (1976) (*S. joannis* var. *puberula* Podp. & Suza): *C. Europe and U.S.S.R.*

(b) Subsp. **joannis**: $2n=44$. *Throughout the range of the species.*

(c) Subsp. **balcanica** Martinovský, *Österr. Bot. Zeitschr.* **118**: 180 (1970): ● *C. part of Balkan peninsula.*

21. S. borysthenica Klokov ex Prokudin in Wulf, *Fl. Kryma* **1(4)**: 25 (1951). Like **20** but leaves with a shorter and sparser tuft of hairs or glabrous at apex; sheaths of upper leaves scabrid; lemma 21–22 mm. *E. & E.C. Europe.* Au Bu Cz Ge Hu Ju Po Rm Rs (C, W, K, E).

(a) Subsp. **borysthenica**: Lemma with ventral line of hairs ending far below the base of awn. *Throughout the range of the species.*

(b) Subsp. **germanica** (Endtmann) Martinovský & Rauschert, *Feddes Repert.* **88**: 320 (1977) (*S. joannis* subsp. *germanica* Endtmann): Lemma with ventral line of hairs reaching base of awn. ● *E. Germany, ?Poland.*

22. S. styriaca Martinovský, *Österr. Bot. Zeitschr.* **118**: 179 (1970). Leaves nearly 1 mm in diameter when convolute, glabrous or with few hairs at the apex; abaxial surface strongly scabrid; upper part of sheaths with dense hairs 0·2(–0·8) mm. Lemma 17–22 mm; awn (31–)37–41(–45) cm. ● *Mountains of S.E. Austria.* Au.

23. S. anomala P. Smirnov, *Del. Sem. Hort. Bot. Univ. Mosq.* **1930**: 15 (1930). Leaves with a tuft of hairs at the apex only when young, the abaxial surface weakly scabrid. Awn up to 25 cm, the column with hairs *c.* 4 mm. ● *On the borders of S.E. Russia and W. Kazakhstan (near Teplovka).* Rs (E).

24. S. danubialis Dihoru & Roman, *Rev. Roum. Biol. (Bot.)* **14**: 26 (1969). Leaves glabrous on both surfaces, scabrid on the adaxial surface; sheaths of basal leaves retrorsely scabrid, of the upper smooth; ligule 3·5–7 mm. Lemma (22–)23–25 mm; awn 28–36·5 cm, the column with hairs 2–3 mm. $2n=44$. *Stony slopes.* ● *By the Danube above Turnu-Severin.* Rm.

25. S. tirsa Steven, *Bull. Soc. Nat. Moscou* **30(2)**: 115 (1857). Very robust. Leaves always convolute, *c.* 0·5 mm in diameter, with a long, setaceous apex; abaxial surface with very short, stiff, subappressed hairs; adaxial surface densely puberulent; basal leaves up to 100 cm, the ligule scarcely visible; sheaths glabrous. Panicle contracted. Glumes long-attenuate. Lemma (16–)18–19·5(–21) mm; awn *c.* 40 cm, the column glabrous, the seta with hairs 5–6 mm. $2n=44$. *C., S. & E. Europe.* Al Au Bu Cz Ga Ge Gr Hs Hu It Ju Rm Rs (C, W, K, E).

(a) Subsp. **tirsa**: Lemma with the ventral line of hairs ending 1–4 mm below the base of the awn, the other lines scarcely ½ as long as the lemma. *Almost throughout the range of the species.*

(b) Subsp. **albanica** Martinovský, *Preslia* **44**: 21 (1972): Lemma with the ventral line of hairs reaching the base of the awn, the other lines more than ½ as long as the lemma. ● *N. Albania.*

26. S. lessingiana Trin. & Rupr., *Mém. Acad. Sci. Pétersb.* ser. 6, **7(2)**: 79 (1843). Leaves convolute, 0·4–0·5 mm in diameter; abaxial surface scabrid, with sparse, stout, conical, subappressed hairs 0·04(–0·1) mm; adaxial surface with slender, unequal, dense hairs on the ribs; sheaths glabrous, smooth; ligule 0·2–0·3 mm. Glumes 20–30 mm. Lemma 8–11 mm, with a ring of long hairs below the base of the awn; awn 12–20(–25) cm, the column glabrous, the seta plumose. $2n=44$. *S.E. Europe.* Bu Rm Rs (C, W, K, E).

(a) Subsp. **lessingiana**: Sheaths of the cauline leaves glabrous. *Throughout the range of the species.*

(b) Subsp. **brauneri** Pacz., *Zap. Krymsk. Obšč. Estestv.* **5**: 151 (1916): Sheaths of the cauline leaves shortly and densely hairy. ● *Krym and adjacent islets.*

27. S. capensis Thunb., *Prodr. Fl. Cap.* 19 (1794) (*S. tortilis* Desf.). Annual or biennial. Stems 10–30(–80) cm, glabrous. Leaves convolute or flat, glabrous or sparsely hairy, smooth; sheaths bearded at the mouth; ligule very short, truncate, shortly ciliate. Panicle 3–10(–15) cm, dense. Glumes long-attenuate,

hyaline. Lemma 6–7 mm, with subappressed setae and a ring of longer hairs below the base of the awn; awn 7–10 cm, the column with hairs *c.* 0·8 mm, the seta with more or less appressed hairs *c.* 0·1 mm. $2n=36$. *Mediterranean region, Portugal.* Al Bl Co Cr Ga Gr Hs It Ju Lu Sa Si.

28. S. barbata Desf., *Fl. Atl.* **1**: 97 (1798). Stems 30–70 cm. Leaves convolute, usually falcate, the abaxial surface glabrous, rarely densely puberulent, the adaxial surface puberulent; sheaths glabrous or puberulent, the uppermost enclosing the base of the inflorescence; ligule (0·1–)0·5–1·2(–3) mm, ciliate. Panicle narrow, with few spikelets. Glumes linear-lanceolate. Lemma (9–)10–13·5 mm, glabrous above except for a ring of hairs below the base of the awn; awn (13–)14·5–19 cm, the column with hairs 0·5–0·8 mm, the seta with hairs 1·5–2 mm. *S. & C. Spain, S. Italy, Sicilia.* Hs It Si.

29. S. arabica Trin. & Rupr., *Sp. Gram. Stip.* 77 (1842). Like **28** but ligule (0·3–)2–5 mm; lemma (7·5–)9·5–11 mm; awn (11·5–)13–15(–16·5) cm. *S.E. Russia.* Rs (E). (*S.W. Asia.*)

Represented in Europe by subsp. **caspia** (C. Koch) Tzvelev, *Nov. Syst. Pl. Vasc.* (*Leningrad*) **11**: 16 (1974).

30. S. orientalis Trin. in Ledeb., *Fl. Alt.* **1**: 83 (1829). Stems 10–30 cm. Leaves convolute, the abaxial surface papillose or tuberculate, the adaxial surface with hairs 0·04–0·06 mm; sheaths glabrous but ciliate, the uppermost enclosing the base of the panicle; ligule *c.* 2 mm, ciliate. Panicle narrow, with few spikelets. Glumes *c.* 18 mm. Lemma 6·5–7·5 mm, hairy all over towards the base and with lines of hairs above. Awn 4·5–5 cm, the column with hairs 0·06–0·2 mm, the seta with hairs 3·5 mm near the base, much shorter near the apex. *S.E. part of U.S.S.R.* Rs (E). (*Siberia, C. Asia.*)

31. S. capillata L., *Sp. Pl.* ed. 2, 116 (1762). Stems 20–70(–100) cm. Leaves convolute, the abaxial surface glabrous but usually tuberculate-scabrid, the adaxial surface with hairs *c.* 0·6 mm; sheaths much longer than the internodes, smooth; ligule of basal leaves 1–2(–3) mm, of upper leaves 15–20 mm. Panicle lax, with many spikelets. Glumes 25–35 mm, long-attenuate. Lemma 10–12(–14) mm, the ventral line of hairs reaching the base of the awn, the other lines shorter; awn 12–18(–23) cm, scabrid. $2n=44$. *S., S.C. & S.E. Europe.* Al Au Bu Cr Cz Ga Ge Gr He Hs Hu It Ju Po Rm Rs (C, W, K, E) Sa Si Tu.

32. S. sareptana A. Becker, *Bull. Soc. Nat. Moscou* **57(1)**: 52 (1882). Like **31** but abaxial surface of leaves with subappressed setae as well as tubercles, the adaxial surface glabrous; sheaths sometimes sparsely puberulent, the lower at most slightly exceeding the internodes; ligule of basal leaves very short, of upper leaves up to 12 mm; ventral line of hairs ¾ as long as lemma; awn 10–15 cm. $2n=44$. *S.E. part of U.S.S.R.* Rs (C, E).

(a) Subsp. **sareptana**: Abaxial leaf-surface strongly scabrid, with rigid hairs and pricklets. *Throughout the range of the species.*

(b) Subsp. **praecapillata** (Alechin) Tzvelev, *Nov. Syst. Pl. Vasc.* (*Leningrad*) **11**: 14 (1974): Abaxial leaf-surface scabrid, with pricklets and sometimes a few rigid hairs. ● *Middle Volga region.*

33. S. fontanesii Parl., *Fl. Ital.* **1**: 167 (1850) (*S. lagascae* auct., non Roemer & Schultes). Stems 45–80 cm. Leaves convolute, 0·4–0·9 mm in diameter, glabrous except for the apex of the ribs on the adaxial surface, smooth; sheaths of the upper leaves about as long as the internodes, glabrous or puberulent above; ligule of basal leaves 0·5–1 mm, of upper leaves 3–7(–10) mm, ciliate. Panicle *c.* 25 cm, with few spikelets. Glumes *c.* 30 mm. Lemma 13–14(–16) mm, none of the lines of hairs reaching the base of the awn but with a ring of hairs at the apex; awn (12–)15–19(–20) cm, the column with subappressed hairs 0·4 mm on the back and sides, the arista with hairs 0·2 mm. Anthers penicillate at apex. *S. Italy and Sicilia; Aegean region.* ?Cr Gr It Si.

34. S. lagascae Roemer & Schultes, *Syst. Veg.* **2**: 333 (1817). Stems up to 80 cm. Leaves usually convolute, the abaxial surface smooth and glabrous, the adaxial surface, at least towards the base, with hairs 0·04–0·2 mm on the ribs, those on the marginal ribs longer than the others; sheaths ciliate and glabrous to puberulent; ligule of basal leaves 0·3–0·5 mm, of upper leaves 2–6 mm, villous. Panicle up to 50 cm, dense. Glumes 30–60 mm, long-attenuate. Lemma (8–)9·5–11·5 mm, with a ring of hairs below the base of the awn; awn 13·5–18(–19·5) cm, weakly geniculate, the column hairy on the angles only, the arista shortly hairy. *N.E. Portugal, C. & S. Spain.* Hs Lu.

35. S. celakovskyi Martinovský, *Preslia* **48**: 187 (1976). Like **34** but the hairs on the marginal ribs of the leaves not longer than the others; lemma 11·8–15 mm; awn (18–)20–25(–29) cm. ● *E.C. Spain* (*Serrania de Cuenca*). Hs.

36. S. offneri Breistr., *Procés-Verb. Soc. Dauph. Étud. Biol.* (*Grenoble*) ser. 3, **17**: 2 (1950) (*S. juncea* auct., non L.). Stems up to 80 cm. Leaves convolute, *c.* 0·5 mm in diameter, minutely and densely hairy on the ribs on the adaxial surface; basal sheaths usually smooth and glabrous; ligule (3–)4·5–5·5 mm, ciliate. Lemma (8·5–)10–13 mm, with the ventral line of hairs somewhat more than ½ as long as the lemma, with a ring of hairs below the base of the awn; awn (8–)9–11 cm, scabrid, the column with hairs 0·4–0·6 mm on the angles, the seta with very short hairs. $2n=44$. *W. Mediterranean region.* Bl Ga Hs It Sa.

37. S. korshinskyi Roshev., *Fl. Az. Ross.* **12**: 163 (1916). Stems up to 70 cm. Leaves convolute, scabrid, the upper much shorter than the basal; ligule very short. Panicle 10–20 cm, contracted, with few spikelets. Glumes 12–16 mm, long-acuminate. Lemma 8–9 mm, rather densely hairy, with a ring of hairs below the base of the awn; awn 9–12 cm, hairy on the angles throughout, the hairs on the seta longer than those on the column, but less than 1 mm. *S.E. Russia.* Rs (?C, E). (*W.C. Asia.*)

38. S. parviflora Desf., *Fl. Atl.* **1**: 98 (1798). Stems up to 70 cm. Leaves flat or involute, glabrous and smooth on the abaxial surface, with minute hairs on the ribs on the adaxial surface; sheaths smooth, ciliate on the margin and densely bearded at the mouth; ligule short, truncate. Panicle up to 30 cm, lax, with numerous spikelets. Glumes unequal, the lower 12–15 mm, the upper 7–10 mm. Lemma 4–7 mm, appressed-hairy below, glabrous above; awn 5–10 cm, obscurely geniculate, minutely hairy throughout. $2n=28$. *C., E. & S.E. Spain, S. France.* Ga Hs.

Reports of this species from Greece and Kriti require confirmation.

39. S. tenacissima L., *Cent. Pl.* **1**: 6 (1755) (*Macrochloa tenacissima* (L.) Kunth). Very robust; stems 60–150(–200) cm. Leaves usually convolute, *c.* 1 mm in diameter, glabrous and smooth on the abaxial surface, densely and minutely puberulent on the adaxial surface; non-flowering shoots with 2 lanate projections 2·5–3 cm, ending in a plumose, subulate apex protruding from the mouth of the sheath; ligule very short, ciliate. Panicle

25–35 cm, dense, with numerous spikelets. Glumes 25–30 mm. Lemma *c.* 10 mm, membranous, hirsute, 2-fid at apex; awn 4–6 cm, the column with hairs 1–4 mm, the arista with minute appressed hairs. Anthers with a tuft of hairs at apex. $2n=40$. *E., C. & S. Spain, S. Portugal, Islas Baleares.* Bl Hs Lu.

40. S. gigantea Link in Schrader, *Jour. für die Bot.* **1799(2)**: 313 (1800) (*Macrochloa arenaria* (Brot.) Kunth). Stems up to 250 cm × 6 mm. Leaves smooth or weakly scabrid and shallowly sulcate on the abaxial surface, minutely and densely puberulent on the adaxial surface; sheaths glabrous, except for the ciliate auricles; ligule very short. Panicle (20–)30–50 cm, very lax. Glumes 25–35 mm, long-attenuate. Lemma 14–18 mm, membranous, with soft hairs 1–5 mm, 2-fid at apex; awn 7–12 cm, scabrid throughout its length. Anthers with a tuft of hairs at apex. $2n=96$. *C. & S. Spain, Portugal.* Hs Lu.

41. S. bromoides (L.) Dörfler, *Herb. Norm.* **34**: 129 (1897) (*S. aristella* L., *Lasiagrostis bromoides* (L.) Nevski). Stems up to 100 cm × 1 mm. Leaves convolute, glabrous and smooth on the abaxial surface, minutely puberulent on the ribs on the adaxial surface; sheaths glabrous except for the puberulent auricles; ligule very short. Panicle 15–30 cm, narrow. Glumes *c.* 10 mm, acuminate. Lemma 6–7 mm, villous below, 2-fid at apex; callus very short, obtuse; awn 1·5–2·5 cm, not geniculate, minutely papillose. $2n=28$. *S. Europe, extending northwards to Hungary.* Al ?Bl Bu Co Cr Ga Gr Hs Hu It Ju Lu Rm Rs (K) Sa Si Tu.

42. S. trichotoma Nees, *Agrost. Brasil.* 375 (1829). Stems up to 50 cm. Leaves convolute, the abaxial surface scabrid, with conical papillae; ligule 1–2 mm. Panicle lax, with divaricate branches. Glumes 6–9 mm. Lemma *c.* 2 mm, obovate, hairy below, tuberculate above; callus very short, obtuse; awn *c.* 3·5 cm, scarcely geniculate, papillose. *Naturalized in S. France and C. Italy.* [Ga It.] (*Temperate South America.*)

105. Achnatherum Beauv.[1] (*Lasiagrostis* Link)

Like *Stipa* but young leaves convolute, not folded; spikelets laterally compressed; lower part of lemma with patent hairs up to 4 mm; awn straight or curved, but not abruptly geniculate and twisted below.

Ligule minute; glumes subequal, the lower (6–)8–9 mm **1. calamagrostis**

Ligule *c.* 6 mm; upper glume $\frac{3}{4}$–$\frac{4}{5}$ as long as lower, the lower 5–6 mm **2. splendens**

1. A. calamagrostis (L.) Beauv., *Agrost.* 20, 146 (1812) (*Calamagrostis argentea* DC., *Lasiagrostis calamagrostis* (L.) Link). Robust, caespitose perennial. Stems 60–120 cm, densely clothed in imbricate, coriaceous, scale-like leaf-sheaths at base when young. Leaves 2–3 mm wide, usually convolute when dry, gradually attenuate into the long, slender apex; sheaths smooth, glabrous or ciliate on margin and auricles; ligule minute. Panicle up to 30 cm, rather lax. Spikelets (6–)8–9 mm, shining, often purplish. Glumes lanceolate, acute, glabrous or shortly hairy, membranous, 3-veined. Lemma 3–4 mm, coriaceous, with patent hairs up to 4 mm on the back; awn *c.* 10 mm, straight or curved. Anthers 3·5–4 mm. $2n=24$. *Rocky or stony ground, mainly in the mountains; calcicole.* ● *S. & S.C. Europe.* Al Au Bu Ga Ge Gr He Hs It Ju Rm.

[1] By T. G. Tutin.

2. A. splendens (Trin.) Nevski, *Acta Inst. Bot. Acad. Sci. URSS* (*Ser.* 1) **4**: 224 (1937) (*Lasiagrostis splendens* (Trin.) Kunth). Like **1** but stems up to 250 cm; ligule *c.* 6 mm, more or less acute; panicle up to 50 cm; spikelets 5–6 mm; upper glume $\frac{3}{4}$–$\frac{4}{5}$ as long as lower; lemma 5–6 mm. *Steppes and saline gravels. S.E. Russia, W. Kazakhstan.* Rs (C, E). (*Siberia, C. Asia.*)

Tribe **Ampelodesmeae** (Conert) Tutin

Leaves linear; silica-bodies transversely elliptical; 2-celled micro-hairs absent; ligule membranous below, ciliate above. Inflorescence a large panicle. Spikelets all hermaphrodite, laterally compressed, with 2–many florets. Rhachilla disarticulating above the glumes and between the florets. Glumes shorter than the spikelet, scarious or chartaceous. Lemma coriaceous, with membranous margin, 5- to 7-veined. Palea 2-keeled. Lodicules 2–3, narrowly lanceolate, the anterior 2 larger and ciliate, the posterior glabrous. Stamens 3. Ovary with a densely hairy appendage; styles 2. Grain subterete, with an adaxial groove; hilum linear, long; embryo small; starch-grains simple. Chromosomes small; basic number 12.

107. Ampelodesmos Link[1]

Robust, caespitose perennial. Leaves flat in the living state. Inflorescence a large panicle. Spikelets strongly laterally compressed. Glumes shorter than the spikelet, somewhat unequal, keeled, 3- to 5-veined, persistent. Lemma linear-lanceolate, coriaceous, 5-veined, villous on the back in the lower half. Palea shorter than lemma. Rhachilla villous.

1. A. mauritanica (Poiret) T. Durand & Schinz, *Consp. Fl. Afr.* **5**: 874 (1894) (*A. tenax* (Vahl) Link). Tussocks attaining 100 cm in diameter. Non-flowering shoots up to 100 cm; flowering stems up to 350 cm × 8 mm, solid. Leaves up to 100 cm × 7 mm, strongly ribbed on both surfaces; sheaths smooth, striate; ligule 8–15 mm, membranous and ciliate below. Panicle up to 50 cm, subsecund. Spikelets 10–15 mm, stramineous to purplish; florets 2–5. Lower glume 7–10 mm, the upper 9–12 mm. Lemma 10–15 mm, shortly 2-dentate, with an awn 1–2 mm. $2n=48$. *Dry places, mainly near the coast. Mediterranean region, eastwards to W. Greece.* Bl ?Co Ga Gr Hs It Sa Si [Lu].

Tribe **Arundineae** Dumort.

Leaves broadly linear; silica-bodies cross-shaped or rounded mixed with somewhat crescentic to saddle-shaped; 2-celled micro-hairs often present; ligule a row of hairs. Inflorescence a large panicle. Spikelets all hermaphrodite, laterally compressed, with 2–many florets. Rhachilla disarticulating above the glumes and between the florets, or above the lowest floret. Callus or back of lemma with abundant, long, silky hairs. Glumes equalling or shorter than the spikelet, hyaline or membranous. Lemma membranous, unawned, rounded on the back. Palea hyaline, 2-veined. Lodicules 2, truncate. Stamens (2–)3. Ovary glabrous; styles 2. Grain with linear, oblong or punctiform hilum; embryo about half as long to as long as grain; starch-grains compound. Chromosomes small; basic number 12.

108. Arundo L.[1]

Large, rhizomatous perennials. Leaves flat; ligule a line of hairs. Inflorescence a lax panicle. Spikelets laterally compressed, with few, mostly hermaphrodite florets. Glumes subequal, membranous, equalling the florets, 3- to 5-veined, persistent. Lemma

3- to 5-veined, with long, soft hairs on the proximal half of the back, not keeled. Rhachilla glabrous.

Spikelets at least 12 mm, usually with 3 florets; lemma 2-fid at apex **1. donax**
Spikelets not more than 10 mm, usually with 1–2 florets; lemma entire at apex **2. plinii**

1. A. donax L., *Sp. Pl.* 81 (1753) (*A. maxima* Forskål). Rhizomes long, woody, swollen in places, covered in coriaceous, scale-like sheaths. Stems up to 600 × 3·5 cm, persisting and flowering in the second year, usually simple. Leaves up to 60 × 6 cm, glaucous, scabrid at the margin; sheaths smooth, glabrous, covering the nodes. Panicle 30–60 cm, oblong. Spikelets 12–18 mm, usually with 3 florets. Glumes lanceolate, long-acute. Lemma lanceolate, 2-fid at apex, with a short awn from the sinus. Anthers *c.* 3 mm. $2n = 110, 112$. *Extensively planted in S. Europe for shelter, and for the manufacture of baskets, reeds for musical instruments and other articles; widely naturalized in ditches and by rivers.* [Al Az Bl Co Cr Ga Gr Hs It Ju Lu Sa Si Tu.] (*?S. & C. Asia.*)

2. A. plinii Turra, *Farset. Nov. Gen.* 11 (1765). Like **1** but stems not more than 300 cm; spikelets 8–10 mm, usually with 1–2 florets; lemma entire at apex. $2n = 72$. *Mediterranean region, Portugal.* Al Co Cr Ga Hs It Ju Lu Sa Si Tu [Bl Bu].

109. **Phragmites** Adanson[1]

Like *Arundo* but spikelets with up to 10 florets; glumes unequal, shorter than the florets; lowest floret male or sterile; lemma glabrous on the back; rhachilla with abundant long hairs.

1. P. australis (Cav.) Trin. ex Steudel, *Nomencl. Bot.* ed. 2, **2**: 324 (1841) (*P. communis* Trin., *Arundo phragmites* L.). Rhizome long, woody, covered with coriaceous scale-like sheaths. Stems 80–350(–1000) × 0·5–1·2 cm, not overwintering, usually simple. Leaves up to 50 × 5 cm, greyish-green, gradually tapering to a long, slender apex; sheaths smooth, glabrous, covering the nodes. Panicle (8–)20–30(–50) cm, oblong to ovoid, often purplish. Spikelets 10–16 mm, with 2–10 florets. Glumes lanceolate, acute, the lower ½–⅔ as long as the upper. Lemma narrowly lanceolate, acute to acuminate. Anthers 1·5–2 mm. $2n = 36, 44, 46, 48, 49, 50, 51, 52, 54, 96$. *Wet places. Almost throughout Europe.* All except Az Fa Is Sb.

P. isiaca Kunth, *Rév. Gram.* **1**: 80 (1829) is a large variant of **1**, with which it intergrades. It does not seem possible to maintain it at specific or subspecific rank.

Tribe **Cortaderieae** Zotov

Like *Arundineae* but dioecious or gynodioecious; silica-bodies rounded to dumbbell-shaped; 2-celled micro-hairs present; lodicules ciliate; basic chromosome number 9.

110. **Cortaderia** Stapf[1]

Large caespitose dioecious perennials. Leaves flat; ligule a line of hairs. Inflorescence a large panicle. Spikelets laterally compressed; florets 2–7. Glumes unequal, membranous, 1-veined. Lemma membranous, villous, 3-veined, with a terminal awn. Rhachilla villous, disarticulating above the glumes and just above each floret.

1. C. selloana (Schultes & Schultes fil.) Ascherson & Graebner, *Syn. Mitteleur. Fl.* **2(1)**: 325 (1900). Dioecious. Stems up to 3 m, stout. Leaves 1–3 m, glaucous, hard, with sharply serrulate cutting margins. Panicle (30–)50–100 cm; branches erecto-patent in male, patent in female plants. Spikelets *c.* 15 mm (incl. awn), silvery or sometimes pinkish. Glumes lanceolate, the upper with a long terminal awn. *Widely cultivated for ornament and naturalized in W. Europe.* [Az Br Ga Hs.] (*South America.*)

[1] By T. G. Tutin.

Tribe **Danthonieae** (G. Beck) C. E. Hubbard

Leaves linear or setaceous; silica-bodies rounded or dumbbell-shaped; 2-celled micro-hairs present; ligule a row of hairs. Inflorescence a panicle. Spikelets all hermaphrodite, somewhat compressed laterally, with 2–10 florets. Rhachilla disarticulating above the glumes and between the florets. Glumes about as long as the lowest lemma, often strongly 3- to 11-veined. Lemma coriaceous or membranous-coriaceous, 2-lobed and often awned from the sinus. Palea 2-keeled. Lodicules 2. Stamens 3. Ovary glabrous; styles 2. Grain with elliptical or linear hilum; starch-grains compound. Chromosomes small; basic number 6, 9, 12.

111. **Danthonia** DC.[1]

Perennials. Leaves flat or involute. Inflorescence a panicle, with few, long-pedicellate spikelets. Spikelets subterete, with 2–5 florets. Glumes subequal, chartaceous, about equalling the spikelet, 5- to 7-veined. Lemma coriaceous, 7- to 9-veined, 2-dentate at apex, with an awn or mucro from the sinus. Palea obtuse or 2-dentate, with 2 keels near the margin. Rhachilla prolonged.

Leaf-sheaths with scattered long hairs; lemma unawned **1. decumbens**
Leaf-sheaths glabrous; lemma awned **2. alpina**

1. D. decumbens (L.) DC. in Lam. & DC., *Fl. Fr.* ed. 3, **3**: 33 (1805) (*Sieglingia decumbens* (L.) Bernh.). Stems 10–60 cm, decumbent to erect. Leaves 0·5–4 mm wide, usually flat, sparsely hairy or glabrous; sheaths with scattered long hairs, bearded at apex; ligule a ring of hairs. Panicle 2–7 cm, with up to 15 spikelets. Spikelets 6–15 mm. Glumes lanceolate to narrowly ovate, rounded below, keeled near apex, smooth. Lemma broadly ovate, 2-dentate, with a mucro in the sinus, usually ciliate up to the middle, densely bearded at base. $2n = 24, 36, 124$. *Most of Europe.* All except Bl Cr Gr Sb Si.

Often cleistogamous, when the florets lack lodicules and have very small anthers. Cleistogamous spikelets also frequently occur in the axils of the sheaths at the base of the flowering stem.

2. D. alpina Vest, *Flora* (*Regensb.*) **4**: 145 (1821) (*D. calycina* (Vill.) Reichenb., non (Lam.) Roemer & Schultes, *D. provincialis* DC.). Like **1** but leaf-sheaths glabrous; leaves usually convolute; panicle seldom with more than 5 spikelets; lemma with 2 long teeth and an awn up to 10 mm, spirally twisted below and somewhat geniculate. $2n = 36$. ● *S. & S.C. Europe.* Al Au Bu Cz Ga Ge ?Gr He Hs Hu It Ju Rm Rs (W).

D. decumbens × *alpina* occurs rarely with the parents.

112. **Schismus** Beauv.[1]

Annuals. Leaves flat or involute. Inflorescence a rather dense panicle. Spikelets laterally compressed, with 5–10 florets. Glumes subequal, much longer than the lowest lemma, strongly 3- to 5-veined, with a wide scarious margin. Lemma 9-veined, membranous, 2-fid or 2-lobed at apex, sometimes with a short awn from the sinus. Palea shorter than to as long as lemma.

Literature: N. L. Bor in C. C. Townsend & E. Guest, *Flora of Iraq* **9**: 377–382. Baghdad. 1968.

Lowest lemma with obtuse to acute lobes $\frac{1}{6}$–$\frac{1}{4}$ as long as rest of lemma; palea longer than entire part of lemma **1. barbatus**
Lowest lemma with acuminate lobes $\frac{1}{3}$–$\frac{1}{2}$ as long as rest of lemma; palea about as long as entire part of lemma **2. arabicus**

1. S. barbatus (L.) Thell., *Bull. Herb. Boiss.* ser. 2, **7**: 391 (1907) (*S. calycinus* Cosson & Durieu, *S. marginatus* Beauv.). Stems 3–15 cm, usually numerous, erect or geniculately ascending, smooth and glabrous. Leaves often hairy above near the base, with a tuft of long hairs at junction of sheath and lamina. Panicle 1–4 cm; pedicels short. Spikelets 5–7 mm. Glumes usually less than 5 mm, lanceolate, glabrous. Lemma 2–3 mm, hairy near the margin in the lower $\frac{1}{2}$–$\frac{2}{3}$, the lowest with obtuse to acute lobes $\frac{1}{6}$–$\frac{1}{4}$ as long as the rest of the lemma. Palea longer than the entire part of the lemma. *Dry, open habitats. Spain and S. France; an occasional casual elsewhere.* Ga Hs. (*N. Africa, S.W. Asia.*)

2. S. arabicus Nees, *Fl. Afr. Austr.* 422 (1841). Like **1** but glumes usually more than 5 mm; lowest lemma with acuminate lobes $\frac{1}{3}$–$\frac{1}{2}$ as long as the rest of the lemma; palea about as long as the entire part of the lemma. *Dry, open habitats. S. Greece and C. Aegean region.* ?Cr Gr. (*S.W. & S.C. Asia, Egypt.*)

Tribe **Molinieae** Jirásek

Leaves linear, flat, deciduous; silica-bodies dumbbell-shaped; slender 2-celled micro-hairs present; ligule a row of hairs. Inflorescence a panicle. Spikelets hermaphrodite, laterally compressed, with 1–4 florets. Rhachilla disarticulating above the glumes and between the florets. Glumes shorter than the spikelet. Lemma membranous, 3-veined, rounded on the back, unawned. Palea 2-keeled. Lodicules 2, obovate. Stamens 3. Ovary glabrous; styles 2. Grain with linear hilum as long as the grain; starch-grains compound but readily separating. Chromosomes small; basic number 9.

113. **Molinia** Schrank[1]

Caespitose perennials. Leaves flat; ligule a row of hairs. Inflorescence a panicle. Spikelets laterally compressed, with 1–4 florets. Glumes subequal, membranous, shorter than the florets, the lower 1-veined or without a vein, the upper 1- to 3-veined. Lemma membranous, 3-veined, rounded on the back. Palea about equalling lemma.

Literature: H. J. Conert, *Die Systematik und Anatomie der Arundineae*, 155–182. Weinheim. 1961. V. Jirásek, *Acta Univ. Carol.* (*Biol.*) **1965**: 227–243 (1965).

1. M. caerulea (L.) Moench, *Meth.* 183 (1794). Stems 15–150(–250) cm, erect, rigid, with 1 node towards the base, disarticulating at this node, the basal internode up to 5 cm, usually swollen and clavate. Leaves 10–50 cm × 3–10 mm, tapering gradually to the apex, deciduous, sparsely hairy or glabrous, scabridulous on the margins; sheaths smooth, hairy near the apex. Panicle 5–40 cm, compact and spike-like, with short branches, to very lax, with long branches. Spikelets 4–9 mm, purple, brownish, yellowish or green. Glumes lanceolate to ovate or oblong, acute. Lemma ovate, acute to obtuse. Anthers 1·5–3 mm, violet-brown. *Throughout Europe, except for some islands, but mainly on mountains in the south.* All except Az Bl ?Co Cr Is Rs (K) Sa Sb Si.

[1] By T. G. Tutin.

Very variable. Two subspecies may be recognized, but many intermediates occur and the correlation between chromosome number and morphology needs further investigation.

(a) Subsp. **caerulea**: Stems usually not more than 90 cm; leaves 3–6(–10) mm wide. Panicle narrow with short, more or less erect branches. Lowest lemma 3(–4) mm, subobtuse. Caryopsis *c.* 2 mm. $2n=36$. *Damp, humus-rich, base-poor soils. Throughout most of the range of the species.*

(b) Subsp. **arundinacea** (Schrank) H. Paul, *Ber. Bayer. Bot. Ges.* **23**: 154 (1938) (*M. arundinacea* Schrank): Stems up to 250 cm; leaves usually 8–12 mm wide. Panicle with long, patent to erecto-patent branches. Lowest lemma 4–6 mm, long-acute. Caryopsis *c.* 3 mm. $2n=$?36, 90. *Somewhat base-rich mineral soils with fluctuating water-table. Locally throughout much of the range of the species, but less common than subsp.* (a).

Tribe **Aristideae** C. E. Hubbard ex Bor

Leaves setaceous to linear, flat or often convolute; silica-bodies dumbbell-shaped or elliptic-oblong; slender 2-celled micro-hairs present; ligule a row of hairs. Inflorescence a panicle. Spikelets all hermaphrodite, terete or somewhat compressed laterally, with 1 floret. Rhachilla disarticulating above the glumes. Glumes membranous, shorter or longer than the floret. Lemma chartaceous, becoming coriaceous, with a terminal, 3-fid awn. Palea hyaline, 2-keeled. Lodicules 2–3, usually finely veined. Stamens 3 or 1. Ovary glabrous; styles 2. Grain with linear hilum as long as the grain; starch-grains compound. Chromosomes small; basic number 11, 12.

114. **Aristida** L.[1]

Caespitose annuals or perennials. Leaves often convolute. Inflorescence a panicle. Spikelets somewhat compressed laterally. Glumes shorter to longer than the floret, unequal, 1- to 3-veined. Lemma convolute, coriaceous, villous at base, with a usually 3-fid terminal awn. Palea short, without or with 2 veins.

1. A. adscensionis L., *Sp. Pl.* 82 (1753). Caespitose perennial or commonly annual. Stems up to 40 cm. Leaves usually convolute, rigid, strongly ribbed; sheaths ribbed, often purplish below; ligule a ring of short hairs. Panicle 15–20 cm, narrow. Spikelets *c.* 10 mm (excluding awn), often purplish. Lower glume 7–8 mm, the upper 9–10 mm. Lemma 8–9 mm; longest branch of the awn up to 25 mm, scabrid. *S. part of Mediterranean region.* Cr ?Gr Hs It Si. (*Tropics and subtropics.*)

A. coerulescens Desf., *Fl. Atl.* **1**: 109 (1798), appears to differ from **1** only in being perennial; in all other characters it seems to fall within the range of variation found in that species.

115. **Stipagrostis** Nees[1]

Like *Aristida* but at least the middle branch of the awn plumose.

Stems 20–50 cm; branches of the awn 10–15 mm **1. pennata**
Stems 40–100 cm; branches of the awn 16–20 mm **2. karelinii**

1. S. pennata (Trin.) De Winter, *Kirkia* **3**: 135 (1963) (*Aristida pennata* Trin.). Perennial with far-creeping rhizome. Stems 20–50 cm, branched from the base. Leaves usually convolute, 0·4–2 mm wide when flat, scabrid on both surfaces and shortly hairy above; ligule a ring of short hairs. Panicle usually 8–20 cm. Spikelets 12–15 mm (excluding awn), whitish. Glumes unequal, the lower longer than the upper. Lemma 4·5–6 mm, half as long

as glumes; callus 0·7–1 mm; branches of the awn 10–15 mm, all plumose. *Sandy steppes and semi-deserts. S.E. Russia.* Rs (E). (*S.W. & C. Asia.*)

2. S. karelinii (Trin. & Rupr.) Tzvelev, *Nov. Syst. Pl. Vasc.* (*Leningrad*) **11**: 71 (1974) (*Aristida karelinii* Trin. & Rupr.). Like **1** but stems 40–100 cm; leaves 1·5–4·5 mm wide when flat; panicle usually 20–40 cm; lemma 6–7 mm; callus 1–1·3 mm; branches of awn 16–20 mm. *Sandy deserts. On the borders of Europe in W. Kazakhstan* (*near Gur'ev*). Rs (E). (*C. Asia.*)

Tribe **Nardeae** Reichenb.

Leaves setaceous; silica-bodies saddle-shaped or rounded; slender 2-celled micro-hairs present; ligule membranous. Inflorescence a unilateral spike. Spikelets all hermaphrodite, triangular in section, with 1 floret. Glumes persistent, the lower very small, the upper usually absent. Lemma chartaceous, with a terminal awn. Palea hyaline, 2-keeled. Lodicules absent. Stamens 3. Ovary glabrous; style 1; stigma papillose. Grain with a short, linear hilum; starch-grains compound. Chromosomes large; basic number 13.

116. **Nardus** L.[1]

Densely caespitose perennials. Leaves setaceous. Inflorescence a unilateral spike. Spikelets triangular in section, with 1 floret. Glumes very small, the upper usually absent. Lemma 3-veined, chartaceous, with an apical awn. Palea slightly shorter than lemma.

1. N. stricta L., *Sp. Pl.* 53 (1753). Stems (3–)10–40(–60) cm, erect, wiry. Leaves 3–20(–30) cm × *c.* 0·5 mm, hard, greyish-green, patent at maturity; sheaths tough, whitish, erect, persistent; ligule up to 2 mm, truncate. Spike (1–)3–8 cm. Spikelets 5–9 mm, in 2 rows along one side of the rhachis. Lemma linear-lanceolate; awn 1–3 mm. Anthers 3·5–4 mm. $2n=26$. *Sandy or peaty soils; calcifuge. Most of Europe, but only on mountains in the south.* All except Bl Cr Rs (K, E) Sa Sb Tu.

Tribe **Lygeeae** Lange

Leaves linear, convolute; silica-bodies circular or elliptical; 2-celled micro-hairs probably absent; ligule membranous. Spikelets solitary, terminal, with 2(–3) florets. Glumes absent. Lemmas of the 2 florets connate by their margins in the lower half, coriaceous. Paleas connate by their backs below, much longer than the lemmas. Lodicules absent. Stamens 3. Ovary glabrous; style 1; stigma papillose. Grain with a linear hilum as long as the grain; embryo small; starch-grains compound. Chromosomes large; basic number 10.

117. **Lygeum** Loefl. ex L.[1]

Caespitose perennial. Leaves convolute. Inflorescence of one terminal spikelet enclosed in a sheath. Spikelet with 2(?–3) florets. Glumes absent. Lemmas of the 2 florets connate by their margins and with abundant long hairs in the lower half, forming a rigid, cylindrical tube, the upper half free, erecto-patent, glabrous. Paleas connate by their backs below, much longer than the lemmas, erect, glabrous.

1. L. spartum L., *Gen. Pl.* ed. 5, [522] (1754). Rhizome and bases of erect shoots covered with coriaceous scales. Stems up to 70 cm, wiry, solid. Leaves up to *c.* 50 cm × 1·5 mm, rigid, very tough; sheaths glabrous; ligule *c.* 7 mm, acute. Inflorescence-sheath 3–4(–9) cm, ovate, acute or with a leaf-like point. Spikelet protruding from the side of the sheath at maturity and falling entire. Lemma *c.* 2 cm. Palea 3–4 cm. Anthers *c.* 15 mm. $2n=40$. *Dry, sandy or clayey, often gypsaceous soils. Mediterranean region.* *Bl Cr Hs It Sa Si.

Tribe **Pappophoreae** Kunth

Leaves linear, often convolute; silica-bodies saddle-shaped; 2-celled micro-hairs present; ligule a row of hairs. Inflorescence a panicle. Spikelets all hermaphrodite, scarcely compressed, with 2–many florets. Rhachilla disarticulating above the glumes only. Glumes longer than the lemmas. Lemma of fertile florets about as long as wide, with 9 prominent veins excurrent as awns. Palea 2-veined, often longer than lemma. Lodicules 2. Stamens 3. Ovary glabrous; styles 2. Grain with basal punctiform hilum; starch-grains compound. Chromosomes small; basic number 10.

118. **Enneapogon** Desv. ex Beauv.[1]

Annuals or perennials. Leaves flat or convolute. Inflorescence a compact or spike-like panicle. Spikelets scarcely compressed, with 3(–6) florets, the lower 1(–3) hermaphrodite, the remainder sterile. Glumes unequal, membranous, longer than the lemmas, (3–)7- to 9-veined. Lemma of hermaphrodite florets elliptic-oblong, with 9 prominent veins produced into awns longer than the lemma. Palea often longer than lemma.

Literature: H. Freitag, *Collect. Bot.* (*Barcelona*) **7**: 483–493 (1968). S. A. Renvoize, *Kew Bull.* **22**: 393–401 (1968).

1. E. persicus Boiss., *Diagn. Pl. Or. Nov.* **1(5)**: 71 (1844). Caespitose perennial; stems 15–20(–30) cm, erect. Leaves convolute, short, rigid, usually more or less horizontal; sheaths with short, glandular and eglandular hairs; ligule a ring of hairs. Panicle 3–6(–12) cm, cylindrical. Spikelets shiny, yellowish or purplish. Glumes 6–7 mm, ovate-lanceolate, with short glandular and eglandular hairs. Lemma 1·7–2 mm, hirsute to above the middle, puberulent near the apex; awns 5–7 mm, 5 longer than the other 4, ciliate in lower ¾, scabrid above. *Dry, open habitats. S.E. Spain* (*c. 15 km W.S.W. of Cartagena*). Hs. (*N.E. Africa, S.W. & C. Asia.*)

The only known European station is a very small one far removed from the main area of the species.

Tribe **Aeluropodeae** Nevski ex Bor

Leaves linear or convolute; silica-bodies dumbbell- or cross-shaped; 2-celled micro-hairs present; ligule a row of hairs. Inflorescence of racemosely arranged, more or less sessile spikes. Spikelets all hermaphrodite, laterally compressed, with 2–many florets. Rhachilla disarticulating above the glumes and between the florets. Glumes shorter than the spikelet. Lemma coriaceous. Palea hyaline, 2-keeled. Lodicules 2. Stamens 3. Ovary glabrous; styles 2. Grain with punctiform hilum; starch-grains compound. Chromosomes small; basic number 10.

119. **Aeluropus** Trin.[2]

Perennials with procumbent stems usually developing as strong rhizomes or stolons; flowering stems procumbent to erect, solitary or caespitose, with many, short internodes. Leaves usually stiffly patent, flat or convolute proximally, folded distally, with a cartilaginous, often pungent apex; ligule of long

[1] By T. G. Tutin. [2] By C. A. Stace.

hairs; leaf-sheaths overlapping, persistent on stolons and rhizomes. Inflorescence a 2-sided raceme of more or less sessile spikes; spikes with up to *c.* 20 closely packed, sessile, flattened spikelets arranged distichously and broadside to axis. Spikelets with (2–)4–8(–12) florets. Glumes slightly unequal, with a wide, membranous margin, mucronate. Lemma similar to glumes. Palea about equalling lemma, 2-veined, strongly keeled and enclosing the grain. Grain oblong-ellipsoid; hilum punctiform, basal.

Inflorescence 10–50 × 4–10 mm; lower spikes on same side of axis of main inflorescence not overlapping **1. littoralis**
Inflorescence 5–20 × 3–8 mm; all spikes closely imbricate **2. lagopoides**

1. A. littoralis (Gouan) Parl., *Fl. Ital.* **1**: 461 (1850) (incl. *A. intermedius* Regel, *A. pungens* (Bieb.) C. Koch). Rhizomes and stolons extensively creeping; flowering stems up to 25 cm, erect or decumbent. Leaves and sheaths strongly and closely ridged, glabrous to sparsely hairy on abaxial surface; leaves up to 5 cm but often much less, glabrous to sparsely hairy on adaxial surface. Inflorescence 10–50 × 4–10 mm, narrowly ovoid; axis of inflorescence and spikes minutely aculeolate to shortly pubescent; lower spikes on same side of axis not overlapping, at least on main inflorescences. Lower glume 1–2·5 mm, 1- to 4-veined; upper glume 1·5–3 mm, 3- to 6-veined. Lemma 1·5–4 mm including mucro, 9- to 11-veined; mucro 0·1–0·3 mm. Glumes and lemma glabrous or hairy on hyaline margins, aculeolate on main veins. $2n=20$. *Sandy places, mostly maritime and saline. Mediterranean region and S.E. Europe.* Al Bl Bu Co Cr Ga Gr Hs It Ju Rm Rs (W, K, E) Si Tu.

Typical *A. littoralis* has glabrous or very sparsely hairy leaves and sheaths, and glabrous lemmas 2–3·5 mm. **A. intermedius** Regel, *Bull. Soc. Nat. Moscou* **41(2)**: 292 (1869) (*A. littoralis* subsp. *intermedius* (Regel) Tzvelev), from S.E. Russia, differs only in its more densely hairy leaves and somewhat longer lemmas (2·3–4 mm), and **A. pungens** (Bieb.) C. Koch, *Linnaea* **21**: 408 (1848) (*A. littoralis* subsp. *pungens* (Bieb.) Tzvelev), also from S.E. Russia, differs only in its somewhat shorter lemmas (1·5–3 mm) which are hairy on the hyaline margins. Each probably merits only varietal status.

2. A. lagopoides (L.) Trin. ex Thwaites *Enum. Pl. Zeyl.* 374 (1864) (*A. repens* (Desf.) Parl.). Like **1** but more compact; stolons and rhizomes far-creeping or not; flowering stems up to 15 cm; at least the lower leaves and sheaths hairy on abaxial surface; leaves mostly less than 15 mm; inflorescence 5–20 × 4–8 mm, ovoid to suborbicular; adjacent spikes on same side of axis closely imbricate; glumes and lemmas hairy on dorsal surface. *Maritime sands. Islands of the Mediterranean region eastwards from Sicilia.* Cr Si ?Tu. (*N. & N.E. Africa, S. & S.C. Asia.*)

1 and **2** are usually quite distinct, but intermediates sometimes occur, especially in W. Asia. Specimens with hairy leaves and sparsely hairy lemmas, but otherwise resembling *A. littoralis*, have been referred to *A. littoralis* var. *intermedius* Cosson & Durieu or var. *hispidulus* Halácsy.

Tribe **Eragrostideae** Stapf (incl. *Sporoboleae* Stapf)

Leaves linear or setaceous; silica-bodies saddle-shaped; 1- or 2-celled, short, swollen or globose micro-hairs present; ligule usually a row of multicellular hairs. Inflorescence a panicle or of spikes or spike-like racemes. Spikelets all hermaphrodite, laterally compressed or subterete, with 1–many florets. Rhachilla disarticulating above the glumes and between the florets from above downwards, or persistent and the grains and lemmas falling in succession from below upwards, with or without the paleas, or rarely the spikelet falling entire. Glumes shorter than the spikelet. Lemma membranous to coriaceous, unawned or rarely with an apical awn, 1- to 3(–5)-veined. Palea 2-keeled. Lodicules 2, truncate. Stamens 1–3. Ovary glabrous; styles 2. Grain sometimes with free pericarp, becoming mucilaginous when wet; hilum punctiform; embryo about half as long as grain; starch-grains compound. Chromosomes small; basic number 9, 10, 12(?6).

120. **Cleistogenes** Keng[1]

Perennials. Leaves flat; ligule a ciliate rim. Inflorescence a rather lax panicle. Spikelets subterete, with (1–)2–5 florets. Glumes unequal, membranous, shorter than the florets, 1-veined. Lemma obscurely 3-veined, keeled above, shortly 2-dentate and often awned at apex. Palea similar to the lemma. Stamens 3. Rhachilla disarticulating above the glumes.

Stems 30–100 cm, straight; awn not more than 3 mm **1. serotina**
Stems not more than 20 cm, flexuous; awn up to 4 mm **2. squarrosa**

1. C. serotina (L.) Keng, *Sinensia* **5**: 149 (1934) (*Diplachne serotina* (L.) Link, *Molinia serotina* (L.) Mert. & Koch). Caespitose, usually with short, stout, densely scaly rhizomes. Stems 30–100 cm, erect, usually with 10–14 leaves. Lower leaves 2–6 mm wide, flat, the upper involute, patent. Terminal panicle 4–10 cm, usually with small axillary inflorescences concealed within the upper leaf-sheaths. Spikelets 6–10 mm. Lemmas widely spaced, lanceolate, puberulent, usually dark purple; awn up to 3 mm. *Dry, rocky places and scrub. S. & S.C. Europe.* Al Au Bu Cz Ga Gr He Hs Hu It Ju Rm Rs (C, W, K, E) Si Tu.

The florets are most usually cleistogamous and without lodicules; those of the axillary inflorescences are apparently always so.

(a) Subsp. **serotina**: Rhizomes densely scaly. Leaves 4–7 mm wide. Awn not more than 1 mm. $2n=40$. *Throughout most of the range of the species, but in U.S.S.R. only in Krym.*

(b) Subsp. **bulgarica** (Bornm.) Tutin, *Bot. Jour. Linn. Soc.* **76**: 361 (1978) (*Diplachne serotina* subsp. *bulgarica* Bornm., *D. bulgarica* (Bornm.) Roshev.): Rhizomes not densely scaly. Leaves not more than 3 mm wide. Awn 2–3 mm. $2n=40$. *S. part of U.S.S.R., E. Romania, E. Bulgaria.*

2. C. squarrosa (Trin.) Keng, *Sinensia* **5**: 156 (1934) (*Diplachne squarrosa* (Trin.) Maxim.). Like **1** but stems up to 20 cm, strongly flexuous; rhizomes not densely scaly; leaves not more than 3 mm wide; spikelets with 1–3 florets; lemma with awn up to 4 mm. *Steppes and sandy ground. S.E. Russia and E. Ukraine.* Rs (C, W, E).

121. **Eragrostis** N. M. Wolf[1]

Annuals or perennials. Leaves flat or convolute, narrow; ligule a ring of hairs (rarely membranous). Inflorescence a panicle. Spikelets laterally compressed, with 2–many florets. Glumes unequal to subequal, membranous, shorter than the florets, 1-veined. Lemma 3-veined, membranous, usually unawned, falling separately or with the palea and grain. Palea hyaline, 2-keeled, often persistent. Stamens 3 or 2. Lodicules 2, minute, rarely absent, not toothed.

Several other species occur as casuals.

[1] By T. G. Tutin.

1 Perennial, with rhizome or stout stock
2 Spikelets ovate, green or purplish-green **9. collina**
2 Spikelets linear, grey or blackish **3. papposa**
1 Annual
3 Spikelets 1–2(–2·5) mm; ligule membranous **8. diarrhena**
3 Spikelets 3–25 mm; ligule a ring of hairs
4 Leaves with glands on the margin
5 Lemma 1·5–2 mm **5. minor**
5 Lemma 2–2·8 mm **4. cilianensis**
4 Leaves without glands on the margin
6 Upper glume 1½–2 times as long as lower
7 Lower panicle-branches 2 or more; lower glume 0·5 mm; lemma with inconspicuous lateral veins **1. pilosa**
7 Lower panicle-branches 1-2; lower glume 1 mm; lemma with conspicuous lateral veins **2. pectinacea**
6 Upper glume about as long as lower
8 Lower leaf-sheaths with small axillary inflorescences **6. barrelieri**
8 Inflorescences all terminal on leafy stems **7. aegyptiaca**

1. E. pilosa (L.) Beauv., *Agrost.* 71, 162 (1812) (incl. *E. gracilis* Velen.). Annual. Stems 5–50 cm, many, erect or geniculate, smooth and glabrous. Leaves up to 15 cm × 3 mm, scabridulous above and scabrid but eglandular on the margin. Panicle up to 20 cm, lax; lower branches 2 or more, more or less verticillate, usually with long hairs in their axils; pedicels mostly shorter than spikelets. Spikelets up to 5 mm, with 5–10 florets. Glumes unequal, the lower 0·5 mm, oblong, the upper 1 mm, ovate. Lemma oblong, acute, greyish with purple apex; basal smooth, the lateral veins inconspicuous. Grain 0·7–0·8 mm. $2n=40$. *Disturbed habitats, usually sandy. Europe, northwards to N.C. France and N.C. Russia, but absent from many of the islands.* Al Au Bu Co Cz Ga Ge Gr He Hs Hu It Ju Lu Rm Rs (C, W, K, E) Sa Si Tu.

E. tef (Zucc.) Trotter, *Bull. Soc. Bot. Ital.* **1918**: 62 (1918) is cultivated on a small scale for its grain and also occurs as a casual in Germany and perhaps elsewhere. It is like **1** but larger in all its parts, with stems up to 100 cm and grain *c.* 1·25 mm, and the lemma is strongly scabrid on the keel. It is native in Ethiopia.

2. E. pectinacea (Michx) Nees, *Fl. Afr. Austr.* 406 (1841). Like **1** but lower panicle-branches 1–2; lower glume 1 mm, the upper 1·5 mm; lemma with conspicuous lateral veins. *Naturalized in W. France.* [Ga.] (*Temperate North America.*)

3. E. papposa (Dufour) Steudel, *Syn. Pl. Glum.* **1**: 263 (1854). Perennial, with creeping rhizome. Stems 10–45 cm, erect or geniculate, smooth and glabrous. Leaves up to 10 cm × 2 mm, scabrid on the margin. Panicle very lax; lower branches usually solitary; pedicels longer than spikelets. Spikelets 3–7 mm, with 4–18 florets. Glumes unequal. Lemma suborbicular, obtuse, grey or blackish. *Rocky or sandy places. S.E. Spain.* Hs. (*N. & C. Africa, extending eastwards to India.*)

4. E. cilianensis (All.) F. T. Hubbard, *Philippine Jour. Sci.* (*Bot.*) **8**: 159 (1913) (*E. major* Host, *E. megastachya* (Koeler) Link). Annual. Stems up to 60 cm, erect or decumbent at base, somewhat glaucous, smooth and glabrous or sparsely hairy. Leaves up to 15 cm × 4 mm, with elevated glands on the margin and midrib. Panicle up to 15 cm, usually rather dense; lower branches usually solitary; pedicels shorter than the spikelets, with 1–2 crateriform glands. Spikelets 4–25 mm, with up to 40 florets. Glumes subequal, ovate, acute. Lemma 2–2·8 mm, broadly ovate, acute, often glandular on the keel, purplish. $2n=20$. *Rocky places and disturbed ground. S. Europe, extending northwards to Hungary; casual and locally naturalized elsewhere in C. Europe.* Al Az Bl Bu Co Cr Ga Gr Hs Hu It Ju Lu Rm Rs (W, K) Sa Si Tu [*Cz Ge He].

5. E. minor Host, *Gram. Austr.* **4**: 15 (1809) (incl. *E. suaveolens* A. Becker ex Claus). Annual. Stems up to 50 cm, erect or geniculate, smooth, with sparse, long hairs. Leaves up to 15 cm × 3 mm, with sparse, long hairs and with elevated glands on the margin. Panicle 4–15 cm, usually rather lax, terminal on stems and leafy branches; lower branches solitary or in pairs; pedicels shorter or longer than the spikelets, with 1–2 crateriform glands. Spikelets 4–11 mm, with 5–12(–20) florets. Glumes subequal, lanceolate to ovate. Lemma 1·5–2 mm, lanceolate to ovate, acute, without glands on the keel, greenish- or purplish-grey. $2n=40$, 80. *Disturbed ground. S., S.E. & S.C. Europe; naturalized elsewhere in C. Europe.* Al Au Az Bu Co Cz Ga Gr He Hs Hu It Ju Lu Rm Rs (C, W, K, E) Sa Si Tu [Ge Po Rs (B)].

6. E. barrelieri Daveau, *Jour. Bot.* (*Paris*) **8**: 289 (1894). Like **5** but leaves glabrous, though sometimes ciliate towards the base; panicles terminal and axillary, the latter arising from the lower nodes and emerging from the tops of the sheaths; spikelets 7–15 mm, with 10–20 florets. *Disturbed ground. W. Mediterranean region.* Bl Ga Hs It Si.

The distribution is probably imperfectly known, owing to confusion with **5**.

7. E. aegyptiaca (Willd.) Link, *Hort. Berol.* **1**: 191 (1827). Annual. Stems up to 40 cm, procumbent or ascending, smooth, glabrous. Leaves up to 3 mm wide, glabrous, scabrid on the margin. Panicle up to 15 cm, rather dense; lower branches usually verticillate; pedicels shorter than the spikelets. Spikelets up to 10 mm, with 15–20 florets. Glumes subequal, lanceolate, acuminate. Lemma oblong-lanceolate, acuminate. Lemma oblong-lanceolate, pale. *Sandy river-banks. S. part of U.S.S.R.* Rs (C, W, E).

8. E. diarrhena (Schultes & Schultes fil.) Steudel, *Syn. Pl. Glum.* **1**: 266 (1854) (*E. kossinskyi* Roshev.). Annual. Stems up to 50 cm, smooth. Leaves up to 5 mm wide, scabrid above; ligule membranous. Panicle up to 20 cm, rather dense; lower branches usually verticillate; pedicels shorter than spikelets. Spikelets 1·5–2·5 mm, with 4–10 florets. Glumes subequal, ovate-lanceolate, obtuse. Lemma ovate-lanceolate, obtuse, usually purplish. ● *S.E. Russia* (*Volga delta*). Rs (E).

9. E. collina Trin., *Mém. Acad. Sci. Pétersb.* ser. 6, **1**: 413 (1830) (*E. arundinacea* (L.) Roshev., non Jedwabn.). Perennial. Stems up to 150 cm, erect, simple, surrounded at the base by short, coriaceous sheaths. Leaves up to 30 cm × 10 mm, smooth, with scabrid margin. Panicle up to 25 cm, lax; lower branches solitary; pedicels shorter than the spikelets. Spikelets 2–2·5 mm, with 3–5 florets. Glumes unequal, the lower lanceolate, acute, the upper ovate-oblong, obtuse. Lemma ovate, obtuse, green or purplish-green. *Saline soils. S.E. Russia.* Rs (E).

122. Sporobolus R. Br.[1]

Perennials. Leaves flat or involute; ligule a row of short hairs. Inflorescence a panicle. Spikelets with 1 floret. Glumes usually unequal, 1-veined. Lemma 1-veined, unawned. Palea like the lemma, usually shallowly 2-fid at apex. Stamens 2–3. Rhachilla disarticulating above the glumes. Grain spherical or oblong-elliptical, enclosed in a gelatinous pericarp.

Literature: W. D. Clayton, *Kew Bull.* **19**: 287–296 (1965). P. Jovet & M. Guédès, *Bull. Cent. Étud. Rech. Sci. Biarritz* **7**: 47–75 (1968).

[1] By A. Hansen.

Rhizome extensively creeping; leaves crowded, distichously arranged; inflorescence ovate or ovate-lanceolate **1. pungens**
Caespitose; leaves few, not distichously arranged; inflorescence long, dense, cylindrical, spike-like **2. indicus**

1. S. pungens (Schreber) Kunth, *Révis. Gram.* **1**: 68 (1829). Widely creeping, with wiry rhizomes and stem-bases, glabrous. Stems 10–30 cm, ascending, simple or branched from the lower nodes. Sheaths crowded, overlapping; leaves 2–8 cm × 2–5 mm, firm, involute, conspicuously distichous, especially on the numerous non-flowering shoots, hairy above. Panicle 3–6 cm, greyish-violet, much-branched, the branches mostly alternate. Spikelets 1·5–2·5 mm, shortly pedicellate, crowded; glumes unequal, the upper nearly as long as the subequal lemma and palea, all lanceolate, acute and glabrous. Anthers 1–1·5 mm. *Maritime sands and marshes. S. Europe.* Bl Co Cr Ga Gr Hs It Ju †Lu *Rm Sa Si.

Sometimes regarded as a variety or subspecies of the pantropical species *S. virginicus* (L.) Kunth.

2. S. indicus (L.) R. Br., *Prodr. Fl. Nov. Holl.* 170 (1810). Stems 60–100 cm, erect, in large clumps with numerous leafy shoots at base. Cauline leaves few, 20–30 cm, long-attenuate, flat or folded, aculeolate on margins and upper surface. Panicle up to 30 cm, linear-cylindrical, stiff, dark greyish, often more open and lax at base. Spikelets 1·5–2·5 mm, crowded on slender, erect, usually appressed branches; glumes unequal, the lower obtuse, the upper acute, half as long as the acute lemma; lemma longer than the obtuse palea. Anthers 0·5 mm. $2n=36$. *Waste places and roadsides. Naturalized in S. Europe.* [Az Bu Ga Hs It Lu.] (*Tropics and subtropics.*)

A highly polymorphic species.

123. Crypsis Aiton[1] (incl. *Heleochloa* Host)

Annuals. Leaves flat. Inflorescence a globose or spicate panicle, usually closely subtended by the enlarged sheaths of the uppermost leaves. Spikelets strongly compressed laterally. Glumes subequal, membranous, 1-veined. Lemma equalling or exceeding glumes, membranous, 1-veined. Palea 2-keeled. Stamens 2–3. Lodicules absent. Rhachilla disarticulating below the glumes.

1 Inflorescence wider than long, the rhachis obsolete **3. aculeata**
1 Inflorescence longer than wide, with a distinct rhachis
 2 Glumes and lemma mucronate or shortly awned **2. acuminata**
 2 Glumes and lemma not mucronate or awned
  3 Sheath of uppermost leaf longer than lamina, scarcely inflated; inflorescence cylindrical **1. alopecuroides**
  3 Sheath of uppermost leaf shorter than lamina, strongly inflated; inflorescence ovoid
   4 Inflorescence dense; spikelets *c.* 3 mm; lemma acute **4. schoenoides**
   4 Inflorescence rather lax; spikelets *c.* 4·5 mm; lemma obtuse **5. turkestanica**

1. C. alopecuroides (Piller & Mitterp.) Schrader, *Fl. Germ.* 167 (1806) (*Heleochloa alopecuroides* (Piller & Mitterp.) Host ex Roemer). Stems up to 30 cm, numerous, geniculately ascending. Leaves green or somewhat glaucous, shortly hairy above; sheaths glabrous, the uppermost longer than lamina, scarcely inflated. Inflorescence up to 8 × 0·8 cm. Spikelets 2–3 mm, shortly pedicellate. Glumes lanceolate, ciliate-serrulate on the keel. Lemma little longer than glumes, but exserted. Stamens 3. *Seasonally wet places. Europe northwards to N.C. France, Czechoslovakia and C. Russia.* ?Al Au Bu Co Cz Ga Gr Hu It Ju Lu Rm Rs (C, W, K, E) Si Tu.

2. C. acuminata Trin. in Sprengel, *Neue Entdeck.* **2**: 57 (1820) (*C. borszczowii* Regel). Like **1** but leaves villous on both surfaces; sheaths with numerous tubercle-based hairs; spikelets *c.* 4 mm; glumes and lemma with a stout mucro or short awn. *Damp places. S.E. Russia.* Rs (E). (*C. Asia.*)

3. C. aculeata (L.) Aiton, *Hort. Kew.* **1**: 48 (1789). Stems up to 20 cm, numerous, procumbent, ascending distally. Leaves glaucous, sparsely hairy to almost glabrous on both surfaces; sheaths glabrous, the upper strongly inflated and shorter than the lamina. Inflorescence capitate, wider than long, the rhachis obsolete. Spikelets *c.* 4 mm, subsessile. Glumes lanceolate, ciliate on the keel and near the apex on the margin. Lemma acute, longer than glumes. Stamens 2. $2n=16$. *Damp, usually saline places. Europe, northwards to N.W. France, Czechoslovakia and S.C. Russia.* ?Al Au Bu Co Cr Cz Ga Gr Hs Hu It Ju Lu Rm Rs (C, W, K, E) Sa Si Tu.

4. C. schoenoides (L.) Lam., *Tabl. Encycl. Méth. Bot.* **1**: 166 (1791) (*Heleochloa schoenoides* (L.) Host). Like **3** but inflorescence longer than wide, with a distinct rhachis, dense; spikelets *c.* 3 mm; glumes not ciliate on the margin; stamens 3. $2n=36$. *Damp places. Europe, northwards to N.W. France, Czechoslovakia and C. Russia.* Al Au Bu Co Cr Cz Ga Gr Hs Hu It Ju Lu Rm Rs (C, W, K, E) Sa Si Tu.

5. C. turkestanica Eig, *Agric. Rec.* (*Tel-Aviv*) **2**: 206 (1929). Like **3** but stems not more than 15 cm, procumbent; inflorescence longer than wide, with a distinct rhachis, rather lax; spikelets *c.* 4·5 mm; glumes not ciliate on the margin; lemma obtuse; stamens 2–3. *Saline sands and gravels. S.E. Russia.* Rs (E). (*C. Asia.*)

124. Eleusine Gaertner[2]

Annuals or perennials. Leaves flat. Ligule a ring of hairs. Inflorescence of several spikes more or less digitately arranged at the top of the flowering stem. Spikelets compressed, with 2–many florets in 2 rows on one side of a broad rhachis. Glumes unequal, shorter than the florets, 1- to 7-veined; lemma 1- to 3-veined, unawned. Stamens 3. Grain striate; pericarp membranous, not adherent to seed.

Annual, with 5–12 slender spikes up to 15 cm **1. indica**
Perennial, with 2–4 thick spikes not more than 3·5 cm **2. tristachya**

1. E. indica (L.) Gaertner, *Fruct. Sem. Pl.* **1**: 8 (1788). Caespitose annual. Stems 15–85 cm, branching near base, erect or geniculate; sheaths compressed, glabrous. Leaves 5–23 cm × 3–6 mm, linear. Inflorescence of 5–12 slender spikes each 3·5–15 cm × 3–5 mm; spikelets elliptical, with 4–9 florets. Glumes unequal, acute, lanceolate-oblong. Lemma lanceolate; keel broadened above middle. Grain 1–1·3 mm, brownish-red. *Roadsides and disturbed ground. Naturalized in S. Europe; casual elsewhere.* [Az Bu Ga ?Hs It Lu.] (*Tropics and subtropics.*)

A polymorphic species.

2. E. tristachya (Lam.} Lam., *Tabl. Encycl. Méth. Bot.* **1**: 203 (1792). Perennial. Stems 10–30 cm, ascending. Leaves 2–15 cm × 2–3 mm. Inflorescence of 2–4 dense spikes each 1·5–3·5 cm × 7–15 mm. Spikelets with 5–10 florets. Glumes unequal, acute, ovate-lanceolate. Lemma ovate-lanceolate, concave, strongly

[1] By T. G. Tutin. [2] By A. Hansen.

keeled. Grain *c.* 1 mm, black. *Roadsides and waste places. Naturalized in S.W. Europe.* [Az Ga Hs It.] (*South America.*)

125. **Dactyloctenium** Willd.[1]

Annuals or perennials. Leaves flat. Inflorescence of digitately arranged spikes. Spikelets laterally compressed, crowded and imbricate, in 2 rows on an axis which is triangular in cross section; florets 3–5, all fertile. Glumes unequal, the lower persistent, the upper deciduous, with a curved awn or mucro; lemma similar to upper glume, with curved awn or mucro. Grain coarsely ridged and sculptured.

1. D. aegyptium (L.) Beauv., *Agrost.* 72, *Expl. Pl.* 10 (1812). Annual, with erect stem 10–50 cm, usually geniculate-ascending and rooting at nodes, glabrous. Leaves *c.* 15 cm × 4–5 mm, linear-acuminate, ciliate with bulbous-based hairs on margins; ligule short, ciliate. Spikes 4–5, 1·5–5 cm; axis straight or falcate, flattened, without spikelets in the distal part. Spikelets 4 mm, usually with 3 florets; upper glume 4 mm (including awn), ovate, 1-veined, strongly keeled, the awn 1·5–2 mm; lemma 4 mm, oblong-gibbous, 3-veined. *Moist, shady places. Naturalized in the Mediterranean region.* [Cr It Si.] (*Tropics and subtropics.*)

Tribe **Chlorideae** J. G. Agardh

Like *Eragrostideae* but inflorescence of solitary, digitate or scattered spikes or spike-like racemes; spikelets with 1(–2) hermaphrodite floret and 1 or more sterile florets or with the rhachilla prolonged; lemma often awned; pericarp of grain never free.

126. **Cynodon** L. C. M. Richard[2]

Perennials. Leaves flat. Inflorescence of usually 3–5 secund spikes digitately arranged at apex of flowering stem. Spikelets laterally compressed, with 1 floret. Glumes subequal, membranous, keeled, 1-veined. Lemma longer than glumes, chartaceous, obscurely 3-veined. Palea 2-keeled. Stamens 3. Rhachilla disarticulating above the glumes.

1. C. dactylon (L.) Pers., *Syn. Pl.* **1**: 85 (1805). Extensively creeping by stolons and scaly rhizomes; stems up to 30 cm. Leaves up to 6 cm, linear-lanceolate; ligule a ring of hairs. Spikes 1–5 cm. Spikelets 2 mm, subsessile on the flattened rhachis. Glumes linear-lanceolate, often purplish. Lemma naviculiform, sparingly villous on keel and margins. Rhachilla glabrous, prolonged. $2n = 36, 40$. *W., S., S.E. & E.C. Europe, northwards to S. England and N. Ukraine.* Al Au Az Bl Br Bu Co Cr Cz Ga Gr He Ho Hs Hu It Ju Lu Rm Rs (C, W, K, E) Sa Si Tu [Ge].

Tribe **Spartineae** (Prat) C. E. Hubbard

Like *Eragrostideae* but silica-bodies rounded; 2-celled microhairs globose, sunk in pits in the epidermis; ligule a row of unicellular hairs; inflorescence of racemosely arranged spikes; spikelets with 1 floret; rhachilla disarticulating below the glumes; lemma (3–)5(–9)-veined; lodicules absent; grain with an ovate to elliptical hilum; embryo nearly as long as grain; basic chromosome number 10.

127. **Spartina** Schreber[2]

Rhizomatous perennials. Leaves flat or convolute. Inflorescence of a number of spikes arranged in a raceme. Spikelets strongly compressed laterally, in 2 rows, closely appressed to one face of the triangular rhachis, each with 1(–2) florets. Glumes unequal, chartaceous, the lower 1-veined, the upper 1- to 3(–6)-veined, about as long as lemma. Lemma 1- to 6-veined, coriaceous, with a wide membranous margin. Palea slightly shorter than lemma.

All species occur in maritime habitats, often on tidal mud-flats.

1 Glumes glabrous or with sparse, very short hairs
 2 Upper glume 1-veined **6. densiflora**
 2 Upper glume with 3 or more veins
  3 Spikelets at least 10 mm; glumes with sparse, very short hairs **4. alterniflora**
  3 Spikelets not more than 7 mm; glumes glabrous but serrulate on mid-vein **5. versicolor**
1 Glumes rather densely hairy with hairs up to 0·5 mm
 4 Anthers 8–13 mm; hairs of the ligule usually 2–3 mm **3. anglica**
 4 Anthers 4–8 mm; hairs of the ligule 0·2–2 mm
  5 Anthers 5–8 mm, indehiscent, without fertile pollen; stems 30–130 cm; leaves 4–12 mm wide **2. × townsendii**
  5 Anthers 4–6 mm, dehiscent, with fertile pollen; stems 15–50 cm; leaves not more than 6 mm wide **1. maritima**

1. S. maritima (Curtis) Fernald, *Rhodora* **18**: 180 (1916) (*S. stricta* (Aiton) Roth). Laxly caespitose; stems 15–70 cm, rather robust. Leaves not more than 6 mm wide, green, often purplish-tinged, the upper cauline erecto-patent; hairs of the ligule 0·2–0·5 mm. Inflorescence 4–10 cm, with (1–)2–3(–5) spikes; rhachis of spikes prolonged up to 14 mm beyond the spikelets. Spikelets 10–15 mm. Glumes linear-lanceolate, rather densely hairy with hairs up to 0·5 mm, the upper 3-veined. Lemma narrowly oblong-lanceolate, minutely hairy above. Anthers 4–6 mm, dehiscent, with fertile pollen. $2n = 60$. *Coasts of S. & W. Europe, from the Netherlands to Jugoslavia.* Be Br Ga Ho Hs It Ju Lu.

2. S. × townsendii H. & J. Groves, *Rep. Bot. Exch. Club Brit. Is.* **1880**: 37 (1881) (*S. alterniflora* × *maritima*). Like **1** but stems 30–130 cm, more robust; leaves 4–12 mm wide, usually yellowish-green; hairs of ligule 1–2 mm; inflorescence 12–35 cm, with usually 2–4 spikes; rhachis prolonged up to 40 mm; spikelets 12–18 mm; upper glume 3- to 6-veined; anthers 5–8 mm, indehiscent, without fertile pollen. $2n = 62$. ● *S. England, W. France; widely planted elsewhere for mud-binding.* Br Ga [Be Da Ge Hb Ho].

3. S. anglica C. E. Hubbard, *Bot. Jour. Linn. Soc.* **76**: 364 (1978). Like **1** but stems 30–130 cm, more robust; leaves 6–15 mm wide, yellowish-green, the upper cauline usually patent; hairs of ligule 2–3 mm; inflorescence 12–35 cm, with 3–6(–12) spikes; rhachis prolonged up to 50 mm; spikelets (14–)16–21 mm; anthers 8–13 mm, dehiscent, with fertile pollen. $2n = 120, 122, 124$. ● *S. England; widely planted elsewhere for mud-binding.* Br [Be Da Ga Ge Hb Ho].

An amphidiploid presumed to have been derived from **2**.

4. S. alterniflora Loisel., *Fl. Gall.* 719 (1807). Laxly caespitose; stems 40–100 cm, robust. Leaves 5–10 mm wide, flat, green; hairs of ligule *c.* 1 mm. Inflorescence 10–25 cm, with (3–)5–13 rather distant spikes; rhachis of spikes prolonged up to 27 mm beyond the spikelets. Spikelets 10–15 mm. Lower glume linear, the upper ovate-lanceolate, with sparse, very short hairs, 3- to 5-veined. Lemma ovate-lanceolate, glabrous. Anthers 5–6 mm. $2n = 62$. *Naturalized in S. England, W. France and N. Spain.* [Br Ga Hs.] (*North America.*)

5. S. versicolor Fabre, *Ann. Sci. Nat.* ser. 3 **13**: 123 (1850). Laxly caespitose; stems 60–150 cm, rather robust. Leaves junci-

[1] By A. Hansen. [2] By T. G. Tutin.

form, 0·8–1·5 mm in diameter, at first purplish; hairs of ligule *c.* 0·2 mm. Inflorescence 6–16 cm, with 2–6 rather distant spikes; rhachis of spikes not prolonged beyond the spikelets. Spikelets 5–7 mm. Glumes lanceolate, glabrous, the upper 3-veined. Lemma ovate-lanceolate, glabrous. Anthers *c.* 4 mm. *S.W. Europe and W. Mediterranean region.* Az Co Ga Hs It Lu Sa Si.

6. S. densiflora Brongn., *Bot. Voy. Coq.* 14 (1829). Densely caespitose; stems up to 150 cm, robust. Leaves junciform, 3–8 mm wide when flat; hairs of ligule 1–2 mm. Inflorescence 10–30 cm, with 2–15 usually overlapping spikes, closely appressed to the axis. Spikelets 8–14 mm. Glumes lanceolate, glabrous or with sparse, very short hairs, both 1-veined. Lemma lanceolate, with sparse, very short hairs. Anthers 3–5 mm. *Naturalized in S.W. Spain.* [Hs.] (*Coasts of temperate South America.*)

Tribe **Zoysieae** Miq.

Leaves usually convolute, plicate or setaceous; silica-bodies saddle-, dumbbell- or cross-shaped; swollen 2-celled micro-hairs present; ligule absent or a row of hairs. Inflorescence a compound raceme. Spikelets all hermaphrodite or some male, falling entire, singly or in groups, dorsally compressed, with 1 floret. Glumes longer than the floret, one or both with curved spines or hooks on the back, or smooth. Lemma and palea hyaline. Lodicules 2 or absent. Stamens 3 or 2. Ovary glabrous; styles 2. Grain with free pericarp; hilum punctiform; starch-grains compound. Chromosomes small; basic number 9, 10.

128. **Tragus** Haller[1]

Annuals. Leaves flat. Inflorescence spike-like. Spikelets dorsally compressed, with 1 floret. Glumes very unequal, the lower minute, hyaline, the upper 7-veined, longer than the floret, chartaceous, with hooked spines on the veins. Lemma 3-veined, hyaline, setulose on the back. Palea as long as lemma. Stamens 3.

1. T. racemosus (L.) All., *Fl. Pedem.* **2**: 241 (1785). Stems up to 40 cm, decumbent or procumbent, rooting at the lower nodes, more or less branched, smooth. Leaves 1–3 cm × 2–3 mm, rigid, acuminate; margin with tubercle-based setae; sheaths somewhat inflated; ligule a line of stout hairs. Inflorescence 2–8 cm. Spikelets *c.* 4 mm, in groups of 2–5 at the ends of short branches, each group falling entire at maturity. Upper glume lanceolate, acuminate. Lemma lanceolate, acute. Anthers *c.* 0·5 mm. *Dry, sandy or stony places. S. & S.C. Europe.* Al Au Bl Bu Co Cz Ga Gr He Hs Hu It Ju Rm Rs (W, K, E) Sa Si Tu [Ge].

Tribe **Oryzeae** Dumort.

Leaves linear; silica-bodies dumbbell-shaped, arranged transversely; elongate, 2-celled micro-hairs present; ligule membranous, lacerate. Inflorescence a panicle. Spikelets all hermaphrodite or very rarely unisexual, laterally compressed, with 1 floret, rarely with 2 sterile florets below it. Glumes minute or absent. Lemmas 1 or 3, membranous to coriaceous, when 3 the two lower scale-like, unawned or with a terminal awn. Palea like the lemma of the fertile floret. Lodicules 2, entire or 2-lobed. Stamens 6, 3 or 1. Ovary glabrous; styles 2. Grain with a linear hilum as long as the grain; starch-grains compound. Chromosomes small; basic number 12.

[1] By T. G. Tutin. [2] By A. Hansen and T. G. Tutin.

129. **Oryza** L.[1]

Robust annuals or perennials. Leaves flat. Inflorescence a panicle. Spikelets strongly laterally compressed, with 1 floret, disarticulating above the glumes, but long-persistent in cultivars. Glumes represented by small, semi-orbicular scales. Sterile lemmas usually 2, much shorter than the fertile lemma, 1-veined. Fertile lemma indurate, with 5 prominent veins. Palea similar to the fertile lemma but narrower and 3-veined. Stamens 6.

1. O. sativa L., *Sp. Pl.* 333 (1753). Annual. Stems up to 100 cm, erect, glabrous. Leaves up to 60 × 1·5 cm, scabrid on the margin; sheaths with ciliate auricles; ligule up to 20 mm, acute, chartaceous. Panicle up to 30 cm, nodding after anthesis. Spikelets up to 12 mm. Glumes *c.* 0·25 mm. Lemma with appressed hairs, particularly on the veins, awned or not. Palea ciliate on the mid-vein. *Cultivated as a cereal (rice) in S. & S.C. Europe.* [Al Bu Cz Ga Gr Hs Hu It Ju Lu Rm Rs (W, K, E).] (*S. Asia.*)

130. **Leersia** Swartz[1]

Like *Oryza* but glumes and sterile lemmas absent; fertile lemma and palea herbaceous; stamens 1–6.

1. L. oryzoides (L.) Swartz, *Nov. Gen. Sp. Pl.* 21 (1788). Rhizomatous perennial. Stems up to 100 cm, decumbent and rooting at the lower nodes; nodes bearded. Leaves up to 30 × 1 cm, long-acute, scabrid on the margin; upper sheaths often inflated, more or less scabrid; ligule *c.* 1 mm, truncate, chartaceous. Panicle 5–17 cm, lax; branches flexuous. Spikelets 5–6 mm, very shortly pedicellate. Fertile lemma strigulose, pectinate-ciliate on keel. $2n = 48$. *Wet places. From S. England and S. Finland southwards to the Açores, C. Italy and Turkey-in-Europe.* Al Au Az Be Br Bu Co Cz Da Fe Ga Ge He Ho Hs Hu It Ju Lu Po Rm Rs (N, B, C, W, E) Su Tu.

The inflorescence is sometimes chasmogamous and completely exserted from the leaf-sheath, with anthers *c.* 3 mm, sometimes cleistogamous and partly or wholly enclosed in the leaf-sheath, with anthers *c.* 0·5 mm, depending on climatic conditions.

131. **Zizania** L.[2]

Annuals or perennials. Leaves flat. Inflorescence a large terminal panicle with patent or ascending branches. Spikelets with 1 floret, unisexual, falling entire. Glumes small or lacking. Male spikelets in the lower part of the panicle, pendent, the lemma unawned or shortly awned; female spikelets in the upper part of the panicle, ascending, the lemma with a long awn.

Annual; stems puberulent at the nodes; awn of female spikelets 5–6 times as long as lemma **1. aquatica**
Perennial; stems glabrous at the nodes; awn of female spikelets slightly longer than lemma **2. latifolia**

1. Z. aquatica L., *Sp. Pl.* 991 (1753). Annual. Stems 150–300 cm, up to 1 cm wide, stout, erect to decumbent, often branched, puberulent at the nodes. Leaves 50–125 cm × 5–25 mm, linear-lanceolate, with scabrid margins; ligule up to 1 cm. Inflorescence up to 40 cm; male spikelets 10 × 1–2 mm, narrowly lanceolate, usually purple-tinged at apex; stamens 6; anthers 4–5 mm, yellow; female spikelets 1·5–2 mm wide, linear, with scabrid awn 5–6 times as long as lemma. Grain 12–20 × 1·4–2 mm, linear, cylindrical, purplish-black. *Occasionally sown by lakes or rivers to attract wild-fowl; locally naturalized in the U.S.S.R. and perhaps elsewhere.* [Rs (B, C, W).] (*North America.*)

2. Z. latifolia (Griseb.) Stapf, *Kew Bull.* **1909**: 385 (1909). Like **1** but perennial; stems up to 2 cm wide, glabrous at the nodes; inflorescence up to 55 cm; awn of female spikelets only slightly longer than the lemma. *Extensively naturalized in the Volga delta.* [Rs (E).] (*Temperate E. Asia.*)

Tribe **Paniceae** R. Br.

Leaves linear to lanceolate or ovate; silica-bodies nodular, dumbbell- or cross-shaped; elongate 2-celled micro-hairs present; ligule membranous or a row of hairs, rarely absent. Inflorescence a panicle or of variously arranged racemes or spikes. Spikelets usually all hermaphrodite, usually falling entire at maturity, dorsally to laterally compressed or terete, with 2 florets, the lower male or sterile, the upper hermaphrodite. Glumes and lower lemma similar in texture. Upper lemma much firmer than the lower. Lodicules usually 2, truncate. Stamens 3. Ovary glabrous; styles 2. Grain mostly with punctiform hilum; embryo about half as long as grain; starch-grains simple. Chromosomes small; basic number 9, 10, 15, 17, 19, rarely 7.

132. **Panicum** L.[1]

Annuals or perennials. Inflorescence a panicle. Spikelets more or less compressed dorsally, unawned, with 2 florets; lower glume shorter than the spikelet; upper glume as long as the spikelet; lower floret male or sterile, its lemma resembling the upper glume, with or without a palea; upper floret hermaphrodite, the lemma crustaceous, clasping only the margins of the palea.

1 Annual, without non-flowering shoots at anthesis
2 Spikelets 4–5·5 mm — **1. miliaceum**
2 Spikelets 2–3 mm
3 Leaf-sheaths hispid — **2. capillare**
3 Leaf-sheaths glabrous — **3. dichotomiflorum**
1 Perennial, with non-flowering shoots at anthesis
4 Spikelets 1·5 mm, pubescent — **4. implicatum**
4 Spikelets 2–5·5 mm, usually glabrous
5 Plant rhizomatous; upper lemma smooth — **5. repens**
5 Plant caespitose; upper lemma rugose — **6. maximum**

1. P. miliaceum L., *Sp. Pl.* 58 (1753). Annual; stems 50–120 cm. Leaves 15–40 cm × 10–20 mm; sheaths hispid. Panicle 10–30 cm, compact, with rigid branches. Spikelets 4–5·5 mm, elliptical, persistent; lower glume ½–⅔ as long as spikelet, sharply acute to acuminate; upper glume and lower lemma many-veined, long-acute. *Cultivated, formerly widely as a cereal, now more locally and mainly for fodder, in C., S. & E. Europe, and widely naturalized.* [Al Au Bl Bu Cz Ga Ge Gr He Hs Hu It Ju Po Rm Rs (N, B, C, W, K, E) Tu.] (*China and C. Asia.*)

2. P. capillare L., *Sp. Pl.* 58 (1753). Annual; stems 20–80 cm, erect or ascending. Leaves 10–30 cm × 5–15 mm; sheaths hispid. Panicle 8–40 cm, deciduous, diffuse, with capillary branches. Spikelets 2–3 mm, elliptical; lower glume ½ as long as the spikelet, acute; upper glume and lower lemma long-acute to attenuate. *Disturbed ground. Naturalized in S., C. & E. Europe, northwards to C. Russia.* [Az ?Cz Ga ?Ge He Hs Hu It Lu Po Rm Rs (C, W, E).] (*North America.*)

3. P. dichotomiflorum Michx, *Fl. Bor. Amer.* **1**: 48 (1803). Annual; stems 50–200 cm, geniculate, ascending. Leaves 10–50 cm × 3–20 mm; sheaths glabrous. Panicle 10–40 cm, diffuse. Spikelets 2–3 mm, narrowly elliptical, deciduous; lower glume *c.* ¼ as long as the spikelet, obtuse to subacute; upper glume and lower lemma acute. *Disturbed ground. Naturalized in S. Europe.* [Ga It.] (*North America.*)

4. P. implicatum Scribner ex Britton & A. Br., *Ill. Fl. U.S. Canad.* **3**: 498 (1898). Perennial, forming a winter rosette of short, lanceolate leaves; stems 20–55 cm. Cauline leaves 2–10 cm × 2–10 mm. Panicle 3–6 cm, spreading, the branches often tangled. Spikelets 1·5 mm, pubescent, elliptical; lower glume ⅓ as long as spikelet, obtuse to acute; upper glume and lower lemma obtuse; upper lemma smooth. *Naturalized in S.W. France.* [Ga.] (*North America.*)

5. P. repens L., *Sp. Pl.* ed. 2, 87 (1762). Aggressively rhizomatous perennial; stems 15–60 cm, erect. Leaves 4–25 cm × 2–8 mm, distichous. Panicle 4–15 cm. Spikelets 2–3 mm, elliptical, glabrous; lower glume ¼ as long as the spikelet, suborbicular, cup-shaped; upper glume and lower lemma acute; upper lemma smooth. $2n = 54$. *Damp, sandy places, mostly near the sea. Mediterranean region, extending to Portugal and N.W. Spain.* Al Bl Co Cr Ga Gr Hs It Ju Lu Sa Si [Az].

6. P. maximum Jacq., *Icon. Pl. Rar.* **1**: 2 (1781). Caespitose perennial; stems 25–75 cm, erect. Leaves 5–25 cm × 3–6 mm. Panicle 6–15 cm. Spikelets 2·3–3 mm, elliptical, sparsely pubescent; lower glume ⅓ as long as the spikelet, obtuse; upper glume and lower lemma obtuse; upper lemma finely transversely rugose. *Calcareous rocks near the sea. Sicilia.* Si. (*Tropics and warm temperate regions.*)

133. **Oplismenus** Beauv.[1]

Annuals or perennials. Inflorescence of unilateral racemes, sometimes reduced to fascicles, arranged along a central axis. Spikelets with 2 florets; glumes subequal, ½–¾ as long as the spikelet, at least the lower awned; lower floret male or sterile, the lemma herbaceous; upper floret hermaphrodite, the lemma subcoriaceous.

1. O. undulatifolius (Ard.) Roemer & Schultes, *Syst. Veg.* **2**: 482 (1817). Perennial with trailing stems 15–50 cm or more. Leaves 1–7 cm × 4–15 mm, narrowly lanceolate to narrowly ovate. Inflorescence 2–8 cm, with cuneate fascicles of 2–6 spikelets. Spikelets 2·5–4 mm, lanceolate; glumes with viscid awns up to 15 mm. *Damp, shady places. Very locally from the E. Pyrenees to N.W. Jugoslavia.* He Hs It Ju. (*S.W. Asia.*)

134. **Echinochloa** Beauv.[1]

Annuals or perennials. Ligule absent in European species. Inflorescence of unilateral racemes arranged along a central axis. Spikelets in several rows, convex abaxially, flattened adaxially, cuspidate or awned, with 2 florets. Glumes unequal, the lower abaxial, shorter than the spikelet, the upper as long as the spikelet. Lower floret male or sterile, the lemma resembling the upper glume; upper floret hermaphrodite, the lemma crustaceous, smooth, clasping only the margins of the palea.

1 Racemes seldom more than 3 cm, simple; spikelets 1·5–3 mm, in 4 regular rows on each raceme, acute to cuspidate, unawned; upper lemma 1·5–2·5 mm — **1. colonum**
1 Longest racemes 2–10 cm; spikelets acuminate or awned, in 2-several irregular rows
2 Spikelets mostly 3–4 mm; upper lemma 2–3 mm; at least the longer racemes with secondary branchlets — **2. crus-galli**
2 Spikelets 3·8–6·5 mm; upper lemma 3·5–5 mm; racemes simple — **3. oryzoides**

[1] By W. D. Clayton.

1. E. colonum (L.) Link, *Hort. Berol.* **2**: 209 (1833). Laxly caespitose annual; stems 10–70 cm. Inflorescence 4–15 cm, the racemes up to 3 cm, simple. Spikelets 1·5–3 mm, in 4 regular rows on each raceme, subglobose to ovate-elliptical, pubescent, acute to cuspidate, unawned; upper lemma 1·5–2·5 mm. *Cultivated ground, ditches and waste places. A frequent casual in S. Europe and locally naturalized in the Mediterranean region; possibly native in the S. part of its range.* [?Bl Cr Ga *It *Hs *Lu *Si.] (*Tropics and subtropics.*)

2. E. crus-galli (L.) Beauv., *Agrost.* 53, 161 (1812). Laxly caespitose annual; stems 25–100 cm. Inflorescence 6–25 cm, the longest racemes 2–10 cm, mostly with short secondary branchlets at the base. Spikelets (2–)3–4(–4·5) mm, in 2 to several irregular rows on each raceme, ovate-elliptical, hispid, acuminate to awned; upper lemma 2–3 mm, including the herbaceous apex. $2n=54$. *Ditches, roadsides and waste places. S. Europe; naturalized further north.* Al Az Bl Bu Co Cr Ga Gr Hs It Ju Lu Rm Rs (W, K, E) Sa Si Tu [Au Be Cz Da Ge He Ho Hu Po Rs (B, C)].

3. E. oryzoides (Ard.) Fritsch, *Verh. Zool.-Bot. Ges. Wien* **41**: 742 (1891). Erect annual; stems 25–150 cm. Inflorescence 6–25 cm, the longest racemes 2–5 cm, usually simple. Spikelets 3·8–6·5 mm, in 2 irregular rows on each raceme, ovate-elliptical, hispid, acuminate to awned; upper lemma 3·5–5 mm, including the herbaceous apex. *A weed of ricefields. S. & S.C. Europe.* [Cz Hs Hu It Lu Rm Rs (W, K, E) ?Sa Si.] (*Origin uncertain.*)

135. Brachiaria (Trin.) Griseb.[1]

Annuals or perennials. Inflorescence of unilateral racemes arranged along a central axis. Spikelets dorsally compressed, unawned, with 2 florets; lower glume adaxial, usually shorter than the spikelet; upper glume almost as long as the spikelet; lower floret male, the lemma resembling the upper glume; upper floret hermaphrodite, the lemma coriaceous to crustaceous, clasping only the margins of the palea.

1. B. eruciformis (Sibth. & Sm.) Griseb. in Ledeb., *Fl. Ross.* **4**: 469 (1853). Laxly caespitose annual; stems 10–50 cm, geniculate. Inflorescence of 3–12 racemes on an axis 1–6 cm long; racemes 0·5–2·5 cm, the spikelets borne singly on a triquetrous rhachis. Spikelets 2–2·5 mm, narrowly ovate; lower glume an ovate scale up to 0·5 mm; upper glume and lower lemma pubescent; upper lemma smooth, obtuse. *Ditches, cultivated fields and damp waste places. Mediterranean region and S.E. part of Balkan peninsula.* Bu Cr Gr Hs It Ju Si Tu [Ga].

136. Eriochloa Kunth[1]

Like *Brachiaria* but spikelets supported on a bead-like swelling; lower glume nearly always vestigial, adherent to the swollen rhachilla-internode; lower floret sometimes sterile.

1. E. succincta (Trin.) Kunth, *Enum. Pl.* **1**: 73 (1833). Laxly caespitose annual; stems 10–60 cm, geniculate. Leaf-blades and sheaths pubescent. Inflorescence of 3–15 racemes each 1–2 cm long. Pedicels scabrid and with scattered, short hairs above. Spikelets 3–3·5 mm, elliptical, thinly pubescent, acute; lower glume vestigial; lower floret reduced to a lemma; upper lemma with a mucro 0·3 mm. *River-banks liable to flooding. S.E. Russia (along the Volga, below Volgograd).* Rs (E).

[1] By W. D. Clayton.

E. villosa (Thunb.) Kunth, *Révis. Gram.* **1**: 30 (1829), from E. Asia, has recently been found in rice-fields in S. Ukraine and S.E. Russia and may be becoming naturalized. It has spikelets 4·5–6 mm and pedicels with dense, long hairs.

137. Digitaria Haller[1]

Annuals or perennials. Leaves flat; ligule membranous. Inflorescence of unilateral racemes arranged subdigitately or upon a short central axis and bearing the spikelets in appressed groups of 1–5 or more. Spikelets dorsally compressed, with 2 florets; lower glume abaxial, small or absent; upper glume as long as or much shorter than the spikelet; lower floret sterile, represented by a lemma usually as long as the spikelet; upper floret hermaphrodite, the lemma chartaceous to cartilaginous, with its hyaline margins enfolding and concealing most of the palea.

1 Upper glume exceeding the upper lemma **1. debilis**
1 Upper glume not exceeding the upper lemma
2 Upper glume as long as the spikelet **4. ischaemum**
2 Upper glume ⅓–¾ as long as the spikelet
3 Veins of lower lemma scaberulous; upper glume ½–½ as long as the spikelet **2. sanguinalis**
3 Veins of lower lemma smooth; upper glume (½–)⅔–¾ as long as the spikelet **3. ciliaris**

1. D. debilis (Desf.) Willd., *Enum. Pl. Horti Berol.* 91 (1809). Annual; stems (10–)20–60 cm, geniculately ascending. Inflorescence of 3–17 racemes each 3–16 cm, subdigitate or with a short central axis; rhachis of raceme triquetrous, the spikelets in pairs. Spikelets (2–)2·4–3·6(–4·5) mm, lanceolate; lower glume a tiny scale, separated from the upper by a distinct internode; upper glume longer than the upper lemma, acuminate; lower lemma 0·3–1 mm shorter than upper glume, acute, appressed-pubescent in stripes. $2n=36$. *Damp places. Portugal and N.W. Spain: W. Italy.* Hs It Lu. (*Africa.*)

An old record from S.W. France has never been confirmed.

2. D. sanguinalis (L.) Scop., *Fl. Carn.* ed. 2, **1**: 52 (1771) (*Panicum sanguinale* L.). Annual; stems 20–60 cm, geniculately ascending. Inflorescence of 2–16 racemes each 3–20 cm, subdigitate; rhachis of raceme triquetrous, winged, the spikelets in pairs. Spikelets 2·3–3·5 mm, ovate-elliptical; lower glume a tiny scale; upper glume ½–½ as long as the upper lemma; lower lemma obscurely pubescent, scaberulous on the veins, sometimes with brownish glassy bristles. $2n=36$. *Sandy places and cultivated ground. S. & S.C. Europe; naturalized or casual further north.* Al Az Bl Bu Co Cr Ga Gr Hs Hu It Ju Lu Rm Rs (W, K, E) Sa Si [Au Be Cz Ge He Ho Po Rs (B, C) Su].

3. D. ciliaris (Retz.) Koeler, *Descr. Gram.* 27 (1802). Like **2** but the upper glume (½–)⅔–¾ as long as the spikelet; lower lemma with smooth veins. *A common weed of rice-fields in Italy and probably elsewhere.* [It.] (*Tropics and subtropics.*)

4. D. ischaemum (Schreber) Muhl., *Descr. Gram. Amer. Sept.* 131 (1817) (*D. filiformis* auct., non (L.) Koeler, *Panicum lineare* auct., non L.). Annual; stems 10–40 cm, geniculately ascending. Inflorescence of 2–6 racemes, each 1·5–11 cm, subdigitate; rhachis of raceme flat, ribbon-like, the spikelets in groups of 3. Spikelets 1·8–2·2 mm, elliptical; lower glume a small hyaline rim; upper glume as long as the spikelet; lower lemma pubescent with clavellate hairs. *In sandy places, often as a weed. C. & S. Europe.* Bu Co Ga Hs Hu It Ju Lu Rm Rs (W, K, E) ?Si Tu [Au Be *Br Cz Da Ge He Ho Po Rs (B, C) Su].

138. Paspalum L.[1]

Glabrous or sparsely hairy annuals or perennials. Leaves flat or convolute; ligule membranous; sheaths often bearded at the mouth. Inflorescence of unilateral racemes arranged digitately or along a central axis, bearing appressed spikelets. Spikelets orbicular to oblong, dorsally compressed, usually plano-convex, with 2 florets; lower glume abaxial, usually absent; upper glume as long as the spikelet; lower floret sterile, represented by a lemma as long as the spikelet; upper floret hermaphrodite, the lemma more or less crustaceous, its narrowly folded margins leaving the palea exposed.

Literature: P. Silva, *Agron. Lusit.* **2**: 5–23 (1940).

1 Upper glume villous
2 Racemes usually 3–5; spikelets 2·8–3·8 mm — **1. dilatatum**
2 Racemes usually 12–18; spikelets 2–3 mm — **2. urvillei**
1 Upper glume glabrous or puberulent
3 Upper glume appressed-puberulent — **3. paspalodes**
3 Upper glume glabrous — **4. vaginatum**

1. P. dilatatum Poiret in Lam., *Encycl. Méth. Bot.* **5**: 35 (1804) (*Digitaria dilatata* (Poiret) Coste). Caespitose perennial; stems 40–180 cm, ascending. Inflorescence of (2–)3–5(–11) racemes on a common axis 2–20 cm; raceme 4–11 cm, with narrowly winged rhachis. Spikelets 2·8–3·8 mm, ovate, yellowish-green; upper glume sparsely hairy on the surface, more densely villous near the margin; lower lemma similar but glabrous. $2n=50$. *Damp, shady places and waste ground. S.W. Europe and Italy.* [Az Ga Hs It Lu.] (*Brazil to Argentina.*)

2. P. urvillei Steudel, *Syn. Pl. Glum.* **1**: 24 (1853). Like **1** but stems 75–250 cm, erect; inflorescence of (6–)12–18(–25) racemes on a common axis 10–40 cm; raceme 7–14 cm; spikelets 2–3 mm. $2n=20$. *Rice-fields and other wet places. Naturalized in W.C. Portugal and perhaps elsewhere in S. Europe.* [Lu.] (*Brazil to Argentina.*)

3. P. paspalodes (Michx) Scribner, *Mem. Torrey Bot. Club* **5**: 29 (1894). Creeping stoloniferous perennial; stems 6–50 cm. Sheaths ciliate on margin. Inflorescence of 2(–4) racemes; racemes 1·5–7 cm, with a narrow, flattened rhachis. Spikelets 2·5–3·5 mm, ovate, plano-convex, relatively plump, pale green; lower glume often present as a small scale; upper glume appressed-puberulent, herbaceous, with distinct mid-vein; lower lemma similar but glabrous. $2n=60$. *Marshy places, mainly near the coast. S. Europe.* [Al Az Bu Ga Gr Hs It Lu Rs (K) Tu.] (*Tropics.*)

4. P. vaginatum Swartz, *Nov. Gen. Sp. Pl.* 21 (1788) (*Digitaria vaginata* (Swartz) Philippe). Like **3** but sheaths glabrous at apex, though ligule ciliate on back; spikelets ovate-elliptical, flattened; lower glume nearly always absent; upper glume glabrous, thinly papery, the mid-vein obscure. $2n=20$. *Maritime sands and rice-fields. S.W. Europe, Sicilia.* [Ga Hs Lu Si.] (*Tropics.*)

139. Stenotaphrum Trin.[1]

Annuals or perennials. Inflorescence spike-like, composed of very short racemes more or less embedded in a thickened central axis. Spikelets with 2 florets; lower glume abaxial, small; upper glume as long as or much shorter than the spikelet; lower floret male or sterile, as long as the spikelet, its lemma and palea chartaceous to coriaceous; upper floret hermaphrodite, otherwise resembling the lower.

[1] By W. D. Clayton.

1. S. secundatum (Walter) O. Kuntze, *Revis. Gen.* **2**: 794 (1891). Stoloniferous perennial; stems 5–30 cm, procumbent. Leaves broadly linear, plicate when young, obtuse. Inflorescence 3–10 cm, the racemes wholly or partially sunk in one face of a corky central axis; racemes 5–10 mm, bearing 1–3 spikelets on a triquetrous rhachis prolonged into a subulate point. Spikelets 4–5 mm, narrowly ovate, pale green. *Seashores and coastal grassland. Naturalized in S.W. Europe and Sicilia.* [Az Bl Ga Hs Lu Si.] (*Tropics and subtropics.*)

140. Setaria Beauv.[1]

Annuals or perennials. Inflorescence a panicle, usually spike-like, the spikelets subtended by bristles which persist on the axis after the spikelets fall. Spikelets oblong to ovate; glumes unequal; lower floret male or sterile, as long as the spikelet; upper floret hermaphrodite, its lemma crustaceous, boat-shaped, often rugose.

All species grow in cultivated ground or waste places. On account of their weedy and ruderal habit it is almost impossible to delimit with confidence their native areas from those in which they are naturalized. They are all found as occasional casuals in N. Europe.

1 Spikelets not deciduous, the upper lemma disarticulating at maturity above the persistent lower lemma — **4. italica**
1 Spikelets deciduous as a whole
2 Upper glume $\frac{1}{2}$–$\frac{3}{4}$ as long as the upper lemma — **1. pumila**
2 Upper glume about as long as the upper lemma
3 Bristles retrorsely barbed, adhering tenaciously to clothing — **2. verticillata**
3 Bristles antrorsely barbed — **3. viridis**

1. S. pumila (Poiret) Schultes in Schultes & Schultes fil., *Mantissa* **2**: 274 (1824) (*S. glauca* auct., non (L.) Beauv., *S. lutescens* F. T. Hubbard). Annual; stems 5–130 cm. Leaves 3–30 cm × 2–10 mm. Panicle 1–15 cm, spike-like, cylindrical, the rhachis hispidulous; bristles 3–8 mm, usually 4–12 per spikelet, antrorsely scabridulous. Spikelets 2·7–3·3 mm, ovate; upper glume $\frac{1}{2}$–$\frac{3}{4}$ as long as the spikelet, exposing the strongly rugose upper lemma. $2n=36, 72$. *S. & S.C. Europe; naturalized northwards to the Netherlands and the Baltic region.* Al Au Az Bl Bu Co Cr Cz Ga Gr Hs Hu It Ju Lu Rm Rs (W, K, E) Sa Si Tu [Be Ge He Ho Po Rs (?N, B, C)].

S. geniculata (Lam.) Beauv., *Agrost.* 51, 178 (1812), from North America, is like **1** but perennial and is more or less naturalized in parts of S.W. Europe. It has $2n=72$.

2. S. verticillata (L.) Beauv., *loc. cit.* (1812). Annual; stems 10–100 cm or more. Leaves 5–30 cm × 4–16 mm. Panicle 2–12 cm, spike-like, more or less cylindrical, often with the spikelets irregularly clustered, the rhachis hispidulous; bristles 3–8 mm, usually 1 per spikelet, retrorsely barbed. Spikelets usually 2–2·3 mm, ellipsoid; upper glume as long as the spikelet; upper lemma finely rugose. $2n=18, 36$, *c.* 54. *S. Europe; naturalized northwards to the Netherlands and the Baltic region.* Al Az Bl Bu Co Cr Ga Gr Hs It Ju Lu Rm Rs (W, ?K, E) Sa Si Tu [Au Be Cz Ge He Ho Hu Po Rs (B, C)].

S. adhaerens (Forskål) Chiov., *Nuovo Gior. Bot. Ital.* nov. ser., **26**: 77 (1919), from Africa, occurs locally in the Mediterranean region. It is one of a number of variants of **2** which do not seem to merit specific rank.

3. S. viridis (L.) Beauv., *Agrost.* 51, 178 (1812). Annual; stems 10–100(–200) cm. Leaves 2–20(–40) cm × 4–12(–25) mm. Panicle 1–10(–20) cm, spike-like, cylindrical, with densely imbricate spikelets, the rhachis pilose to villous; bristles 5–10

mm, 1–3 per spikelet, antrorsely scabridulous. Spikelets 1·8–2·2 mm, ellipsoid; upper glume as long as the spikelet; upper lemma finely rugose. $2n=18$. *Most of Europe.* All except Az Br Fa Hb Is Rs (N) Sb, but probably only as an alien in Da Fe No Rs (B) Su.

S. verticillata × **viridis** is like **3** but has the rhachis hispidulous. It has $2n=36$ and occurs spontaneously throughout most of S. Europe, and is naturalized in C. Europe.

4. S. italica (L.) Beauv., *loc. cit.* (1812). Annual; stems up to 150 cm. Leaves 15–45 cm × 6–20 mm. Panicle 4–30 cm, spike-like, ellipsoid to cylindrical or more often lobed, the rhachis villous; bristles 2–16 mm, 2–5 per cluster of spikelets, antrorsely scabridulous. Spikelets 2–3 mm, broadly ellipsoid; upper glume ⅔ as long to almost as long as the spikelet; upper lemma smooth, disarticulating from the rest of the spikelet at maturity. *Cultivated for fodder and bird-seed in the southern half of Europe and often locally naturalized.* [Au Bu Cr Cz Ga Ge Gr He Hs Hu It Ju Po Rm Rs (C) Sa Tu.]

Origin unknown, but probably derived from **3.**

141. **Pennisetum** L. C. M. Richard[1]

Annuals or perennials. Inflorescence spike-like, each spikelet or cluster of spikelets enclosed by an involucre of slender bristles which are free throughout and fall with the spikelets. Spikelets lanceolate to oblong, with two florets; lower glume often minute; upper glume very small or up to as long as the spikelet; lower floret male or sterile, its lemma as long as the spikelet or much reduced; upper floret hermaphrodite, its lemma membranous to thinly coriaceous.

Inflorescence linear; spikelets 4·5–6·5 mm **1. setaceum**
Inflorescence broadly cylindrical to subglobose; spikelets 7–14 mm **2. villosum**

1. P. setaceum (Forskål) Chiov., *Bull. Soc. Bot. Ital.* **1923**: 113 (1923). Densely caespitose perennial; stems 20–100 cm. Leaves up to 30 cm × 3 mm, convolute, scabrid, rigid. Inflorescence 10–30 cm, linear; involucres with slender peduncles 1–3 mm; bristles 1·6–4 cm, ciliate below. Spikelets 4·5–6·5 mm. *Dry slopes. N.W. Sicilia, Isole Lipari.* Si. (*N.E. Africa.*)

2. P. villosum R. Br. ex Fresen., *Mus. Senck.* **2**: 134 (1837). Laxly caespitose perennial; stems 10–100 cm. Leaves 7–70 cm × 2–6 mm, flat or folded. Inflorescence 2–10 cm, broadly cylindrical to subglobose; involucres subsessile to shortly peduncular; bristles 3·5–7 cm, plumose below. Spikelets 7–14 mm. $2n=45$. *Dry places. A frequent casual in the W. Mediterranean region and Portugal; naturalized in Italy and the Açores.* [Az It.] (*Ethiopia.*)

142. **Cenchrus** L.[1]

Annuals or perennials. Inflorescence spike-like; rhachis angular; each spikelet or cluster of spikelets enclosed by an involucre of more or less flattened bristles or spines, which are connate below to form a disc or cup and fall with the spikelets. Spikelets lanceolate or ovate, unawned, with 2 florets; lower glume up to half as long as spikelet, sometimes absent; upper glume as long as spikelet; lower floret male or sterile, its lemma as long as spikelet; upper floret hermaphrodite, its lemma firmly membranous to coriaceous.

Involucre of flexuous bristles free almost to the base **1. ciliaris**
Involucre of rigid spines, the inner connate for half their length **2. incertus**

[1] By W. D. Clayton.

1. C. ciliaris L., *Mantissa Alt.* 302 (1771). Perennial; stems 25–100 cm. Leaves 3–23 cm × 2–9 mm. Panicle 2–12 cm, with glabrous rhachis; involucre 6–15 mm, elongate, containing 2–4 spikelets, the bristles flexuous, ciliate, connate only at the base to form a disc 0·5–1·5 mm in diameter, antrorsely scabrid. Spikelets 2–5·6 mm. *Dry hillsides. Sicilia and Isole Lipari.* Si. (*Africa, S.W. Asia.*)

2. C. incertus M. A. Curtis, *Boston Jour. Nat. Hist.* **1**: 135 (1837). Annual; stems 10–90 cm. Leaves 6–18 cm × 3–7 mm. Panicle 4–10 cm; involucre 8–12 mm, globose, containing 2–3 spikelets; spines 8–40, the inner long, accrescent, retrorsely scabrid, the outer shorter, few, downward pointing. Spikelets 3·5–5·8 mm. *Disturbed ground. Naturalized in C. Mediterranean region.* [?Az Co ?Ga ?Hs It.] (*Tropical and warm-temperate America.*)

C. longispinus (Hackel) Fernald, *Rhodora* **45**: 388 (1943), from North America, is perhaps becoming naturalized in S. Europe. It is like **2** but has 45–75 spines, the outer numerous, and the spikelets 6–7·8 mm.

143. **Tricholaena** Schrader[1]

Perennials, rarely annuals. Inflorescence a panicle. Spikelets oblong in outline, unawned; lower glume very small or absent; upper glume as long as the spikelet, thinly membranous, indistinctly 5-nerved, slightly emarginate to acute; lower floret male, its lemma similar to the upper glume; upper floret hermaphrodite, the lemma thinly cartilaginous, clasping only the margins of the palea.

1. T. teneriffae (L. fil.) Link, *Handb.* **1**: 91 (1829). Perennial; stems 10–60 cm, wiry, ascending. Panicle 3–15 cm, narrowly oblong. Spikelets 2·5–3·5 mm; upper glume and lower lemma tuberculate-hirsute with white hairs extending 0·5–4 mm beyond the apex. *Dry stony slopes. S.W. Italy, Sicilia.* It Si. (*S.W. Asia, N. Africa, Atlantic Islands.*)

Tribe **Andropogoneae** Dumort.

Leaves linear to lanceolate or ovate, flat or convolute; silica-bodies dumbbell- or cross-shaped; slender 2-celled micro-hairs present; ligule membranous, sometimes ciliate. Inflorescence usually a panicle or of 1 or more variously arranged racemes. Spikelets usually in pairs, one sessile with a lower male or sterile and an upper hermaphrodite floret, the other pedicellate, with 2 male or sterile florets. Pedicellate spikelets usually deciduous, the sessile spikelets usually falling with a joint of the rhachis. Glumes more or less coriaceous, longer than the florets. Lemmas membranous, the upper often with a geniculate awn. Palea shorter than lemma, often absent. Lodicules 2, truncate, or absent. Stamens 1–3. Ovary glabrous; styles 2, sometimes connate for most of their length. Grain with punctiform, basal hilum; embryo often half as long as grain; starch-grains simple. Chromosomes small; basic number 5, 9–14, 17, 19.

144. **Imperata** Cyr.[1]

Rhizomatous perennials. Inflorescence a narrow, often spike-like panicle with tough branches bearing paired similar spikelets, each borne upon a slender pedicel. Spikelets with 2 florets, terete; glumes as long as the spikelet, membranous; lower floret reduced to a hyaline lemma; upper floret hermaphrodite, with unawned hyaline lemma and shorter palea; stamens 1–2.

1. I. cylindrica (L.) Raeuschel, *Nomencl. Bot.* ed. 3, 10 (1797) (*Saccharum cylindricum* (L.) Lam.). Stems up to 120 cm. Leaf-blades up to 60 × 0·3–0·6 cm, convolute, rigidly erect. Panicle up to 20 cm, densely cylindrical, obscured in silky white hairs. Spikelets 4–5 mm, lanceolate; stamens 2. $2n = 50, 60$. *Open, sandy habitats, usually by rivers or the seashore. S. Europe.* Al Bl Bu Co Cr Ga Gr Hs It Ju Lu Sa Si Tu.

145. Saccharum L.[1]

Perennials, often tall. Inflorescence a large, often plumose panicle with persistent branches bearing fragile racemes of paired similar spikelets. Spikelets with 2 florets, lanceolate, dorsally compressed, enveloped in long hairs from the callus; glumes as long as the spikelet; lower floret reduced to a hyaline lemma; upper floret hermaphrodite, the lemma hyaline (sometimes reduced to a subulate vestige).

1 Lemma awnless
2 Axis of panicle hirsute **1. spontaneum**
2 Axis of panicle glabrous to pubescent **2. officinarum**
1 Lemma awned
3 Panicle narrowly ovate, lobed, plumose; lower glume attenuate **3. ravennae**
3 Panicle linear to lanceolate, with racemes appressed to the axis; lower glume obtuse to subacute **4. strictum**

1. S. spontaneum L., *Mantissa Alt.* 183 (1771). Tall rhizomatous perennial; stems 2–4 m or more. Leaf-blades mostly 5–15 mm wide. Panicle 25–60 cm, the axis hirsute; racemes 3–15 cm, usually much longer than the supporting branches. Spikelets 3·5–7 mm, the callus with silky white hairs 2–3 times as long as the spikelet; glumes membranous above, subcoriaceous in the lower third, glabrous on the back, ciliate above; upper lemma subulate and up to 3 mm or absent. *Moist soils. Sicilia.* Si. (*S. Asia, N. & E. Africa.*)

2. S. officinarum L., *Sp. Pl.* 54 (1753). Like **1** but leaf-blades up to 40 mm wide; panicle 100 cm or more, broadly pyramidal, the axis glabrous to pubescent. *Cultivated in S. Spain* (*sugar-cane*). [Hs.] (*New Guinea; widely cultivated in the tropics and subtropics.*)

3. S. ravennae (L.) Murray, *Syst. Veg.* 88 (1774) (*Erianthus ravennae* (L.) Beauv.). Caespitose perennial; stems up to 3 m. Panicle 25–60 cm, narrowly ovate, plumose, lobed; racemes 1–2 cm, much shorter than the flexuous supporting branches. Spikelets 3·5–5 mm, the callus-hairs about as long as the spikelet; lower glume membranous, hirsute on the back or glabrous, attenuate to an acute apex; upper lemma 2·5–3 mm, lanceolate, hyaline, with a terminal awn 3–4 mm. *By water and on coastal sands. Mediterranean region; S.W. & E. Bulgaria.* Al Bl Bu Co Cr Ga Gr Hs It Ju Si Tu [Rm].

4. S. strictum (Host) Sprengel, *Pugillus* **2**: 16 (1815) (*Erianthus hostii* Griseb.). Caespitose perennial; stems up to 2 m. Panicle 10–25 cm, linear to lanceolate, dense; racemes 2–6 cm, about as long as the stiff supporting branches, appressed to the axis. Spikelets 4·5–5·5 mm, the callus-hairs about as long as the spikelet; lower glume cartilaginous, purplish, glabrous on the back, hirsute on the margin, abruptly contracted to an obtuse or subacute apex; upper lemma 3–4 mm, lanceolate, with a terminal awn 2–6 mm. *Damp sands and stony streamsides. Balkan peninsula, extending to N.E. Italy and S. Romania.* Al Bu Gr It Ju Rm Tu.

[1] By W. D. Clayton.

146. Sorghum Moench[1]

Annuals or perennials, mostly robust. Inflorescence a large terminal panicle with persistent branches bearing short fragile racemes of paired dissimilar spikelets. Sessile spikelets with 2 florets, dorsally compressed; lower floret reduced to a hyaline lemma; upper floret hermaphrodite, the lemma 2-dentate with a glabrous geniculate awn. Pedicellate spikelets male or sterile, smaller than the sessile, unawned.

1 Perennial weed or ruderal; spikelets deciduous at maturity **1. halepense**
1 Annual; cultivated
2 Sessile spikelets 6–7·5 mm, ellipsoid, narrow, tardily deciduous **2. sudanense**
2 Sessile spikelets 4–6 mm, ovoid to subglobose, persistent **3. bicolor**

1. S. halepense (L.) Pers., *Syn. Pl.* **1**: 101 (1805). Perennial with abundant creeping rhizomes; stems 50–150 cm. Panicle 10–30 cm, lanceolate, the ultimate racemes bearing up to 5 pairs of spikelets. Sessile spikelets 4·5–5·5 mm, ellipsoid; awn 10–16 mm, or absent. Pedicellate spikelets 4·5–6 mm, narrowly lanceolate, purplish. $2n = 40, 41, 42, 43$. *Dry, open habitats. Possibly native in the E. Mediterranean region; widely naturalized as a weed and ruderal in S. & S.C. Europe.* [Al Az Bl Bu Co *Cr Cz Ga *Gr He Hs Hu It Ju Lu Rm Rs (W, K) Sa Si *Tu.] (*N. Africa, S.W. Asia.*)

2. S. sudanense (Piper) Stapf in Oliver, *Fl. Trop. Afr.* **9**: 113 (1917). Annual; stems 150–300 cm. Panicle 15–30 cm, ovate to pyramidal, lax, the racemes bearing 2–5 pairs of spikelets. Sessile spikelets 6–7·5 mm, ellipsoid; awn 10–16 mm. Pedicellate spikelets 5·5–8 mm, narrowly lanceolate. *Cultivated as a fodder crop in S.E. & E.C. Europe.* [Au Bu Cz Hu Rm Rs (W, K, E).] (*Sudan.*)

3. S. bicolor (L.) Moench, *Meth.* 207 (1794). Like **2** but very variable; sessile spikelets 4–6 mm, ovoid to subglobose, persistent. *Cultivated mainly as a grain crop. S., S.E. & S.C. Europe.* [Au Bu Co Cz Ga Gr Hs Hu It Ju Lu Rm Rs (C, W, K, E).] (*Tropical Africa; widely cultivated elsewhere in the tropics.*)

There is a great diversity of variants, which are best treated as cultivars of a single species (see J. D. Snowden, *The Cultivated Races of* Sorghum. London. 1936.)

147. Chrysopogon Trin.[1]

Perennials. Inflorescence a terminal panicle with slender whorled branches each bearing a triad of 1 sessile and 2 pedicellate spikelets. Sessile spikelets with 2 florets, more or less compressed laterally; lower floret reduced to a hyaline lemma; upper floret hermaphrodite, the lemma 2-dentate or entire, geniculately awned. Pedicellate spikelets male or sterile, narrowly lanceolate.

1. C. gryllus (L.) Trin., *Fund. Agrost.* 188 (1820). Coarsely caespitose perennial; stems 30–120 cm. Panicle 10–25 cm, lanceolate to ovate. Sessile spikelets 5–8 mm, purplish, the callus *c.* 2 mm, acute, with reddish-brown hairs; lower glume spinulose on margin; upper glume aristate; upper lemma minutely 2-dentate, with a geniculate awn 2–3·5 cm. Pedicellate spikelets 7–12 mm, aristate. *Dry places. S. & S.C. Europe.* Al Au Bu Cz Ga Gr He Hu It Ju Rm Rs (W) Tu.

148. **Dichanthium** Willemet[1]

Annuals or perennials. Inflorescence of 1–many fragile racemes bearing paired, dissimilar spikelets, one sessile, the other pedicellate. Sessile spikelets with 2 florets, compressed dorsally; lower floret reduced to a hyaline lemma; upper floret hermaphrodite, with entire lemma passing into a glabrous, geniculate awn. Pedicellate spikelets male or sterile, unawned.

Lower glume of sessile spikelet with a deep circular pit — **1. insculptum**

Lower glume of sessile spikelet without a pit — **2. ischaemum**

1. D. insculptum (A. Richard) W. D. Clayton, *Kew Bull.* **32**: 3 (1977) (*Andropogon insculptus* A. Richard). Caespitose, scrambling or stoloniferous perennial; stems 25–200 cm. Inflorescence sub-digitate or with a short central axis, of 3–20 racemes each 2–8 cm; internodes and pedicels with a translucent line. Spikelets 3–4·5 mm, narrowly elliptical, glossy, acute; awn 15–25 mm. Lower glume of sessile spikelet with a deep circular pit. Pedicellate spikelet with 0–3 pits. *Dry, open habitats. Sicilia.* Si. (*Africa.*)

2. D. ischaemum (L.) Roberty, *Boissiera* **9**: 160 (1960) (*Andropogon ischaemum* L.). Caespitose perennial; stems 15–100 cm, ascending. Inflorescence subdigitate, of 3–15 racemes each 3–7 cm; internodes and pedicels with a translucent line. Spikelets 3·5–4·5 mm, narrowly elliptical, chartaceous, acute; awn 10–15 mm. Lower glume of sessile spikelet and pedicellate spikelet without pits. *Dry places. Europe northwards to N. France and Poland.* Au Bu Co Cz Ga Ge Gr He Hs Hu It Ju Lu Po Rm Rs (W, K, E) Tu.

149. **Andropogon** L.[1]

Annuals or perennials. Inflorescence of paired or digitate fragile racemes bearing paired, dissimilar spikelets, one sessile, the other pedicellate. Sessile spikelet with 2 florets, the callus inserted in the cupuliform apex of the internode; lower glume with 2 keels; lower floret reduced to a hyaline lemma; upper floret hermaphrodite with 2-dentate lemma passing into a glabrous, geniculate awn. Pedicellate spikelets male or sterile, unawned or finely aristulate.

1. A. distachyos L., *Sp. Pl.* 1046 (1753). Caespitose perennial, sericeous-pubescent at the base; stems 25–100 cm. Inflorescence a terminal pair of racemes each 4–14 cm. Sessile spikelet 8–16 mm, lanceolate; lower glume more or less flat on the back, with a membranous wing on the lateral keels; upper glume with a slender awn 4–10 mm; upper lemma with awn 15–30 mm. Pedicellate spikelet aristulate. $2n=40$. *Mediterranean region.* Al Co Cr Ga Gr Hs It Ju Sa Si.

A. gerardii Vitman, *Summa Pl.* **6**: 16 (1792), from North America, has been recorded from S. France and may perhaps be naturalized. It has usually 3–6 digitate racemes and the lower glume of the sessile spikelet is unwinged.

150. **Hyparrhenia** N. J. Andersson ex E. Fourn.[1]

Annuals or perennials. Inflorescence of pairs of fragile racemes bearing paired dissimilar spikelets. Sessile spikelet with 2 florets, the callus oblique; lower glume rounded on the back, without keels; lower floret reduced to a hyaline lemma; upper floret hermaphrodite, with 2-dentate lemma passing into a hairy geniculate awn. Pedicellate spikelets male or sterile, usually longer than the sessile, unawned or finely aristulate.

[1] By W. D. Clayton.

1. H. hirta (L.) Stapf in Oliver, *Fl. Trop. Afr.* **9**: 315 (1919) (*Andropogon hirtus* L., *Cymbopogon hirtus* (L.) Thomson). Caespitose perennial; stems 30–60(–100) cm. Inflorescence up to 30 cm, of 2–10 raceme-pairs; racemes 2–4 cm, each with 4–7 pairs of spikelets. Sessile spikelet 4–6·5 mm, linear-elliptical, white-villous, the callus acute; awn 10–35 mm. Pedicellate spikelet 3–7 mm, narrowly lanceolate, villous, unawned. $2n=30, 40$. *Dry, open habitats. Mediterranean region, Portugal.* Al Bl Co Cr Ga Gr Hs It Ju Lu Sa Si.

151. **Heteropogon** Pers.[1]

Annuals or perennials. Inflorescence a fragile raceme bearing paired dissimilar spikelets (but similar and unawned in lower part of raceme). Sessile spikelets with 2 florets, terete, with pungent callus; lower floret reduced to a hyaline lemma; upper floret hermaphrodite, the lemma narrow, convolute, with an apical hairy geniculate awn. Pedicellate spikelets male or sterile, lanceolate, larger than the sessile, unawned, with a long slender callus.

1. H. contortus (L.) Beauv. ex Roemer & Schultes, *Syst. Veg.* **2**: 836 (1817). Caespitose perennial; stems 30–100 cm. Racemes 3–10 cm, solitary or few, the awns forming a twisted spire. Sessile spikelets 5·5–10 mm, including a pungent callus 2–3 mm; awn 5–8 cm. Pedicellate spikelets 5–15 mm, glabrous to tuberculate-villous. *Dry, open habitats. W. & C. Mediterranean region, extending to S. Switzerland.* Bl Ga He Hs It Ju Si.

152. **Phacelurus** Griseb.[1]

Rhizomatous perennials. Inflorescence of 1–several fragile racemes, arranged subdigitately or on a short common axis, and bearing paired spikelets; internodes and pedicels stout. Sessile spikelets with 2 florets, dorsally compressed; lower floret male, with hyaline lemma and palea; upper floret hermaphrodite, with hyaline unawned lemma. Pedicellate spikelets similar to the sessile but with both florets male.

1. P. digitatus (Sibth. & Sm.) Griseb., *Spicil. Fl. Rumel.* **2**: 424 (1846). Coarse perennial; stems 70–150 cm. Racemes 1–7, each 20–35 cm, stiff, borne subdigitately or on a central axis up to 15 cm. Sessile spikelets 10–18 mm, narrowly lanceolate, acute. Pedicellate spikelets with an oblong callus 1–3 mm. $2n=20$. *Ditches and other wet places. S.E. Europe.* Al Bu Gr ?Ju Tu.

153. **Hemarthria** R. Br.[1]

Caespitose or rhizomatous perennials. Inflorescence of terminal and axillary spike-like racemes, with a tough rhachis and one sessile and one pedicellate spikelet at each node. Spikelets with 2 florets, dorsally compressed and more or less sunk in the rhachis, to which the pedicel is adnate, unawned; lower glume coriaceous; lower floret reduced to a hyaline lemma; upper floret hermaphrodite.

1. H. altissima (Poiret) Stapf & C. E. Hubbard, *Kew Bull.* **1934**: 109 (1934). Rhizomatous perennial; stems up to 2·5 m, procumbent. Racemes 4–10 cm. Spikelets 4–6 mm, the sessile elliptic-oblong, with obtuse to emarginate lower glume, the pedicellate narrowly triangular, with subacute to acute lower glume. *Shallow water and muddy places. Mediterranean region.* Bl Cr Gr Hs It Si. (*Africa.*)

154. Coix L.[1]

Annuals. Leaves flat. Inflorescence of 3 spikelets, 1 female and 2 sterile, enclosed in a bony involucre, and a terminal spike of male spikelets. Male spikelets in groups of 2 or 3, dorsally compressed; glumes chartaceous; lemma and palea membranous; stamens 3. Female spikelets with suborbicular, beaked glumes and membranous lemma and palea. Lodicules absent.

1. C. lacryma-jobi L., *Sp. Pl.* 972 (1753). Stems up to 2 m, erect, smooth, glabrous. Leaves up to 5 cm wide, lanceolate, cordate at base, acuminate; ligule *c.* 10 mm. Male spikelets 6–8 mm. Involucres 8–10 mm, ovoid to globose, white or bluish, very hard. Stigmas protruding far beyond the involucre. *Cultivated for ornament and locally naturalized in the Mediterranean region.* [Ga Hs It Si.] (*Tropical Asia and Africa.*)

155. Zea L.[1]

Annual. Leaves flat. Male inflorescence a terminal panicle of spike-like racemes; female inflorescences axillary, of numerous spikelets arranged in longitudinal rows on a thickened axis, the whole enclosed in leaf-sheaths. Male spikelets in pairs, one subsessile, the other pedicellate; florets 2; glumes equal, membranous; lemma and palea hyaline; stamens 3; lodicules 2. Female spikelets with 2 florets, the lower sterile; glumes wider than long, fleshy below, hyaline above; lemmas short, hyaline; lodicules absent; style long, shortly 2-fid at apex, hairy throughout its length.

1. Z. mays L., *Sp. Pl.* 971 (1753). Stems up to 4(–9) m, 2–6 cm in diameter, solid, erect, rooting at the lower nodes. Leaves 3–12(–15) cm wide, undulate; ligule 3–5 mm, truncate. Male inflorescence up to 20 × 20 cm, erect; spikelets 6–15 mm. Female inflorescences *c.* 20 cm; peduncles with short internodes; styles 15–25(–40) cm, exserted from the apex of the sheaths at and after anthesis; caryopsis 5–10 mm, dorsiventrally compressed, usually cuneiform. *Extensively cultivated for its grain (maize, corn) in S. & S.C. Europe, and more recently as green fodder in parts of N. Europe.* [All except Da Fa Fe Is No Su Rs (N, B) Sb.] (*Not known wild; first cultivated in Mexico.*)

PRINCIPES

CXCIV. PALMAE[2]

Shrubs or trees; stem usually unbranched. Leaves large, persistent, petiolate with a conspicuous sheath. Inflorescence a simple or branched spadix, enveloped by 1 or several spathes. Flowers hermaphrodite or unisexual, hypogynous. Perianth usually of 2 whorls of 3. Anthers dehiscing longitudinally. Ovary of 1–3 free or united carpels; ovules 1 in each carpel. Fruit a berry or drupe.

In addition to those described below, numerous species are planted in the Mediterranean region on roadsides and in parks. The more conspicuous and widely planted of these include:

Washingtonia filifera (J. A. Linden) H. A. Wendl., *Bot. Zeit.* **37**: 68 (1879), from S. California, a tree up to 20 m with flabellate leaves long-persistent after withering and clothing the upper part of the stout, grey stem, splitting into segments leaving intersegmental filaments.

Livistona australis (R. Br.) C. F. P. Mart., *Hist. Nat. Palm.* **3**: 241 (1838), from E. Australia, a tree 15–25 m with flabellate leaves, the persistent bases projecting from the slender, brownish stem in young plants.

Howeia forsterana (C. Moore & F. Mueller) Becc., *Malesia* **1**: 41 (1877), from Lord Howe Island, a tree up to 12 m with pinnatisect leaves leaving annular scars on the slender, smooth, grey stem, the leaf-segments distichous.

Arecastrum romanzoffianum (Cham.) Becc., *Agric. Colon.* **10**: 455 (1916), from S. America, a tree up to 15 m with pinnatisect leaves leaving annular scars on the slender, grey, smooth stem, the leaf segments in groups of 3–5.

Jubaea chilensis (Molina) Baillon, *Hist. Pl.* **13**: 397 (1895) (*J. spectabilis* Humb., Bonpl. & Kunth), from Chile, a tree up to 28 m with short pinnatisect leaves leaving rhombic scars on the stout, grey, smooth stem.

Literature; G. Roster, *Boll. Soc. Tosc. Ort.* (1913, 1914, 1915). J. de C. e Vasconcellos & J. do A. Franco, *Portug. Acta Biol.* (B), **2**: 289–425 (1948).

1 Leaves flabellate; plant usually not more than 1·5 m, often ± acaulescent **1. Chamaerops**

1 Leaves pinnatisect; plant up to 30 m, caulescent **2. Phoenix**

1. Chamaerops L.[3]

Dioecious or polygamo-dioecious, caespitose shrubs, rarely arborescent. Leaves flabellate, divided to ⅓–½ into numerous induplicate, ensiform, 2-fid segments; petiole about as long as lamina, spinose-dentate. Spadices pedunculate, densely branched; spathes 2–4. Flowers yellow. Stamens with short, broad filaments. Ovary of 3 free carpels. Fruit with a fibrous, fleshy mesocarp rich in butyric acid. Seeds sulcate, not grooved on ventral side.

Trachycarpus fortunei (Hooker) H. A. Wendl., *Bull. Soc. Bot. Fr.* **8**: 429 (1861) (*T. excelsus* auct., non (Thunb.) H. A. Wendl.), from C. & E. China, is frequently cultivated for ornament in S. and W. Europe. It is like *Chamaerops* but with solitary stems up to 12 m, covered with black fibres, petiole minutely denticulate, fruit purplish-black and seeds grooved on the ventral side.

1. C. humilis L., *Sp. Pl.* 1187 (1753). Acaulescent or with a short, obconical stem not more than 1·5–2 m in the wild, covered with grey or whitish fibres. Leaves with a green to glaucous, flat lamina up to 80 cm. Spadices up to 35 cm; spathe more or less lanate at margin. Fruits (8–)12–30(–45) mm, globose, ovoid or oblong, yellow or brown. *Sandy or rocky ground, mainly near the coast. W. Mediterranean region, eastwards to Malta; S. Portugal.* Bl Ga Hs It Lu Sa Si.

Frequently cultivated for ornament in the Mediterranean region when it often develops as a tree with stems up to 3 m or more.

[1] By T. G. Tutin. [2] Edit. V. H. Heywood. [3] By J. do Amaral Franco.

2. Phoenix L.[1]

Dioecious; trees. Leaves pinnatisect, with numerous induplicate, linear-lanceolate, long-acuminate segments, the proximal shorter, spinescent; petiole much shorter than lamina, unarmed. Spadices pedunculate, with few, simple branches; spathe 1. Flowers yellowish. Stamens with subulate filaments. Ovary of 3 free carpels. Fruit a berry, developing usually from 1 carpel only. Seeds deeply grooved along ventral side.

1 Fruit 2·5–7·5 cm; plant up to 30 m **1. dactylifera**
1 Fruit 1·4–2·3 cm; plant not more than 20 m
2 Fruit succulent; stem single **2. canariensis**
2 Fruit not succulent; stems usually several **3. theophrasti**

1. P. dactylifera L., *Sp. Pl.* 1188 (1753). Up to 30 m; stems slender, usually several. Leaves erect-arcuate, glaucous, the median segments 30–40 cm, rigid. Female flowers with inner perianth-segments twice as long as outer. Fruit 2·5–7·5 cm, usually orange, scarcely fibrous, succulent. *Cultivated on a small scale for ornament and for its fruits (dates) throughout much of S. Europe, and on a large scale in S.E. Spain (near Elche).* [Hs.] (*N. Africa and S.W. Asia.*)

2. P. canariensis hort. ex Chabaud, *Provence Agric.* **19**: 293 (1882). Like **1** but not more than 20 m, with a single much stouter stem; green leaves with median leaf-segments 40–50 cm, very stiff; female flowers with inner perianth-segments only slightly exceeding the outer; fruit 1·5–2·3 cm, orange or dark purple. *Frequently planted for ornament in the Mediterranean region and S.W. Europe; locally casual and possibly naturalized.* (*Islas Canarias.*)

3. P. theophrasti W. Greuter, *Bauhinia* 3: 243 (1967). Plant not more than 10 m; stems slender, usually several. Leaves erect-arcuate, subglaucous, the median segments 30–40 cm, rigid, the proximal spinose, yellowish. Female flowers with inner perianth-segments about as long as the outer. Fruit 1·4–1·6 cm, yellowish-brown becoming blackish, fibrous, not succulent. *Sandy ground near the sea.* ● *Kriti.* Cr.

SPATHIFLORAE

CXCV. ARACEAE[2]

Perennial, usually glabrous herbs, with underground rhizomes or tubers. Leaves all basal, usually with distinct petiole, and often with more or less reticulate venation. Flowers small, often unisexual, arranged in a compact spike (*spadix*), subtended and usually partly enfolded by a large, petaloid or leaf-like bract (*spathe*), the axis of the spadix often prolonged beyond the flower-bearing zone as a fleshy, usually coloured *appendix*. In monoecious plants the female flowers are at or near the base of the spadix, the male flowers above them; vestigial, sterile flowers, usually in the form of filiform papillae, may also be present. Perianth of 4–6 free, sepaloid segments, or (more usually) absent. Stamens 1–6, rarely more. Ovary superior or nude, sometimes sunk in the axis of the spadix, 1- to 3-locular; stigma usually sessile or subsessile. Fruit a berry, sometimes rather dry.

A large family, centred in the wet tropics, where it includes many epiphytes and climbers. The majority of European species have more or less fetid flowers and are pollinated by flies.

Measurements of the scape include the spadix and spathe.

Literature: A. Engler & K. Krause in Engler, *Pflanzenreich* **73(IV. 23F)**: 1–249 (1920).

1 Leaves peltate **5. Colocasia**
1 Leaves not peltate
2 Leaves pedately divided into ±numerous segments **10. Dracunculus**
2 Leaves entire or with 2 basal lobes
3 Spathe ±flat, not enfolding the spadix even at the base
4 Leaves linear to ensiform, without distinct petiole; spathe similar, green **1. Acorus**
4 Leaves cordate-orbicular to -ovate, with distinct petiole; spathe suborbicular, white on adaxial surface **2. Calla**
3 Base of spathe tubular, or convolute with overlapping margins, enfolding and concealing at least the base of the spadix or its peduncle
5 Spathe bright yellow
6 Leaves 8–15 cm, hastate-sagittate **6. Arum**
6 Leaves 40–120 cm, truncate at base **3. Lysichiton**
5 Spathe white, green, brown, purple, black or pale greenish-yellow
7 Spathe with margins connate at base, forming a closed tube
8 Male and female flowers contiguous on the spadix; leaves with cordate or sagittate base **8. Arisarum**
8 Male and female zones separated by a zone of the spadix which is naked or bears sterile flowers; leaves with cuneate or truncate base **7. Biarum**
7 Spathe with margins at base overlapping but free
9 Spadix ±horizontal, expanded laterally into wings which are adnate to the inner surface of the spathe; female flower solitary **9. Ambrosina**
9 Spadix erect, free from spathe, bearing several female flowers
10 Spadix without appendix, covered up to the apex by sessile anthers **4. Zantedeschia**
10 Spadix with conspicuous appendix; male flowers restricted to a narrow zone concealed by the spathe **6. Arum**

1. Acorus L.[3]

Stock a rhizome. Leaves linear to ensiform, parallel-veined, without distinct petiole. Spadix apparently lateral, the base of the leaf-like spathe continuing the line of the scape; appendix absent. Flowers hermaphrodite, with 6 perianth-segments. Stamens 6. Ovary 2- or 3-locular; seeds few.

1. A. calamus L., *Sp. Pl.* 324 (1753). Rhizome stout. Base of leaves and scape pinkish. Leaves 50–125 × 0·7–2 cm, acute, often with part of the margin undulate, with a conspicuous, usually excentric midrib. Leaves and rhizome fragrant when bruised. Scape triquetrous, equalling or exceeding the leaves. Spathe 15–90 cm, the lower part stem-like, the upper part leaf-like. Spadix 5–9 × 0·6–1·2 cm, obtuse, ascending or erecto-patent; flowers greenish-yellow, very numerous and densely packed. Perianth-segments 2 × 1 mm, obovate-cuneate. Berry not formed

[1] By J. do Amaral Franco. [2] Edit. D. A. Webb. [3] By C. T. Prime.

in Europe. $2n=24$, 36. *Marshy river-banks and shallow water. Naturalized throughout a large part of Europe, but absent from the extreme north, the south-west, and most of the Mediterranean region.* [Au Be Br Bu Cz Da Fe Ga Ge Hb He Ho Hu It Ju No Po Rm Rs (B, C, W, E) Su.] (*S. & E. Asia, W. North America.*)

Introduced into Europe through Turkey about 1550, as a medicinal plant.

2. Calla L.[1]

Stock a rhizome. Leaves petiolate, entire. Spathe persistent, erect, nearly flat, not enfolding the spadix. Spadix without appendage, shorter than spathe. Flowers mostly hermaphrodite, but the uppermost often male; perianth absent. Stamens 6 (rarely more). Ovary 1-locular; seeds 6–8.

1. C. palustris L., *Sp. Pl.* 968 (1753). Rhizome stout, green, clothed in persistent, membranous, sheathing leaf-bases. Leaves 5–12 × 4–11 cm, orbicular to broadly ovate, cordate, cuspidate; petiole 5–35 cm. Scape about equalling the leaves. Spathe similar to leaves in shape, but smaller, white on inner (adaxial) surface; 2 or 3 spathes sometimes present on a single scape. Spadix 1–3 × 0·7–2 cm. Flowers yellowish-green, numerous, densely packed. Berry *c.* 5 mm, red. $2n=36$, 72. *Swamps and lake-margins. N., C. & E. Europe, westwards to Belgium and southwards to S. Romania and S.C. Russia.* Au Be Cz Da Fe Ga Ge He Ho No Po Rm Rs (N, B, C, W, E) Su [Br].

3. Lysichiton Schott[2]

Stock a rhizome. Leaves shortly petiolate, entire. Spathe deciduous, erect, boat-shaped, loosely investing the spadix, its basal part prolonged into a narrow, tubular sheath which closely surrounds the peduncle, but is split down one side, at least in upper part. Spadix shorter than spathe, without appendix. Flowers hermaphrodite; perianth-segments 4. Stamens 4. Ovary 1- to 2-locular; seeds 2.

1. L. americanus Hultén & St John, *Svensk Bot. Tidskr.* **25**: 455 (1932). Robust plant, forming large clumps. Leaves 40–120 × 27–70 cm, ovate, truncate at base, appearing after the flowers. Scape shorter than leaves. Spathe up to 25 cm, bright yellow, deciduous. Spadix 5–12 cm, stout, greenish. Perianth-segments and filaments often unequal. Berry green, partly embedded in spadix. *Cultivated for ornament, and naturalized on river-banks in a few places in Britain and Ireland.* [Br Hb.] (*W. North America.*)

4. Zantedeschia Sprengel[1]

Stock a short rhizome. Leaves long-petiolate, entire. Spathe persistent, obliquely infundibuliform, the lower part with overlapping margins, closely enfolding base of spadix. Spadix without appendix, shorter than spathe. Flowers unisexual, without perianth. Male and female flowers contiguous, the male zone much longer; female flowers with 3 spathulate staminodes. Stamens 2–3. Ovary 1- to 3-locular; seeds *c.* 6.

1. Z. aethiopica (L.) Sprengel, *Syst. Veg.* **3**: 765 (1826). Leaves 15–45 × 10–25 cm, sagittate with rounded lobes, acuminate; petiole up to 75 cm. Scape somewhat exceeding the leaves. Spathe up to 25 cm, rhombic-ovate, the cuspidate apex recurved. Spadix about half as long as spathe, the upper part entirely covered by densely crowded, bright yellow anthers, the limits of individual flowers being quite obscure. Berry yellow, seldom formed in Europe. *Widely cultivated for ornament in S. & W. Europe and locally naturalized.* [Az Co Ju.] (*South Africa.*)

5. Colocasia Schott[1]

Stock a depressed-globose tuber, with slender underground stolons. Leaves entire, peltate, long-petiolate. Spathe persistent, the lower part with overlapping margins, closely enfolding base of spadix. Spadix with short appendix, much shorter than spathe. Flowers unisexual, without perianth. Male flowers separated from female by a gap bearing scale-like sterile flowers. Stamens 3, connate throughout their length to form a stout column. Ovary 1-locular; seeds fairly numerous.

1. C. esculenta (L.) Schott in Schott & Endl., *Melet. Bot.* 18 (1832) (*C. antiquorum* Schott). Plant very robust, with large tuber and coarse foliage. Leaves up to 60 × 35 cm, cordate-sagittate, shining, conspicuously veined, the lamina usually deflexed; petiole up to 100 cm, stout, inserted *c.* ⅓ of the distance from sinus to apex of lamina. Scapes shorter than leaves. Spathe 20–45 cm, lanceolate, acuminate, the basal part which enfolds the spadix green, the upper part dull orange-yellow. Spadix less than half as long as spathe. *Formerly cultivated in S. Europe for its edible tubers and petioles, and locally naturalized in marshes or beside water.* [Az Hs It Ju Lu Sa Si.] (*Tropical Asia, perhaps also tropical America; widely cultivated throughout the tropics.*)

Inflorescences are seldom, if ever, produced by naturalized plants in Europe, and in some cultivars they are unknown, even in the tropics.

6. Arum L.[1]

Stock a tuber. Leaves petiolate, hastate to sagittate. Spathe withering before fruit is ripe, the lower part with overlapping margins. Spadix with long appendix. Flowers unisexual, without perianth, the male separated from the female, but not widely. Sterile flowers usually present, both between male and female and above the male (rarely very few or absent). Stamens 3–4. Ovary 1-locular; berry red; seeds 1–6.

The form of the tuber is of taxonomic importance; there are two main types. A *vertical* tuber is discoid or depressed-globose, with the shoot appearing from near the centre of the upper surface. A *horizontal* tuber is irregularly cylindrical, with the axis of the cylinder horizontal and the shoot appearing at one end of the axis. Young tubers are often aberrant in form; the character should be judged by inspection of several mature tubers.

Literature: G. Dihoru, *Rev. Roum. Biol. (Bot.)* **15**: 71–84 (1970). J. Hruby, *Bull. Soc. Bot. Genève* ser. 2, **4**: 113–160 (1912). C. T. Prime, *Lords and Ladies*. London. 1960. A. Terpó, *Acta Bot. Acad. Sci. Hung.* **18**: 215–225 (1973).

1 Flowering in autumn — **7. pictum**
1 Flowering in spring or early summer
 2 Sterile flowers absent or very few — **6. creticum**
 2 Sterile flowers fairly numerous
  3 Leaves appearing in spring
   4 Tuber horizontal; leaves often with blackish spots — **2. maculatum**
   4 Tuber vertical; leaves without spots — **3. orientale**
  3 Leaves appearing in autumn or early winter
   5 Spadix about equalling spathe — **4. elongatum**
   5 Spadix much shorter than spathe
    6 Tuber horizontal; spathe white or pale green, sometimes tinged with purple — **1. italicum**
    6 Tuber vertical; spathe purplish-black — **5. petteri**

[1] By C. T. Prime. [2] By D. A. Webb.

1. A. italicum Miller, *Gard. Dict.* ed. 8, no. 2 (1768). Plant 25–50(–70) cm. Tuber *c.* 5 cm, horizontal. Leaves appearing in autumn or early winter; lamina 15–35 cm, sagittate to hastate, shiny; petiole 15–40 cm. Peduncle usually ⅓–½ as long as petioles, rarely almost as long. Spathe 15–40 cm, drooping early at apex. Spadix ⅓(-½) as long as spathe; appendix stout, yellow. Sterile flowers present above and below the male. Fruiting spike 10–15 cm. Flowering in late spring or early summer. *Hedges and disturbed ground. S. & W. Europe, northwards to S. England.* Al Az Bl Br Bu Co Cr Ga Gr He Hs It Ju Lu Rs (K) Sa Si Tu [Ho].

1 Spathe tinged with purple, at least at the margin; peduncle nearly as long as petioles **(d)** subsp. **byzantinum**
1 Spathe white or pale greenish-yellow, not tinged or edged with purple, though rarely with purple spots; peduncle much shorter than petioles
2 Spathe pure white inside **(c)** subsp. **albispathum**
2 Spathe pale greenish-yellow inside
3 Leaves with conspicuous whitish veins; lateral lobes divergent **(a)** subsp. **italicum**
3 Leaves concolorous or with dark spots; lateral lobes convergent, sometimes overlapping **(b)** subsp. **neglectum**

(a) Subsp. **italicum**: Leaves with conspicuous whitish veins; lateral lobes divergent. Peduncle much shorter than petioles. Spathe pale greenish-yellow. Seeds 3–4. $2n=84$. *Almost throughout the range of the species.*

(b) Subsp. **neglectum** (Townsend) Prime, *Watsonia* **5**: 107 (1961): Leaves concolorous, or rarely with dark spots; lateral lobes convergent, sometimes overlapping. Peduncle much shorter than petioles. Spathe pale greenish-yellow. Seeds 1–2. $2n=84$. *W. Europe and W. Mediterranean region.*

(c) Subsp. **albispathum** (Steven) Prime, *Bot. Jour. Linn. Soc.* **76**: 384 (1978) (*A. albispathum* Steven): Like subsp. **(b)** but spathe pure white inside, greenish outside. *Krym.* (*S.W. Asia.*)

(d) Subsp. **byzantinum** (Blume) Nyman, *Consp.* 755 (1882): Like subsp. **(b)** but peduncle nearly as long as petioles; spathe pale green, tinged with purple at least on the margin. *E. part of Balkan peninsula, Kriti.*

2. A. maculatum L., *Sp. Pl.* 966 (1753). Plant 25–40 cm. Tuber *c.* 2 cm, horizontal. Leaves appearing in spring; lamina (7–)10–20 cm, hastate to sagittate, often with blackish spots, usually shiny; petiole 15–25 cm. Peduncle at least ⅔ as long as petioles, sometimes about equalling them. Spathe 10–20(–25) cm, pale yellowish-green, often with purple margin and spots. Spadix *c.* ½ as long as spathe; appendix purple, rarely yellow. Sterile flowers present above and below the male. Fruiting spike 3–4 cm. Seeds 1–3. Flowering in late spring. $2n=56$. *Woods and hedges; somewhat calcicole. W., C. & S. Europe, northwards to Scotland, and extending eastwards to W. Ukraine.* ?Al Au Be Bl Br Bu Co Cr Cz Ga Ge Gr Hb He Ho Hs Hu It Ju Lu Po Rm Rs (W) Sa ?Si ?Tu [Da].

The geographical limits in the east are uncertain owing to confusion with 3, and in parts of the south owing to confusion with **1**.

3. A. orientale Bieb., *Fl. Taur.-Cauc.* **2**: 407 (1808). Plant 10–40 cm. Tuber 2·5–5 cm in diameter, vertical, more or less discoid. Leaves appearing in spring; lamina 10–30 cm, sagittate, not spotted; petiole 10–20 cm. Peduncle 8–25 cm. Spathe 7–15 cm, pale green, variably tinged with purple but not spotted. Spadix *c.* ⅔ as long as spathe; appendix dull purple. Sterile flowers present above and below the male. Fruiting spike *c.* 7 cm. Flowering in late spring or early summer. *Shady places. E.C. Europe and Balkan peninsula, extending locally northwards to S. Sweden, westwards to Sicilia and eastwards to Krym.* ?Al Au Bu Cz Da Gr Hu It Ju Po Rm Rs (C, W, K) Si Su ?Tu.

The form of the tuber is the only certain character by which this species can be distinguished from **2**, though other characters can give confirmatory evidence. The correlation between tuber-shape and chromosome-number has, however, been sufficiently demonstrated in several different parts of Europe to justify the maintenance of two distinct species.

1 Appendix of spadix narrowed below to a distinct stalk; leaves shiny **(a)** subsp. **orientale**
1 Appendix of spadix without distinct stalk; leaves dull
3 Appendix of spadix 3–4 mm in diameter **(b)** subsp. **lucanum**
3 Appendix of spadix 5–7 mm in diameter **(c)** subsp. **danicum**

(a) Subsp. **orientale** (incl. *A. besseranum* Schott): $2n=28$. *From Poland and E. Austria eastwards to Krym.*

(b) Subsp. **lucanum** (Cavara & Grande) Prime, *Bot. Jour. Linn. Soc.* **76**: 384 (1978) (*A. lucanum* Cavara & Grande): $2n=28$. *C. & S. Italy, Sicilia; S.W. Jugoslavia.*

(c) Subsp. **danicum** (Prime) Prime, *loc. cit.* (1978) (*A. maculatum* subsp. *danicum* Prime): $2n=28$. *E. Denmark, S. Sweden.*

4. A. elongatum Steven, *Bull. Soc. Nat. Moscou* **30(3)**: 67 (1857) (*A. orientale* subsp. *elongatum* (Steven) Engler). Like **3(a)** but leaves appearing in autumn; spathe up to 25 cm, brownish-purple inside; spadix about as long as spathe, with appendix indistinctly stalked; flowering in spring. Fruiting spike 5–7 cm. *Woods and scrub. S. Ukraine; E. part of Balkan peninsula.* Bu Gr Rs (W, K, E) ?Tu.

5. A. petteri Schott, *Syn. Aroid.* 12 (1856) (*A. nigrum* Schott). Plant 25–50 cm. Tuber 5–7 cm in diameter, vertical, subglobose. Leaves appearing in autumn, dull green; lamina 10–20 cm, hastate to hastate-sagittate; petiole 20–30 cm. Peduncle *c.* 5 cm. Spathe 15–20 cm, purplish-black. Spadix much shorter than spathe; appendix stout, dark purplish-grey. Sterile flowers present above and below the male. Flowering in spring. *Stony ground.* ● *W. Jugoslavia, N. Greece.* Gr Ju.

A plant from S.E. Italy described as *A. nigrum* var. *apulum* Carano is probably a hybrid between **1(a)** and **3(b)**. It has $2n=56$.

A. longispathum Reichenb., *Icon. Fl. Germ.* **7**: 5 (1845) (*A. orientale* subsp. *longispathum* (Reichenb.) Engler), described from a single gathering from W. Jugoslavia, resembles **5** in some features and **1** in others, but differs from both in the narrow, long-acuminate lamina of the spathe. Assessment of its taxonomic status must await its rediscovery.

6. A. creticum Boiss. & Heldr. in Boiss., *Diagn. Pl. Or. Nov.* **2(13)**: 9 (1853). Plant 30–40 cm. Tuber 2–5 cm in diameter, vertical, subglobose. Leaves appearing in autumn; lamina 8–15 cm, hastate-sagittate, dark green, shiny, the basal lobes with an angular segment projecting outwards and a rounded segment overlapping the sinus; petiole *c.* 25 cm. Peduncle as long as petioles or longer. Spathe 7–12 cm, white, pale green or yellow, less constricted and more inflated at base than in other species. Spadix shorter or longer than spathe, dark purple or yellow. Sterile flowers often absent; if present, few and small. Flowering in spring. $2n=28$. *Stony mountainsides.* ● *Kriti.* Cr.

7. A. pictum L. fil., *Suppl.* 410 (1781). Plant 30–50 cm. Tuber *c.* 5 cm in diameter, vertical, subglobose. Leaves appearing in autumn, with or shortly after the inflorescence; lamina 15–30 cm, cordate-sagittate, shiny, delicately white-veined; petiole 20–25 cm, with wide, sheathing base. Peduncle 5–10 cm. Spathe

15–25 cm, dark reddish-purple. Spadix shorter than spathe, of the same colour. Sterile flowers present above the male, but usually absent between male and female. Fruiting spike 3–5 cm. Flowering in autumn. $2n=28$. *Stony places in scrub.* ● *Islands of W. Mediterranean region.* Bl Co It Sa.

7. **Biarum** Schott[1]

Stock a depressed-globose or more or less discoid tuber, with apical bud. Scarious scale-leaves usually conspicuous, concealing base of foliage-leaves and of inflorescence. Foliage leaves entire, with or without distinct petiole. Scape usually short. Spathe withering before fruit is ripe, the lower part with margins united to form a tube. Spadix with long appendix. Flowers unisexual, without perianth, the male widely separated from the female. Sterile flowers usually present between male and female; sometimes present also above the male. Stamens 1–2. Ovary 1-locular, with a single ovule. Berry white or pale green, sometimes striped with purple.

This genus is very imperfectly understood, and its study is made more difficult by the fact that plants seldom have leaves and flowers present at the same time. The taxonomy presented below must be regarded as provisional.

In most species the first-formed leaves of each season, and also those of young plants are shorter, wider and more distinctly petiolate than are mature leaves. Descriptions refer primarily to the latter.

Literature: S. Talavera, *Lagascalia* **6**: 275–296 (1976).

1 Spathe strongly cucullate, with tube about as long as lamina **1. davisii**
1 Spathe not cucullate; tube not more than ½ as long as lamina
2 Sterile flowers present above the male, as well as between male and female **2. tenuifolium**
2 Sterile flowers present only between male and female, or entirely absent
3 Flowering in late spring; the lower sterile flowers variously connate, forming branched filaments **5. spruneri**
3 Flowering in autumn or winter; sterile flowers all consisting of simple filaments
4 Tube of spathe cylindrical; sterile flowers usually more than 8 **3. carratracense**
4 Tube of spathe inflated, ±globose; sterile flowers usually less than 8 **4. dispar**

1. B. davisii Turrill, *Gard. Chron.* ser. 3, **104**: 437 (1939). Leaves with distinct petiole 2–4 cm and ovate-oblong lamina 1·5–3 cm × (5–)10–13 mm, truncate at base. Scape 3–4 cm, slender. Spathe 3–5 × 1·5–2·5 cm, greenish-white spotted with pinkish-brown, the lower half tubular, strongly ventricose, the upper half forming a triangular, acuminate, cucullate, forwardly-curved lamina. Female flowers 10–20; zone of male flowers 8–10 mm. Sterile flowers sometimes present between male and female and above male, but very small and few, and often absent. Appendix of spadix slender, dark red, shorter than spathe. Anthers obtuse. Stigma sessile. Flowering in late autumn, without leaves. *Stony hillsides and rock-crevices.* ● *Kriti.* Cr.

2. B. tenuifolium (L.) Schott in Schott & Endl., *Melet. Bot.* 17 (1832). Leaves 5–20(–40) cm × 3–15 mm, linear to oblong or spathulate, with or without distinct petiole, flat or undulate. Scape not more than 5 cm, underground. Spathe 8–20(–30) cm; tube 2·5–6 cm, cylindrical, whitish; lamina lanceolate-acuminate, not cucullate, dark purple, tinged with green outside, 3–5 times as long as the tube. Zone of female flowers *c.* 3 mm, of male flowers 6–8(–12) mm; sterile flowers well-developed as numerous, mainly simple filaments, between male and female zones and also some (very variable in number) above the male. Appendix of spadix slender, purple, exceeding the spathe. Anthers obtuse, dehiscing by lateral slits. Stigma sessile. Seeds 4–5 × 2–3 mm. Flowering in late summer or autumn, without leaves, or rarely in late spring or early summer, with leaves. $2n=16$, 20, 22, 26. *Mediterranean region, C. & S. Portugal.* Al Cr Gr Hs It Ju Lu Si.

Very variable, but the customary division into subspecies according to dimensions of leaves, spathe and spadix is of little value, at least in Europe. The recorded chromosome numbers show, unfortunately, no clear correlation with either morphology or geographical range. The plants from S.W. Europe, with $2n=22$ and 26 respectively have been distinguished as **B. arundanum** Boiss. & Reuter, *Pugillus* 110 (1852), and **B. galiani** Talavera, *Lagascalia* **6**: 289 (1976). The former has the lower sterile flowers regularly whorled, and a few of them are 2-fid; in *B. galiani*, which differs from the other variants in its calcifuge habit, a few of the sterile flowers are 3-fid. Variants from Kriti, with strongly undulate leaves, also have the sterile flowers whorled; they have been referred to **B. zeleborii** Schott, *Österr. Bot. Wochenbl.* **7**: 245 (1857), originally described from W. Anatolia.

Until the variation of the complex has been more thoroughly studied over its entire geographical range, the taxonomic status of these variants must remain uncertain.

3. B. carratracense (Haenseler ex Willk.) Font Quer, *Butll. Inst. Catalana Hist. Nat.* **26**: 53 (1926) (*Ischarum haenseleri* (Willk.) Schott). Leaves oblong to oblanceolate, usually with distinct petiole, flat or slightly undulate. Scape up to 14 cm. Spathe 10–35 cm; tube 2–6 cm, cylindrical; lamina 4–5 times as long as tube, lanceolate, dark reddish-purple, sometimes tinged with green outside. Zone of female flowers *c.* 5 mm, of male flowers 6–10 mm, separated by a gap of *c.* 15 mm bearing 8–20 filiform sterile flowers. No sterile flowers present above the male. Appendix of spadix usually about equalling the spathe, dark reddish-purple, rarely green. Anthers dehiscing by an apical pore. Style short but distinct. Seeds 5–6 × 4–5 mm. Flowering in autumn. $2n=98$, *c.* 96. ● *S. Spain.* Hs.

Included by some authors under **B. bovei** Blume, *Rumphia* **1**: 114 (1836), from S.W. Asia and Egypt, and possibly conspecific. The Spanish plant, however, seems to be smaller in all its parts, and has a much narrower spathe and leaves.

4. B. dispar (Schott) Talavera, *Lagascalia* **6**: 289 (1976). Like **3** but spathe not more than 25 cm, with tube 1–4 cm, strongly inflated and subglobose; spadix usually shorter than spathe; sterile flowers (0–)1–8(–12). $2n=74$. *S.W. Spain and S.E. Portugal; Sardegna.* Hs Lu Sa.

5. B. spruneri Boiss., *Diagn. Pl. Or. Nov.* **2(13)**: 5 (1853). Like **3** but spathe 10–15 cm, about equalling the spadix; sterile flowers between male and female variously connate, forming branched filaments; anthers apiculate; flowering in late spring, with leaves. *Dry hillsides.* ● *S. Greece.* Gr.

B. fraasianum (Schott) N.E. Br., *Jour. Linn. Soc. London* (*Bot.*) **18**: 254 (1880), was inadequately described from a single gathering in S.E. Greece. It may be a variant of **5.**

8. **Arisarum** Miller[2]

Stock a tuber or rhizome. Leaves petiolate, entire. Spathe withering before fruit is ripe, the lower part with margins united to form a closed tube, the upper part cucullate, enfolding and

[1] By C. T. Prime and D. A. Webb. [2] By C. T. Prime.

partly concealing upper part of spadix. Spadix shorter than or equalling spathe, with long appendix. Flowers unisexual, without perianth, the female 1–6, at extreme base of spadix, with *c.* 20 male flowers immediately above them; sterile flowers absent. Stamen 1. Ovary 1-locular; berry greenish.

Spathe acute to mucronate; appendix of spadix greenish, with cylindrical, clavate or globular apex **1. vulgare**
Spathe terminating in a long, filiform process much longer than the remainder; appendix of spadix with whitish, oblong-lingulate apex **2. proboscideum**

1. A. vulgare Targ.-Tozz., *Ann. Mus. Firenze.* **2(2)**: 67 (1810). Stock an irregular, more or less ovoid tuber. Plant 20–40 cm. Leaves 6–12 × 4–10 cm, ovate to hastate-sagittate, obtuse or shortly mucronate, cordate at base; petiole long and slender, purple-spotted. Spathe 3–5 cm, erect, the basal part pale green with longitudinal stripes of dull reddish-purple, the upper part dark green to purplish-brown. Appendix of spadix greenish. Female flowers 4–5. Seeds 2–6. *Mediterranean region, C. & S. Portugal, Açores.* Al Az Bl Co Cr Ga Gr Hs It Ju Sa Si.

(a) Subsp. **vulgare**: Scapes about equalling petioles. Upper part of spathe and spadix curved forward; appendix of spadix somewhat exserted from spathe, its apex cylindrical or somewhat clavate. $2n=56$. *Throughout the range of the species.*

(b) Subsp. **simorrhinum** (Durieu) Maire & Weiller in Maire, *Fl. Afr. Nord* **4**: 241 (1957): Scapes much shorter than petioles. Spathe and spadix erect, scarcely curved forward; apex of appendix of spadix enlarged to form a globular mass which more or less closes the mouth of the spathe. *S. & E. Spain.* (*N. Africa.*)

2. A. proboscideum (L.) Savi, *Osserv. Div. Piante* 6 (1816). Stock a short, slender rhizome. Plant 12–20(–30) cm. Leaves 6–15 cm, sagittate, obtuse or mucronate; petioles not spotted. Scapes much shorter than petioles. Spathe dark brown or brownish-green distally, paler proximally, sometimes striped with dull purple, the apical part strongly cucullate, curved forward, and terminating in a filiform process 5–15 cm long. Appendix of spadix with swollen, oblong-lingulate, whitish apex, included in spathe. Female flowers 1–3. Seeds numerous. $2n=28$. *Shady places.* ● *C. & S. Italy; S.W. Spain.* Hs It.

Cultivated in gardens as a curiosity, the upper part of the spathe (which is all that protrudes from beneath the leaves) bearing a striking resemblance to the tail and hindquarters of a mouse.

9. Ambrosina Bassi[1]

Stock a short, tuberous rhizome. Leaves long-petiolate, entire. Spathe persistent, with free, somewhat overlapping margins, enfolding the whole spadix. Spadix winged, with wings adnate to the spathe, bearing a single female flower at the base and a few male flowers on the opposite side near the apex; appendix short, conical. Perianth absent. Anthers 2, sessile. Style present. Ovary 1-locular; fruit a rather dry berry; seeds numerous.

1. A. bassii L., *Gen. Pl.* ed. 6, 579 (1764). Petioles and inflorescence procumbent to ascending. Leaves 2–6 × 1·5–3 cm, broadly lanceolate to orbicular-oblong, sometimes veined and spotted with purplish-red; petiole slender. Scape shorter than leaves. Spathe and spadix more or less horizontal. Spathe *c.* 2 cm, green with purple spots, boat-shaped with margins directed upwards, abruptly narrowed to a purple, subulate, suberect apex. Spadix with lateral wings adnate to spathe, so as to divide the cavity of the latter into an upper and a lower chamber, the upper side bearing a female flower at the base and numerous slender papillae distal to it, the lower side bearing *c.* 8 male flowers in 2 rows. *Grassland and low scrub. C. & S. Italy and islands of C. Mediterranean region.* Co It Sa Si.

10. Dracunculus Miller[2]

Stock a tuber. Leaves long-petiolate, deeply divided pedately into more or less numerous segments. Spathe withering before fruit is ripe, the lower part convolute, with overlapping margins, closely enfolding the base of the spadix, the upper part more or less flat. Spadix about as long as spathe, with a short floral zone and a long, stout appendix. Flowers unisexual, without perianth; zones of male and female flowers of about equal length. Stamens 2–3. Ovary 1-locular; seeds few.

Adaxial surface of spathe and appendix of spadix smooth and glabrous **1. vulgaris**
Adaxial surface of spathe hairy; appendix of spadix covered with filiform processes **2. muscivorus**

1. D. vulgaris Schott in Schott & Endl., *Melet. Bot.* 17 (1832) (*Arum dracunculus* L.). Plant up to 100 cm. Leaves 15–20 × 25–35 cm, more or less reniform in outline; segments 9–15, elliptical to oblong-lanceolate, acute; petiole with long, wide sheathing base, spotted with dark purple, concealing base of scape so as to make some leaves appear cauline. Spathe 20–40(–55) cm, glabrous, with abaxial surface greenish and adaxial dark brownish-purple; upper part lanceolate, erect; margins undulate. Spadix with male and female zones almost contiguous; sterile flowers few, sometimes absent; appendix with short, pale stalk, the remainder dark purple. Berry orange-red. $2n=32$. *Woods and scrub. E. & C. Mediterranean region, extending to S. Bulgaria; cultivated as a curiosity and occasionally naturalized elsewhere.* ?Al Bu Co Cr Gr It Ju Sa Si [Ga ?Hs Lu].

2. D. muscivorus (L. fil.) Parl., *Fl. Ital.* **2**: 253 (1857) (*Arum muscivorum* L. fil.). Like **1** but leaves more irregularly divided, with shape and size of segments very variable (often with the median segment much wider than the others): petiole-base with lilac spots; upper part of spathe broadly ovate, more or less patent, with adaxial surface hairy, greenish with purple streaks; conspicuous sterile flowers present above and below the male flowers, those above gradually passing into slender, subulate processes which cover the appendix. $2n=56$. *Scrub and grassy places, mostly near the sea.* ● *Islands of W. Mediterranean region.* Bl Co Sa.

[1] By C. T. Prime.

[2] By C. T. Prime and D. A. Webb.

CXCVI. LEMNACEAE[1]

Small aquatic perennial herbs. Fronds floating or submerged, flowering at the surface of the water, multiplying by buds from one median or two lateral pouches, the new fronds separating or remaining linked. Roots simple, on the ventral surface of the fronds, or absent. Inflorescence minute, consisting of 1 stamen and 1 ovary in a cavity on the dorsal surface of the frond, or 2 stamens and 1 ovary enclosed in a sheath and in a bud-pouch. Ovary 1-locular; style short, undivided; ovules 1–4, basal. Fruit a utricle; seeds 1–4.

All the species of the family are found in fresh water.

Literature: C. den Hartog & F. van der Plas, *Blumea* **18**: 355–368 (1970).

1 Fronds not more than 1 mm, floating, with neither roots nor veins and with a single, basal median bud-pouch; raphides absent **1. Wolffia**

1 Fronds more than 1 mm, floating or submerged, usually with roots and veins and with two lateral bud-pouches; raphides present

2 Fronds floating or submerged, each with a single root and 1–3(–5) often inconspicuous veins **2. Lemma**

2 Fronds floating, each with at least 2 roots and 3–15 veins **3. Spirodela**

1. Wolffia Horkel ex Schleiden[2]

Fronds not more than 1 mm, floating, symmetrical, with neither roots nor veins. Bud-pouch 1, basal, median, infundibuliform, with circular opening. Raphides absent. Inflorescence consisting of 1 stamen and 1 ovary in a single cavity on the upper surface of the frond. Anthers 1-locular, dehiscing apically. Ovary globose; ovule 1, orthotropous. Fruit globose; seed smooth.

1. W. arrhiza (L.) Horkel ex Wimmer, *Fl. Schles.* ed. 3, 140 (1857) (*W. michelii* Schleiden, *Lemna arrhiza* L.). Fronds 0·5–1 mm, ellipsoid or subglobose, light green. $2n=50$. *From England and Lithuania southwards to W.C. Portugal, Sicilia and Bulgaria.* Au Be Br Bu Co Cz Ga Ge Ho Hs Hu It Ju Lu Po Rm Rs (B, C, W) Si.

The smallest European vascular plant. Flowers are never produced in Europe.

2. Lemna L.[2]

Fronds more than 1 mm, floating or submerged, separate or connected, symmetrical or asymmetrical, flat or slightly swollen, rarely inflated; roots one per frond or absent; veins 1–3(–5). Bud-pouches 2, lateral. Raphides present. Inflorescence consisting of 2 stamens and 1 ovary enclosed in a sheath and in one of the two bud-pouches. Anthers 2-locular, dehiscing transversely. Ovary globose; ovules 1 or 4–6, orthotropous to anatropous. Fruit more or less globose; seeds longitudinally ribbed, rarely smooth.

1 Fronds 5–15 mm, wholly submerged except when flowering, translucent, ±acute and serrulate at apex, several linked by conspicuous stalks **1. trisulca**

1 Fronds 2–6 mm, floating, opaque, obtuse or rounded at the apex, entire, free or a few linked by inconspicuous stalks

2 Fronds 1-veined, oblong or falcate **5. valdiviana**

2 Fronds 3(–5)-veined, sometimes obscurely so, ovate, elliptical, obovate or suborbicular

3 Fronds grey-green or reddish-brown on the dorsal surface, frequently strongly swollen beneath, the ventral surface with up to 40–50 meshes 0·2–0·7 mm **2. gibba**

3 Fronds usually light green on the dorsal surface, always ±flat on both surfaces, the ventral surface with not more than 15–20 meshes 0·1–0·25 mm

4 Fronds almost symmetrical; roots with a wingless sheath and an obtuse cap **3. minor**

4 Fronds very asymmetrical; roots with a winged sheath and an acute cap **4. perpusilla**

Subgen. **Staurogeton** Reichenb. Submerged, but rising to the surface to produce flowers. Fronds with persistent stalks.

1. L. trisulca L., *Sp. Pl.* 970 (1753). Fronds 5–15 mm, submerged, translucent, oblong to narrowly ovate, more or less acute and serrulate at apex, 3-veined. Flowering fronds floating and smaller than the sterile ones. Ovule 1. $2n=40, 44$. *Most of Europe except some of the islands.* All except Al Az Bl Co Cr Fa Is Sb.

Subgen. **Lemna**. Floating. Fronds with fugacious stalks.

2. L. gibba L., *Sp. Pl.* 970 (1753). Fronds 2–5 mm, floating, opaque, broadly ovate to suborbicular, rounded at the apex, entire, frequently strongly swollen beneath, 3(–5)-veined, the dorsal surface grey-green or sometimes reddish-brown, the ventral surface with 40–50 meshes 0·2–0·7 mm. Ovules 4–6. $2n=40, 50, 64$. *Most of Europe, northwards to c. 63° N. in Sweden.* All except ?Al Az Cr Fa Is Rs (N) Sb; extinct in No.

3. L. minor L., *Sp. Pl.* 970 (1753). Fronds 1·5–5 mm, floating, opaque, almost symmetrical, elliptical to narrowly ovate or obovate, rounded at the apex, entire, more or less flat on both surfaces, 3-veined, the dorsal surface light green, the ventral surface with 10–20 meshes 0·1–0·25 mm. Roots with a wingless sheath and an obtuse cap. Ovule 1. $2n=40, 42, 50$. *Most of Europe.* All except Fa Is Sb.

4. L. perpusilla Torrey, *Fl. New-York* **2**: 245 (1843) (*L. paucicostata* Hegelm. ex Engelm.). Fronds 2–6 mm, floating, opaque, very asymmetrical, obovate-elliptical, rounded at the apex, entire, more or less flat on both surfaces, 3-veined, the dorsal surface light green. Roots with a winged sheath and an acute cap. $2n=40$. *Naturalized locally in rice-fields in N. Italy and S. France.* [Ga It.] (*Asia, Africa, North and South America.*)

5. L. valdiviana Philippi, *Linnaea* **33**: 239 (1864). Fronds 2–6 mm, floating, opaque, frequently very asymmetrical, oblong or falcate, rounded at the apex, entire, more or less flat and light green on both surfaces, obscurely 1-veined. $2n=40$. *Naturalized locally in S.W. France* (*Lac Marion, near Biarritz*). [Ga.] (*North and South America.*)

3. Spirodela Schleiden[2]

Fronds floating, separate or 2–5 connected, flat to inflated, asymmetrical, with an inferior scale and a superior fugacious scale, 3- to 15-veined; roots 2–18 on each frond, rarely absent. Bud-pouches 2, lateral. Rhaphides present. Inflorescence consisting of 2 stamens and 1 ovary enclosed in a sheath and in one of the two bud-pouches. Anthers 2-locular, dehiscing transversely. Ovary globose; ovules 1 or 2–4, orthotropous to anatropous. Fruit more or less globose; seeds longitudinally ribbed or smooth.

1. S. polyrhiza (L.) Schleiden, *Linnaea* **13**: 392 (1839) (*Lemna polyrhiza* L.). Fronds 4–10 mm, floating, opaque, asymmetrical, ovate to suborbicular, rounded at the apex, entire, flat on both surfaces, 5- to 9-veined, the dorsal surface dark green and shining, the ventral surface often purplish; roots usually 5–15 per frond. $2n=40$. *Most of Europe except the extreme north and south.* Au Be Br Bu Cz Da Fe Ga Ge Hb He Ho Hs Hu It Ju Lu No Po Rm Rs (N, B, C, W, K, E) Sa Su Tu.

Very rarely flowering.

S. oligorrhiza (Kurz) Hegelm., *Lemnac.* 147 (1868), with fronds 2–5 mm and roots 2–5 per frond, has been recorded from rice-fields in N.W. Italy (S. of Matara) and is perhaps becoming naturalized.

[1] Edit. D. H. Valentine. [2] By A. Lawalrée.

PANDANALES

CXCVII. SPARGANIACEAE[1]

Monoecious. Flowers in unisexual, sessile or pedunculate, globose capitula, the female capitula below, the male above. Perianth-segments scale-like, (1–)3–4(–6) in female flowers, 1–6 in male flowers. Stamens 1–8. Ovary superior, 1(–3)-locular. Fruit dry, indehiscent, 1-seeded; exocarp spongy; endocarp hard; style persistent (rarely minute or absent).

1. Sparganium L.[2]

Glabrous, aquatic or semi-terrestrial perennial herbs, with fibrous roots and creeping rhizomes. Stems erect or floating. Leaves linear, distichous, sheathing at base, erect or floating, gradually passing into scale-like bracts.

All species occur in still or slowly running fresh water.

Literature: K. O. P. P. Graebner in Engler, *Pflanzenreich* **2(IV. 10)**: 10–24 (1900). W. Rothert, *Acta Horti Bot. Univ. Jurjev.* **11**: 11–32 (1910).

1 Perianth-segments thick, with dark brown to black apex; seeds with 6–10 longitudinal ridges; inflorescence usually much branched **1. erectum**

1 Perianth-segments thin, uniformly light brown; seeds without longitudinal ridges; inflorescence simple or with a few branches at base

2 Style in fruit deflexed; inflorescence usually with 1 or 2 branches at base, the branches bearing 2–3 female capitula **2. gramineum**

2 Style in fruit straight; inflorescence simple, the lower female capitula often stalked

3 Leaves sharply keeled; female capitula crowded together; male capitulum or capitula usually contiguous with uppermost female capitulum **5. glomeratum**

3 Leaves 3-angled or flat, not keeled; female capitula remote; male capitulum or capitula remote from uppermost female capitulum

4 Male capitula more than 3, remote; leaves triangular in transverse section near base **3. emersum**

4 Male capitula not more than 3, crowded together; leaves not triangular in transverse section near base

5 Style minute or absent; fruits broadly obovoid **7. hyperboreum**

5 Style distinct, beak-like; fruits ellipsoid to obovoid

6 Leaf-like bract subtending lowest female capitulum 10–60 cm, at least twice as long as inflorescence; leaves inflated at base; male capitula usually 2, contiguous and appearing as one elongated capitulum **4. angustifolium**

6 Leaf-like bract subtending lowest female capitulum 1–5(–8) cm, scarcely exceeding inflorescence; leaves only slightly inflated at base; male capitulum usually solitary, globose **6. minimum**

Subgen. **Sparganium**. Perianth-segments thick, with dark brown to black apex. Seeds with 6–10 longitudinal ridges.

1. S. erectum L., *Sp. Pl.* 971 (1753) (*S. ramosum* Hudson). Semi-terrestrial herb (30–)50–150(–200) cm, robust, erect. Leaves usually erect, rarely floating, triangular in transverse section, keeled below. Inflorescence branched, very rarely simple, with male capitula borne above female capitula on lateral branches. *Throughout Europe except for some islands.* All except Az Fa Is Sb.

1 Fruit 7–9 mm (excluding style), 2–3·5 mm wide, ellipsoid, the upper and lower parts both shiny, light brown, almost terete; ovary 1-locular **(c)** subsp. **neglectum**

1 Fruit obpyramidal, the upper part dull, dark brown or black, the lower part shiny, light brown, distinctly angled in transverse section

2 Fruit (5–)6–8(–10) mm (excluding style), (3–)4–6(–7) mm wide, the upper part flattened; ovary (1–)2(–3)-locular **(a)** subsp. **erectum**

2 Fruit 6–7(–8) mm (excluding style), 2·5–4·5 mm wide, the upper part domed and rugose below style; ovary usually 1-, rarely 2-locular **(b)** subsp. **microcarpum**

(a) Subsp. **erectum** (*S. ramosum* subsp. *polyedrum* Ascherson & Graebner, *S. erectum* subsp. *polyedrum* (Ascherson & Graebner) Schinz & Thell., *S. polyedrum* (Ascherson & Graebner) Juz.): *Much of Europe, but absent from most of the north.*

(b) Subsp. **microcarpum** (Neuman) Domin, *Preslia* **13–15**: 53 (1935), *S. erectum* subsp. *neglectum* var. *microcarpum* (Neuman) Hayek, *S. microcarpum* (Neuman) Čelak.): *Almost throughout the range of the species.*

(c) Subsp. **neglectum** (Beeby) Schinz & Thell. in Schinz & R. Keller, *Fl. Schweiz* ed. 3, **2**: 14 (1914) (*S. neglectum* Beeby, *S. ramosum* subsp. *neglectum* (Beeby) Neuman): $2n=30$. *Most of Europe, northwards to c. 58° N. in Sweden.*

S. erectum subsp. **oocarpum** (Čelak.) Domin, *Preslia* **13–15**: 53 (1935) (*S. ramosum* var. *oocarpum* (Čelak.) Ascherson & Graebner, *S. erectum* subsp. *neglectum* var. *oocarpum* (Čelak.) Hayek), with uniformly light brown, ovoid to globose fruit 5–8 × 4–7 mm, is only partly fertile and may be the hybrid *S. erectum* subsp. *erectum* × subsp. *neglectum*; it occurs throughout most of Europe but is commonest in the south-east.

Subgen. **Xanthosparganium** Holmberg. Perianth-segments thin, uniformly light brown. Seeds smooth.

Hybrids between all the species in this subgenus have been reported. **2 × 3** and **2 × 4** (both often called *S. speirocephalum* Neuman) are widespread and often replace the parents in parts of N. Fennoscandia. **3 × 4** is widespread and often locally abundant.

2. S. gramineum Georgi, *Bemerk. Reise* **1**: 232 (1775) (*S. friesii* Beurl.). Stem up to 100 cm, floating. Leaves very long, floating, plano-convex or semi-terete, not inflated at base. Inflorescence elongate, often branched at base; branches with 2–3 female capitula and often without male capitula; main axis with 3–7 female capitula and 2–6 male capitula. Lower bracts longer than inflorescence, usually floating. Capitula remote, axillary, sessile, or lower female capitula pedunculate. Fruit ovoid, dark grey to dark brown, pedicellate; style abruptly deflexed from base. $2n=30$. *N. Europe, westwards to E. Norway.* Fe No Rs (N, B, C) Su.

3. S. emersum Rehmann, *Verh. Naturf. Ver. Brünn* **10**, *Abh.*: 80 (1871) (*S. diversifolium* Graebner, *S. simplex* Hudson). Stem 20–60 cm, erect or floating. Leaves both erect and floating, triangular in transverse section, sheathing but not inflated at base. Inflorescence simple. Lower bracts longer than the inflorescence,

[1] Edit. S. M. Walters. [2] By C. D. K. Cook.

erect. Female capitula 3–6, remote, the lower often pedunculate. Male capitula 3–10, distinct, remote, all borne on main axis. Fruit ellipsoid, often pedicellate; style straight. $2n=30$. *Much of Europe, but absent from many of the islands and parts of the Mediterranean region.* Al Au Be Br Bu Cz Da Fe Ga Ge Hb He Ho Hs Hu It Ju Lu No Po Rm Rs (N, B, C, W, E) Sa Si Su.

4. S. angustifolium Michx, *Fl. Bor. Amer.* **2**: 189 (1803) (*S. affine* Schnizlein). Stem up to 100 cm, floating or rarely erect. Leaves flat in transverse section, inflated and sheathing at base. Inflorescence simple. Lowest bract 10–60 cm, at least twice as long as inflorescence. Female capitula 2–4, remote, the lower usually pedunculate. Male capitula (1–)2(–3), crowded and appearing as one elongated capitulum on main axis. Fruit ellipsoid, brown, shortly pedicellate; style straight. $2n=30$. *N. & N.C. Europe, extending southwards in the mountains to N. Portugal, the Alps and Macedonia.* Au Be Br Bu Cz Da Fa Fe Ga Ge Gr Hb He Hs Ho Is It Ju Lu No Po Rs (N, B, C) Su.

5. S. glomeratum Laest. ex Beurl., *Öfvers. Kongl. Vet.-Akad. Förhandl.* **9**: 192 (1853). Stem up to 40 cm, erect. Leaves with winged keel below, not inflated at base. Inflorescence simple, congested. Lowest bract at least 3 times as long as inflorescence. Female capitula (2–)3–5(–6), crowded together on the main axis, rarely the lower pedunculate and somewhat remote. Male capitula 1–2, usually contiguous with uppermost female capitulum. Fruit constricted around the middle, the lower part ovoid, the upper part tapering into the style, brown, shortly pedicellate. $2n=30$. *N. Europe, southwards to White Russia.* Fe No Rs (N, B, C) Su.

6. S. minimum Wallr., *Erst. Beitr. Fl. Hercyn.* **2**: 297 (1840). Stem 8–30 cm, floating, very rarely erect, with 4–9 internodes. Leaves flat, thin, usually translucent, slightly inflated at base. Inflorescence simple. Lowest bract 1-5(-8) cm, scarcely exceeding inflorescence. Female capitula (1–)2–3(–4), usually sessile, remote. Male capitulum separated from the female by an obvious internode, solitary (rarely 2 and then close together and appearing as one). Fruit obovoid, pale brown, sessile, with short, beak-like style. $2n=30$. *Europe southwards to the Pyrenees, N. Appennini and S. Bulgaria.* Au Be Br Bu Cz Da Fe Ga Ge Hb He Ho Hs Hu Is It Ju No Po Rm Rs (N, B, C, W, E) Su.

7. S. hyperboreum Laest. ex Beurl., *Öfvers. Kongl. Vet.-Akad. Förhandl.* **9**: 192 (1853). Stem up to 30 cm, floating, with not more than 5 internodes. Leaves elliptical in transverse section, rather thick, not translucent. Inflorescence simple. Lowest bract distinctly longer than inflorescence. Female capitula 2–3(–4), irregularly disposed, the lower mostly pedunculate and remote, the upper sessile and crowded. Male capitulum remote from the female, solitary (rarely 2 and then close together and appearing as one). Fruit broadly obovoid, pale brownish-yellow, shortly pedicellate; style minute or absent. $2n=30$. *Fenno-scandia and N. Russia; one station in S. Alps.* Fe Is It No Rs (N) Su.

CXCVIII. TYPHACEAE[1]

Monoecious. Flowers usually surrounded by hairs or scales (sometimes interpreted as perianth-segments), in 2 dense, superposed, cylindrical, spike-like partial inflorescences, the female below, the male above. Male flowers with simple or forked hairs or linear-lanceolate scales, or naked; stamens in clusters of 1–3 (–8); filaments often irregularly united. Female flowers on branched stalks, with hairs and sometimes also with scales, the branches with sterile flowers. Ovary superior, 1-locular, on a hairy stalk; style persistent; ovule solitary. Fruit dry, usually dehiscent.

All species grow in marshes or shallow water, at the margins of lakes, pools and rivers.

1. Typha L.[2]

Glabrous, aquatic or semi-terrestrial perennial herbs, with fibrous roots and creeping rhizomes. Stems erect, corm-like at base. Leaves mostly basal, linear, distichous, erect; sheath closely enveloping the stem, tapering or auriculate above; lamina linear, elongate, semi-cylindrical to flat, sometimes somewhat keeled below, with a layer of air-filled cavities.

Literature: G. Dihoru, *Rev. Roum. Biol. (Bot.)* **17**: 79–86 (1972). J.-B. Gèze, *Études botaniques et agronomiques sur les* Typha *et quelques autres Plantes palustres.* Villefranche-de-Rouergue. 1912. K. O. P. P. Graebner in Engler, *Pflanzenreich* **2(IV. 8)**: 8–16 (1900).

The following hybrids have been recorded in nature and have been experimentally produced: *T.* × *argoviensis* Hausskn. (**5** × **6**), *T.* × *glauca* Godron (*T. elata* Boreau) (**1** × **5**), *T.* × *provincialis* A. Camus (*T.* × *glauca* auct., non Godron) (**2** × **5**), *T.* × *bavarica* Graebner (**1** × **6**); also **1** × **2**. Varying degrees of fertility are found in these hybrids.

1 Leaves not more than 3 mm wide; male flowers without hairs and scales; hairs of female flowers distinctly swollen at apex **3. minima**

1 Leaves usually more than 3 mm wide; male flowers with hairs or scales; hairs of female flowers not or slightly swollen at apex

2 Female flowers with scales

3 Leaf-sheaths usually auriculate; scales of male flowers simple or forked; scales of female flowers dark brown, opaque **1. angustifolia**

3 Leaf-sheaths usually tapering into lamina; scales of male flowers often laciniate at apex; scales of female flowers light brown, translucent **2. domingensis**

2 Female flowers without scales

4 Leaf-sheaths auriculate; male part of inflorescence 2–4 times as long as female **4. laxmannii**

4 Leaf-sheaths tapering into lamina; male part of inflorescence not longer than female

5 Female part of inflorescence dark brown when mature, about as long as male; seeds (0·9–)1·2–1·6 mm **5. latifolia**

5 Female part of inflorescence silvery-grey when mature, distinctly longer than male; seeds 0·7–0·9 mm **6. shuttleworthii**

1. T. angustifolia L., *Sp. Pl.* 971 (1753). Usually not more than 200 cm, slender. Leaf-sheaths usually closed at throat; sheath-margins free but parallel, usually auriculate above; lamina 3–6 mm wide, dark green. Flowering stems *c.* ⅔ as long as leaves. Male and female parts of inflorescence separated by (0·5–)3–8(–12) cm; female part 8–20 × 1·3–2·5 cm, 6–10 times as long as wide, dark or reddish-brown, becoming mottled with age.

[1] Edit. S. M. Walters. [2] By C. D. K. Cook.

Male flowers with hairs or linear scales entire or forked at apex; pollen-grains single. Female flowers with spathulate, dark brown, opaque, firm scales; stigmas broad, flat-topped, the same colour as the scales, exceeding scales and hairs. Seeds 1–1·3 mm. $2n=30$. *Most of Europe, northwards to* 63° *N. in Finland.* All except ?Al Az Bl Cr Fa ?Gr Is Sb.

Some of the records for S. Europe are perhaps referable to **2.**

2. T. domingensis (Pers.) Steudel, *Nomencl. Bot.* 860 (1824) (*T. angustata* Bory & Chaub.). Up to 300 cm or more, robust. Leaf-sheaths usually open at throat; sheath-margins free, usually tapering into a pale to yellowish-green lamina 5–12 mm wide. Flowering stems equalling or slightly shorter than leaves. Male and female parts of inflorescence separated by 0·5–6 cm; female part 15–25 × 1·5–2·5 cm, 10 or more times as long as wide, light brown. Male flowers with linear scales often laciniate at apex; pollen-grains usually single. Female flowers with obovate-apiculate, pale brown, translucent, fragile scales; stigmas linear, darker than the scales, at least as long as scales and hairs. Seeds 0·8–1·2 mm. $2n=30$. *S. Europe.* Al Bl Bu Co Cr Ga Gr Hs It Ju Lu ?Rm Rs (W, E) Sa Si Tu [He].

3. T. minima Funck in Hoppe, *Bot. Taschenb.* **1794**: 118, 187 (1794). 25–75 cm, slender. Leaf-sheaths open at throat; lamina usually absent on flowering stems, the lamina of leaves on the non-flowering stems 1–2(–3) mm wide. Flowering stems shorter than leaves. Male and female parts of the inflorescence contiguous or separated; female part 1·5–4·5 cm, oblong-ovoid to cylindrical, dark brown, often subtended by a leaf-like bract. Male flowers without scales or hairs; pollen-grains in tetrads. Female flowers with spathulate scales; hairs with swollen, globose apex, as long as scales; stigmas linear, longer than hairs. Fruits indehiscent. *Usually on river-gravels; somewhat calcicole. C. Europe, extending to E. Romania, Italy and S.E. France.* Au Cz Ga Ge He Hu It Ju Rm.

T. lugdunensis P. Chab., *Bull. Soc. Hort. Rhône* **1850**: 49 (1850) (*T. martinii* Jordan, *T. gracilis* Jordan, non Rafin.), recorded from river-banks in E. France, W. Switzerland and S.W. Germany, is like **3**, but a lamina is present in leaves on flowering stems. In Europe this plant appears to be distinct and flowers later than **3**, but in S.W. & C. Asia similar plants are found which grade into **3**.

4. T. laxmannii Lepechin, *Nova Acta Acad. Sci. Petrop.* **12**: 84 (1801) (*T. stenophylla* Fischer & C. A. Meyer). (70–)80–120 (–150) cm, slender. Leaf-sheaths usually open at throat; sheath-margins usually auriculate; lamina 2-4(–7) mm wide. Flowering stems shorter than leaves. Male and female parts of inflorescence separated by (0·5–)1–6 cm; female part (3–)4–9(–12) cm, ¼–½ as long as male part, oblong-ovoid to ovoid, pale brown. Male flowers with hairs and scales; pollen-grains single. Female flowers without scales; stigmas flattened, elliptical, longer than hairs. Seeds 0·95–1·1 mm. *S.E. Europe.* ?Al Bu Gr Rm Rs (W, ?K, E) [Cz *Ga Ge Hu *It].

5. T. latifolia L., *Sp. Pl.* 971 (1753). Up to 200 cm or more, robust. Leaf-sheaths usually open at throat; sheath-margins free, usually tapering at throat into a pale green lamina 8–20 mm wide. Flowering stems somewhat shorter than leaves. Male and female parts of inflorescence usually contiguous or separated by not more than 2·5 cm; female part (5–)8–15(–21) × 1·8–3 cm, up to 6 times as long as wide, dark brown, blotched with white in age; male part (3–)6–14(–21) cm. Male flowers with simple hairs; pollen-grains in tetrads. Female flowers without scales; hairs 30–50, borne on a zone (0·7–)1–1·6(–3·5) mm long at base of gynophore; stigmas lanceolate to rhombic, fleshy, persistent, brown or dark brown, longer than hairs. Seeds (0·9–)1·2–1·5 (–1·6) mm. $2n=30$. *Almost throughout Europe.* All except Az Cr Fa Is Sb.

6. T. shuttleworthii Koch & Sonder in Koch, *Syn. Fl. Germ.* ed. 2, 786 (1844). Usually not more than 150 cm, robust. Leaf-sheaths usually open at throat; sheath-margins free, usually tapering at throat into a pale green lamina 5–10(–15) mm wide. Flowering stems somewhat shorter than leaves. Male and female parts of inflorescence contiguous or very nearly so; female part (5–)6–14(–20) cm, brown when young, becoming silvery-grey with age; male part 1–9 cm. Male flowers with simple hairs; pollen grains in tetrads. Female flowers without scales; hairs 5–25, borne on a zone (0·3–)0·5–0·6(–1·2) mm long at base of gynophore; stigmas lanceolate, fleshy, persistent, about as long as the hairs. Seeds 0·7–0·9 mm. *Somewhat calcifuge. S.C. & S.E. Europe, extending to E. France and N. Italy.* Al Au Bu Cz Ga Ge He ?Hu It Ju Rm.

CYPERALES

CXCIX. CYPERACEAE[1]

Herbs, usually glabrous and rhizomatous. Stems usually solid, often trigonous. Leaves often grass-like, sometimes reduced to sheaths. Flowers wind-pollinated, hermaphrodite or unisexual, each in the axil of a glume and arranged in 1- to many-flowered spikelets. Spikelets solitary or variously aggregated in compound, often bracteate inflorescences, and often with 1 or more empty glumes. Perianth absent, or composed of bristles (more rarely scales). Stamens usually 2 or 3, with basifixed anthers. Style simple; stigmas 2 or 3. Ovary unilocular, with solitary, erect ovule. Nut usually with 2 or 3 angles. Seed endospermic.

Two important new treatments of this family have appeared, wholly or in part, during the preparation of this account. These have been taken into consideration, but the reader is referred to them for more detailed, if occasionally divergent, information. These are T. V. Egorova in An. A. Fedorov, *Fl. Part. Eur. URSS* **2**: 83–219 (1976); and W. Schultze-Motel in Hegi, *Ill. Fl. Mitteleur.* ed. 3, **2(1)**: 1 (1966).

[1] Edit. S. M. Walters.

1 All leaves reduced to sheaths
 2 Nut with a persistent, usually swollen style-base **4. Eleocharis**
 2 Nut without a persistent style-base
  3 Glumes spirally arranged **1. Scirpus**
  3 Glumes distichous **7. Cyperus**
1 At least some leaves with well-developed lamina
 4 Perianth-bristles conspicuous, silky, much exceeding the glumes, at least in fruit
  5 Perianth-bristles numerous **3. Eriophorum**
  5 Perianth-bristles 4–6 **1. Scirpus**

4 Perianth-bristles absent, or inconspicuous and not exceeding the glumes
6 Flowers unisexual; nut enclosed in a utricle or closely enfolded by a scale
7 Nut enfolded by a scale, the margins of which are free or connate only at the base **11. Kobresia**
7 Nut enclosed in a utricle **12. Carex**
6 Flowers mostly hermaphrodite; nut neither enclosed in a utricle nor enfolded by a scale
8 Glumes distichous
9 Glumes less than 4 mm **7. Cyperus**
9 Glumes more than 4 mm
10 Plant with stout, creeping rhizome, rarely somewhat caespitose **7. Cyperus**
10 Plant densely caespitose, without creeping rhizome **10. Schoenus**
8 Glumes spirally arranged
11 Style with long, patent hairs; annual (rarely perennial) **6. Fimbristylis**
11 Style without long, patent hairs; usually perennial
12 Spikelets distichously arranged in a spike **2. Blysmus**
12 Spikelets not distichously arranged
13 Spikelet solitary **1. Scirpus**
13 Spikelets 2 or more
14 Spikelets with 1–3 flowers (though also with empty glumes at the base)
15 Leaves 10–15 mm wide; perianth-bristles absent **8. Cladium**
15 Leaves 1–3 mm wide; perianth-bristles 5–13 **9. Rhynchospora**
14 Spikelets with more than 3 flowers
16 Glumes puberulent **5. Fuirena**
16 Glumes glabrous (though sometimes ciliate on keel, or scabrid)
17 Glumes with a curved arista **7. Cyperus**
17 Glumes without a curved arista (sometimes shortly mucronate)
18 Bracts 3–8 **7. Cyperus**
18 Bracts 1 or 2 **1. Scirpus**

1. Scirpus L.[1]

(Incl. *Bolboschoenus* (Ascherson) Palla, *Holoschoenus* Link, *Isolepis* R. Br., *Schoenoplectus* (Reichenb.) Palla, *Trichophorum* Pers.)

Perennials or annuals. Stems terete or trigonous, usually leafy. Inflorescence of 1 or more variously arranged, but never distichous, spikelets, usually bracteate. Spikelets 1- to many-flowered, terete. Glumes spirally arranged. Flowers hermaphrodite; perianth of 0–6 bristles. Stamens 1–3. Stigmas 2–3. Nut trigonous or biconvex, usually apiculate, without a persistent style-base.

S. pendulus Muhl., *Descr. Gram. Amer. Sept.* 44 (1817) (*S. lineatus* auct., non Michx), native of North America, has been recorded from N.E. Switzerland and S.E. Czechoslovakia, and is perhaps becoming naturalized; it is a caespitose perennial with robust, leafy stems 50–150 cm, bracts shorter than the inflorescence, numerous brownish spikelets on drooping pedicels in a lax inflorescence, with lateral inflorescences often present, and perianth-bristles scarcely exceeding the glumes.

1 Spikelets in globose heads **11. holoschoenus**
1 Spikelets not in globose heads
2 Stems branched, submerged or (in land form) procumbent **16. fluitans**
2 Stems simple, erect or ascending
3 Inflorescence obviously terminal
4 Spikelet solitary, without bracts
5 Plant with long stolons; perianth-bristles absent or less than ½ as long as nut **19. pumilus**
5 Plant without stolons; perianth-bristles longer than nut
6 Stems terete, smooth; perianth-bristles not more than 4 mm **18. cespitosus**
6 Stems trigonous, scabrid at apex; perianth-bristles up to 25 mm **17. hudsonianus**
4 Spikelets more than 1, or solitary and with obvious, leaf-like bracts
7 Spikelets more than 8 mm, few, in a ±condensed inflorescence **3. maritimus**
7 Spikelets less than 8 mm, numerous, in a lax inflorescence
8 Rooting, procumbent non-flowering shoots often present; perianth-bristles flexuous, smooth **2. radicans**
8 Rooting non-flowering shoots absent; perianth-bristles straight, rough **1. sylvaticus**
3 Inflorescence apparently lateral, with a stem-like bract usually overtopping spikelets
9 Annual; stems less than 2 mm in diameter
10 Bract less than 2 cm
11 Nut with concave sides and acute angles **13. pseudosetaceus**
11 Nut with convex sides and obtuse angles
12 Nut usually shiny, with prominent longitudinal ribs **12. setaceus**
12 Nut dull, smooth or finely papillose **14. cernuus**
10 Bract more than 2 cm
13 Nut *c.* 1 mm, prominently transversely rugose **9. supinus**
13 Nut *c.* 2 mm, smooth or obscurely rugose **10. juncoides**
9 Perennial, often robust or rhizomatous; stems usually more than 2 mm in diameter
14 Caespitose, with stems never more than 100 cm
15 Stems not more than 1 mm in diameter
16 Nut with convex sides and obtuse angles **12. setaceus**
16 Nut with concave sides and acute angles **13. pseudosetaceus**
15 Stems at least 2 mm in diameter
17 Lowest bract exceeding inflorescence; perianth-bristles (4–)6 **5. mucronatus**
17 Lowest bract shorter than inflorescence; perianth-bristles absent **15. prolifer**
14 Rhizomatous, with stems often more than 100 cm
18 Stems terete **4. lacustris**
18 Stems trigonous
19 Stems with 2 or 3 leaves; perianth-bristles absent or rudimentary **6. pungens**
19 Stems leafless except for uppermost sheath which usually bears a lamina; perianth-bristles well-developed
20 Perianth-bristles spathulate **7. litoralis**
20 Perianth-bristles linear **8. triqueter**

Sect. SCIRPUS. Terrestrial, rhizomatous perennials. Stems simple, trigonous, leafy. Inflorescence terminal, compound. Perianth-bristles 6. Stamens and stigmas 3. Nut trigonous, smooth.

1. S. sylvaticus L., *Sp. Pl.* 51 (1753). Rooting non-flowering shoots absent. Stems 30–120 cm, glabrous, solitary. Leaves 5–20 mm wide, flat, scabrid on midvein and margin. Bracts 2–4, leaf-like to setaceous. Spikelets 3–4 mm, ovoid, obtuse, in fascicles of 2–5(–9) at apices of ultimate rays. Glumes 1·5–2·9 mm, ovate, obtuse, mucronulate, green or greenish-brown, ciliate on margin and apex. Perianth-bristles as long as or slightly longer than nut, retrorsely barbed, straight. Nut *c.* 1 mm, obovoid or subglobose, dull, yellowish-brown. $2n=62$, 64. *Damp, usually shady places. Most of Europe, but rare in the Mediterranean region.* Al Au Be Br Bu Cz Da Fe Ga Ge Gr Hb He Ho Hs Hu It Ju No Po Rm Rs (N, B, C, W, K, E) Su Tu.

[1] By R. A. DeFilipps.

S. atrovirens Willd., *Enum. Pl. Horti Berol.* 79 (1809), native of North America, is like **1** but with spikelets in fascicles of 8–20 at the apices of the ultimate rays, usually brownish-red glumes and perianth-bristles smooth below; it has been reported frequently as a casual in C. Europe and N.E. France and is perhaps becoming naturalized.

2. S. radicans Schkuhr, *Ann. Bot.* (*Usteri*) **4**: 48 (1793). Like **1** but stems caespitose; long, procumbent non-flowering shoots present which root and form new plants at their apices; spikelets 3–8 mm, lanceolate, ovoid-lanceolate or elliptical, acute, usually solitary at apices of ultimate rays; glumes not mucronulate; perianth-bristles 2–3 times as long as nut, smooth or with only a few retrorse hairs towards apex, flexuous. *Damp places. From S. Norway and Finland southwards to the Vosges, N. Italy and C. Romania.* Au Cz Fe Ga Ge Hu It Ju No Po Rm Rs (N, B, C, W) Su.

Sect. BOLBOSCHOENUS (Ascherson) Beetle. Terrestrial, rhizomatous perennials with tuberous stolons. Stems simple, trigonous, leafy. Inflorescence terminal, more or less simple. Perianth-bristles (0–)1–6. Stamens 3. Stigmas 2–3. Nut plano-convex, lenticular or trigonous, smooth.

3. S. maritimus L., *Sp. Pl.* 51 (1753). Stems 30–120 cm, scabrid above. Leaves 2–10 mm wide, flat, glabrous or scabrid on midvein and margin. Bracts 2–4, leaf-like to setaceous. Inflorescence a sessile fascicle of 1-several spikelets, or of rays up to 5 cm bearing 1–6 spikelets at their apices. Spikelets 8–45 mm, ovoid or lanceolate. Glumes 5.5–7.5 mm, ovate, emarginate with a scabrid awn 1–3 mm in the sinus, glabrous or puberulent. Perianth-bristles retrorsely barbed, shorter than to longer than nut. Nut 0.9–3 mm, obovoid, shiny, brown to black. $2n = 80$, *c.* 104. *Damp places and marshes, usually saline. Most of Europe.* All except Fa Is Sb.

(a) Subsp. **maritimus** (*Bolboschoenus maritimus* (L.) Palla; incl. *B. compactus* (Hoffm.) Drobov, *B. planiculmis* (F. W. Schmidt) Egorova): Glumes reddish- or dark-brown. Nut plano-convex or trigonous. *Throughout the range of the species.*

(b) Subsp. **affinis** (Roth) T. Norlindh, *Bot. Not.* **125**: 404 (1972) (*Bolboschoenus affinis* (Roth) Drobov, *B. popovii* Egorova): Glumes whitish-yellow, stramineous or silvery-membranaceous. Nut lenticular. *S.E. Russia, W. Kazakhstan.* (*Caucasus to India.*)

Sect. PTEROLEPIS (Reichenb.) Bentham & Hooker fil. (Sect. *Schoenoplectus* (Reichenb.) Bentham & Hooker fil.). Terrestrial or semi-aquatic, usually rhizomatous perennials, rarely annuals. Stems simple, trigonous or terete, usually with leafless sheaths below, the uppermost sheath often with a short lamina. Inflorescence apparently lateral, subtended by 1–2 bracts, the lower forming an apparent prolongation of the stem. Perianth-bristles 1–6. Stamens 3. Stigmas 2–3. Nut plano-convex, biconvex or trigonous, usually smooth.

4. S. lacustris L., *Sp. Pl.* 48 (1753). Rhizomatous perennial. Stems 50–300 cm, solitary, terete, with leafless sheaths below, the upper sheath often with a short lamina. Lower bract usually shorter than the inflorescence. Spikelets 3–10 mm, ovoid, in fascicles arranged in a head or a simple or compound umbel with unequal rays. Glumes 3–4 mm, broadly obovate, emarginate, with obtuse lateral lobes, mucronate, often fimbriate-ciliate, reddish-brown. Perianth-bristles 5–6, retrorsely scabrid, as long as or longer than nut. Stigmas 2–3. Nut 2–3 mm, smooth, greyish-brown. *Usually in water. Almost throughout Europe.* All except Az Fa Is Sb.

(a) Subsp. **lacustris** (*Schoenoplectus lacustris* (L.) Palla): Stems up to 300 cm, green. Glumes more or less glabrous. Stigmas usually 3. Nut 2·5–3 mm, compressed-trigonous. $2n = 42$. *In fresh water. Almost throughout the range of the species.*

(b) Subsp. **tabernaemontani** (C. C. Gmelin) Syme in Sowerby, *Engl. Bot.* ed. 3, **10**: 64 (1870) (*S. glaucus* Sm., non Lam., *S. tabernaemontani* C. C. Gmelin, *Schoenoplectus tabernaemontani* (C. C. Gmelin) Palla): Stems not more than 150 cm, more or less glaucous. Glumes with dense red papillae, especially above. Stigmas usually 2. Nut 2–2·5 mm, plano- or biconvex. $2n = 38$, 42, 44. *Mainly in brackish water. Throughout most of the range of the species.*

The distinction between the two subspecies is relatively clear throughout much of Europe, but in the south part of European U.S.S.R. more variation is encountered, and a third taxon has been distinguished as **S. hippolyti** V. Krecz., *Not. Syst.* (*Leningrad*) **7**: 28 (1937), which combines the green stems and relatively smooth glumes of subsp. (a) with the plano-convex nut and 2 stigmas of subsp. (b). On a world scale, the complex of taxa related to **4** is very difficult (see T. Koyama, *Jour. Fac. Sci. Tokyo Univ.* (*Bot.*) **7**: 321–324 (1958)).

S. × carinatus Sm., *Engl. Bot.* **28**: 1983 (1809) (**4** × **8**; incl. *S. kalmussii* Ascherson, Abromeit & Graebner), occurs mainly in C. & N.W. Europe; it has the general appearance of **4**, but the stems are terete below and trigonous above the middle, the nuts are plano-convex, and the glumes often have some red papillae.

5. S. mucronatus L., *Sp. Pl.* 50 (1753) (*Schoenoplectus mucronatus* (L.) Palla). Perennial. Stems 40–100 cm, densely caespitose, trigonous, with leafless sheaths. Lower bract exceeding the inflorescence. Spikelets 4–12 mm, ovoid to oblong, 2–20 in a compact, sessile fascicle. Glumes 3–4 mm, broadly obovate, obtuse, mucronate, glabrous, reddish, with green midvein. Perianth-bristles (4–)6, retrorsely scabrid, slightly longer than nut. Stigmas (2)3. Nut 1·5–2·5 mm, obovoid, trigonous, blackish-brown, transversely rugulose. *Marshes. C. & S. Europe, eastwards to E. Ukraine and extending to W.C. France.* Au Az Bu Co Cz Ga Ge Gr He Hs Hu It Ju Lu Po Rm Rs (W) Si.

6. S. pungens Vahl, *Enum. Pl.* **2**: 255 (1805) (*S. americanus* auct. eur., non Pers.). Like **5** but rhizomatous; stems solitary; uppermost 2–3 sheaths with lamina; spikelets 1–6; glumes emarginate, with acute lateral lobes, ciliate; perianth-bristles absent or rudimentary; stigmas 2; nut plano-convex, yellowish-brown, smooth. *Marshes. W. & C. Europe, extending to S.C. Italy.* Au †Be ?Cz Ga Ge He Ho Hs Hu It Lu Po †Rs (B) [Br].

7. S. litoralis Schrader, *Fl. Germ.* 142 (1806) (*Schoenoplectus litoralis* (Schrader) Palla). Rhizomatous perennial. Stems 30–200 cm, solitary, trigonous, with leafless sheaths below, the upper sheath usually with a lamina. Lower bract equalling or exceeding the inflorescence. Spikelets 5–15 mm, ovoid to oblong, mostly in fascicles in compound umbels with unequal rays. Glumes 3–4 mm, broadly obovate, emarginate, mucronate, glabrous, brown, with scarious margin. Perianth-bristles 4–6, spathulate-dilated and hairy at apex, longer than nut. Stigmas 2(3). Nut 1–2(–3) mm, obovoid, plano- or biconvex (rarely trigonous), smooth, brown. *Damp places. S. Europe, extending northwards to S.W. Hungary.* ?Au Bu Co Cr Gr Hs Hu It Ju Rm Si.

8. S. triqueter L., *Mantissa* 29 (1767) (*Schoenoplectus triqueter* (L.) Palla). Rhizomatous perennial. Stems 50–150 cm, solitary, with leafless sheaths below, the uppermost sheath usually with a short lamina. Lower bract equalling or exceeding the inflorescence. Spikelets 5–10 mm, ovoid, mostly in sessile fascicles, with a few pedunculate fascicles. Glumes 3·5–4 mm, broadly obovate, emarginate, mucronate, fimbriate-ciliate, reddish-brown, with green midvein. Perianth-bristles 6, linear, not dilated at apex,

retrorsely scabrid throughout, shorter than to equalling nut. Stigmas 2. Nut 2·5–3 mm, ellipsoid-obovoid, plano- or biconvex, smooth, reddish-brown. *Damp or wet places. W., C. & S. Europe.* Au Be Br Bu Cz Ga Ge Hb He Ho Hs Hu It Ju Lu Rm Rs (W, E) Sa Si.

S. ehrenbergii Boeckeler, *Linnaea* **36**: 712 (1870), from S.E. Russia (near Orenburg), combines the apparently lateral inflorescence of **8** with the longer (6–7 mm) and awned glumes of **3**. It is regarded by some authors as a hybrid between these two species.

9. S. supinus L., *Sp. Pl.* 49 (1753) (*Schoenoplectus supinus* (L.) Palla; incl. *Scirpus melanospermus* C. A. Meyer). Annual. Stems 3–30 cm × 0·5–2 mm. Bract up to 15 cm, usually much exceeding the inflorescence. Spikelets (1–)2–12(–20) in the inflorescence, 3–12 mm, ovoid or lanceolate. Glumes 2·5–4 mm, ovate or elliptical, obtuse, shortly apiculate, reddish- or purplish-brown, with green midvein, glabrous, or ciliolate at apex. Perianth-bristles 4–6, rudimentary or short, rarely equalling nut. Stigmas 3. Nut 1–1·6 mm, obovoid, brown or black, dull, prominently transversely and undulately rugose. *Damp places. Europe northwards to N.C. France, C. Poland and N. Ukraine.* Au Bu Cz Ga Ge Gr He Hs Hu It Ju Po Rm Rs (C, W, K, E) Tu.

10. S. juncoides Roxb., *Fl. Indica* **1**: 218 (1820). Like **9** but stems up to 60 cm; bract up to 8 cm; spikelets 1–6 in the inflorescence; perianth-bristles 6, slightly shorter than nut, retrorsely barbed; nut 2 mm, obscurely transversely rugose or nearly smooth. *Naturalized in rice-fields in C. Portugal.* [Lu.] (*Tropical and subtropical Asia, North America, Australia.*)

Sect. HOLOSCHOENUS (Link) Koch. Terrestrial, rhizomatous perennials. Stems simple, terete, mostly with leafless sheaths below. Inflorescence apparently lateral, of 1–many compact, globose, sessile or pedunculate heads, subtended by 1–2 bracts, the lower bract forming an apparent prolongation of the stem and usually exceeding the inflorescence. Perianth-bristles absent. Stamens 3. Nut trigonous, smooth.

11. S. holoschoenus L., *Sp. Pl.* 49 (1753) (*Holoschoenus vulgaris* Link). Stems 30–150 cm, smooth, with leafless sheaths below, the upper sheaths often with a short, semi-terete lamina; sheaths splitting into a fibrous reticulum at maturity. Bracts 1–2, semi-terete, the lower erect. Spikelets 2·5–4 mm, ovoid, obtuse, arranged in 1–10 compact globose heads up to 12 mm wide, at least one of which is sessile, the others on unequal, sometimes compound rays. Glumes 1·5–3 mm, obovate, truncate, mucronate, whitish or brownish, with green midvein, ciliate on margin and keel. Nut 0·6–1·3 mm, obovoid, shiny, brownish-white. *Damp places. Europe, northwards to S. England and White Russia.* Al Au †Be Bl Br Bu Co Cr Cz Ga Ge Gr He Hs Hu It Ju Lu Po Rm Rs (C, W, K, E) Sa Si Tu.

Several intergrading variants with imprecise geographical ranges, based on number and size of heads, length of upper involucral bract, and vigour (length and width of stem), have been given varietal to specific rank; their characteristics may be found variously mixed, even on stems arising from the same rhizome.

Sect. ISOLEPIS (R. Br.) Griseb. Terrestrial, caespitose annuals or perennials. Stems simple, terete, usually slender, sometimes leafy below. Inflorescence apparently lateral, simple or compound, usually a sessile fascicle of 1-several spikelets, with a terete or subterete bract (rarely 2) appearing as a prolongation of the stem. Perianth-bristles absent. Stamens 1–3. Stigmas 2–3. Nut trigonous.

12. S. setaceus L., *Sp. Pl.* 49 (1753) (*Isolepis setacea* (L.) R. Br., *Schoenoplectus setaceus* (L.) Palla). Annual or perennial. Stems 3–30 cm × 0·3–0·5 mm. Bract up to 2 cm, usually exceeding the inflorescence. Spikelets 1–4(–10) in the inflorescence, 2–5 mm, ovoid. Glumes 1·3–2·1 × 0·6–1·2 mm, ovate or broadly elliptical, obtuse, shortly apiculate, purplish-brown, with green midvein, glabrous. Perianth-bristles absent. Stamens 1–2. Nut 0·5–1·2 mm, obovoid, with convex faces and obtuse angles, shiny, brown or black, prominently longitudinally ribbed and finely transversely striate. $2n = 28$. *Damp places. Most of Europe except the north-east.* All except ?Al Bl Cr Fe Rs (N, ?C) Sa Sb Tu.

13. S. pseudosetaceus Daveau, *Bol. Soc. Brot.* **9**: 33 (1891). Like **12** but stems not more than 15 cm; nut with slightly concave faces and acute angles, dull, pale brown, finely papillose. *Damp places. Portugal, S. Spain.* Hs Lu.

14. S. cernuus Vahl, *Enum. Pl.* **2**: 245 (1805) (*S. savii* Sebastiani & Mauri, *Schoenoplectus cernuus* (Vahl) Hayek). Like **12** but annual; bract not more than 1 cm and often shorter than the inflorescence; spikelets 1(–3) in the inflorescence; glumes white or greenish; nut broadly obovoid or suborbicular, dull, almost smooth or finely longitudinally papillose. *Damp places. S. & W. Europe, northwards to N.W. Scotland.* ?Al Az Bl Br Co Cr Ga Gr Hb Hs It Ju Lu Sa Si Tu.

15. S. prolifer Rottb., *Descr. Icon. Rar. Pl.* 55 (1773). Caespitose perennial, without or with short, ascending rhizomes. Stems (10–)25–60(–90) cm × 1–4 mm. Bract 2–10 mm, shorter than or equalling the cluster of spikelets. Inflorescence a cluster of 5–20 spikelets, usually with 1–5(–10) pedunculate additional clusters of spikelets; spikelets 2–10 mm, linear. Glumes 2–2·5 × *c.* 1 mm, ovate to oblong-lanceolate, subobtuse or apiculate, pale reddish-brown-scarious, with greenish midrib, glabrous. Perianth-bristles absent. Stamens 3. Nut *c.* 1 mm, ovoid, yellowish, minutely reticulate. *Naturalized in S.W. France (near Bayonne).* [Ga.] (*S. Africa, Australia, New Zealand.*)

Sect. ELEOGITON (Link) Pax. Floating or submerged aquatic perennials, rarely terrestrial. Stems branched, compressed, leafy. Inflorescence a terminal, solitary spikelet on an axillary peduncle; bract absent. Perianth-bristles absent. Stamens 3. Stigmas 2–3. Nut biconvex or trigonous, smooth.

16. S. fluitans L., *Sp. Pl.* 48 (1753) (*Isolepis fluitans* (L.) R. Br.). Stems 5–50(–130) cm, rooting at the nodes, with slender rhizomes. Leaves up to 100 × 2 mm. Peduncles up to 10 cm. Spikelets 2–5 mm, ovoid. Glumes 2 mm, ovate, obtuse, pale greenish. Nut 1·2–1·5 mm, obovoid, whitish or yellowish. $2n = 60$. *Usually in still or slow-moving water. W. & W.C. Europe, extending to S. Sweden and C. Italy.* Az Be Br ?Cz Da Ga Ge Ho Hs It ?Ju Lu No ?Po Su.

Sect. BAEOTHRYON (Ehrh. ex A. Dietr.) Bentham & Hooker fil. Terrestrial perennials. Stems simple, trigonous or terete, with leafless sheaths at the base, the uppermost sheath with a short lamina. Inflorescence a solitary, terminal spikelet. Perianth-bristles 0–6. Stamens 3. Nut trigonous, smooth.

17. S. hudsonianus (Michx) Fernald, *Rhodora* **8**: 161 (1906) (*Trichophorum alpinum* (L.) Pers., *Scirpus alpinus* (L.) Dalla Torre & Sarnth., non Schleicher ex Gaudin, *Eriophorum alpinum* L.). Densely caespitose, with very short rhizomes, without stolons. Stems 10–40 cm, trigonous, scabrid above. Leaf-lamina up to 1(–3) cm. Spikelet 5–7 × *c.* 3 mm, ellipsoid to lanceolate, with 8–12 flowers. Glumes oblong-ovate, obtuse,

yellowish-brown, with greenish midvein, the lowest with leaf-like apex about equalling the spikelet. Perianth-bristles 4–6, up to 25 mm in fruit, smooth, white. Nut 1–1·5 mm, obovoid, shining, dark brown. *Damp places, usually on base-rich peat. N. & C. Europe, extending locally southwards in the mountains to S. Spain, N. Italy and S. Ural; a few lowland stations in C. Russia.* Au †Br Cz Da Fe Ga Ge He Hs †Hu It Ju No Po ?Rm Rs (N, B, C) Su.

18. S. cespitosus L., *Sp. Pl.* 48 (1753). Densely caespitose or tussock-forming, without rhizomes or stolons. Stems 5–35(–60) cm, terete, smooth. Leaf-lamina 0·3–1 cm. Spikelet 3–6(–8) × *c.* 3 mm, obovoid to linear, with 3–20 flowers. Glumes linear-lanceolate, acute, yellowish- to reddish-brown, with greenish midvein, the 2 lowest with obtuse, leaflike apex about equalling the spikelet. Perianth-bristles 5–6, *c.* 1½ times as long as nut, smooth or papillose at apex, brownish. Nut 1·5–2 mm, obovoid-trigonous, dull, greyish- to yellowish-brown. $2n=104$. *Damp, peaty places. Europe, southwards to C. Spain, Corse and S. Bulgaria, but only in the N. & N.W. parts of the U.S.S.R.* Au Be Br Bu Co Cz Da Fa Fe Ga Ge ?Gr Hb He Ho Hs ?Hu Is It Ju Lu No Po Rs (N, B, C) Su.

(a) Subsp. **cespitosus** (*Trichophorum cespitosum* (L.) Hartman subsp. *austriacum* (Palla) Hegi): Basal sheaths shining; uppermost sheath with suborbicular opening *c.* 1 mm and narrow scarious margin clasping the stem. Spikelets with 3–10 flowers. Perianth-bristles usually smooth. *Throughout most of the range of the species.*

(b) Subsp. **germanicus** (Palla) Broddeson, *Bot. Not.* **1912**: 82 (1912) (*Trichophorum cespitosum* subsp. *germanicum* (Palla) Hegi): Basal sheaths dull; uppermost sheath with oblanceolate opening 2–3 mm and reddish scarious margin loosely surrounding the stem. Spikelets with 8–20 flowers. Perianth-bristles usually papillose at apex. *W. Europe, extending eastwards to Bornholm.*

19. S. pumilus Vahl, *Enum. Pl.* **2**: 243 (1805) (*Trichophorum pumilum* (Vahl) Schinz & Thell., *Scirpus alpinus* Schleicher ex Gaudin). Densely caespitose, with long stolons. Stems 3–15 cm, terete, smooth. Leaf-lamina 0·5–1·5 cm. Spikelet 2–3 × 2 mm, ovoid, with 2–4 flowers. Glumes ovate, apiculate or subobtuse, reddish-brown, with paler or greenish midvein, the 2 lowest sometimes with obtuse apex about equalling the spikelet. Perianth-bristles 3 or absent, less than ½ as long as nut. Nut *c.* 1·5 mm, obovoid to ellipsoid, scarcely shiny, yellowish- to blackish-brown. *Damp places; calcicole. Norway; Alps; W. Carpathians; C. & S. Ural; everywhere very local and rare.* Cz Ga He It No Rs (E). (*Temperate Asia and North America.*)

2. Blysmus Panzer[1]

Perennials. Stems terete, sometimes trigonous above, leafy mostly below. Inflorescence a simple or compound terminal spike of sessile, distichously arranged spikelets, sometimes bracteate. Spikelets several-flowered, terete. Glumes spirally arranged. Flowers hermaphrodite; perianth absent or of 3–6 barbed bristles. Stamens 3. Stigmas 2. Nut plano-convex or biconvex, without a persistent style-base.

Perianth-bristles at least twice as long as the nut, retrorsely barbed, brown; nut 1·5–2 mm; leaves flat; spikelets usually 10–25 per spike **1. compressus**

Perianth-bristles much shorter than the nut, antrorsely barbed, white, or absent; nut 3–4 mm; leaves involute; spikelets 3–8 per spike **2. rufus**

[1] By R. A. DeFilipps.

1. B. compressus (L.) Panzer ex Link, *Hort. Berol.* **1**: 278 (1827) (*Scirpus compressus* (L.) Pers., non Moench). Rhizome long, scaly. Stems 3·5–45 cm, solitary or caespitose. Leaves 1–4 mm wide, flat, with the margin scabrid especially near apex. Spikelets 4–10 × 2–3 mm, ovate-lanceolate, (3–)10–25 in each spike. Glumes 3–5 × 2–3 mm, ovate to lanceolate, obtuse to acute, keeled, 2- to 9-veined, yellowish- or reddish-brown. Perianth-bristles 3–6, at least twice as long as the nut, retrorsely barbed, brown. Nut 1·5–2 mm, obovoid, dark brown, shining, smooth. *Marshes and other damp places. Europe except the south-west and most of the islands.* Al Au Be Br Bu Cz Da Fe Ga Ge Gr He Ho Hu It Ju No Po Rm Rs (N, B, C, W, K, E) Sa Su.

2. B. rufus (Hudson) Link, *loc. cit.* (1827). Like **1** but leaves involute, smooth; spikelets 3–8 per spike; glumes dark brown; perianth-bristles much shorter than the nut, antrorsely barbed, white, or absent; nut 3–4 mm, yellow or yellowish-brown. *Marshes, usually saline. Coasts of N. Europe, southwards to Wales and the Netherlands; inland in N. Germany.* Br ?Cz Da Fe Ge Hb Ho No Po Rs (N, B, C) Su.

3. Eriophorum L.[2]

Perennials. Stems terete or trigonous, leafy. Inflorescence a solitary, compact, terminal, erect spikelet, or an umbel of many-flowered, bracteate spikelets often with long and flexuous peduncles. Glumes spirally arranged. Flowers hermaphrodite; perianth of numerous soft hairs (bristles) which elongate after anthesis. Stamens and stigmas 3. Nut trigonous, more or less compressed, without a persistent style-base.

Literature: M. Raymond, *Svensk Bot. Tidskr.* **48**: 65–82 (1954).

1 Spikelets several, pedunculate, subtended at the base by 1–3 ± leaf-like bracts
2 Peduncles smooth; stems subterete except at apex; anthers 2·5–5 mm **1. angustifolium**
2 Peduncles scabrid; stems trigonous throughout (at least when fresh); anthers 1·5–2 mm
3 Plant caespitose; leaves 3–8 mm wide, the uppermost cauline without a ligule; glumes 1-veined, with hyaline margin **2. latifolium**
3 Plant rhizomatous; leaves 1–2 mm wide, the cauline with a short ligule; glumes with several veins, without a hyaline margin **3. gracile**
1 Spikelet 1, sessile, erect, without leaf-like bracts
4 Plant caespitose
5 Glumes grey, translucent, the lowest not bract-like; anthers 2·5–3 mm, linear; bristles pure white **4. vaginatum**
5 Glumes blackish, ± opaque, the lowest bract-like; anthers 0·5–1·5 mm, narrowly elliptical; bristles tinged with brown **5. brachyantherum**
4 Plant rhizomatous
6 Lower leaf-sheaths reddish; bristles reddish-brown, ± erect; anthers 2–3 mm, linear **6. russeolum**
6 Lower leaf-sheaths yellowish-brown; bristles pure white, patent; anthers *c.* 1 mm, ovate **7. scheuchzeri**

1. E. angustifolium Honckeny, *Vollst. Syst. Verz.* 153 (1782). Plant rhizomatous; stems 15–75 cm, subterete, trigonous only at apex, leafy. Leaves (2–)3–5(–7) mm wide, canaliculate, narrowed into a long triquetrous apex; lamina of uppermost cauline leaf usually at least 1½ times as long as the more or less inflated sheath; ligule short. Spikelets (1–)3–7, more or less drooping; peduncles smooth; bracts 1–2, shortly sheathing, about equalling spikelet. Lower glumes ovate-lanceolate, the upper lanceolate, 1-veined, reddish-brown below, greyish-brown or sometimes black above; margins broadly hyaline. Bristles 40–50 mm, white, entire at apex; anthers 2·5–5 mm. Nut 1–3 × 0·75–1 mm, ob-

[2] By A. C. Jermy.

ovoid, dark brown. $2n=58$. *Wet peat or shallow water; calcifuge. Most of Europe, but absent from much of the Mediterranean region and the south-east.* Al Au Be Br Bu Cz Da Fa Fe Ga Ge Gr Hb He Ho Hs Hu Is It Ju Lu No Po Rm Rs (N, B, C, W, E) Sb Su.

Very variable. Several arctic and alpine variants have been described, of which the most distinctive is **E. triste** (Th. Fries) Á. Löve & Hadač, *Bot. Not.* **1950**: 34 (1950) (*E. angustifolium* subsp. *triste* (Th. Fries) Hultén); it has narrow leaves and nearly capitate inflorescence with blackish scales and needs further investigation; it has $2n=60$, and has been recorded from Svalbard and Iceland.

2. E. latifolium Hoppe, *Bot. Taschenb.* **1800**: 108 (1800). Plant laxly caespitose; stems 20–70 cm, trigonous throughout, leafy. Leaves 3–8 mm wide, flat, with a short triquetrous apex; lamina of uppermost cauline leaf about equalling the close-fitting sheath; ligule absent. Spikelets 2–12, more or less drooping; peduncles usually trigonous, scabrid; bracts 2–3, very shortly sheathing, black at least below, about equalling spikelet. Lower glumes ovate-lanceolate, the upper lanceolate, 1-veined, reddish-brown below, greyish-brown or sometimes black above; margins very narrowly hyaline. Bristles *c.* 25 mm, white, branched at apex; anthers 1·5–2 mm. Nut 3–3·5 × 1–1·4 mm, narrowly obovoid, trigonous, reddish-brown. $2n=54$, 72. *Marshes and bogs, usually with moderately base-rich water. Most of Europe, but local in the south and mainly on mountains.* Al Au Be Br Bu Cz Da Fe Ga Ge Hb He Ho Hs Hu It Ju No Po Rm Rs (N, B, C, W, E) Su.

3. E. gracile Koch ex Roth, *Catalecta Bot.* **2**: 259 (1800). Plant rhizomatous; stems 25–60 cm, slender, trigonous, leafy only in lower half. Leaves 1–2 mm wide, 3-angled, slightly canaliculate on adaxial side; lamina of cauline leaf rarely more than half as long as the close-fitting sheath; ligule short. Spikelets 3–6, more or less drooping; peduncles trigonous, finely scabrid; bracts 1–2, shorter than spike, brownish. Glumes ovate, several-veined, yellowish- or greenish-brown tinged with grey; margins not hyaline. Bristles *c.* 20 mm, white, entire at apex; anthers 1·5–2 mm. Nut 2·5–3 mm, ellipsoid-cylindrical, yellowish-brown. *Marshes, bogs, lake-margins and wet woods. Europe southwards to the Pyrenees, N. Italy and S. Bulgaria.* Au Be Br Bu Cz Da Fe Ga Ge Hb He Ho Hu It Ju No Po Rm Rs (N, B, C, W, E) Su.

4. E. vaginatum L., *Sp. Pl.* 52 (1753). Plant forming large, compact tussocks; stems (15–)30–60(–80) cm, terete below, trigonous above, leafy in lower half. Leaves *c.* 1 mm wide, shorter than the stems, trigonous, with brown fibrous sheaths; lamina of cauline leaf absent or a dark, membranous apex to the strongly inflated sheath; ligule absent. Spikelet 1; bracts absent. Glumes ovate-lanceolate, acuminate, 1-veined, grey, translucent, the lower 10–15 darker and sterile, deflexed after anthesis. Bristles *c.* 25 mm, white; anthers 2·5–3 mm, linear. Nut 2–3 mm, ovoid. $2n=58$. *Bogs and moorland. N., N.E. & C. Europe, extending southwards locally, and mainly in the mountains, to S. Spain, N. Italy and Macedonia.* Au Be Br Bu Cz Da Fa Fe Ga Ge Gr Hb He Ho Hs Hu It Ju No Po Rm Rs (N, B, C, W, E) Su.

5. E. brachyantherum Trautv. & C. A. Meyer in Middendorff, *Reise Nord. Öst. Sibir.* **1(2), 3**: 98 (1856). Like **4** but tussocks smaller and less compact; glumes darker, less membranous, the lowest larger and bract-like, opaque, 3-veined; bristles *c.* 20 mm, often brown-tinged; anthers 0·5–1·5 mm, narrowly elliptical. *Tundra and bogs. Fennoscandia and N. Russia, southwards to c.* 62° *N.* Fe No Rs (N, C) Su.

6. E. russeolum Fries ex Hartman, *Handb. Skand. Fl.* ed. 3, **2**: 13 (1838). Plant rhizomatous; stems 10–80 cm, terete, leafy in lower half. Leaves *c.* 1 mm wide, as long as or longer than stems, trigonous, more or less canaliculate on adaxial surface; lower sheaths reddish; lamina of cauline leaves absent or a dark, membranous apex to the slightly inflated sheath. Spikelet 1; bracts absent, or lowest glume bract-like, 3-veined. Glumes ovate-lanceolate, dark greyish-brown to blackish, with wide hyaline margin, the lowest 2–6 empty. Bristles *c.* 30 mm, reddish-brown, usually erect; anthers 2–3 mm, linear. Nut *c.* 2 mm, oblong-obovoid, with distinct beak. *Tundra, bogs and lake-shores. Arctic and subarctic Fennoscandia, arctic Russia.* Fe ?Is No Rs (N) Su.

E. × medium N. J. Andersson, *Bot. Not.* **1857(4)**: 62 (1857) (*E. russeolum* subsp. *rufescens* (N. J. Andersson) Hyl.), is morphologically intermediate between **6** and **7**, and is possibly a hybrid since it is recorded from the area of the putative parents.

7. E. scheuchzeri Hoppe, *Bot. Taschenb.* **1800**: 104 (1800). Plant rhizomatous; stems 8–40 cm, terete, leafy towards base. Leaves 1–2 mm wide, shorter than stems, linear and canaliculate at base, trigonous above; lower sheaths yellowish-brown; cauline leaves with inflated sheath, without or with a short lamina. Spikelet 1; bracts absent, or lowest glume bract-like, 3-veined. Glumes ovate-lanceolate, greyish-brown to blackish, with narrow hyaline margin, the lowest 2–6 empty. Bristles up to 30 mm, pure white, often patent or deflexed; anthers *c.* 1 mm, ovate. Nut *c.* 2 mm, oblong, subterete. *Wet bogs and tundra and muddy or peaty lake-margins. N. Europe, southwards to S. Norway and C. Ural; mountains of C. & S. Europe from the Carpathians to the Pyrenees, N. Appennini and Macedonia.* Au ?Cz Fe Ga Ge He Hs Is It Ju No Rm Rs (N, W, C) Sb Su.

4. Eleocharis R. Br.[1]

Glabrous perennials (rarely annuals). Stems simple, green, leafless except for basal sheaths. Inflorescence a single, usually many-flowered, terete terminal spikelet. Glumes spirally arranged. Flowers hermaphrodite; perianth of 0–8 bristles. Stamens 2 or 3. Stigmas 2 or 3. Nut usually trigonous or biconvex, with a persistent, usually swollen style-base (stylopodium).

Measurements of the nut exclude the stylopodium. Ripe fruit is necessary for the determination of several species. The shape of the uppermost leaf-sheath provides a constant and valuable character.

All the species grow in wet places.

Literature: S.-O. Strandhede, *Op. Bot.* (*Lund*) **10(2)**: 1–187 (1966) (*E. palustris* group). S.-O. Strandhede & R. Dahlgren, *Bot. Not.* **121**: 1–10, 145–152, 305–311, 465–470 (1968) (illustrations and cytology of all Scandinavian species).

1 Spikelet with 2–7(–8) flowers; stylopodium not swollen, not or scarcely constricted at junction with nut, and therefore not clearly demarcated from it
2 Stems less than 0·5 mm in diameter, capillary; plant reproducing freely by whitish tubers terminating capillary stolons **2. parvula**
2 Stems 0·5–1 mm in diameter; plant without tubers **1. quinqueflora**
1 Spikelet usually with more than 7 flowers; stylopodium clearly demarcated from nut and usually swollen and constricted at base
3 Nut triquetrous or trigonous, rarely subterete
4 Nut longitudinally ribbed; plants often growing ± submerged

[1] By S. M. Walters.

5 Stems less than 0·5 mm in diameter, capillary; spikelet with only the lowest glume empty, completely encircling its base **3. acicularis**
5 Stems 0·5–1 mm in diameter; spikelet with 2 lowest glumes empty, each half-encircling its base **4. bonariensis**
4 Nut smooth or ± punctate, not longitudinally ribbed; plants rarely growing submerged
6 Rhizomatous; spikelet subglobose **(8–13). palustris** group
6 Densely caespitose; spikelet ovoid-lanceolate **14. multicaulis**
3 Nut compressed, ± biconvex
7 Rhizomatous perennial; uppermost leaf-sheath almost transversely truncate **(8–13). palustris** group
7 Densely caespitose annual or perennial; uppermost leaf-sheath obliquely truncate
8 Perennial; spikelet with only the lowest glume empty, completely encircling its base, often proliferating vegetatively **15. carniolica**
8 Annual; spikelet with the 2 lowest glumes empty, each half-encircling its base, never proliferating vegetatively
9 Nut shiny, black; stylopodium minute **7. atropurpurea**
9 Nut dull, brown; stylopodium at least half as wide as nut
10 Stylopodium *c.* ⅔ as wide as nut; stems usually not more than 1 mm in diameter **5. ovata**
10 Stylopodium nearly as wide as nut; stems up to 1·5 mm in diameter **6. obtusa**

1. E. quinqueflora (F. X. Hartmann) O. Schwarz, *Mitt. Thür. Bot. Ges.* **1**: 89 (1949) (*E. pauciflora* (Lightf.) Link, *E. vierhapperi* Bojko, *Scirpus pauciflorus* Lightf.). Caespitose perennial, with short, stout rhizome and slender underground stolons. Stems up to 30 cm, 0·5–1 mm in diameter; uppermost sheath pale brownish, obliquely truncate. Spikelet 4–10 mm, 3- to 7-flowered, brown; lowest glume often with floret, obtuse, more than half as long as spikelet, and encircling its base. Stamens and stigmas 3. Nut *c.* 2 mm, trigonous, finely striate, black when fresh, turning grey when dry; stylopodium elongate, very slightly constricted at junction with nut. Bristles 4–6, about as long as nut. $2n=132$ (134). *Wet, peaty ground, usually base-rich. Much of Europe, but rare in the south.* Al Au Be Br Bu Co Cz Da Fa Fe Ga Ge Gr Hb He Ho ?Hs Hu Is It Ju No Po Rs (N, B, C, W, K, E) Su.

2. E. parvula (Roemer & Schultes) Link ex Bluff, Nees & Schauer, *Comp. Fl. Germ.* ed. 2, **1(1)**: 93 (1836) (*E. pygmaea* Torrey, *Scirpus parvulus* Roemer & Schultes). Very delicate, caespitose perennial with capillary stolons terminating in easily-detached, whitish tubers. Stems capillary, up to 8 cm; uppermost sheath very thin, pale brownish. Spikelet 2–3(–5) mm, 3- to 5(–8)-flowered, greenish; lowest glume obtuse, empty, *c.* ¾ as long as spikelet and encircling its base. Stamens and stigmas 3. Nut *c.* 1 mm, triquetrous, smooth, pale yellow; stylopodium not constricted at junction with nut. Bristles usually longer than nut. $2n=10$. *Tidal mud; rarely by inland saline lakes. From C. Fennoscandia southwards to Portugal, C. Jugoslavia & S.E. Russia; very local over much of its range.* Br Da Fe Ga Ge Hb †He Hs It Ju Lu No Po Rm Rs (B, C, W, ?K, E) Sa Su.

3. E. acicularis (L.) Roemer & Schultes, *Syst. Veg.* **2**: 154 (1817) (*Scripus acicularis* L.). Slender, rhizomatous perennial with capillary, angled stems usually few together; in non-flowering, submerged state up to 50 cm, in flowering, terrestrial state (on mud) not more than 10 cm. Uppermost sheath thin, brownish, truncate, somewhat inflated. Spikelet 2–4 mm, 3- to 11(–15)-flowered, dark brown; lowest glume usually empty, obtuse, not more than half as long as spikelet and encircling its base. Stamens and stigmas 3. Nut *c.* 1 mm, weakly trigonous or subterete, finely longitudinally ribbed, pale brown or whitish; stylopodium small, subconical, clearly constricted at junction with nut. Bristles 0–1, absent or caducous, never more than half as long as nut. $2n=20$. *Shallow water, or on sand or gravel subject to intermittent flooding. Most of Europe, but rare in the Mediterranean region.* All except ?Al Az Bl Cr Fa Rs (K) Sa Sb Si.

Often occurring in a totally submerged and persistently vegetative state.

4. E. bonariensis Nees, *Jour. Bot.* (*Hooker*) **2**: 398 (1840) (*Scirpus striatulus* (Desv.) Coste). Like **3** but larger, with flowering stems up to 40 cm; uppermost sheath firm in texture, very obliquely truncate; spikelet 4–12 mm, pale brown, with 2 subequal empty glumes each half-encircling its base; bristles 3–4, about equalling nut, persistent. *Naturalized on estuarine river-banks in W. France.* [Ga.] (*South America.*)

5. E. ovata (Roth) Roemer & Schultes, *Syst. Veg.* **2**: 152 (1817) (*Scirpus ovatus* Roth). Densely caespitose annual with stems up to 40 cm and *c.* 1 mm in diameter. Uppermost leaf-sheath greenish, very obliquely truncate and sometimes with a rudimentary lamina; other sheaths purplish. Spikelet 4–8 mm, ovoid to subconical, many-flowered, reddish-brown; glumes ovate-orbicular, the lowest 2 small, empty, subequal, each half-encircling base of spikelet. Stamens 2 or 3; stigmas 2. Nut *c.* 1 mm, biconvex, broadly obovate, smooth, brown; stylopodium mammiform, *c.* ⅔ as wide as nut, clearly constricted at junction with nut. Bristles 4–7, much longer than nut. *Open, marshy ground, seasonally inundated; usually impermanent and rare. C. Europe, extending locally to the Netherlands, W. France, Sicilia and E.C. Russia.* Au Be Cz Ga Ge He Ho Hu It Ju Po Rm Rs (B, C, W, E) Si.

6. E. obtusa (Willd.) Schultes in Schultes & Schultes fil., *Mantissa* **2**: 89 (1824). Like **5** but more robust, with stems up to 1·5 mm in diameter; stamens 3; stylopodium nearly as wide as nut. *Naturalized in rice-fields in N. Italy and S.W. Portugal.* [It Lu.] (*North America.*)

7. E. atropurpurea (Retz.) C. Presl, *Reliq. Haenk.* **1**: 196 (1828). Like **5** but more delicate, with stems up to 10 cm and not more than 0·3 mm in diameter; spikelet 2–4 mm; nut *c.* 0·5 mm, shining, black; stylopodium minute, flattened and *c.* ¼ as wide as nut; bristles never as long as fruit, often rudimentary or absent. *Sandy ground, seasonally inundated. Italy, S. Switzerland.* *He *It.

Widespread in the tropics and subtropics and perhaps introduced in Europe, where it was first recorded in 1830.

A related species, **E. geniculata** (L.) Roemer & Schultes, *Syst. Veg.* **2**: 150 (1817) (*E. caduca* (Delile) Schultes), also widespread in the tropics, has been recorded from Italy, Sicilia and Sardegna. It differs most clearly in the larger nut (*c.* 1 mm).

E. olivacea Torrey, *Ann. Lyc. New York* **3**: 300 (1836), from E. North America, and **E. flavescens** (Poiret) Urban, *Symb. Antill.* **4**: 116 (1903), from Central America, have both been recorded as weeds in rice-fields in N. Italy and Portugal; they have a greenish-brown nut *c.* 1 mm, with a conical stylopodium.

(8–13). E. palustris group. Perennial, rhizomatous plants very variable in size; stems up to 100 cm, 1–8 mm in diameter. Uppermost leaf-sheath almost transversely truncate; leaf-sheaths and stem-bases often reddish or purplish. Spikelet 3–30 mm, many-flowered, pale straw-coloured to dark brown; lowest glume empty, encircling base of spikelet, or 2 lowest glumes empty,

each half-encircling. Stamens 3. Stigmas 2. Nut 1·2–2·2 mm, biconvex, obovate or elliptical, more or less finely punctate, pale yellow to dark brown; stylopodium very variable, but always constricted at junction with nut. Bristles (0)4–8, variably developed.

A widespread group in which taxonomic difficulty is partly attributable to polyploidy and hybridization. The following treatment distinguishes at least the more important European taxa.

1 Only the lowest glume of spikelet empty, encircling base of spikelet
2 Stylopodium minute, *c.* ¼ as wide as nut; lowest glume up to ½ as long as spikelet **13. oxylepis**
2 Stylopodium at least ½ as wide as nut; lowest glume rarely more than ½ as long as spikelet **12. uniglumis**
1 Two lowest glumes of spikelet empty, subequal, and each half-encircling base of spikelet
3 Stylopodium at least twice as long as wide **10. austriaca**
3 Stylopodium less than twice as long as wide
4 Stylopodium longer than wide; bristles 4, rarely 0 **8. palustris**
4 Stylopodium wider than long; bristles 4–8
5 Bristles 4(–5); glumes usually with wide hyaline margin **9. mitracarpa**
5 Bristles (5–)6–8; glumes with narrow hyaline margin **11. mamillata**

8. E. palustris (L.) Roemer & Schultes, *Syst. Veg.* **2**: 151 (1817) (*Scirpus palustris* L.; incl. *Eleocharis boissieri* Podp., *E. crassa* Fischer & C. A. Meyer ex A. Becker). Stems pliable, not easily cracked, with more than 20 vascular bundles (not especially obvious as ridges when dry). Spikelet 5–30 mm, with 2 subequal, empty glumes, each half-encircling its base. Nut very finely punctate. Bristles (0)4, very variably developed. *Wet meadows, marshes, and shallow water. Throughout Europe.* All except Sb.

Very variable, especially in size of plant and development of rhizome.

(a) Subsp. **palustris** (*E. palustris* subsp. *microcarpa* Walters; incl. *E. intersita* Zinserl.): Spikelet usually with 40–70 florets. Glumes from middle of spikelet 2·75–3·5 mm. Nut 1·2–1·4(–1·5) mm. Stomatal length 35–56 μ. $2n=16$.

(b) Subsp. **vulgaris** Walters, *Jour. Ecol.* **37**: 194 (1949): Spikelet usually with 20–40 florets. Glumes from middle of spikelet 3·5–4·5 mm. Nut (1·3–)1·5–2 mm. Stomatal length 50–77 μ. $2n=(37)\ 38\ (39, 40)$.

Both subspecies are widespread in N. & C. Europe, but subsp. (b) seems to be rare in much of S. Europe, and subsp. (a) relatively rare in the British Isles. The taxonomic distinction is less easy to make in much of C. Europe than in Britain and Scandinavia, and other, as yet undistinguished, taxa may be present.

9. E. mitracarpa Steudel, *Syn. Pl. Glum.* **2**: 77 (1854) (*E. argyrolepidoides* Zinserl.). Like **8** but glumes usually with a wide hyaline margin; stylopodium mitriform, wider than long; perianth-bristles 4(–5). *S. part of U.S.S.R.* Rs (C, W, K, E).

10. E. austriaca Hayek, *Sched. Fl. Stir. Exsicc.* **19–20**: 8 (1910) (*E. leptostylopodiata* Zinserl.). Stems weak and easily cracked, with 12–16 vascular bundles (visible especially in dried material as distinct ridges). Spikelet 8–20 mm, with 2 subequal, empty glumes each half-encircling its base, in ripe fruit broadly conical, usually yellowish-brown. Nut very finely punctate; stylopodium at least twice as long as wide, with small constriction at junction with nut. Bristles (4–)5(–6), well-developed and usually much longer than nut. $2n=16$. *Marshes, lake-shores and streamsides, mainly in upland regions; usually on base-rich soils. Scattered through a large part of Europe, from N. Norway to N. Spain, C. Jugoslavia and S. Ural.* Au Br Cz Ga Ge He Hs Hu It Ju No Po Rm Rs (C, W, E).

11. E. mamillata H. Lindb. fil. in Dörfler, *Herb. Norm.* **44**: 108 (1902). Like **10** but stems with 8–12 vascular bundles as distinct ridges; spikelets in ripe fruit ovoid to broadly conical, usually dark brown; stylopodium mammiform, much wider than long, with obvious constriction at junction with nut; bristles (5–)6–8, well-developed and usually much longer than nut. $2n=16$. *Peat-bogs, ditches, and lake margins; calcifuge. N. & C. Europe, extending to N. Ukraine.* Au Bu Cz Fe Ga Ge He Hu Ju No Po Rm Rs (N, B, C, ?W) Su.

10 is treated by Strandhede as a subspecies of **11**. The artificial hybrid (produced by Strandhede) is fully fertile, and morphological intermediates of presumed hybrid origin certainly occur in nature. They are rare, however, apparently because even where the species are sympatric the ecological separation is quite marked.

12. E. uniglumis (Link) Schultes in Schultes & Schultes fil., *Mantissa* **2**: 88 (1824) (*Scirpus uniglumis* Link; incl. *E. klingei* (Meinsh.) B. Fedtsch., *E. korshinskyana* Zinserl.). Rhizome usually well developed; stems up to 60 cm, and up to 1·5 mm in diameter, firm but slender, smooth, often shiny, with 15–20 vascular bundles (not especially obvious as ridges when dry). Base of stems, rhizome and leaf-sheaths reddish-purple. Spikelet up to 12 mm, ovoid-lanceolate, dark brown, with 10–30 florets more widely spaced than in other species of the group; lowest glume empty, encircling base of spikelet. Nut coarsely punctate. Bristles 0–4(–5), often poorly developed, and rarely much longer than nut. $2n=(40–44)\ 46\ (54–92)$. *Saline or base-rich marshes. Most of Europe, but rare in much of the south.* All except ?Al Az Bl Co Lu Sb Si Tu.

Variable, but usually less so than **8**. The cytological variation is to some extent correlated with variation in fruit size, and Strandhede has distinguished subsp. **sterneri** Strandhede, *Bot. Not.* **114**: 433 (1961), from Öland and Gotland, with larger fruit, pollen and stomata than the type, and with $2n=74–82$. Large-fruited, high polyploid variants occur elsewhere in Europe, but apparently only sporadically. Fertile intermediates with **8(b)**, with various chromosome numbers between 38 and 46, occur not infrequently where the two species grow together, and are almost certainly of hybrid origin. **8(b)** itself is intermediate between **8(a)** and **12**, and may be of ancient hybrid origin from these two widespread taxa.

13. E. oxylepis (Meinsh.) B. Fedtsch., *Rast. Turkestan* 165 (1915). Like **12** but stems weak and easily cracked; lowest glume up to half as long as spikelet, usually pale brown; stylopodium minute, mammiform to conical, *c.* ¼ as wide as nut. *E.C. Ukraine to W. Kazakhstan.* Rs (W, E). (*Siberia, C. Asia.*)

14. E. multicaulis (Sm.) Desv., *Obs. Pl. Angers* 74 (1818) (*Scirpus multicaulis* Sm.). Densely caespitose perennial with slender stems up to 30 cm and 1–1·5 mm in diameter. Base of stem and leaf-sheaths straw-coloured or pale brown; uppermost sheath very obliquely truncate and acute. Spikelet 5–15 mm, ovoid-lanceolate, usually acute, 10- to 30-flowered, brown, often proliferating vegetatively. Lowest glume empty, usually *c.* ¼ as long as spikelet, encircling its base. Stamens 3; stigmas 3. Nut 1·3–1·5 mm, triquetrous, smooth, yellowish- or olive-brown;

stylopodium broadly triangular-pyramidal, clearly demarcated from nut but fitting closely to it. Bristles 4–6, longer than nut. $2n=20$. *Peat-bogs and wet, sandy heaths; calcifuge. W. Europe, northwards to* 61° 30′ *in Norway, and extending eastwards to S.E. Sweden, S.W. Poland and N.W. Jugoslavia; isolated stations in the E. Carpathians and Kriti.* Az Be Br Co Cr Da Ga Ge Hb Ho Hs It Ju Lu No Po Rs (W) Sa Su.

15. E. carniolica Koch, *Syn. Fl. Germ.* ed. 2, 853 (1844). Caespitose perennial with almost capillary stems up to 30 cm and *c.* 0·5 mm in diameter. Leaf-sheaths pale brown; uppermost very obliquely truncate and acute. Spikelet 3–13 mm, many-flowered, pale brown, often proliferating vegetatively. Lowest glume empty, usually less than ¼ as long as spikelet, encircling its base. Stamens 2(3); stigmas 2. Nut 1–1·5 mm, obovate, biconvex with acute margins, narrowed into a short neck, pale brown, shiny; stylopodium narrowly compressed-conical, acute, clearly demarcated from nut. Bristles 6 or 7, longer than nut. $2n=20$. *River-banks and seasonally flooded grassy places. E.C. Europe and N. part of the Balkan peninsula, extending to N. Italy and W. Ukraine.* Au Bu Cz Hu It Ju Rm Rs (C, W). (*Afghanistan.*)

5. Fuirena Rottb.[1]

Perennials. Stems trigonous, leafy. Inflorescence bracteate, of many-flowered, terete spikelets arranged in panicles or fascicles. Glumes spirally arranged, puberulent. Flowers hermaphrodite; perianth usually absent, sometimes represented by minute scales or bristles. Stamens and stigmas 3. Nut sharply trigonous, sometimes with small, persistent style-base.

1. F. pubescens (Poiret) Kunth, *Enum. Pl.* **2**: 182 (1837). Rhizomatous perennial. Stems 20–70 cm, pubescent at nodes and at apex. Leaves 2–7 mm wide, pubescent near the apex; sheaths pubescent at ligule. Inflorescence a subsessile fascicle of 2–8 spikelets, or a panicle of several to many spikelets, with unequal, puberulent rays. Spikelets 6–11 × 4–5 mm, ellipsoid to ovoid. Glumes 3–5 × 1·5–2 mm, ovate to elliptical, obtuse, keeled, 3-veined, puberulent, greyish-brown, with an awn 1–2·5 mm. Perianth absent, or of 3 bristles up to 0·3 mm. Nut 0·8–1·5 mm, obovoid, white to yellowish-brown, smooth or rugulose. *W. Mediterranean region, C. & S. Portugal; Kriti.* Bl Co Cr Hs It Lu.

6. Fimbristylis Vahl[1]

Annuals (rarely perennials). Stems more or less trigonous, leafy below. Inflorescence a simple or compound, bracteate umbel of 1–many spikelets. Spikelets many-flowered. Glumes spirally arranged. Flowers hermaphrodite, or the upper male; perianth absent. Stamens 1–3. Stigmas 2 (rarely 3). Style with long, patent hairs. Nut biconvex (rarely trigonous); style-base deciduous (sometimes tardily).

Measurements of glumes refer to those in the middle of the spikelet.

All species occur in wet places.

F. cioniana Savi, *Mém. Valdarn.* **3** (*Sci.*): 98 (1842), an annual species described from N. Italy, and widespread in Tropical Africa, has not been recently seen in Europe and may be extinct. It differs from the other European species in having 3 stigmas and a trigonous nut.

1 Perennial with stems at least 1·5 mm in diameter **4. ferruginea**
1 Annual with stems rarely more than 1 mm in diameter
2 Style-base with deflexed hairs; nut smooth or nearly so; glumes with an arista 0·5–1 mm **3. squarrosa**
2 Style-base glabrous; nut with longitudinal ribs; glumes with a mucro not more than 0·5 mm
3 Spikelets 1–1·5 mm wide; nut with 6 or 7 vertical rows of cells on each face **1. bisumbellata**
3 Spikelets 2–4 mm wide; nut with 9(–12) vertical rows of cells on each face **2. annua**

1. F. bisumbellata (Forskål) Bubani, *Dodecanthea* 30 (1850) (*F. dichotoma* auct., non (L.) Vahl). Glaucous, caespitose, semi-procumbent to erect annual. Stems up to 25 cm, *c.* 1 mm in diameter. Leaves up to 2 mm wide, flat, apically serrulate and obtuse. Inflorescence usually spreading, with many spikelets. Spikelets 3–5 × 1–1·5 mm, narrowly ovoid, sharply angled. Glumes 2–3 mm, light reddish-brown, matt, thin, ovate, keeled with a narrow, 1-veined green midrib. Nut *c.* 0·75 × 0·6 mm, biconvex, yellowish, with 6 or 7 vertical rows of cells on each face; style-base glabrous, deciduous. *River-banks and rice-fields. S. Europe.* Al Bu Ga Gr He Hs It Ju Lu Rm Rs (W) Si Tu.

2. F. annua (All.) Roemer & Schultes, *Syst. Veg.* **2**: 95 (1817) (*F. dichotoma* auct., ?an (L.) Vahl). Like **1** but inflorescence narrow, with few spikelets; spikelets 4–7 × 2–4 mm, ovoid, subacute; glumes shining, firm, with a wide 3-veined midrib; nut 1–1·25 × 0·8 mm, with 9–12 vertical rows of cells on each face. *Wet places, probably introduced.* Ga He It.

3. F. squarrosa Vahl, *Enum. Pl.* **2**: 289 (1805). Caespitose annual. Stems 2–18 cm, less than 1 mm in diameter. Leaves not more than 0·5 mm wide, glabrous or puberulent. Bracts 3–6. Inflorescence usually with more than 10 spikelets. Spikelets 5–7 × 0·5–1 mm, lanceolate or oblong. Glumes *c.* 1·5 × 1 mm (including arista), lanceolate, acuminate with a more or less recurved arista 0·5–1 mm, glabrous, the lowest puberulent on the midvein, brown. Stamen 1. Stigmas 2. Nut 0·5–0·8 mm, biconvex, smooth or sometimes minutely longitudinally striate, yellowish to reddish-brown; style-base with deflexed hairs, somewhat persistent. *Wet places. Naturalized in N.W. & W.C. Italy.* [It.] (*Tropics and subtropics.*)

4. F. ferruginea (L.) Vahl, *op. cit.* 291 (1805) (incl. *F. sieberana* Kunth). Caespitose perennial with short rhizomes. Stems 20–80 cm, 1·5–3 mm in diameter, rigid, striate, with few rigid cauline leaves and more or less coriaceous, brownish basal sheaths. Bracts 2 or 3. Inflorescence with (1–)5–10(–25) spikelets. Spikelets 5–20 × 3–4 mm, ovoid to oblong-ovoid, dull brown. Glumes 3–5 × 2–3 mm, oblong to broadly ovate, more or less hairy distally. Stamens 3. Stigmas 2. Nut 1–1·5 × 0·75–1·25 mm, biconvex, smooth, brownish; style-base deciduous. *Kriti; S. Spain.* Cr *Hs. (*Tropics and subtropics.*)

A widespread, variable species only recently recorded from Europe.

7. Cyperus L.[1]

Annuals, biennials or perennials. Stems terete or trigonous, leafy. Inflorescence of spikelets arranged in umbels or fascicles, bracteate. Spikelets with 1–many flowers, terete or compressed. Glumes distichously or, more rarely, spirally arranged. Flowers hermaphrodite; perianth absent. Stamens 1–3. Stigmas 2–3. Nut lenticular, plano-convex or trigonous, without a persistent style-base.

Measurements and numbers of rays refer in the case of a compound inflorescence to the primary rays.

[1] By R. A. DeFilipps.

All species, unless there is an indication to the contrary, grow on river-banks or in marshes or wet grassland.

Literature: G. Kükenthal in Engler, *Pflanzenreich* **101(IV.20)** (1935–1936).

1 Inflorescence with 100–200 rays; stems 200–500 cm **1. papyrus**
1 Inflorescence with 0–25 rays; stems 1–150(–200) cm
2 Glumes spirally arranged or irregularly distichous
3 Inflorescence of one sessile head; bracts 3–8; glumes with a mucro 0·2–0·5 mm **14. michelianus**
3 Inflorescence usually of several heads, at least 1 pedunculate; bracts 2–4; glumes with a curved arista 1 mm **24. hamulosus**
2 Glumes regularly distichous
4 Spikelets with 1–2 flowers
5 Nut trigonous; glumes smooth **26. ovularis**
5 Nut lenticular; glumes minutely setulose on keel **27. brevifolius**
4 Spikelets with more than 2 flowers
6 Nut lenticular or plano-convex; stigmas usually 2
7 Inflorescence apparently lateral, of sessile spikelets; bracts 2–3, the lower one erect, forming an apparent prolongation of the stem; stem leafless, or the uppermost sheaths with a lamina not more than 10 cm
8 Spikelets broadly lanceolate or ovate, obtuse; bracts conspicuously dilated at the base; glumes with a pale green area *c.* 1 mm wide on back **16. pannonicus**
8 Spikelets oblong or oblong-lanceolate, acute; bracts not conspicuously dilated at the base; glumes with a pale green area 0·2–0·5 mm wide on back **17. laevigatus**
7 Inflorescence terminal, a simple or compound umbel of pedunculate heads, or of 1 head; bracts 2–25, the lower not forming an apparent prolongation of the stem; stem usually leafy
9 Nut with a broad side (face) against the rhachilla
10 Rhizomatous perennial; stems 30–120 cm, solitary; glumes 1·5–2 mm wide; nut dark brown or black **15. serotinus**
10 Annual, without rhizomes; stems 1–35(–50) cm, caespitose; glumes 0·5–0·8 mm wide; nut white or pale brown
11 Inflorescence a simple to compound umbel; glumes 1–1·3 mm, often with an erect mucro 0·1 mm; nut white; bracts not dilated at the base **11. fuscus**
11 Inflorescence of 1 sessile head; glumes 1·2–2·5 mm, with an ascending to patent mucro 0·2–0·5 mm; nut pale brown; bracts dilated at the base **14. michelianus**
9 Nut with a narrow side (angle) against the rhachilla
12 Glumes conspicuously sulcate **20. mundtii**
12 Glumes not sulcate
13 Glumes with a 3-veined keel **19. polystachyos**
13 Glumes with a 1-veined keel
14 Glumes dark or reddish-brown **18. flavidus**
14 Glumes yellowish **21. flavescens**
6 Nut trigonous; stigmas usually 3
15 Spikelets with 2–3 flowers **26. ovularis**
15 Spikelets with 4–40 flowers
16 Stamen 1
17 Glumes with an ascending to curved mucro or arista 0·2–1 mm; leaves 0·5–2 mm wide
18 Glumes with a curved arista 1 mm; inflorescence usually of several pedunculate heads **25. squarrosus**
18 Glumes with an ascending to patent mucro 0·2–0·5 mm; inflorescence of 1 sessile head **14. michelianus**
17 Glumes without a mucro or arista; leaves 2–10 mm wide
19 Glumes 2–3 mm, lanceolate or ovate-lanceolate **8. eragrostis**
19 Glumes 0·5–0·7 mm, obovate or suborbicular **12. difformis**
16 Stamens 2 or 3
20 Glumes with a conspicuous mucro 0·2–3 mm
21 Rhizomes present; leaves and bracts with revolute margins; glumes 5–8 mm, with a mucro 1–3 mm **13. capitatus**
21 Rhizomes absent; leaves and bracts flat; glumes 1·2–2·5 mm, with a mucro up to 0·5 mm **14. michelianus**
20 Glumes not mucronate, or with a minute mucro up to 0·1 mm
22 Plant leafless
23 Bracts 8–12, with revolute margins; rays 8–12 **9. textilis**
23 Bracts 12–25, flat; rays 20–25 **10. alternifolius**
22 Plant with leaves
24 Rhachilla not winged; glumes 0·5–1·3 mm
25 Glumes 1–1·3 mm, ovate, acute to obtuse, often with a mucro 0·1 mm; nut white; stems usually 2–35 cm **11. fuscus**
25 Glumes 0·5–0·7 mm, obovate or suborbicular, obtuse, not mucronate; nut pale yellow or yellowish-green; stems 20–75 cm **12. difformis**
24 Rhachilla winged; glumes 1·5–5 mm
26 Glumes persistent and falling with the articulated rhachilla
27 Glumes straw-coloured or golden-brown; nut linear-oblong, reddish-grey; perennial **22. strigosus**
27 Glumes purplish-red; nut ±obovoid, black; annual **23. congestus**
26 Glumes deciduous from the persistent, not articulated rhachilla
28 Spikelets aggregated into dense heads; rhizomes absent
29 Nut linear-oblong; glumes 0·5 mm wide, linear or linear-lanceolate **6. glomeratus**
29 Nut obovoid; glumes *c.* 1·5 mm wide, elliptical or ovate **7. glaber**
28 Spikelets not in heads, ±laxly arranged; rhizomes present
30 Spikelets 0·5–1 mm wide, linear; glumes *c.* 1 mm wide; rhizomes very short; tubers absent; wings of rhachilla pale yellow, deciduous **2. auricomus**
30 Spikelets 1–2·5 mm wide, linear to oblong; glumes 1·5–2 mm wide; rhizomes long; tubers sometimes present; wings of rhachilla white, persistent
31 Glumes concave, pale yellow to yellowish-brown, with prominently raised veins **5. esculentus**
31 Glumes keeled, dark brown or reddish, with rather inconspicuously raised veins or lines
32 Rhizomes 3–10 mm wide, covered with broad scales; tubers absent; rays often more than 10 cm **3. longus**
32 Rhizomes *c.* 1 mm wide, with ±remote, narrow scales, sometimes bearing tubers; rays not more than 10 cm **4. rotundus**

Sect. CYPERUS. Rhachilla not articulated. Glumes deciduous. Spikelets with 4–many flowers. Stigmas 3 (rarely 2). Nut trigonous (rarely plano-convex), with a face against the rhachilla.

1. C. papyrus L., *Sp. Pl.* 47 (1753). Caespitose, leafless perennial; rhizomes short, thick, woody; stems 200–500 cm. Bracts 4–10, much shorter than the inflorescence. Inflorescence a compound umbel; rays *c.* 100–200, 12–21 cm. Spikelets 8–11(–20) × 0·8–1 mm, linear, with 6–22 flowers, patent. Rhachilla winged. Glumes 1·5–2 × *c.* 1 mm, elliptic-ovate, obtuse, reddish to straw-coloured or pale brown, with a hyaline margin. Stamens 3. Nut $\frac{1}{2}$–$\frac{3}{5}$ as long as the glumes, yellowish-brown. *Naturalized in E. Sicilia.* [Si.] (*C. Africa and Nile valley.*)

2. C. auricomus Sieber ex Sprengel, *Syst. Veg.* **1**: 230 (1824). Subcaespitose perennial; rhizomes short; stems 50–150 cm.

Leaves 4–20 mm wide, subequalling the stems. Bracts 5–7, exceeding the inflorescence. Inflorescence a compound umbel; rays 6–10, up to 18 cm. Spikelets 8–12 × 0·5–1 mm, linear, with 14–20 flowers, patent. Rhachilla winged. Glumes 1·8–2 × *c.* 1 mm, ovate or elliptical, obtuse, often with a mucro *c.* 0·1 mm, reddish, straw-coloured or golden-yellow towards the margin. Stamens 3. Nut ½–¾ as long as the glumes, brown. *Naturalized in N.E. Spain (by the R. Tordera).* [Hs.] (*Africa.*)

3. C. longus L., *Sp. Pl.* 45 (1753) (*Pycreus longus* (L.) Hayek; incl. *C. badius* Desf.). Perennial; rhizomes long, 3–10 mm wide, knotted, covered with broad scales; tubers absent; stems 20–150 cm, solitary. Leaves 2–10 mm wide, shorter than to equalling the stems. Bracts 2–6, the outer exceeding the inflorescence. Inflorescence a simple or compound umbel; rays 2–10, up to 35 cm. Spikelets 4–25(–60) × 1–2 mm, linear to oblong, with 6–32 flowers, ascending to patent. Rhachilla broadly winged. Glumes 2–3 × 1·5–2 mm, ovate or elliptical, obtuse, dark brown or reddish with greenish keel. Stamens 3. Nut ⅓–¾ as long as the glumes, brownish to black. *S., W. & C. Europe, northwards to S. England.* Al Au Az Bl Br Bu Co Cr Ga †Ge Gr He Hs Hu It Ju Lu Rm Rs (K, E) Sa Si Tu.

Variable in length of stems, rays and spikelets, width of leaves, and number of bracts and rays. Variants having 2–5 rays which are up to 5 cm long and spikelets 4–12 mm, which occur almost throughout the European range of the species, have been named subsp. **badius** (Desf.) Murb., *Contr. Fl. Nord-Ouest Afr.* **3**: 27 (1899) (*Pycreus badius* (Desf.) Hayek), but intermediates are frequent and the plants in question are worth no more than varietal rank.

4. C. rotundus L., *Sp. Pl.* 45 (1753) (*Pycreus rotundus* (L.) Hayek). Like **3** but rhizomes *c.* 1 mm wide, with rather remote, narrow scales, sometimes with tubers 10–15 × 5–10 mm; stems 10–60 cm; rays not more than 10 cm. *S. & W.C. Europe.* Al Au Az Bl Bu Co Cr Ga Gr He Hs It Ju Lu Sa Si Tu.

5. C. esculentus L., *Sp. Pl.* 45 (1753) (*C. melanorhizus* Delile, *Pycreus esculentus* (L.) Hayek; incl. *C. aureus* Ten., non Georgi). Annual or perennial; rhizomes long, slender, scaly, sometimes with tubers up to 15 mm; stems 5–60(–90) cm, solitary. Leaves 2–10 mm wide, shorter than to exceeding the stems. Bracts 2–9, usually several exceeding the inflorescence. Inflorescence a simple or compound umbel; rays 4–10, up to 10 cm. Spikelets 5–16 × 1–2·5 mm, linear to oblong, with 6–22 flowers, ascending to patent. Rhachilla broadly winged. Glumes 2–3 × *c.* 2 mm, lanceolate to ovate, obtuse, concave, pale yellow to yellowish-brown. Stamens 3. Nut ½ as long as the glumes, reddish or dark grey. *Mediterranean region and S.W. Europe; cultivated here and locally in S.C. Europe for its edible tubers (tiger nuts).* Al Az Bu Co Ga Gr It Lu Si [Au Bl *Cr *Hs Rs (W)].

The cultivated plant is var. *sativus* Boeckeler; it has larger, more elongate tubers marked with conspicuous bands, and seldom flowers.

6. C. glomeratus L., *Cent. Pl.* **2**: 5 (1756) (*Pycreus glomeratus* (L.) Hayek). Annual or perennial; rhizomes absent or creeping; stems 10–80 cm, solitary or caespitose. Leaves 2–10 mm wide, shorter than to exceeding the stems. Bracts 2–6, exceeding the inflorescence. Inflorescence a compound umbel or a sessile, dense head; rays up to 9, up to 10 cm. Spikelets 5–12 × 1–1·5 mm, linear, with 8–20 flowers, ascending to patent. Rhachilla narrowly winged. Glumes (1·5–)2–2·3 × 0·5 mm, linear or linear-lanceolate, obtuse, pale- or reddish-brown, with greenish keel. Stamens 3. Nut ⅗ as long to as long as the glumes, linear-oblong, dark brown. *C. & S.E. Europe.* Au Bu Cz Ga Gr He Hu It Ju Rm Rs (W, E).

7. C. glaber L., *Mantissa Alt.* 179 (1771) (*Pycreus glaber* (L.) Hayek). Caespitose annual; stems 8–50 cm. Leaves 2–6 mm wide, shorter than to exceeding the stems. Bracts 2–5, exceeding the inflorescence. Inflorescence a simple umbel of dense heads; rays up to 8, up to 6 cm. Spikelets 6–15 × 2 mm, linear or oblong-lanceolate, with 10–24 flowers, patent. Rhachilla narrowly winged. Glumes 2–2·5 × *c.* 1·5 mm, elliptical or ovate, acute, reddish, straw-coloured or brownish, with a wide greenish centre and a narrow hyaline margin. Stamens (2)3. Nut ½–⅗ as long as the glumes, obovoid, brown or blackish. *C. & S.E. Europe.* Au Bu Gr It Ju Rm Rs (W, K, E) Si Tu.

8. C. eragrostis Lam., *Tabl. Encycl. Méth. Bot.* **1**: 146 (1791) (*C. vegetus* Willd.). Perennial; rhizomes short, thick; stems 25–90 cm, solitary. Leaves 4–10 mm wide, shorter than to as long as the stems. Bracts 5–11, exceeding the inflorescence. Inflorescence a simple to compound umbel of dense heads; rays 8–10, up to 12 cm. Spikelets 8–13 × 1·8–3 mm, narrowly lanceolate, with 14–30 flowers, patent. Rhachilla not winged. Glumes 2–3 × 1–1·5 mm, lanceolate or ovate-lanceolate, acuminate, straw-coloured or yellowish-red, with greenish centre. Stamen 1. Nut *c.* ½ as long as the glumes, grey. $2n = 42$. *Naturalized in S.W. Europe.* [Az Ga Hs Lu.] (*Tropical America.*)

9. C. textilis Thunb., *Prodr. Pl. Cap.* 18 (1794). Caespitose, leafless perennial; rhizomes short, thick, woody; stems 60–90 cm. Bracts 8–12, with revolute margins, exceeding the inflorescence. Inflorescence a compound umbel of rather dense heads; rays 8–12, up to 6 cm. Spikelets 6–8 × 1·5–2 mm, lanceolate, with 8–20 flowers, patent. Rhachilla not winged. Glumes 1·5–2 × *c.* 1 mm, ovate, acute, with a mucro *c.* 0·1 mm, pale yellow or brown, often with a greenish centre. Stamens 3. Nut *c.* ½ as long as the glumes, brown. *Naturalized in Açores (São Miguel).* [Az.] (*S. Africa.*)

10. C. alternifolius L., *Mantissa* 28 (1767). Like **9** but bracts 11–25, flat; rays 20–25. *Cultivated for ornament and naturalized in C. Portugal and Açores.* [Az Lu.] (*Africa.*)

This widely naturalized plant, including the material from Açores and Portugal, has recently been identified as **C. involucratus** Rottb., *Descr. Icon. Rar. Pl.* 22 (1773) (*C. alternifolius* L. subsp. *flabelliformis* (Rottb.) Kük.). See H. Baijnath, *Kew Bull.* **30**: 522–526 (1975).

11. C. fuscus L., *Sp. Pl.* 46 (1753). Caespitose annual; stems 2–35(–50) cm. Leaves 1–5 mm wide, shorter than to exceeding the stems. Bracts 2–5, exceeding the inflorescence. Inflorescence a simple or compound umbel; rays (1–)3–8(–15), up to 4 cm. Spikelets 3–6(–12) × 1–2 mm, linear or oblong, with 10–20(–40) flowers, patent. Rhachilla not winged. Glumes 1–1·3 × 0·7–0·8 mm, ovate, acute to obtuse, often with a mucro 0·1 mm, dark- or reddish-brown, with greenish keel. Stamens 2. Nut ¾ as long to as long as the glumes, trigonous or rarely plano-convex, white. $2n = 72$. *Most of Europe except parts of the north.* All except Az Fa Fe Hb Is No Sb.

12. C. difformis L., *Cent. Pl.* **2**: 6 (1756). Caespitose annual; stems 20–75 cm. Leaves 2–7 mm wide, shorter than the stems. Bracts 2–4, exceeding the inflorescence. Inflorescence a simple or compound umbel of dense heads; rays 3–8, up to 5 cm. Spikelets 2–8 × *c.* 1 mm, linear, with 10–40 flowers, patent. Rhachilla not winged. Glumes 0·5–0·7 × 0·5 mm, obovate or suborbicular, obtuse, reddish or brownish with paler centre.

Stamen 1(2–3). Nut subequalling the glumes, pale yellow or yellowish-green. *S. Europe.* Al Bu Co Ga Gr Hs It Ju Lu Rm Rs (W) Si Tu [Az.]

Widespread as a weed in rice-fields; its European distribution as a native is for this reason uncertain.

13. C. capitatus Vandelli, *Fasc. Pl.* 5 (1771) (*C. schoenoides* Griseb., *Galilea mucronata* (L.) Parl.). Perennial; roots lanate; rhizomes long, thick, with broad scales; stems 10–50 cm, solitary. Leaves 1–6 mm wide, with revolute margins. Bracts 3–6, with revolute margins, conspicuously dilated and often reddish at the base, exceeding the inflorescence. Inflorescence a dense, sessile, hemispherical to globose head. Spikelets 8–20 × 3–4 mm, lanceolate, with 4–12 flowers, patent. Rhachilla not winged. Glumes 5–8 × 2·5–4 mm, broadly lanceolate or ovate, obtuse but with a rigid mucro 1–3 mm, reddish or purplish, but yellowish-green in apical half, with a wide hyaline margin. Stamens 3. Nut *c.* $\frac{2}{5}$ as long as glumes, brownish-yellow. $2n=72$. *Coastal sandy places. S. Europe.* Al Bl Bu Co Cr Ga Gr Hs It Ju Lu Sa Si Tu.

14. C. michelianus (L.) Link, *Hort. Berol.* **1**: 303 (1827) (*Scirpus michelianus* L.). Caespitose annual; stems 1–28 cm. Leaves 0·5–2 mm wide, flat, shorter than to exceeding the stems. Bracts 3–8, dilated at the base, exceeding the inflorescence. Inflorescence a dense, sessile, ovoid to globose head. Spikelets 2–4 × 1–2 mm, lanceolate or oblong-lanceolate, with 8–20 flowers, patent. Rhachilla not winged. Glumes 1·2–2·5 × 0·5–0·6 mm, lanceolate, ovate-lanceolate or elliptical, acuminate, with an ascending to patent mucro 0·2–0·5 mm, hyaline or whitish-yellow, with greenish keel. Stamens 1–3. Nut $\frac{1}{3}$–$\frac{1}{2}$ as long as the glumes, plano-convex or trigonous, pale brown. *S. & C. Europe.* Au Bu Cz Ga Ge Gr †He Hu It Ju Lu Po Rm Rs (C, W, E).

(a) Subsp. **michelianus** (*Dichostylis michelianus* (L.) Nees): Glumes in 3 rows. *Throughout the range of the species.*

(b) Subsp. **pygmaeus** (Rottb.) Ascherson & Graebner, *Syn. Mitteleur. Fl.* **2(2)**: 273 (1904) (*C. pygmaeus* Rottb., *Dichostylis pygmaeus* (Rottb.) Nees): Glumes distichous. *N. Greece.*

Subsp. (a) usually has 2 stigmas and a plano-convex nut, but trigonous nuts with 2 or 3 stigmas are occasionally found; subsp. (b) can have both plano-convex nuts with 2 stigmas and trigonous nuts with 3 stigmas, sometimes even in the same inflorescence.

Sect. JUNCELLUS Griseb. Rhachilla not articulated. Glumes deciduous. Spikelets with 5-many flowers. Stigmas 2. Nut plano-convex, with a face against the rhachilla.

15. C. serotinus Rottb., *Descr. Icon. Rar. Pl.* 31 (1773) (*Pycreus serotinus* (Rottb.) Hayek). Perennial; rhizomes long; stems 30–120 cm, solitary. Leaves 4–10 mm wide, subequalling to exceeding the stems. Bracts 3–5, exceeding the inflorescence. Inflorescence a compound umbel; rays 5–10, up to 15 cm. Spikelets 5–20(–30) × 2–3·5 mm, lanceolate or oblong-lanceolate, with 8–30 flowers, patent. Rhachilla not winged. Glumes 2–2·5 × 1·5–2 mm, broadly ovate to orbicular, obtuse, reddish-brown, with a greenish centre and a wide hyaline margin. Stamens 3. Nut $\frac{3}{4}$ as long as to subequalling the glumes, dark brown or black. *S. & E. Europe.* Al Au Bu Co Ga †He Hs Hu It Ju Lu Rm Rs (C, W, E) Tu.

16. C. pannonicus Jacq., *Fl. Austr.* **5**: 29 (1778) (*Acorellus pannonicus* (Jacq.) Palla). Caespitose, usually leafless annual or perennial; rhizomes very short; stems 1–40 cm; uppermost sheath sometimes with a lamina up to 5 cm × 1 mm. Bracts 2–3, conspicuously dilated at the base, the lower erect, forming an apparent prolongation of the stem, exceeding the inflorescence, the upper patent, shorter than to exceeding the inflorescence. Inflorescence a fascicle of 2–8 sessile spikelets. Spikelets 5–15 × 2–4 mm, broadly lanceolate or ovate, obtuse, with 10–40 flowers, ascending. Rhachilla not winged. Glumes 1·5–2 × 1·5–2·5 mm, ovate or suborbicular, obtuse, reddish or purplish-brown, with pale greenish stripe *c.* 1 mm wide in the centre. Stamens 3. Nut $\frac{3}{4}$ as long as to equalling the glumes, yellowish-brown. *C. & S.E. Europe.* Al Au Bu Cz Hu Ju Rm Rs (C, W, K, E).

17. C. laevigatus L., *Mantissa Alt.* 179 (1771). Perennial, often leafless; rhizomes slender, inconspicuous, usually long; stems 5–50 cm, caespitose or solitary, the sheaths sometimes with a lamina up to 10 cm × 2 mm. Bracts 2, not conspicuously dilated at the base, the lower erect, forming an apparent prolongation of the stem and exceeding the inflorescence, the upper patent, shorter than the inflorescence. Inflorescence a fascicle of 1–40 sessile spikelets. Spikelets 5–23 × 2 mm, oblong or oblong-lanceolate, acute, with 20–50 flowers, ascending. Rhachilla not winged. Glumes 2–2·5 × 1·5–1·8 mm, ovate or suborbicular, obtuse, pale green to blackish with paler greenish stripe 0·2–0·5 mm wide in the centre. Stamens 3. Nut $\frac{1}{3}$–$\frac{2}{3}$ as long as the glumes, yellowish- or greyish-brown. *Mediterranean region, S. Portugal.* Bl Cr Ga Gr Hs It Lu Sa Si.

(a) Subsp. **laevigatus**: Spikelets not more than 10 mm, up to 40 in the inflorescence. Glumes pale green or straw-coloured. *Pantelleria.* (*Widespread in tropics and subtropics.*)

(b) Subsp. **distachyos** (All.) Maire & Weiller in Maire, *Fl. Afr. Nord* **4**: 35 (1957) (*C. distachyos* All., *Acorellus distachyos* (All.) Palla): Spikelets up to 23 mm, not more than 6 in the inflorescence. Glumes purplish-brown or blackish. *Throughout the range of the species.*

Sect. PYCREUS (Beauv.) Griseb. Rhachilla not articulated. Glumes deciduous. Spikelets with 10–many flowers. Stigmas 2. Nut lenticular, with an angle against the rhachilla.

18. C. flavidus Retz., *Obs. Bot.* **5**: 13 (1788) (*C. globosus* All., non Forskål, *Pycreus globosus* (All.) Reichenb.). Caespitose annual, biennial or perennial; rhizomes absent or short; stems 10–65 cm. Leaves 0·5–3 mm wide, shorter than the stems. Bracts 2–5, exceeding the inflorescence. Inflorescence simple (rarely compound), a sessile dense to lax head of spikelets or an umbel of several subsessile or rayed heads; rays up to 5, up to 3 cm. Spikelets 5–35 × 2–2·5 mm, linear or oblong-lanceolate, broadly acute to obtuse, with 10–60 flowers, patent. Rhachilla not winged. Glumes 2–3 × 1·5–2 mm, lanceolate or ovate, obtuse, without a mucro, dark- or reddish-brown, with a 1-veined, greenish keel and conspicuous, narrow hyaline margin. Stamens 2. Nut $\frac{1}{3}$–$\frac{1}{2}$ as long as the glumes, brown. *S. Europe.* Bu Cr Ga Gr Hs It.

19. C. polystachyos Rottb., *Descr. Icon. Rar. Pl.* 39 (1773). Like **18** but perennial; spikelets up to 15 mm, narrowly acute; glumes yellowish, straw-coloured or yellowish-brown, acute, with a 3-veined keel and a mucro 0·1 mm. *Naturalized in S. Italy* (*Ischia*). [It.] (*Tropics.*)

20. C. mundtii (Nees) Kunth, *Enum. Pl.* **2**: 17 (1837) (*C. eragrostis* sensu Willk., non Lam.). Perennial; rhizomes long; stems 15–50 cm, solitary. Leaves 3–5 mm wide, shorter than the stems. Bracts 3–5, shorter than to slightly exceeding the inflorescence. Inflorescence a simple or compound umbel; rays 4–10, up to 5 cm. Spikelets 5–15 × 2 mm, lanceolate or oblong-lanceolate, with 10–36 flowers, patent. Rhachilla not

winged. Glumes 1·5–2 × 1–1·5 mm, ovate, obtuse, conspicuously sulcate, brown or reddish-brown with yellowish-green centre. Stamens 3. Nut *c.* ½ as long as the glumes, brown. *S.W. Spain.* Hs. (*Africa, India.*)

21. C. flavescens L., *Sp. Pl.* 46 (1753) (*Pycreus flavescens* (L.) Reichenb.). Caespitose annual; rhizomes absent or short; stems 1–50 cm. Leaves 0·5–3 mm wide, shorter than to exceeding the stems. Bracts 2–5, exceeding the inflorescence. Inflorescence a lax head of sessile spikelets, or a simple umbel with 1–4 rays, up to 5·5 cm long. Spikelets 5–15 × 2–3 mm, lanceolate or oblong-lanceolate, with 10–28 flowers, patent. Rhachilla not winged. Glumes 1·5–2·2 × 1–1·5 mm, elliptical or ovate, obtuse, yellowish, with greenish keel, without a conspicuously differentiated margin. Stamens 2–3. Nut ⅓–½ as long as the glumes, brownish-black. *Europe, except for much of the north.* Al Au Be Bu Co Cr Cz Ga Ge Gr He Ho Hs Hu It Ju Lu Po Rm Rs (B, C, W, K, E) Sa Si Tu [Az].

Sect. MARISCUS (Gaertner) Endl. Rhachilla articulated near its base. Glumes persistent. Spikelets with (2–)6–many flowers. Stigmas 3. Nut trigonous, with a face against the rhachilla.

22. C. strigosus L., *Sp. Pl.* 47 (1753). Caespitose perennial; rhizomes short; stems 15–120 cm. Leaves 2–12 mm wide, equalling or exceeding the stems. Bracts 4–6, the outer exceeding the inflorescence. Inflorescence a simple or compound umbel of lax or dense, ovoid-cylindrical heads; rays 2–12, up to 8 cm. Spikelets 8–30 × 1 mm, linear, with (3–)6–25 flowers, ascending to patent. Rhachilla winged. Glumes 3·5–5 × *c.* 1·5 mm, oblong-lanceolate, acuminate, often with a mucro 0·1 mm, straw-coloured or golden-brown, with a greenish keel and a narrow hyaline margin. Stamens 3. Nut *c.* ⅔ as long as the glumes, linear to linear-oblong, reddish-grey. *Naturalized in N.W. Italy.* [It.] (*North America.*)

23. C. congestus Vahl, *Enum. Pl.* **2**: 358 (1805) (*Pycreus congestus* (Vahl) Hayek). Like **22** but annual; glumes purplish-red; nut more or less obovoid, black. *Naturalized in C. Portugal (near Coimbra); casual elsewhere in S. Europe.* [Lu.] (*S. Africa, Australia.*)

24. C. hamulosus Bieb., *Fl. Taur.-Cauc.* **1**: 35 (1808) (*Dichostylis hamulosa* (Bieb.) Nees). Caespitose annual; stems 2–15 cm. Leaves 0·5–1 mm wide, shorter than to equalling the stems. Bracts 2–4, exceeding the inflorescence. Inflorescence usually of several dense heads, the central sessile, the lateral rayed; rays 1–3, up to 1 cm. Spikelets 3–4 × 1·5–2 mm, ovoid-oblong, with 6–8 flowers. Rhachilla not winged. Glumes *c.* 0·8 × 0·5 mm (excluding arista), in 3 rows or irregularly distichous, lanceolate, acuminate, with a curved arista 1 mm, 5-veined, purplish-brown, with greenish keel. Stamen 1. Nut *c.* ⅔ as long as to equalling the glumes, oblong, brown. *E. Europe.* Bu Rm Rs (C, W, E).

25. C. squarrosus L., *Cent. Pl.* **2**: 6 (1756) (*C. aristatus* Rottb.). Like **24** but rays up to 5 cm; spikelets 3–9 mm, linear-oblong, with 6–18 flowers; glumes distichous, 7- to 9-veined; nut ⅓–½ as long as the glumes. *Naturalized in N. Italy (near Pavia).* [It.] (*Tropics.*)

26. C. ovularis (Michx) Torrey, *Ann. Lyc. New York* **3**: 278 (1836). Perennial; rhizomes short; stems 20–60 cm, solitary or caespitose. Leaves 3–10 mm wide, usually shorter than the stems. Bracts 4–7, exceeding the inflorescence. Inflorescence a simple umbel of dense heads; rays 1–11, up to 10 cm. Spikelets 3–8 × 1 mm, linear-lanceolate, with 2–3 flowers, patent. Rhachilla winged. Glumes 3–4 × 1 mm, lanceolate, acute, often with a mucro 0·1 mm, prominently 7- to 13-veined, reddish or straw-coloured, with greenish keel. Stamens 3. Nut *c.* ⅗ as long as the glumes, ellipsoid or oblong, brown. *Naturalized in Açores.* [Az.] (*E. North America.*)

Sect. KYLLINGA (Rottb.) Endl. Rhachilla articulated near its base, minute. Glumes persistent. Spikelets with 1–2 flowers. Stigmas 2. Nut lenticular, with an angle against the rhachilla.

27. C. brevifolius (Rottb.) Hassk., *Cat. Horto Bogor.* 24 (1844). Perennial; rhizomes slender; stems 3–40 cm, solitary or caespitose. Leaves 1·5–3 mm wide, shorter than to exceeding the stems. Bracts 3–4, exceeding the inflorescence. Inflorescence of 1(–3) dense heads. Spikelets 2–3·5 × 0·8–1 mm, lanceolate, with 1 flower. Rhachilla not winged. Glumes 2–3·5 × 2–2·5 mm, unequal, lanceolate, acuminate, with a mucro 0·2–0·4 mm, whitish or yellowish, with minutely setulose greenish keel. Stamens 1–3. Nut *c.* ½ as long as the glumes, yellowish to brown. *Naturalized in Açores and W. Portugal.* [Az Lu.] (*Tropical America, Asia.*)

8. **Cladium** Browne[1]

Perennials. Stems terete. Inflorescence a terminal panicle of terete, 1- to 3-flowered spikelets aggregated into dense clusters. Glumes spirally arranged. Flowers mostly hermaphrodite; perianth absent. Stamens 2(–3). Stigmas (2–)3. Nut ovoid-trigonous, with small, persistent style-base.

Literature: G. Kükenthal, *Feddes Repert.* **51**: 1–17, 139–193 (1942).

1. C. mariscus (L.) Pohl, *Tent. Fl. Bohem.* **1**: 32 (1809). Plant robust, with far-creeping rhizomes, forming extensive pure stands. Stems 125–250 cm, hollow, leafy. Leaves up to 200 cm, persisting for several years; sheath broad, brown, fibrous; lamina 10–15 mm wide at base, tapered to a narrow, triquetrous apex, glaucous, hard and rigid, sharply keeled, with cutting, serrulate margins. Panicle 30–70 × 5–12 cm, with sheathing bracts; clusters with 5–10 spikelets. Spikelets 3–4 mm, ovoid; uppermost flower usually male. Upper 1–3 glumes fertile, the lower 2–4 sterile and smaller. Nut *c.* 3 mm, shining brown. $2n = 36$, *c.* 60. *Fens and lake-margins, usually in base-rich water. Europe, northwards to* 62° 15′ *N. in C. Finland.* All except Fa Is Rs (N) Sb Tu.

9. **Rhynchospora** Vahl[1]

Perennials. Stems terete or trigonous, leafy. Spikelets terete, 2- or 3-flowered, in terminal, and usually also in axillary, pedunculate clusters or panicles. Glumes spirally arranged. Flowers hermaphrodite; perianth of 5–13 scabrid bristles. Stamens 2–3. Stigmas 2. Nut lenticular or trigonous, with a persistent, beak-like style-base.

Literature: G. Kükenthal, *Bot. Jahrb.* **74**: 375–509 (1949); **75**: 90–195 (1950); 273–314 (1951).

1 Spikelets irregularly arranged in a slender, diffuse panicle; nut transversely rugulose **3. rugosa**
1 Spikelets aggregated in 1–3 compact clusters; nut smooth
2 Spikelets white at anthesis; bract usually not exceeding the terminal cluster of spikelets (rarely exceeding it by up to 15 mm) **1. alba**
2 Spikelets reddish-brown at anthesis; bract exceeding the terminal cluster of spikelets by (10–)25–50 mm **2. fusca**

[1] By D. A. Webb.

1. R. alba (L.) Vahl, *Enum. Pl.* **2**: 236 (1805). Rhizome short; stems 10–40(–60) cm, somewhat caespitose. Basal leaves 10–15 cm × 1–2 mm, the cauline somewhat shorter, the basal and lower cauline often with axillary bulbils. Spikelets 5 mm, fusiform, white at anthesis, pale brown later, forming a dense, terminal, obpyramidal or semi-globose cluster up to 10 × 15 mm, often with 1 or 2 similar but smaller axillary clusters lower down the stem. Uppermost bract exceeding the terminal cluster, if at all, by not more than 15 mm. Perianth-bristles 9–13, retrorsely barbed. Nut smooth. $2n=26$, 42. *On wet, acid peat. Most of Europe, except the Mediterranean region and the south-east.* Au Be Br Cz Da Fe Ga Ge Hb He Ho Hs †Hu It Ju Lu No Po Rm Rs (N, B, C, W, E). Su.

2. R. fusca (L.) Aiton fil. in Aiton, *Hort. Kew.* ed. 2, **1**: 127 (1810). Rhizome far-creeping; stems 15–35 cm, scarcely caespitose. Leaves up to 15 cm × 1 mm; bulbils absent. Spikelets 6 mm, oblong-ovoid, reddish-brown, in a dense, terminal, ovoid cluster up to 12 × 10 mm, often with 1(–2) smaller axillary clusters below. Uppermost bract exceeding the terminal cluster by (10–)25–50 mm. Perianth-bristles 5–6, antrorsely barbed. Nut smooth. $2n=32$. *Bog-pools. N., W. & C. Europe, extending southwards to N. Italy.* Au Be Br Cz Da Fe Ga Ge Hb He Ho It Ju No Po Rs (N, B, C) Su.

3. R. rugosa (Vahl) S. Gale, *Rhodora* **46**: 93 (1944). Rhizome short; stems 40–65 cm, caespitose. Leaves 20–35 cm × 1·5–3 mm, somewhat glaucous. Spikelets *c.* 4 mm, ovoid, dark brown, in an irregular, diffuse panicle. Uppermost bract shorter or longer than inflorescence. Perianth-bristles 6, antrorsely barbed. Nut transversely regulose. *Wet places. S.W. Spain, W. Portugal.* Hs Lu. (*Tropics and subtropics.*)

The records of this species from the Iberian peninsula and N.W. Africa are very few, and are very remote from the rest of its distribution-range, but there is no evidence to suggest that the plant has been introduced by man.

10. Schoenus L.[1]

Perennials. Stems terete. Leaves all basal. Inflorescence terminal, capitate, of 1–10 somewhat flattened, 1- to 4-flowered spikelets, subtended by 1 or 2 bracts with sheathing base and herbaceous lamina. Glumes distichous. Flowers hermaphrodite; perianth of 3–6 small bristles or absent. Stamens 3. Stigmas 3. Nut trigonous, without a persistent style-base.

Literature: G. Kükenthal, *Feddes Repert.* **44**: 1–32, 65–101, 161–195 (1938).

Inflorescence of usually more than 4 spikelets; lower bract usually considerably exceeding the inflorescence, its lamina longer than its sheathing base **1. nigricans**

Inflorescence of 1–3(–4) spikelets; lower bract usually about equalling the inflorescence, its lamina shorter than or equalling its sheathing base **2. ferrugineus**

1. S. nigricans L., *Sp. Pl.* 43 (1753). Stems 15–60(–90) cm, densely caespitose. Leaves half as long as to slightly longer than stems; sheaths blackish at base, reddish-brown above; lamina narrowly linear, canaliculate, hard and wiry, greyish-green. Inflorescence (excluding bracts) 10–18 × 8–18 mm, with (2–)5–10 spikelets; lower bract usually considerably exceeding inflorescence, with lamina (7–)12–30(–90) mm, usually much longer than the sheathing base. Glumes *c.* 8 mm, blackish-brown; keel scabrid-denticulate. Perianth-bristles absent or very small. Nut *c.* 1·5 mm, obtusely trigonous, creamy-white. $2n=44$, 54. *Usually in fens and other at least seasonally wet, base-rich habitats; less often on maritime sands or acid peat. Europe, northwards to N. Scotland, and eastwards to Estonia and Krym.* All except Az Fa Fe Is Rs (N, C, E): extinct in No.

2. S. ferrugineus L., *Sp. Pl.* 43 (1753). Like **1** but rather less robust; leaves often less than half as long as stems; sheaths reddish-brown, scarcely black at base; inflorescence 7–12 × 2–8 mm, with 1–3(–4) spikelets; lower bract usually about equalling inflorescence, with lamina 3–7 mm and shorter than or equalling the sheathing base; glumes 6–7 mm, with smooth keel; perianth-bristles (3–)6, exceeding the nut. $2n=76$. *Wet places on base-rich or slightly acid peat. From Fennoscandia and N.W. Russia southwards to S.E. France, C. Jugoslavia and S.E. Russia, but very local over much of its range.* ?Al Au †Br Cz Da Fe Ga Ge He ?Hu It Ju No Rm Rs (N, B, C, W, E) Su [Bu].

S. karpatii Pénzes, *Acta Bot. Acad. Sci. Hung.* **8**: 333 (1962), described from the coast of S. Albania (near Diviaka), appears to differ from **2** only in its shorter and somewhat wider bracts and glumes; other features mentioned in the diagnosis are less constant. It should probably be regarded as no more than a variety of **2**.

Hybrids between **1** and **2** are fairly frequent where these species grow together. They are closer to **2** in habit and general appearance of the spikelets, but resemble **1** in the long lamina of the bract and the darker glumes and leaf-sheaths.

11. Kobresia Willd.[2]
(incl. *Elyna* Schrader)

Perennials. Stems subterete, leafy at base. Inflorescence a single, simple spike-like panicle (called a spike for convenience in this account), or an elongated aggregation of such sessile spikes on an unbranched axis. Flowers unisexual, mostly in 1- or 2-flowered spikelets each with a basal glume; perianth absent. Stamens 3. Female flowers enfolded by a scale (perigynium), the margins of which are free or connate only at the base; stigmas usually 3. Nut trigonous; style more or less persistent.

Literature: G. Kükenthal in Engler, *Pflanzenreich* **38(IV. 20)** (*Cyperaceae–Caricoideae*): 33–50 (1909). N. A. Ivanova, *Bot. Žur.* **24**: 455–503 (1939).

Basal sheaths leafless; spike solitary; lateral spikelets 2-flowered **1. myosuroides**

Basal sheaths leafy; spikes 3–10; lateral spikelets 1-flowered **2. simpliciuscula**

1. K. myosuroides (Vill.) Fiori in Fiori & Paol., *Fl. Anal. Ital.* **1**: 125 (1896) (*K. bellardii* (All.) Degl. ex Loisel., *K. scirpina* Willd., *Elyna myosuroides* (Vill.) Fritsch). Densely caespitose. Stems 5–30 cm, erect; basal sheaths leafless, brown, shining. Leaves equalling or longer than stems, 0·5–1·5(–2) mm wide, canaliculate. Spike solitary, 10–25(–30) × 2–3 mm, with 10–20 spikelets. Terminal spikelet of several male flowers; lateral each with 1 male flower above and 1 female flower below. Glumes brown, with scarious margin. Nut 1·5–2·5(–3) mm, brown, shining. $2n=60$. *Dry places; calcicole. Iceland, Fennoscandia and N. Ural; mountains of C. & S. Europe from the Pyrenees to the Carpathians and S.W. Bulgaria.* Au Bu Cz Fe Ga Ge He Hs Is It Ju No Rm Rs (N, C) Su.

K. sibirica (Turcz. ex Ledeb.) Boeckeler, *Linnaea* **39**: 7 (1875), differing from **1** chiefly in having wider spikes with the lateral spikelets each containing 1 male and 2–5 female flowers, has

[1] By D. A. Webb. [2] By A. O. Chater.

been recorded from the C. Ural at 59° 40′ N., very close to the boundary of Europe.

2. K. simpliciuscula (Wahlenb.) Mackenzie, *Bull. Torrey Bot. Club* **50**: 349 (1923) (*K. caricina* Willd.). Densely caespitose. Stems 3–20(–30) cm, erect; basal sheaths leafy, pale orange-brown, not shining. Leaves usually about half as long as stems, 0·5–1·5(–2) mm wide, more or less canaliculate. Spikes 3–10, 6–8 × 2–3 mm, sessile in an ovoid-oblong inflorescence, each with 4–8 spikelets. Spikelets 1-flowered, the upper male, the lower female. Glumes reddish-brown, with scarious margin. Nut 2–3 mm, pale brown, not shining. $2n=76$. *Damp places; calcicole. N. Europe, from N. England to c.* 66° *N. in Fennoscandia; Pyrenees, Alps, Carpathians.* Au Br Cz Fe Ga Ge He Hs It No Po Rm Rs (N) Su.

12. Carex L.[1]

Perennials. Stems simple, usually leafy, often trigonous in section. Leaf-base usually sheathing, with a ligule at junction of leaf and sheath. Inflorescence of one or more spike-like panicles (called spikes for convenience in this account). Flowers unisexual, in 1-flowered spikelets, each subtended by a glume; perianth absent. Male flowers with 2–3 stamens. Female flowers enclosed in a utricle (perigynium) from which the stigmas (and rarely also the prolonged axis of the spikelet) project. Stigmas 2–3. Nut biconvex or trigonous.

In this account measurements of stems include the inflorescence; characters of leaves refer to those on the non-flowering shoots; the length of the ligule (which can, however, best be seen on flowering stems) is measured from the level at which the leaf-sheath joins the leaf-lamina to the apex of the ligule (and is not just the length of the free part of the ligule); characters of the inflorescence refer to the time when the fruit is ripe, and characters of male and female spikes, in Subgen. *Carex*, refer to the terminal and the lowest spike respectively unless otherwise indicated; characters of glumes and utricles refer to those in the middle of the spike, and the female glumes usually have a pale or greenish midrib which is normally not mentioned in the descriptions; measurements of length of utricles include the beak when present; unless otherwise indicated descriptions of the venation of utricles refer only to the abaxial surface and exclude the 2 or 3 often prominent veins that may be present on the edges or angles of the utricle.

The habit of the plant supplies important diagnostic characters; many species are caespitose but emit creeping rhizomes, and inadequate material may fail to show this.

Abnormalities in the arrangement of the inflorescence, particularly with regard to the positions of male and female flowers, are not uncommon; it is not practicable to allow for any but the most common of these in the key and descriptions. Spikes on long peduncles arising from the base of the stem, characteristic of certain species, occur as rare abnormalities in many others.

Hybrids occur between many of the species; they are usually intermediate morphologically between the parents and sterile, with empty utricles, and with anthers remaining undehisced and concealed beneath the male glumes. Hybrids that are at least partially fertile occur, however, especially in the *C. flava* group (**96–102**) and in Sect. *Phacocystis* (**154–169**).

Literature: G. Kükenthal in Engler, *Pflanzenreich* **38(IV. 20)** *Cyperaceae-Caricoideae*: 67–767 (1909). T. V. Egorova, *Osoki SSSR, Vidy Podroda* Vignea. Moskva & Leningrad. 1966. (Subgen. *Vignea* in the U.S.S.R.); *Nov. Syst. Pl. Vasc.* (*Leningrad*) **9**: 64–95 (1972). (Subgen. *Carex* in the U.S.S.R.). B. Achtarov, *Rodăt* Carex (*Ostrica*) *v Bălgarija.* Sofija. 1957. (Bulgaria.) L. Fenaroli, *Ann. Sperim. Agraria* (*Roma*) nov. ser., **3**: 621–684 (1949). (Italy.) A. C. Jermy & T. G. Tutin, *British Sedges.* London. 1968. (British Isles.) C. Vicioso, *Estudio Monografico sobre el Genero* 'Carex' *en España* (*Bol. Inst. For. Inv. Exper. Madrid*, No. 79). Madrid. 1959. (Spain.)

1 Spike solitary
2 Stigmas 3
3 Utricles densely pubescent **176. scirpoidea**
3 Utricles glabrous
4 Without creeping rhizomes, densely caespitose
5 Lower female glumes less than 5 mm **177. pyrenaica**
5 Lower female glumes more than 50 mm **1. phyllostachys**
4 With creeping rhizomes, usually not caespitose
6 Utricles patent-deflexed
7 Utricles (2·5–)3·5–4·5(–6) mm, with a bristle protruding from aperture of beak **170. microglochin**
7 Utricles 5–7 mm, without a bristle **171. pauciflora**
6 Utricles erecto-patent to erect
8 Leaves circinnate towards apex; female glumes equalling or exceeding utricles **172. rupestris**
8 Leaves straight; female glumes *c.* ½ as long as utricles **173. obtusata**
2 Stigmas 2
9 Monoecious, with male flowers at base of spike **36. ursina**
9 Dioecious, or monoecious with male flowers at apex of spike
10 Female glumes persistent, the utricles falling first
11 Monoecious; utricles pale brown or greenish
12 Stems terete, smooth; utricles with faint veins **174. nardina**
12 Stems trigonous, scabrid above; utricles veinless **175. capitata**
11 Usually dioecious; utricles dark brown or dark reddish- or blackish-brown
13 Densely caespitose, without creeping rhizomes **32. davalliana**
13 Not or laxly caespitose, with creeping rhizomes **30. dioica**
10 Female glumes caducous, falling before the utricles
14 Utricles 3–4 mm **177. pyrenaica**
14 Utricles 4·5–7 mm
15 Utricles acute, not beaked; lower male glumes acute; laxly caespitose **178. pulicaris**
15 Utricles with a long beak; lower male glumes obtuse; densely caespitose
16 Stems (12–)20–40 cm; spike (20–)25–30 mm; female glumes pale brown **179. peregrina**
16 Stems 5–25 cm; spike 15–25 mm; female glumes reddish-brown **180. macrostylon**
1 Spikes 2 or more
17 Spikes all ±similar in appearance, the terminal usually at least partly female
18 Stigmas 3
19 At least the terminal spike male at apex
20 Lateral spikes pendent
21 Terminal spike 7–12 mm; female glumes usually purplish-black, utricles 3·5–5 mm **140. atrofusca**
21 Terminal spike 12–20 mm; female glumes dark reddish-brown; utricles 5–6(–7) mm **141. frigida**
20 All spikes erect
22 Spikes dense
23 Inflorescence whitish or pale yellowish **46. baldensis**
23 Inflorescence brown to blackish
24 Utricles 5–8 mm **47. curvula**
24 Utricles 3–4 mm
25 Female spikes 10–20 mm; female glumes exceeding utricles **146. atrata**
25 Female spikes 5–8 mm; female glumes shorter than utricles **147. parviflora**
22 Spikes lax
26 Lowest spike sessile or shortly pedunculate, not arising from base of stem

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27 Lower female glumes at least 50 mm **1. phyllostachys**
27 Lower female glumes less than 50 mm **2. distachya**
26 Lowest spike with a long peduncle arising from base of stem
28 Utricles 3–4·5 mm; female glumes exceeding utricles **114. oedipostyla**
28 Utricles 6–7 mm; female glumes shorter than utricles **115. illegitima**
19 At least the terminal spike male at base
29 Lowest spike erect, sessile or with a peduncle less than 1 cm
30 Spikes in a dense cluster
31 Utricles black or blackish-purple (sometimes with pale margins) **147. parviflora**
31 Utricles greenish-brown **150. norvegica**
30 At least the lowest spike 1 cm or more from the one above
32 Terminal spike clavate; lateral spikes ovoid or obovoid **148. buxbaumii**
32 All spikes cylindrical **149. hartmanii**
29 Lowest spike pendent, with a peduncle at least 1 cm
33 Utricles 1·5–2 mm **68. krausei**
33 Utricles 3–5·5 mm
34 Lowest bract usually exceeding spike, not sheathing or with a sheath less than 5 mm
35 Lowest spike entirely female; female glumes scarcely longer than and about as wide as utricles **146. atrata**
35 Lowest spike with at least one male flower at base; female glumes about twice as long as and *c.* ⅔ as wide as utricles **144. magellanica**
34 Lowest bract with a sheath 5–25 mm, usually shorter than spike
36 Densely caespitose, without creeping rhizomes; utricles gradually narrowed into beak **136. fuliginosa**
36 Laxly caespitose, with short, creeping rhizomes; utricles abruptly contracted into beak **140. atrofusca**
18 Stigmas 2
37 All spikes with female flowers at top
38 Body of utricle distinctly winged for at least part of its length
39 Caespitose, without or with short creeping rhizomes
40 Inflorescence pale green or yellowish; utricles 7–10 mm **26. bohemica**
40 Inflorescence brown; utricles 3–5 mm
41 Inflorescence (1·5–)2–4 cm, oblong to irregularly cylindrical, pale brown **27. ovalis**
41 Inflorescence 1–2 cm, ovoid to pyramidal, dark brown **28. macloviana**
39 Not caespitose, with long, creeping rhizomes
42 Utricles conspicuously veined
43 Leaves 1–2 mm wide, usually shorter than stems; female glumes dark brown **13. ligerica**
43 Leaves 2–3 mm wide, exceeding stems; female glumes pale yellowish-brown **14. reichenbachii**
42 Utricles obscurely veined
44 Leaves not more than ½ as long as stems; spikes reddish-brown **17. praecox**
44 Leaves exceeding stems; spikes pale greenish-brown **18. brizoides**
38 Utricles unwinged, except sometimes narrowly so on the beak
45 Female glumes blackish
46 Stems curved, decumbent, longer than leaves; utricles rounded at apex, not scabrid **153. bicolor**
46 Stems straight, erect, shorter than leaves; utricles with a very short, scabrid beak **154. rufina**
45 Female glumes greenish, whitish, or pale to reddish-brown
47 Lowest bract exceeding inflorescence, leaf-like **25. remota**
47 Lowest bract shorter than inflorescence, usually not leaf-like
48 Utricles patent
49 Utricles with a distinct beak
50 Spikes subglobose; utricles with 2-fid beak **29. echinata**
50 Spikes oblong-ovoid to oblong; utricles with entire beak **33. elongata**
49 Utricles beakless
51 Lower spikes separated by at least 1 cm; utricles prominently veined **43. loliacea**
51 Spikes contiguous or separated by not more than 0·5 cm; utricles obscurely veined **44. tenuiflora**
48 Utricles erect
52 Terminal spike clavate, male for at least half its length; female glumes equalling or exceeding and concealing utricles
53 Leaves 2–3 mm wide, flat **37. mackenziei**
53 Leaves 0·5–1(–2) mm wide, canaliculate or flat **35. glareosa**
52 Terminal spike not or scarcely clavate, male for less than half its length; female glumes shorter than and not concealing utricles
54 Spikes greenish or pale brown, at least the lower usually ± distant and not overlapping
55 Utricles with a long, asymmetrical slit down the back of the beak **42. brunnescens**
55 Utricles without a slit down the back of the beak
56 Inflorescence 0·5–1 cm; utricles with inconspicuous veins **44. tenuiflora**
56 Inflorescence 1·5–5 cm; utricles with prominent veins
57 Utricles with scabrid, straight-sided beak **40. curta**
57 Utricles with smooth, concave-sided beak **41. lapponica**
54 Spikes dark brown, usually all overlapping
58 Spikes (5–)8–12(–18) **33. elongata**
58 Spikes 2–4(–6)
59 Lateral spikes entirely female **35. glareosa**
59 Lateral spikes with male flowers at base
60 Utricles *c.* 2 mm
61 Leaves exceeding and usually concealing stems **36. ursina**
61 Leaves shorter than stems **34. lachenalii**
60 Utricles at least 2·5 mm
62 Stems usually smooth; spikes usually ellipsoid; utricles with a parallel-sided beak 0·75–1 mm **34. lachenalii**
62 Stems scabrid above; spikes ovoid-globose to ovoid or oblong-clavate; utricles with a conical beak not more than 0·5 mm
63 Spikes 5–10 mm, ovoid-globose **38. heleonastes**
63 Spikes 3–5 mm, oblong-clavate **39. marina**
37 At least one spike with male flowers at top
64 Densely caespitose, without creeping rhizomes
65 Utricles patent
66 Utricles 2–2·5 mm **8. vulpinoidea**
66 Utricles 3–6 mm
67 Stems less than 2 mm thick; leaves 2–4(–5) mm wide; utricles veinless except for faint veins at base **(9–11). muricata** group
67 Stems more than 2 mm thick; leaves (2–)4–8(–10) mm wide; utricles distinctly veined ± throughout
68 Ligule longer than wide, not overlapping edges of leaf; utricles shining, smooth, with oblong, thin-walled epidermal cells **7. otrubae**
68 Ligule wider than long, overlapping edges of leaf; utricles not shining, papillose, with isodiametric, thick-walled epidermal cells **6. vulpina**
65 Utricles erect or erecto-patent
69 Inflorescence very dense, capitate **23. foetida**
69 Inflorescence ± lax, oblong, cylindrical or very interrupted
70 Utricles plane on adaxial side, weakly convex on abaxial side; spikes greenish at least at anthesis **(9–11). muricata** group

70 Utricles weakly to strongly convex on adaxial side, strongly convex on abaxial side; spikes brown (or rarely pale yellowish-brown) even at anthesis
71 Basal sheaths fibrous **4. appropinquata**
71 Basal sheaths entire
72 Tussock-forming; lower clusters of spikes ± pedunculate **3. paniculata**
72 Not tussock-forming; lower spikes or clusters of spikes sessile **5. diandra**
64 Not or laxly caespitose, with creeping rhizomes
73 Female glumes blackish; utricles 1·5–2·5 mm
74 Stems curved, decumbent, longer than leaves; utricles rounded at apex, not scabrid **153. bicolor**
74 Stems straight, erect, shorter than leaves; utricles with a very short, scabrid beak **154. rufina**
73 Female glumes not blackish
75 Utricles 10–20 mm **22. physodes**
75 Utricles less than 6 mm
76 Body of utricle distinctly winged for at least part of its length
77 Middle spikes entirely male; terminal or upper spikes entirely female **15. disticha**
77 Middle spikes with both male and female flowers; terminal or upper spikes with at least some male flowers
78 Middle spikes with female flowers above and male flowers below **14. reichenbachii**
78 Middle spikes with male flowers above and female below
79 Utricles conspicuously veined **12. arenaria**
79 Utricles obscurely veined **16. repens**
76 Utricles unwinged, except sometimes narrowly so on the beak
80 At least the lower spikes ± distant, not overlapping **45. disperma**
80 All spikes overlapping
81 Stems smooth
82 Utricles with prominent veins, usually shorter than glumes **21. stenophylla**
82 Utricles with faint veins, exceeding glumes
83 Stems 2–18 cm; utricles gradually narrowed into beak **24. maritima**
83 Stems (5–)15–30 cm; utricles abruptly contracted into beak **19. chordorrhiza**
81 Stems scabrid at least at apex
84 Laxly caespitose, with short, creeping rhizomes
85 Inflorescence less than 2 cm, ovoid to pyramidal, dense **23. foetida**
85 Inflorescence at least 2 cm, oblong to cylindrical **5. diandra**
84 Not caespitose, with long, creeping rhizomes
86 Inflorescence oblong to oblong-ovoid, not lobed, the separate spikes scarcely evident; female glumes acute **21. stenophylla**
86 Inflorescence distinctly lobed, the separate spikes clearly evident at least at the base; female glumes cuspidate or aristate **20. divisa**
17 Spikes dissimilar in appearance, the terminal or upper usually entirely male, the lower usually entirely female
87 Stigmas 2; utricles usually ± biconvex or plano-convex
88 Utricles inflated, patent **58. saxatilis**
88 Utricles not inflated, erect or erecto-patent
89 Utricles with a long, 2-fid beak
90 Lowest spike with a peduncle 4–12 cm **71. vulcani**
90 Lowest spike sessile **135. mucronata**
89 Utricles not beaked, or with a short, emarginate beak
91 At least the lowest spike pendent with a long, filiform peduncle **(155–161). paleacea group**
91 Spikes erect or drooping, but not pendent
92 At least the lower female glumes 3-veined
93 Densely caespitose and tussock-forming, without creeping rhizomes **164. elata**
93 Not or laxly caespitose, with creeping rhizomes
94 Utricles 3·5–5 mm, prominently veined
95 Leaves (4–)7–10 mm wide **51. acutiformis**
95 Leaves 1·5–2(–3) mm side **169. trinervis**
94 Utricles 2·5–3·5(–4) mm, veinless or faintly veined
96 Utricles faintly veined **(155–161). paleacea group**
96 Utricles veinless
97 Stems 3–5(–20) cm; female spikes 5–15 mm **(155–161). paleacea group**
97 Stems 20–100(–130) cm; female spikes (15–)40–70(–100) mm **162. aquatilis**
92 Female glumes 1-veined
98 Densely caespitose, sometimes tussock-forming, without creeping rhizomes
99 Utricles puberulent **124. pilulifera**
99 Utricles glabrous
100 Margins of leaves rolling inwards on drying; basal sheaths brown or reddish-brown **167. nigra**
100 Margins of leaves rolling outwards on drying
101 Basal sheaths dark reddish-brown or -black; leaves green; utricles 2–2·5 mm **165. caespitosa**
101 Basal sheaths yellowish-brown; leaves glaucous; utricles 2·5–4 mm **164. elata**
98 Not or laxly caespitose, with creeping rhizomes
102 Stems 3–5(–20) cm; lowest bract dilated and ± enfolding stem at base; utricles with a beak *c.* 0·4 mm wide **(155–161). paleacea group**
102 Stems usually more than 5 cm; lowest bract not dilated or enfolding stem; utricles with a beak not more than 0·3 mm wide, or ± without a beak
103 Utricles veined, sometimes obscurely so
104 Utricles 3·5–5 mm, uniformly greyish-green, with a prominent, emarginate beak *c.* 0·3 mm wide **51. acutiformis**
104 Utricles 2–3·5 mm, green or tinged with black or brown in part, with a minute, entire beak not more than 0·2 mm wide
105 Leaves 1–3(–5) mm wide, the margins rolling inwards on drying; male spike usually solitary **167. nigra**
105 Leaves (3–)5–10 mm wide, the margins rolling outwards on drying; male spikes usually 2–4 **168. acuta**
103 Utricles veinless
106 Lowest bract exceeding inflorescence; stems obtusely trigonous, brittle **162. aquatilis**
106 Lowest bract not exceeding inflorescence; stems sharply trigonous, not brittle
107 Stems 5–40 cm; basal sheaths entire **163. bigelowii**
107 Stems 40–120 cm; basal sheaths reticulately fibrous **166. buekii**
87 Sitgmas 3; utricles usually trigonous or terete in section
108 Utricles hairy on at least part of the surface of the body
109 Utricles with a prominent, ± 2-fid beak usually more than 0·5 mm
110 Utricles less than 5 mm
111 Utricles densely tomentose **50. lasiocarpa**
111 Utricles puberulent to scabrid-pubescent
112 Lowest spike sessile, with glumaceous or setaceous bract
113 Female glumes dark reddish-brown **125. tricolor**
113 Female glumes pale reddish-brown **126. amgunensis**
112 Lowest spike pedunculate, with leaf-like bract
114 Basal sheaths with lamina
115 Leaves 0·5–1 mm wide, with inrolled margins **133. kitaibeliana**
115 Leaves 1–4 mm wide, flat **131. sempervirens**
114 Basal sheaths without lamina
116 Lowest spike pendent **137. ferruginea**
116 Lowest spike erect
117 Female glumes dark reddish- or purplish-brown; utricles 3–4 mm **139. fimbriata**
117 Female glumes whitish to pale greenish-brown; utricles 1·5–2·5 mm **118. grioletii**

110 Utricles 5 mm or more
118 Leaf-sheaths hairy
119 Stems 3–5 mm wide at base; lowest bract usually shorter than inflorescence; utricles with a scabrid beak **48. hirta**
119 Stems 7–10 mm wide at base; lowest bract usually exceeding inflorescence; utricles with a smooth beak **49. atherodes**
118 Leaf-sheaths glabrous
120 Utricles 8–12 mm **82. hordeistichos**
120 Utricles 5–7·5 mm
121 Leaves 0·5–2 mm wide, with inrolled margins
122 Female spikes 5–8 mm wide **50. lasiocarpa**
122 Female spikes 3–4 mm wide **133. kitaibeliana**
121 Leaves 1–7 mm wide, flat
123 Lowest bract with a sheath less than 10 mm **134. macrolepis**
123 Lowest bract with a sheath at least 10 mm
124 Male spike 2–3 mm wide **131. sempervirens**
124 Male spike 5–10 mm wide
125 Densely caespitose; beak of utricle 1–1·5 mm **79. brevicollis**
125 Not caespitose; beak of utricle 2–3 mm **80. michelii**
109 Utricles without or with a short, usually conical, entire or emarginate beak not more than 0·5 mm
126 Plant not or only laxly caespitose, with creeping rhizomes
127 Female spikes lax
128 Lowest bract shorter than spike **108. pediformis**
128 Lowest bract exceeding spike **72. flacca**
127 Female spikes dense
129 Utricles with prominent veins
130 Lowest spike with a filiform peduncle arising from base of stem; stems smooth **105. rorulenta**
130 Lowest spike not arising from base of stem; stems scabrid at least above
131 Utricles 3–3·5 mm; female glumes dark brown **116. globularis**
131 Utricles 1·5–2·5 mm; female glumes whitish or pale greenish-brown **118. grioletii**
129 Utricles ±veinless
132 Utricles 4–5 mm, plano-convex, hispid-denticulate on margin with teeth *c.* 0·1 mm **73. hispida**
132 Utricles 1·5–4 mm, biconvex or subterete, without teeth on margin or with teeth less than 0·1 mm
133 Male spikes usually 2 or more; basal sheaths remaining entire **72. flacca**
133 Male spike solitary; basal sheaths becoming fibrous
134 Lowest bract exceeding spike; leaves ±glaucous **117. tomentosa**
134 Lowest bract usually much shorter than spike; leaves not glaucous
135 Lowest bract with a sheath 3–5 mm; female glumes equalling utricles, without or with a narrow scarious margin **111. caryophyllea**
135 Lowest bract not sheathing or with a sheath less than 2 mm; female glumes usually shorter than utricles, with a wide scarious margin
136 Female glumes glabrous; utricles 2–2·5(–3) mm, gradually narrowed into a beak not scarious at apex **119. ericetorum**
136 Female glumes sparsely puberulent; utricles 1·5–2 mm, ±abruptly contracted into a beak scarious at apex **120. melanocarpa**
126 Plant ±densely caespitose, without creeping rhizomes
137 Lowest spike with a long, filiform peduncle arising from base of stem
138 Utricles equalling or exceeding glumes, abruptly contracted into beak **104. hallerana**
138 Utricles shorter than glumes, gradually narrowed into an obscure beak **113. depressa**
137 Lowest spike not with a long peduncle arising from base of stem
139 Inflorescence comprising ±all of stem; female spikes with 2–4 flowers **109. humilis**
139 Inflorescence comprising not more than ⅔ of stem; female spikes with usually more than 4 flowers
140 Female spikes lax
141 Flowering stems terminal in middle of leaf-rosettes, usually leafy below **108. pediformis**
141 Flowering stems lateral, leafless
142 Utricles 3–4(–4·5) mm, ±equalling glumes **106. digitata**
142 Utricles 2–3 mm, 1½–2 times as long as glumes **107. ornithopoda**
140 Female spikes dense
143 Lowest bract with a sheath at least 5 mm **112. umbrosa**
143 Lowest bract not sheathing, or with a sheath less than 5 mm
144 Lowest bract glumaceous or setaceous, brown
145 Male spike *c.* 5 mm wide, subclavate; female glumes brown or reddish-brown **122. fritschii**
145 Male spike *c.* 2 mm wide, linear-ellipsoid; female glumes blackish or dark purplish-brown
146 Utricles 3–4·5 mm; leaves 1·5–2 mm wide **121. montana**
146 Utricles 2–2·5(–3) mm; leaves 2–4 mm wide **119. ericetorum**
144 Lowest bract ±leaf-like, green
147 Lowest spike with a peduncle 1–1·5 cm **123. markgrafii**
147 Lowest spike sessile
148 Leaves with ±revolute margins; female glumes with wide scarious margin **126. amgunensis**
148 Leaves flat or ±canaliculate; female glumes with narrow scarious margin
149 Male spike *c.* 5 mm wide, subclavate **122. fritschii**
149 Male spike *c.* 2 mm wide, linear-ellipsoid **124. pilulifera**
108 Utricles glabrous on surface of body, though sometimes ciliate or hispid-denticulate on margin or on beak
150 At least the lowest spike pendent
151 Male spikes 2 or more
152 Utricles without or with an entire or weakly emarginate beak less than 0·5 mm
153 Leaves more than 7 mm wide **62. pendula**
153 Leaves less than 7 mm wide **72. flacca**
152 Utricles with a usually strongly 2-fid beak more than 0·5 mm
154 Plants with creeping rhizomes and stout stems, not caespitose
155 Utricles ovoid-globose, abruptly contracted into beak, patent **56. rhynchophysa**
155 Utricles ovoid to ovoid-ellipsoid, gradually narrowed into beak, ascending
156 Female glumes exceeding utricles **53. riparia**
156 Female glumes shorter than utricles **57. vesicaria**
154 Caespitose plants, without or with very short creeping rhizomes, usually with ±slender stems
157 Female spikes 6–10 mm wide
158 Leaves 6–12 mm wide **84. laevigata**
158 Leaves 2–4 mm wide
159 Male spike 7–12 mm; female glumes usually purplish-black; utricles 3·5–5 mm **140. atrofusca**
159 Male spikes 12–20 mm; female glumes dark reddish-brown; utricles 5–6(–7) mm **141. frigida**
157 Female spikes 3–5 mm wide
160 Female spikes 10–20 mm, oblong-ovoid **131. sempervirens**
160 Female spikes 20–70 mm, cylindrical
161 Utricles with prominent veins and scabrid beak **86. hochstetterana**
161 Utricles ±veinless, with smooth beak

162 Basal sheaths pale brown, entire; lowest bract with a sheath 20–100 mm **64. sylvatica**
162 Basal sheaths dark brown, fibrous; lowest bract with a sheath 10–15 mm **65. arnellii**
151 Male spike solitary
163 Utricles without or with a truncate or obliquely truncate beak
164 Not or laxly caespitose, with distinct creeping rhizomes
165 Utricles ± veinless **72. flacca**
165 Utricles ± veined
166 Lowest bract with a sheath 10–20 mm **145. laxa**
166 Lowest bract not sheathing or with a sheath not more than 5 mm
167 Female spikes 3–4 mm wide, with 5–8 flowers **143. rariflora**
167 Female spikes 5–7 mm wide, with 7–20 flowers
168 Leaves 1–1·5(–2) mm wide; female glumes less than 1½ times as long as and at least as wide as utricles; lateral spikes entirely female **142. limosa**
168 Leaves 2–4 mm wide; female glumes more than 1½ times as long as and only *c.* ¾ as wide as utricles; lateral spikes male at base **144. magellanica**
164 Densely caespitose, without creeping rhizomes
169 Utricles 5–7 mm **66. debilis**
169 Utricles less than 5 mm
170 Female spikes 50–160 mm **62. pendula**
170 Female spikes less than 30 mm
171 Terminal spike with female flowers at apex; leaves about equalling stems **68. krausei**
171 Terminal spike entirely male; leaves not more than ½ as long as stems
172 Terminal spike overtopping the lateral spikes **69. ledebourana**
172 Terminal spike overtopped by at least one of the lateral spikes **67. capillaris**
163 Utricles with a distinct, 2-fid or prominently emarginate beak
173 Female spikes 5–12 mm wide
174 Utricles patent; lowest bract greatly exceeding inflorescence **54. pseudocyperus**
174 Utricles erect; lowest bract not exceeding inflorescence
175 Lowest bract shorter than spike; female spikes ovoid, usually all overlapping **140. atrofusca**
175 Lowest bract usually exceeding spike; female spikes cylindrical to oblong-ovoid, at least the lower distant
176 Utricles veinless **141. frigida**
176 Utricles prominently veined
177 Leaves 6–12 mm wide; ligule 7–15 mm **84. laevigata**
177 Leaves 3–6 mm wide; ligule 1–2 mm **87. binervis**
173 Female spikes 2·5–5 mm wide
178 Utricles with smooth beak
179 Leaves 0·5–1 mm wide **138. brachystachys**
179 Leaves 2–15 mm wide
180 Female glumes acuminate **64. sylvatica**
180 Female glumes obtuse **66. debilis**
178 Utricles with scabrid or serrulate beak
181 Female spikes 30–60 mm, usually with male flowers at apex **86. hochstetterana**
181 Female spikes 5–30 mm, without male flowers
182 Leaves 0·5–1 mm wide, with inrolled margins **133. kitaibeliana**
182 Leaves 1–3(–4) mm wide, flat
183 Female spikes 5–10 mm, ovoid; lowest bract with a sheath 3–5(–10) mm **132. firma**
183 Female spikes 10–30 mm, cylindrical to oblong-ovoid; lowest bract with a sheath 10–50 mm
184 Densely caespitose, without creeping rhizomes; basal sheaths with lamina **131. sempervirens**
184 Laxly caespitose, with creeping rhizomes; basal sheaths without lamina **137. ferruginea**
150 Spikes not pendent
185 Leaf-sheaths or leaves or stems hairy
186 Utricles 6–9 mm **49. atherodes**
186 Utricles 2·5–5 mm
187 Female spikes lax, distant **81. pilosa**
187 Female spikes dense, crowded (or sometimes the lowest distant) **103. pallescens**
185 Leaf-sheaths, leaves and stems glabrous
188 Lowest bract not sheathing
189 Persistent unbranched part of style protruding from apex of utricle **152. stylosa**
189 Style not persistent and protruding
190 Male spike overtopped by the female; utricles scarcely beaked **151. holostoma**
190 Male spike overtopping the female; utricles distinctly beaked
191 Utricles papillose
192 Utricles 4–5 mm, plano-convex, hispid-denticulate on margin with teeth *c.* 0·1 mm **73. hispida**
192 Utricles 1·5–4 mm, biconvex or subterete, without teeth on margin or with teeth less than 0·1 mm **72. flacca**
191 Utricles smooth
193 Plant ± densely caespitose, without or with very short creeping rhizomes
194 Stems scabrid above **122. fritschii**
194 Stems smooth
195 Female spikes 2–3 mm wide, lax **110. glacialis**
195 Female spikes 3–12 mm wide, dense
196 Lowest bract glumaceous or setaceous; utricles winged **95. durieui**
196 Lowest bract leaf-like; utricles not winged **(96–102). flava** group
193 Plant not or only laxly caespitose, with long, creeping rhizomes
197 Female spikes with not more than 15 flowers
198 Female spikes sessile; utricles 2·5–3 mm **129. supina**
198 Female spikes pedunculate; utricles 3–4 mm **130. liparocarpos**
197 Female spikes with more than 15 flowers
199 Lowest bract shorter than inflorescence, patent or deflexed; leaves 1–2 mm wide **59. rotundata**
199 Lowest bract equalling or exceeding inflorescence, erect; leaves 2–15 mm wide
200 Utricles with an emarginate beak *c.* 0·5 mm **51. acutiformis**
200 Utricles with a 2-fid beak at least 0·75 mm
201 Female glumes exceeding utricles **53. riparia**
201 Female glumes shorter than utricles
202 Utricles patent, ± abruptly contracted into beak
203 Male spike solitary **61. mollissima**
203 Male spikes 2–7
204 Stems obtusely trigonous; leaves 2–4 (–7) mm wide, glaucous; female spikes 6–10 mm wide **55. rostrata**
204 Stems sharply trigonous; leaves (6–) 8–15 mm wide, bright green; female spikes 10–13 mm wide **56. rhynchophysa**
202 Utricles erect or erecto-patent, gradually narrowed into beak
205 Utricles (6–)7–8 mm **57. vesicaria**
205 Utricles 3·5–5·5 mm
206 Leaves usually shorter than stems, with inrolled margins; utricles greenish-brown, with conspicuous, sunken veins **52. melanostachya**

206 Leaves usually exceeding stems, flat; utricles blackish-purple at least in part, ± veinless **60. stenolepis**

188 Lowest bract sheathing
207 Plant not or only laxly caespitose, with long, creeping rhizomes
208 Lowest bract equalling or exceeding inflorescence
209 Utricles papillose on surface of body; male spikes usually more than 1
210 Utricles 1·5–4 mm, biconvex or subterete, without teeth on margin or with teeth less than 0·1 mm **72. flacca**
210 Utricles 4–5 mm, plano-convex, hispid-denticulate on margin with teeth *c.* 0·1 mm **73. hispida**
209 Utricles smooth on surface of body
211 Utricles 7–9 mm **78. depauperata**
211 Utricles 3–4 mm **130. liparocarpos**
208 Lowest bract shorter than inflorescence
212 Utricles without or with a smooth, usually truncate or emarginate beak
213 Female glumes whitish **128. alba**
213 Female glumes reddish- to blackish-brown
214 Utricles shining; basal sheaths purplish-brown
215 Female glumes reddish-brown; utricles 3–4 mm, with distinct veins at base **130. liparocarpos**
215 Female glumes dark purplish- or blackish-brown; utricles 4–5 mm, obscurely veined **77. asturica**
214 Utricles not shining; basal sheaths very pale brown
216 Sheath of lowest bract inflated; leaves yellowish to dark green; utricles gradually narrowed into a beak 0·5–1 mm **75. vaginata**
216 Sheath of lowest bract not inflated; leaves glaucous; utricle scarcely beaked, or abruptly contracted into a beak *c.* 0·5 mm
217 Leaves shorter than stems, flat; female spikes usually not overlapping **74. panicea**
217 Leaves usually equalling or exceeding stems; female spikes usually overlapping **76. livida**
212 Utricles with a scabrid, usually 2-fid beak
218 Utricles 7–9 mm, with obliquely truncate beak **78. depauperata**
218 Utricles 3–7 mm, with ± 2-fid beak
219 Female spikes less than 5 mm wide
220 Leaves less than ½ as long as stems, tapered from base; male spikes 5–10 mm **132. firma**
220 Leaves at least ½ as long as stems, linear; male spike 15–50 mm
221 Stems obtusely trigonous, smooth; male spike 30–50 mm **137. ferruginea**
221 Stems sharply trigonous, usually scabrid above; male spike 15–25 mm **139. fimbriata**
219 Female spikes at least 5 mm wide
222 Utricles blackish-brown **141. frigida**
222 Utricles green or pale brownish-green
223 Utricles 3–4(–5) mm; male spike 2–3 mm wide **94. hostiana**
223 Utricles 5–7 mm; male spike 5–10 mm wide
224 Leaves 3–5(–7) mm wide; utricles with a beak 1–1·5 mm **79. brevicollis**
224 Leaves 2–3 mm wide; utricle with a beak 2–3 mm **80. michelii**
207 Plant ± densely caespitose, without or with very short creeping rhizomes
225 Stems lateral, leafless **107. ornithopoda**
225 Stems terminal in middle of leaf-rosettes, usually leafy at base
226 Utricles without or with an entire, truncate, obliquely truncate or emarginate beak
227 Utricles 7–9 mm **78. depauperata**
227 Utricles less than 7 mm
228 Female spikes (25–)40–100(–120) mm; leaves 5–13 mm wide
229 Spikes 3–6 mm wide, dense; utricles purplish-brown **63. microcarpa**
229 Spikes 2–3 mm wide, lax; utricles green **70. strigosa**
228 Female spikes 3–35 mm; leaves 0·5–8 mm wide
230 Male spike usually more than 3 mm wide
231 Basal sheaths pale to blackish-brown; lowest bract with a sheath 5–10 mm **112. umbrosa**
231 Basal sheaths reddish or purplish; lowest bract with a sheath less than 5 mm **122. fritschii**
230 Male spike not more than 3 mm wide
232 Female spikes lax
233 Utricles 2–2·5 mm; leaves 0·5–1(1–·5) mm wide **110. glacialis**
233 Utricles 4–5 mm; leaves 3–8 mm wide **127. olbiensis**
232 Female spikes dense
234 Leaves canaliculate or with inrolled margins, glaucous or greyish-green
235 Utricles 2·5–4 mm **92. extensa**
235 Utricles 1·75–2 mm **(96–102). flava** group
234 Leaves flat, green, yellowish- or greyish-green
236 Utricles ascending **91. diluta**
236 Utricles patent or deflexed **(96–102). flava** group
226 Utricles with a ± 2-fid beak
237 Utricles 8–12 mm **82. hordeistichos**
237 Utricles 1·5–7 mm
238 Lowest bract equalling or exceeding inflorescence
239 Male spikes 2–5
240 Stems 5–50 cm; utricles 5–7 mm, with a narrow, serrulate wing **83. secalina**
240 Stems 50–100 cm; utricles 4–5 mm, unwinged **86. hochstetterana**
239 Male spike usually solitary; utricles not winged
241 Male spike 5–10 mm wide **79. brevicollis**
241 Male spike less than 5 mm wide
242 Beak of utricle strongly aculeolate with patent pricklets at least some of which are 0·1 mm **93. mairii**
242 Beak of utricle smooth, or weakly scabrid with ascending teeth or cilia less than 0·1 mm
243 Utricles patent or deflexed
244 Utricles not shining; spikes ovoid **(96–102). flava** group
244 Utricles shining; spikes oblong to cylindrical **90. punctata**
243 Utricles ascending
245 Leaves canaliculate or with inrolled margins, glaucous or greyish-green **92. extensa**
245 Leaves flat, green, yellowish- or greyish-green
246 Utricles 2·5–3 mm, veinless **89. cretica**
246 Utricles 3–4·5 mm, prominently veined **91. diluta**
238 Lowest bract shorter than inflorescence
247 Most or all female spikes crowded near apex of stem, the lower with their peduncles not or scarcely exserted from sheath of bract, or female spike solitary
248 Utricles narrowly winged **95. durieui**
248 Utricles not winged
249 Beak of utricle strongly aculeolate with patent pricklets at least some of which are 0·1 mm **93. mairii**

249 Beak of utricle smooth, or weakly scabrid with ascending teeth or cilia less than 0·1 mm **(96–102). flava group**
247 Female spikes ± distant, usually with exserted peduncles
250 Sheath of lowest bract loose, ± inflated **79. brevicollis**
250 Sheath of lowest bract tight, not inflated
251 Utricles patent or deflexed
252 Beak of utricles strongly aculeolate with patent pricklets at least some of which are 0·1 mm **93. mairii**
252 Beak of utricles smooth, or weakly scabrid with ascending teeth or cilia less than 0·1 mm
253 Female glumes reddish-brown, with wide, silvery, scarious margin **94. hostiana**
253 Female glumes pale or reddish-brown, without or with a narrow, inconspicuous margin, or glumes entirely scarious except for green midrib
254 Utricles shining; spikes oblong to cylindrical **90. punctata**
254 Utricles not shining; spikes ovoid **(96–102). flava group**
251 Utricles ascending or erect
255 Upper bracts shorter than spikes; lower bracts usually shorter than spikes; apex of leaf-sheath of cauline leaves truncate or concave opposite the ligule (mountains of C. & S. Europe)
256 Basal sheaths with lamina
257 Leaves 0·5–1 mm wide, with inrolled margins **133. kitaibeliana**
257 Leaves 1–4 mm wide, flat
258 Leaves less than ½ as long as stems, tapered from base **132. firma**
258 Leaves at least ½ as long as stems, linear
259 Sheath of lowest bract 10–30 mm **131. sempervirens**
259 Sheath of lowest bract 3–7 mm **134. macrolepis**
256 Basal sheaths without lamina
260 Female spikes 6–8(–10) mm wide **141. frigida**
260 Female spikes 2·5–4·5 mm wide
261 Stems sharply trigonous, usually scabrid above **139. fimbriata**
261 Stems obtusely trigonous, smooth
262 Leaves 1–3 mm wide, flat; utricles with a scabrid beak **137. ferruginea**
262 Leaves 0·5–1 mm wide, the margins inrolled when dry; utricles with a smooth beak **138. brachystachys**
255 All bracts exceeding spikes, or rarely the uppermost equalling or slightly shorter (usually lowlands, or in mountains of N. & W. Europe)
263 Apex of leaf-sheath of cauline leaves truncate or concave opposite the ligule; female spikes very lax **64. sylvatica**
263 Apex of leaf-sheath of cauline leaves usually convex or with an ovate projection opposite the ligule; female spikes dense
264 At least some leaves on plant usually more than 6 mm wide; ligule usually more than 5 mm
265 Female glumes greenish- or reddish-brown; utricles pale greenish-brown, gradually narrowed into beak **84. laevigata**
265 Female glumes dark purplish-brown; utricles usually dark brown, abruptly contracted into beak **85. camposii**
264 Leaves not more than 6 mm wide; ligule less than 5 mm
266 Utricles 2·5–3 mm, veinless **89. cretica**
266 Utricles 3–5 mm, with prominent veins
267 Female glumes with prominent silvery, scarious margin **94. hostiana**
267 Female glumes without or with narrow, inconspicuous scarious margin
268 Basal sheaths orange-brown; female glumes dark reddish- or purplish-brown **87. binervis**
268 Basal sheaths pale to dark brown; female glumes pale brown to pale reddish-brown
269 Beak of utricle 0·75–1 mm, usually scabrid **88. distans**
269 Beak of utricle *c.* 0·5 mm, usually smooth **91. diluta**

Subgen. **Indocarex** Baillon. Monoecious. Spikes male above and female below, solitary or 2 or more, all similar in appearance, in a simple or paniculately branched inflorescence. Lateral spikes arising from a fertile utricle or a utriculiform scale open at one side. Stigmas 3.

1. C. phyllostachys C. A. Meyer, *Verz. Pfl. Cauc.* 30 (1831). Caespitose. Stems 15–45 cm, sharply trigonous, scabrid above; basal sheaths reddish- or blackish-brown, entire. Leaves 1·5–3 mm wide, equalling or exceeding the stems, flat, green or greyish-green. Inflorescence 2–5 cm, of 1-2 approximate, lax spikes, each with 2–5 female flowers, the lower, if present, shortly pedunculate and arising from a usually fertile utricle. Lower female glumes 5–20 cm, leaf-like. Utricles 5–6 mm, ovoid, greyish-green, prominently veined, abruptly contracted into a short, smooth beak. *Woods. S. Jugoslavia (W. Makedonija).* Ju. *(Caucasian region.)*

2. C. distachya Desf., *Fl. Atl.* **2**: 336 (1799) (*C. linkii* Schkur, *C. longiseta* Brot.). Densely caespitose. Stems (10–)15–45 cm, obtusely trigonous, smooth or scabrid at apex; basal sheaths blackish-brown, entire. Leaves 0·5–1(–2) mm wide, equalling the stems, flat, green or greyish-green. Inflorescence usually occupying at least half the stem. Spikes 2–4, very lax, with 2–5 female flowers, the upper sessile, the lower very remote, shortly pedunculate and arising from a utriculiform scale; lower bracts leaf-like, greatly exceeding inflorescence. Female glumes slightly exceeding utricles, or the lower leaf-like and up to as long as spike. Utricles 4–6 mm, ellipsoid, pale greenish-brown, with one prominent vein on each face, abruptly contracted into a short, smooth beak. $2n=74$. *Dry places. S. Europe.* ?Al Bl Bu Co Cr Ga Gr Hs It Ju Lu Sa Si Tu.

Subgen. **Vignea** (Beauv. ex Lestib.) Kük. Monoecious, with 2 or more spikes all similar in appearance, hermaphrodite or unisexual, in a simple or paniculately branched inflorescence, or with a solitary spike with male flowers at base; or dioecious,with a solitary spike. Lateral spikes without a scale between the bract and the lowest glume. Stigmas usually 2.

Sect. HELEOGLOCHIN Dumort. (Sect. *Paniculatae* (J. Carey) Christ). Caespitose. Stems trigonous, scabrid above. Inflorescence usually branched; spikes numerous, male above and female below (or the lower entirely female); lowest bract shorter than branch, usually setaceous or glumaceous. Female glumes

equalling or slightly shorter than utricles. Utricles ovoid-orbicular to -pyriform, erect or erecto-patent, weakly to strongly convex on adaxial side, strongly convex on abaxial side, with a serrulate or scabrid 2-fid beak. Stigmas 2.

3. C. paniculata L., *Cent. Pl.* **1**: 32 (1755). Forming dense tussocks; roots stout, felted. Stems 40–100(–150) cm; basal sheaths pale to blackish-brown, entire. Leaves 3–7 mm wide. Inflorescence 5–15(–20) cm, lax and irregularly lobed, usually much-branched below, with ovoid spikes, the lower sometimes entirely female. Female glumes pale to orange-brown, with wide scarious margin. Utricles 2·5–3(–4) mm, dark brown, weakly to strongly veined, gradually narrowed into an often almost winged beak. $2n=60$, 62, 64. *Wet places; usually in base-rich habitats. Europe northwards to c.* 63° *N. in Russia, but absent from most of the Mediterranean region and the south-east.* Al Au Be Br Bu Cz Da Fe Ga Ge Gr Hb He Ho Hs Hu It Ju Lu No Po Rm Rs (N, B, C, W) Si Su.

(a) Subsp. **paniculata**: Inflorescence 5–15(–20) cm. Female glumes brown or orange-brown, smooth on keel. Utricles 2·5–3 mm, weakly veined. *Throughout the range of the species except Portugal and S.W. Spain.*

(b) Subsp. **lusitanica** (Schkuhr) Maire, *Bull. Soc. Hist. Nat. Afr. Nord* **20**: 205 (1929): Inflorescence 10–20 cm. Female glumes whitish or very pale brown, the lowest scabrid-ciliate on keel. Utricles 3–4 mm, strongly veined. *W. part of Iberian peninsula. (N.W. Africa.)*

C. szovitsii V. Krecz. in Komarov, *Fl. URSS* **3**: 593 (1935), a very closely related plant from the Caucasus, has been reported from Krym. It differs from subsp. **(b)** chiefly in having leaves up to 10 mm wide and utricles up to 4·5 mm, and its relationship with this subspecies is uncertain.

C. × *boenninghausiana* Weihe (**3** × **25**) is a frequent hybrid in many parts of Europe.

4. C. appropinquata Schumacher, *Enum. Pl. Saell.* **1**: 266 (1801) (*C. paradoxa* Willd., non J. F. Gmelin). Forming dense tussocks; roots slender or stout, not felted. Stems 30–80(–100) cm; basal sheaths blackish, becoming fibrous. Leaves 1–3 mm wide. Inflorescence 4–8 cm, lax and irregularly lobed, branched below, with narrowly ovoid spikes. Female glumes reddish-brown, with wide scarious margin. Utricles 2·5–3 mm, dark brown, prominently veined almost throughout, abruptly contracted into a rather narrow, pale brown beak. $2n=64$. *Wet places; usually calcicole. Most of Europe from C. France, N. Italy and C. Greece northwards.* Au Be Br Cz Da Fe Ga Ge Gr Hb He Ho Hu It Ju No Po Rm Rs (N, B, C, W, E) Su.

5. C. diandra Schrank, *Cent. Bot. Anmerk.* 57 [49] (1781) (*C. teretiuscula* Good.). Laxly caespitose, with short ascending rhizomes; roots slender, not felted. Stems 20–60(–100) cm; basal sheaths greyish- to blackish-brown, more or less shiny and entire. Leaves 1–2(–5) mm wide. Inflorescence 2–3(–5) cm, oblong to cylindrical, lobed, usually branched below, with 5–10 ovoid, overlapping spikes or clusters of spikes. Female glumes pale to dark reddish-brown, with wide scarious margin. Utricles 2·5–3 mm, dark brown, prominently veined near base, narrowed into a wide, pale-brown, usually curved beak. $2n=60$. *Fens and marshes. Europe, from S. France, N. Italy and Crna Gora northwards.* Au Be Br Cz Da Fe Ga Ge Hb He Ho Hu Is It Ju No Po Rm Rs (N, B, C, W, E) Su.

Sect. VULPINAE (J. Carey) Christ. Caespitose, without creeping rhizomes, sometimes forming tussocks. Stems trigonous with sharp or winged angles, scabrid above. Inflorescence branched, with numerous spikes in 5–10(–14) ovoid, contiguous or overlapping clusters (or rarely the lowest slightly separate); spikes male above and female below; lowest bract setaceous to leaf-like. Female glumes shorter than utricles. Utricles plano-convex, distinctly veined, patent, gradually narrowed into a scabrid, almost winged, 2-fid beak. Stigmas 2.

6. C. vulpina L., *Sp. Pl.* 973 (1753) (*C. compacta* Lam.). Stems 30–100 cm, narrowly winged, with concave faces; basal sheaths dark brown, becoming blackish-fibrous. Leaves (2–)4–8(–10) mm wide, dark green; ligule broadly triangular, wider than long, overlapping edges of leaf. Spikes ovoid, in an irregular inflorescence 3–7(–10) cm; lowest bract setaceous, usually shorter than the spike, with conspicuous, reddish-brown auricles. Female glumes ovate, acuminate or aristate, dark reddish-brown. Utricles (3·5–)4–5 mm, ovate-elliptical, dark brown, dull and papillose, with isodiametric, thick-walled epidermal cells; beak with an asymmetrical slit down the back. $2n=68$. *Wet or shady places. Europe northwards to* 61° *N. in N.W. Russia, but absent from much of the west and south.* Al Au Be Br Bu Co ?Cr Cz Da Fe Ga Ge Gr He Ho Hs Hu It Ju No Po Rm Rs (N, B, C, W, K, E) Su ?Tu.

The distribution is very uncertain because of confusion with **7**, which has in general a more western and southern range and is probably the commoner species over most of Europe.

7. C. otrubae Podp., *Publ. Fac. Sci. Univ. Masaryk* **12**: 15 (1922) (*C. vulpina* auct., non L., *C. compacta* sensu V. Krecz., non Lam.). Like **6** but stems not or scarcely winged, with plane faces; basal sheaths pale brown; leaves bright green, becoming orange-tinged when dead; ligule ovate-lanceolate, acute, longer than wide, not overlapping edges of leaf; lowest bract often leaf-like and as long as the inflorescence, without auricles; female glumes scarcely aristate, pale orange-brown; utricles 5–6 mm, ovate and less narrowed at base, greenish- or orange-brown to dark grey, shining and smooth, with oblong, thin-walled epidermal cells; beak not slit down the back. $2n=58$, 60. *Ditches and other damp places. Europe northwards to* 63° *N. in Norway.* All except Al ?Co Fa Is Sb ?Tu.

C. × *pseudaxillaris* K. Richter (**7** × **25**; *C.* × *axillaris* auct., non Good.) is a frequent hybrid in some parts of Europe.

Sect. PHLEOIDEAE (Meinsh.) Egorova. Like Sect. *Vulpinae* but inflorescence with lower branches usually slightly remote; utricles veinless or with very faint veins, abruptly contracted into an unwinged beak.

8. C. vulpinoidea Michx, *Fl. Bor. Amer.* **2**: 169 (1803). Stems 30–100 cm; basal sheaths dark brown. Leaves 2–4 mm wide. Spikes ovoid-oblong, clustered on numerous branches, crowded into an elongate, lobed inflorescence 5–10 cm, the lower clustered on short branches; bracts filiform or leaf-like, the lower exceeding the spikes. Female glumes ovate-oblong, aristate, pale reddish-brown. Utricles 2–2·5 mm, ovate-orbicular, pale greenish-brown, abruptly contracted into beak. *Frequent as a casual in N.W. & C. Europe and locally naturalized.* [Br Cz Ga He Ho Po.] (*North America.*)

Sect. PHAESTOGLOCHIN Dumort. (Sect. *Muehlenbergianae* (L. H. Bailey) Kük.). Like Sect. *Vulpinae* but stems with more or less obtuse angles; inflorescence usually simple, with 3–10 spikes; utricles veinless or with faint veins at base, sometimes erect, sometimes abruptly contracted into the always unwinged beak.

(9–11). C. muricata group. Stems 20–100 cm; basal sheaths becoming fibrous. Leaves 2–4(–5) mm wide, flat, usually shorter

than stems. Spikes globose to ovoid. Lowest bract shorter than spike to exceeding inflorescence. Female glumes ovate, acuminate and often aristate, with a usually narrow scarious margin. Utricles 3–6 mm, lanceolate to ovate, veinless or with faint veins at base.

A very difficult group in need of comprehensive study throughout its range. The exact distribution of several of the taxa recognized here is uncertain.

1 Roots and often basal sheaths and base of stems purplish-tinged; ligule distinctly longer than wide; utricles corky and thickened at base **9. spicata**
1 Roots, basal sheaths and base of stems not purplish-tinged; ligule not longer than wide; utricles completely filled by the nut, not corky and thickened at base
2 Lowest 3–4 spikes or branches separated from each other by a gap of much more than their own length **11. divulsa**
2 Lowest spikes overlapping or separated from each other by a gap of not more than their own length
3 Ligule usually wider than long; inflorescence 3–5(–8) cm; utricles ± equally narrowed at both ends **11. divulsa**
3 Ligule about as wide as long; inflorescence 2–3(–4) cm; utricles truncate or rounded at base **10. muricata**

9. C. spicata Hudson, *Fl. Angl.* 349 (1762) (*C. contigua* Hoppe; incl. *C. lumnitzeri* (Rouy) V. Krecz.). Roots purplish-brown. Basal sheaths on stems often purplish-tinged. Leaves with lanceolate, acute ligule which is distinctly longer than wide. Spikes 3–10, crowded (or the lowest slightly remote) into a dense, oblong inflorescence 2–3·5(–5) cm. Female glumes pale, often purplish-brown. Utricles 4·5–5·5(–6) mm, ovate-lanceolate, at least twice as long as wide, corky and thickened at base, greenish or pale yellowish-brown, patent, gradually narrowed into beak. $2n=58$, 60. *Grassy, usually damp places. Europe northwards to c.* 62°*N. in Norway and Russia, but absent from much of the Mediterranean region.* ?Al Au Be Br Bu Cr Cz Da Fe Ga Ge Gr Hb He Ho Hs Hu It Ju No Po Rm Rs (N, B, C, W, K, E) Su Tu.

10. C. muricata L., *Sp. Pl.* 974 (1753). Roots blackish-brown. Basal sheaths on stems brown, becoming blackish. Leaves with suborbicular or triangular, obtuse ligule which is about as wide as long. Spikes 4–7, crowded (or the lowest slightly remote) into a dense, oblong inflorescence 2–3(–4) cm. Female glumes pale to blackish-brown. Utricles 3–4·5 mm, ovate, less than twice as long as wide, not corky or thickened at base, yellowish- to blackish-brown, rather abruptly narrowed into beak. $2n=c.\,56$, 58. *Dry places. Most of Europe except for parts of the north-east.* All except Bl Cr Fa Is ?Rs (N) Sa Si Sb Tu.

(a) Subsp. **muricata** (*C. pairaei* subsp. *borealis* Hyl.): Comparatively robust plants; stems usually strongly scabrid above. Spikes globose. Female glumes blackish- or dark reddish-brown, much darker and shorter than the greenish or brownish utricles. Utricles (3·5–)4–4·5 mm, rounded at base, prominently flanged at the margin, strongly patent. *Usually calcicole. Mainly in N. & E. Europe.*

(b) Subsp. **lamprocarpa** Čelak., *Anal. Květ. Česká* 88 (1879) (*C. pairaei* F. W. Schultz, *C. cuprina* auct., non Nendtvich ex A. Kerner): Comparatively slender plants; stems usually weakly scabrid. Spikes ovoid. Female glumes pale brown, similar in colour to or paler than, and almost as long as the utricles. Utricles 3–3·5 mm, truncate at base, scarcely flanged at the margin, erecto-patent. *Usually calcifuge. Mainly in S. & W. Europe.*

11. C. divulsa Stokes in With., *Arr. Brit. Pl.* ed. 2, **2**: 1035 (1787). Roots brown or blackish-brown. Basal sheaths on stems pale brown, becoming dark to blackish-brown. Leaves with suborbicular, triangular or depressed, obtuse ligule which is about as wide as or wider than long. Spikes 5–8, at least the lowest usually well-separated from each other, and often on 1–3 short, lateral branches, in an inflorescence 3–10(–20) cm. Female glumes whitish- or pale greenish-brown. Utricles 3·5–5(–5·5) mm, ovate to ovate-elliptical, almost equally narrowed at both ends, not corky or thickened at base, pale to dark brown, with faint veins at base, gradually narrowed into beak. $2n=56$, 58. *Europe northwards to* 59°*N. in Sweden, but only on the western and southern margins of the U.S.S.R.* All except Fa Fe Is Rs (N, ?C) Sa Sb.

(a) Subsp. **divulsa**: Stems comparatively weak. Leaves 2–3 mm wide, with suborbicular or triangular ligule about as wide as long. Inflorescence 5–10(–20) cm; lowest 3–4 spikes or branches separated from each other by a gap of much more than their own length, at least one branch usually present at base of inflorescence-axis. Utricles 3·5–4(–4·5) mm, pale to yellowish-brown, appressed to erecto-patent. *Grassy, usually shady places. Mainly in the southern and western parts of the range of the species.*

(b) Subsp. **leersii** (Kneucker) Walo Koch, *Mitt. Bad. Landesver. Naturk. Natursch. Freiburg* nov. ser., **11**: 259 (1923) (*C. pairaei* var. *leersii* (Kneucker) Kük., *C. polyphylla* Kar. & Kir.): Stems comparatively robust. Leaves 3–4(–5) mm wide, with depressed ligule usually wider than long. Inflorescence 3–5(–8) cm; lowest 2 spikes separated from each other by a gap of not more than their own length, usually all sessile on the main axis of the inflorescence. Utricles 4·5–5(–5·5) mm, dark brown, patent. *Dry places; calcicole. Throughout most of the range of the species but absent from parts of the south-west.*

C. chabertii F. W. Schultz, *Flora* (*Regensb.*) **54**: 21 (1871), described from W. Germany and recorded from several other countries, is like subsp. (b), with a short, rather dense inflorescence, but has erecto-patent utricles 5–5·5 mm; it is probably of little taxonomic significance and can readily be distinguished from **9** by the absence of corky thickening at the base of the utricle.

Sect. AMMOGLOCHIN Dumort. Rhizomes far-creeping. Stems sharply trigonous, scabrid above. Inflorescence simple, lobed; spikes 3–30, male above and female below, or female above and male below, or some entirely male or entirely female, linear-oblong to ovoid; lowest bract setaceous to leaf-like. Female glumes usually equalling or slightly shorter than utricles, ovate- to oblong-lanceolate, subacute to acuminate, with narrow scarious margin. Utricles ovate to oblong-lanceolate, plano-convex, with a scabrid, 2-fid beak. Stigmas 2.

12. C. arenaria L., *Sp. Pl.* 973 (1753). Stems 10–40(–90) cm; basal sheaths dark brown, prominent; dead leaves persistent. Leaves 1·5–4(–5) mm wide, about as long as stems. Spikes 5–18, the terminal male, the middle male above and female below, the lower female, crowded into an irregularly ovoid-oblong, lobed inflorescence 3–8 cm, the lowest spike sometimes rather remote. Female glumes yellowish or pale reddish-brown. Utricles 4–5·5 mm, pale yellowish- or greenish-brown, conspicuously veined, with a broad scarious, denticulate or ciliolate margin, winged throughout or at least in the upper ½, more or less abruptly contracted into a long beak. $2n=58$, 64. *Sandy places, mainly on the coast.* ● *N., N.C. & W. Europe, northwards to c.* 63°*N. in Norway and eastwards to near Leningrad.* Be Br Da Fe Ga Ge Hb Ho Hs Lu No Po Rs (B, C) Su.

The distribution of male and female flowers in the middle spikes is sometimes variable and the distinction from **14** is thus not always clear.

13. C. ligerica Gay, *Ann. Sci. Nat.* ser. 2, **10**: 360 (1838) (incl. *C. colchica* Gay). Like **12** but smaller and more slender in all its parts; stems up to 30(–50) cm, with usually pale brown basal sheaths; leaves 1–2 mm wide, usually shorter than stems; spikes 4–7(–10), all female above and male below (the lowest rarely entirely female), in a usually more compact inflorescence 2–3(–4) cm; female glumes darker brown; utricles 3·5–5 mm, with a narrower scarious wing. $2n=58$. *Dry, sandy places. From Latvia and Denmark southwards to W. France, Turkey-in-Europe and W. Kazakhstan, but absent from most of C. Europe.* Bu Da Ga Ge Ho Po Rm Rs (B, C, W, K, E) Su Tu.

14. C. reichenbachii Bonnet, *Petite Fl. Paris.* 420 (1883). Stems 30–50 (–90) cm; basal sheaths pale brown. Leaves 2–3 mm wide, exceeding stems. Spikes 5–12, all with female flowers above and male below, or the upper entirely male or male above, ovoid, crowded into an irregular oblong, lobed inflorescence 3–5 cm, the lower spikes often somewhat remote. Female glumes pale yellowish-brown. Utricles *c.* 5 mm, pale greenish, conspicuously veined, with a wide, denticulate, scarious wing in the upper ¾, gradually narrowed into a long beak. *Dry, sandy places.* ● *From N. France to N.E. Germany and Czechoslovakia.* Be Cz Ga Ge Ho Po.

A little-understood plant, perhaps of hybrid origin from **18** and some other species. **C. pseudobrizoides** Clavaud, *Bull. Trav. Soc. Pharm. Bordeaux* **13**: 156 (1873), described from S.W. France, is possibly conspecific with **14**.

15. C. disticha Hudson, *Fl. Angl.* 347 (1762) (*C. intermedia* Good., non Retz.). Stems (15–)30–100(–120) cm; basal sheaths dark brown. Leaves 2–4(–6) mm wide, shorter than or almost equalling stems. Spikes 15–30, the lower and upper usually female, oblong-ovoid, the middle usually male, crowded into an irregularly lobed, long inflorescence 3–7(–10) × 1–2 cm, often conspicuously contracted in the middle, the lowest spikes sometimes slightly remote. Female glumes reddish-brown. Utricles 4–5 mm, brown or reddish-brown, conspicuously veined, with a narrow, scarious, scabrid wing in the upper ¾, gradually narrowed into beak. $2n=62$. *Damp meadows. Much of Europe, but absent from the extreme north and most of the Mediterranean region.* Au Be Br Bu Cz Da Fe Ga Ge ?Gr Hb He Ho Hs Hu It Ju No Po Rm Rs (B, C, W, ?K, E) Su.

16. C. repens Bellardi, *App. Fl. Pedem.* 42 (1792). Like **15** but spikes 8–12, the upper male, the middle male above and female below, the lower female, linear-oblong, all crowded into an oblong, lobed inflorescence 3–5 cm or the lowest slightly remote; utricles pale greenish, obscurely veined, with a wider scarious, scabrid wing extending to the base. $2n=70$. *Coniferous woods and scrub.* ● *C. Europe and N. Italy; very local.* Au ?Ga Ge Hu It Po Rm.

Many populations of this species do not produce viable seed and it is possibly of hybrid origin.

17. C. praecox Schreber, *Spicil. Fl. Lips.* 63 (1771) (*C. schreberi* Schrank; incl. *C. praecox* subsp. *intermedia* (Čelak.) Schultze-Motel). Stems (5–)10–30(–45) cm; basal sheaths pale brown. Leaves 1–2 mm wide, not more than ½ as long as stems. Spikes 3–7, female above, male at base, oblong, straight or rarely slightly curved, more or less crowded in an oblong-ovoid, lobed inflorescence 1·5–2·5(–3) cm. Female glumes reddish-brown. Utricles 2–4 mm, reddish-brown, obscurely veined, with a narrow, scarious, scabrid wing in the upper ½–¾, more or less abruptly contracted into a short beak. $2n=58$. *Dry, sandy or grassy places. Most of Europe, except Fennoscandia and the islands, but local in the west.* Al Au Be Bu ?Co Cz Ga Ge He Ho Hs Hu It Ju Po Rm Rs (N, B, C, W, K, E) ?Sa ?Tu [Fe].

18. C. brizoides L., *Cent. Pl.* **1**: 31 (1755). Stems 25–50(–100) cm; basal sheaths pale, sometimes slightly reddish-brown. Leaves 1·5–3 mm wide, exceeding stems. Spikes (3–)5–8(–15), female above, male below, oblong-clavate and slightly curved outwards, contiguous, or the lowest separated from the others, in a lobed inflorescence 1·5–3 cm. Female glumes pale brown or greenish. Utricles 3–4(–4·5) mm, greyish-green, obscurely veined, with a narrow, scarious, scabrid wing throughout, gradually narrowed into a long beak. $2n=58$. *Damp, shady places.* ● *From Latvia and N. France southwards to the Pyrenees, C. Jugoslavia and C. Ukraine.* Al Au Be Cz Ga Ge He Ho Hs Hu It Ju Po Rm Rs (B, C, W).

Sect. DIVISAE Christ ex Kük. Rhizomes long. Stems trigonous or subterete. Inflorescence simple, ovoid to oblong; spikes 2–12, ovoid, crowded, male above, female below, the upper sometimes entirely male, the lower sometimes entirely female; lowest bract glumaceous to leaf-like. Female glumes slightly shorter to slightly longer than utricles, ovate to ovate-oblong, acute or aristate, usually with a narrow scarious margin. Utricles ovate, plano- or concavo-convex, with a 2-fid beak. Stigmas 2.

19. C. chordorrhiza L. fil., *Suppl.* 414 (1781). Rhizomes very long, sympodially branched, with long, ascending branches. Stems (5–)15–30 cm, ascending, subterete, smooth; basal sheaths greyish-brown. Leaves 1–2(–2·5) mm wide. Spikes 2–5, the lower sometimes entirely female, in a dense, ovoid inflorescence 0·7–1·5 × 0·5–1 cm; lowest bract glumaceous. Female glumes slightly shorter than utricles, acute, pale to dark reddish-brown. Utricles 3–4·5(–5) mm, yellowish- to dark reddish-brown, with faint veins, abruptly contracted into a short, smooth beak. $2n=60$, *c.* 66. *Very wet bogs, usually amongst* Sphagnum. *N. & C. Europe, extending south-westwards to the Pyrenees and south-eastwards to C. Ukraine.* Au Br Cz Da Fe Ga Ge He Is No Po Rm Rs (N, B, C, W) Su.

20. C. divisa Hudson, *Fl. Angl.* 348 (1762) (incl. *C. chaetophylla* Steudel, *C. rivalis* sensu Willk., non Good., *C. setifolia* Godron, non G. Kunze). Rhizomes stout, far-creeping. Stems (5–)10–50(–80) cm, erect, trigonous, more or less scabrid at least at apex; basal sheaths dark brown. Leaves 1– to 3(–5) mm wide. Spikes 3–8(–12), the upper often entirely male, in a dense ovoid to more or less lax, lobed, oblong inflorescence (0·7–)1·5–2·5(–4) × 0·5–1·2 cm; lowest bract glumaceous to leaf-like and greatly exceeding the inflorescence. Female glumes equalling or slightly exceeding utricles, acute and cuspidate or aristate, dark, sometimes slightly reddish-brown, usually with a narrow scarious margin. Utricles 2·5–4 mm, yellowish- to dark reddish-brown, with prominent, slender veins, more or less gradually narrowed into a short, more or less scabrid beak. $2n=60$, 62. *Sandy or damp, grassy places. S., S.C. & W. Europe, northwards to C. England and the Netherlands; mainly coastal in the northern part of the range.* Al Au Be Bl Br Bu Co Cr Cz Ga Gr †Hb Ho Hs It Ju Lu Rm Rs (K) Sa Si Tu.

Sect. PHYSODEAE Christ ex Kük. Rhizomes long, slender, creeping. Stems obtusely trigonous. Inflorescence oblong or oblong-ovoid, usually dense; spikes 3–10, male above, female below; lowest bract glumaceous or setiform. Female glumes ovate to oblong-lanceolate, acute, with a wide scarious margin. Utricles ovate and plano-convex or strongly inflated, abruptly contracted into a short beak. Stigmas 2.

21. C. stenophylla Wahlenb., *Kungl. Svenska Vet.-Akad. Handl.* nov. ser., **24**: 142 (1803) (incl. *C. uralensis* C. B. Clarke).

Stems (3–)10–40 cm, usually scabrid above; basal sheaths pale to blackish-brown. Leaves 0·5–1(–2·5) mm wide, canaliculate or involute, usually shorter than stems. Spikes (3–)5–10, in a dense inflorescence 0·8–1·5(–3) × 0·5–1 cm. Female glumes equalling or exceeding (rarely slightly shorter than) utricles, reddish-brown. Utricles 3–4·5 mm, ovate, strongly convex abaxially, yellowish- to dark reddish-brown, with prominent veins, with usually slightly scabrid beak. $2n=60$. *Dry places. C. Europe, from N. Italy to Czechoslovakia and extending to E. Romania; S. & E. Ukraine and S. Russia.* Au Cz ?Hs Hu It Ju Rm Rs (C, W, K, E).

22. C. physodes Beib., *Mém. Soc. Nat. Moscou* **2**: 104 (1809). Stems 15–40 cm, smooth; basal sheaths pale reddish-brown, prominent and persistent. Leaves *c.* 0·5 mm wide, plicate, shorter than stems. Spikes 3–7, in a sometimes slightly interrupted inflorescence 1–3 × 2–4 cm. Female glumes much shorter than utricles, reddish-brown. Utricles 10–20 mm, oblong to ellipsoid, strongly inflated and bladder-like, reddish-brown, with distinct but slender veins and smooth beak. *Sandy deserts. S.E. Russia, W. Kazakhstan.* Rs (E).

Sect. FOETIDAE (L. H. Bailey) Kük. Not or laxly caespitose, with creeping rhizomes. Stems trigonous. Inflorescence dense, ovoid or pyramidal; spikes numerous, on 3–15 very short branches, the terminal or upper entirely male and the remainder male above and female below, or all male above and female below, or the lower entirely female; lowest bract glumaceous or setiform. Female glumes *c.* ¾ as long as utricles. Utricles ovate to ovate-lanceolate, plano-convex, with faint veins, gradually narrowed into a 2-fid beak. Stigmas 2.

23. C. foetida All., *Fl. Pedem.* **2**: 265 (1785). Laxly caespitose and with creeping rhizomes. Stems 5–30 cm, erect or ascending and slightly curved, sharply trigonous, scabrid above; basal sheaths blackish- or orange-brown, often fibrous. Leaves 1·5–3 mm wide, flat. Inflorescence 1–1·8 × 0·8–1·5 cm (rarely elongate), with 8–15 branches, dark brown. Female glumes ovate-lanceolate, acuminate or acute, blackish-brown, without or with a very narrow scarious margin. Utricles 3–4 mm, erect or erecto-patent, yellowish-brown at base, blackish-brown above, with a long, scabrid beak. $2n=58$. *Damp, grassy or stony places, 1700–3050 m. C. & E. Pyrenees, Alps and mountains of Jugoslavia.* Au Ga He Hs It Ju.

24. C. maritima Gunnerus, *Fl. Norv.* **2**: 131 (1772) (*C. incurva* Lightf.). Rhizome long, slender, creeping. Stems 2–18 cm, ascending, often strongly curved, obtusely trigonous, smooth; basal sheaths pale brown. Leaves up to 1(–2) mm wide, plicate or with involute margins. Inflorescence (0·5–)1–1·8 × (0·5–)0·7–1·3 cm, with 3–8(–10) branches, usually pale reddish-brown. Female glumes ovate-orbicular, obtuse or acute, but usually mucronulate, usually dark brown, with scarious margin. Utricles 3–5 mm, patent, yellowish-brown but blackish at least at apex, with a short, usually sparsely scabrid beak. $2n=60$. *Sandy, gravelly or rocky places. Coasts of arctic and N.W. Europe, extending to S.W. Sweden; inland on mountains in Norway and Iceland; also in the Alps.* Au Br Da Fa Ga He ?Hs Is It No Rs (B) Sb Su.

Subsp. **setina** (Christ) Egorova, *Nov. Syst. Pl. Vasc.* (*Leningrad*) **1965**: 73 (1965) (*C. setina* (Christ) V. Krecz.), from the coasts of arctic Europe, differs in being smaller in all its parts, with very narrow leaves, the inflorescence not more than 1 cm and the utricles not more than 4 mm; similar plants can, however, be found elsewhere throughout the range of the species and they do not seem worth taxonomic recognition.

Sect. REMOTAE (Ascherson) C. B. Clarke. Densely caespitose, usually forming tussocks. Stems sharply trigonous, scabrid at apex. Inflorescence very lax; spikes 5–10, oblong-ovoid, male below and female above, or the lower entirely female; lowest bract leaf-like, exceeding inflorescence. Female glumes slightly shorter than utricles. Utricles ovate-lanceolate, plano-convex, membranous, suberect, gradually narrowed into a short, wide, scabrid, 2-fid beak. Stigmas 2.

25. C. remota L., *Fl. Angl.* 24 (1754). Stems 30–60(–100) cm; basal sheaths brownish. Leaves 1·5–2 mm wide. Inflorescence 8–20 cm; spikes 4–10 mm, the lower separated from each other by 5–7 cm. Female glumes ovate, acute, whitish or pale brownish. Utricles 2·5–3·5 mm, pale yellowish-green, distinctly veined. $2n=62$. *Damp, shady places. Most of Europe, northwards to c. 63°N. in Norway.* All except Az Bl Fa Is Rs (N) Sb.

Sect. CYPEROIDEAE Koch. Caespitose, short-lived perennials. Stems rather flaccid, trigonous, smooth. Inflorescence capitate, rarely oblong; spikes many, very crowded and indistinct, female above and male below; lowest bract leaf-like. Female glumes *c.* ½ as long as utricles, linear-lanceolate, acute. Utricles linear-lanceolate, plano-convex, membranous, gradually narrowed into a very long, denticulate, 2-fid beak occupying most of their length. Stigmas 2.

26. C. bohemica Schreber, *Beschr. Gräser* **2**: 52 (1772) (*C. cyperoides* Murray). Stems 5–30(–60) cm; basal sheaths few, pale brown. Leaves 1·5–2·5 mm wide. Inflorescence 1·5–2·5 cm in diameter; bracts 2–5, the lowest 3–15 cm, erect, the others also leaf-like but patent. Female glumes whitish-scarious. Utricles 7–10 mm, pale green to pale yellow, obscurely veined, with a narrow, scarious, denticulate margin. $2n=80$. *Damp, sandy or muddy places. C. Europe and U.S.S.R.; a few isolated stations elsewhere; everywhere inconstant and very local and perhaps only casual in some localities.* Au Az Be Cz Da Fe Ga Ge He Hu It Ju Lu Po Rm Rs (N, C, W, E).

Sect. OVALES (Kunth) Christ. Caespitose and with short rhizomes. Stems obtusely trigonous below, sharply so and scabrid above. Inflorescence simple, pyramidal to irregularly cylindrical, brown; spikes 2–10, ovoid, female above and male below; lowest bract glumaceous, or setaceous and equalling spike. Utricles ovate-elliptical, plano-convex, suberect, membranous, with a narrow denticulate wing in at least the upper half, gradually narrowed into a distinct, winged, denticulate, 2-fid beak. Stigmas 2.

27. C. ovalis Good., *Trans. Linn. Soc. London* **2**: 148 (1794) (*C. leporina* auct., non L.; incl. *C. argyroglochin* Hornem.). Stems (5–)10–60(–90) cm, often curved; basal sheaths brown, becoming fibrous. Leaves 1·5–3(–4) mm wide. Inflorescence (1·5–)2–4 cm; spikes (2–)3–7(–10), 5–15 mm, almost always all overlapping. Female glumes equalling utricles, ovate, acuminate, pale or reddish-brown, with narrow but prominent scarious margin. Utricles 3·5–5 mm, pale brown, prominently veined. $2n=64$, 66, 68. *Usually in damp, base-poor habitats. Throughout Europe, but rare in the extreme north and only on mountains in the south.* All except ?Az Bl Cr Is Rs (K) Sb Tu.

28. C. macloviana D'Urv., *Mém. Soc. Linn. Paris* **4**: 599 (1826). Like **27** but usually not more than 40 cm; inflorescence 1–2 cm, ovoid to pyramidal; spikes 4–6, crowded; female glumes slightly shorter than utricles, acute or subacute, dark brown, with usually inconspicuous scarious margin; utricles 3–4·5 mm, often dark brown. $2n=86$. *Meadows, pastures and grassy paths. N. Sweden and adjacent parts of Norway and Finland; Iceland.* Fe Is No Su. (*North America, Greenland, Kamchatka.*)

Sect. STELLULATAE (Kunth) Christ. Densely or laxly caespitose. Stems obtusely trigonous. Inflorescence simple, lax; spikes (2–)3–5(–7), subglobose, the terminal female above and male below, the others entirely female; lowest bract usually glumaceous. Female glumes *c.* ¾ as long as utricles, ovate, acute. Utricles ovate, plano-convex, strongly patent, subcoriaceous, abruptly contracted into a scabrid, deeply 2-fid beak. Stigmas 2.

29. C. echinata Murray, *Prodr. Stirp. Gotting.* 76 (1770) (*C. stellulata* Good., *C. muricata* auct., non L.). Stems 5–40(–90) cm, smooth, or scabrid at apex; basal sheaths pale greyish-brown. Leaves 1–2·5 mm wide. Inflorescence 1–2·5(–3) cm; spikes separated by not more than 0·7 cm. Female glumes pale, often reddish-brown, with wide scarious margin. Utricles 3–4 mm, greenish-brown to dark brown, with slender veins. $2n=56$, 58. *Marshes and bogs; calcifuge. Europe, except for parts of the north-east, south-east and of the Mediterranean region; only on mountains in the south.* All except Bl Cr Rs (K) Sa Sb Si.

Sect. PHYSOGLOCHIN Dumort. (Sect. *Dioicae* (Tuckerman) Pax). Usually dioecious, with solitary spike. Caespitose or not. Stems subterete, smooth or scabrid above. Male spike rarely with female flowers at base; glumes lanceolate or oblong-lanceolate, acute or subacute. Female spike oblong-ovoid to cylindrical; glumes ovate, subobtuse to acute, with scarious margin. Utricles ovate to linear-lanceolate, plano-convex, subcoriaceous, appressed to patent or recurved, with a distinct beak. Stigmas 2.

30. C. dioica L., *Sp. Pl.* 972 (1753). Rhizomes slender, creeping. Stems (3–)5–40 cm, usually smooth; basal sheaths pale brown. Leaves shorter than stems, setaceous. Male spike 7–20 × *c.* 2 mm; glumes reddish-brown. Female spike 7–13 × 5–7 mm, oblong-ovoid, dense throughout; glumes 2·5–4 mm, almost as long as utricles, more or less reddish-brown. Utricles 2·5–3·5 mm, ovate, dark or reddish-brown, with prominent veins, patent but not recurved at maturity, more or less abruptly contracted into a short, scabrid beak. $2n=52$, 60. *Damp places. N. Europe, southwards to the Pyrenees, C. Romania and S.E. Russia.* Au Br Cz Da Fa Fe Ga Ge Hb He Ho Hs Is It Ju No Po Rm Rs (N, B, C, W, E) Sb Su.

Hybrids are frequently formed with species of Sect. *Canescentes* and with **24.**

31. C. parallela (Laest.) Sommerf., *Suppl. Fl. Lapp.* 39 (1826). Like **30** but laxly caespitose or with creeping rhizomes; female spike 8–18 × 4–7 mm; cylindrical to oblong-ovoid, usually lax at least below; glumes sometimes shorter than utricles; utricles 3–4·5 mm, ovate-lanceolate to oblong-ovate, gradually narrowed into a more or less smooth beak, patent to appressed at maturity. *Damp places. Arctic Europe, extending southwards to c.* 62 °*N. in Norway.* Fe No Rs (N, C) Sb Su.

(a) Subsp. **parallela**: Not caespitose, with creeping rhizomes. Female glumes about as long as utricles. Utricles 3–3·5(–4) mm, ovate to oblong-ovate, erecto-patent to appressed at maturity. $2n=44$. *Throughout the range of the species.*

(b) Subsp. **redowskiana** (C. A. Meyer) Egorova, *Nov. Syst. Pl. Vasc. (Leningrad)* **10**: 104 (1973) (*C. redowskiana* C. A. Meyer): Laxly caespitose and with very short rhizomes. Female glumes *c.* ½ as long as utricles. Utricles 3·5–4·5 mm, ovate-lanceolate, patent at maturity. *Arctic Russia and N. Ural.*

32. C. davalliana Sm., *Trans. Linn. Soc. London* **5**: 266 (1800). Densely caespitose, without creeping rhizomes. Stems (1–)10–40(–50) cm, usually scabrid above; basal sheaths dark brown. Leaves setaceous-canaliculate, shorter than stems. Male spike 15–20 × *c.* 2 mm, oblong; glumes 2·5–3 mm, dark, often reddish-brown. Utricles 3·5–4·5 mm, linear-lanceolate, dark reddish- or blackish-brown, with weak veins, patent or recurved when ripe, gradually narrowed into a long, more or less smooth beak. $2n=46$. *Damp, usually base-rich habitats. From N. France and Estonia southwards to E.C. Spain, C. Italy and Macedonia.* Au †Br Co Cz †Da Ga Ge Gr He Hs Hu It Ju Po Rm Rs (B, C, W).

Sect. ELONGATAE (Kunth) Kük. Densely caespitose. Stems sharply trigonous, scabrid. Inflorescence simple, lax; spikes (5–)8–12(–18), oblong to oblong-ovoid, usually all overlapping, all female above and male below or the lower entirely female; lowest bract usually setaceous and shorter than spike. Female glumes ½–⅔ as long as utricles, ovate, subacute, with wide scarious margin. Utricles oblong-lanceolate, often recurved, plano-convex, membranous, more or less patent, gradually narrowed into a scabrid or smooth, entire beak. Stigmas 2.

33. C. elongata L., *Sp. Pl.* 974 (1753). Stems (15–)30–70(–100) cm; basal sheaths pale brown. Leaves 2–6 mm wide, yellowish-green. Inflorescence 3–10 cm; spikes 5–15 mm. Female glumes reddish-brown. Utricles 3–4 mm, yellowish- to reddish-brown, prominently veined. $2n=56$. *Damp woods and marshy places. From arctic Norway southwards to C. France, the S. Carpathians and S.E. Russia.* Au Be Br Cz Da Fe Ga Ge ?Gr Hb He Ho Hu It Ju No Po Rm Rs (N, B, C, W, E) Su.

Sect. CANESCENTES (Fries) Christ. More or less caespitose. Stems sharply or obtusely trigonous, scabrid or smooth. Inflorescence simple; spikes 1–7(–12), globose to oblong, female above and male below, or the lateral spikes entirely female; lowest bract glumaceous or setaceous. Female glumes ovate, usually obtuse. Utricles ovate and plano-convex to ellipsoid and subinflated, membranous or coriaceous, suberect to patent, usually with a short, conical or obscure beak. Stigmas 2.

Literature: T. W. Böcher, *Acta Arct.* **5**: 1–31 (1952). G. Halliday & A. O. Chater, *Feddes Repert.* **80**: 77–106 (1969). H. Toivonen, *Ann. Bot. Fenn.* **11**: 225–230 (1974).

34. C. lachenalii Schkuhr, *Beschr. Abbild. Riedgr.* 51 (1801) (*C. lagopina* Wahlenb., *C. tripartita* auct., non All.). Laxly or densely caespitose, with short, creeping rhizomes. Stems (3–)10–20(–50) cm, obtusely trigonous, smooth or scabrid only at apex; basal sheaths brown. Leaves 1–2 mm wide, flat, clear green, with stomata only on abaxial surface. Inflorescence (0·5–)1–2 cm, ovoid to oblong, dense; spikes (2–)3–4(–5), 7–10 mm, ellipsoid (rarely ovoid), all male below and female above, overlapping. Female glumes slightly shorter than utricles, dark reddish-brown, usually with a narrow scarious margin. Utricles (1·5–)2·5–3 mm, ovate or obovate, plano-convex, erect, yellowish-brown below, dark brown towards apex, with slender veins, gradually narrowed into a distinct, parallel-sided, smooth beak 0·75–1 mm, with a slit down the back. $2n=58$, 62, 74. *Marshes, damp grassland and heaths. N. Europe, southwards to C. Scotland; mountains of C. & S.W. Europe.* Au Br Cz Fe Ga He Hs Is It ?Ju Lu No Po Rm Rs (N, ?C, W) Sb Su.

35. C. glareosa Wahlenb., *Kungl. Svenska Vet.-Akad. Handl.* nov. ser., **24**: 146 (1803) (incl. *C. marina* auct., non Dewey). Like **34** but densely caespitose; leaves 0·5(–2) mm wide, often canaliculate, grey-green or glaucous, with stomata on both surfaces; spikes 2–3(–4), the terminal oblong-clavate, female above, male below, the others oblong, female; utricles 2–3·5 (–4) mm, broadly ovate to fusiform, concolorous, pale greenish to reddish-brown, conical but scarcely beaked at apex, with straight or scarcely concave sides. $2n=66$. *Salt-marshes and*

maritime rocks. Coats of N. Europe, southwards to 58° *N.* Fe Is No Rs (N, B, C) Sb Su.

36. C. ursina Dewey, *Amer. Jour. Sci. Arts* **27**: 240 (1835) Caespitose and with short rhizomes. Stems 2–5 cm, obscurely trigonous, smooth, curved, usually concealed by the very narrow, canaliculate, more or less smooth leaves. Spikes 4–6 mm, solitary or very rarely 2 close together, ovoid or subglobose, female above and male below. Female glumes *c.* ⅔ as long as utricles, ovate, obtuse, reddish-brown. Utricles *c.* 2 mm, ovate, plano-convex, suberect, pale greyish-green, sometimes brown at apex, with faint veins and an obscure beak with a slit down the back. $2n=64$. *Maritime sands. Spitsbergen; Arctic Russia (Vajgač).* Rs (N) Sb. (*Arctic Asia, arctic and subarctic North America.*)

37. C. mackenziei V. Krecz. in Komarov, *Fl. URSS* **3**: 183 (1935). Laxly to densely caespitose, with ascending and often long rhizomes. Stems 10–40 cm, obtusely trigonous, smooth or slightly scabrid at apex; basal sheaths pale brown, persistent and conspicuous. Leaves 2–3 mm wide, flat, greyish- or yellowish-green. Inflorescence 2–5 cm, lax; spikes 3–6, the terminal 12–20 mm, clavate, female only in the upper ½, male below, the lateral 8–15 mm, oblong, entirely female, usually all overlapping or lowest slightly remote. Female glumes equalling (or slightly exceeding) and concealing utricles, yellowish- or pale reddish-brown, with narrow scarious margin. Utricles 2·75–3·5 mm, broadly ovate-elliptical, plano-convex, erect, greyish-green, prominently veined, gradually narrowed into an indistinct, conical, sparsely scabrid beak. $2n=64$. *Coastal and estuarine marshes. Coasts of N. Europe, southwards to* 56° *N. in S. Sweden.* Fe Is No Rs (N, B, C) Su.

The hybrid **37** × **40** (*C.* × *pseudohelvola* Kihlman) is common in marshes in Fennoscandia, especially by the Gulf of Bothnia.

38. C. heleonastes L. fil., *Suppl.* 414 (1781). Caespitose. Stems 15–40 cm, sharply trigonous, scabrid above; basal sheaths pale brown. Leaves 1–2 mm wide, bluish-green. Inflorescence 1–2 cm, ovoid-oblong, dense; spikes 3–4(–6), 5–10 mm, ovoid-globose to ovoid, each with 6–10 flowers, male below, female above, all overlapping. Female glumes slightly shorter than utricles, pale to reddish-brown, with wide scarious margin. Utricles 2·75–3·5 mm, ovate-elliptical, plano-convex, pale brown, becoming dark brown at apex, erecto-patent, with slender veins, gradually narrowed into a short concave-sided, conical, usually slightly scabrid beak *c.* 0·5 mm. $2n=$ *c.* 64. *Damp places. N. Europe, westwards to S.W. Norway and N.W. Germany; Iceland; Alps; isolated stations in the E. Carpathians and W. Bulgaria.* Au Bu Fe Ga Ge He Is It No Po Rm Rs (N, B, C, W) Su.

39. C. marina Dewey, *Amer. Jour. Sci. Arts* **29**: 247 (1836) (*C. amblyrhyncha* V. Krecz.). Like **38** but 10–15(–30) cm; inflorescence not more than 1·5 cm, narrower; spikes 2(–3), 3–5 mm, oblong-clavate; utricles 2·5–3 mm, elliptical, the apex conical with weakly convex, usually smooth margins. *Boggy tundra and gravelly shores. Arctic Europe (Spitsbergen; Vajgač).* Rs (N) Sb. (*Circumpolar-arctic.*)

The plant from Europe (and Greenland) has been called subsp. **pseudolagopina** (Sørensen) Böcher, *Feddes Repert.* **80**: 106 (1969); subsp. **marina**, from Siberia and North America, differs in having usually (2–)3(–4) spikes usually equal in size (not the terminal larger than the others), narrower leaves and a more distinct beak.

40. C. curta Good., *Trans. Linn. Soc. London* **2**: 145 (1794) (*C. canescens* auct., non L.; incl. *C. hylaea* V. Krecz.). Caespitose, usually with ascending rhizomes. Stems (10–)20–50(–70) cm, sharply trigonous, scabrid above; basal sheaths pale greyish- or pinkish-brown, persistent. Leaves (1·5–)2–3(–4) mm wide, flat, pale or greyish-green. Inflorescence (2–)3–5 cm, lax; spikes (3–)4–7(–12), 5–8(–10) mm, ovoid-oblong, all female above and male below, the upper overlapping, the lower often separated from each other by a gap of about their own length. Female glumes slightly shorter than utricles, whitish or pale yellowish-brown and mostly scarious. Utricles 2–2·5(–3) mm, ovate to ovate-elliptical, plano-convex, erect, pale green to pale greyish-yellow, prominently veined, gradually narrowed into an obscure, conical, straight-sided, scabrid beak, without a slit down the back. $2n=54$, 56. *Wet, usually base-poor habitats. Europe, southwards to the Pyrenees, Macedonia and C. Ukraine.* Au ?Az Be Br Bu Cz Da Fe Ga Ge Hb He Ho Hs Hu Is It Ju No Po Rm Rs (N, B, C, W, E) Su.

41. C. lapponica O. F. Lang, *Linnaea* **24**: 539 (1851). Like **40** but stems 15–40 cm; leaves 1–1·5 mm wide; inflorescence 1·5–4 cm; spikes 3–6, 3–5 mm, ovoid-globose; utricles 1·5–2 mm, more abruptly contracted into a concave-sided, smooth beak. Sphagnum-*bogs and other wet places. N. Fennoscandia and N. Russia, southwards to c.* 64° *N.* Fe No Rs (N) Su.

C. bonanzensis Britton, *Bull. New York Bot. Gard.* **2**: 160 (1901), a closely related plant with dark brown female glumes ½–⅔ as long as the utricles, occurs in Siberia and North America and has been erroneously reported from arctic Russia.

42. C. brunnescens (Pers.) Poiret in Lam., *Encycl. Méth. Bot., Suppl.* **3**: 286 (1813) (incl. subsp. *vitilis* (Fries) Kalela, *C. vitilis* Fries). Like **40** but stems more slender, with basal sheaths darker brown; leaves 1·5–2 mm wide, often brighter green; inflorescence 1·5–3(–5) cm; spikes 3–5 mm, usually ovoid-globose; female glumes often darker brown; utricles 2–3(–3·5) mm, brown, sometimes veined only below, abruptly contracted into a prominent, concave-sided beak with an asymmetrical slit down the back. $2n=56$. *Mainly in damp and shady places. N. & C. Europe, extending to the Maritime Alps and S.C. Russia.* Au Cz Fe Ga Ge He Is It Ju No Po Rm Rs (N, B, C) Su.

43. C. loliacea L., *Sp. Pl.* 974 (1753). Caespitose and with slender, creeping rhizomes. Stems 20–40 cm, slender but more or less rigid, erect or ascending, trigonous, scabrid at apex; basal sheaths brown. Leaves 1–2 mm wide, bright green. Inflorescence 1–3 cm, lax; spikes (2–)3–5(–7), subglobose, each with 1–6 female flowers above and 1–4 male flowers below, the lower separated from each other by 1–1·5 cm; lowest bract glumaceous or setiform. Female glumes *c.* ½ as long as utricles, whitish-brown. Utricles 2–3(–3·5) mm, broadly ellipsoid, patent, greenish or brownish, prominently veined, not beaked. $2n=54$. Sphagnum-*bogs, heaths and damp woods. Fennoscandia and N. half of U.S.S.R., extending to N.E. Poland and N.E. Romania.* Fe No Po Rm Rs (N, B, C, ?W) Su.

44. C. tenuiflora Wahlenb., *Kungl. Svenska Vet.-Akad. Handl.* nov. ser., **24**: 147 (1803). Like **43** but leaves greyish-green; inflorescence 0·5–1 cm, dense; spikes 2–4, with 4–10 female flowers, contiguous or separated by not more than 0·5 cm; utricles usually ascending, with slender, inconspicuous veins, slightly more narrowed at apex but not beaked. Sphagnum-*bogs and damp woods. N.E. Europe, extending westwards to* 10° 45′ *E. in Norway.* Fe No Rs (N, C) Su.

Sect. DISPERMAE Ohwi. Like Sect. *Canescentes* but spikes male above and female below, or the terminal entirely male.

45. C. disperma Dewey, *Amer. Jour. Sci. Arts* **8**: 266 (1824) (*C. tenella* Schkuhr, non Thuill.). Very laxly caespitose and with slender, creeping rhizomes. Stems 20–50 cm, filiform, weak and often decumbent, trigonous, scabrid above; basal sheaths brown. Leaves 1–1·5 mm wide, bright green. Inflorescence 2–4 cm, very lax; spikes 2–6, globose, each with 1–2 male flowers above and 2–3 female below (or the terminal entirely male), the lower separated from each other by 1–2 cm; lowest bract setiform. Female glumes *c.* ⅔ as long as utricles, whitish-brown. Utricles 2·5–3 mm, broadly ellipsoid, subinflated, patent, yellowish-green to dark brown, shining, weakly veined, abruptly contracted into a very short, cylindrical, smooth beak. *Damp woods and heaths. N.E. Europe, extending to S.E. Norway and N.E. Poland.* Fe No Po Rs (N, B, C) Su.

Sect. BALDENSES Kük. Densely caespitose. Stems obtusely trigonous, smooth. Inflorescence capitate to irregularly oblong; spikes several, oblong-ovoid, male above and female below. Utricles trigonous in section, with or without a beak. Stigmas 3.

The two species put together here for convenience differ from all the others in Subgen. *Vignea* in having 3 stigmas; their affinities are uncertain and they do not seem to be closely related to each other.

46. C. baldensis L., *Cent. Pl.* **2**: 32 (1756). Stems 10–30(–40) cm, smooth; basal sheaths reddish- or orange-brown. Leaves 2–4 mm wide. Inflorescence *c.* 1·5 × 2·5 cm, capitate; spikes 3–9; bracts 2–5, (1–)2–5(–10) cm, patent, leaf-like. Female glumes whitish or pale yellowish. Utricles 4–5 mm, oblong-ellipsoid, very obtusely trigonous, whitish becoming dark brown, faintly veined, not beaked. $2n = 88, 90$. *Dry, rocky places; calcicole.* ● *Alps from 9° 15′ E. to 11° 30′ E., mainly in the south.* Au Ge He It.

47. C. curvula All., *Fl. Pedem.* **2**: 264 (1785). Stems 3–30(–40) cm, smooth; basal sheaths pale brown, persistent and conspicuous. Leaves 1–2·5 mm wide. Inflorescence 1–2(–3) cm, ovoid to irregularly oblong, more or less dense; spikes (2–)4–6; lowest bract glumaceous, with a setaceous apex, rarely leaf-like. Utricles 5–8 mm, lanceolate, trigonous with 2 angles almost winged, yellowish- or greenish-brown at base, dark brown above, almost veinless, gradually narrowed into a long, smooth, 2-fid *beak*. $2n = c.\ 86$. *Grassy and rocky places.* ● *Mountains of S. & S.C. Europe.* Au Bu Ga He Hs It Ju Rm Rs (W).

(a) Subsp. **curvula**: Roots pale brown. Stems and leaves curved. Leaves canaliculate, in transverse section 7–12 times as wide as thick. Female glumes reddish-brown, with wide scarious margin. *Calcifuge. Throughout most of the range of the species.*

(b) Subsp. **rosae** Gilomen, *Mitt. Naturf. Ges. Bern* **1937**: xxvii (1937): Roots dark or blackish-brown. Stems straight; leaves weakly curved. Leaves plano-convex in transverse section and 3–5 times as wide as thick. Female glumes pale, often yellowish-brown, with wide scarious margin. *Calcicole. Alps, Pyrenees.*

The distribution of the two subspecies is uncertain, but subsp. (a) is much the more widespread.

Subgen. **Carex**. Monoecious. Spikes 2 or more, dissimilar in appearance and usually unisexual, at least the terminal one male and the basal one female, in a usually simple inflorescence usually with 3 stigmas, or spikes similar in appearance and at least the terminal one with both male and female flowers, with 2 stigmas; rarely spike solitary, with both male and female flowers, with 2 stigmas. Lateral spikes usually with a scale between the bract and the lowest glume.

Sect. CAREX. Laxly caespitose, with long rhizomes. Stems obtusely trigonous; basal sheaths without lamina. Male spikes usually several, linear-lanceolate, shortly pedunculate. Female spikes oblong-clavate to cylindrical, erect; lowest bract sheathing. Female glumes slightly shorter to slightly longer than utricles. Utricles ovoid-ellipsoid, subcoriaceous, prominently veined, usually hairy, gradually narrowed into a 2-fid beak. Stigmas 3.

48. C. hirta L., *Sp. Pl.* 975 (1753). Stems (10–)15–50(–100) cm, 3–5 mm wide at base, smooth; basal sheaths brown or reddish-brown, usually entire. Leaves 2–5 mm wide, flat, usually hairy at least on sheaths, green. Male spikes 2–3(–4); glumes usually hairy. Female spikes 2–3, 10–45 × 7–10 mm, dense above, lax below, distant from the male but sometimes overlapping each other, the lowest with peduncles up to 2(–10) cm; lowest bract exceeding spike but usually shorter than inflorescence, with a sheath 3–40 mm. Female glumes acuminate-aristate, pale greenish-brown. Utricles 5–7 mm, green or brownish-green, pubescent all over, with a scabrid beak 1·5–2 mm. $2n = 112$. *In a wide variety of habitats, usually on damp sands or in grassy places. Europe, except the extreme north and south.* All except Az Bl Cr Fa Is Sa Sb Si.

49. C. atherodes Sprengel, *Syst. Veg.* **3**: 828 (1826) (*C. aristata* R. Br., non Honckeny, *C. siegertiana* Uechtr.; incl. *C. orthostachys* C. A. Meyer). Like **48** but stems 30–100(–150) cm, 7–10 mm wide at base, sometimes scabrid at apex; basal sheaths fibrous; leaves up to 7 mm wide, sometimes with revolute margins, sparsely hairy beneath and on sheaths; male spikes 2–5, the glumes glabrous; female spikes (2–)3–4(–5), 25–80 mm; lowest bract usually exceeding inflorescence; utricles 6–9 mm, glabrous or sparsely hairy near apex, with a smooth beak 2–3·5 mm. *Wet places. E. Europe, southwards to* 48° *N. in Ukraine, and extending westwards to N.E. Germany.* Fe Ge Po Rs (N, B, C, W, E).

50. C. lasiocarpa Ehrh., *Hannover. Mag.* **9**: 132 (1784). Stems (30–)45–120 cm, smooth or slightly scabrid above; basal sheaths yellowish- to reddish-brown. Leaves 1–2 mm wide, with inrolled margins, greyish-green. Male spikes 1–3. Female spikes 1–3, 10–35 × 5–8 mm, dense, distant and usually not overlapping, the lowest subsessile or with peduncles up to 2 cm; lowest bract equalling or exceeding inflorescence, with a sheath up to 5(–10) mm. Female glumes acute, brown or reddish-brown. Utricles 3·5–5 mm, greyish-green, densely tomentose, with a ciliate-scabrid beak *c.* 1 mm. $2n = c.\ 56$. *Fens, wet bogs and lake-margins. Europe, southwards to the Pyrenees, C. Italy, S. Jugoslavia and S. Ukraine.* Au Be Br Cz Da Fe Ga Ge Hb He Ho Hs Hu It Ju No Po Rm Rs (N, B, C, W, E) Su.

Sect. PALUDOSAE (Fries) Christ. Rhizomes long, stout. Stems sharply trigonous; basal sheaths without lamina. Male spikes usually several, linear-ellipsoid, subsessile or shortly pedunculate. Female spikes oblong to cylindrical, dense, distant or the upper overlapping, erect or pendent. Female glumes oblong-lanceolate, acuminate, purplish-brown. Utricles ovate-elliptical and plano-convex or ovoid and inflated, glabrous, erecto-patent or erect, more or less beaked. Stigmas usually 3.

51. C. acutiformis Ehrh., *Beitr. Naturk.* **4**: 43 (1789) (*C. paludosa* Good.). Stems (30–)50–150 cm, scabrid above; basal sheaths reddish- to greyish-brown, entire. Leaves equalling or exceeding stems, (4–)7–10 mm wide, flat or plicate, glaucous-green. Male spikes 2–3(–4), with subobtuse glumes. Female spikes (1–)3–4, 20–50(–70) × 6–8 mm, erect, the lowest sessile or with a peduncle up to 1(–4) cm; lowest bract exceeding inflorescence. Female glumes ⅔–1¼ times as long as utricles. Utricles 3·5–5 mm, ovate-elliptical, plano-convex, ascending, greyish-green, finely papillose, prominently veined, more or less abruptly contracted into a usually smooth, emarginate beak

c. 0·5 mm. Stigmas sometimes 2. $2n = c.$ 38, 78. *Wet meadows, marshes and ditches. Most of Europe, northwards to* 62° 30′ *N. in Sweden, and southwards to C. Spain, Sicilia and S. Bulgaria.* Al Au Be Br Bu Co Cz Da Fe Ga Ge ?Gr Hb He Ho Hs Hu It Ju No Po Rm Rs (N, B, C, W, K, E) Sa Si Su.

52. C. melanostachya Bieb. ex Willd., *Sp. Pl.* **4**: 299 (1805) (*C. nutans* Host, non J. F. Gmelin). Like **51** but stems (15–)30–50(–100) cm, slender, scarcely scabrid above; basal sheaths more or less fibrous; leaves usually shorter than stems, 2–4(–5) mm wide, greyish-green, with inrolled margins; male spikes 1–2(–3), with acute glumes; female spikes (1–)2–3(–4), 10–35 × 5–10 mm; lowest bract equalling or slightly exceeding inflorescence; female glumes *c.* ⅔ as long as utricles; utricles 3·5–5·5 mm, biconvex, greenish-brown, not papillose, with sunken veins, gradually narrowed into a smooth, 2-fid beak *c.* 0·75 mm. *Wet grassland. C. & S.E. Europe, extending westwards to W.C. France and north-eastwards to c.* 54° 30′ *E. in E.C. Russia.* Au Bu Cz Ga Ge ?Gr Hu It Ju Rm Rs (C, W, K, E).

53. C. riparia Curtis, *Fl. Lond.* **2 (4)**: t. 60 (1783). Like **51** but leaves up to 15 mm wide; male spikes (2–)3–6, with acuminate glumes; female spikes (1–)2–5, 30–100 × 8–12 mm, the lowest often pendent, with peduncles up to 5(–10) cm; female glumes exceeding utricles; utricles 5–6·5 mm, ovoid, inflated, greenish-brown, not papillose, with slender veins, gradually narrowed into a smooth, 2-fid beak *c.* 1 mm. $2n = 72$. *Wet meadows, marshes and ditches. Europe, northwards to c.* 62° *N. in Finland.* All except Az Bl Cr Fa Is Sb.

Sect. PSEUDOCYPEREAE (L. H. Bailey) Kük. Laxly caespitose, with short rhizomes. Stems sharply trigonous, scabrid. Male spike solitary, linear, shortly pedunculate. Female spikes oblong to cylindrical, dense, all at the same level and equalling or exceeding the male, pendent, with long, filiform peduncles. Female glumes ovate, long-aristate. Utricles ovoid-ellipsoid, patent, prominently veined, glabrous, gradually narrowed into a smooth, 2-fid beak. Stigmas 3.

54. C. pseudocyperus L., *Sp. Pl.* 978 (1753). Stems 30–100 cm; basal sheaths pale brown, entire. Leaves exceeding stems, 5–10(–15) mm wide, yellowish-green. Female spikes 3–5, 20–60(–100) × 8–12 mm; lowest bract greatly exceeding inflorescence, with sheath 2–12 mm. Female glumes equalling or exceeding utricles, pale greenish-brown, with scarious margin. Utricles 4–5·5 mm, green or pale brownish-green. $2n = 66$. *Lake-margins, ditches and wet fens. Most of Europe, from S.C. Finland southwards to C. Spain, Sicilia and Macedonia.* Al Au Be Br Bu Co Cz Da Fe Ga Ge Hb He Ho Hs Hu It Ju Lu No Po Rm Rs (N, B, C, W, K, E) Si Su.

Sect. VESICARIAE (O. F. Lang) Christ. Rhizomes creeping. Stems trigonous. Male spikes linear, subsessile or shortly pedunculate. Female spikes subglobose to cylindrical, dense, erect or pendent; lowest bract not sheathing. Female glumes shorter than utricles, ovate-lanceolate, more or less acute. Utricles membranous, inflated, glabrous, patent to erecto-patent, with a smooth, 2-fid or emarginate beak. Stigmas 2 or 3.

55. C. rostrata Stokes in With., *Arr. Brit. Pl.* ed. 2, **2**: 1059 (1787) (*C. ampullacea* Good., *C. inflata* sensu V. Krecz., non Hudson). Stems 20–100 cm, erect, stout, obtusely trigonous, smooth or scabrid above; basal sheaths reddish-brown, without lamina, entire. Leaves exceeding stems, 2–4(–7) mm wide, flat or often canaliculate or with inrolled margins, glaucous. Male spikes 2–4. Female spikes 2–3(–5), 30–70(–100) × 6–10 mm, cylindrical, overlapping or remote, erect, subsessile or with peduncles up to 1(–4) cm; lowest bract equalling or exceeding inflorescence. Female glumes reddish-brown. Utricles 4–6 mm, ovoid, more or less patent, pale yellowish-green, not or scarcely shining, with slender veins, abruptly contracted into a 2-fid beak 1–1·5 mm. Stigmas 3. $2n = 60$, 72–74, 76, 82. *Shallow water, bogs and marshes; somewhat calcifuge. Most of Europe, but rare in the south-west and south-east.* Al Au Be Br Bu ?Co Cz Da Fa Fe Ga Ge Gr Hb He Ho Hs Hu Is It Ju No Po Rm Rs (N, B, C, W, E) Su.

Forming hybrids with most of the other species in the section.

56. C. rhynchophysa Fischer, C. A. Meyer & Avé-Lall., *Ind. Sem. Hort. Petrop.* **9**, *Suppl.*: 9 (1844) (*C. laevirostris* (Blytt ex Fries) Fries). Like **55** but stems 50–120 cm, sharply trigonous, scabrid above; leaves often not exceeding stems, (6–)8–15 mm wide, bright green; male spikes 3–7; female spikes 50–80 × 10–13 mm, the lower sometimes slightly pendent; utricles 5–7 mm, ovoid-globose, very inflated, shining. *Ditches, lake-margins and wet woods, often in water. N.E. Europe, extending southwards to* 52° 30′ *N. in S. Ural and westwards to S.E. Norway and N.E. Poland.* Fe No Po ?Rm Rs (N, B, C) Su.

57. C. vesicaria L., *Sp. Pl.* 979 (1753). Like **55** but stems up to 120 cm, sharply trigonous, scabrid above; basal sheaths purplish-brown; leaves (3–)4–8 mm wide, green or yellowish-green; female spikes (1–)2–3, 20–40(–70) × 10–15 mm, the lowest with peduncle up to 4 cm and sometimes pendent; utricles (6–)7–8 mm, ovoid-ellipsoid, inflated, erecto-patent, more or less shiny, brownish-yellow, gradually narrowed into a beak 1·5–2 mm. $2n = 70$, 74, 82, 86, 88. *Marshes and shallow water. Most of Europe, southwards to N.E. Spain, S. Italy and S. Bulgaria.* Au Be Br Bu Co Cz Da Fe Ga Ge Hb He Ho Hs Hu It Ju No Po Rm Rs (N, B, C, W, K, E) Su.

58. C. saxatilis L., *Sp. Pl.* 976 (1753). Stems 10–30(–60) cm, erect or ascending, slender, trigonous, usually scabrid above; basal sheaths purplish-brown, without lamina, entire. Leaves equalling or slightly shorter than stems, 2–4 mm wide, plicate or canaliculate, green. Male spikes 1(–2). Female spikes 1–2(–4), 7–20 × 5–7 mm, subglobose to oblong, usually overlapping, erect and subsessile or (var. *laxa* (Trautv.) Ohwi) the lowest with a peduncle up to 1(–5) cm and pendent; lowest bract exceeding spike but shorter than inflorescence, suberect. Female glumes dark purplish-brown, with narrow scarious margin near apex. Utricles 3–4(–4·5) mm, ovoid-biconvex, erecto-patent to patent, yellowish-brown below, blackish-purple above, slightly shining, scarcely veined, abruptly contracted into an emarginate beak *c.* 0·5 mm. Stigmas 2. $2n = 80$. *Tundra, flushes and wet, peaty ground; somewhat calcicole. N. Europe, southwards to* 56° *N. in Scotland.* Br Fa Fe Is No Rs (N) Sb Su.

Very variable. Hybrids with **55**, **57**, **59** and **60** are frequent, and are often partly fertile.

59. C. rotundata Wahlenb., *Kungl. Svenska Vet.-Akad. Handl.* nov. ser., **24**: 153 (1803). Like **58** but stems always erect, stouter and more rigid; basal sheaths often pale brown; leaves usually shorter than stems, 1–2 mm wide, greyish-green, more rigid, canaliculate with inrolled margins; female spikes subsessile; lowest bract usually patent or deflexed; utricles 2·5–4 mm, strongly inflated and patent; stigmas 3. *Tundra, flushes and wet peaty ground; somewhat calcifuge. N. & W. Fennoscandia, arctic and subarctic Russia.* Fe No Rs (N) Su.

Partly fertile hybrids with **55** and **58** occur frequently and are often confused with both these species.

60. C. stenolepis Less., *Reise Norweg. Loffod.* 301 (1831). Like **58** but stems 20–50 cm; leaves usually exceeding stems, 3–4·5 mm wide, flat or plicate; female spikes 15–30(–35) × 7–10 mm, oblong-ovoid to cylindrical, with peduncles up to 1·5 cm; lowest bract exceeding inflorescence; utricles 4–5 mm, ovoid-ellipsoid, ascending, gradually narrowed into a 2-fid beak *c.* 1 mm; stigmas 3. *Bogs. Arctic Russia and N. Fennoscandia, southwards to c.* 63° *N. in Sweden.* Fe No Rs (N) Su.

Intermediate morphologically between **57** and **58** and perhaps of hybrid origin. **C. × grahamii** Boott, *Trans. Linn. Soc. London* **19**: 215 (1844), is the name given to largely sterile plants, believed to be transient hybrids between these two species; they differ from **60** chiefly in their paler utricles, more abruptly contracted into a longer beak, and occur in the same area as **60** and in Scotland.

61. C. mollissima Christ, *Kungl. Svenska Vet.-Akad. Handl.* nov. ser., **22 (10)**: 181 (1888). Stems 25–40 cm, erect, slender, compressed-trigonous, scabrid above; basal sheaths brown, without lamina, becoming slightly fibrous. Leaves exceeding stems, 3–7 mm wide, flat, green. Male spikes solitary. Female spikes 2–4, 15–30 × 7–8 mm, cylindrical, overlapping, erect, subsessile or with peduncles up to 3(–4) cm; lowest bract exceeding inflorescence. Female glumes reddish-brown. Utricles 4–5·5 mm, ovoid, more or less patent, greenish-yellow, shining, with slender veins, more or less abruptly contracted into a 2-fid or emarginate beak 1–1·5 mm. *Marshes and shallow water. N. & C. Ural.* Rs (N, C). (*N. & E. Siberia.*)

Sect. RHYNCHOCYSTIS Dumort. (Sect. *Maximae* (Ascherson) Kük.). Densely caespitose. Stems sharply trigonous. Male spike cylindrical. Female spikes cylindrical, dense; lowest bract about equalling inflorescence, sheathing. Female glumes ovate to lanceolate, acute or acuminate. Utricles ovoid to ellipsoid, membranous, glabrous, gradually or abruptly narrowed into a short, weakly emarginate beak. Stigmas 3.

62. C. pendula Hudson, *Fl. Angl.* 352 (1762) (*C. maxima* Scop.). Stems 50–180(–240) cm, smooth; basal sheaths reddish- or purplish-brown. Leaves (8–)10–20 mm wide, dark or yellowish-green above, somewhat glaucous beneath. Male spikes 1(–2), 55–160 mm. Female spikes (3–)4–5(–7), 50–260 × 5–7 mm, sometimes male at apex, the lower with peduncles at least half as long as spike, pendent; lowest bract with a sheath (30–)50–100 mm. Female glumes shorter than or exceeding utricles, reddish-brown. Utricles 3–3·5 mm, pale to brownish-green, faintly veined. $2n = 58, 60, 62$. *Woods and other damp, shady places. W., C. & S. Europe, northwards to c.* 58°*N. in Scotland.* Al Au Az Be Br Bu Co Cr Cz Da Ga Ge Gr Hb He Ho Hs Hu It Ju Lu Po Rm Rs (W, K) Sa Si Su Tu.

63. C. microcarpa Bertol. ex Moris, *Stirp. Sard.* **1**: 48 (1827). Like **62** but stems not more than 100 cm, slightly scabrid above; leaves not more than 13 mm wide, glaucous; female spikes 40–100(–120) × 3–6 mm, erect; female glumes equalling or slightly exceeding utricles; utricles 2·5–3·3 mm, more or less veinless, purplish-brown-puncticulate. $2n = 60$. *Damp places.* ● *Corse, Sardegna, C. Italy.* Co It Sa.

Sect. STRIGOSAE (Fries) Christ. Caespitose, without or with short creeping rhizomes. Stems trigonous, smooth. Male spikes cylindrical to subclavate, more or less pedunculate. Female spikes oblong to cylindrical, lax, usually pendent; lowest bract sheathing. Female glumes shorter than utricles, ovate to ovate-lanceolate. Utricles obovoid- to ellipsoid-trigonous, membranous, usually veinless, glabrous, with a more or less distinct, 2-fid to truncate beak. Stigmas 3.

Literature: Á. Löve, D. Löve & M. Raymond, *Canad. Jour. Bot.* **35**: 715–761 (1957) (spp. **67–69**).

64. C. sylvatica Hudson, *Fl. Angl.* 353 (1762). Caespitose, with very short rhizomes. Stems 10–70(–200) cm; basal sheaths pale brown, not fibrous. Leaves shorter than stems, 3–15 mm wide. Male spikes 1(–7), 10–45 × 2–3 mm. Female spikes (2–)3–5(–6), 20–70 × 3–5 mm, the upper overlapping the male spike, the lower distant, pendent, with filiform peduncles 5–25 cm, rarely branched; lowest bract usually exceeding spike but shorter than inflorescence, with a sheath 20–100 mm. Female glumes acuminate, greenish, with wide scarious margin. Utricles 4–5·5 mm, obovoid- to ellipsoid-trigonous, pale greenish, more or less veinless, more or less abruptly contracted into a long, slender, smooth, 2-fid beak. *Woods and other shady places. Most of Europe northwards to c.* 65° *N. in Norway.* All except Az Bl Cr Fa Fe Is Lu Rs (N) Sa Sb.

(a) Subsp. **sylvatica**: Stems usually not more than 100 cm. Leaves less than 10 mm wide. Male spike 1(–2), 10–40 mm. Female spikes 20–60 mm, with long-exserted peduncles, rarely branched. $2n = 58$. *Throughout the range of the species except for parts of N.E. Spain.*

(b) Subsp. **paui** [Sennen] A. & O. Bolós in A. Bolós, *Veg. Com. Barcelon.* 246 (1950): Stems 75–200 cm. Leaves at least 10 mm wide. Male spikes 2–7, 40–45 mm. Female spikes 50–70 mm, with peduncles not or scarcely exserted from the bract-sheath, often branched. *N.E. Spain.* (N.W. Africa.)

65. C. arnellii Christ, *Kungl. Svenska Vet.-Akad. Handl.* nov. ser., **22 (10)**: 177 (1888). Like **64 (a)** but basal sheaths dark brown, strongly fibrous and persistent; male spikes 2–3; female spikes 2–3, not more than 40 mm; lowest bract with sheath 10–15 mm. *Woods and scrub. C. & E. Russia, from c.* 54° *to c.* 57° *N.* Rs (C, E). (*Temperate Asia.,*

66. C. debilis Michx, *Fl. Bor.-Amer.* **2**: 172 (1803). Densely caespitose, wthout creeping rhizomes. Stems 30–60 cm; basal sheaths reddish-brown. Leaves equalling or shorter than stems, 2–7 mm wide. Male spike solitary, 20–35 × 1–2 mm. Female spikes 2–4, 20–60 × *c.* 3 mm, lax, the lower pendent, with filiform peduncles 0·5–1 cm and sometimes branched; lowest bract exceeding spike but shorter than inflorescence, with a sheath 30–70 mm. Female glumes obtuse, scarious. Utricles 5–7 mm, ellipsoid, pale greenish-brown, scarcely veined, gradually narrowed into a long, smooth beak very oblique and white-scarious at apex. *Woods and damp places. Açores* (*Faial*). Az. (*W. North America.*)

67. C. capillaris L., *Sp. Pl.* 977 (1753). Caespitose, without creeping rhizomes. Stems 2–40(–60) cm; basal sheaths pale or reddish-brown, becoming fibrous. Leaves not more than half as long as stems, 0·5–2·5 mm wide. Male spike solitary, 5–10 × *c.* 1 mm, overtopped by the female. Female spikes 2–4, 5–15(–25) × 2–4 mm, 5- to 8(–12)-flowered, lax, all, except sometimes the lowest, digitately clustered, pendent, with filiform peduncles 1–4 cm; lowest bract equalling inflorescence, with a sheath 5–20 mm usually enclosing all the peduncles. Female glumes acute or obtuse, caducous. Utricles 2–4 mm, ellipsoid-ovoid, greyish-brown, shiny, veinless, gradually narrowed into a short, truncate beak scarious at the apex. *Stony or grassy places; usually calcicole. N. Europe; mountains of C. & S. Europe southwards to Sierra Nevada and Crna Gora.* Au Br Cz Fa Fe Ga Ge He Hs Is It Ju No Po Rm Rs (N, B, C, W, E) Sb Su.

(a) Subsp. **capillaris** (incl. *C. chlorostachys* Steven): Male spike completely exserted from sheath of bract. Female spikes

2–4. Female glumes pale brownish-scarious. Beak of utricle scabrid. $2n=54$. *Stony or grassy places; usually calcicole. Throughout the range of the species.*

(b) Subsp. **fuscidula** (V. Krecz. ex Egorova) Á. & D. Löve, *Bot. Not.* **128**: 504 (1976) (*C. fuscidula* V. Krecz ex Egorova): Male spike at least partly enclosed in sheath of bract. Female spikes 2(–3). Female glumes reddish-brown. Beak of utricle usually smooth. *Tundra. Arctic Russia and N. Ural.* (*Siberia, North America.*)

68. C. krausei Boeckeler, *Bot. Jahrb.* **7**: 279 (1886). Like **67 (a)** but stems not more than 16 cm; terminal spike with female flowers at apex; lateral spikes up to 6, more distant, the lower often branched; utricles 1·5–2 mm, very shortly beaked. $2n=36$. *Grassy places. Iceland.* Is [Rs (N)]. (*North America.*)

The plants from Iceland belong to subsp. **porsildiana** (Polunin) Á. & D. Löve, *Acta Horti Gotob.* **20**: 175 (1956) (*C. capillaris* subsp. *porsildiana* (Polunin) Böcher); subsp. **krausei**, known only from Alaska, differs chiefly in its larger utricles 2·5–3 mm.

69. C. ledebourana C. A. Meyer ex Trev., *Bull. Soc. Nat. Moscou* **36 (1)**: 540 (1863). Like **67 (a)** but male spike 8–15 × 3–5 mm, exceeding female spikes; female spikes (1–)2(–3), distant; female glumes reddish-brown; utricles *c.* 3 mm. *Damp places. N.E. Russia.* Rs (N). (*Siberia, Mongolia.*)

70. C. strigosa Hudson, *Fl. Angl.* ed. 2, 411 (1778). Laxly caespitose, with short rhizomes. Stems (20–)30–100 cm; basal sheaths pale brown, without lamina. Leaves ½–¾ as long as stems, 5–12 mm wide. Male spike solitary, 30–40(–80) × 1–2 mm. Female spikes 2–5(–7), (25–)40–80 × 2–3 mm, cylindrical, the upper overlapping, the lower distant and suberect or arcuate, with slender peduncles 3–7 cm; lowest bract longer than spike but shorter than inflorescence, leaf-like, with a sheath 30–50 mm. Female glumes acute, greenish-brown, with narrow scarious margin. Utricles 3–4 mm, ellipsoid-trigonous, green, glabrous, gradually narrowed into a short, conical, truncate beak less than 0·5 mm. $2n=66$. *Woods and other damp, shady places. S., C. & W. Europe, northwards to Denmark and eastwards to Bulgaria.* Au Be Br Bu Cz Da Ga Ge Hb He Ho Hs Hu It Ju Po Rm Rs (W).

Sect. GRACILES Kük. Like Sect. *Strigosae* but utricles ovate, plano-convex, with a long, slender, 2-fid beak.

71. C. vulcani Hochst. in Seub., *Fl. Azor.* 22 (1844). Caespitose, with short, stout rhizomes. Stems (30–)40–100 cm; basal sheaths brownish. Leaves equalling or shorter than stems, 2–4·5 mm wide. Male spike solitary, 20–60 × 1–3 mm, rarely female at apex or base. Female spikes 3–5, 20–50 × (3–)4–6 mm, fairly dense, the upper crowded and overlapping the male, sometimes male at apex, the lower distant, erect or pendent, with peduncles 4–12 cm, sometimes branched; lowest bract equalling or exceeding inflorescence, with a sheath 30–50 mm. Female glumes acuminate, scarious. Utricles (4–)4·5–5·5 mm, pale greenish, veinless, abruptly contracted into a scabrid beak. *Scrub in small volcanic craters.* ● *Açores.* Az.

Sect. GLAUCAE (Ascherson) Christ. Not or laxly caespitose, with long creeping rhizomes. Stems obtusely trigonous, usually smooth. Male spikes usually several, cylindrical, more or less pedunculate. Female spikes cylindrical, dense or lax, erect or pendent; lowest bract leaf-like, usually at least as long as inflorescence, often sheathing. Female glumes oblong-ovate to elliptic-lanceolate. Utricles oblong-ovoid to obovoid, or ovate to obovate and plano-convex, membranous, more or less veinless, papillose to hispid-scabridulous, abruptly contracted into a short beak. Stigmas 3.

72. C. flacca Schreber, *Spicil. Fl. Lips., App.* 178 (1771). Stems (10–)20–50(–90) cm; basal sheaths brown, often purplish-tinged, entire. Leaves (1·5–)3–6 mm wide, shorter than stems, glaucous beneath, dark green above, gradually acute at apex. Male spikes (1–)2–3(–4), 15–40 × 2–3 mm. Female spikes 1–5, 12–30(–60) × 3–7 mm, usually overlapping; lowest bract exceeding spike and usually inflorescence, not sheathing or with a sheath up to 3(–10) mm. Female glumes acute or acuminate, sometimes aristate, purplish-black to pale reddish-brown, 1-veined. Utricles 2–4 mm, broadly ellipsoid to obovoid, greenish-brown to purplish-black, papillose or hispidulous, with hairs less than 0·1 mm, rounded at apex and with a minute beak not more than 0·2 mm. *In a wide variety of habitats; usually calcicole. Most of Europe, but absent from much of the north-east.* All except Az Rs (N) Sb.

Extremely variable, especially in the mountains of C. & S. Europe, but only two subspecies can be at present usefully recognized.

(a) Subsp. **flacca** (*C. glauca* Scop. *C. diversicolor* Crantz pro parte; incl. *C. claviformis* Hoppe, *C. glauca* subsp. *claviformis* (Hoppe) Schinz & R. Keller): Female spikes usually dense, usually distinctly pedunculate and often pendent. Female glumes acute or sometimes aristate, entire, not or usually only slightly exceeding utricles, 1-veined. Utricles 2–3 mm, obovoid, rounded above, patent or erecto-patent. $2n=76, 90$. *Throughout the range of the species but absent from much of the Mediterranean region.*

(b) Subsp. **serrulata** (Biv.) W. Greuter, *Boissiera* **13**: 167 (1967) (*C. serrulata* Biv., *C. cuspidata* Host, *C. glauca* subsp. *cuspidata* (Host) Suess.): Female spikes lax, sessile or subsessile, erect. Female glumes with a denticulate arista, equalling or exceeding the utricles, 3-veined. Utricles 3–4 mm, broadly ellipsoid, rather narrowed above, erecto-patent or erect. $2n=76, 90$. *S. Europe.*

73. C. hispida Willd. in Schkuhr, *Beschr. Abbild. Riedgr.* 63 (1801). Stems 45–100 cm; basal sheaths blackish-brown, prominently fibrous. Leaves 4–8 mm wide, shorter than stems, glaucous. Male spikes (2–)3–5, 30–100 × 2·5–7 mm. Female spikes 2–5(–7), 40–120 × 7–12 mm, overlapping, dense, the upper often male above, subsessile or the lower shortly pedunculate, erect; lowest bract usually equalling or exceeding inflorescence, without or with a sheath up to 40 mm. Female glumes exceeding utricles, with a scabrid arista (rarely shorter than utricles and muticous), brown or reddish-brown, 3-veined. Utricles 4–5 mm, ovate or obovate, plano-convex, pale yellowish- or greenish-brown, often purple-spotted above, hispid-denticulate on margin with teeth *c.* 0·1 mm, often hispid-scabridulous on surface, with a parallel-sided beak 0·3–0·5 mm. $2n=38, 42$. *Ditches, marshes and shallow water. Mediterranean region, C. & S. Portugal.* Bl Co Cr Ga Gr Hs It Lu Sa Si.

Sect. PANICEAE (O. F. Lang) Christ. Rhizomes short, slender, creeping. Stems obscurely trigonous, usually smooth. Male spike solitary, cylindrical-subclavate, long-pedunculate. Female spikes cylindrical, lax, erect; lowest bract leaf-like, sheathing. Female glumes shorter than utricles, ovate, acute, with scarious margin. Utricles oblong- to obovoid-ellipsoid, membranous, glabrous, obscurely veined, usually with a short, entire to emarginate beak. Stigmas 3.

74. C. panicea L., *Sp. Pl.* 977 (1753). Stems (5–)10–50(–90) cm, smooth; basal sheaths very pale brown, usually with lamina. Leaves shorter than stems, (1–)2–4(–6) mm wide, flat, glaucous.

Male spike 10–20 × 3–4 mm. Female spikes 1–3, 10–30 × 5–6 mm, erect, the upper subsessile, the lower with peduncles 1–2 cm, usually not overlapping; lowest bract usually exceeding spike but shorter than inflorescence, with a narrow sheath (0·5–)10–15 mm. Female glumes purplish- or blackish-brown. Utricles 3–4·5 mm, obovoid-ellipsoid, slightly asymmetrical, pale greenish-brown, tinged with purplish-brown, abruptly contracted into a short, cylindrical, entire or weakly emarginate beak *c.* 0·5 mm. $2n=32$. *Marshes, heaths and damp grassland. Most of Europe, but rare in the Mediterranean region and much of the U.S.S.R.* All except Bl Cr Rs (K) Sa Sb Si Tu.

75. C. vaginata Tausch, *Flora* (*Regensb.*) **4**: 557 (1821) (*C. sparsiflora* (Wahlenb.) Steudel). Like **74** but leaves 3–5 mm wide, yellowish- to dark green; male spike 7–15 mm; female spikes 5–25 mm, the lower with peduncles 1–5 cm; lowest bract often shorter than spike, with an inflated sheath 5–30 mm; utricles up to 5 mm, less asymmetrical, gradually narrowed into a more or less emarginate beak 0·5–1 mm. $2n=32$. *Damp places in woods and on mountains. N. Europe; locally in the mountains of C. & S.W. Europe from the W. Carpathians and Sudeten Mts. to the E. Pyrenees.* Au Br Cz Fe Ga Ge He Hs Is No Po Rs (N, B, C, ?W, E) Su.

Dwarf plants from arctic Russia and other parts of N. Europe have been called subsp. **quasivaginata** (C. B. Clarke) Malyschev, *Vysok. Fl. Vost. Sajana* 90 (1965) (*C. algida* Turcz. ex V. Krecz.), but do not seem of sufficient significance to merit such recognition.

76. C. livida (Wahlenb.) Willd., *Sp. Pl.* **4**: 285 (1805). Like **74** but stems 15–30(–50) cm, often scabrid above; leaves usually equalling or exceeding the stems, canaliculate, whitish-glaucous; female spikes usually overlapping; lowest bract with a sheath 5–10(–20) mm; utricles oblong-ellipsoid, symmetrical, glaucous- to yellowish-green, more or less beakless. $2n=32$. *Peat-bogs and other very wet places. Fennoscandia and adjacent parts of N.W. Russia; N. Iceland.* Fe Is No Rs (N, C) Su.

77. C. asturica Boiss. in Boiss. & Reuter, *Pugillus* 117 (1852). Like **74** but basal sheaths dark purplish-brown, without lamina; leaves sometimes green; female spikes 5–20 mm; lowest bract with a more or less inflated sheath 5–20 mm; utricles 4–5 mm, less asymmetrical, purplish- or blackish-brown, shining, abruptly contracted into a very short, entire beak less than 0·5 mm. $2n=46$. *Subalpine pastures.* ● *Mountains of N.W. Spain and N. Portugal.* Hs Lu.

Sect. RHOMBOIDALES Kük. Caespitose or not. Stems trigonous, smooth or scabrid. Male spike solitary, cylindrical to oblong-clavate, pedunculate. Female spikes oblong to cylindrical, lax or dense, erect, distant; lowest bract leaf-like, sheathing. Female glumes ovate, acute or acuminate to mucronate, usually with a scarious margin. Utricles obovoid or obovoid-ellipsoid, membranous or subcoriaceous, glabrous or pubescent, abruptly contracted into beak. Stigmas 3.

78. C. depauperata Curtis ex With., *Arr. Brit. Pl.* ed. 2, **2**: 1049 (1787). Laxly caespitose, with short rhizomes. Stems 30–100 cm, obtusely trigonous, smooth; basal sheaths reddish- or purplish-brown, entire, without lamina. Leaves shorter than stems, 2–4 mm wide. Male spike 20–35 × 2–3 mm, cylindrical. Female spikes 2–4, 10–20 × 5–7 mm, lax, with 2–6(–10) flowers, with peduncles 1·5–8 cm; lowest bract usually equalling or exceeding inflorescence, with a sheath 10–50 mm. Female glumes *c.* ¾ as long as utricles, brown, with wide scarious margin. Utricles 7–9 mm, obovoid-ellipsoid, greyish- or greenish-brown, prominently veined, glabrous, with a long, scabrid, obliquely truncate beak 2·5–3·5 mm. $2n=44$. *Dry woods and scrub. W. & S. Europe, northwards to S. Ireland; local.* Al Be Br Bu Co Ga Ge Gr Hb He Hs It Ju Rm Rs (K) Si.

79. C. brevicollis DC. in Lam. & DC., *Fl. Fr.* ed. 3, **5**: 295 (1815). Densely caespitose and with stout rhizomes. Stems 20–60 cm, compressed-trigonous, scabrid above; basal sheaths brown, becoming fibrous. Leaves equalling or slightly shorter than stems, 3–5(–7) mm wide. Male spike 15–25 × 5–10 mm, oblong-obovoid, pedunculate. Female spikes 1–3, 15–25 × 7–10 mm, oblong to obovoid, dense, with 6–15 flowers, usually not overlapping male spike; peduncles 1·5–3(–5) cm; lowest bract about equalling spike, with a sheath 15–30 mm. Female glumes about equalling utricles, ovate-lanceolate, acuminate, orange-brown, without a scarious margin. Utricles 5–7 mm, obovoid, pale brownish-green, sparsely puberulent, often glabrescent, weakly veined, with a short, scabrid, 2-fid beak 1–1·5 mm. *Open woods, mountain grassland and dry, stony slopes. S. France, N. Spain; S.E. & E.C. Europe, southwards to C. Bulgaria.* Bu Cz Ga Hs Hu Ju Rm Rs (W).

80. C. michelii Host, *Syn. Pl. Austr.* 507 (1797). Like **79** but not caespitose, with long, slender rhizomes; stems obtusely trigonous, sometimes smooth; leaves shorter than stems, 2–3 mm wide; male spike 10–20 × 5–7 mm, oblong-clavate; female spikes 1–2, 10–20 mm; female glumes pale brown; utricles often glabrous, with a beak 2–3 mm. $2n=62$, *c.* 70. *Dry grassland and scrub. From S.W. Poland and S.C. Russia southwards to C. Italy and N. Bulgaria.* Au Bu Cz Hu It Ju Po Rm Rs (C, W, K, E) [?Ga]

81. C. pilosa Scop., *Fl. Carn.* ed. 2, **2**: 226 (1772). Rhizomes long, slender. Stems 20–50 cm, erect, slender, compressed-trigonous, smooth; basal sheaths purplish- or reddish-brown, entire, without lamina. Leaves equalling or exceeding stems, 5–10 mm wide, ciliate and sparsely hairy beneath. Male spike 15–30 × 3–5 mm, oblong-clavate. Female spikes 2–3(–4), 20–40 × 4–5 mm, lax, with 7–20 flowers; peduncles 1–5 cm; lowest bract shorter than spike, with sheath 15–35 mm. Female glumes slightly shorter than utricles, pale or reddish-brown. Utricles 3·5–5 mm, obovoid, green or pale brown, with slender veins, glabrous, with a short, smooth, 2-fid beak 1–1·5 mm. $2n=44$. *Woods, usually deciduous.* ● *From C. France and the Leningrad region southwards to C. Italy and Turkey-in-Europe.* Au Bu Cz Ga Ge He Hu It Ju Po Rm Rs (B, C, W, E) Tu.

Sect. SECALINAE (O. F. Lang) Kük. Densely caespitose, without creeping rhizomes. Stems obtusely trigonous, smooth. Male spikes usually several, cylindrical-subclavate. Female spikes oblong, dense; lowest bract leaf-like, exceeding inflorescence. Female glumes shorter than utricles, ovate, acute, with wide scarious margin. Utricles lanceolate, plano-convex, coriaceous, with a narrow, serrulate wing, with slender veins, glabrous or puberulent, gradually narrowed into a long, scabrid, 2-fid beak.

82. C. hordeistichos Vill., *Hist. Pl. Dauph.* **2**: 221 (1787). Stems (5–)10–30(–50) cm; basal sheaths reddish-brown, sometimes becoming fibrous. Leaves exceeding stems, 3–5 mm wide, flat, glaucous-green. Male spikes (1–)2–3, crowded, the terminal 10–20 × 2–4 mm. Female spikes 2–4, 20–40 × 8–10 mm, the upper subsessile and crowded but remote from the male, the lowest often distant and with a peduncle 1–3 cm; lowest bract with a sheath 10–25 mm. Female glumes pale greenish-brown. Utricles 8–12 mm, in distinct vertical rows, pale yellowish- or orange-brown, sparsely scabrid-puberulent on surface. *Damp places. S.E. & E.C. Europe, northwards to C. Czechoslovakia; W. & W.C. Europe, from C. Germany to S. Spain; very local over*

most of its range. Au Bu ?Co Cz Ga Ge Hs Hu Ju Rm Rs (C, W, K, E).

83. C. secalina Willd. ex Wahlenb., *Kungl. Svenska Vet.-Akad. Handl.* nov. ser., **24**: 151 (1803). Like **82** but stems slender; leaves 2–3(–4) mm wide, female spikes 2–5, 10–30 × 5–8 mm, all more or less distant, with peduncles up to 5 cm; lowest bract with a sheath up to 40 mm; utricles 5–7 mm, not in distinct rows, smooth except for margins and beak, glabrous. *Damp, usually saline places. C. & E. Europe, from C. Germany to S.E. Russia.* Au Cz Ge Hu Po Rm Rs (W, E).

Sect. ELATAE Kük. Caespitose, with short creeping rhizomes. Stems trigonous, smooth or slightly scabrid. Male spikes 1–several, cylindrical. Female spikes oblong to cylindrical, more or less dense; lowest bract leaf-like, sheathing. Female glumes ovate-lanceolate, acuminate or aristate. Utricles obovoid-ellipsoid, membranous, glabrous, prominently veined, suberect to erecto-patent, with a 2-fid beak. Stigmas 3.

84. C. laevigata Sm., *Trans. Linn. Soc. London* **5**: 272 (1800) (*C. helodes* auct., non Link). Stems (30–)50–120 cm, erect, stout, sharply trigonous, usually slightly scabrid above; basal sheaths pale brown, entire, without lamina. Leaves *c.* ½ as long as stems, (4–)6–12 mm wide, keeled, pale green; apex of inner side of sheath with a rounded projection; ligule 7–15 mm. Male spike 1(–3), 20–60 × 2–3 mm. Female spikes (2–)3–4, 20–60 × 6–8 mm, distant, the lower suberect or pendent, with peduncles 3–15 cm; lowest bract exceeding spike but shorter than inflorescence, with a sheath 20–120 mm. Female glumes slightly shorter than utricles, acuminate, greenish- or reddish-brown. Utricles 4–5·5 mm, pale greenish-brown, gradually narrowed into a scabrid beak 1–1·5 mm. $2n=72$. *Damp, usually shady places.* ● *W. Europe, northwards to Scotland; S. Bulgaria.* Be Br Bu Co Ga Ge Hb Ho Hs Lu.

Plants from S. Spain with leaves not more than 4 mm wide resemble **88** in general appearance, but can be distinguished chiefly by the long ligule.

85. C. camposii Boiss. & Reuter, *Pugillus* 117 (1852). Like **84** but more densely caespitose; stems smooth; apex of inner side of leaf-sheath usually truncate, the ligule sometimes shorter; female spikes 5–7 mm wide, erect, their peduncles not or scarcely exceeding the bract-sheath; female glumes dark purplish-brown; utricles 3–3·5 mm, usually dark brown, abruptly contracted into a usually scabrid beak *c.* 1 mm. $2n=68$. *Flushes and streamsides.* ● *Mountains of S.E. Portugal and S. Spain.* Hs Lu.

86. C. hochstetterana Gay ex Seub., *Fl. Azor.* 22 (1844). Stems 50–100 cm, erect, slender, obtusely trigonous, smooth; basal sheaths blackish-brown, entire, without lamina. Leaves shorter than stems, 2–4 mm wide, flat, pale green; ligule less than 1 mm. Male spikes 1–4, 20–50 × 2–4 mm, contiguous. Female spikes 3–5, (15–)30–60 × 4–5 mm, usually male at apex, at least the lower distant, usually pendent, with filiform peduncles 1–3(–6) cm; lowest bract usually shorter than to exceeding inflorescence, with a sheath 15–30 mm. Female glumes equalling utricles, aristate, greenish- or pale reddish-brown. Utricles 4–5 mm, pale brown, gradually narrowed into a scabrid beak *c.* 1 mm. *Grassy places.* ● *Açores.* Az.

Sect. SPIROSTACHYAE (Drejer) L. H. Bailey. Caespitose, sometimes with short creeping rhizomes. Stems obtusely trigonous. Male spike usually solitary, subcylindrical, sessile or pedunculate. Female spikes cylindrical to ovoid, dense, erect to pendent; lowest bract leaf-like. Female glumes shorter than utricles, usually obtuse and mucronate. Utricles ovoid-ellipsoid, usually prominently veined and speckled with brown or reddish-brown, with an emarginate to 2-fid beak. Stigmas 3.

87. C. binervis Sm., *Trans. Linn. Soc. London* **5**: 268 (1800). Caespitose, with short creeping rhizomes. Stems (15–)30–150(–200) cm, smooth or scabrid above; basal sheaths orange-brown, entire. Leaves *c.* ½ as long as stems, 3–6 mm wide, keeled, dark green; ligule 1–2 mm. Male spike solitary, 20–55 × 3–4 mm. Female spikes 2–4(–6), 15–45 × 5–8 mm, distant, the lower usually pendent, with filiform peduncles 1–15 cm; lowest bract exceeding spike but shorter than inflorescence, with a sheath 10–70 mm. Female glumes dark reddish- or purplish-brown. Utricles 3·5–5 mm, blackish- or purplish-brown, or green, prominently veined, more or less abruptly contracted into a scabrid, 2-fid beak 1–1·5 mm. $2n=74$. *Grassland, moorland and rocky places; calcifuge. W. Europe, northwards to c. 64°N. in Norway, but absent from E. France and the W. part of the Mediterranean region.* Be Br Fa Ga Ge Hb Hs Lu No. (*N.W. Africa.*)

88. C. distans L., *Syst. Nat.* ed. 10, **2**: 1263 (1759). Densely caespitose. Stems (10–)25–60(–100) cm, smooth; basal sheaths pale to dark brown, entire. Leaves *c.* ½ as long as stems, 2–6 mm wide, flat, dull or greyish-green; ligule 2–3 mm. Male spike 1(–2), 15–40 × 2–4 mm. Female spikes 2–3(–4), 10–30 × 5–8 mm, distant, erect, the lower with peduncles 1–4 cm; lowest bract exceeding spike but shorter than inflorescence, erect, with a sheath 10–35 mm. Female glumes pale brown or pale reddish-brown. Utricles (3–)4–5 mm, ascending, pale greenish-brown, not shining, prominently veined, abruptly contracted into a usually scabrid, 2-fid beak 0·75–1 mm. $2n=72, 74$. *Damp places. Most of Europe except the north-east and extreme north.* All except ?Az Fa Is Rs (N) Sb.

Extremely variable, especially in S. Europe.

89. C. cretica Gradstein & Kern, *Acta Bot. Neerl.* **17**: 242 (1968). Like **88** but less densely caespitose; stems 15–30 cm; leaves 1·5–2·5 mm wide, pale green; male spike 10–15 × 2–3 mm; female spikes 7–15 × 3–4 mm, the lower with peduncles 0·5–1(–3) cm; lowest bract sometimes equalling or exceeding inflorescence; female glumes mostly scarious; utricles 2·5–3 mm, veinless, with a beak 0·5–0·75 mm. *Damp places.* ● *W. Kriti.* Cr.

90. C. punctata Gaudin, *Agrost. Helv.* **2**: 152 (1811). Like **88** but less densely caespitose, with short rhizomes; leaves 4–8 mm wide, bright green; male spike 10–30 × 2–3 mm; female spikes 7–25 × 5–7 mm, cylindrical or oblong; lowest bract almost as long as or exceeding inflorescence; female glumes sometimes mostly scarious except for green midrib; utricles 3–4 mm, slightly inflated, more or less patent, shining, with slender veins, with a usually smooth beak. $2n=68$. *Damp, grassy or rocky places, usually near the sea. W. & S. Europe, extending locally north-eastwards to S.W. Sweden, N. Poland and S.E. Austria.* Au Az Br Bu Co Cr Ga Ge Gr Hb He Ho Hs It Ju Lu No Po Sa Si Su Tu.

91. C. diluta Bieb., *Fl. Taur.-Cauc.* **2**: 388 (1808) (incl. *C. aspratilis* V. Krecz., *C. karelinii* Meinsh.). Like **88** but stems 5–50 cm; leaves sometimes green or yellowish-green; male spike 10–25(–30) mm; female spikes 8–20(–30) mm, the upper 2–3 usually approximate; lowest bract usually equalling or exceeding inflorescence; utricles 3–4·5 mm, with a usually smooth, emarginate or weakly 2-fid, sometimes wide beak *c.* 0·5 mm. *Saline meadows and streamsides. C. & S. parts of U.S.S.R.* Rs (C, W, ?K, E).

92. C. extensa Good., *Trans. Linn. Soc. London* **2**: 175 (1794). Densely caespitose. Stems 3–75 cm, rigid, smooth; basal sheaths blackish-brown, becoming slightly fibrous. Leaves about as long as stems, 1–3 mm wide, canaliculate or the margins inrolled, glaucous or greyish-green. Male spike 1(–3), 5–25 × 2–3 mm. Female spikes 2–4, 5–15(–20) × 4–6 mm, erect, overlapping or the lowest remote, with peduncles 0·3–1 cm; lowest bract greatly exceeding inflorescence, patent, with a sheath 3–10 mm. Female glumes reddish-brown. Utricles 2·5–4 mm, ascending, greyish- or greenish-brown, often reddish-spotted, not shining, prominently veined, gradually narrowed into a smooth, emarginate beak 0·5–0·75 mm. $2n = 60$. *Salt-marshes and maritime rocks. Coasts of Europe northwards to c.* 61° *N. in Sweden.* All except Au Cz Fa He Hu Is Rs (N, C, E) Sb Tu.

93. C. mairii Cosson & Germ., *Obs. Pl. Crit.* 18 (1840) (incl. *C. loscosii* Lange, *C. winkleri* Lange). Densely caespitose. Stems 20–80 cm, scabrid at apex; basal sheaths brown, becoming slightly fibrous. Leaves *c.* ½ as long as stems, 2·5–5(–7) mm wide, flat, pale green. Male spike solitary, 10–30 × 2–4 mm. Female spikes 2–3(–5), 7–10(–15) × 5–7 mm, erect, all more or less approximate to the male or the lowest separated from the rest by not more than 1(–2) times its own length, with peduncles 0·5–1 cm; lowest bract exceeding spike and often inflorescence, patent, with a sheath 3–10 mm. Female glumes pale reddish-brown. Utricles 3–4 mm, patent, pale greenish-brown, shining, with slender veins, abruptly contracted into a 2-fid beak 0·5–1 mm which is strongly aculeolate with patent pricklets. $2n = 68$, 70. *Damp meadows and streamsides. Spain and France, just extending to N.W. Italy.* Ga Hs It. (*N.W. Africa.*)

Sect. CERATOCYSTIS Dumort. (Sect. *Flavae* (O. F. Lang) Christ). Like Sect. *Spirostachyae* but female spikes ovoid to oblong, erect; lowest bracts sometimes glumaceous; female glumes ovate, acute to subobtuse, not mucronate; utricles not speckled, sometimes ovate and plano-convex.

94. C. hostiana DC., *Cat. Pl. Horti Monsp.* 88 (1813) (*C. hornschuchiana* Hoppe). Very laxly caespitose, with short rhizomes. Stems 15–50(–80) cm, smooth or slightly scabrid at apex; basal sheaths pale brown, fibrous. Leaves *c.* ½ as long as stems, 2–5 mm wide, pale green, flat. Male spike 1(–2), 10–30 × 2–3 mm, pedunculate. Female spikes 1–3(–5), 7–20 × 5–8 mm, obovoid to oblong, distant and not overlapping, with peduncles 0·7–5 cm; lowest bract exceeding spike but shorter than inflorescence, with a sheath 7–40 mm. Female glumes reddish-brown, with prominent scarious margin. Utricles 3–4(–5) mm, obovoid, ascending or almost patent, green, prominently veined, not shining, abruptly contracted into a scabrid, 2-fid beak 0·75–1·5 mm. $2n = 56$. *Damp grassland and wet heaths. Much of Europe, but absent from most of the east and rare in the Mediterranean region.* Au Be Br Bu Cz Da Fa Fe Ga Ge Gr Hb He Ho Hs Hu It Ju No Po Rm Rs (B, C, W) Su.

Sterile hybrids are frequent between **94** and other members of the section, especially with **98** (*C.* × *fulva* Good.) and with **101.**

95. C. durieui Steudel, *Nomencl. Bot.* ed. 2, **1**: 289 (1840). Caespitose, with very short rhizomes. Stems 20–70 cm, smooth; basal sheaths brown. Leaves shorter than stems, 0·5–1 mm wide, canaliculate, greyish-green. Male spike solitary, 15–20 × 2–3 mm, shortly pedunculate. Female spikes 1(–2), 7–10 × 5–8 mm, ovoid-globose, overlapping the male, subsessile; lowest bract glumaceous, or setaceous and about equalling spike. Female glumes reddish-brown, with narrow scarious margin. Utricles 6–7 mm, ovate, plano-convex, patent or ascending, yellowish-green, scarcely shining, obscurely veined, narrowly winged, gradually or abruptly narrowed into a scabrid, 2-fid beak *c.* 2 mm. $2n = 52$. *Damp grassland.* ● *N.W. Spain, N.W. Portugal.* Hs Lu.

(96–102). C. flava group. More or less caespitose, with short rhizomes. Stems smooth; basal sheaths pale greyish- or yellowish-brown. Male spike solitary, 5–20 × 1–3 mm. Female spikes 2–4(–5), ovoid, the lower shortly pedunculate; lowest bract leaf-like, with a sheath 1–25 mm. Female glumes yellowish- to reddish-brown, often with a narrow scarious margin. Utricles with a smooth or slightly scabrid, 2-fid or emarginate beak.

An extremely critical group, in need of experimental study throughout its range. Only the more distinctive of the many described taxa are recognized here, and all show a great deal of variation; at least partially fertile hybrids occur between most of the species, but it is not known how much of the variation is attributable to this. Although the group has been studied in some detail in Fennoscandia and the British Isles, it remains difficult to name satisfactorily many plants from both areas, and little is known about the variation in the mountains of C. & S. Europe. (See especially E. W. Davies, *Watsonia* **3**: 66–84 (1953); 129–137 (1955); A. Palmgren, *Fl. Fenn.* **2**: 1–165 (1959); E. Patzke & D. Podlech, *Decheniana* **113**: 265–273 (1960); L. Fagerström, *Acta Soc. Fauna Fl. Fenn.* **79 (3)**: 1–14 (1967).)

1 Beak of utricle deflexed or curved, usually at least ½ as long as the usually ± curved body
2 Utricles 5–7 mm; male spike usually subsessile; leaves up to 7 mm wide **96. flava**
2 Utricles 1·5–5 mm; male spike usually pedunculate; leaves not more than 4 mm wide
3 Leaves from ⅔ as long as to equalling stems; utricles gradually narrowed into beak **97. jemtlandica**
3 Leaves *c.* ½ as long as stems; utricles abruptly contracted into beak
4 Stems usually more than 15 cm; utricles (3–)3·5–5 mm, with beak 1·5–2 mm **98. lepidocarpa**
4 Stems not more than 15 cm; utricles 1·5–3(–3·5) mm, with beak 0·5–1·5 mm **99. nevadensis**
1 Beak of utricle neither deflexed nor curved, usually less than ½ as long as the ± straight body
5 Male spike usually sessile; utricles abruptly contracted into beak **102. serotina**
5 Male spike usually pedunculate; utricles gradually narrowed into beak
6 Utricles 1·75–2 mm **102. serotina**
6 Utricles 3–4 mm
7 Stems erect; leaves 1–3·5 mm wide; utricles usually not more than 3·5 mm **100. bergrothii**
7 Stems ascending; some leaves usually more than (3–)3·5 mm wide; utricles usually more than 3·5 mm **101. demissa**

96. C. flava L., *Sp. Pl.* 975 (1753) (incl. *C. flavella* V. Krecz.). Stems (10–)20–50(–90) cm, erect. Leaves about equalling or slightly shorter than stems, 3–7 mm wide, yellowish-green, flat. Male spikes usually subsessile, sometimes with a peduncle up to 20 mm. Female spikes 10–15 × 10–12 mm, crowded, the lowest usually somewhat remote; lowest bract greatly exceeding inflorescence, patent or deflexed. Utricles 5–7 mm, broadly ellipsoid, yellowish-green to yellow, prominently veined, the central ones patent, the lower deflexed, all curved and gradually narrowed into a curved beak 1·5–2·5 mm usually comprising at least ⅓ of the length of the utricle. $2n = 30$, 33, 60, 64. *Wet woods, fens and marshes; usually calcicole. Most of Europe, but absent from much of the Mediterranean region.* All except Az Bl Cr Gr ?Hb Sa Si Sb Tu.

97. C. jemtlandica (Palmgren) Palmgren, *Mem. Soc. Fauna Fl. Fenn.* **13**: 126 (1938). Stems (15–)20–50 cm, erect. Leaves

from ⅔ as long as to equalling stems, 2–4 mm wide, dark green, flat. Peduncle of male spike almost absent or up to 10 mm. Female spikes 7–12 × 7–10 mm, the upper crowded or at least overlapping, the lowest sometimes remote; lowest bract exceeding inflorescence, patent or deflexed. Utricles 3·5–5 mm, broadly ellipsoid, greenish-yellow, prominently veined, the central ones patent, the lower deflexed, curved, gradually narrowed into a curved beak 1–2 mm usually comprising at least ⅓ of the length of the utricle. *Fens.* ● *Fennoscandia and Baltic region.* Fe ?He No Rs (N, B) Su.

98. C. lepidocarpa Tausch, *Flora* (*Regensb.*) **17**: 179 (1834) (*C. flava* subsp. *lepidocarpa* (Tausch) Nyman). Stems (10–)20–35(–75) cm, erect. Leaves *c.* ½ as long as stems, 2–3(–4) mm wide, green or yellowish-green, flat. Peduncle of male spike 5–30 mm. Female spikes 6–13 × 6–8 mm, the upper often overlapping, the lower usually somewhat remote; lowest bract equalling or exceeding inflorescence, patent or deflexed. Utricles (3–)3·5–5 mm, obovoid-ellipsoid, greenish- or brownish-yellow, prominently veined, the central ones patent, the lower deflexed, all curved and rather abruptly contracted into a recurved or deflexed beak 1·5–2 mm usually comprising at least ⅓ of the length of the utricle. $2n = 58, 68$. *Wet places; usually calcicole. N., N.W. & C. Europe, extending very locally southwards to N. Spain and C. Greece.* ?Al Au Be Br Bu Co Cz Da Fe Ga Ge Gr Hb He Ho Hs Hu It Ju No Po Rm Rs (N, B, C, ?W) Su.

99. C. nevadensis Boiss. & Reuter, *Pugillus* 118 (1852) (incl. *C. flava* var. *alpina* Kneucker). Stems 3–15 cm, erect. Leaves *c.* ½ as long as stems, 1·5–3 mm wide, green or yellowish-green, flat. Peduncle of male spike 3–15 mm. Female spikes 5–10 × 5–7 mm, the upper often overlapping, the lower usually somewhat remote; lower bract equalling or slightly exceeding inflorescence, patent or deflexed. Utricles 1·5–3(–3·5) mm, obovoid-ellipsoid, greenish-yellow to reddish-brown, prominently veined, the central ones patent, the lower deflexed, all slightly curved and abruptly contracted into a curved beak 1–1·5 mm comprising more than ⅓ of the length of the utricle. $2n = 68$. *Wet places.* ● *Alps; Sierra Nevada; mountains of Corse.* Au Co Ga Ge He Hs It ?Ju.

100. C. bergrothii Palmgren, *Comment. Biol.* **20 (3)**: 4 (1958). Stems 12–30 cm, erect. Leaves about equalling stems, 1–3·5 mm wide, green or yellowish-green, flat. Male spike sessile or with peduncle up to 10 mm. Female spikes 5–12 × 6–8 mm, the upper overlapping, the lowest sometimes remote; lowest bract usually exceeding inflorescence and suberect. Utricles 3–3·5(–4) mm, broadly ellipsoid and distinctly inflated, greenish- or brownish-yellow, prominently veined, the central ones patent, the lower sometimes deflexed, straight, abruptly narrowed into a straight beak *c.* 1 mm comprising less than ⅓ of the length of the utricle. *Fens and wet woods* ● *Fennoscandia and N.W. Russia.* ?Da Fe No Rs (N, B, C) Su.

101. C. demissa Hornem., *Dansk Oekon. Plantel.* ed. 3, **1**: 939 (1821) (*C. tumidicarpa* N. J. Andersson). Stems 5–20(–40) cm, ascending. Leaves at least as long as stems, 2–5 mm wide, green or yellowish-green, flat. Peduncle of male spike 3–25 mm. Female spikes 7–13 × 6–8 mm, the upper usually overlapping, the lowest often very remote; lowest bract usually greatly exceeding inflorescence, erect to deflexed. Utricles (3–)3·5–4 mm, broadly ellipsoid, usually green, prominently veined, all patent or ascending, straight, gradually narrowed into a straight beak *c.* 1 mm usually comprising less than ⅓ of the length of the utricle. $2n = 70$. *Damp places; usually calcifuge. N., W. & C. Europe, southwards to N.W. Portugal and eastwards to S. Finland.* Au Az Be Br Cz Da Fa Fe Ga Ge Hb He Ho Hs Is Lu No Po Rs (B) Su.

Plants from Açores (and Madeira), described as **C. tumidicarpa** subsp. **cedercreutzii** Fagerström, *Acta Soc. Fauna Fl. Fenn.* **79 (3)**: 3 (1967), differ from **101** chiefly in having narrower leaves 1–2(–4) mm wide, usually sessile male spikes, and narrower utricles 3–3·5 mm, more abruptly narrowed into an often slightly curved beak. Very similar plants occur in Ireland, and the relationship between these plants and **101** and **102** is uncertain.

102. C. serotina Mérat, *Nouv. Fl. Env. Paris* ed. 2, **2**: 54 (1821). Stems 2–20(–40) cm, erect or ascending. Leaves about equalling or exceeding stems, 1–3(–4) mm wide, flat or canaliculate, yellowish- to greyish-green. Male spike usually sessile. Female spikes 3–8 × 3–6 mm, crowded, the lowest sometimes remote; lowest bract greatly exceeding inflorescence, patent. Utricles 1·75–3·5 mm, obovoid, greenish-yellow to greyish-green, with slender veins, the central ones patent or ascending, the lower sometimes deflexed, straight, with a straight beak 0·25–1 mm comprising less than ⅓ of the length of the utricle. *Europe eastwards to c. 40° E. in C. Russia, but rare in the Mediterranean region; some isolated stations in S. Ural.* All except Al Bl Cr Rs (K, E) Sa Sb Tu.

(a) Subsp. **serotina** (*C. oederi* auct., non Retz., *C. flava* subsp. *oederi* Syme pro parte; incl. *C. kotilaini* Palmgren): Stems (3–)8–20(–40) cm. Leaves (1–)1·5–3(–4) mm wide, flat, yellowish-green. Female spikes 5–8 mm. Utricles (2–)2·5–3(–3·5) mm, greenish-yellow, abruptly contracted into a beak 0·5–1 mm; nut not filling utricle. $2n = 35, 68, 70$. *Wet places; somewhat calcicole. Throughout the range of the species.*

(b) Subsp. **pulchella** (Lönnr.) Van Ooststr. in Heukels & Wachter, *Bekn. Schoolfl. Nederl.* ed. 7, 319 (1949) (*C. pulchella* (Lönnr.) Lindman, non S. Berggren): Stems (2–)5–8(–18) cm. Leaves 1–2·5 mm wide, flat or canaliculate, greyish-green. Female spikes 3–5 mm. Utricles 1·75–2 mm, greyish-green, gradually narrowed into a beak less than 0·5 mm; nut filling utricle. $2n = 70$. *Maritime sands, salt-marshes and lake-shores.* ● *Coasts of N.W. Europe and the Baltic region, and inland in scattered localities in C. Europe and N.W. Russia.*

Sect. POROCYSTIS Dumort. Caespitose, without creeping rhizomes. Stems sharply trigonous, scabrid above. Male spike solitary, cylindrical. Female spikes oblong, dense, erect, usually all at about the same level or only the lowest distant; lowest bract leaf-like, usually exceeding inflorescence, not or scarcely sheathing. Female glumes shorter than utricles, ovate to lanceolate, acuminate. Utricles oblong-ellipsoid, membranous, glabrous, faintly veined, not beaked. Stigmas 3.

103. C. pallescens L., *Sp. Pl.* 977 (1753). Stems (5–)15–60(–90) cm; basal sheaths pale to dark brown, often reddish. Leaves 2–5 mm wide, shorter than the stems, usually hairy beneath. Male spike 7–12 × 1–2 mm, often exceeded by the female. Female spikes 2–3(–4), (5–)10–20(–30) × 4–6 mm, the lowest with a peduncle 5–20(–40) mm. Female glumes pale or whitish-brown, often largely scarious, with brownish midrib. Utricles 2·5–4 mm, whitish to brownish-green, shining. $2n = 62, 64, 66$. *Damp grassland and open woods. Much of Europe, but absent from parts of the south and north-east.* All except Az Bl Cr Fa Lu Sa Sb Si.

Sect. HALLERANAE (Ascherson & Graebner) Rouy. Caespitose or not. Stems obtusely trigonous. Male spike solitary, cylindrical, sessile or shortly pedunculate. Female spikes ovoid to subglobose, dense, overlapping, the lower 1–3 usually on long peduncles arising from base of stem. Female glumes usually

shorter than utricles, acute or acuminate. Utricles obovoid-trigonous, sparsely puberulent at least above, prominently veined, with an emarginate beak. Stigmas 3.

104. C. hallerana Asso, *Syn. Stirp. Arag.* 133 (1779) (*C. alpestris* All.). Densely caespitose. Stems (5–)10–40 cm, slender, scabrid above; basal sheaths brown, fibrous. Leaves shorter or longer than stems, 1–2·5 mm wide. Male spike 10–20 × *c.* 3 mm. Female spikes 1–3(–6), 8–10(–15) × *c.* 5 mm, the upper 1–3 sessile or shortly pedunculate. Female glumes brown or reddish-brown, with scarious margin. Utricles (3–)4–5 mm, greenish-brown, abruptly contracted into a very short beak. $2n=50$, 52, 54. *Dry places. S. & S.C. Europe.* Al Au Bl Bu Co Cr Cz Ga Ge Gr He Hs Hu It Ju Lu Rm Rs (K) Sa Si Tu.

105. C. rorulenta Porta, *Nuovo Gior. Bot. Ital.* **19**: 321 (1887). Like **104** but not caespitose, with long, slender rhizomes; stems 3–10(–15) cm, filiform, smooth; leaves 0·5–1 mm wide; male spike 5–6 × 1–2 mm; female spikes 1–3, 4–6 mm; utricles 3–3·5 mm, more gradually narrowed at apex into a longer beak. $2n=48$–50. *Dry, stony places.* ● *Islas Baleares.* Bl.

Sect. DIGITATAE (Fries) Christ. Caespitose, sometimes with short creeping rhizomes. Stems obtusely trigonous. Male spike solitary, linear. Female spikes linear to oblong or fusiform, lax; lowest bract up to about as long as spike, glumaceous to leaf-like, sheathing. Female glumes obovate to lanceolate, with scarious margin. Utricles obovoid to subglobose, membranous, usually more or less stipitate, puberulent or glabrous, usually veinless, with a very small or obscure beak. Stigmas 3.

106. C. digitata L., *Sp. Pl.* 975 (1753) (*C. ornithopoda* auct. balcan. pro parte, non Willd.). Caespitose, with short, ascending rhizomes. Stems 10–30(–40) cm, conspicuously lateral and leafless, decumbent to erect, smooth or weakly scabrid above; basal sheaths reddish-purple, conspicuous, becoming fibrous. Leaves shorter or longer than stems, (0·5–)2–5(–6) mm wide, flat, green or dark green. Male spike 8–15 × 1–1·5 mm, subsessile. Female spikes 2–3(–4), 10–25 × 2–3 mm, linear, very lax, the upper subsessile and exceeding the male spike, the lower with peduncles 1–2(–4) cm and overlapping the upper or distant; lowest bract glumaceous, with a sheath 3–8 mm. Female glumes about equalling utricles, obovate, obtuse or emarginate, sometimes apiculate, reddish-brown. Utricles 3–4(–4·5) mm, yellowish-brown, puberulent, veinless, abruptly contracted into an obscure, conical, subentire beak. $2n=48$, 50, 52, 54, *Woods and dry, rocky or grassy places. Most of Europe, but rare in the extreme west and most of the Mediterranean region.* Au Be Br Bu Co Cz Da Fe Ga Ge He Ho Hs Hu It Ju No Po Rm Rs (N, B, C, W, K, E) Su.

Plants from Finland, known as var. *pallens* Fristedt, showing some of the characters of **108 (b)** are probably of hybrid origin. The hybrid between **106** and **107** is frequent.

107. C. ornithopoda Willd., *Sp. Pl.* **4**: 255 (1805). Like **106** but stems 5–15(–25) cm; basal sheaths yellowish- to dark reddish-brown, becoming fibrous; leaves shorter than the stems, 1–3 mm wide, pale green; male spike 4–8 × 1–1·5 mm, sessile; female spikes 3–10(–15) × 2–3 mm, lax, the lower sessile or with peduncles up to 0·5 cm and at almost the same level as the upper; female glumes ½–⅔ as long as utricles, yellowish- to reddish- or blackish-brown; utricles 2–3 mm, yellowish to dark reddish-brown, sometimes glabrous. *Dry grassland and scrub; calcicole.* ● *Much of Europe, but absent from the south-east and much of the Mediterranean region.* Al Au Be Br Co Cz Fe Ga Ge He Hs It Ju No Po Rm Rs (N, B, C, W) Su.

(a) Subsp. **ornithopoda** (*C. pedata* auct., ?an L.): Stems up to 15(–25) cm, erect or decumbent, straight or weakly curved, smooth or scabrid above. Male spike up to 8 mm. Female spikes 2–3(–4), 5–10(–15) mm, the lower on peduncles up to 0·5 cm. Female glumes yellowish- to reddish-brown. Utricles 2·5–3 mm, puberulent. $2n=c.\ 46$, 52, 54. *Throughout most of the range of the species.*

(b) Subsp. **ornithopodioides** (Hausm.) Nyman, *Consp.* 772 (1882) (*C. ornithopodioides* Hausm.): Stems 5–10 cm, strongly curved and decumbent, smooth. Male spike not more than 6 mm. Female spikes usually 2, 3–5 mm, sessile or subsessile. Female glumes reddish-brown to blackish. Utricles 2–2·5 mm, glabrous. $2n=54$, 56. *Mountains of C. & S. Europe.*

108. C. pediformis C. A. Meyer, *Mém. Sav. Étr. Pétersb.* **1**: 219 (1831). Caespitose, sometimes forming tussocks, usually with stout rhizomes. Stems (10–)20–50(–60) cm, terminal, erect or ascending, scabrid at least above; basal sheaths reddish- or purplish-brown, fibrous. Leaves 1·5–3 mm wide, shorter or longer than stems, flat or with revolute margins, green. Male spike 5–25 × 1–4 mm, sessile or shortly pedunculate. Female spikes 2–3(–4), 15–30 × 2–4 mm, oblong-linear, lax, the upper usually exceeding the male spike, shortly pedunculate, the lower distant, with peduncles 20–50 mm; lowest bract setaceous or leaf-like, with a sheath 10–20 mm. Female glumes equalling utricles, ovate to lanceolate, acute, often mucronate, reddish-brown. Utricles 3–4 mm, obovoid-trigonous, yellowish- or brownish-green, puberulent, gradually narrowed into an obscure, conical, entire beak. *E. & E.C. Europe, southwards to S.C. Russia and Czechoslovakia and extending westwards to S.E. Norway.* ?Au Cz Fe †It No Po Rm Rs (N, B, C, W, E) Su.

1 Densely caespitose, without creeping rhizomes
(a) subsp. **pediformis**
1 Laxly caespitose, with short, creeping rhizomes
2 Male spike not reaching beyond the uppermost female spike
(b) subsp. **rhizodes**
2 Male spike reaching beyond the uppermost female spike
(c) subsp. **macroura**

(a) Subsp. **pediformis**: Densely caespitose, forming tussocks, without creeping rhizomes. Leaves shorter than stems. Male spike 5–10 × 3–4 mm, shorter than or equalling uppermost female spike. Utricles 3–3·5 mm, with prominent veins at least at base. *Steppes and dry, stony slopes. C. & E. Russia.*

(b) Subsp. **rhizodes** (Blytt) H. Lindb. fil., *Sched. Pl. Finl. Exsicc.* **1–8**: 44 (1907) (*C. rhizina* Blytt ex Lindblom): Laxly caespitose, with creeping rhizomes. Leaves equalling or exceeding stems. Male spike 5–12 × 1–2(–3) mm, shorter than or equalling uppermost female spike. Utricles 3·5–4 mm, obscurely veined. *Dry woods and scrub. Throughout the range of the species.*

(c) Subsp. **macroura** (Meinsh.) Podp., *Publ. Fac. Sci. Univ. Masaryk* **101**: 21 (1928) (*C. macroura* Meinsh.): Laxly caespitose, with short, creeping rhizomes. Leaves usually about equalling stems. Male spike 10–25 × 1–3 mm, exceeding uppermost female spike. Utricles 3–3·5 mm, obscurely veined. *Dry woods. C. & S. Ural.*

A record of subsp. (c) from W. Czechoslovakia requires confirmation.

109. C. humilis Leysser, *Fl. Halens.* 175 (1761). Caespitose, forming tussocks. Stems 2–10(–15) cm, ascending or erect, smooth; basal sheaths reddish- or purplish-brown, fibrous, persistent. Leaves greatly exceeding stems, 1–1·5(–2) mm wide, flat or canaliculate, greyish-green. Male spike 10–15(–20) × 2–4 mm, long-pedunculate. Female spikes 2–4, 5–10 × 1–2 mm,

fusiform, with 2–4 flowers, distant and not overlapping, with peduncles 2–8 mm; lowest bract glumaceous, with a sheath 3–8 mm. Female glumes about equalling utricles, obovate, obtuse or mucronate, reddish-brown. Utricles 2·5–3 mm, greenish- or yellowish-brown, often reddish at apex, puberulent, obscurely veined, abruptly contracted into a minute, entire beak. $2n=36$, 38. *Dry places. Europe, from S. England, N. Poland and C. Russia southwards, but rare in the Mediterranean region.* Al Au Be Br Bu Co Cz Ga Ge Gr He Hs Hu It Ju Po Rm Rs (C, W, K, E).

110. C. glacialis Mackenzie, *Bull. Torrey Bot. Club* **37**: 244 (1910). Densely caespitose, with short, creeping rhizomes. Stems 3–15(–20) cm, suberect, smooth; basal sheaths reddish-brown. Leaves much shorter than stems, 0·5–1(–1·5) mm wide, plicate or canaliculate, pale green, often curled towards apex. Male spike 4–8 × 0·5–1 mm wide, subsessile. Female spikes 1–3, 4–8 × 2–3 mm, oblong, lax, subsessile or with peduncles up to 5 mm, overlapping, the upper not overtopping the male spike; lowest bract setaceous, with a sheath *c.* 1 mm. Female glumes ½–¾ as long as utricles, subglobose, obtuse to subacute, dark reddish- or purplish-brown. Utricles 2–2·5 mm, not stipitate, brownish-green, veinless, abruptly contracted at apex into a very short, cylindrical beak with a scarious apex. $2n=34$. *Dry, stony, exposed places; calcicole. N. Europe, southwards to* 59° 30′ *N. in Norway and C. Ural.* Fe Is No Rs (N, C) Su.

Sect. MITRATAE Kük. Caespitose, often with creeping rhizomes. Stems trigonous, usually scabrid above. Male spike usually solitary, sessile or shortly pedunculate. Female spikes ovoid to oblong, dense; lowest bract glumaceous to leaf-like, sheathing. Female glumes ovate-lanceolate to obovate, obtuse to acuminate, usually with a scarious margin. Utricles obovoid, membranous, more or less puberulent, with a usually short, emarginate beak. Stigmas 3.

111. C. caryophyllea Latourr., *Chlor. Lugd.* 27 (1785) (*C. praecox* Jacq., non Schreber, *C. verna* Chaix, non Lam.; incl. *C. ruthenica* V. Krecz.). Laxly caespitose, with short, creeping rhizomes. Stems 3–30(–50) cm, obtusely trigonous, usually scabrid above; basal sheaths pale to dark brown, becoming fibrous. Leaves 1·5–3 mm wide, usually shorter than stems, green or greyish-green. Male spike solitary, 10–15(–30) × 2–3 mm. Female spikes 1–2(–3), 5–15 × 3–5 mm, with peduncles 3–5 (–10) mm, overlapping; lowest bract glumaceous or setiform, usually shorter than spike (rarely leaf-like and longer), with a sheath 3–5 mm. Female glumes equalling utricles, ovate, obtuse to acute or acuminate, reddish- to yellowish-brown. Utricles 2–3 mm, brown or greenish-brown, sparsely puberulent, more of less veinless, narrowed at apex into a short, conical, often obscure, emarginate beak. $2n=62$, 64, 66, 68. *Dry, grassy or stony places. Europe, northwards to* 63° *N. in Sweden.* All except Az Bl Cr Fa Is Rs (N) Sb.

112. C. umbrosa Host, *Gram. Austr.* **1**: 52 (1801) (*C. polyrrhiza* Wallr.). Densely caespitose, without creeping rhizomes. Stems 5–45 cm, obtusely trigonous, usually scabrid above; basal sheaths pale to blackish-brown, fibrous. Leaves 1·5–3·5 mm wide, up to about as long as stems, pale green. Male spike 1(–2), 5–15 × 3–5 mm. Female spikes 1–3, 5–12(–20) × 4–5 mm, at least the lowest with peduncle 5–10 mm, usually overlapping; lowest bract setiform or leaf-like, usually about as long as the spike, with a sheath 5–10 mm. Female glumes shorter than utricles, obovate to ovate-lanceolate, obtuse or acute, usually mucronate, reddish- or orange-brown. Utricles 2·5–4 mm, whitish- or yellowish-green, more or less puberulent, rarely glabrescent, usually obscurely veined, abruptly contracted into a usually short, conical, slightly emarginate beak. *From Belgium and C. Poland southwards to N. Spain, C. Italy and S.W. Bulgaria; Ural.* Au Be Bu Cz Ga Ge He Hs Hu It Ju Po Rm Rs (N, C, W) Sa.

1 Leaves less than half as long as the stems, more or less appressed to the ground in a rosette (b) subsp. **huetiana**
1 Leaves at least half as long as the stems, erect or suberect
2 Stems ±scabrid above; female spikes overlapping; utricles 2·5–3 mm (a) subsp. **umbrosa**
2 Stems smooth; female spikes not overlapping; utricles 3–4 mm (c) subsp. **sabynensis**

(a) Subsp. **umbrosa**: Stems 15–45 cm, more or less scabrid above. Leaves about as long as stems, erect. Male spike 10–15 × *c.* 5 mm, subsessile. Female spikes up to 12(–20) mm, overlapping. Female glumes obovate, mucronate. Utricles 2·5–3 mm, obscurely veined, with short, conical, slightly emarginate beak. $2n=62$, 66. *Woods and other shady places.* ● *Throughout the range of the species except Ural.*

(b) Subsp. **huetiana** (Boiss.) Soó, *Acta Bot, Acad. Sci. Hung.* **16**: 371 (1970) (*C. mixta* Miégeville): Stems 5–15(–20) cm, smooth. Leaves less than half as long as stems, more or less appressed to the ground in a rosette. Male spike 5–10 × *c.* 3 mm, subsessile. Female spikes 5–8 mm, overlapping. Female glumes ovate-lanceolate, obtuse to acute, not or scarcely mucronate. Utricles 2·5–3 mm, obscurely veined, with long, slightly emarginate beak. *Damp, stony or grassy slopes. Pyrenees and mountains of Balkan peninsula.*

(c) Subsp. **sabynensis** (Less. ex Kunth) Kük. in Engler, *Pflanzenreich* **38 (IV. 20)** (*Cyper.-Caric.*): 468 (1909) (*C. sabynensis* Less. ex Kunth): Stems 15–30 cm, very slender, smooth. Leaves at least half as long as stems, suberect. Male spike 5–10 × *c.* 3 mm, pedunculate. Female spikes 5–8 mm, not overlapping. Female glumes ovate-lanceolate, acute, not or scarcely mucronate. Utricles 3–4 mm, distinctly veined, with long, 2-fid beak. *Mountain woods, bogs and tundra. Ural.* (*Caucasian region and Anatolia.*)

113. C. depressa Link in Schrader, *Jour. für die Bot.* **1799 (2)**: 309 (1800). Densely caespitose, with very short rhizomes. Stems 5–20(–50) cm, obtusely trigonous, often scabrid at apex; basal sheaths brown or reddish-brown, fibrous. Leaves 1–4 mm wide, shorter or longer than stems, pale green. Male spike solitary, 5–10 × 1·5–2 mm. Female spikes (1–)2–3(–4), 10–20 × 4–7 mm, the upper shortly pedunculate and often overlapping, the lower with long peduncles arising from base of stem; lowest bract leaf-like, usually exceeding inflorescence. Female glumes exceeding utricles, ovate-lanceolate to obovate, acuminate, mucronate or aristate, pale to reddish-brown. Utricles 2–4 mm, greenish-brown, puberulent, more or less veined, gradually narrowed into an obscure, conical, weakly emarginate beak. *Woods and dry grassland. S.W. Europe; Carpathians; very local in S.E. Europe.* ?Bl Co Cz Ga Hs It Ju Lu Po Rm Rs (W, K) Tu.

(a) Subsp. **depressa** (incl. *C. basilaris* Jordan): Stems scabrid above. Leaves rather rigid. Upper female spikes usually not overlapping; usually 2 or more female spikes arising from base of stem. Female glumes greatly exceeding utricles, acuminate. Utricles obscurely veined. *S.W. Europe.*

(b) Subsp. **transsilvanica** (Schur) Egorova, *Nov. Syst. Pl. Vasc. (Leningrad)* **9**: 80 (1972) (*C. transsilvanica* Schur; incl. *C. euxina* (Woronow & Marc.) V. Krecz.): Stems smooth. Leaves flaccid. Upper female spikes overlapping; usually only a solitary female spike arising from base of stem. Female glumes only slightly exceeding utricles, mucronate or shortly aristate. Utricles with distinct but slender veins. *Carpathians and S.E. Europe.*

Sect. GYNOBASIDAE Trabut. Caespitose, and with creeping rhizomes. Stems trigonous, scabrid above. Spikes with male flowers in a linear cluster at apex and laxly arranged female flowers on a more or less zigzag axis below; at least the lowest spike long-pedunculate and arising from base of stem; lowest bract leaf-like, exceeding inflorescence. Female glumes ovate, usually aristate. Utricles ellipsoid to obovoid-ellipsoid, subcoriaceous, glabrous, gradually narrowed at apex into an obscure, conical, entire beak. Stigmas 3.

114. C. oedipostyla Duval-Jouve, *Bull. Soc. Bot. Fr.* **17**: lxx (1870) (*C. ambigua* Link, non Moench). Caespitose, with very short creeping rhizomes. Stems 5–25 cm; basal sheaths brown. Leaves exceeding stems, 1·5–2 mm wide, pale green. Spikes 2–3, 7–15 mm, each with 3–5 male and 2–4 remote female flowers, the lateral spike or spikes arising from base of stem. Female glumes exceeding utricles, long-aristate, green, with wide scarious margin. Utricles 3–4·5 mm, obovoid-ellipsoid, pale green, prominently veined. *Dry places. S.W. Europe.* Bl Ga Hs Lu Sa.

115. C. illegitima Cesati in Friedrichsthal, *Reise* 271 (1838). Caespitose and with long, stout, creeping rhizomes. Stems 15–40 cm; basal sheaths blackish-brown, prominent and persistent. Leaves 1–3 mm wide, exceeding stems, glaucous-green. Spikes 2–5, 15–30 mm, each with 5–15 male and 1–6 overlapping female flowers, the upper spikes overlapping, subsessile, the lower arising from base of stem. Female glumes shorter than utricles, ovate, often shortly aristate, obtuse to acute, blackish-brown, without or with a very narrow scarious margin. Utricles 6–7 mm, ellipsoid, substipitate at base, pale green, obscurely veined. *Dry rocky places and scrub. W. coasts of Greece and Jugoslavia; Pantelleria.* Gr Ju Si. (*Anatolia.*)

Sect. ACROCYSTIS Dumort. (Sect. *Montanae* (Fries) Christ). Caespitose or not. Stems trigonous. Male spike usually solitary, cylindrical to subclavate, usually sessile or subsessile. Female spikes globose to oblong, dense; lowest bract glumaceous to leaf-like, sometimes sheathing. Female glumes usually shorter than utricles, usually ovate to obovate. Utricles ovoid to subglobose, membranous, usually puberulent, sometimes beakless. Stigmas (2–)3.

116. C. globularis L., *Sp. Pl.* 975 (1753). Laxly caespitose and with long, slender rhizomes. Stems 20–50 cm, scabrid above; basal sheaths reddish or purplish. Leaves 1–2 mm, equalling or exceeding stems, greyish-green. Male spike solitary, 5–15(–20) × 1·5–2 mm. Female spikes 2–3, 3–5(–7) × 3–5 mm, globose to ovoid-oblong, sessile or shortly pedunculate, not overlapping; lowest bract leaf-like, exceeding spike and up to as long as inflorescence, without or with a sheath up to 2 mm. Female glumes obtuse, usually dark brown, with scarious margin. Utricles 3–3·4 mm, ovoid-trigonous, pale brownish-green, distinctly veined, densely brownish-puberulent, abruptly contracted into a short, conical beak. *Damp woods and peaty ground; somewhat calcifuge. N.E. Europe, extending westwards to S. Norway and S.E. Russia.* Fe No Po Rs (N, B, C, W, E) Su.

117. C. tomentosa L., *Mantissa* 123 (1767) (*C. filiformis* auct., non L.). Rhizomes slender, creeping. Stems (10–)20–50 cm, scabrid above; basal sheaths reddish-brown or purple, becoming fibrous. Leaves 1·5–2(–2·5) mm wide, shorter than stems, glaucous-green. Male spike 1(–2), 10–30 × *c.* 2 mm. Female spikes 1–2, 5–15(–20) × 4–5 mm, oblong to subglobose, dense, erect, sessile or shortly pedunculate, usually overlapping; lowest bract longer than spike but shorter than inflorescence, more or less patent, not or shortly sheathing. Female glumes acute or apiculate, reddish- or purplish-brown. Utricles 2–3 mm, obovoid or subglobose, pale green, veinless, densely white-puberulent, almost beakless or with an emarginate beak less than 0·2 mm. $2n=48$. *Meadows and woods; usually calcicole. From C. England and Estonia southwards to E. Spain, C. Italy and C. Greece.* ?Al Au Be Br Bu Cz Ga Ge Gr He Ho Hs Hu It Ju Po Rm Rs (B, C, W, K, E) Su Tu.

Plants from C. Italy with glaucous leaves, female spikes up to 40 mm and long-acuminate or aristate female glumes have been called *C. tomentosa* var. *lucana* N. Terracc. and may merit subspecific status.

118. C. grioletii Roemer in Schkuhr, *Beschr. Abbild. Riedgr.* **2**: 76 (1806). Like **117** but somewhat caespitose; stems 30–75 (–100) cm, scabrid more or less throughout; leaves 2–5·5 mm wide, usually equalling stems; inflorescence 10–25(–40) cm; male spike 15–60 mm; female spikes (3–)4–5(–6), 5–15 × 4–5 mm, ovoid, not overlapping, the lower long-pedunculate; lowest bract usually exceeding inflorescence, erect, with a sheath 5–35 (–100) mm; female glumes whitish or pale greenish-brown; utricles 1·5–2·5 mm, obovoid, prominently veined, usually glabrous below, with a sometimes 2-fid beak up to 0·4 mm. $2n=48$. *Usually in damp, shady places. Mediterranean region from E. Spain to Crna Gora; very local.* *Ga Hs It Jt Si. (*Caucasian region.*)

119. C. ericetorum Pollich, *Hist. Pl. Palat.* **2**: 580 (1777) (incl. *C. approximata* All.). More or less caespitose, with short creeping rhizomes. Stems 5–30(–45) cm, weakly scabrid at apex; basal sheaths dark, often purplish-brown, becoming fibrous. Leaves 2–4 mm wide, shorter or longer than stems, rigid, usually greyish-green. Male spike solitary, 10–15(–20) × 1·5–3 mm, subclavate, subsessile. Female spikes 1–3, 6–15 × *c.* 5 mm, ovoid to oblong, erect, subsessile, overlapping; lowest bract 2–3 mm, glumaceous, scarcely sheathing. Female glumes obtuse to acute, dark reddish- or purplish-brown (rarely pale brown), with wide scarious, often fimbriate margin, glabrous. Utricles 2–2·5(–3) mm, obovoid or obovoid-ellipsoid, brownish-green, veinless, densely puberulent, gradually narrowed into a short, conical beak, not scarious at apex. $2n=30$. *Dry, grassy and sandy places; usually calcicole. Most of Europe, but absent from the extreme west, the Mediterranean region and parts of the south-east.* Au Be Br Bu Cz Da Fe Ga Ge He Ho Hs Hu It Ju No Po Rm Rs (N, B, C, W, E) Su.

120. C. melanocarpa Cham. ex Trautv. in Middendorff, *Reise Nord. Öst. Sibir.* **1 (2), 1**: 21 (1856). Like **119** but stems not more than 15 cm, smooth; leaves 1·5–2·5 mm wide, shorter than stems; male spike 6–13 mm, linear, pedunculate; female spikes 3–7 × *c.* 3 mm; female glumes purplish-brown, sparsely puberulent; utricles 1·5–2 mm, dark reddish-brown, sparsely puberulent, rather abruptly contracted into beak, with scarious apex. *Stony slopes and woods. On the borders of Europe at c.* 66° 30′ *N. in N. Ural.* Rs (N). (*N. Siberia.*)

121. C. montana L., *Sp. Pl.* 975 (1753). Densely caespitose, with short, ascending or long, creeping rhizomes. Stems (5–)10–40 cm, scabrid above; basal sheaths reddish or purplish, becoming fibrous. Leaves 1·5–2 mm wide, shorter or longer than stems, pale green, persistent, sparsely hairy above but glabrescent. Male spike solitary, 10–20 × *c.* 2 mm, linear-ellipsoid. Female spikes 1–3(–4), 5–8 × 4–6 mm, ovoid, sessile, usually overlapping; lowest bract up to as long as spike (rarely longer), glumaceous or setaceous, scarcely sheathing. Female glumes ovate or obovate, obtuse, often mucronate, blackish- or dark purplish-brown, often with narrow scarious margin. Utricles 3–4·5 mm, obovoid, substipitate, greenish-brown, often

blackish above, faintly veined, densely puberulent, rounded at apex and with a minute, emarginate beak. $2n=38$. *Dry slopes, scrub and open woods. From C. England, S. Sweden and C. Russia southwards to N. Spain, Corse and S.W. Bulgaria.* Au Be Br Bu Co Cz Da †Fe Da Ga Ge He Hs Hu It Ju Po Rm Rs (B, C, W, ?E) Su.

122. C. fritschii Waisb., *Verh. Zool.-Bot. Ges. Wien* **44** (*Sitzungsber.*): 51 (1895). Like **121** but stems (20–)40–65 cm; leaves (1·5–)2–4 mm wide, glabrous; male spike 15–25 × *c.* 5 mm, subclavate; female spikes up to 12 mm; female glumes acute, brown or reddish-brown; utricles whitish-green, sometimes glabrous, more or less abruptly contracted into a short but distinct, emarginate beak. $2n=30$. *Woods and dry grassland.* ● *C. Europe.* Au Cz Ga Ge He Hu It Ju.

123. C. markgrafii Kük., *Ber. Deutsch. Bot. Ges.* **44**: 420 (1926). Like **121** but stems not more than 25 cm; basal sheaths brown; lower female spike distant, with a peduncle 10–15 mm; lowest bract leaf-like, up to as long as inflorescence; female glumes equalling utricles, lanceolate, dark brown; utricles 3·5–4 mm, prominently veined. *Calcareous mountain rocks, c.* 1700 *m.* ● *C. Albania* (*Shën Ndue, E. of Tiranë*). Al.

Further information about this species is required.

124. C. pilulifera L., *Sp. Pl.* 976 (1753). Densely caespitose. Stems 5–30(–40) cm, smooth or weakly (rarely strongly) scabrid above; basal sheaths yellowish- to reddish-brown, fibrous. Leaves 1·5–3 mm wide, shorter than stems, flat or slightly canaliculate, pale, usually greyish-green. Male spike solitary, 5–15 × *c.* 2 mm. Female spikes 2–4, 5–8 mm, globose to ovoid, sessile, overlapping or the lowest remote; lowest bract usually exceeding spike, leaf-like, usually patent, not sheathing. Female glumes acute or acuminate, dark, usually reddish-brown, with narrow scarious margin. Utricles 1·5–3·5 mm, obovoid, greyish-green, sparsely to densely puberulent, more or less veinless, abruptly contracted into an emarginate, usually conical beak not more than 0·5 mm. ● *Europe eastwards to the Leningrad region and the E. Carpathians; a few stations in C. Russia.* Au Az Be Br Co Cz Da Fa Fe Ga Ge Hb He Ho Hs Hu Is It Ju Lu No Po Rm Rs (B, C, W) Su.

(a) Subsp. **pilulifera**: Lowest bract usually shorter than inflorescence. Male spike up to 15 mm. Female spikes *c.* 5 mm wide. Utricles obovoid. Stigmas 3. $2n=18$. *Dry places; calcifuge. Throughout the range of the species except Açores.*

(b) Subsp. **azorica** (Gay) Franco & Rocha Afonso, *Bot. Jour. Linn. Soc.* **76**: 366 (1978) (*C. azorica* Gay): Lowest bract usually exceeding inflorescence. Male spike not more than 8 mm. Female spikes *c.* 3 mm wide. Utricles biconvex. Stigmas 2. *Damp, grassy places above* 600 *m.* ● *Açores.*

125. C. tricolor Velen., *Sitz.-Ber. Böhm. Ges. Wiss.* **7**: 58 (1890). Like **124 (a)** but often with creeping rhizomes; male spike *c.* 3 mm wide; lowest bract glumaceous; female glumes with wide scarious margin; utricles up to 4 mm, abruptly contracted into a more or less 2-fid, parallel-sided beak 0·75–1 mm. *Dry mountain grassland; calcifuge.* ● *Mountains of W. Bulgaria.* Bu.

126. C. amgunensis Friedrich Schmidt Petrop., *Mém. Acad. Sci. Pétersb.* ser. 7, **12 (2)**: 69 (1868). Like **124 (a)** but stems scabrid above; leaves not more than 2 mm wide, with more or less revolute margins; lowest bract often setaceous; female spikes 1–2, overlapping; female glumes pale reddish-brown, with wide scarious margin; utricles abruptly contracted into a more or less parallel-sided, sometimes 2-fid beak 0·5–1 mm. *Coniferous woods and dry, stony slopes. E. Russia.* Rs (N, C). (*N. Asia.*)

Sect. CAREYANAE Kük. Densely caespitose, without creeping rhizomes. Stems trigonous, smooth or slightly scabrid above. Male spike solitary, shortly pedunculate. Female spikes oblong-cylindrical, lax; lowest bract leaf-like, exceeding spike and sometimes inflorescence, sheathing. Female glumes equalling or shorter than utricles, ovate, aristate. Utricles obovoid-trigonous, stipitate, membranous, abruptly contracted into a short, conical, often curved, scarcely emarginate beak. Stigmas 3.

127. C. olbiensis Jordan, *Obs. Pl. Crit.* **3**: 241 (1846). Stems 20–50(–100) cm; basal sheaths purplish-black, without lamina, entire. Leaves about equalling stems, 3–8 mm wide. Male spike 10–25 × 2–3 mm. Female spikes 2–3, 10–35 × 4–6 mm, with 3–12 flowers, suberect, the upper subsessile, the lower usually distant, with peduncles 1–8 cm; lowest bract with a sheath 10–40 mm. Female glumes whitish-scarious. Utricles 4–5 mm, brownish-white, prominently veined. $2n=46$. *Dry woods. Mediterranean region, from N.E. Spain to Jugoslavia.* Co Ga Hs It Ju Si.

Sect. LAMPROCHLAENAE (Drejer) L. H. Bailey. More or less laxly caespitose and with long, slender, creeping rhizomes. Stems usually obtusely trigonous. Male spike solitary, cylindrical. Female spikes globose to oblong, more or less dense; lowest bract glumaceous or setaceous, usually shorter than spike. Female glumes oblong to ovate-orbicular, obtuse to acuminate, with scarious margin. Utricles obovoid-ellipsoid to -trigonous, subcoriaceous, glabrous, with a short, entire to 2-fid beak. Stigmas 3.

128. C. alba Scop., *Fl. Carn.* ed. 2, **2**: 216 (1772). Stems 10–25(–40) cm, smooth or weakly scabrid above; basal sheaths yellowish-brown. Leaves usually shorter than stems, 0·5–1·5 (–2) mm wide, pale green. Male spike 10–15 × 1–1·5 mm, pedunculate. Female spikes 1–3, 5–10 × 4–7 mm, ovoid to oblong, on peduncles 1–5 cm, the upper usually overtopping the male spike, the lower overlapping at least the peduncle of the upper; lowest bract with a usually somewhat inflated sheath 7–15 mm. Female glumes ½–⅔ as long as utricles, obovate, acute, whitish. Utricles 3·5–4 mm, brown or blackish-brown, prominently veined, abruptly contracted into a short, conical, smooth, entire beak with a hyaline apex. $2n=54$. *Dry woods, scrub and stony slopes. S.C. Europe, extending to the E. Pyrenees and C. Jugoslavia; N.E. Russia.* Au Cz Ga Ge He Hs Hu It Ju Po Rm Rs (N, C, W).

129. C. supina Willd. ex Wahlenb., *Kungl. Svenska Vet.-Akad. Handl.* nov. ser., **24**: 158 (1803). Stems 5–20(–30) cm, scabrid above; basal sheaths purplish-brown, becoming fibrous. Leaves 0·5–1·5 mm wide, shorter than stems, dark green. Male spike 8–13 × *c.* 2 mm, sessile or shortly pedunculate. Female spikes 1–3, 5–8 × *c.* 5 mm, ovoid or globose, with 3–10 flowers, sessile, overlapping or separated; lowest bract not sheathing. Female glumes slightly shorter than utricles, ovate-oblong, acute or acuminate, reddish-brown. Utricles 2·5–3 mm, yellowish- to reddish-brown, shining, scarcely veined, abruptly contracted into a short, cylindrical, smooth, truncate to 2-fid beak. $2n=38$. *Dry places, usually on sandy soils. C. Europe, E. Romania, S. part of U.S.S.R.* Au Cz Ge Hu It Ju Po Rm Rs (C, W, K, E).

The inflorescence is sometimes reduced to a solitary male spike with 1–2 female flowers at the base, and the plant is then difficult to distinguish from **173.**

130. C. liparocarpos Gaudin, *Étrennes Fl.* 153 (1804) (*C. nitida* Host, non Hoppe). Like **129** but stems often smooth above;

leaves 1–3 mm wide, pale green; male spike 5–20 × *c.* 2 mm, shortly pedunculate or subsessile; female spikes (1–)2–3, 5–15 × *c.* 5 mm, oblong to globose, with 5–15 flowers, the lowest with a peduncle 7–20 mm; lowest bract usually with a sheath up to 5–10(–15) mm; female glumes sometimes exceeding the utricles, obtuse to acute; utricles 3–4 mm, with distinct veins at base and a usually obscure, entire beak. *Dry, open, stony or sandy places. From N.W. France and S. Czechoslovakia southwards to N. Spain, N. Greece and Krym.* Au Bu Cz Ga Gr He Hs Hu It Ju Rm Rs (W, K, E) ?Si Tu.

(a) Subsp. **liparocarpos**: Lowest bract not sheathing or with a sheath not more than 10 mm. Female glumes shorter than the utricles, ovate-orbicular, obtuse. $2n=38$. *Throughout the range of the species.*

(b) Subsp. **bordzilowskii** (V. Krecz.) Egorova, *Nov. Syst. Pl. Vasc.* (*Leningrad*) **9**: 84 (1972) (*C. bordzilowskii* V. Krecz.): Lowest bract with a sheath up to 15 mm. Female glumes equalling or exceeding the utricles, oblong-ovate, acute. *Mountains of Krym, 1100–1300 m.* (*Caucasian region.*)

Sect. AULOCYSTIS Dumort. (Sect. *Frigidae* Christ). Caespitose or not. Stems trigonous. Terminal spike male, or female above and male below, or male above and female below, or male in the middle, usually pedunculate; lateral spikes entirely female (rarely the upper 1–2 entirely male), lax or dense; lowest bract usually leaf-like, shorter than or rarely equalling inflorescence, more or less sheathing. Female glumes shorter than or rarely equalling utricles, ovate to lanceolate, obtuse to acute or lanceolate. Utricles obovoid to linear-lanceolate, more or less compressed-trigonous to plano-convex, membranous, glabrous or hairy, with a distinct, 2-fid beak. Stigmas 3, rarely 2.

Literature: W. Dietrich, *Feddes Repert.* **75**: 1–40 (1967).

131. C. sempervirens Vill., *Hist. Pl. Dauph.* **2**: 214 (1787) (incl. subsp. *tristis* auct. eur., non (Bieb.) Kük.). Densely caespitose, usually forming tussocks, without creeping rhizomes. Stems 10–40(–60) cm, erect, slender, obscurely trigonous, usually smooth; basal sheaths yellowish- to dark reddish-brown, with lamina, often fibrous. Leaves half as long to almost as long as stems, 1–3(–4) mm wide, more or less flaccid, green. Male spikes 1(–3), 10–15 × 2–3 mm. Female spikes 2–3, 10–20 × 4–5 mm, oblong-ovoid, fairly dense, erect or the lower somewhat pendent, distant, the upper subsessile or shortly pedunculate and usually overlapping the base of the male spike, the lower with peduncles 2–8(–12) cm; lowest bract with a sheath 10–30 mm. Female glumes blackish- or reddish-brown, with scarious margin. Utricles (3·5–)4–6·5(–7·5) × 1–1·5 mm, oblong-ellipsoid, yellowish-brown to dark brown, weakly veined, glabrous or more or less scabrid-pubescent, gradually narrowed into a long, serrulate, scarious-margined 2-fid beak. Stigmas 3. $2n=30$ (31, 32), 34, 68. *Dry grassland and rocky slopes.* ● *Mountains of C. & S. Europe from the Carpathians to N. Spain, N. Appennini and Macedonia.* Al Au Bu Cz Ga Ge ?Gr He Hs It Ju Po Rm Rs (W).

Extremely variable, and perhaps divisible into several subspecies.

132. C. firma Host, *Syn. Pl. Austr.* 509 (1797). Like **131** but forming dense cushions or mats; stems 5–20(–30) cm; basal sheaths yellowish- to blackish-brown, entire, persistent; leaves less than half as long as stems, tapered from the base, rigid; male spike solitary, 5–10 × 2–3 mm; female spikes 1–3, 5–10 × 3–4 mm, ovoid, with peduncles 0·3–1(–2) cm; lowest bract with a sheath 3–5(–10) mm; utricles 3·5–4·5 × 1–1·5 mm, glabrous on surface of body. $2n=34$, 68. *Stony grassland and rocks, above 1300 m; calcicole.* ● *Alps, Carpathians, N. & C. Appennini and mountains of N.W. Jugoslavia.* Au Cz Ga Ge He It Ju Po Rm Rs (W).

133. C. kitaibeliana Degen ex Becherer, *Ber. Schweiz. Bot. Ges.* **70**: 178 (1960) (*C. laevis* Kit. ex Willd., non J. F. Gmelin). Like **131** but stems usually somewhat scabrid above; leaves often less than half as long as stems, 0·5–1 mm wide, the margins inrolled; male spike solitary, 3–4 mm wide; female spikes 1(–2), 4–15 × 3–4 mm; utricles 3·5–5 mm. $2n=36$. *Dry, grassy or rocky places; calcicole. C. Appennini; mountains of Balkan peninsula.* Al Bu Gr It Ju.

134. C. macrolepis DC., *Cat. Pl. Horti Monsp.* 89 (1813). Like **131** but stems (15–)30–75 cm, rather stout, often somewhat scabrid above; basal sheaths reddish- or blackish-brown; leaves 1·5–4 mm wide; male spike solitary, 10–20 × 3–4 mm, oblong-clavate; female spikes 1–2(–3), 10–25 × 5–7 mm, erect, approximate, with peduncles 3–7 cm; lowest bract with a sheath 3–7 mm; female glumes with wide, prominent scarious margin; utricles 5–7 × 1·5–2 mm, obovoid or ellipsoid, trigonous, dark brown, prominently veined, appressed-pubescent. $2n=36$, 37. *Dry woods and rocky pastures.* ● *Appennini; mountains of Albania and W. & S. Greece.* Al It Gr.

135. C. mucronata All., *Fl. Pedem.* **2**: 268 (1805). Densely caespitose, without creeping rhizomes. Stems 7–40 cm, erect or nodding, filiform, obscurely trigonous, smooth; basal sheaths pale, often pinkish-brown, mostly with lamina, somewhat fibrous. Leaves shorter than stems, 0·3–0·5 mm wide, canaliculate, usually circinnate towards apex. Male spike solitary, 7–12 × 1·5–3 mm. Female spikes 1–2, 5–10 × 4–5 mm, ovoid, dense, sessile, overlapping each other and base of male spike; lowest bract sometimes glumaceous, scarcely sheathing. Female glumes dark, often reddish-brown, with scarious margin. Utricles 4–5 mm, linear- to ovate-lanceolate, plano-convex, dark brown, with slender veins, sparsely puberulent, gradually narrowed into a long, scabrid, 2-fid beak. Stigmas 2. $2n=34$, 36. *Dry, rocky places; calcicole. Alps, N. & C. Appennini and mountains of N.W. Jugoslavia.* Au ?Co Ga Ge He It Ju ?Rm.

136. C. fuliginosa Schkuhr, *Beschr. Abbild. Riedgr.* 91 (1801). Caespitose, without creeping rhizomes. Stems (5–)10–30(–40) cm, erect or nodding, slender, obtusely trigonous, smooth or slightly scabrid; basal sheaths pale, often whitish-brown, rigid, with lamina, prominent and erect. Leaves usually not more than half as long as stems, 2–5 mm wide, flat. Spikes (2–)3–4(–5), 10–20(–25) × 6–8 mm, oblong-ellipsoid to clavate, dense, the terminal male at base and female above, the remainder female, usually all overlapping and nodding, with peduncles 1–5 cm; lowest bract with a sheath 5–20 mm. Female glumes dark reddish- or blackish-brown, with narrow scarious margin. Utricles 4–5·5 mm, lanceolate, flattened-trigonous, greenish-yellow to dark reddish-brown, glabrous, veinless, gradually narrowed into a scabrid, 2-fid beak. *Rock-ledges, stream-sides and wet, stony places. Arctic Europe, mountains of Norway, N. & C. Ural; Alps and Carpathians; mountains of S.W. Bulgaria.* Au Bu Cz Fe Ga Ge It Ju No Rm Rs (N, W) Sb Su.

(a) Subsp. **fuliginosa**: Leaves *c.* ½ as long as stems. Spikes 15–20(–25) mm, the terminal clavate, the remainder oblong-ellipsoid. $2n=40$. *Calcifuge.* ● *Alps, Carpathians and mountains of S.W. Bulgaria.*

(b) Subsp. **misandra** (R. Br.) Nyman, *Consp.* 771 (1882) (*C. misandra* R. Br.): Leaves ¼–½ as long as stems. Spikes 10–15 mm, all clavate. $2n=40$. *Calcicole. N. Europe.*

137. C. ferruginea Scop., *Fl. Carn.* ed. 2, **2**: 225 (1772). Laxly to densely caespitose, usually with creeping rhizomes. Stems

10–90 cm, erect, nodding, slender, obscurely trigonous, smooth; basal sheaths dark purplish-brown, without lamina, scarcely fibrous. Leaves up to as long as stems, 1–3 mm wide, flat. Male spike solitary, 12–50 × 2–3 mm. Female spikes (1–)2–4, 10–30 × 2·5–4·5 mm, cylindrical, usually lax, nodding or erect, with long filiform peduncles, the lowest 1·5–10 cm; lowest bract with a sheath 10–50 mm. Female glumes reddish- or blackish-brown, sometimes with a scarious margin. Utricles 3–7 mm, ovoid-trigonous, greenish-, reddish- or blackish-brown, glabrous or hairy, with slender veins, gradually or abruptly contracted into a short, scabrid, 2-fid beak. *Grassy and rocky places.* ● *Alps; S. Carpathians; mountains of S. Europe from N. Spain to S.W. Bulgaria.* ?Al Au Bu Ga Ge He Hs It Ju Rm.

Records of subsp. (a) from the E. Pyrenees require confirmation.

1 Creeping rhizomes present
2 Female spikes pendent; utricles 3–4 mm; male spike 12–30 mm **(a) subsp. ferruginea**
2 Female spikes erect; utricles 4·5–7 mm; male spike 30–50 mm **(c) subsp. caudata**
1 Creeping rhizomes absent
3 Female spikes pendent; utricles hairy, abruptly contracted into the beak **(b) subsp. australpina**
3 Female spikes erect; utricles glabrous or subglabrous, gradually narrowed into the beak
4 Utricles 3·5–4·5 mm; leaves not more than 1·5 mm wide; stems 30–50 cm **(e) subsp. tendae**
4 Utricles 5–6 mm; leaves at least 1·5 mm wide; stems 70–90 cm **(d) subsp. macrostachys**

(a) Subsp. **ferruginea**: Laxly caespitose, with creeping rhizomes. Stems 10–70 cm. Leaves *c.* 2 mm wide. Male spike 12–30 mm. Female spikes pendent. Female glumes without scarious margin. Utricles 3–4 mm, usually glabrous, gradually or abruptly contracted into beak. $2n = 39, 40$. *Alps; S. Carpathians; mountains of W. Jugoslavia and S.W. Bulgaria.*

(b) Subsp. **australpina** (Becherer) W. Dietr., *Feddes Repert.* **75**: 18 (1967) (*C. refracta* auct., non Willd.): Densely caespitose, without creeping rhizomes. Stems 30–70 cm. Leaves *c.* 2 mm wide. Male spike 20–40 mm. Female spikes pendent. Female glumes with scarious margin. Utricles 3·5–4·5 mm, hairy, abruptly contracted into beak. $2n = 38, 40$. *S. Alps from c.* 9° *to c.* 12° 15′ *E.*

(c) Subsp. **caudata** (Kük.) Pereda & Laínz, *Bol. Inst. Estud. Astur.* (*Ser. C*) **3**: 183 (1961): Densely caespitose, with creeping rhizomes. Stems 30–60 cm. Leaves *c.* 2 mm wide. Male spike 30–50 mm. Female spikes erect. Female glumes with scarious margin. Utricles 4·5–7 mm, glabrous, gradually narrowed into beak. 750–1300 *m. N. Spain* (*Cordillera Cantábrica*).

(d) Subsp. **macrostachys** (Bertol.) Arcangeli, *Comp. Fl. Ital.* 745 (1882): Like subsp. (c) but without creeping rhizomes; stems up to 90 cm; male spike 20–35 mm; utricles 5–6 mm, glabrous. $2n = 40$. *Alpi Apuane.*

(e) Subsp. **tendae** W. Dietr., *Feddes Repert.* **75**: 20 (1967): Like subsp. (c) but without creeping rhizomes; leaves 1–1·5 mm wide; male spike 15–30 mm; utricles 3·5–4·5 mm, glabrous. $2n = 38$. *S.W. Alps.*

138. C. brachystachys Schrank in Schrank & Moll, *Naturh. Briefe* **2**: 285 (1785) (*C. tenuis* Host.) Like **137 (b)** but stems (5–)10–40 cm, very slender; basal sheaths sometimes pale purplish-brown; leaves 0·5–1 mm wide, the margins inrolled when dry; male spike 10–22 × *c.* 2 mm, sometimes female above; at least the lower female spikes nodding; utricles ellipsoid-ovoid or -lanceolate, pale greenish or pale brown, glabrous, gradually narrowed into a smooth, 2-fid beak. $2n = 40$. *Damp, shady places; calcicole.* ● *Mountains of C. & S. Europe westwards to the C. Pyrenees, southwards to C. Appennini and C. Jugoslavia and eastwards to the S. Carpathians.* Au Cz Ga Ge He Hs It Ju Po Rm.

139. C. fimbriata Schkuhr, *Beschr. Abbild. Riedgr., Nachtr.* 61 (1806). Not or scarcely caespitose, with short, stout rhizomes. Stems 10–45 cm, erect, slender, sharply trigonous, usually scabrid above; basal sheaths purplish-brown, without lamina, entire. Leaves shorter than stems, 2·5–4 mm wide, flat, prominently keeled. Male spike usually solitary, 15–25 × 2–3 mm. Female spikes 1–3, 10–25 × 3–4 mm, cylindrical, fairly dense, erect, the upper subsessile, the lower with peduncles 1–3·5 cm; lowest bract with a sheath 5–10(–15) mm. Female glumes dark reddish- or purplish-brown, with narrow scarious margin. Utricles 3–4 mm, ovoid-ellipsoid, greenish- to dark reddish-brown, usually sparsely hairy, with slender veins, gradually narrowed into a scabrid, 2-fid beak. $2n = 42$. *Rocky or grassy places,* 1800–3050 *m.* ● *Alps, eastwards to c.* 10° *E.* Ga He It.

140. C. atrofusca Schkuhr, *Beschr. Abbild. Riedgr.* 106 (1801) (*C. ustulata* Wahlenb.). Laxly caespitose, with short rhizomes. Stems 10–40 cm, erect, nodding, rather stout, trigonous, smooth; basal sheaths yellowish-brown, without lamina, entire or slightly fibrous. Leaves not more than half as long as stems, 2–4 mm wide, flat. Male spike usually solitary, 7–12 × 3–4 mm, oblong-ovoid, often partly female. Female spikes 2–4(–6), 8–20 × 7–10 mm, ovoid, all (except sometimes the lowest) overlapping each other and the male in a secund cluster, pendent, with filiform peduncles; lower peduncles 1·5–4 cm; lowest bract shorter than spike, with a sheath 5–15(–25) mm. Female glumes purplish-black (rarely yellowish-brown) without or with an obscure scarious margin. Utricles 3·5–5 mm, broadly elliptical, flattened, purplish-black (rarely yellowish-brown), glabrous, veinless, abruptly contracted into a short, smooth or scabrid, 2-fid beak. $2n = 38, 40$. *Damp places. Alps, Carpathians, N. Ural, N. & W. Fennoscandia, Scotland.* Au Br Cz Fe Ga He It Ju No Rm Rs (N, ?W) Su.

141. C. frigida All., *Fl. Pedem.* **2**: 270 (1785). Like **140** but stems 20–50(–70) cm, often scabrid above; basal sheaths pale brown; leaves sometimes as long as stems; male spike 12–20 × 3–4 mm, cylindrical, sometimes with female flowers at base or at base and apex; female spikes 15–35 × 6–8(–10) mm, oblong-obovoid to subcylindrical, usually more or less distant, the lower suberect or nodding, with filiform peduncles (1–)2–12 cm; lowest bract usually exceeding spike, with a sheath 10–30 mm; female glumes dark reddish-brown; utricles 5–6(–7) mm, linear-ellipsoid, somewhat flattened, blackish-brown, usually scabrid on the angles, gradually narrowed into a long, usually scabrid, 2-fid beak. $2n = 56, 58$. *Streamsides and wet, mountain grassland.* ● *Mountains of S.C. & S. Europe from the Vosges to N. Spain and C. Italy; Crna Gora.* Au Co Ga Ge He Hs It Ju.

Sect. LIMOSAE (O. F. Lang) Christ. Not caespitose, with slender rhizomes. Stems trigonous. Terminal spike male, or female above and male below; lateral spikes female, sometimes with a few male flowers at the base, ovoid to oblong, pendent; lowest bract leaf-like, shorter or longer than inflorescence, sometimes sheathing. Female glumes ovate to ovate-lanceolate. Utricles ellipsoid to obovoid, more or less compressed-trigonous, membranous, glabrous, with a very short or obscure, truncate beak. Stigmas 3.

The taxonomy of the species in this section is uncertain, especially in N. Europe where **142** and **143** can be difficult to separate.

142. C. limosa L., *Sp. Pl.* 977 (1753). Rhizomes far-creeping. Stems 10–40(–60) cm, sharply trigonous, smooth or scabrid above; basal sheaths reddish- to yellowish-brown, without lamina, persistent. Leaves 1–1·5(–2) mm wide, shorter than stems, glaucous or greyish-green. Terminal spike male, 10–25 × 1–2 mm; lateral spikes 1–2(–3), (5–)10–20 × 5–7 mm, ovoid to oblong, dense, approximate, pendent, with peduncles 1–4 cm, female, with 9–20 flowers; lowest bract leaf-like, usually shorter than the inflorescence, not sheathing or with a sheath less than 5 mm. Female glumes slightly exceeding in length and at least as wide as utricles, acute or mucronate, reddish- or purplish-brown. Utricles 3·5–4·5 mm, greyish- or bluish-green, prominently veined, abruptly contracted into beak. $2n = 56$, 62, 64. *Wet bogs and peaty lake-margins. N., N.W. & C. Europe, extending locally southwards to the Pyrenees, S. Bulgaria and S.E. Russia.* Au Be Br Bu Cz Da Fe Ga Ge Hb He Ho Hs †Hu Is It Ju No Po Rm Rs (N, B, C, W, E) Su.

143. C. rariflora (Wahlenb.) Sm. in Sowerby, *Engl. Bot.* **35**: t. 2516 (1813). Like **142** but rhizomes short, ascending; stems 10–20(–40) cm, obtusely trigonous, smooth; basal sheaths often becoming fibrous; leaves 1–3 mm wide, pale green; male spike 5–10 mm; lateral spikes 5–12 × 3–4 mm, narrowly oblong, lax, on peduncles 0·5–1 cm, with 5–8 flowers; female glumes blackish- or dark purplish-brown; utricles obscurely beaked. $2n = c.$ 52, 54. *Peat-bogs and wet tundra. N. & W. Fennoscandia and N. Russia, Iceland, Scotland.* Br Fe Is No Rs (N) Su.

Hybrids are frequently formed with **144.**

144. C. magellanica Lam., *Encycl. Méth. Bot.* **3**: 385 (1789). Like **142** but rhizomes short, ascending; leaves 2–4 mm wide, often equalling the stems, pale green; terminal spike often female at apex; lateral spikes lax, with 7–13 female flowers and 1–3 male flowers at the base; lowest bract usually exceeding the inflorescence; female glumes almost twice as long as and *c.* ⅔ as wide as utricles, acuminate or aristate; utricles weakly veined. $2n = 58$. *Bogs and other wet places. N. & C. Europe; an outlying station in S.E. France (Mont Cenis).* Au Br Cz Fe Ga Ge Hb He Is It No Po Rm Rs (N, B, C, ?W) Su.

The European plant is subsp. **irrigua** (Wahlenb.) Hiitonen, *Suomen Kasvio* 161 (1933) (*C. irrigua* (Wahlenb.) Sm. ex Hoppe; incl. *C. magellanica* subsp. *planitiei* (Ascherson & Graebner) Schultze-Motel); subsp. **magellanica** occurs in South America southwards from 40°S., and differs chiefly in having the terminal spike almost always female at the apex, more male flowers in the lateral spikes and longer and wider female glumes.

145. C. laxa Wahlenb., *Kungl. Svenska Vet.-Akad. Handl.* nov. ser., **24**: 156 (1803). Like **142** but stems 20–40 cm, rather flaccid, obtusely trigonous, smooth; basal sheaths dull, pale brown; leaves flat; lateral spikes usually 2, rather lax, distant; lower bract shorter than the inflorescence, with a sheath 10–20 mm; female glumes obtuse and mucronate to subacute, reddish-brown; utricles more gradually narrowed into beak. *Wet peat-bogs. Fennoscandia, southwards to* 62° *N.* Fe No Rs (N) Su.

Sect. ATRATAE Christ. Caespitose and with creeping rhizomes. Stems sharply trigonous. Terminal spikes female above and male below, or male above and female below, or entirely male; lateral spikes female, cylindrical to ovoid-globose; lowest bract usually leaf-like, not or very shortly sheathing. Female glumes ovate to ovate-lanceolate, usually blackish. Utricles ellipsoid to broadly obovoid, subterete or biconvex, membranous, glabrous, veinless or obscurely veined at base, with a short, entire or emarginate beak, or beakless. Stigmas 3, rarely 2.

146. C. atrata L., *Sp. Pl.* 976 (1753). Caespitose, with short rhizomes. Stems (10–)20–60 cm; basal sheaths dark purplish- or blackish-brown, usually entire. Leaves shorter than or equalling stems, flat or the margins rolled outwards, pale green or glaucous. Inflorescence nodding, a lax cluster of 2–7 oblong or oblong-ellipsoid spikes 10–35 mm, the terminal female above and male below, the rest female; lowest spike with a peduncle at least half as long as itself, usually pendent; lowest bract leaf-like, usually exceeding inflorescence, erect or erecto-patent. Female glumes acute, purplish-black, often with a pale margin. Utricles 3–5 mm, broadly ovoid to obovoid, abruptly contracted into a short, emarginate beak. *Grassy or rocky places. N. Europe southwards to Wales and S. Norway; S. Ural; mountains of C. & S. Europe.* Au Br Bu Cz Fa Fe Ga Ge Gr He Hs Is It Ju No Po Rm Rs (N, C, W) Su.

1 Utricles shining, yellow or pale orange — **(c)** subsp. **caucasica**
1 Utricles dull, yellowish to black
2 Stems usually more than 30 cm, scabrid; utricles 4–5 mm — **(b)** subsp. **aterrima**
2 Stems usually less than 30 cm, smooth; utricles 3–4 mm — **(a)** subsp. **atrata**

(a) Subsp. **atrata**: Stems (10–)20–30(–50) cm, slender, rigid, smooth. Leaves 3–5(–10) mm wide. Spikes 10–20 mm. Female glumes exceeding utricles. Utricles 3–4 mm, dull greenish- or brownish-yellow, often with purplish spots or blackish-purple above, veinless. $2n = 52$, 54. *Throughout most of the range of the species except S. Ural.*

(b) Subsp. **aterrima** (Hoppe) Čelak., *Prodr. Fl. Böhm.* 67 (1867) (*C. aterrima* Hoppe; incl. *C. perfusca* V. Krecz.): Stems 30–60 cm, stout, rather flaccid, scabrid above. Leaves 5–10 mm wide. Spikes 15–35 mm. Female glumes equalling or slightly exceeding utricles. Utricles 4–5 mm, dull black or purplish-black, with greenish base, veinless. *Mountains of C. & S. Europe; S. Ural.*

(c) Subsp. **caucasica** (Steven) Kük. in Engler, *Pflanzenreich* **38 (IV. 20)** (*Cyper.-Caric.*): 400 (1909) (*C. caucasica* Steven): Like subsp. **(b)** but sometimes with supplementary spikes at base of lateral spikes; female glumes shorter than utricles; utricles 3–4 mm, shining, yellow or pale orange, obscurely veined at base. *Ural.*

Hybrids between subsp. **(a)** and **150 (a)** (*C.* × *candriana* Kneucker), are common in N. Fennoscandia.

147. C. parviflora Host, *Gram. Austr.* **1**: 64 (1801) (*C. nigra* All., non (L.) Reichard, *C. atrata* subsp. *nigra* (Gaudin) Hartman). Like **146 (a)** but stems 10–20 cm, sometimes slightly scabrid; basal sheaths sometimes yellowish-brown and becoming fibrous; leaves (1–)2–4 mm wide, sometimes exceeding the stems; inflorescence usually erect; spikes not more than 4, 5–8 mm, oblong- to globose-ovoid, erect, sessile or subsessile, approximate; terminal spike sometimes male at apex or throughout; lowest bract usually patent or deflexed; female glumes slightly shorter than the utricles; utricles 2·5–4 mm, black, or blackish-purple, usually greenish at base and paler at the margin. $2n = 54$. *Rocks, screes and alpine grassland. Mountains of C. & S. Europe, from the Carpathians to N. Spain, C. Italy and S.W. Bulgaria.* Au Bu Cz Ga Ge He Hs It Ju Po Rm.

148. C. buxbaumii Wahlenb., *Kungl. Svenska Vet.-Akad. Handl.* nov ser., **24**: 163 (1803). Laxly caespitose and with long rhizomes. Stem 15–80 cm, scabrid above; basal sheaths dark brownish- or blackish-red, becoming somewhat fibrous. Leaves shorter than stems, 2–4 mm wide, glaucous or greyish-green, the margins usually inrolled. Inflorescence lax, sometimes nodding, of 3–4(–6) spikes; terminal spike 10–25 × 5–10 mm, clavate, female above, male below; lateral spikes 10–25 × 5–10 mm, ovoid or obovoid, sessile or subsessile, distant and usually not

overlapping, female; lowest bract leaf-like, usually equalling or exceeding the inflorescence, more or less erect. Female glumes shorter than to exceeding utricles, usually asymmetrical, dark reddish-brown. Utricles 2–4·5 mm, pale green, with a minute, emarginate beak. *Fens and wet meadows. Mainly in C. & E. Europe and Fennoscandia, but extending locally westwards to Iceland, Scotland and N.W. France, and southwards to C. Italy.* Au Br Bu Cz Da Fe Ga Ge †Hb He Ho Is It Ju No Po Rm Rs (N, B, C, W, E) Su.

A detailed account of the variation of this and **149** can be found in A. J. Cajander, *Ann. Bot. Soc. Zool.-Bot. Fenn. Vanamo* **5 (5)** (1935).

(a) Subsp. **buxbaumii** (*C. polygama* Schkuhr, non J. F. Gmelin): Female glumes acuminate or aristate, equalling or exceeding utricles. Utricles 3–4·5 mm, ellipsoid, gradually narrowed into a very short beak. $2n = c.\ 74$, *c.* 100. *Throughout most of the range of the species, but less widespread in N. Europe than subsp.* (b).

(b) Subsp. **alpina** (Hartman) Liro, *Ann. Acad. Sci. Fenn. (Ser. A)* **42**: 523 (1938) (*C. adelostoma* V. Krecz.): Female glumes acute to acuminate, shorter than or rarely equalling utricles. Utricles 2–3 mm, obovoid, rounded at apex and abruptly contracted into an indistinct beak. $2n = 106$. *N. Europe, southwards to S. Norway.*

149. C. hartmanii Cajander, *Ann. Bot. Soc. Zool.-Bot. Fenn. Vanamo* **5 (5)**: 23 (1935) (*C. emasculata* V. Krecz.). Like **148 (b)** but stems less rigid and inflorescence usually nodding; leaves dark green; all spikes 15–35 × 4–7 mm, cylindrical (or sometimes the upper lateral ones ovoid), usually overlapping; lowest bract usually slightly shorter than or equalling the inflorescence; female glumes equalling or slightly exceeding utricles, acuminate or slightly aristate, symmetrical. *Wet meadows. C. Europe, extending northwards to* 61° *N. in Fennoscandia, eastwards to S. Ural and southwards to S. Jugoslavia.* Au Cz Da Fe ?Ga Ge He Ho Hu It Ju No Po Rs (B, C, W, E) Su.

The distribution, especially in the southern part of the range, is uncertain because of former confusion with **148**.

150. C. norvegica Retz., *Fl. Scand. Prodr.* 179 (1779). Caespitose, with short rhizomes. Stems 5–60 cm, smooth or slightly scabrid above; basal sheath purplish- or blackish-brown, not or scarcely fibrous. Leaves 1·5–5 mm wide. Inflorescence a dense cluster of 2–4(–5) ovate to oblong, erect, sessile or subsessile spikes 5–12 mm, the terminal female above and male below, the rest female; lowest bract leaf-like, equalling or slightly exceeding inflorescence. Female glumes acute or obtuse, purplish- or brownish-black, sometimes with a narrow scarious margin. Utricles 1·8–3·5 mm, greenish to greyish-brown, blackish at apex, with a short, flat, emarginate beak. $2n = 56$. *N. Europe southwards to* 57° *N. in Scotland; E. & E.C. Alps.* Au Br Fe ?Ga He Is It No Rs (N, C) Su.

A detailed account of the variation in this species can be found in A. Kalela, *Ann. Bot. Soc. Zool.-Bot. Fenn. Vanamo* **19 (3)** (1944).

1 Utricles 1·8–2·5 mm, abruptly contracted into beak; female glumes *c.* ¾ as long as utricles — (a) subsp. **norvegica**
1 Utricles 2·5–3·5 mm, gradually narrowed into beak; female glumes *c.* ½ as long as utricles
2 Leaves soft; lowest bract erect; utricles up to 3·5 mm — (b) subsp. **inferalpina**
2 Leaves rigid; lowest bract patent or deflexed; utricles not more than 3 mm — (c) subsp. **pusterana**

(a) Subsp. **norvegica** (*C. alpina* Liljeblad, non Schrank, *C. halleri* auct., ?an Gunnerus): Usually densely caespitose. Stems 5–40 cm. Leaves *c.* ½ as long as stems, 1·5–3 mm wide, rigid, dark green. Terminal spike of inflorescence larger than the rest; lowest bract erect. Female glumes *c.* ¾ as long as utricles. Utricles 1·8–2·5 mm, broadly ovoid or obovoid, suberect, abruptly contracted into a scabrid beak *c.* 0·25 mm. *Damp places. Almost throughout the range of the species.*

(b) Subsp. **inferalpina** (Wahlenb.) Hultén, *Lunds Univ. Årsskr.* nov. ser., **38 (1)**: 348 (1942) (incl. *C. angarae* Steudel): Laxly caespitose. Stems 20–60 cm. Leaves usually almost as long as stems, 2·5–5 mm wide, soft, dark green. Terminal spike of inflorescence larger than the rest; lowest bract erect. Female glumes *c.* ½ as long as utricles. Utricles 2·5–3·5 mm, ellipsoid, more or less patent, gradually narrowed into a usually smooth beak *c.* 0·75 mm. *Damp woods and marshy meadows. Fennoscandia and N. Russia, usually at lower altitudes than subsp.* (a).

(c) Subsp. **pusterana** (Kalela) Chater, *Bot. Jour. Linn. Soc.* **76**: 365 (1978) (*C. angarae* subsp. *pusterana* Kalela, *C. media* subsp. *pusterana* (Kalela) Schultze-Motel): Usually densely caespitose. Stems 10–40 cm. Leaves *c.* ½ as long as stems, rigid, pale green. Terminal spike of inflorescence about the same size as the rest; lowest bract patent or deflexed. Female glumes *c.* ½ as long as utricles. Utricles 2·5–3 mm, ellipsoid, more or less patent, gradually narrowed into a usually scabrid beak *c.* 0·75 mm. *Damp, stony places; calcifuge.* ● *E. Alps.*

151. C. holostoma Drejer, *Revis. Crit. Caric. Bor.* 29 (1841). Not or only laxly caespitose, with long rhizomes. Stems 10–20(–35) cm, scabrid above; basal sheaths purplish-brown, entire, without lamina. Leaves 1·5–2(–3) mm wide, equalling or shorter than stems, yellowish- or greyish-green. Inflorescence very compact; terminal spike 3–5 mm, entirely male, overtopped and concealed by the (2–)3(–4) sessile, approximate, oblong female spikes 5–10 × 2–3 mm (rarely the lowest spike somewhat distant); lowest bract setaceous, usually shorter than spike. Female glumes ½–¾ as long as utricles, acute, blackish. Utricles 1·8–2·5 mm, obovoid, green, usually becoming brownish-black at least above, rounded at apex and scarcely beaked. *Streamsides, mainly in the mountains, and wet tundra. Arctic Fennoscandia.* Fe ?Is No Rs (N) Su.

152. C. stylosa C. A. Meyer, *Mém. Sav. Étr. Pétersb.* **1**: 222 (1831). Caespitose, with short creeping rhizomes. Stems (10–)20–45 cm, scabrid above; basal sheaths dark or reddish-brown, leafless, becoming fibrous. Leaves shorter than stems, 2–3 mm wide, green or greyish-green, flat. Terminal spike 8–15 × *c.* 2 mm, entirely male, shortly pedunculate. Lateral spikes 2–3, 8–15 × 4–5 mm, entirely female, oblong, usually overlapping each other and often overlapping base of male spike, erect, with peduncles 0·5–3 cm; lowest bract usually about equalling spike, leaf-like. Female glumes *c.* ⅔ as long as utricles, subobtuse, blackish- or dark reddish-brown, with narrow scarious margin. Utricles 2·5–3·5 mm, ellipsoid-ovoid, greenish- to brownish-yellow, often dark brown towards apex, papillose, gradually narrowed into a soft, conical, usually smooth, truncate beak, with persistent unbranched part of style protruding for *c.* 1 mm. *Sandy or boggy places. Arctic Norway.* No. (*N. Siberia, North America.*)

153. C. bicolor All., *Fl. Pedem.* **2**: 267 (1785). Laxly caespitose and with short rhizomes. Stems 5–20(–25) cm, procumbent to erect and usually nodding, slightly scabrid at apex; basal sheaths pale yellowish- or whitish-brown. Leaves shorter than stems, 1–2(–3) mm wide, flat, greyish- or yellowish-green. Spikes

2–4(–5), 5–10(–20) mm, oblong or ovoid-oblong, dense, the upper sessile, the lowest with a peduncle up to 1(–2) cm, all at more or less the same level, the terminal female above and male below (or rarely entirely male), the rest entirely female; lowest bract usually leaf-like and equalling or exceeding inflorescence. Female glumes equalling or slightly exceeding utricles, obtuse or mucronate, dark reddish- to blackish-brown. Utricles 1·5–2·5 mm, obovate, biconvex, pale greyish-green, papillose, rounded at apex. Stigmas 2. $2n=16$, *c.* 48, 50, 52. *Streamsides and damp sand or gravel. N. Europe, southwards to c.* 62° *N.; C. & E. Pyrenees, Alps, E. Carpathians; very local.* Au Ga He Hs Is It Ju No Rm Rs (N, W) Su.

Sect. PHACOCYSTIS Dumort. (Sect. *Acutae* (Fries) Christ). Caespitose or not. Stems trigonous. Male spikes 1–several, more or less cylindrical, or the terminal spike female above and male below; lateral spikes female, cylindrical to oblong-ovoid, usually dense; lowest bract leaf-like, not sheathing. Female glumes 1- or 3-veined. Utricles narrowly elliptical to obovate, plano-convex or lenticular, membranous, glabrous, more or less abruptly contracted into a very short, entire or emarginate beak. Stigmas 2.

Partially fertile hybrids have been synthesized between many of the species in this section. Sterile or partially fertile hybrids also occur in the wild, and some of the species recognized here are probably of hybrid origin. Much information on these problems can be found in J. S. Faulkner, *Bot. Jour. Linn. Soc.* **65**: 271–300 (1972); **67**: 233–253 (1973).

154. C. rufina Drejer, *Revis. Crit. Caric. Bor.* 28 (1841). Laxly caespitose and with short rhizomes. Stems 2–8 cm, procumbent or ascending, curved and concealed by the leaves, trigonous, smooth; basal sheaths greyish- or yellowish-brown. Leaves exceeding stems, 1–1·5 mm wide, pale green. Spikes 3–4(–5), 5–10 mm, oblong-ovoid, dense, sessile or the lowest with a peduncle up to 0·5 cm, all at more or less the same level, the terminal female above and male below (or rarely entirely male), the lateral female; lowest bract usually equalling or exceeding inflorescence. Female glumes slightly shorter than utricles, ovate-orbicular, rounded at apex, blackish-purple. Utricles 2–2·5 mm, obovate, pale greenish-brown, purplish-black at apex, scarcely veined, with margin scabrid above. $2n=60$. *Snow-patches. Iceland, W. Fennoscandia.* Is No Su. (*Greenland, C. Canada.*)

(155–161). C. palaecea group. Usually not caespitose, with creeping rhizomes. Leaves yellowish- or greyish-green. Terminal spike entirely male. Female glumes usually 3-veined, often with an awn. Utricles faintly veined or veinless.

This group consists largely of plants of seashore and estuarine habitats in N. Europe; their taxonomic status is confused.

1 At least the lower spike pendent, with a long, filiform peduncle
2 Female glumes yellowish- to pale reddish-brown, with a serrulate awn **155. paleacea**
2 Female glumes dark reddish-brown to purplish-black, without or with an entire awn **156. lyngbyei**
1 Spikes erect or drooping, but not pendent
3 At least the lower female glumes at least twice as long as utricles, with a long awn
4 Female glumes strongly papillose on the back, not more than 3 times as long as utricles **157. vacillans**
4 Female glumes smooth on the back, up to 5 times as long as utricles **158. recta**
3 Female glumes less than twice as long as utricles, awnless or with a short awn
5 Stems 3–5(–20) cm, usually ascending; female spikes 5–10 mm; lowest bract dilated and ±enfolding stem at base **161. subspathacea**
5 Stems (5-)10–50(–70) cm, erect; female spikes 15–50 mm; lowest bract not dilated or sheathing
6 Stems 30–50(–70) cm; female glumes dark brown or dark reddish-brown **159. halophila**
6 Stems (5–)10–20(–40) cm; female glumes pale reddish-brown **160. salina**

155. C. paleacea Schreber ex Wahlenb., *Kungl. Svenska Vet.-Akad. Handl.* nov. ser., **24**: 164 (1803) (*C. paralia* V. Krecz.). Rhizomes stout, creeping. Stems 25–50 cm, sharply trigonous or almost winged, with concave faces, smooth; basal sheaths without lamina, greyish- or blackish-brown, mostly entire. Leaves equalling or longer than stems, 4–8 mm wide, yellowish-green. Male spikes 1–3. Female spikes 5–7, 20–50 mm, remote, long-pedunculate and pendent, the uppermost sometimes subsessile and male above; lowest bract exceeding inflorescence. Female glumes 3–5 times as long as utricles, oblong-oblanceolate, yellowish- to pale reddish-brown, 3-veined, with narrow scarious margin, abruptly contracted into a very long greenish-brown, serrulate awn. Utricles 3–3·5 mm, obovate, greyish- or pale brownish-green, faintly veined; beak *c.* 0·2 × 0·2 mm. $2n=72, 73$. *Salt-marshes and estuarine mud and sand. Coasts of Fennoscandia and N.W. Russia.* Fe No Rs (N) Su.

156. C. lyngbyei Hornem., *Fl. Dan.* **32**: 6 (1827). Rhizomes stout, creeping. Stems 20–90(–125) cm, sharply trigonous, smooth or slightly scabrid at apex; basal sheaths purplish-brown, mostly entire. Leaves shorter than stems, 3–6 mm wide, yellowish-green. Male spikes 2–3. Female spikes 2–4, 20–80 mm, dense or rather lax, long-pedunculate and pendent; lowest bract exceeding the inflorescence. Female glumes 2–3 times as long as utricles, lanceolate, acuminate, dark reddish-brown to purplish-brown, 3-veined, often with a short awn. Utricles *c.* 3 mm, ovate-orbicular, greyish-green, faintly veined; beak *c.* 0·2 × 0·2 mm, $2n=72$. *Wet places. Iceland, Færöer.* Fa Is. (*Greenland, North America, N.E. Asia.*)

157. C. vacillans Drejer in Hartman, *Svensk Norsk Excurs.-Fl.* 131 (1846) (*C. kattegatensis* Fries ex Lindman). Laxly caespitose and with stout, creeping rhizomes. Stems 30–50(–70) cm, sharply trigonous, smooth or scabrid at apex; basal sheaths without lamina, blackish- or reddish-brown, entire. Leaves equalling or exceeding stems, 3–4(–5) mm wide, green or yellowish-green. Male spikes 1–3(–4), female spikes 2–4, 20–50 mm, overlapping, erect or suberect, the lower with peduncles 1–3 cm; lowest bracts exceeding inflorescence. Female glumes 1½–3 times as long as utricles, ovate-lanceolate, acute, dark brown or dark reddish-brown, 3-veined, strongly papillose on the back, at least the lower more or less abruptly contracted into a pale brown, more or less scabrid awn. Utricles 2·5–3 mm, obovate, pale greenish-brown, faintly veined; beak *c.* 0·2 × 0·2 mm. *Salt-marshes and estuarine mud.* ● *W. coasts of Fennoscandia from* 57° *to* 67° *N.* No Su.

Probably of hybrid origin from **155** and **167.**

158. C. recta Boott in Hooker, *Fl. Bor.-Amer.* **2**: 220 (1839). Like **157** but larger in all its parts and often tussock-forming; stems up to 100 cm; leaves up to 6 mm wide; female spikes up to 80 mm; female glumes up to 5 times as long as utricles, smooth on the back, usually with a longer awn. $2n=$?73, *c.* 74, ?75. *Estuarine mud. N.E. Scotland.* Br ?Fa ?No. (*North America.*)

Probably of hybrid origin from **155** and **162.**

159. C. halophila F. Nyl., *Spicil. Pl. Fenn.* **2**: 21 (1844) (*C. recta* auct., non Boott). Like **157** but leaves often shorter than

stems; female glumes usually not more than twice as long as utricles, without or with a short awn, smooth or only very weakly papillose on the back; beak of utricle *c.* 0·2 × 0·4 mm. *Salt-marshes and estuarine mud.* ● *Coasts of N. Fennoscandia southwards to* 63° *N. in Finland.* Fe No Su Rs (N).

More or less indistinguishable from transient hybrids between **155** and **162** except by its fertility; it is probably of hybrid origin from these species and occurs over a wide area and is stable in its characters. The relationship between **159** and **158** is uncertain, but there is a fairly clear distinction in the size of the plants and in the development of the awn on the female glumes, as well as in the beak of the utricle.

160. C. salina Wahlenb., *Kungl. Svenska Vet.-Akad. Handl.* nov. ser., **24**: 165 (1824) (*C. discolor* F. Nyl.). Rhizomes stout, creeping. Stems (5–)10–20(–40) cm, obtusely trigonous, smooth or scabrid at apex; basal sheaths without lamina, reddish-brown. Leaves exceeding stems, 2–4 mm wide, greyish-green. Male spikes 1–2; female spikes 2–4, 15–30 mm, overlapping, erect, with peduncles up to 1(–2) cm; lowest bract equalling or exceeding inflorescence. Female glumes about equalling utricles, ovate-lanceolate, acute or shortly aristate, pale reddish-brown, 3-veined. Utricles 2·5–3·5 mm, obovate, pale yellowish- or greenish-brown, faintly veined; beak *c.* 0·2 × 0·4 mm. *Salt-marshes and estuarine mud. Coasts of N. Europe, southwards to* 62° *N. in Norway and eastwards to* 41° *E. in N.W. Russia.* ?Fa Is No Rs (N).

Morphologically intermediate between **155** and **161** and possibly of hybrid origin.

161. C. subspathacea Wormsk. in Hornem., *Fl. Dan.* **26**: 6 (1816). Rhizomes very long and slender. Stems 3–5(–20) cm, obtusely trigonous, smooth; basal sheaths brownish, soon decaying. Leaves usually equalling or exceeding stems, greyish-green. Male spike usually solitary. Female spikes (1–)2–3, 5–15 mm, overlapping, erect, subsessile or with peduncles up to 1·5 cm; lowest bract equalling the inflorescence, dilated and more or less enfolding the stem at the base. Female glumes slightly shorter than utricles, ovate, subacute, dark blackish- or reddish-brown, usually 3-veined. Utricles (2·5–)3–3·5(–4) mm, oblong-ovate, greyish-green, not or faintly veined, rather gradually narrowed into beak *c.* 0·3 × 0·4 mm. $2n = 42$. *Lowest zones of salt-marshes and on mud-flats and gravelly sea-shores. Arctic and Atlantic coasts of Europe, southwards to* 63° *N.* Is No Rs (N) Sb.

162. C. aquatilis Wahlenb., *Kungl. Svenska Vet.-Akad. Handl.* nov. ser., **24**: 165 (1803). Laxly caespitose and with stout, creeping rhizomes. Stems 20–100(–130) cm, obtusely trigonous, smooth, brittle; basal sheaths purplish- or reddish-brown, entire, mostly with lamina. Leaves 3–5(–7) mm wide, exceeding stems, somewhat glaucous and papillose above, green and smooth beneath; margins rolling inwards on drying. Male spikes (1–)2–3. Female spikes 3–5, (15–)40–70(–100) mm, dense, erect, overlapping, shortly pedunculate; lowest bract exceeding the inflorescence. Female glumes equalling or shorter than utricles, oblong-ovate, subobtuse, purplish- to reddish-brown, usually with lateral veins, with a narrow scarious margin. Utricles 2–3 mm, obovate or broadly elliptical, green, veinless. $2n = 76$, 77, 84. *Riversides and other wet places. N. Europe, extending southwards to S. Ireland and White Russia.* Br Fe Ge Hb Ho No Rs (N, B, C, E) Su.

Small plants from the Arctic with pale green, more or less smooth leaves, a solitary male spike, female spikes 1–3 cm, rather longer, acute female glumes and brownish utricles are intermediate between **162** and **163** and may either be hybrids, or be referable to subsp. **stans** (Drejer) Hultén, *Kungl. Svenska Vet.-Akad. Handl.* ser. 4, **8(5)**: 74 (1962) (*C. stans* Drejer), which occurs in North America, Greenland and N. Siberia.

163. C. bigelowii Torrey ex Schweinitz, *Ann. Lyc. New York* **1**: 67 (1824). Usually not caespitose, with stout, creeping rhizomes. Stems 5–40 cm, sharply trigonous, smooth or slightly scabrid at apex; basal sheaths blackish- or reddish-brown, shining, entire, mostly without lamina, persistent. Leaves 1·5–7 mm wide, shorter than stems, often arcuate, somewhat glaucous, somewhat papillose above; margins rolling outwards on drying. Male spikes 1(–2). Female spikes 2–3, 10–35 mm, overlapping and often crowded, shortly pedunculate (or the lowest with a long peduncle from the base of the stem); lowest bract shorter than the inflorescence. Female glumes equalling or exceeding utricles, ovate, obtuse or acute, sometimes mucronate, purplish-black, usually with narrow scarious margin. Utricles 2–3·5 mm, broadly elliptical, green, usually blackish- or purplish-brown above, veinless. $2n = 70$. *Heaths and dry, stony places. N. Europe, extending southwards to S. Ural; mountains of C. Europe from the Harz to the S. Carpathians.* Au Br ?Bu Cz Fa Fe Ge Hb Is ?Ju No Po Rm Rs (N, C, W) Sb Su.

An extremely variable species whose infraspecific taxonomy is confused by its apparent similarity to small variants of **162** in the Arctic, by the occurrence of numerous hybrids and by the fact that published work on it has never taken full account of the variation over the whole range. The precise distribution of subsp. **(a)** and **(b)**, and the validity of the distinction between them in N. Europe, is very uncertain; some authors indeed consider that subsp. **(a)** does not occur in Europe at all. The following treatment represents a summary of the available information. For further details see V. N. Gorodkov, *Žur. Russk. Bot. Obšč.* **15**: 179–186 (1930); T. V. Egorova in A. I. Tolmachev, *Flora arctica URSS* **3**: 107–111. Moskva & Leningrad. 1966; J. Holub, *Folia Geobot. Phytotax.* (*Praha*) **3**: 183–192 (1968); and W. Schultze-Motel, *Willdenowia* **4**: 322–325 (1968).

1 Male spike with a peduncle 0·5–2·5 cm, distinctly exserted above the female spikes; female spikes at least 5 times as long as wide; utricles not beaked **(a) subsp. bigelowii**
1 Male spike subsessile or with a peduncle not more than 0·5 cm, not exserted; female spikes not more than 4 times as long as wide; utricles with a minute beak
2 Leaves 1·5–4 mm wide; female glumes purplish-black throughout **(c) subsp. arctisibirica**
2 Leaves 4–7 mm wide; female glumes with pale midrib
3 Laxly caespitose, with short creeping rhizomes, stems up to 40 cm; male spike 15–20 mm, pale or reddish-brown **(d) subsp. ensifolia**
3 Not caespitose, with long creeping rhizomes; stems not more than 30 cm; male spike 10–15 mm, purplish-black **(b) subsp. rigida**

(a) Subsp. **bigelowii** (*C. hyperborea* Drejer): Not caespitose, with long creeping rhizomes. Stems 20–40 cm. Leaves 2–4(–5) mm wide. Male spike 10–15(–20) × 2·5–3 mm, purplish-black, with a peduncle 0·5–2·5 cm. Female spikes 15–35 mm, at least 5 times as long as wide. Female glumes obtuse, mostly equalling utricles in length and width, purplish-black, with paler midrib. Utricles 2·5–3·5 mm, not beaked. $2n = 68$–71. *N. Europe.*

(b) Subsp. **rigida** Schultze-Motel, *Willdenowia* 4: 326 (1968) (*C. rigida* Good., non Schrank): Not caespitose, with long creeping rhizomes. Stems 5–30 cm. Leaves 4–7 mm wide. Male spike (5–)10–15 × 3–5 mm, purplish-black, subsessile or with a peduncle up to 0·5 cm. Female spikes 10–20 mm, not more than 4 times as long as wide. Female glumes obtuse, mostly equalling utricles in length and width, purplish-black, with paler

midrib. Utricles 2·5–3 mm, with a minute beak. *C. & N.W. Europe, W. Fennoscandia.*

(c) Subsp. **arctisibirica** (Jurtzev) Á. & D. Löve, *Univ. Colorado Stud. Biol.* **24**: 22 (1966): Like subsp. (b) but laxly caespitose and with shorter creeping rhizomes; stems more slender; leaves 1·5–4 mm wide; female glumes purplish-black even on the midrib. *N. Russia.* (*N. Siberia.*)

(d) Subsp. **ensifolia** (Turcz. ex Gorodkov) J. Holub, *Folia Geobot. Phytotax.* (*Praha*) **3**: 190 (1968) (*C. ensifolia* (Turcz. ex Gorodkov) V. Krecz.): Like subsp. (b) but laxly caespitose and with shorter creeping rhizomes; stems 20–40 cm, more slender; male spike 15–20 mm, pale or reddish-brown; female glumes mostly longer and narrower than utricles, acute, dark reddish-brown. *S. Ural.* (*Siberia.*)

164. C. elata All., *Fl. Pedem.* **2**: 272 (1785). Densely caespitose and tussock-forming, without creeping rhizomes. Stems 20–120 cm, sharply trigonous, usually scabrid above; basal sheaths without lamina, strongly keeled, yellowish-brown, becoming conspicuously reticulately fibrous. Leaves (1–)2–6 mm wide, shorter than or equalling stems, glaucous; margins rolling outwards on drying. Male spikes 1–2(–3), 20–50(–70) mm. Female spikes 2–4, 15–70 mm, dense, usually overlapping; lowest bract usually shorter than the spike and rarely more than half as long as inflorescence, erect. Female glumes about as long as to slightly shorter than utricles, lanceolate-elliptical, blackish-brown, usually without a scarious margin. Utricles 2·5–4 mm, narrowly elliptical to obovate-orbicular, pale to dark greyish-green, often reddish or brownish above, veinless or with slender veins. $2n=74$–78, 80. *Fens and shallow water. Europe, northwards to Scotland, C. Finland and C. Ural, but absent from much of the south.* Au Be Br Co Cz Da Fe Ga Ge Gr Hb He Ho Hs Hu It Ju Lu No Po Rm Rs (N, B, C, W, E) Sa Si Su.

Two subspecies can be recognized. Slender plants with leaves 1–2 mm wide and broad utricles from N.C. Europe have been called subsp. **fallax** (Marsson) Suess. in Hegi, *Ill. Fl. Mitteleur.* ed. 2, **2**: 101 (1939); they lack the anatomical characters of subsp. (b) and are best regarded as a variant of subsp. (a), although they are in other respects intermediate.

(a) Subsp. **elata** (*C. stricta* Good., non Lam.): Stems up to 120 cm. Leaves up to 4(–6) mm wide; outer cell-walls and cuticle of upper epidermis thin; papillae on lower epidermis oblong-conical. Female glumes usually obtuse. Utricles narrowly to broadly elliptical, greyish-green, with distinct but slender veins. *Mainly in base-rich habitats. Throughout the range of the species eastwards to c.* 30° *E.*

(b) Subsp. **omskiana** (Meinsh.) Jalas, *Ann. Bot. Fenn.* **1**: 49 (1964) (*C. omskiana* Meinsh.): Stems not more than 80 cm. Leaves not more than 3·5 mm wide; outer cell-walls and cuticles of upper epidermis thickened; papillae on lower epidermis low, rounded. Female glumes usually acute. Utricles obovate-orbicular to broadly elliptical, pale greyish-green, often reddish or brownish above, veinless or obscurely veined. *Mainly in base-poor habitats. E. & E.C. Europe, southwards to N.W. Ukraine.*

165. C. cespitosa L., *Sp. Pl.* 978 (1753) (incl. *C. inumbrata* V. Krecz., *C. retorta* (Fries) V. Krecz.). Like **164(a)** but stems not more than 50(–80) cm, slender, the basal sheaths dark reddish-brown or -black, not or weakly keeled, usually with lamina; leaves 1–3(–4) mm wide, bright or yellowish-green, usually purplish below; male spike solitary, 10–20 mm; female spikes 1–2(–3), 10–20(–30) mm; utricles 2–2·5 mm, suborbicular to broadly elliptical, greyish- to brownish-green, not or very obscurely veined. $2n=78$–80. *Damp meadows and woods. N. & C. Europe, extending to S.C. France, N. part of Balkan peninsula and W. Kazakhstan, but absent from most of the north-west.* Au Cz Da Fe Ga Ge ?He Ho Hu It Ju No Po Rm Rs (N, B, C, W, E) Su.

166. C. buekii Wimmer, *Fl. Schles.* ed. 3, 81 (1857). Rhizomes stout, creeping. Stems 40–120 cm, sharply trigonous, scabrid above; basal sheaths without lamina, keeled, reddish- or blackish-brown, becoming conspicuously reticulately fibrous. Leaves 4–10 mm wide, shorter than stems, bright or greyish-green; margins rolling outwards on drying. Male spikes 1–3, 25–60 mm. Female spikes 3–5, 40–100 mm, erect or drooping, overlapping; lowest bract usually exceeding spike but shorter than inflorescence. Female glumes slightly shorter than utricles, oblong-lanceolate, obtuse or acute, blackish-brown. Utricles 2–2·5 mm, ovate or obovate, yellowish-green, often purple-spotted, veinless. *By rivers and lakes, and in other intermittently flooded places. From C. Germany eastwards to E. Bulgaria and W. Kazakhstan.* Au Bu Cz Ge Hu ?It Ju Po Rm Rs (?C, W, E).

167. C. nigra (L.) Reichard, *Fl. Moeno-Francofurt.* **2**: 96 (1778) (*C. goodenowii* Gay, *C. vulgaris* Fries, *C. acuta* auct., non L.). Rhizomes slender, long or short, or sometimes absent and plant caespitose or often tussock-forming. Stems (2–)10–60(–90) cm, sharply trigonous, usually scabrid above; basal sheaths brown or reddish-brown, not keeled, mostly with lamina, not or scarcely fibrous. Leaves 1–3(–5) mm wide, shorter than or equalling stems, green; margins rolling inwards on drying. Male spikes 1(–2), 5–30 mm. Female spikes 1–3(–4), 10–40(–50) mm, dense, overlapping or the lower distant; lowest bract usually exceeding the spike but shorter than the inflorescence. Female glumes slightly shorter than utricles, oblong-ovate to -lanceolate, obtuse or acute, dark blackish- or reddish-brown, sometimes with a narrow scarious margin. Utricles 2–3·5 mm, ovate to obovate-elliptical, green, usually blackish or brownish above, obscurely to more or less prominently veined. $2n=82$–85. *Usually in marshes or wet grassland. Most of Europe, but rare in the extreme south.* All except Bl Cr ?Rs (K) Sb Tu.

Extremely variable, especially in the development of tussocks and creeping rhizomes and in other vegetative characters, but the taxonomic significance of this variation is not well understood. Much experimental work is needed before any useful subdivision into subspecies can be attempted. The most frequently recognized variants are discussed below.

In N. & N.C. Europe there is a clinal tendency, increasing with latitude, to form large tussocks. Plants of this kind from N. Russia, completely lacking creeping rhizomes, have been called **C. wiluica** Meinsh. ex Maack, *Viljujsk. Okr. Jakutsk. Obl.* **2**: 308 (1886) (*C. juncella* subsp. *wiluica* (Meinsh. ex Maack) Egorova), while such plants with creeping rhizomes, widespread in N. Europe, have been called **C. juncella** (Fries) Th. Fries, *Bot. Not.* **1857**: 207 (1857) (*C. nigra* var. *juncea* (Fries) Hyl., *C. nigra* subsp. *juncella* (Fries) Lemke, *C. goodenowii* subsp. *juncea* (Fries) Lindman, *C. vulgaris* subsp. *juncella* (Fries) Nyman). The latter have $2n=76$, 84. Both are best considered as varieties of **167.**

Several variants, mostly dwarf plants with long creeping rhizomes, have been described from the mountains of C. & S. Europe. Dwarf, very slender plants from the mountains of C. & S.W. Europe, with long, slender, creeping rhizomes, stems 5–15 cm and rather prominently veined utricles, have been called subsp. **alpina** (Gaudin) Lemke, *Feddes Repert.* **67**: 3 (1963) (subsp. *obesa* (All.) H. P. Fuchs ex Janchen, *C. vulgaris* subsp. *alpina* (Gaudin) Arcangeli, *C. stolonifera* Hoppe, *C. fusca* var. *stolonifera* (Hoppe) C. Vicioso). Very dwarf plants from over

1500 m in Corse, Sicilia and S. Spain (Sierra Nevada), with long, creeping rhizomes, stems 2–5 cm, rather wide, short leaves and obscurely veined utricles, have been called **C. intricata** Tineo in Guss., *Fl. Sic. Syn.* **2**: 574 (1843) (*C. rigida* subsp. *intricata* (Tineo) Nyman, *C. rigida* var. *intricata* (Tineo) Briq., *C. nigra* subsp. *intricata* (Tineo) Rivas Martínez, *C. fusca* var. *intricata* (Tineo) C. Vicioso, *C. cespitosa* var. *intricata* (Tineo) Fiori, *C. goodenowii* var. *intricata* (Tineo) H. Lindb. fil.; incl. *C. navasi* Merino); they have usually been referred to **163** but must certainly be considered a variant of **167**. Plants from the Carpathians and mountains of the Balkan peninsula with purplish-black, shining basal sheaths have been called **C. dacica** Heuffel, *Flora* (*Regensb.*) **18**: 247 (1835) (*C. nigra* subsp. *dacica* (Heuffel) Soó, *C. fusca* subsp. *dacica* (Heuffel) Şerbănescu & E. I. Nyárády); these have also erroneously been referred to **163**.

C. reuterana Boiss. in Boiss. & Reuter, *Pugillus* 216 (1852) (*C. fusca* var. *reuterana* (Boiss.) C. Vicioso), from Portugal and N. & C. Spain, has smooth stems, slender female spikes and rather elliptical utricles; similar plants can be found elsewhere in the range of **167** and this variant is probably of little taxonomic significance.

168. C. acuta L., *Sp. Pl.* 978 (1753) (*C. gracilis* Curtis; incl. *C. graciliformis* V. Krecz., *C. fuscovaginata* sensu V. Krecz., non Kük., *C. mauritanica* Boiss. & Reuter, *C. sareptana* V. Krecz.). Caespitose and with long, stout rhizomes. Stems 30–120(–150) cm, sharply trigonous, usually scabrid above; basal sheaths usually with lamina, pale to dark reddish-brown, usually with prominent transverse veins, entire. Leaves (3–)5–10 mm wide, equalling or exceeding stems, green, papillose beneath; margins rolling outwards on drying. Male spikes (1–)2–4, 20–60 mm. Female spikes 2–4(–8), 30–100(–150) mm, dense, usually overlapping, erect or nodding; lowest bract usually exceeding the inflorescence. Female glumes shorter or longer than utricles, ovate-oblong to lanceolate, obtuse or acute, blackish- or reddish-brown. Utricles 2–3·5 mm, elliptical to broadly ovate, green or pale brownish-green, often purplish above, with slender but distinct veins. $2n=72$, 74–76, 78, 82–85. *Riversides, marshes and other wet places. Most of Europe, but rare in the extreme south.* All except Co Cr Fa Is ?Rs (K) Sb Tu.

Very variable, especially in C. & E. Europe, but it does not seem that subspecies can be usefully recognized.

169. C. trinervis Degl. in Loisel., *Fl. Gall.* **2**: 731 (1807) (*C. glauca* subsp. *trinervis* (Degl.) Ascherson & Graebner). Rhizomes long, slender. Stems 10–30(–60) cm, obtusely trigonous, smooth or scabrid at apex; basal sheaths few, pale brown, entire. Leaves 1·5–2(–3) mm wide, equalling or exceeding stems, canaliculate, greyish- or glaucous-green. Male spikes 1–4, 20–40 mm. Female spikes 2–4, 10–40 mm, dense, crowded; lowest bract canaliculate, exceeding inflorescence. Female glumes equalling or slightly shorter than utricles, oblong-ovate, subobtuse, brownish, with 2 lateral veins. Utricles 3·5–5 mm, elliptical to broadly ovate, yellowish- to greyish-green, often purplish-spotted, prominently veined. *Damp maritime sands and heaths.* ● *Coasts of W. Europe from Denmark to C. Portugal.* Be Da Ga Ge Ho ?Hs Lu.

Subgen. **Primocarex** Kük. Dioecious, or monoecious with male flowers at top of spike and female flowers below. Spike solitary. Stigmas 2–3.

A very heterogeneous assemblage of sections whose affinities are a matter of much conjecture. Other sections formerly included here have, following Kreczetowicz and other authors, been treated as reduced members of Subgen. *Vignea* and will be found there.

Sect. LEUCOGLOCHIN Dumort. Monoecious. Spike lax. Female glumes caducous. Utricles fusiform-oblong or ellipsoid-lanceolate, with faint veins, glabrous, patent or deflexed, gradually narrowed into a long, conical, smooth beak. Stigmas 3.

170. C. microglochin Wahlenb., *Kungl. Svenska Vet.-Akad. Handl.* nov. ser., **24**: 140 (1803). Rhizomes short, ascending. Stems 5–15(–25) cm, erect, slender, subterete, smooth; basal sheaths pale brown. Leaves usually not more than half as long as stems, *c.* 0·5 mm wide. Spike 8–15 mm, with 3–12(–17) female flowers. Female glumes 2–2·5 mm, ovate-lanceolate, obtuse, brown, with scarious margin. Utricles (2·5–)3·5–4·5(–6) mm, ellipsoid-lanceolate, pale greenish-brown; bristle-like prolonged axis of spikelet arising from base of nut protruding for 0·5–2·5 mm from aperture of beak. $2n=48$, 58. *Wet, base-rich habitats. N. Europe, southwards to N.E. Poland; Alps.* Au Br Fe Ga †Ge He Is It No Po Rs (N, ?B) Su.

171. C. pauciflora Lightf., *Fl. Scot.* **2**: 543 (1777). Rhizome long, ascending. Stems 5–20(–40) cm, erect, slender, obtusely trigonous, smooth; basal sheaths pale brown. Leaves usually not more than half as long as stems, up to 1(–1·5) mm wide. Spike 5–10 mm, with 2–5 female flowers. Female glumes 4–6 mm, ovate to oblong, subacute, pale to reddish-brown. Utricles 5–7 mm, fusiform-oblong, yellowish- to pale reddish-brown, with faint veins, without a protruding bristle. $2n=46$, 76. *Peat-bogs and wet moorland; usually among* Sphagnum *spp. N. & C. Europe, extending locally to S.C. France and N. Ukraine.* Au Br Cz Da Fe Ga Ge Hb He It Ju No Po Rm Rs (N, B, C, W) Su.

Sect. PETRAEAE (O. F. Lang) Kük. Monoecious. Spike lax or dense. Female glumes persistent. Utricles ovoid-oblong or obovoid, with faint veins, glabrous, erecto-patent or erect, abruptly contracted into a short, smooth beak. Stigmas 3.

172. C. rupestris All., *Fl. Pedem.* **2**: 264 (1785). Caespitose and with long creeping rhizomes. Stems 5–20 cm, erect or curved, obtusely trigonous, scabrid at apex; basal sheaths pale to dark reddish-brown. Leaves shorter than or equalling stems, 1–2 mm wide, flat or folded, conspicuously curled towards apex. Spike 10–20 mm, with 3–6 female flowers. Female glumes equalling or exceeding utricles, ovate, obtuse, reddish-brown, with scarious margin. Utricles 2·5–4 mm, obovoid, greenish-brown. $2n=50$, 52. *Dry, rocky and stony places; usually calcicole. N. Europe, southwards to C. Scotland and C. Ural; mountains of C. & S. Europe southwards to the Pyrenees; S.W. Bulgaria.* Au Br Bu ?Co Cz Fe Ga Ge He Hs Is It Ju No Rm Rs (N, C, W) Sb Su.

173. C. obtusata Liljeblad, *Kungl. Svenska Vet.-Akad. Handl.* nov. ser., **14**: 69 (1793). Rhizomes long-creeping. Stems 5–15 (–40) cm, erect, trigonous, scabrid above; basal sheaths dark purplish-brown. Leaves shorter than or equalling stems, 1–2 mm wide, flat, straight. Spike 5–10(–20) mm, with 5–10 female flowers. Female glumes *c.* ½ as long as utricles (the lowest sometimes longer and aristate or leaf-like), ovate, subacute, reddish-brown, with a wide scarious margin. Utricles 2·5–4(–4·5) mm, ovoid-oblong, orange- or reddish-brown, shining. *Dry, sandy places. N.E. Germany; S. Sweden; W. Ukraine; a few localities in C. & N. Russia.* Ge Rs (N, C, W) Su. (*N. Asia, W. North America.*)

Sect. NARDINAE Kük. Monoecious. Spike dense. Female glumes persistent. Utricles ovate or elliptical, plano-convex, veinless or with faint veins, glabrous, erect or erecto-patent, gradually narrowed into a more or less distinct, smooth or scabrid beak. Stigmas 2.

174. C. nardina Fries, *Nov. Fl. Suec., Mantissa* **2**: 55 (1839). Densely caespitose, forming flattened cushions. Stems 3–10 cm, procumbent or erect, usually curved, terete, smooth; basal sheaths numerous, reddish-brown. Leaves usually exceeding stems, setaceous, rigid, usually curved and often procumbent. Spikes 5–8 mm, ovoid. Female glumes 2·5–3 mm, ovate, obtuse, reddish-brown, with a narrow scarious margin. Utricles 3–3·5 mm, elliptical, pale brown, with faint veins, strongly stipitate. $2n=70$. *Dry, exposed, stony places in the mountains; calcicole. Svalbard; Iceland; Arctic Sweden and Norway.* Is No Sb Su.

175. C. capitata L., *Syst. Nat.* ed. 10, **2**: 1261 (1759) (incl. *C. arctogena* H. Sm.). Densely caespitose. Stems 10–40 cm, erect, trigonous, scabrid above; basal sheaths purplish-brown. Leaves usually shorter than stems, setaceous. Spike 4–9 mm, ovoid or suborbicular. Female glumes 1·5–2·5 mm, ovate, obtuse, yellowish to reddish-brown, with scarious margin. Utricles 2–3·5 mm, ovate, greenish, often brownish at apex, veinless. $2n=50$. *Damp, usually base-rich and peaty places. N. Europe, southwards to c.* 60° *N. in E. Russia; E. Alps.* Au Fe †Ge Is It No Rs (N, C) Su.

Sect. SCIRPINAE (Tuckerman) Kük. Dioecious. Female spike dense, with persistent glumes. Utricles ovoid-oblong, with distinct veins, densely pubescent, erect, with a distinct, short beak. Stigmas 3.

176. C. scirpoidea Michx., *Fl. Bor.-Amer.* **2**: 171 (1803). Laxly caespitose or with creeping rhizomes. Stems 5–15 (–20) cm, erect trigonous, scabrid above; basal sheaths dark brown, fibrous. Leaves shorter than stems, 1·5–3 mm wide, flat. Male spike 10–15 mm. Male glumes reddish-brown. Female spike 10–15 × 3–4 mm, cylindrical or oblong. Female glumes 2–3 mm, ovate, obtuse, blackish. Utricles 2·5–3 mm, yellowish-brown. *Wet mountain grassland. Arctic Norway (Solvågtind, near Saltdal).* No. (*North America, Greenland, N.E. Asia.*)

Sect. UNCINIIFORMES Kük. Monoecious. Spike lax or dense. Female glumes caducous. Utricles oblong to ovoid-ellipsoid, or lanceolate to oblong-elliptical and plano-convex, veinless, glabrous, patent or deflexed, acute or with a beak. Stigmas usually 2.

177. C. pyrenaica Wahlenb., *Kungl. Svenska Vet.-Akad. Handl.* nov. ser., **24**: 139 (1803). Densely caespitose. Stems 5–35 cm, erect, rather stout, sometimes curved, obtusely trigonous, smooth or scabrid at apex; basal sheaths dull brown. Leaves usually shorter than stems, 1–2 mm wide, flat. Spike (5–)10–15(–25) mm, oblong-ovoid, dense, with 10–30 female flowers. Male glumes linear-lanceolate, acute. Female glumes 2·5–3·5 mm, oblong-ovate, subobtuse, dark reddish-brown, with narrow scarious margin. Utricles 3–4 mm, oblong- to ovoid-ellipsoid, reddish-brown, shining, gradually narrowed into an obscure, smooth beak. Stigmas sometimes 3. *Mountain pastures and damp, rocky places. Pyrenees and Cordillera Cantábrica; S. Carpathians; S.W. Bulgaria.* Bu Ga Hs Rm.

178. C. pulicaris L., *Sp. Pl.* 972 (1753). Usually laxly caespitose, without creeping rhizomes. Stems 5–25(–40) cm, erect, very slender, obtusely trigonous or terete, smooth; basal sheaths dull brown. Leaves shorter than or equalling stems, setaceous. Spike 10–25 mm, with 5–10 female flowers, lax. Lower male glumes acute. Female glumes 3·5–4·5 mm, ovate-oblong, acute, reddish-brown, with scarious margin near apex. Utricles 4·5–5·5 mm, lanceolate to oblong-elliptical, plano-convex, orange- to blackish-brown, shining, more or less stipitate at base, acute but not beaked at apex, deflexed at maturity. $2n=58, 60$. *Damp places.* ● *N., C. & W. Europe, southwards to N. Spain and eastwards to Estonia.* Au Be Br Cz Da Fa Fe Ga Ge Hb He Ho Hs Is It Ju No Po Rs (B) Su.

179. C. peregrina Link., *Hort. Berol.* **1**: 334 (1827). Like **178** but densely caespitose; stems (12–)20–40 cm; leaves up to 1·5 mm wide; spike (20–)25–35 mm, very lax; lower male glumes obtuse; female glumes obtuse, usually pale brown or darker but not reddish towards apex; utricles 5·5–7 mm, oblong-ellipsoid, usually greenish-brown, rather abruptly contracted into a long beak. *Woods and scrub. Açores.* Az. (*Madeira.*)

180. C. macrostylon Lapeyr., *Hist. Abr. Pyr.* 562 (1813) (*C. decipiens* sensu Willk., non Gay). Like **178** but densely caespitose; leaves much shorter than stems; spike with 8–13 female flowers; lower male glumes obtuse; female glumes 4–5 mm; utricles 5–6 mm, fusiform, gradually narrowed into a long beak. *Dry grassland.* ● *Pyrenees and Cordillera Cantábrica.* Ga Hs.

SCITAMINEAE

CC. MUSACEAE[1]

Perennial herbs or trees. Leaves alternate or basal, often very large, with sheathing base, long petiole and entire lamina. Flowers hermaphrodite or unisexual, zygomorphic. Perianth petaloid, the 6 segments variously connate or free. Stamens 5. Ovary inferior, 3-locular; fruit a capsule or berry.

Literature: K. Schumann in Engler, *Pflanzenreich* **1(IV. 45)**: 1–45 (1900).

1. Musa L.[2]

Giant, scapose herbs with monocarpic shoots, but in many species perennating by suckers. Stock a subglobose, underground tuber. Leaves basal; sheaths very long, fibrous, persistent, tubular but with free margins, each wrapped around the younger sheaths so as to form a rigid, erect false stem; lamina oblong, obtuse, splitting very readily at right angles to the midrib. Scape slender, enclosed in the cavity of the false stem and emerging from between the youngest leaves. Inflorescence a long spike, often pendent; flowers in whorls, each whorl in the axil of a large bract. Flowers of basal whorls female, those of middle and distal whorls male; some hermaphrodite flowers sometimes present between the two. Staminodes present in female flowers and abortive gynoecium in male. Perianth with 5 segments connate to form a shortly 5-lobed tube open along the adaxial side; the sixth segment (adaxial) shorter, free. Stigma shortly 3-lobed. Fruit an elongate berry; seeds (in wild species) numerous.

Literature: N. W. Simmonds, *The Evolution of the Bananas*. London. 1962. *Bananas*, ed. 2. London. 1966.

[1] Edit. D. A. Webb. [2] By D. A. Webb.

1. M. cavendishii Lamb. ex Paxton, *Paxton's Mag. Bot.* **3**: 51 (1837). Glabrous except for pubescent scape and inflorescence-axis. Suckers present. False stems 2–3 m. Leaves 120–200 × 40–60 cm. Inflorescence up to 1 m, pendent. Bracts *c.* 10 cm, broadly ovate, dull reddish-purple. Perianth-tube 2–3 cm, yellowish-white. Stamens shorter than perianth-tube; anthers longer than filaments. Berry 12–18 cm, oblong, obscurely trigonous, more or less curved, bright yellow, later brown, recurved upwards towards base of inflorescence; seeds abortive; pulp firm, pale yellow. *Cultivated on a small scale in the warmest parts of Europe for its fruits (bananas).* [Az Cr ?Gr Hs Si.] (*Originated under the influence of human selection in India or S.E. Asia.*)

The dimensions given refer to the species as seen in Europe. Other cultivars grown in the tropics can have much larger false stems and leaves.

It seems almost impossible to devise a satisfactory scientific nomenclature for cultivated bananas. It is generally agreed that the great majority of cultivars are either autotriploids (with a few autotetraploids) of *M. acuminata* Colla, or else triploid hybrids between *M. acuminata* and *M. balbisiana* Colla. The name *M. paradisiaca* L. is based on a cultivar of the latter (hybrid) origin, as is also the later name *M. sapientum* L., which may therefore be regarded as a synonym. It seems probable, however, that all bananas cultivated for fruit in Europe (as well as the great majority of those imported to Europe) are autopolyploids deriving solely from *M. acuminata*. They can hardly, therefore, be included under *M.* × *paradisiaca*; on the other hand they are much closer to it in morphology than they are to *M. acuminata*, and they are virtually isolated genetically from the latter. The name *M. cavendishii* Lamb. ex Paxton is therefore used, as being apparently the earliest binomial which can with confidence be regarded as based on a cultivated *acuminata*-triploid. It must be realized, however, that the context is one in which the species-concept has little relevance.

CCI. ZINGIBERACEAE[1]

Rhizomatous, perennial herbs. Leaves alternate, with sheathing base, short petiole and entire lamina, the sheath produced distally on either side of the petiole as a ligule. Flowers hermaphrodite, zygomorphic. Perianth with distinct calyx and corolla, the members of each whorl connate, at least at the base. Stamens 3–5, inserted at apex of corolla-tube; one (the adaxial of the inner whorl) fertile and with normal structure; the others represented by staminodes, of which the two of the inner whorl are united to form a conspicuous, petaloid *labellum* on the abaxial side of the flower. Ovary inferior; seeds numerous.

The structure of the flower is confusing. In many species (including the only European representative) the calyx could be mistaken for a bracteole, the corolla-lobes resemble staminodes, the staminodes are petaloid, and the style is invisible without dissection.

1. Hedychium Koenig[2]

Stems simple, erect, leafy. Leaves distichous, mostly basal, but with very long sheathing base, so as to appear evenly distributed up the stem. Flowers in terminal, bracteate spikes. Calyx narrowly tubular, not lobed. Corolla-tube long and slender; lobes linear to oblanceolate. Lateral staminodes petaloid, similar to labellum but smaller. Ovary 3-locular. Fruit a subglobose, loculicidal capsule; seeds remaining *in situ* long after dehiscence.

Literature: K. Schumann in Engler, *Pflanzenreich* **20(IV. 46)**: 40–59 (1904).

1. H. gardneranum Sheppard ex Ker-Gawler, *Bot. Reg.* **9**: t. 774 (1824). Glabrous. Stems 1–2 m, stout. Leaves *c.* 30 × 15 cm, elliptic-oblong, acuminate, with truncate, subamplexicaul base; petiole appressed to stem. Spike 20–30 cm; flowers very fragrant. Calyx 3 cm, membranous. Corolla-tube 4–5 cm, very slender; lobes *c.* 4 cm, linear, green, pendent. Staminodes pale yellow, the two lateral 3 × 0·7 cm, narrowly oblong, the labellum 3 × 2 cm, with broadly elliptical, 2- or 3-lobed limb and short orange claw. Filament of fertile stamen 5–6 cm, bright orange-red, deeply canaliculate; anther *c.* 0·7 cm. Style filiform, concealed in the groove of the filament; stigma green, capitate, just appearing above the anther. Seeds red, later grey, with aril. *Cultivated ground and woodland-margins. Extensively naturalized in the Açores.* [Az.] (*Himalaya.*)

CCII. CANNACEAE[1]

Rhizomatous, perennial herbs. Leaves basal, distichous, with sheathing base, sometimes distinct petiole, and entire lamina. Flowers hermaphrodite, asymmetrical. Perianth of distinct calyx and corolla, each with 3 segments. Androecium of 1–4 petaloid staminodes and one asymmetrical member, which is mainly petaloid but bears at one side near the apex a single fertile anther-lobe; style petaloid, adnate in its lower half to the semi-fertile stamen. Ovary inferior, 3-locular; fruit a capsule; seeds numerous.

Literature: F. Kränzlin in Engler, *Pflanzenreich* **56(IV. 47)**: 1–77 (1912).

1. Canna L.[2]

Leaf-bases convolute, forming an erect false stem as in *Musa*, up the centre of which grows the scape. Flowers in terminal, bracteate, spike-like panicles. Sepals usually herbaceous, free, equal, persistent in fruit. Petals often somewhat unequal, free for most of their length, but united with each other and the staminodes near the base to form a short tube. Staminodes large and brightly-coloured. Ovary and capsule verrucose.

The large-flowered plants of this genus widely used for decorative bedding in S. Europe are complex hybrids, mostly of obscure origin; **C. flaccida** Salisb., *Icon. Stirp. Rar.* t. 2 (1791), from the S.E. United States, is perhaps the most important parent species.

[1] Edit. D. A. Webb. [2] By D. A. Webb.

1. C. indica L., *Sp. Pl.* 1 (1753). Plant up to 150 cm, glabrous. Leaves up to 50 × 25 cm, elliptical, acuminate; petiole very short or absent. Inflorescence lax, each branch with 2 shortly pedicellate flowers. Bracts 1·5 × 1 cm, pruinose. Sepals *c.* 1 cm, pruinose. Petals 3–4 cm, subequal, lanceolate, acuminate, erect, pale pink. Staminodes 4, the outer three 4–6 × 1–1·5 cm, obovate-oblanceolate, pinkish-red, suberect and all standing on adaxial side of flower, the fourth staminode and the semi-fertile stamen about as long but narrower, both twisted and somewhat deflexed abaxially, orange-yellow spotted with crimson. Capsule 3 × 2 cm. *Cultivated for ornament in the warmest parts of Europe, and locally naturalized.* [Az Si.] (*Tropical America and West Indies.*)

MICROSPERMAE

CCIII. ORCHIDACEAE[1]

Perennial herbs with rhizomes, vertical stock or tuberous roots, terrestrial, sometimes saprophytic, usually with mycorrhiza. Stems sometimes swollen at base to form pseudobulbs. Leaves entire, spirally arranged or distichous, rarely subopposite, reduced to scales or sheaths in saprophytes. Inflorescence a spike or raceme. Flowers zygomorphic, epigynous, usually hermaphrodite. Perianth-segments 6, in 2 whorls; median inner segment (*labellum*) usually larger and of different shape from the others, usually directed downwards owing to the ovary or the pedicel twisting through 180°, often with basal spur. Anthers and stigma borne on a *column* formed from fused filaments and style; stamens 1, rarely 2, with sessile or subsessile, 2-locular anthers behind or at the summit of the column; pollen-grains single or in tetrads, bound by elastic threads in packets (*pollinia*) which may be narrowed into a sterile, stalk-like *caudicle*. Ovary inferior, 1-locular, with parietal placentation, rarely 3-locular; stigmas 3, all fertile, or with the median sterile and often consisting of a beak-like process (*rostellum*) between the anthers and fertile stigmas; rostellum often forming 1 or 2 viscid bodies (*viscidia*) to which the pollinia are attached; viscidia sometimes enclosed in 1(2), simple or 2-lobed, membranous, pocket-like outgrowths (*bursicles*) of the rostellum. Fruit a capsule, dehiscing by 3 or 6 longitudinal slits; seeds numerous, minute, with undifferentiated embryo and no endosperm.

Literature: E. G. Camus, *Iconographie des Orchidées d'Europe et du Bassin méditerranéen.* Paris. 1921; *Texte.* Paris. 1929. G. Keller, R. Schlechter & R. von Soó, *Monographie und Iconographie der Orchideen Europas und des Mittelmeergebietes* **1–5**. Berlin. 1925–1944. H. Sundermann, *Europäische und mediterrane Orchideen.* Hildesheim. 1975.

1 Plant without green leaves
 2 Spur long, slender
  3 Labellum entire, directed downwards **4. Limodorum**
  3 Labellum 3-lobed, directed upwards **5. Epipogium**
 2 Spur very short or absent
  4 Stem with numerous scales; labellum *c.* twice as long as other perianth-segments **6. Neottia**
  4 Stem with 2–4 scales; labellum about as long as other perianth-segments **31. Corallorhiza**
1 Plant with green leaves or green, bract-like scales on a green stem
 5 Flowers without a spur
  6 Labellum large, inflated, slipper-shaped
   7 Plant with solitary pseudobulb and one foliage-leaf; anther 1 **32. Calypso**
   7 Plant with creeping rhizomes and 2–4 foliage-leaves; anthers 2 **1. Cypripedium**
  6 Labellum neither inflated nor slipper-shaped
   8 Labellum with distinctively coloured and shaped central area (*speculum*) **30. Ophrys**
   8 Labellum without speculum
    9 Labellum directed upwards
     10 Labellum shorter than outer perianth-segments; inner perianth-segments *c.* ½ as long as the outer **35. Hammarbya**
     10 Labellum about as long as outer perianth-segments; inner perianth-segments as long as or slightly shorter than the outer
      11 Outer perianth-segments not more than 3 mm; labellum densely tuberculate beneath towards apex; plant with 2 pseudobulbs borne one above the other **34. Microstylis**
      11 Outer perianth-segments at least 5 mm; labellum not tuberculate towards apex; plant with 2 pseudobulbs joined by short horizontal stolon **33. Liparis**
    9 Labellum directed downwards
     12 Labellum divided by a constriction into a concave basal part (*hypochile*) and a flat, downward- or forward-pointing distal part (*epichile*)
      13 Plant with tubers; epichile pendent **29. Serapias**
      13 Plant with rhizomes or stolons; epichile not pendent
       14 Outer perianth-segments not more than 4 mm **9. Goodyera**
       14 Outer perianth-segments at least 7 mm
        15 Flowers patent or pendent, pedicellate, in a ± secund spike; column not longer than wide **2. Epipactis**
        15 Flowers suberect, sessile or subsessile, not in a secund spike; column longer than wide **3. Cephalanthera**
     12 Labellum not clearly divided by a constriction into hypochile and epichile
      16 Flowers white, arranged in 1–3 spiral rows or in a secund spike **8. Spiranthes**
      16 Flowers yellowish, greenish or purplish, neither arranged in spiral rows nor in a secund spike
       17 Leaves about equalling stem, linear; labellum entire or shallowly lobed **14. Chamorchis**
       17 Leaves distinctly shorter than stem, oblong to linear-lanceolate; labellum conspicuously lobed
        18 Plant with rhizomes; labellum 2-lobed **7. Listera**
        18 Plant with 1 or 2 tubers; labellum 3-lobed, the median lobe sometimes 2-fid
         19 Plant with 1 tuber at anthesis; median lobe of labellum entire **11. Herminium**
         19 Plant with 2 tubers at anthesis; median lobe of labellum deeply 2-fid **25. Aceras**
 5 Flowers with a spur
  20 Labellum with median lobe much exceeding the lateral and spirally twisted
   21 Bracts equalling or shorter than flowers; outer perianth-segments connivent with inner lateral to form a galea **26. Himantoglossum**
   21 Bracts exceeding flowers; outer perianth-segments erecto-patent, not connivent to form a galea **27. Barlia**

[1] Edit. D. M. Moore.

20 Labellum entire or with median lobe not much exceeding the lateral and not spirally twisted
22 Labellum divided by a constriction into a concave basal part (*hypochile*) and a flat distal part (*epichile*) **3. Cephalanthera**
22 Labellum not divided into hypochile and epichile
23 Labellum entire or crenulate
24 Spur not more than 2 mm **17. Nigritella**
24 Spur more than 2 mm
25 Flowers greenish-white **13. Platanthera**
25 Flowers white or pink to purple or brownish, not greenish-white
26 Spur 25–30 mm **13. Platanthera**
26 Spur less than 25 mm
27 Bracts membranous **24. Orchis**
27 Lower bracts herbaceous **19. Dactylorhiza**
23 Labellum 3- or 5-lobed or 3-dentate at apex
28 Perianth-segments free, not forming a galea
29 Flowers yellowish-green; spur saccate **10. Gennaria**
29 Flowers pinkish-lilac; spur cylindrical-conical **23. Traunsteinera**
28 At least some perianth-segments connivent to form a galea
30 Spur more than 10 mm
31 Spur *c.* 1 mm wide
32 Labellum shallowly 3-lobed, without ridges at base; tubers palmately lobed **15. Gymnadenia**
32 Labellum deeply 3-lobed, with 2 longitudinal ridges at base; tubers entire **28. Anacamptis**
31 Spur more than 1 mm wide
33 All bracts membranous **24. Orchis**
33 Lower bracts herbaceous **19. Dactylorhiza**
30 Spur not more than 10 mm
34 Labellum 3-dentate at apex, the lateral teeth parallel and much longer than the median **18. Coeloglossum**
34 Labellum 3- or 5-lobed, the lateral lobes not parallel
35 Lobes of labellum prolonged into long, filiform, ±spiral processes **21. Comperia**
35 Lobes of labellum without long, filiform processes
36 All bracts membranous
37 Lateral lobes of labellum linear **22. Neotinea**
37 Lateral lobes of labellum oblong, ovate or rhombic **24. Orchis**
36 At least the lower bracts herbaceous
38 Outer perianth-segments connate almost to apex **20. Steveniella**
38 Outer perianth-segments free, though sometimes connivent to form a galea
39 Perianth-segments at least 5 mm
40 Spike secund; lateral lobes of labellum linear-setaceous **12. Neottianthe**
40 Spike not secund; lateral lobes of labellum oblong **19. Dactylorhiza**
39 Perianth-segments not more than 3 mm
41 Spur 4–5 mm, as long as or slightly shorter than ovary; flower pinkish-lilac, purple or white **15. Gymnadenia**
41 Spur not more than 2·5 mm, $\frac{1}{3}-\frac{1}{2}$ as long as ovary; flower yellowish- or greenish-white **16. Pseudorchis**

Subfam. **Cypripedioideae**

Fertile stamens 2; pollen not united in pollinia. Fertile stigmas 3.

1. Cypripedium L.[1]

Plants with creeping rhizomes. Stems with 2–4 leaves. Flowers solitary, rarely 2(–3), large. Perianth-segments patent; outer median ovate to elliptical, erect, the outer lateral connate in basal half; inner oblong to lanceolate, often twisted. Labellum large, concave, inflated, slipper-shaped; spur absent. Column stout, surmounted by large petaloid sterile anther partly closing mouth of labellum. Stigmas peltate; rostellum absent. Viscidia absent; bursicles absent.

1 Stem with 2 leaves; median outer perianth-segment 1·8–2·8 cm **3. guttatum**
1 Stem with 3–4 leaves; median outer perianth-segment 3·5–6 cm
2 Labellum yellow, distinctly shorter than other perianth-segments **1. calceolus**
2 Labellum pinkish to purplish, not or slightly shorter than other perianth-segments **2. macranthos**

1. C. calceolus L., *Sp. Pl.* 951 (1753). Rhizome long. Stem 15–50 cm, glandular-pubescent, with brown basal sheaths. Leaves 3–4, (7–)10–17 × 3·5–7(–10) cm, elliptical to ovate-oblong, acute to acuminate, sparsely pubescent. Flowers 1(–3), subtended by a large leaf-like bract. Perianth-segments 6–9 cm, reddish-brown, rarely yellow-green (f. *viridiflorum* Blytt); outer median 3·5–5 cm, ovate- to elliptic-lanceolate, the lateral forming a slightly narrower, downward-pointing bifid segment; inner 4–6 cm, asymmetrical, linear-lanceolate, acuminate. Labellum *c.* 3 cm, shorter than other perianth-segments, obovoid, rounded at apex, pale yellow, with reddish spots inside. $2n=20$. *Woods and meadows; calcicole. N., C., E. & S.E. Europe, westwards to Norway and the S.W. Alps; isolated stations in N. England and the E. Pyrenees. Much rarer than formerly over much of its range.* Au Br Bu Cz Da Fe Ga Ge Gr He Hs Hu It Ju No Po Rm Rs (N, B, C, W, K, E) Su.

2. C. macranthos Swartz, *Kungl. Svenska Vet.-Akad. Handl.* nov. ser., **21**: 251 (1800). Like **1** but rhizome short; perianth-segments lilac, the outer median 4–6 cm, the inner ovate-lanceolate to lanceolate; labellum (4–)4·5–7 cm, slightly shorter to longer than other perianth-segments, pinkish to purplish. *Woods and clearings. U.S.S.R., from E. White Russia to C. & S. Ural.* Rs (C).

3. C. guttatum Swartz, *loc. cit.* (1800). Rhizome long. Stem 15–50 cm, glandular-pubescent, with brown basal sheaths, with 2 leaves at about the middle. Leaves 6–12 × 3·5–6 cm, elliptical to elliptic-ovate, acute to acuminate, sparsely pubescent. Flower solitary, subtended by large leaf-like bract. Median outer perianth-segment 1·8–2·8 cm, white, often with purple blotches or spots, the lateral outer shorter, green; inner *c.* 2 cm, panduriform. Labellum 2–2·3 cm, obovoid, rounded at apex, white, with large, more or less confluent lilac spots. *Woods and clearings. Russia, from c.* 51° *to c.* 60° *N.* Rs (N, C, E).

Subfam. **Orchidoideae**

Fertile stamen 1; pollen united in pollinia. Fertile stigmas 2, often confluent.

2. Epipactis Zinn[1]
(*Helleborine* Miller)

Plants with horizontal or vertical rhizome and numerous fleshy roots. Stem leafy. Flowers pedicellate, patent or pendent, in more or less secund spikes. Perianth-segments free, patent or connivent, the inner similar to the outer but smaller. Labellum with concave or cupuliform basal part (*hypochile*) separated by narrow joint or fold from the flat, forward-directed distal part (*epichile*), with basal tubercles or ridges; spur absent. Column short. Rostellum usually large and globose, sometimes absent. Viscidia absent; bursicles absent.

A difficult genus, particularly with regard to those species (**3–5**, **7**) which are largely or entirely autogamous.

[1] By D. M. Moore.

Literature: J. Holub, *Preslia* **42**: 330–349 (1970). A. & C. Nieschalk, *Abh. Ver. Naturk. Kassel* **63**: 1–40 (1970). L. Reichling, *Arch. Inst. G.-D. Luxemb.* (*Sci. Nat.*) nov. ser., **22**: 123–145 (1955). K. Senghas & H. Sundermann (edit.), *Jahresb. Naturw. Ver. Wuppertal* **23**: 1–132 (1970). D. P. Young, *Watsonia* **2**: 253–276 (1952); **5**: 127–139 (1962); *Bot. Not.* **1953**: 253–270 (1953); *Bull. Jard. Bot. Bruxelles* **28**: 123–127 (1958).

1 Rhizome long, creeping; hypochile with 2 erect lateral lobes, connected to epichile by a narrow joint **1. palustris**
1 Rhizome short, horizontal or vertical; hypochile without lateral lobes, connected to epichile by 1 or more folds
2 Rhachis, pedicels and ovary densely pubescent
3 Leaves 4–10 cm, distichous; flowers deep purple **8. atrorubens**
3 Leaves 1–3 cm, spirally arranged; flowers greenish, with reddish tinge **9. microphylla**
2 Rhachis, pedicels and ovary ± glabrous to scabridulous
4 Leaves distichous; rostellum absent, at least at maturity; flowers frequently cleistogamous or partially so
5 Flowers patent or obliquely pendent; hypochile purplish or pinkish inside **(3–5). leptochila** group
5 Flowers pendent; hypochile greenish-white inside **7. phyllanthes**
4 Leaves spirally arranged; rostellum prominent and persistent; flowers not cleistogamous
6 Leaves greyish or purplish; epichile at least as long as wide **6. purpurata**
6 Leaves green; epichile not longer than wide **2. helleborine**

1. E. palustris (L.) Crantz, *Stirp. Austr.* ed. 2, **2**: 462 (1769) (*Helleborine palustris* (L.) Schrank). Rhizome long, creeping. Stem 15–50(–70) cm, pubescent above, purplish below, with sheathing scales. Leaves spirally arranged, 4–8, 5–15 × 2–4 cm, oblong to oblong-lanceolate, subacute to acuminate, the upper smaller. Raceme 6–15(–20) cm, 7- to 14-flowered; bracts lanceolate, the lower equalling flowers, the others shorter. Flowers patent when mature; outer perianth-segments 8–12 mm, lanceolate to ovate-lanceolate, greenish, with faint violet stripes, the inner whitish, pinkish below. Labellum 10–12 mm; hypochile slightly concave, with an erect triangular lobe at each side, pinkish-white, with orange-yellow papillae and purplish lines inside; epichile connected by narrow joint, ovate, obtuse, as long as wide, white, with red veins, with undulate margin and lobed basal protuberance. Rostellum persistent. Ovary pubescent. $2n = 40$, 44, 46, 48. *Marshes and other damp places. Most of Europe except the extreme north and parts of the Mediterranean region.* Al Au Be ?Bl Br Bu Cz Da Fe Ga Ge Gr Hb He Ho Hs Hu It Ju Lu No Po Rm Rs (N, B, C, W, K, E) Su Tu.

2. E. helleborine (L.) Crantz, *op. cit.* 467 (1769) (*Helleborine latifolia* (L.) Moench). Rhizome short, oblique or horizontal. Stem 35–80(–100) cm, pubescent above, often purplish below, with sheathing scales. Leaves spirally arranged, 4–10, 5–17 × 2·5–10 cm, ovate-elliptical to suborbicular, acute to shortly acuminate. Raceme (7–)10–40 cm, 15- to 50-flowered; bracts lanceolate to ovate-lanceolate, the lower equalling or exceeding flowers. Flowers obliquely pendent; outer perianth-segments 10–13 mm, elliptic-ovate, greenish, the inner pinkish-violet towards the base. Labellum 9–11 mm; hypochile cupuliform, greenish outside, dark reddish-brown inside; epichile cordate to broadly ovate, with recurved acute apex, shorter than to as long as wide, greenish-white, pink or purplish, with 2(–3) smooth or slightly rugose basal protuberances. Rostellum persistent. Ovary glabrous or sparsely hairy. $2n = 36$, 38, 40, 44. *Woods and scrub; sometimes among maritime sand-dunes. Almost throughout Europe.* All except Az ?Bl Fa Is Sb.

(3–5). E. leptochila group. Rhizome short, vertical or oblique. Stem 20–70 cm, pubescent, especially above, usually purplish below, with sheathing scales. Leaves distichous, 4–10, ovate to lanceolate, acute, with more or less undulate margin. Bracts linear-lanceolate, the lower exceeding the flowers. Hypochile cupuliform, pale greenish, reddish-mottled inside.

A group of largely autogamous taxa which are probably derived from the allogamous facies of 3 and which are possibly conspecific. The distributions are not well-known and dubious records have been omitted below.

1 Epichile acuminate, with flat apex; outer perianth-segments acuminate **3. leptochila**
1 Epichile subobtuse, with recurved apex; outer perianth-segments obtuse
2 Epichile as long as wide; anther stipitate **5. dunensis**
2 Epichile wider than long; anther sessile **4. muelleri**

3. E. leptochila (Godfery) Godfery, *Jour. Bot.* (*London*) **59**: 146 (1921). Leaves 5–10 × (1·5–)2–5 cm, dull yellow- or dark green. Raceme 7·5–25 cm, up to 25-flowered. Flowers patent or obliquely pendent; perianth-segments pale green, the outer 7–15 mm, lanceolate, acuminate. Labellum 4–9 mm; hypochile usually with nectar; epichile cordate, acuminate, with flat apex, as long as or longer than wide, somewhat concave and yellow-greenish with white margin, rarely flat and green (var. *cleistogama* (C. Thomas) D. P. Young), with 2 smooth or slightly rugose, white or pinkish basal protuberances. Rostellum absent at anthesis; anther prominently stipitate. Ovary tuberculate, with sparse, blackish hairs. $2n = 36$. *Woods and scrub, usually in dense shade; calcicole.* ● *N.W. & C. Europe; one station in N. Greece.* Au Be Br Cz Da Ga Ge Gr He Ho Hu Ju.

4. E. muelleri Godfery, *op. cit.* 106 (1921). Leaves 4–8(–10) × (1·5–)2–4 cm, yellowish-green. Raceme 5–12(–17) cm, (10–)15- to 25(–40)-flowered. Flowers patent or slightly erecto-patent; perianth-segments yellowish-green, the outer 7–11 mm, ovate-lanceolate. Labellum 7–9(–10) mm; hypochile without nectar; epichile cordate, subobtuse, usually with recurved apex, wider than long, pale pink or greenish, with 2(–3) smooth basal protuberances. Rostellum usually absent; anther sessile, attached almost directly above the stigma. *Open woods and clearings; calcicole.* ● *W. & C. Europe.* Au Be Cz Ga Ge He Ho Hu.

5. E. dunensis (T. & T. A. Stephenson) Godfery, *op. cit.* **64**: 68 (1926). Like **4** but epichile as long as wide; anther stipitate. *Maritime sand-dunes.* ● *N. England and N. Wales.* Br.

Records for continental Europe are probably referable to **4.**

6. E. purpurata Sm., *Engl. Fl.* **4**: 41 (1828). Rhizome short, vertical. Stem 20–70 cm, pubescent above, purplish below, with sheathing scales. Leaves spirally arranged, 5–10, 6–10 × 2–5 cm, ovate-lanceolate to lanceolate, acute to shortly acuminate, greyish or purplish. Raceme 15–25 cm, many-flowered; bracts linear, acuminate, the lower usually exceeding flowers. Flowers obliquely pendent when mature; outer perianth-segments 10–12 mm, lanceolate, subobtuse, green outside, whitish inside, the inner whitish, sometimes with pinkish tinge. Labellum 8–10 mm; hypochile cupuliform, greenish outside, usually mottled with violet inside; epichile triangular-cordate, acute, with recurved apex, as long as or longer than wide, whitish, with 2–3 smooth, confluent basal protuberances. Rostellum persistent. Ovary scabridulous. $2n = 40$. *Woods; somewhat calcicole.* ● *N.W. & C. Europe, extending south-eastwards to Bulgaria.* Au Be Br Bu Cz Da Ga Ge ?Gr He Hu Ju Po Rm Rs (W).

7. E. phyllanthes G.E. Sm., *Gard. Chron.* **1852**: 660 (1852). Rhizome short, horizontal or oblique. Stem (8–)20–45(–65) cm, glabrous or sparsely pubescent, green. Leaves distichous, 3–6, 3·5–7 × 3–5 cm, orbicular to lanceolate, acute to acuminate, often concave, the margin sometimes undulate. Raceme up to 15 cm, 15- to 35-flowered; bracts linear-lanceolate, acuminate, the lower usually exceeding flowers. Flowers pendent; outer perianth-segments 8–10 mm, lanceolate to ovate-lanceolate, acuminate, pale yellowish-green, the inner pale yellowish-green, sometimes with violet tinge. Labellum 6–8 mm; hypochile cupuliform to shallowly concave, whitish or greenish; epichile sometimes not clearly separated from hypochile, ovate-lanceolate to cordate, acute or acuminate, usually longer than wide, greenish-white to pinkish, often rugose or with two protuberances at base. Rostellum absent. Ovary more or less glabrous. $2n=36$. *Open woodland, scrub and among coastal dunes; calcicole.* ● *N.W. & W.C. Europe, extending to S. Sweden.* ?Au Br Da Ga Hb Su.

An autogamous species showing much variation, particularly in labellum shape, but intermediates are frequent and it is not possible to recognize categories above the varietal level.

Plants from Denmark and S. Sweden, which have been called **E. confusa** D. P. Young, *Bot. Not.* **1953**: 263 (1953) (*E. persica* auct., non (Soó) Hausskn. ex Nannf.), seem to differ from **7** only in their smaller size and in chromosome number ($2n=40$) and do not merit recognition at specific rank.

8. E. atrorubens (Hoffm.) Besser, *Prim. Fl. Galic.* **2**: 220 (1809) (*E. atropurpurea* Rafin., *E. rubiginosa* (Crantz) Gaudin, *Helleborine atropurpurea* (Rafin.) Schinz & Thell.). Rhizome short, more or less horizontal. Stem (15–)20–60(–100) cm, glabrous or sparsely pubescent, violet below, with sheathing scales. Leaves distichous, 5–10, 4–10 × 1·5–4·5 cm, ovate to ovate-lanceolate, acute to acuminate. Raceme 7–25 cm, 8- to 18-flowered, the rhachis densely pubescent; bracts lanceolate, acute, the lowest equalling or sometimes exceeding flowers. Flowers patent; perianth-segments deep purple, the outer 6–7 mm, ovate, acuminate, the inner elliptical. Labellum 5·5–6·5 mm; hypochile cupuliform, green, with red margin, with red spots inside; epichile cordate-reniform, acute, with recurved apex, wider than long, deep reddish-purple, with 2(–3) rugose protuberances at base. Rostellum persistent. Ovary densely pubescent. $2n=40+0$–7 B. *Woods and rocky slopes; calcicole. Much of Europe, but rare in the Mediterranean region.* Al Au Be Br Bu Cz Da Fe Ga Ge Gr Hb He Ho Hs Hu It Ju No Po Rm Rs (N, B, C, W, K, E) Su Tu.

9. E. microphylla (Ehrh.) Swartz, *Kungl. Svenska Vet.-Akad. Handl.* nov. ser., **21**: 232 (1800) (*Helleborine microphylla* (Ehrh.) Schinz & Thell.). Rhizome short, vertical or oblique. Stem 15–40 cm, pubescent above, with basal sheathing scales. Leaves spirally arranged, 3–6, 1–2·5(–3) × *c.* 1 cm, shorter than internodes, lanceolate to linear-lanceolate, acuminate. Raceme 3–12 cm, 4- to 15-flowered, the rhachis densely pubescent; bracts lanceolate, acuminate, the lower as long as flowers. Flowers patent, outer perianth-segments *c.* 7 mm, elliptic-ovate, subobtuse, greenish with reddish tinge outside, whitish-green inside, the inner ovate, whitish-green. Labellum 6·5–7 mm; hypochile cupuliform, greenish-brown; epichile orbicular-ovate, subobtuse, whitish or pale pink, with crenate, slightly undulate margin and 2 rugose protuberances at base. Rostellum persistent. Ovary densely pubescent. $2n=40$. *Woods; calcicole. S. & C. Europe, extending to N.C. France.* Al Au Be Bl Bu Co Cr Cz Ga Ge Gr He Hs Hu It Ju Po Rm Rs (K) Sa Si.

3. Cephalanthera L. C. M. Richard[1]

Plants with short, creeping rhizome. Stem leafy. Flowers few, large, suberect, sessile or subsessile, in a lax spike, scentless. Perianth-segments similar, usually connivent to give campanulate flowers. Labellum constricted between the suberect concave basal part (*hypochile*) and the forward-directed distal part (*epichile*) which has a recurved apex and 3–9 interrupted longitudinal ridges above; spur absent or very short. Column long, erect. Rostellum absent. Viscidia absent; bursicles absent.

1 Spur present, short
 2 Outer perianth-segments not more than 20 mm; spur 1–2 mm; epichile with 3–6 ridges **3. cucullata**
 2 Outer perianth-segments at least 25 mm; spur 3–4 mm; epichile with 7–9 ridges **4. epipactoides**
1 Spur absent
 3 Flowers pink or purplish; upper part of stem and ovaries pubescent; epichile acute **5. rubra**
 3 Flowers white; upper part of stem and ovaries glabrous; epichile obtuse
  4 Lower leaves ovate to ovate-lanceolate; bracts exceeding the ovary; outer perianth-segments obtuse **1. damasonium**
  4 Lower leaves lanceolate; bracts much shorter than ovary; outer perianth-segments acute **2. longifolia**

1. C. damasonium (Miller) Druce, *Ann. Scott. Nat. Hist.* **1906**: 225 (1906) (*C. alba* (Crantz)) Simonkai, *C. grandiflora* S. F. Gray, *C. pallens* L. C. M. Richard). Stem 15–60 cm, erect, angled, glabrous, with 2–3 brownish basal sheaths. Leaves 4–10 cm, subobtuse to acuminate, the lowest short, ovate-lanceolate, the middle oblong-ovate, the upper lanceolate. Spike up to 12 cm, 3- to 12(–16)-flowered. Flowers white or creamy-white, usually closed and tubular-campanulate, all but lowest much exceeded by bracts. Perianth-segments 15–20 mm, obtuse; outer oblong; inner lateral oblong-lanceolate, shorter than the outer. Labellum shorter than other perianth-segments, white, yellowish within, with an orange-yellow crescentic mark at base of hypochile; epichile with 3–5 orange-yellow ridges, obtuse; spur absent. Ovary glabrous. $2n=32$. *Woods and other shady places; somewhat calcicole. S., C. & W. Europe, northwards to England and S.E. Sweden, and extending eastwards to S.W. part of U.S.S.R.* Al Au Be Bl Br Bu Co Cz Da Ga Ge Gr He Ho Hs Hu It Ju Po Rm Rs (B, C, W, K) Sa Si Su Tu.

2. C. longifolia (L.) Fritsch, *Österr. Bot. Zeitschr.* **38**: 81 (1888). Like **1** but stem slightly ridged above and with 2–4 whitish, sometimes greenish-tipped, basal sheaths; leaves 7–20 cm, lanceolate, the uppermost linear; flowers exceeding all but lowest bracts, usually more open; perianth-segments 10–16 mm, the outer lanceolate, acute. $2n=32$. *Woods and other shady places. Most of Europe except the extreme north and most of the north-east.* All except Az Cr Fa Is Rs (N, E) Sb; extinct in Ho.

3. C. cucullata Boiss. & Heldr. in Boiss., *Diagn. Pl. Or. Nov.* **2(13)**: 12 (1853). Stem 15–30 cm, erect, glabrous, with *c.* 4 whitish basal sheaths. Leaves 2·5–6 cm, oblong-lanceolate, acute, cucullate. Spike 4–15 cm, (4–)7- to 24-flowered. Flowers white or pinkish, open, all but the lowest exceeding the bracts. Outer perianth-segments 14–20 mm, oblong-lanceolate, acute; inner lateral 12–16 mm, ovate-oblong, subobtuse or acute. Labellum slightly shorter than other perianth-segments; hypochile with rounded lateral lobes; epichile cordate, subacute, with 3–6 ridges; spur 1–2 mm, conical, obtuse. Ovary glabrous. *Mountain woods and scrub. Kriti.* Cr.

[1] By D. M. Moore.

4. C. epipactoides Fischer & C. A. Meyer, *Ann. Sci. Nat.* ser. 4, **1**: 30 (1854). Like **3** but stem 30–100 cm; spike 10- to 20-flowered; outer perianth-segments 25–36 mm, the inner 18–25 mm; hypochile with truncate lateral lobes; epichile triangular-lanceolate, with 7–9 ridges; spur 3–4 mm, subacute. *N. Aegean region.* Gr Tu. (*W. Anatolia.*)

Perhaps better treated as a subspecies of **3**.

5. C. rubra (L.) L. C. M. Richard, *Orchid. Eur. Annot.* 38 (1817). Stem 20–60 cm, erect, striate and glandular-pubescent above, with a few brownish, sometimes green-tipped, basal sheaths. Leaves 5–8, 5–12 cm, acute, the lower oblong-lanceolate to lanceolate, the upper linear-lanceolate. Spike up to 12 cm, (2–)3- to 10(–12)-flowered. Flowers bright pink or purplish, open, exceeding most or all of the bracts. Outer perianth-segments 17–22(–25) mm, lanceolate, subacute, patent, glandular-pubescent outside; inner lateral 15–18(–20) mm, ovate-lanceolate, subacute, connivent. Labellum about as long as outer perianth-segments, white, the epichile acute, with purple margin and 7–9 narrow yellowish ridges; spur absent. Ovary glandular-pubescent. $2n=48$. *Woods; usually calcicole. Most of Europe, northwards to S. England and S. Finland.* Al Au Be Br Bu Co Cr Cz Da Fe Ga Ge Gr He †Ho Hs Hu It Ju Lu No Po Rm Rs (B, C, W, K, E) Sa Si Su Tu.

4. Limodorum Boehmer[1]

Violet saprophytes with short rhizome. Stem clothed with scale-like sheaths. Green leaves absent. Flowers in an erect, spike-like raceme. Perianth-segments free, patent. Labellum entire. Spur long, slender, curved upwards. Column long. Viscidium solitary; bursicles absent.

1. L. abortivum (L.) Swartz, *Nova Acta Reg. Soc. Sci. Upsal.* **6**: 80 (1799) (*Ionorchis abortiva* (L.) G. Beck). Rhizome densely covered with thickish roots. Stems 40–80 cm, erect, robust, rigid; scales numerous. Racemes (10–)15–33 cm, lax, 4- to 25-flowered. Perianth-segments *c.* 2 cm, the outer oblong-lanceolate, the inner slightly shorter and narrower, violet. Labellum 1·6–1·7 cm, triangular, with undulate margins, yellow and violet. Spur up to 1·5 cm, cylindrical. $2n=56$. *Woods and shady grassland; calcicole. C. & S. Europe, extending north-westwards to Belgium.* Al Au Be Bl Bu Co Cr Cz Ga Ge Gr He Hs Hu It Ju Lu Rm Rs (K) Sa Si.

Plants found in W.C. Portugal (N. of Lisboa), and also in N. Africa, have been distinguished as subsp. **trabutianum** (Batt.) Rouy, *Fl. Fr.* **13**: 208 (1912), which has a very short spur, a sub-linear labellum and $2n=60$. It occurs intermingled with the typical form and probably merits no more than varietal status.

5. Epipogium R. Br.[1]

Pinkish saprophytes with coralloid rhizomes; roots absent. Stem with few sheathing scales. Green leaves absent. Flowers pendent, in a raceme. Perianth-segments free, directed downwards. Labellum 3-lobed, directed upwards. Spur slender, directed upwards. Column short. Rostellum small. Viscidia 2, distinct; bursicles absent.

1. E. aphyllum Swartz, *Summa Veg. Scand.* 32 (1814). Rhizome whitish, with many short, lobed branches and 1–2 filiform stolons. Stem 5–20 cm, erect, pinkish, with many short reddish streaks, turgid, with swelling near base, with 2–5 short, brownish, sheathing scales. Flowers 1–5(–7), pendent on short, slender pedicels. Perianth-segments subequal, curved downwards; outer linear, yellowish or reddish; inner lanceolate, obtuse, yellowish, with short violet lines. Labellum with 2 short, rounded, lateral lobes and a large concave, ovate to triangular, undulate middle lobe, white or pinkish, with violet spots and papillae. Spur *c.* 8 mm, rounded at apex, white tinged with yellow or reddish outside. *Woods. N. & C. Europe, extending southwards in the mountains to the Pyrenees, C. Appennini, N.W. Greece and Krym.* Au Be Br Bu Cz Da Fe Ga Ge Gr He Hu It Ju No Po Rm Rs (N, B, C, W, K) Su.

[1] By D. M. Moore.

6. Neottia Ludwig[1]

Yellowish-brown saprophytes, with short, creeping rhizome covered with thick, fleshy roots to form a nest-like mass. Green leaves absent. Stem covered with brownish scales. Flowers numerous, in a spike-like raceme, fragrant. Perianth-segments subequal or the inner somewhat shorter, somewhat convergent into an open galea. Labellum saccate at base, 2-lobed distally; spur absent. Column long, slender. Rostellum wide, flat. Viscidia absent; bursicles absent.

1. N. nidus-avis (L.) L. C. M. Richard, *Orchid. Eur. Annot.* 37 (1817). Stem 20–45 cm, erect; scales 3–5 cm, scarious, sheathing. Racemes 5–21 cm, rather lax below; bracts shorter than ovary, lanceolate-acuminate, scarious; pedicels 3–6 mm, twisted. Perianth-segments 4–6 mm, ovate- to elliptic-oblong, obtuse, yellowish-brown, rarely whitish or yellowish. Labellum 8–12 mm, obliquely pendent, greyish-brown, the undivided part oblong, with 2 small lateral teeth near base, the lobes cordate-oblong, obtuse, divergent. $2n=36$. *Shady woodland, especially on humus-rich soils. Most of Europe, but rare in the extreme north.* All except Az Cr Fa Is Sb.

7. Listera R. Br.[1]

Plants with short rhizome and slender roots. Leaves usually 2, subopposite, sessile, borne just below middle of stem. Inflorescence a rather lax, spike-like raceme. Perianth-segments subequal, patent or somewhat convergent. Labellum 2–3 times as long as other segments, deeply 2-fid distally, rarely with 2 small basal lobes, secreting nectar in central furrow; spur absent. Column short, erect. Rostellum wide, flat. Viscidia absent; bursicles absent.

Leaves 5–20 cm; raceme 7–25 cm, many-flowered	**1. ovata**
Leaves 1–2·5 cm; raceme 1·5–6 cm, 4- to 12-flowered	**2. cordata**

1. L. ovata (L.) R. Br. in Aiton, *Hort. Kew.* ed. 2, **5**: 201 (1813). Rhizome rather thick. Stem 20–60 cm, erect, glabrous below, pubescent above, with 2–3 brownish, membranous basal sheaths and 1–3 minute bract-like leaves distally. Leaves 2, 5–20 cm, broadly ovate-elliptical, obtuse or mucronate. Raceme 7–25 cm; flowers numerous, shortly pedicellate; bracts minute, ovate-lanceolate. Perianth-segments 4–5 mm; outer ovate, obtuse, green; inner narrowly oblong, yellowish-green. Labellum 7–15 mm, obcuneate, divided almost to middle into 2 narrowly oblong lobes, yellowish-green; basal lobes tooth-like, or absent. $2n=34$ +0–2B, 35, 36, 37, 38. *Woods, scrub, grassland and marshy ground. Almost throughout Europe, but less common in the south.* All except Az Bl Fa Lu Sb Tu.

2. L. cordata (L.) R. Br., *loc. cit.* (1813). Rhizome slender, creeping. Stem (4·5–)6–20 cm, erect, glabrous below, sparsely pubescent above, with 1–2 brownish, membranous basal sheaths.

Leaves 2(–4), 1–2·5 cm, ovate-deltate, mucronate. Raceme 1·5–6 cm; flowers 4–12, shortly pedicellate; bracts minute, triangular. Perianth-segments 2–2·5 mm, oblong-elliptical, obtuse; outer green, the median somewhat cucullate, the lateral and inner narrower, directed forward, green outside, reddish inside. Labellum 3·5–4·5 mm, obcuneate, divided to about the middle into 2 diverging linear lobes, purplish; basal lobes linear-lanceolate. $2n=38, 40$. *Damp woods (mainly coniferous) and moorland. N. & C. Europe, extending southwards to the Pyrenees, N. Appennini and S. Bulgaria.* Au Br Bu Cz Da Fa Fe Ga Ge Hb He Ho Hs Is It Ju No Po Rm Rs (N, B, C, W) Su.

8. Spiranthes L. C. M. Richard[1]

Roots fleshy, more or less tuberous. Spike-axis twisted, so that flowers are arranged in one or more spiral rows. Perianth-segments subequal, free or variously connate or connivent. Flowers fragrant, geniculate or arcuate, the ovary suberect, the perianth and column horizontal. Labellum about equalling the other perianth-segments, oblong, entire. Spur absent. Rostellum deeply 2-fid, with narrow, acute lobes, between which lies the single visicidium; bursicles absent. Anther largely hidden behind rostellum.

1 Leaves ovate-elliptical, patent, in a basal rosette; cauline leaves reduced to scales **1. spiralis**

1 Leaves linear-lanceolate to narrowly oblong, ±erect, some of them cauline

2 Flowers in one spiral row; bracts 6–7 mm; leaves obtuse **2. aestivalis**

2 Flowers in 3 spiral rows; bracts 10–17 mm; leaves acute **3. romanzoffiana**

1. S. spiralis (L.) Chevall., *Fl. Gén. Env. Paris* **2**: 330 (1827) (*S. autumnalis* L. C. M. Richard). Roots tuber-like, oblong-ellipsoid. Stem 6–20(–35) cm, glandular-pubescent, bearing 3–7 closely appressed, lanceolate scale-leaves. Foliage-leaves 2–3·5 cm, ovate-elliptical, acute, glabrous, glaucous, in a basal rosette, usually withered at anthesis, but next year's rosette appears during anthesis beside the flowering stem. Spike 3–10 cm, slender, with 6–20 flowers in one spiral row. Bracts 6–7 mm, acuminate. Perianth-segments 6–7 mm, oblong, white, the upper 3 connivent and forming with the labellum a tube enclosing the column, the outer lateral segments patent. Labellum 6–7 mm, with upwardly curved margins and undulate-crenulate apex, yellowish-green. Flowering in autumn or late summer. $2n=30$. *Grassland. S., W. & C. Europe, extending northwards to E. Denmark.* All except Az Fa Fe Is No Rs (N, B, C, K, E) Sb Su.

Even among orchids this species is noteworthy for the irregularity of its flowering; in certain regions, especially in the northern part of its range, populations often do not flower for many seasons.

2. S. aestivalis (Poiret) L. C. M. Richard, *Orchid. Eur. Annot.* 36 (1817). Roots cylindrical-conical or fusiform. Stem 12–30 (–40) cm, glandular-puberulent above. Leaves 5–12 cm × 4–9 mm, linear-lanceolate, obtuse, suberect, mostly basal but 1–2 on lower part of stem, passing into lanceolate scales above, present at anthesis. Spike 3–10 cm, slender, with 6–20 flowers in one spiral row. Bracts 6–9 mm, acuminate. Perianth-segments free, suberect, white, the outer 6–7 mm, lanceolate, the inner 5–6 mm, oblong. Labellum 6–7 mm, with upwardly-curved margins, deflexed at apex, white. Flowering in mid-summer. *Wet meadows and marshes. S., W. & C. Europe, but rare in the Mediterranean region.* Au Be †Br Co Cz Ga Ge ?Gr He Ho Hs Hu It Ju †Lu Sa.

A diminishing species, especially in the northern part of its range.

S. sinensis (Pers.) Ames, *Orchidaceae* **2**: 53 (1908) (*S. amoena* (Bieb.) Sprengel, *S. australis* auct. ross., non (R. Br.) Lindley), which is found throughout temperate Asia, may perhaps occur just inside the limits of Europe in C. Ural. It resembles **2** in most characters, but the perianth-segments are bright pink and the labellum has 2 callosities near its base.

3. S. romanzoffiana Cham., *Linnaea* **3**: 32 (1828). Roots cylindrical, relatively slender. Stem 12–25 cm, sparsely glandular-puberulent above. Leaves basal and cauline, linear-lanceolate to narrowly oblong, acute, suberect, the lower 7–12 cm × 5–13 mm, the upper cauline smaller but not reduced to scales, present during anthesis. Spike 3–6 × 2 cm, dense, with 12–35 flowers in 3 spiral rows. Bracts 10–17 mm, ovate, acuminate. Perianth *c.* 12 mm, white tinged with green or cream, all segments, including the labellum, connate in lower half. Labellum somewhat constricted below the sharply deflexed, crenulate apex. Flowering in mid- to late summer. $2n=60$. *Damp, peaty ground and lake-shores. Ireland, W. Scotland, S.W. England.* Br Hb. (*North America.*)

9. Goodyera R. Br.[1]

Like *Spiranthes* but with stolons and without tubers; leaves conspicuously net-veined; spiral arrangement of flowers less marked or absent; labellum shorter than outer perianth-segments, the basal part (*hypochile*) strongly concave, the distal part (*epichile*) triangular, flat.

1. G. repens (L.) R. Br. in Aiton, *Hort. Kew.* ed. 2, **5**: 198 (1813). Stolons branched, slender, overground; roots few and short. Plant 10–25 cm, glandular-pubescent, at least in inflorescence. Lower leaves 3–6, 1·5–3 × 1–2 cm, ovate, narrowed abruptly to a sheathing petiole, with 5 longitudinal and numerous transverse veins; upper leaves reduced to sheaths, sometimes with a small linear lamina, a transitional leaf with well-developed, narrowly oblong lamina often present. Spike 3–7 cm, slender, lax, secund, often with a slight spiral twist. Flowers white, fragrant. Perianth-segments 3–4 mm, ovate to lanceolate, obtuse, the 3 uppermost forming a galea. $2n=30, 40$. *Coniferous or mixed woods. Europe, southwards to the Pyrenees, the Alps and Bulgaria.* Au *Be Br Bu Cz Da Fe Ga Ge He Ho Hs Hu It Ju No Po Rm Rs (N, B, C, W, K) Su.

10. Gennaria Parl.[2]

Tuber oblong. Stem bearing 2 alternate leaves in upper half. Flowers in a dense spike. Perianth-segments free. Labellum 3-lobed. Spur short. Rostellum short. Stigmas shortly stipitate. Viscidia small; bursicles absent.

1. G. diphylla (Link) Parl., *Fl. Ital.* **3**: 405 (1860) (*Orchis cordata* Willd., *O. diphylla* (Link) Samp.). Stem 15–30 cm. Lower leaf 40–70 × 25–70 mm, the upper much smaller, both elliptical- to triangular-ovate, cordate at base. Flowers many, yellowish-green, shortly pedicellate, in a spike up to 10 cm. Perianth-segments convergent or slightly divergent, campanulate; outer oblong, obtuse, slightly concave; inner slightly larger, rhombic, obtuse. Labellum ovate-oblong, green; lobes linear-lanceolate, obtuse, the middle somewhat larger. Spur saccate, obtuse, slightly dorsally compressed. *Shady places. S. & C. Portugal, S.W. Spain; N. Sardegna.* Hs Lu Sa. (*N. Africa; Madeira, Islas Canarias.*)

[1] By D. A. Webb. [2] By D. M. Moore.

11. Herminium Guett.[1]

Tubers globose. Cauline leaves present. Perianth-segments erecto-patent or somewhat convergent, but not forming a distinct galea. Labellum conspicuously 3-lobed, slightly longer than the other perianth-segments; spur absent. Viscidia distinct; bursicle very rudimentary.

1. H. monorchis (L.) R. Br. in Aiton, *Hort. Kew.* ed. 2, **5**: 191 (1813). Tuber solitary at anthesis, 2–4 others appearing later on slender, underground stolons. Plant 7–25 cm. Lower leaves 2–3(–4), 20–70 × 3–10 mm, elliptic-oblong to linear-lanceolate, the upper 0–2, linear-subulate, bract-like. Spike 1·5–9 cm, slender, sometimes secund, usually rather lax. Flowers yellowish-green, honey-scented. Outer perianth-segments 2·5–3 mm, ovate-lanceolate, obtuse, the inner *c.* 3·5 mm, oblong-lanceolate, often shallowly lobed near base. Labellum 3·5–4 mm; lobes oblong, the 2 lateral projecting at right angles or curved forwards, much shorter than the middle. $2n=40$. *Grassland. Much of Europe, but absent from the extreme north and most of the Mediterranean region and the south-west.* Au Be Br Bu Cz Da Fe Ga Ge He Ho †Hu It Ju No Po Rm Rs (N, B, C, W, E) Su.

12. Neottianthe Schlechter[1]

Tubers usually ellipsoid. Basal leaves 2. Perianth-segments more or less equal, connivent into a galea. Labellum deeply 3-lobed, densely papillose. Spur conical, curved, shorter than ovary, directed downwards and forwards. Viscidia close together, above the stigma; bursicles absent.

1. N. cucullata (L.) Schlechter, *Feddes Repert.* **16**: 292 (1919) (*Gymnadenia cucullata* (L.) L. C. M. Richard). Tubers ellipsoid to subglobose, sometimes emarginate or shortly 2-lobed. Plant 10–30 cm, glabrous. Basal leaves 5–7 × 1·5–3 cm, elliptical; cauline leaves 1–2, small and bract-like. Spike 3–8 cm, secund, rather lax. Flowers lilac-pink. Perianth-segments 6–8 × 1–1·5 mm, acuminate. Labellum 7–9 mm, somewhat deflexed; lateral lobes linear-setaceous; middle lobe longer, linear-oblong. Spur *c.* 5 mm, slightly dilated at apex. *Damp woods and mountain meadows. U.S.S.R. and Poland, from c.* 57° *N. in Latvia and C. Ural southwards to* 49° 30′ *N. in W. Ukraine.* Po Rs (B, C, W).

13. Platanthera L. C. M. Richard[1]

Stock usually with tubers. Leaves few, usually only the lowest 1–3 well developed, the upper reduced to sheaths or with a small, bract-like lamina. Flowers white or green, in a usually fairly dense spike. Outer lateral perianth-segments patent, the inner lateral shorter, connivent with the outer median to form a galea. Labellum linear-oblong to rhombic-lanceolate, entire. Spur more or less cylindrical. Stigma single, flat; rostellum inconspicuous. Viscidia distinct; bursicles absent.

1 Spur 18–30 mm, longer than ovary
2 Anther-lobes parallel, almost contiguous; spur acute **1. bifolia**
2 Anther-lobes convergent above, but widely separated below; spur somewhat dilated at apex **2. chlorantha**
1 Spur 2–8 mm, shorter than ovary
3 Stem with 1 well-developed leaf; spike with 3–6 flowers **5. obtusata**
3 Stem with at least 2 well-developed leaves; spike with numerous flowers
4 Lowest 2 leaves much larger than the others **3. micrantha**
4 Lowest 2 leaves not contrasting markedly with the others, the second and third from the base being usually the largest **4. hyperborea**

[1] By D. A. Webb.

1. P. bifolia (L.) L. C. M. Richard, *Orchid. Eur. Annot.* 35 (1817) (*Orchis bifolia* L.). Tubers 2, more or less conical, attenuate at apex. Plant 25–50 cm. Foliage-leaves 2, 7–16 × 2·5–8 cm, basal, subopposite, oblanceolate-oblong to obovate or broadly elliptical. Cauline leaves 2–5; lamina usually 1–3 cm, occasionally larger but always much narrower than that of basal leaves. Spike up to 20 cm; flowers white, slightly tinged with green, fragrant. Perianth-segments of the galea 5–7 mm; outer lateral segments 8–10 mm. Labellum 8–12 mm, linear-oblong, pendent. Spur 25–30 mm, slender, subulate, more or less horizontal, much longer than ovary. Anther-cells parallel, almost contiguous. $2n=42$. *Open woods, meadows and damp heaths. Almost throughout Europe, but rarer in the Mediterranean region.* All except Az Cr Is Rs (K) Sb.

2. P. chlorantha (Custer) Reichenb. in Moessler, *Handb.* ed. 2, **2**: 1565 (1828) (*Orchis montana* auct., vix F. W. Schmidt). Like **1** but flowers more strongly tinged with green, less fragrant, and with slightly larger perianth-segments; spur 18–27 mm, slightly dilated at apex; anther-cells convergent above but widely separated below. $2n=42$. *Woods, meadows and damp heaths. Much of Europe, but absent from parts of the north, east and south-west.* All except Az Bl Cr Fa Is Lu Rs (N, E) Sa Sb.

3. P. micrantha (Hochst.) Schlechter, *Feddes Repert.* **16**: 378 (1920). Tubers 2, ovoid-ellipsoid. Plant 20–50 cm. Lowest 2 leaves 6–15(–17) × 2–6·5 cm, oblanceolate-oblong to elliptical, usually one distinctly above the other but rarely subopposite; above them 2–6 much smaller leaves passing into the bracts. Spike 8–13 cm; flowers green. Perianth-segments 2–4 mm. Labellum 2–4 mm, narrowly oblong to oblong-elliptical, horizontal. Spur 2·5–8 mm, obtuse, ⅓–½ as long as ovary. *Mountain grassland.* ● *Açores.* Az.

Variable, especially in length of spur; in most plants this is 2–3·5 mm, but in some it is 5–8 mm. The long-spurred variants have been distinguished as **P. azorica** Schlechter, *loc. cit.* (1920) (*Habenaria longibracteata* Hochst.), but as variation in other characters shows little correlation and as there is no clear geographical or ecological separation, they are best treated as a variety of **3.**

4. P. hyperborea (L.) Lindley, *Gen. Sp. Orchid.* 287 (1835). Roots cord-like, or forming very slender, conical tubers. Plant 6–35 cm. Leaves 4–7, distributed evenly on the stem, the 2–3 lowest 3–13 × 0·6–2 cm, lanceolate to oblong or ovate-elliptical, obtuse, the others acute and diminishing in size upwards but not contrasting sharply with the lower. Spike (2–)3–9 cm; flowers numerous, greenish, fragrant. Perianth-segments 3–4 mm. Labellum 3–7 mm, broadly lanceolate, obtuse, horizontal. Spur 3·5–4·5 mm, obtuse, curved, shorter than ovary. $2n=84$. *Meadows and moorland. Iceland.* Is. (*Arctic and subarctic America.*)

5. P. obtusata (Pursh) Lindley, *op. cit.* 284 (1835). Roots cord-like, fleshy but scarcely tuberous. Plant 6–20 cm. Foliage-leaf solitary, basal, 4–6 × 1·5–2 cm, elliptical, tapered to a sheathing base which is largely enclosed in a hyaline sheath representing a second basal leaf; a third leaf, small and bract-like, is present on upper part of stem. Spike short, rather dense; flowers 3–6, greenish-white. Perianth-segments 2–3 mm. Labellum 3–3·5 mm, rhombic-lanceolate, horizontal or somewhat deflexed. Spur 2·5–3 mm, curved, half as long as ovary. $2n=126$. *Calcareous*

mountain heaths. Arctic Fennoscandia. No Su. (*E. & E.C. Asia, North America.*)

The European plant belongs to subsp. **oligantha** (Turcz.) Hultén, *Lunds Univ. Årsskr.* nov. ser., **39(1)**: 481 (1943) (*P. oligantha* Turcz., *Lysiella oligantha* (Turcz.) Nevski), which is also found in E. Siberia. Subsp. *obtusata*, which is confined to America, has an obovate leaf, a laxer spike, a longer, narrower labellum and a longer spur. Plants from E. North America are very distinct from those from Europe and Asia, but intermediates are found in Alaska.

14. **Chamorchis** L. C. M. Richard[1]

Tubers 2, ellipsoid. Leaves all basal; stem without scale-leaves. Perianth-segments connivent into a galea, the three outer equal, somewhat longer than the inner. Labellum slightly longer than the other perianth-segments, ovate, entire or shallowly 3-lobed. Spur absent. Rostellum inconspicuous. Viscidia distinct; bursicle simple.

1. C. alpina (L.) L. C. M. Richard, *Orchid. Eur. Annot.* 35 (1817) (*Herminium alpinum* (L.) Lindley). Glabrous. Stem 4–10 cm. Leaves 4–8, about equalling stem, linear, erect. Flowers 3–10 in a short, rather lax spike. Perianth-segments greenish-yellow, variably tinged with purplish-brown, the outer 3·5 mm, broadly oblong, the inner narrower and slightly shorter. Labellum 4 mm, yellowish-green. $2n=42$. *Mountain pastures; calcicole.* ● *Fennoscandia; Alps; Carpathians.* Au Cz Fe Ga Ge He It Ju No Po Rm Rs (N) Su.

15. **Gymnadenia** R. Br.[2]

Tubers laterally compressed, palmately lobed. Stem leafy. Flowers in a spike. Outer lateral perianth-segments patent or curved downwards, the outer median connivent with the inner lateral to form a galea. Labellum shallowly 3-lobed, directed downwards. Spur long, slender. Column short, erect. Rostellum long. Viscidia 2, long, linear; bursicles absent.

Spur 11–18 mm, longer than ovary	**1. conopsea**
Spur 4–5 mm, not longer than ovary	**2. odoratissima**

1. G. conopsea (L.) R. Br. in Aiton, *Hort. Kew.* ed. 2, **5**: 191 (1813). Tubers with 3–6 obtuse lobes. Stem 15–65 cm, erect, glabrous, with 2–3 brownish basal sheaths. Leaves 4–8, linear-lanceolate, denticulate, the lower 6–20(–25) cm, slightly conduplicate and keeled, obtuse or subacute, the upper smaller, acuminate, bract-like. Spike (3–)6–16 cm, cylindrical, sometimes pyramidal at first, many-flowered. Flowers pinkish- or reddish-lilac, rarely purple or white, usually fragrant. Perianth-segments 4–5 mm, obtuse; outer oblong-ovate, patent or curved downwards, the median concave; inner broadly ovate. Labellum 3·5–5 mm, rhombic, the lobes subequal, rounded. Spur 11–18 mm, 1½–2 times as long as ovary, somewhat arcuate, acute, rarely obtuse. $2n=40$, 80, *c.* 97, *c.* 117, *c.* 119. *Grassland, marshes, fens and scrub; somewhat calcicole. Most of Europe except for parts of the south-west and south-east.* Al Au Be Br Bu Cz Da Fe Ga Ge Gr Hb He Ho Hs Hu It Ju Lu No Po Rm Rs (N, B, C, W, K, E) Si Su.

Three subspecies have been recognized by J. Bisse, *Feddes Repert.* **67**: 187–188 (1967), based primarily on material from Germany and utilizing leaf-width and -disposition, spike-density, diameter and odour of the flowers, and spur-width. It is uncertain whether the characters used are valid over the whole range of the species and further study is required.

2. G. odoratissima (L.) L. C. M. Richard, *Orchid. Eur. Annot.* 35 (1817) (*Orchis odoratissima* L.). Like **1** but stem 15–30(–45) cm; leaves linear, acute; perianth-segments 2·5–3 mm, the outer lateral patent; labellum 2·3–3 mm, the lateral lobes much shorter than the middle; spur 4–5 mm, obtuse, as long as or slightly shorter than ovary. $2n=40$. *Grassland; calcicole. From S. Sweden and W.C. Russia southwards to N. Spain, N. Italy and C. Jugoslavia.* Au Be Cz Ga Ge He Hs Hu It Ju Po Rm Rs (B, C, W) Su.

A record from N. England requires confirmation.

16. **Pseudorchis** Séguier[2] (*Leucorchis* E. H. F. Meyer)

Like *Gymnadenia* but with outer and inner perianth-segments more or less connivent to form a galea. Spur short.

Tubers divided to base; leaves 4–6; bracts 3-veined; spur ⅓–½ as long as ovary, cylindrical, obtuse	**1. albida**
Tubers divided to about ½ way to base; leaves 3–4; bracts 1-veined; spur *c.* ½ as long as ovary, filiform, acute	**2. frivaldii**

1. P. albida (L.) Á. & D. Löve, *Taxon* **18**: 312 (1969). (*Leucorchis albida* (L.) E. H. F. Meyer, *Gymnadenia albida* (L.) L. C. M. Richard). Tubers divided to base, with the slender cylindrical divisions thickened distally. Stem 12–30(–40) cm, erect, glabrous, with 2–3 membranous sheathing scales at base. Lower leaves *c.* 4, 2·5–8 × 1–1·5 cm, obtuse; upper leaves 1–2, narrower, acute. Spike 3–7 cm, cylindrical, dense, many-flowered; bracts 3-veined. Flowers 2–3 mm, yellowish- or greenish-white. Outer perianth-segments obtuse, the lateral obliquely ovate, the median ovate, concave; inner slightly shorter, oblong-ovate, obtuse. Labellum 3-lobed; lateral lobes linear-lanceolate, acuminate; middle lobe larger, rather obtuse. Spur 2(–2·5) mm, ⅓–½ as long as ovary, cylindrical, obtuse, thickened distally and somewhat curved downwards. *Damp meadows, pastures and grassy heaths. Europe, southwards to the Pyrenees, S. Appennini and S. Bulgaria, but absent from the U.S.S.R. except the extreme north and west.* Au Be Br Bu Cz Da Fa Fe Ga Ge Hb He †Ho Hs Is It Ju No Po Rm Rs (N, W) Su.

(a) Subsp. **albida**: Lower leaves usually oblong-spathulate, erect. Spike very dense; bracts equalling ovary, with minutely denticulate margin. Lateral outer perianth-segments 2–3 mm. ● *Throughout most of the range of the species, northwards to C. Sweden.*

(b) Subsp. **straminea** (Fernald) Á. & D. Löve, *loc. cit.* (1969) (*Leucorchis albida* subsp. *straminea* (Fernald) Á. Löve): Lower leaves usually ovate-oblong, more or less patent. Spike often shorter and less dense than in subsp. (a). Bracts exceeding ovary, with entire or minutely crenulate margin. Lateral outer perianth-segments more than 3 mm. $2n=40$, 42. *N. Europe, southwards to S. Norway.*

2. P. frivaldii (Hampe ex Griseb.) P. F. Hunt, *Orchid Rev.* **79**: 141 (1971) (*Leucorchis frivaldii* (Hampe ex Griseb.) Schlechter). Like **1** but leaves 3–4, narrower, the upper bract-like; spike shorter; bracts 1-veined; flowers rather larger, white (rarely pale pink). ● *Mountains of Balkan peninsula, from Crna Gora to N. Greece; one station in S. Carpathians.* ?Al Bu Gr Ju Rm.

17. **Nigritella** L. C. M. Richard[2]

Tubers digitate. Stem with numerous leaves. Flowers in a dense spike, vanilla-scented. Perianth-segments free, subequal.

[1] By D. A. Webb. [2] By D. M. Moore.

Labellum entire. Spur short. Column short. Rostellum small. Viscidia small; bursicle very rudimentary. Ovary straight.

Literature: G. Beauverd, *Bull. Soc. Bot. Genève* ser. 2, **17**: 335–338 (1926).

1. N. nigra (L.) Reichenb. fil., *Icon Fl. Germ.* **13–14**: 102 (1851) (*Gymnadenia nigra* (L.) Reichenb.). Stems 5–30 cm, somewhat angled, rather slender. Leaves 3–20 cm, linear to linear-lanceolate, acute to subobtuse, canaliculate, with denticulate margins. Spike 10–25 cm, many-flowered. Flowers 5–10 mm. Perianth-segments lanceolate to sublinear, acute. Labellum subtriangular to lanceolate-ovate, acuminate, entire or sometimes crenulate. Spur saccate, obtuse, violet or whitish. $2n=64$. *Meadows; somewhat calcicole. Norway and Sweden; mountains of Europe southwards to N. Spain, C. Appennini and S. Greece.* Al Au Bu Ga Ge Gr He Hs It Ju No Rm Su.

1 Lateral inner perianth-segments *c.* ½ as wide as the outer; flowers usually blackish-crimson (a) subsp. **nigra**
1 Lateral inner perianth-segments about as wide as the outer; flowers red to whitish
2 Spike ±cylindrical; basal leaves 7–12 **(b) subsp. rubra**
2 Spike conical; basal leaves 12–18 **(c) subsp. corneliana**

(a) Subsp. **nigra**: Basal leaves 7–10. Spike conical, later elongating somewhat. Flowers blackish-crimson, rarely red, white or yellowish. Inner perianth-segments 2- to 3-veined, the lateral *c.* ½ as wide as the outer. *Throughout the range of the species.*

(b) Subsp. **rubra** (Wettst.) Beauverd, *Bull. Soc. Bot. Genève* ser. 2, **17**: 337 (1926) (*N. rubra* (Wettst.) K. Richter): Basal leaves 7–10. Spike more or less cylindrical. Flowers red. Inner perianth-segments 3-veined, the lateral about as wide as the outer. *C. & E. Alps; mountains of Romania.*

(c) Subsp. **corneliana** Beauverd, *op. cit.* 336 (1926): Basal leaves 12–18. Spike conical, later elongating somewhat. Flowers white, tinged with pink. Inner perianth-segments 1-veined, the lateral about as wide as the outer. ● *S.W. Alps.*

18. **Coeloglossum** Hartman[1]

Tubers 2, ovoid, palmately lobed. Basal and cauline leaves present. Flowers in a lax spike. Outer lateral perianth-segments erecto-patent, the outer median connivent with the inner lateral to form a galea. Labellum 3-dentate at apex. Spur very short. Column short. Rostellum 3-angled, with 2 lateral lobes. Viscidia 2, oblong; bursicle very rudimentary.

1. C. viride (L.) Hartman, *Handb. Skand. Fl.* 329 (1820). Tubers with 2–4 tapering segments. Stem 6–35(–40) cm, angled above, with brownish, sheathing basal scales. Leaves 2–5, 3–8(–11) cm, the basal suborbicular to elliptic-ovate or -lanceolate, obtuse, the upper smaller, lanceolate, acute. Spike 2–10 (–15) cm, cylindrical, 5- to 25-flowered. Flowers inconspicuous, greenish, sometimes with reddish or purplish-brown tint. Perianth-segments 4·5–6(–7) mm, subequal; outer ovate, subobtuse, the median concave; inner narrower, linear, subobtuse. Labellum 6–8(–9) mm, obcuneate, flat, yellowish or yellowish-brown, the middle apical tooth shorter than the lateral. Spur *c.* 2 mm, saccate, obtuse, greenish-white. $2n=40$. *Grassland and wood-margins. Europe southwards to C. Spain, S. Appennini, S. Bulgaria and Krym, but only on mountains in the south.* Al Au Be Br Bu Cz Da Fa Fe Ga Ge Hb He Ho Hs Hu Is It Ju No Po Rm Rs (N, B, C, W, K) Su.

[1] By D. M. Moore.

19. **Dactylorhiza** Necker ex Nevski[2]

Tubers 2–3, usually palmately 2- to 5-fid, more or less elongated at the apex, rarely oblong-cylindrical and shallowly 2(–4)-fid. Perianth-segments free, equal or the inner smaller, patent or deflexed, rarely convergent. Labellum porrect or slightly decurved. Spur present. Lower bracts herbaceous. Rostellum 3-lobed, the middle lobe short, lamelliform. Viscidia in one simple bursicle.

A taxonomically difficult genus in which many species show marked variation within and between different populations and in which interspecific hybrids are both frequent and of generally high fertility. Amongst the commonest hybrids are **8 × 4, 8 × 6(e), 8 × 12, 6(d) × 4, 6(d) × 12, 6(e) × 11(b)** and **12 × 11(b)**; hybrid plants can be more frequent, and more vigorous, than the parent species in a population, especially in the cases of **6(e) × 11(b)** and **6(e) × 12**. In some instances populations of more or less stabilized hybrid segregates are known, as in **6(e) × 12**, while it has been suggested that some taxa, such as some subspecies of **6**, have originated in this way. Intergeneric hybrids are known between **6(d)** and **6(e)** and both *Coeloglossum viride* and *Gymnadenia conopsea.*

Literature: J. Heslop-Harrison, *Trans. Proc. Bot. Soc. Edinb.* **35**: 26–66 (1948); *Svensk Bot. Tidskr.* **45**: 608–635 (1951); *Watsonia* **2**: 371–391 (1953); *Ber. Geobot. Inst. Rübel (Zürich)* **1953**: 53–82 (1954). E. Nelson, *Monographie und Ikonographie der Gattung* Dactylorhiza. Zürich. 1976. R. von Soó, *Bot. Arch. (Leipzig)* **23**: 61–83 (1928); *Ann. Univ. Sci. Budapest. Rolando Eötvös* **3**: 335–357 (1960); *Jahresb. Naturw. Ver. Wuppertal* **25**: 37–48 (1972). P. Vermeulen, *Studies on Dactylorchids.* Utrecht. 1947. K. Senghas, *Jahresb. Naturw. Ver. Wuppertal* **21–22**: 32–67 (1968).

1 All 5 perianth-segments convergent into a galea; stem with stolons **1. iberica**
1 Lateral outer perianth-segments not forming part of galea; stolons absent
2 Tubers shallowly 2- to 4-fid or -dentate at apex, rarely subentire
3 Stem with 4–5 distant leaves in lower half; spur not more than 15 mm **2. sambucina**
3 Stem with up to 10 leaves in a lax basal rosette; spur 12–25 mm **3. sulphurea**
2 Tubers deeply 2- to 5-fid
4 Lateral outer perianth-segments patent; stem usually solid **(11–13). maculata** group
4 Lateral outer perianth-segments suberect; stem usually hollow **(4–10). incarnata** group

1. D. iberica (Bieb.) Soó, *Nom. Nov. Gen. Dactylorhiza* 3 (1962) (*Orchis iberica* Bieb.). Tubers cylindrical to napiform, long-attenuate, 2- to 3-fid at apex. Stem 25–50 cm, erect, with 3–5 distant leaves in lower half, with stolons. Leaves erecto-patent to suberect, linear-lanceolate, without dark spots. Raceme ovoid or cylindrical. Bracts narrowly lanceolate, as long as or longer than ovary. Flowers pink; labellum with purple spots; spur white towards the base. Perianth-segments oblong or ovate-lanceolate, acute, all convergent into a galea; outer 8–10 mm, 3-veined, the inner up to 8 mm, 1-veined. Labellum up to 10 × 7–8 mm, patent, obovate, cuneate-flabellate at base, 3-lobed (rarely entire) at apex, minutely papillose-puberulent; lobes equal, the middle narrowly triangular, the lateral broadly triangular, crenulate. Spur narrowly cylindrical, curved, up to *c.* ½ as long as ovary. *Marshes. Mountains of Greece and Krym.* Gr Rs (K) ?Tu. (*S.W. Asia.*)

[2] By R. de Soó.

2. D. sambucina (L.) Soó, *loc. cit.* (1962) (*Orchis sambucina* L.). Tubers oblong-cylindrical, subentire or shortly lobed. Stem 10–30 cm, usually with 4–5 distant leaves in lower half. Leaves without dark spots; lower obovate-oblanceolate to narrowly oblanceolate, more or less obtuse; upper lanceolate; uppermost often reaching the base of inflorescence. Raceme ovoid or shortly cylindrical, many-flowered. Bracts lanceolate, longer than ovary. Flowers pale yellow or purple, rarely bicoloured. Outer perianth-segments 7–10 mm, oblong, obtuse, the 2 lateral patent, the median convergent into a galea with the shorter, obliquely ovate inner perianth-segments; inner segments not enlarged towards the base. Labellum 7–8 × 7–8 mm, porrect, suborbicular, 3-lobed; lobes short, ovate-triangular, obtuse. Spur 8–15 mm, deflexed or horizontal. $2n = ?40, 42$. *Meadows, scrub and open woods. Much of Europe, but absent from many of the islands and most of the U.S.S.R.* Al Au Bu Co Cz Da Fe Ga Ge Gr He Hs Hu It Ju Lu No Po Rm Rs (B, C, W) Sa Si Su.

(a) Subsp. **sambucina**: Raceme dense. Spur up to 15 mm, deflexed, conical-cylindrical, somewhat curved upwards, shorter than to about as long as ovary. *Almost throughout the range of the species except for parts of the south-west.*

(b) Subsp. **insularis** (Sommier) Soó, *loc. cit.* (1962): Raceme lax. Spur 8–10 mm, patent, cylindrical, straight, distinctly shorter than ovary. $2n = 60$. ● *From Portugal to W.C. Italy.*

3. D. sulphurea (Link) Franco, *Bot. Jour. Linn. Soc.* **76**: 336 (1978) (*Orchis sulphurea* Link, *O. sambucina* Ten., non L.). Like **2** but stem with a basal rosette of up to 10 leaves; leaves narrowly oblong; lateral inner perianth-segments enlarged towards base; labellum broadly obovate in outline, the lateral lobes oblong-ovate, the middle lobe oblong-rectangular or almost square to suborbicular; spur 12–25 mm, horizontal. *S. Europe.* ?Al ?Bl Bu Cr Gr Hs It Ju Lu Rm Rs (K) Sa Si Tu.

1 Middle lobe of labellum longer than lateral lobes — **(a) subsp. sulphurea**
1 Middle lobe of labellum shorter than lateral lobes
2 Spur longer than ovary — **(b) subsp. pseudosambucina**
2 Spur not longer than ovary — **(c) subsp. siciliensis**

(a) Subsp. **sulphurea**: Middle lobe of labellum longer than the lateral, oblong-rectangular. Spur cylindrical, shorter than ovary. ● *N. Portugal, W. Spain.*

(b) Subsp. **pseudosambucina** (Ten.) Franco, *loc. cit.* (1978) (*Orchis mediterranea* subsp. *pseudosambucina* (Ten.) Klinge, *O. pseudosambucina* Ten.): Middle lobe of labellum shorter than the lateral, almost square to suborbicular. Spur cylindrical, distinctly longer than ovary. *Throughout the range of the species.*

(c) Subsp. **siciliensis** (Klinge) Franco, *op. cit.* 367 (1978) (*Orchis mediterranea* subsp. *siciliensis* Klinge): Like subsp. **(b)** but spur conical or saccate-cylindrical, rarely cylindrical, shorter than to as long as ovary. ● *Italy, Sicilia, Sardegna.*

(4–10). D. incarnata group. Stem usually hollow. Lower bracts usually as long as or longer than flowers, lanceolate. Lateral outer perianth-segments, suberect, the middle convergent into a galea with the inner segments.

1 Lower leaves not more than 4 times as long as wide, ± elliptical, usually widest at or below the middle
2 Stem not more than 20 cm; outer perianth-segments and labellum 6–7 mm — **5. pseudocordigera**
2 Stem (10–)20–60(–75) cm; outer perianth-segments 6–12 mm; labellum 5–12 mm
3 Leaves 4–8, the uppermost often reaching base of inflorescence — **6. majalis**
3 Leaves 2–5, the uppermost seldom reaching inflorescence — **7. cordigera**
1 Lower leaves more than 4 times as long as wide, usually lanceolate, gradually attenuate from base
4 Labellum 5–7·5(–9) mm; outer perianth-segments 5–6(–9) mm — **4. incarnata**
4 Labellum 5·5–16 mm; outer perianth-segments (6–)7–13 mm
5 Outer perianth-segments 7–8(–10) mm
6 Flowers purple; labellum with deflexed margin — **8. traunsteineri**
6 Flowers pink; labellum flat — **9. russowii**
5 Outer perianth-segments 8–13 mm
7 Stem not more than 30 cm; leaves usually with dark spots — **7. cordigera**
7 Stem 30–110 cm; leaves without dark spots — **10. elata**

4. D. incarnata (L.) Soó, *Nom. Nov. Gen. Dactylorhiza* 3 (1962) (*Orchis incarnata* L.). Tubers deeply 3- to 5-fid, more or less elongated at apex. Stem up to 70 cm, erect, broadly fistular, with 4–5 distant leaves. Leaves lanceolate, gradually attenuate from the wide base, acute, sometimes cucullate at apex; uppermost often as long as or longer than the inflorescence. Raceme cylindrical, dense, many-flowered. Flowers red, pinkish, white or purple; labellum with spots, rarely yellowish-white. Outer perianth-segments 5–6(–9) mm, ovate-oblong, obtuse. Labellum 5–7·5(–9) × 5–9·5 mm, slightly recurved, minutely papillose, ovate-rhombic to orbicular, entire to 3-lobed, shallowly crenulate. Spur deflexed, conical to conical-cylindrical, attenuate, up to ½ as long as ovary. $2n = 40$. *Marshes, fens and bogs. Most of Europe, but rare in the Mediterranean region.* Al Au Be Br Bu Cz Da ?Fa Fe Ga Ge ?Gr Hb He Ho Hs Hu It Ju No Po Rm Rs (N, B, C, W, K, E) Su.

1 Flowers pinkish to lilac, rarely white — **(a) subsp. incarnata**
1 Flowers red or purple
2 Flowers deep crimson — **(b) subsp. coccinea**
2 Flowers purple, often streaked with red
3 Leaves erect, cucullate, usually without spots — **(c) subsp. pulchella**
3 Leaves erecto-patent, not cucullate, usually with dark spots on both surfaces — **(d) subsp. cruenta**

(a) Subsp. **incarnata**: Stems up to 70 cm. Leaves erect, often cucullate, usually without spots. Flowers pinkish to lilac, rarely white. *Throughout the range of the species.*

(b) Subsp. **coccinea** (Pugsley) Soó, *op. cit.* 4 (1962): Stems up to 70 cm. Leaves erect, often cucullate, usually without spots. Flowers deep crimson. ● *Britain and Ireland.*

(c) Subsp. **pulchella** (Druce) Soó, *loc. cit.* (1962): Stems up to 70 cm. Leaves erect, often cucullate, usually without spots. Flowers purple, often streaked with red. ● *Britain and Ireland.*

(d) Subsp. **cruenta** (O. F. Mueller) P. D. Sell, *Watsonia* **6**: 317 (1967) (*Dactylorhiza cruenta* O. F. Mueller): Stems 12–30 cm. Leaves erecto-patent or gradually arcuate-patent, not cucullate, usually with dark spots on both surfaces. Flowers purple, often streaked with red. $2n = 40$. *N. & E. Europe; Alps.*

Variants with brownish-purple spots on the leaves occur sporadically in N. & C. Europe and have been named subsp. **haematodes** (Reichenb. fil.) Soó, *Nom. Nov. Gen. Dactylorhiza* 4 (1962). Variants with 3–4 narrowly lanceolate leaves 1–1·5 cm, slender stem and few-flowered racemes have been named subsp. **serotina** (Hausskn.) Soó & D. Moresby Moore, *Bot. Jour. Linn. Soc.* **76**: 367 (1978), (*O. incarnata* var. *borealis* Neuman, var. *dunensis* Druce, var. *cambrica* Pugsley). They occur sporadically throughout W., N. & N.C. Europe. Variants with yellowish-white flowers have been named subsp. **ochroleuca** (Boll) P. F. Hunt & Summerhayes, *Watsonia* **6**: 130 (1965); they occur sporadically throughout a large part of the range of the species.

5. D. pseudocordigera (Neuman) Soó, *Nom. Nov. Gen. Dactylorhiza* 4 (1962). Like **4(c)** but stem not more than 20 cm; leaves erecto-patent, the lower elliptical, with dense, dark spots;

flowers purplish-red; perianth-segments and labellum 6–7 mm; spur conical, ½ as long as ovary. *Fens and calcareous grassland.* ● *Norway and N. Sweden.* No Su.

6. D. majalis (Reichenb.) P. F. Hunt & Summerhayes, *Watsonia* **6**: 130 (1965) (*D. latifolia* (L.) Soó pro parte). Tubers deeply 2- to 5-fid, somewhat elongated at apex. Stem up to 75 cm, with 4–8 distant leaves. Leaves erecto-patent, with or without brown spots, the upper reaching or exceeding the base of the inflorescence. Raceme ovoid to cylindrical. Outer perianth-segments 6–12 mm, ovate- to oblong-lanceolate, obtuse. Inner perianth-segments obliquely lanceolate to ovate. Labellum 5–14 × 6–15 mm, suborbicular or wider than long, entire, or 3-lobed with lateral lobes ovate-triangular, rounded or truncate, crenulate, and middle lobe triangular, shorter to longer than the lateral. Spur deflexed, conical-cylindrical, ½ as long as to almost as long as ovary. $2n=80$. *Damp meadows and fens. W. & C. Europe; Baltic region and N. Russia.* Au Be Br Cz Da Ga Ge Hb He Ho Hs Hu It Ju Po Rm Rs (N, B, C, W) Su.

1 Leaves with small dark spots near apex or unspotted; labellum subentire or obscurely 3-lobed
2 Outer perianth-segments 6–7 mm; labellum 5–7 mm, with irregular dark lines or spots **(d) subsp. purpurella**
2 Outer perianth-segments 9–10 mm; labellum 10–12 mm, with a central cluster of small spots **(e) subsp. praetermissa**
1 Leaves usually with large or irregular spots
3 Lower leaves elliptical or obovate, widest at or above the middle; labellum usually subentire **(c) subsp. alpestris**
3 Lower leaves lanceolate to oblong-ovate, widest at or below the middle; labellum usually distinctly 3-lobed
4 Flowers purplish-lilac; middle lobe of labellum without markings **(a) subsp. majalis**
4 Flowers deep violet-purple; middle lobe of labellum with broken loop or line markings **(b) subsp. occidentalis**

(a) Subsp. **majalis** (*O. latifolia* L. pro parte): Stem up to 60 cm. Lower leaves broadly lanceolate, oblong or oblong-ovate, usually widest at or below the middle, with large or irregular spots. Flowers purplish-lilac. Labellum 9–10 mm, usually 3-lobed, rarely subentire; middle lobe without markings. Early-flowering. *Throughout most of the range of the species.*

(b) Subsp. **occidentalis** (Pugsley) P. D. Sell, *Acta Fac. Rer. Nat. Univ. Comen. Bot.* **14**: 19 (1968): Stem up to 25 cm. Lower leaves broadly lanceolate, oblong or oblong-ovate, usually widest at or below the middle, usually with large or irregular spots. Flowers deep violet-purple. Labellum 9–10 mm, 3-lobed or subentire; middle lobe with broken loop or line markings. Early-flowering. $2n=80$. ● *Britain and Ireland.*

(c) Subsp. **alpestris** (Pugsley) Senghas, *Jahresb. Naturw. Ver. Wuppertal* **21–22**: 51 (1968): Stem up to 30 cm. Lower leaves elliptical or obovate, widest at or above the middle, with large or irregular spots. Flowers purplish-lilac. Labellum 9–10 mm, subentire, rarely 3-lobed; middle lobe without markings. Late-flowering. ● *Alps, Pyrenees.*

(d) Subsp. **purpurella** (T. & T. A. Stephenson) D. Moresby Moore & Soó, *Bot. Jour. Linn. Soc.* **76**: 367 (1978) (*Orchis purpurella* T. & T. A. Stephenson, *Dactylorhiza purpurella* (T. & T. A. Stephenson) Soó): Stem 20–45 cm. Lower leaves lanceolate, widest below the middle, without spots or with small dark spots near the apex. Flowers bright or deep reddish-purple. Labellum 5–9 mm, subentire or shallowly and equally 3-lobed, with irregular dark lines or spots. $2n=80$. ● *N.W. Europe.*

(e) Subsp. **praetermissa** (Druce) D. Moresby Moore & Soó, *loc. cit.* (1978) (*Orchis praetermissa* Druce): Stem up to 75 cm. Lower leaves lanceolate, widest below middle, without spots. Flowers pale or dull reddish-purple. Labellum 10–14 mm, shallowly and equally 3-lobed, with a central cluster of small spots. $2n=80$. ● *N.W. Europe.*

D. baltica (Klinge) Orlova in Min., *Konsp. Fl. Pskovsk. Obl.* 57 (1970) (*Orchis latifolia* subsp. *dunensis* Soó), from parts of N., C. & E. Europe, is like subsp. (d) but has narrower leaves, the labellum 5–8 mm and 3-lobed, and the spur usually ¾, not ½ as long as the ovary. It may perhaps merit subspecific status.

7. D. cordigera (Fries) Soó, *Nom. Nov. Gen. Dactylorhiza* 5 (1962). Tubers deeply 2- to 4-fid, somewhat elongated at apex. Stem up to 30 cm, erect or slightly flexuous, with 2–5 distant leaves. Leaves usually with dark spots on both surfaces; lower lanceolate to obovate, patent; upper lanceolate, erect; uppermost seldom reaching the inflorescence. Raceme ovoid to oblong. Bracts longer than ovary. Flowers purple; labellum dark purple. Outer perianth-segments 8–12 mm, oblong-lanceolate, obtuse. Labellum 7–11 × 8–16 mm. Spur deflexed. $2n=80$. *Mountain grassland. S.E. Europe.* Al Bu Gr Ju Rm Rs (W).

1 Spur 8–11 mm, conical-cylindrical, up to ¾ as long as ovary **(c) subsp. siculorum**
1 Spur 6–8 mm, saccate, not more than ½ as long as ovary
2 Labellum ±abruptly cuneate at base, ±suborbicular, sometimes shortly 3-lobed at apex **(b) subsp. bosniaca**
2 Labellum widest towards base, broadly rhombic **(a) subsp. cordigera**

(a) Subsp. **cordigera**: Inner perianth-segments oblong. Labellum broadly rhombic, widest at the base, subentire or 3-lobed. Spur 6–8 mm, saccate, up to ½ as long as ovary. *Throughout the range of the species.*

(b) Subsp. **bosniaca** (G. Beck) Soó, *loc. cit.* (1962): Inner perianth-segments obliquely ovate. Labellum abruptly cuneate at the base, more or less suborbicular, sometimes shortly 3-lobed at apex. Spur 6–8 mm, saccate, less than ½ as long as ovary. ● *Albania, Jugoslavia, Bulgaria.*

(c) Subsp. **siculorum** (Soó) Soó, *loc. cit.* (1962): Inner perianth-segments obliquely lanceolate. Labellum suborbicular, entire to deeply 3-lobed. Spur 8–11 mm, conical-cylindrical, up to ¾ as long as ovary. ● *Romania and W. Ukraine.*

8. D. traunsteineri (Sauter) Soó, *loc. cit.* (1962) (*Orchis traunsteineri* Sauter). Tubers deeply 2- to 4-fid, filiform-elongated at apex. Stem 20–50 cm, more or less flexuous, narrowly fistular, with distant leaves. Leaves linear- to oblong-lanceolate, acute or obtuse. Raceme cylindrical, more or less lax, many-flowered. Bracts longer than ovary. Flowers purple. Outer perianth-segments 7–8 mm, oblong-lanceolate, obtuse, inner segments obliquely ovate. Labellum 5·5–9 mm, porrect, obcordate, subdeltate or suborbicular, subentire to 3-lobed, with deflexed margin; lateral lobes ovate or obovate, rounded, crenulate; middle lobe oblong, obtuse, at least as long as the lateral. Spur pendent, conical-cylindrical, ½ as long to nearly as long as ovary. $2n=80$, 122. *Fens and marshes. N. & C. Europe.* Au Br Cz ?Da Fe Ge Hb He †Ho It Ju No Po Rs (N, B, C, W) Su.

1 Raceme few-flowered; labellum 5·5–7 mm, the lateral lobes longer than the middle; spur *c.* ¾ as long as ovary **(c) subsp. lapponica**
1 Raceme many-flowered; labellum 7–9 mm, the middle lobe at least as long as the lateral; spur *c.* ½ as long as ovary
2 Leaves erecto-patent, slightly introrsely curved; labellum with middle lobes distinctly longer than the lateral **(a) subsp. traunsteineri**
2 Leaves often arcuate-patent, strongly curved; labellum subentire to shallowly 3-lobed, with middle lobe slightly longer than the lateral **(b) subsp. curvifolia**

(a) Subsp. **traunsteineri** (*O. ruthei* M. Schulze): Leaves 3–5, erecto-patent, somewhat introrsely curved, usually without spots. Labellum 7–9 mm, 3-lobed; middle lobe longer than lateral

lobes. *Throughout most of the range of the species, but rare in parts of the north.*

(b) Subsp. **curvifolia** (Nyl.) Soó, *op. cit.* 6 (1962): Leaves 2–4, often arcuate-patent and strongly curved, keeled on upper surface. Labellum 7–9 mm, subentire to shallowly 3-lobed; middle lobe slightly longer than lateral lobes. *Sweden, Finland, N. Russia.*

(c) Subsp. **lapponica** (Laest. ex Hartman) Soó, *Bot. Jour. Linn. Soc.* **76**: 367 (1978) (*Orchis lapponica* Laest. ex Hartman): Leaves 2–3, the lower patent, the upper erect. Labellum 5·5–7 mm, 3-lobed; lateral lobes longer than the middle lobe. ● *N. Fennoscandia.*

9. D. russowii (Klinge) J. Holub, *Preslia* **36**: 253 (1964). Like **9(a)** but tubers not elongated at apex; stem more or less erect, with 4–5 leaves; raceme dense; flowers pink; labellum flat, the middle lobe triangular, acute; spur slightly shorter than ovary. $2n=120$. ● *From E. Germany to C. Russia.* Ge Po Rs (B, C).

10. D. elata (Poiret) Soó, *Nom. Nov. Gen. Dactylorhiza* 7 (1962). Tubers deeply 2- to 4-fid, more or less elongated at apex. Stem 30–110 cm, erect, narrowly fistular, with 6–10 distant leaves. Leaves erecto-patent, linear- to ovate-lanceolate, without spots, the uppermost bract-like. Raceme cylindrical, many-flowered, lax or dense. Bracts longer than the ovary. Flowers violet-purple, rarely pink. Outer perianth-segments 10–13 mm, lanceolate or ovate-lanceolate; inner segments obliquely lanceolate. Labellum 9–16 × 12–24 mm, porrect, flat or slightly convex, ovate, suborbicular or flabellate, subentire to 3-lobed, minutely papillose; lateral lobes often deflexed. Spur cylindrical or conical-cylindrical, about as long as ovary. $2n=80$. *Wet meadows and marshes. S.W. Europe, extending eastwards to Sicilia.* Co Ga Hs Lu Si.

Only subsp. **sesquipedalis** (Willd.) Soó, *loc. cit.* (1962), occurs in Europe. Subsp. **elata**, from N. Africa, is distinguished by its smaller flowers, the labellum being as long as or slightly longer than wide, and its saccate-cylindrical spur.

(11–13). D. maculata group. Tubers deeply 3- to 4-fid, more or less elongated at apex. Stem up to 60 cm, erect or slightly flexuous, usually solid. Leaves erecto-patent. Upper leaves bract-like. Raceme conical, becoming ovoid or oblong. Bracts lanceolate. Flowers yellowish-white, pink, lilac, reddish or purple. Outer perianth-segments ovate to oblong, obtuse, the 2 lateral patent, the median convergent into a galea with the obliquely ovate or ovate-lanceolate inner segments. Labellum 7–11 × 9–13 mm, flat, 3-lobed; lateral lobes oblong-triangular, ovate, or inconspicuous. Spur shorter than to as long as ovary.

The distribution of **12** and **13** is difficult to ascertain because of frequent misidentification of specimens.

1 Middle lobe of labellum much narrower than the lateral **11. maculata**
1 Middle lobe of labellum about as wide as the lateral
2 Lower bracts usually shorter than flowers; spur 6–9 mm, cylindrical **12. fuchsii**
2 Lower bracts usually longer than flowers; spur 7–13 mm, saccate or conical-cylindrical **13. saccifera**

11. D. maculata (L.) Soó, *loc. cit.* (1962) (*Orchis maculata* L.). Stem with 5–12 distant leaves. Leaves with or without dark spots; lower linear-lanceolate to ovate or oblong, acute to obtuse. Bracts mostly shorter than the flowers. Outer perianth-segments 7–11 mm. Middle lobe of labellum shorter than to as long as (rarely longer than) and much narrower than the lateral lobes. Spur 3–11 mm, cylindrical, shorter than to as long as ovary. $2n=40$, 60, 80. *Moorland, grassland and damp woods; mainly on acid soils. Much of Europe, but absent from most of the south-east.* ?Al Au Be ?Bl Br Co ?Cz Da Fa Fe Ga Ge Hb He Ho Hs ?Hu Is It Ju Lu No Po Rm Rs (N, B, C, W) Si Su.

1 Flowers yellowish-white; leaves without dark spots **(e) subsp. transsilvanica**
1 Flowers pink, lilac, reddish or purple; leaves with or without dark spots
2 Lower leaves broadly lanceolate to ovate
3 Stem not more than 60 cm, solid; spur ⅔ as long to as long as ovary **(a) subsp. maculata**
3 Stem 10–20 cm, hollow; spur shorter than ovary **(d) subsp. islandica**
2 Lower leaves linear- to oblong-lanceolate or narrowly oblong
4 Lower leaves narrowly oblong; middle lobe of labellum at least as long as lateral lobes **(c) subsp. schurii**
4 Lower leaves linear- to oblong-lanceolate; middle lobe of labellum much shorter than to as long as lateral lobes **(b) subsp. elodes**

(a) Subsp. **maculata**: Stem up to 60 cm, solid. Cauline leaves 6–10, usually with spots, the lower ovate to oblong. Flowers purplish; labellum with middle lobe shorter than to as long as the lateral lobes. Spur ⅔–¾ as long to as long as ovary. *Throughout most of the range of the species.*

(b) Subsp. **elodes** (Griseb.) Soó, *loc. cit.* (1962): Stem up to 30 cm, solid. Cauline leaves 4–8, with or without spots, the lower oblong to linear-lanceolate. Flowers pink, pale lilac or reddish; labellum with middle lobe shorter than to as long as the lateral lobes. Spur *c.* ½ as long as ovary. $2n=40$, 80. *Throughout the range of the species, except parts of the south-east.*

(c) Subsp. **schurii** (Klinge) Soó, *Rev. Roum. Biol.* (*Bot.*) **12**: 229 (1967): Like subsp. (b) but cauline leaves with a few spots, the lower narrowly oblong; middle lobe of labellum as long as or longer than the lateral lobes. ● *Carpathians.*

(d) Subsp. **islandica** (Á. & D. Löve) Soó, *Nom. Nov. Gen. Dactylorhiza* 7 (1962): Stem 10–20 cm, hollow. Cauline leaves 5–7, without spots, the lower ovate, elliptical or broadly lanceolate. Flowers pink, pale lilac or reddish; labellum with middle lobe as long as the lateral lobes. Spur shorter than ovary. $2n=80$. ● *Iceland.*

(e) Subsp. **transsilvanica** (Schur) Soó, *loc. cit.* (1962): Stem up to 60 cm, solid. Cauline leaves 6–10, without spots, the lower oblong-lanceolate or narrowly oblong. Flowers yellowish-white; labellum with middle lobe as long as to much longer than the lateral lobes. Spur shorter than ovary. *S.E. & S.C. Europe.*

12. D. fuchsii (Druce) Soó, *op. cit.* 8 (1962) (*D. maculata* subsp. *fuchsii* Hyl.). Leaves obovate-oblong to elliptical, usually erecto-patent. Bracts usually shorter than flowers. Outer perianth-segments 6–9 mm. Labellum deeply 3-lobed, the middle lobe at least as long as and about as wide as the lateral lobes. Spur 6–9 mm, cylindrical. *Grassland and open woods; mainly on base-rich soils. Much of Europe but absent from most of the south.* Au Be Br Co Cz Da Fe Ga Ge Hb He Ho Hu Is It Ju No Po Rm Rs (N, B, C, W, E) Su.

1 Flowers white, except for numerous purple markings on the labellum **(c) subsp. sooana**
1 Flowers pink, pale lilac or reddish-purple, rarely entirely white
2 Stem not more than 25 cm, with 1–2 leaves **(b) subsp. psychrophila**
2 Stem not more than 60 cm, with 7–12 leaves **(a) subsp. fuchsii**

(a) Subsp. **fuchsii**: Stem up to 60 cm, with 7–12 leaves. Flowers pink, pale lilac or reddish-purple, rarely white. $2n=40$. *Throughout most of the range of the species.*

(b) Subsp. **psychrophila** (Schlechter) J. Holub, *Preslia* **36**: 252 (1964): Stem up to 25 cm, with 1–2 leaves. Flowers pink to reddish-purple, rarely white. ● *C. Europe and Fennoscandia.*

(c) Subsp. **sooana** (Borsos) Borsos, *Ann. Univ. Sci. Budapest. Rolando Eötvös* **4**: 76 (1961): Stem up to 60 cm, with 7–12 leaves. Flowers white except for stripes or spots on the labellum. ● *Hungary*.

13. D. saccifera (Brongn.) Soó, *Nom. Nov. Gen. Dactylorhiza* 8 (1962) (*Orchis maculata* subsp. *macrostachys* (Tineo) Hayek). Leaves without spots, the lower obovate to elliptical. At least the lower bracts usually distinctly (up to 2 times) longer than the flowers. Outer perianth-segments up to 10 mm. Labellum deeply 3-lobed, the middle lobe about as long and as wide as the lateral lobes. Spur 7–13 mm, saccate- or conical-cylindrical. $2n=40$, 80. *Damp meadows and woods. S. Europe.* Al Bu Gr Hs It Ju Lu Rm ?Sa Si ?Tu.

20. **Steveniella** Schlechter[1]

Tubers 2, orbicular or oblong, entire. Outer perianth-segments connate almost to apex; inner small, about as long as the anther. Labellum patent, papillose, 3-lobed. Spur short. Rostellum 3-lobed; middle lobe erect, cucullate. Viscidia in one 2-lobed bursicle.

1. S. satyrioides (Steven) Schlechter, *Feddes Repert.* **15**: 295 (1918). Stem 25–40 cm, erect, with 1 leaf just above base and 2 acute, leaf-like sheaths above. Leaf oblong-ovate to oblanceolate. Spike cylindrical. Bracts erecto-patent, lanceolate to ovate, acuminate. Perianth-segments greenish, tinged with brown or purple; outer 6–8 mm, erect, oblong-ovate, acute; inner *c.* 4 mm, linear-ligulate, obtuse. Labellum 6–7 × 4–4·5 mm, deeply 3-lobed, brownish-green; lateral lobes small, square or rhombic; middle lobe long, oblong, obtuse, decurved. Spur 2–2·5 mm, conical or oblong-conical, directed downwards. *Open woods and mountain meadows. Krym.* Rs (K). (*S.W. Asia.*)

21. **Comperia** C. Koch[1]

Tubers 2, ovoid. Perianth-segments all connivent into a galea. Labellum convex, papillose, 3-lobed, the lobes prolonged into filiform, somewhat spiral processes. Spur present. Rostellum 3-lobed, the middle lobe short, lamelliform. Viscidia in one simple bursicle.

1. C. comperiana (Steven) Ascherson & Graebner, *Syn. Mitteleur. Fl.* **3**: 620 (1907) (*C. taurica* C. Koch). Stem 25–55 cm, erect, with 3–4 leaves and 2–3 leaf-like sheaths above. Leaves oblong to oblong-ovate. Spike cylindrical, lax or dense. Bracts linear to linear-lanceolate, equalling or somewhat exceeding the ovary. Galea brownish-purple. Outer perianth-segments 12–15 mm, elliptical; inner *c.* 10 mm, obliquely lanceolate, with 1–2 long teeth on each side. Labellum up to 4 cm, cuneate at base, convex, pale pink; lateral lobes 1–1·3 cm wide at base, lanceolate, with apical process 2·5–2·7 cm; middle lobe triangular-ovate, with 2 filiform processes up to 2·8 cm. Spur shorter than ovary, directed downwards, cylindrical. *Open woods. S.W. Krym.* Rs (K). (*Anatolia.*)

22. **Neotinea** Reichenb. fil.[2]

Tubers ellipsoid, entire. Basal leaves 2–4. Perianth-segments more or less equal, connivent into a galea. Labellum scarcely longer than other perianth-segments, 3-lobed. Spur very short. Stigmas approximated at base, diverging above in the form of a V. Viscidia distinct, enclosed in a 2-lobed bursicle.

[1] By R. de Soó. [2] By D. A. Webb.

1. N. maculata (Desf.) Stearn, *Ann. Mus. Goulandris* **2**: 79 (1974) (*N. intacta* (Link) Reichenb. fil., *Aceras densiflorum* (Brot.) Boiss.). Tubers *c.* 20 × 12 mm. Plant 8–25(–40) cm, glabrous, somewhat glaucous. Leaves 3–6, the basal 3–12 × 1–3 cm, oblong, mucronate, patent, the cauline smaller and erect, all usually with small, purplish-brown spots in longitudinal lines. Spike 2–6 cm, dense, sometimes secund. Flowers never opening fully and usually self-pollinated, dull pink or greenish-white. Perianth-segments 3–4 mm, acute to acuminate. Labellum horizontal; lateral lobes linear; middle lobe longer, oblong, often 2- or 3-lobed at apex. Spur 1·5–2 mm, broadly conical, obtuse. $2n=40$. *Woods, scrub and stony grassland. Mediterranean region and Portugal; Ireland and Isle of Man.* Bl Br Co Cr Ga Gr Hb Hs It Ju Lu Sa Si.

23. **Traunsteinera** Reichenb.[1]

Tubers 2, ovoid, entire. Perianth-segments ovate to ovate-lanceolate, acuminate or sometimes with spathulate apex. Labellum patent, 3-lobed, glabrous. Spur short. Rostellum 3-lobed, the middle lobe erect, linear-cucullate. Viscidia in a somewhat rudimentary, 2-lobed bursicle.

1. T. globosa (L.) Reichenb., *Fl. Saxon.* 87 (1842). Stem 15–65 cm, erect, curved, with 2–3 leaves and 2–3 pinkish bracts above. Leaves oblong-lanceolate or subobovate. Spike pyramidal-globose, becoming ellipsoid. Bracts lanceolate, 1- to 3-veined, as long as or longer than the ovary. Flowers pinkish-lilac; inner perianth-segments and labellum with purple spots. Outer perianth-segments 5–6 mm; inner slightly shorter. Labellum *c.* 4·5 × 3 mm, almost square, widened at the base, deeply 3-lobed to *c.* ½-way; lateral lobes ovate, obtuse or acute; middle lobe broadly oblong, the apex sometimes denticulate. Spur ⅓–½ as long as ovary, cylindric-conical, directed downwards. $2n=42$. *Meadows, mainly in the mountains. From the Vosges and S. Poland southwards to N. Spain, N.C. Italy and S. Bulgaria.* ?Al Au Bu Cz Ga Ge He Hs Hu It Ju Po Rm Rs (W, K).

24. **Orchis** L.[1]

Tubers 2–3, globose to ellipsoid, entire. Perianth-segments free, equal, or sometimes the inner smaller, all convergent into a galea or the outer patent and deflexed. Labellum porrect or slightly decurved, entire to 3-lobed, glabrous or papillose. Spur present. Bracts membranous. Rostellum 3-lobed, the middle lobe short, lamelliform. Viscidia in a 2-lobed bursicle.

Literature: R. von Soó, *Bot. Arch.* (*Leipzig*) **23**: 35–61 (1928); *Jahresb. Naturw. Ver. Wuppertal* **25**: 37–48 (1972).

1 At least the lateral outer perianth-segments patent or deflexed, the median sometimes convergent into a galea with the 2 inner perianth-segments
2 Flowers at apex of spike opening first **2. boryi**
2 Flowers at base of spike opening first
3 Leaves linear or lanceolate, narrowed towards apex, patent **23. laxiflora**
3 Leaves oblong to oblong-lanceolate or -ovate, rarely lanceolate, gradually narrowed towards base, appressed or in a basal rosette
4 Spur filiform or linear-conical, attenuate towards apex
5 Spur linear-conical, wider towards mouth; inner perianth-segments oblong-ovate, subobtuse **21. anatolica**
5 Spur filiform, not wider towards mouth; inner perianth-segments ovate, obtuse **22. quadripunctata**
4 Spur cylindrical or saccate
6 Two lateral outer perianth-segments erecto-patent or patent-deflexed; spur directed downwards; bracts 5- to 7-veined

7 Labellum undivided **15. saccata**
7 Labellum 3-lobed
8 Spike long-cylindrical; spur saccate; base of labellum with 2 inconspicuous ridges **16. patens**
8 Spike ovoid or shortly cylindrical; spur conic-cylindrical; base of labellum with 2 conspicuous ridges **17. spitzelii**
6 Two lateral outer perianth-segments deflexed, rarely erecto-patent; spur patent; bracts 1- to 3-veined
9 Flowers pink to purple; outer perianth-segments ovate or oblong-lanceolate, obtuse to acuminate **18. mascula**
9 Flowers pale yellow; outer perianth-segments ovate-oblong, obtuse
10 Spur slightly shorter than ovary; spike dense; leaves oblong or oblong-obovate, distributed along lower half of stem **19. pallens**
10 Spur as long as or longer than ovary; spike lax to dense; leaves lanceolate or oblong-lanceolate, crowded at base of stem **20. provincialis**
1 All 5 perianth-segments ±convergent into a galea
11 Labellum entire **1. papilionacea**
11 Labellum 3-lobed
12 Spur patent or somewhat curved upwards; labellum about as wide as or somewhat wider than long
13 Spur filiform; flowers at apex of spike opening first **2. boryi**
13 Spur cylindrical; flowers at base of spike opening first
14 Spur about as long as to slightly longer than labellum **3. morio**
14 Spur much longer than labellum **4. longicornu**
12 Spur directed downwards; labellum longer than wide
15 Middle lobe of labellum entire or denticulate, without purple spots
16 Stem with 4–7 leaves; leaves linear to narrowly lanceolate; spur conical, slightly incurved and not narrowly attenuate towards apex **5. coriophora**
16 Stem with sheaths only; leaves oblong-lanceolate; spur subhamate-incurved, narrowly attenuate towards apex **6. sancta**
15 Middle lobe of labellum deeply emarginate to 2-fid, usually with purple spots
17 Bracts somewhat shorter than to about as long as ovary; median lobe of labellum not apiculate between the lobules
18 Outer perianth-segments 3–3·5 mm; spike ovoid, becoming cylindrical; spur ¼–½ as long as ovary **7. ustulata**
18 Outer perianth-segments 6–12 mm; spike conical, becoming ovoid; spur at least ½ as long as ovary
19 Stem 15–45 cm; flowers pale violet-lilac; middle lobe of labellum cuneate-obovate, emarginate; spur ½ as long as ovary **8. tridentata**
19 Stem 7–20 cm; flowers white or greenish-pink; middle lobe of labellum orbicular-obovate, usually not emarginate; spur sometimes longer than ovary **9. lactea**
17 Bracts much shorter than ovary; middle lobe of labellum with an apiculum, teeth or laciniae between the lobules
20 Lobules of middle lobe of labellum linear, with teeth or linear laciniae between them
21 Base of labellum with 2 triangular lamellae, scarcely papillose; lateral lobes and lobules of the middle lobe of the labellum ±flat, acute **10. italica**
21 Base of labellum without lamellae, minutely papillose; lateral lobes and lobules of middle lobe of labellum subfalcate, obtuse **11. simia**
20 Lobules of middle lobe of labellum ovate or oblong, with an apiculum or teeth between them
22 Perianth-segments brownish-purple **14. purpurea**
22 Perianth-segments pink, whitish or yellowish-green
23 Spur narrowly cylindrical, ½ as long as ovary; galea whitish- or greyish-pink; labellum purple, white at base **12. militaris**
23 Spur broadly cylindrical, ¼–½ as long as ovary; galea and labellum yellowish-green **13. punctulata**

1. O. papilionacea L., *Syst. Nat.* ed. 10, **2**: 1242 (1759). Tubers globose. Stem 20–40 cm, erect, with basal rosette of leaves and sheaths above. Leaves lanceolate to linear-lanceolate. Spike ovoid, lax, few-flowered, rarely cylindrical and rather dense. Bracts lanceolate, 3- to 4-veined, longer than ovary. Flowers purple, rarely red or brownish. All perianth-segments convergent into a galea; outer 10–15(–18) mm, ovate-oblong, the inner similar. Labellum 12–16(–25) × 12–16(–25) mm, undivided, unguiculate, suborbicular or obcordate, constricted at the base, rarely ovate-flabellate or obscurely 3-lobed. Spur deflexed, cylindrical, shorter than ovary. $2n=32$. *Grassland; calcicole. S. Europe.* ?Al Bl Bu Co Cr Ga Gr Hs It Ju Lu Rm Sa Si Tu.

Var. *grandiflora* Boiss., from Spain, has the labellum 20–25 × 20–25 mm.

2. O. boryi Reichenb. fil., *Icon. Fl. Germ.* **13**: 19 (1851). Tubers globose. Stem 20–45 cm, with a basal rosette of leaves and crowded sheaths above. Leaves lanceolate to oblong-obovate. Spike short, often capitate, dense, the distal flowers opening first. Bracts lanceolate, ½ as long as ovary. Flowers violet. Outer perianth-segments *c.* 7 mm, oblong-ovate, more or less patent; inner 4–5 mm, ovate. Labellum *c.* 8 × 8 mm, suborbicular, with 3 subequal lobes; middle lobe entire, longer than the lateral. Spur *c.* 15 × 2 mm, filiform, obtuse, somewhat shorter than ovary, patent or somewhat curved upwards. ● *S. Greece, Kriti.* Cr Gr.

3. O. morio L., *Sp. Pl.* 940 (1753). Tubers subglobose or ellipsoid. Stem 5–50 cm, erect, with a basal rosette of leaves and crowded sheaths above. Leaves broadly lanceolate to oblong-ovate. Spike shortly oblong or pyramidal, rarely cylindrical, the basal flowers opening first. Bracts lanceolate, with several veins, shorter to slightly longer than ovary. Flowers purplish-violet, red, pink, green or white. All perianth-segments convergent into a galea; outer oblong-ovate, rarely divaricate, the inner somewhat smaller. Labellum up to 10 × 10 mm, usually glabrous, suborbicular to reniform, shallowly 3-lobed, sometimes with darker spots; middle lobe dilated, truncate, sometimes emarginate, usually longer than the lateral. Spur cylindrical, almost equalling to slightly longer than the labellum, patent or somewhat curved upwards. $2n=36$. *Europe, northwards to N. England, S. Norway and Estonia, and eastwards to C. Russia.* All except Az Cr Fa Fe Is Rs (N, E) Sb.

1 Tubers 3 (1 subsessile, 2 long-stipitate); labellum plicate; spur clavate, wider towards the apex, truncate or emarginate **(c)** subsp. **champagneuxii**
1 Tubers 2, shortly stipitate; labellum flat; spur not clavate, narrowed towards apex, obtuse or acuminate
2 Spur usually shorter than ovary; outer perianth-segments 8–10 mm **(a)** subsp. **morio**
2 Spur usually as long as ovary; outer perianth-segments 6–8 mm **(b)** subsp. **picta**

(a) Subsp. **morio**: Tubers 2, shortly stipitate. Outer perianth-segments 8–10 mm. Labellum flat. Spur narrowed towards apex, obtuse or acuminate, usually shorter than ovary. $2n=36$. *Throughout most of the range of the species, but absent from much of the south-east.*

(b) Subsp. **picta** (Loisel.) Arcangeli, *Comp. Fl. Ital.* ed. 2, 167 (1894): Tubers 2, shortly stipitate. Outer perianth-segments 6–8 mm. Labellum flat. Spur narrowed towards apex, obtuse or acuminate, usually as long as ovary. *S. Europe.*

(c) Subsp. **champagneuxii** (Barn.) Camus, *Icon. Orchid. Eur.*

154 (1929) (*O. champagneuxii* Barn.): Tubers 3 (1 subsessile, 2 long-stipitate). Outer perianth-segments 6–8 mm. Labellum plicate. Spur clavate, wider towards apex, truncate or emarginate, shorter than to as long as ovary. ● *S.W. Europe.*

4. O. longicornu Poiret, *Voy. Barb.* **2**: 247 (1789). Tubers subglobose, shortly stipitate. Stem 10–30 cm, erect, with basal rosette of leaves, and with crowded sheaths above. Leaves oblong-lanceolate. Spike shortly oblong, rarely cylindrical, rather dense, the basal flowers opening first. Bracts lanceolate, with several veins, about as long as ovary. All perianth-segments convergent into a galea; outer *c.* 6 mm, oblong, white or pale pink; inner somewhat smaller, white. Labellum about as wide as long, broadly reniform, purplish-violet, minutely punctulate, shallowly 3-lobed; middle lobe broadly triangular, usually somewhat shorter than the lateral. Spur *c.* 16 mm, cylindrical, becoming clavate and wider towards the apex, patent or somewhat curved upwards, much longer than labellum. $2n=36$. *W. Mediterranean region.* Bl Co Ga It ?Lu Sa Si.

5. O. coriophora L., *Sp. Pl.* 940 (1753). Tubers subglobose or ellipsoid. Stem 15–40 cm, erect, with 4–7 leaves below and sheaths above. Leaves linear to narrowly lanceolate. Spike oblong or cylindrical, dense. Bracts lanceolate, 1-veined, as long as or longer than ovary. All perianth-segments convergent into a galea; outer 5–10 mm, ovate-lanceolate or oblong, acute or acuminate, the inner somewhat longer; galea violet-brown. Labellum longer than wide, purplish-green, without spots, 3-lobed; lateral lobes sub-rhombic, entire, crenate or denticulate; middle lobe oblong, entire. Spur conical, directed downwards, slightly incurved towards the apex, ½ to twice as long as ovary. $2n=36$. *S., C. & E. Europe, northwards to Belgium and Lithuania.* Al Au Be Bl Bu Co Cr Cz Ga Ge Gr He †Ho Hs Hu It Ju Lu Po Rm Rs (B, C, W, K, E) Sa Si Tu.

1 Spur ½ as long as labellum — (a) subsp. **coriophora**
1 Spur as long as or longer than labellum
2 Labellum (6–)8–10 mm; flowers fragrant or inodorous — (b) subsp. **fragrans**
2 Labellum 5–6(–8) mm; flowers fetid — (c) subsp. **martrinii**

(a) Subsp. **coriophora**: Galea acute. Labellum 6–8 mm, the middle lobe scarcely longer than the lateral. Spur ½ as long as labellum. Flowers fetid. *Throughout the range of the species except for parts of the Mediterranean region.*

(b) Subsp. **fragrans** (Pollini) Sudre, *Fl. Toulous.* 187 (1907): Galea acuminate. Labellum (6–)8–10 mm, the middle lobe distinctly longer than the lateral. Spur about as long as or longer than labellum. Flowers fragrant (rarely inodorous). $2n=20, 38$. *S., S.C. & S.E. Europe.*

(c) Subsp. **martrinii** (Timb.-Lagr.) Nyman, *Consp.* 691 (1882) (incl. *O. coriophora* var. *carpetana* Willk.): Like subsp. (b) but labellum 5–6(–8) mm; spur about twice as long as labellum; flowers fetid. *W.C. Spain and Portugal.*

6. O. sancta L., *Syst. Nat.* ed. 10, **2**: 1242 (1759). Like **5** but stem with a rosette of leaves clasping the base, with sheaths above; leaves oblong-lanceolate; lower bracts 3- to 5-veined; flowers larger, pale lilac; perianth-segments 9–12 mm, long-acuminate; labellum with lateral lobes acutely dentate to sinuately serrate, the middle lobe entire or denticulate; spur subhamate-incurved, strongly narrowed towards the apex. *Islands of Aegean region.* Cr Gr.

7. O. ustulata L., *Sp. Pl.* 941 (1753). Tubers subglobose or ellipsoid. Stem 12–35 cm, erect, with 2–3 basal leaves, 1–3 leaves in the lower half and sheaths above. Leaves oblong. Spike ovoid, becoming cylindrical, dense. Bracts ovate-lanceolate, 1-veined, shorter than to about as long as ovary. All perianth-segments convergent into a galea; outer 3–3·5 mm, ovate, brownish-purple on outer surface; inner narrowly oblong, pink. Labellum 4–8 mm, longer than wide, white or pale pink with purple spots, 3-lobed; middle lobe dilated at apex, 2-lobed, rarely entire; lateral lobes oblong, obtuse. Spur cylindrical, directed downwards, ¼–½ as long as ovary. $2n=42$. *From N. England and the Leningrad region southwards to N. Spain, S. Italy, Macedonia and C. Ukraine.* Al Au Be Br Bu Cz Da Ga Ge Gr He †Ho Hs Hu It Ju Po Rm Rs (?N, B, C, W, E) Su.

8. O. tridentata Scop., *Fl. Carn.* ed. 2, **2**: 190 (1772). Tubers ellipsoid or ovoid. Stem 15–45 cm, erect, with 3–4 leaves at or above the base, and with sheaths above. Leaves oblong. Spike conical at first, becoming ovoid. Bracts lanceolate, acuminate, 1-veined, shorter than to about as long as ovary. Flowers pale violet-lilac. All perianth-segments convergent into a galea; outer ovate or ovate-oblong; inner oblong. Labellum longer than wide, with purple spots, 3-lobed; lateral lobes oblong, truncate, oblique and denticulate at apex; middle lobe twice as long as the lateral, cuneate-obovate, emarginate, with 2 obliquely square lobules, often with apiculum in sinus. Spur cylindrical, directed downwards, ½ as long as ovary. $2n=42$. *C. & S. Europe.* Al Au Bl Bu Co Cr Cz Ga Ge Gr He Hs Hu It Ju Lu Po Rm Rs (K) Sa Si Tu.

(a) Subsp. **tridentata**: Plant often robust. Spike dense. Outer perianth-segments 6–8(–10) mm, acute. Labellum 6–9 mm, the middle lobe entire at apex. *Throughout much of the range of the species, but absent from the Mediterranean region.*

(b) Subsp. **commutata** (Tod.) Nyman, *Consp.* 691 (1882): Plant often slender. Spike lax. Outer perianth-segments 8–10 (–12) mm, acuminate. Labellum 8–10 mm, the middle lobe sometimes denticulate at apex. *S. & S.C. Europe.*

9. O. lactea Poiret in Lam., *Encycl. Méth. Bot.* **4**: 594 (1798). Like **8** but stem 7–20 cm; flowers white or greenish-pink; labellum with squarish-oblong or linear lobes and orbicular-obovate middle lobe, denticulate at apex, usually not emarginate; spur sometimes longer than ovary. $2n=42$. *Mediterranean region and Balkan peninsula.* Bu Co Cr Ga Gr Hs It Ju Sa Si Tu.

10. O. italica Poiret in Lam., *op. cit.* 600 (1798) (*O. longicruris* Link). Tubers ovoid or ellipsoid. Stem 20–40 cm, erect or slightly flexuous, with 5–8 leaves in basal rosette and with sheaths above. Leaves oblong-lanceolate, with undulate margin. Spike conical at first, becoming globose or ovoid. Bracts ovate, 1-veined, ¼–⅓ as long as ovary. Perianth-segments *c.* 10 mm, ovate-lanceolate, acuminate, all convergent into a galea; galea pale pink-lilac with purple veins. Labellum 12–16 mm, longer than wide, pink, often with purple spots, 3-lobed; lateral lobes linear, acute; middle lobe divided into 2 acute, elongate-linear lobules, with short, narrowly linear laciniae between; all segments more or less flat; base of labellum with 2 triangular lamellae, scarcely papillose. Spur cylindrical, directed downwards, ½ as long as ovary. $2n=42$. *Mediterranean region, C. & S. Portugal.* ?Al Bl Cr Gr Hs It Ju Lu Si.

11. O. simia Lam., *Fl. Fr.* **3**: 507 (1779). Tubers ovoid or ellipsoid. Stem 20–45 cm, erect or subflexuous, with 3–5 leaves near base or in lower half and with sheaths above. Leaves oblong-lanceolate or -ovate, flat. Spike ovoid or broadly cylindrical. Bracts ovate-lanceolate, usually ½ as long as ovary. Perianth-segments *c.* 10 mm, ovate-lanceolate or oblong, acuminate, all convergent into a galea; galea pale greyish-pink. Labellum 14–16 mm, longer than wide, pinkish-purple with

purple spots, 3-lobed; lateral lobes linear, obtuse; middle lobe divided into 2 narrowly linear, obtuse lobules, with short teeth between; all segments subfalcate; base of labellum without lamellae, minutely papillose. Spur cylindrical, directed downwards, ½ as long as ovary. $2n=42$. *S. & W. Europe, northwards to S. England and S.W. Hungary.* ?Al Be Br Bu Cr Ga Ge Gr He Ho Hs Hu It Ju Rm Rs (K) Tu.

12. O. militaris L., *Sp. Pl.* 941 (1753). Tubers ovoid or ellipsoid. Stem 20–45 cm, erect, with 3–5 leaves near base and with sheaths above, naked in the uppermost part. Leaves oblong-lanceolate or -ovate, flat. Spike conical at first, becoming cylindrical. Bracts ovate-lanceolate, often violet, usually much shorter than ovary. Perianth-segments all convergent into a galea; outer 10–15 mm, ovate or ovate-lanceolate, acute, pink; inner linear; galea whitish- or greyish-pink, with purple veins inside. Labellum 12–15 mm, longer than wide, purple, white at the base, 3-lobed; lateral lobes linear, obtuse; middle lobe narrow, transversely oblong at the apex, 2-lobed, the lobules ovate or oblong, rarely linear, with short teeth between; all segments flat, very rarely arcuate or revolute. Spur narrowly cylindrical, directed downwards, usually ½ as long as ovary. $2n=42$. *From S. England and N.W. Russia southwards to N.C. Spain, C. Italy and Bulgaria.* Au Be Br Bu Cz Ga Ge He Ho Hs Hu It Ju Po Rm Rs (B, C, W, K, E) Su Tu.

13. O. punctulata Steven ex Lindley, *Gen. Sp. Orchid.* 273 (1835). Tubers ellipsoid. Stem 25–60 cm, erect, with 4–7 leaves in lower half, usually with sheaths above. Leaves oblong. Spike cylindrical, many-flowered. Bracts ovate, much shorter than ovary. Perianth-segments all convergent into a galea; outer 8–15 mm, oblong-ovate, more or less obtuse, pink; inner shorter, linear-oblong; galea yellowish-green. Labellum longer than wide, yellowish-green, often with purple spots, 3-lobed; lateral lobes oblong, truncate; middle lobe narrowed toward the base, widened and subreniform at the apex, 2-lobed, the lobules with short apiculum between. Spur broadly cylindrical, directed downwards. *E. part of Balkan peninsula; Krym.* ?Bu Gr Rs (K) Tu. (*Caucasus, S.W. Asia.*)

(a) Subsp. **punctulata**: Galea up to 8 mm. Labellum up to 10 mm; lateral lobes narrowly oblong; lobules of middle lobe broadly oblong. Spur *c.* ⅓ as long as ovary. *Krym.*

(b) Subsp. **sepulchralis** (Boiss. & Heldr.) Soó, *Feddes Repert.* **24**: 28 (1927) (*O. sepulchralis* Boiss. & Heldr.): Galea up to 15 mm. Labellum up to 15 mm; lateral lobes and lobules of middle lobe broadly oblong. Spur *c.* ½ as long as ovary. *Balkan peninsula.*

14. O. purpurea Hudson, *Fl. Angl.* 334 (1762). Tubers ellipsoid or subglobose. Stem 30–80 cm, erect, with 3–6 leaves in the lower half, and sheaths above, naked in the uppermost part. Leaves oblong or oblong-ovate. Spike cylindrical, many-flowered. Bracts ovate-lanceolate, usually much shorter than ovary. Perianth-segments all convergent into a galea; outer 12–14 mm, ovate, acute, brownish-purple on the outside; inner somewhat shorter, linear-lanceolate; galea brownish-purple, or pink and with dense purple spots. Labellum (8–)10–15 mm, longer than wide, white or pink with purple spots, 3-lobed, rarely indistinctly lobed or subentire; lateral lobes oblong-linear, truncate; middle lobe usually obcordate, sometimes triangular, often rather orbicular, 2-lobed, the lobules usually obovate-oblong, truncate, crenate-dentate, rarely rounded or acuminate, with a rather large tooth between. Spur shortly cylindrical, directed downwards, ⅓–½ as long as ovary. $2n=40$, 42. *From Denmark southwards to N. Spain, Sardegna, N. Greece and Krym.* Al Au Be Br Bu Co Cz Da Ga Ge Gr He Ho Hs Hu It Ju Po Rm Rs (W, K) Sa Tu.

15. O. saccata Ten., *Fl. Nap.* **1**, *Prodr.* 53 (1811) (?*O. collina* Solander ex A. Russell). Tubers ovoid. Stem 12–35 cm, erect, with basal rosette of 2–4 leaves and with dense sheaths above. Leaves oblong-ovate, usually with dark spots. Spike oblong or cylindrical, often few-flowered. Bracts ovate-lanceolate, 5- to 7-veined, the lower longer than ovary. Flowers brownish- or greenish-purple. Outer perianth-segments 10–12 mm, ovate-oblong, obtuse, the 2 lateral erecto-patent or patent-deflexed, often dark olive-green, the median curved foward; inner lanceolate-oblong. Labellum *c.* 10 mm, entire, ovate or orbicular, obtuse, more or less crenulate at apex. Spur saccate-conical, directed downwards, ½ as long as ovary. $2n=36$. *Mediterranean region.* Al Bl Cr Ga Gr It Sa Si Tu.

16. O. patens Desf., *Fl. Atl.* **2**: 318 (1799) (*O. brevicornis* Viv.). Tubers ovoid. Stem 25–70 cm, erect, with a basal rosette or cluster of 3–5 leaves and with sheaths above. Leaves oblong-ovate to lanceolate. Spike long-cylindrical. Bracts linear-lanceolate, 5- to 7-veined, *c.* ½ as long to as long as ovary. Flowers purple. Outer perianth-segments 8–10 mm, oblong, obtuse, greenish towards the base, the 2 lateral patent-deflexed, the median curved forward or erecto-patent; inner lanceolate-oblong. Labellum 9–10 mm, ovate, spotted, 3-lobed; lateral lobes obliquely oblong, truncate; middle lobe broadly obcordate, emarginate, with 2 truncate, crenulate lobules; base of labellum with 2 inconspicuous ridges. Spur saccate, directed downwards, shorter than labellum, *c.* ½ as long as ovary. *W. Mediterranean region.* Bl Hs It Si.

17. O. spitzelii Sauter ex Koch, *Syn. Fl. Germ.* 686 (1837). Tubers ovoid. Stem 20–40 cm, erect or slightly flexuous, with a basal rosette or cluster of 2–4 leaves and with sheaths above. Leaves oblong-ovate to ovate- or oblong-lanceolate. Spike ovoid or shortly cylindrical, dense. Bracts linear-lanceolate or lanceolate, 5- to 7-veined, slightly longer than or as long as ovary. Flowers purple. Outer perianth-segments 7–10 mm, oblong-ovate, obtuse, the 2 lateral patent-deflexed, the median convergent with the ovate-lanceolate inner perianth-segments into a galea. Labellum 8 × 10 mm, broadly ovate, spotted, deeply 3-lobed; lateral lobes ovate, obtuse; middle lobe widened, obovate, emarginate, crenulate; base of labellum with 2 conspicuous ridges. Spur longer than labellum, ⅓–¾ as long as ovary, *E. Alps, N. & C. Italy and Balkan peninsula; isolated stations in Sweden (Gotland), E. Spain, S.E. France and Kriti.* Al Au Bu Cr Ga †Ge Gr Hs It Ju Su.

(a) Subsp. **spitzelii**: Leaves dull. Outer perianth-segments brownish inside, without spots, without a pale margin. Spur conic-cylindrical, more or less horizontal. $2n=42$. *Throughout the range of the species except Kriti.*

(b) Subsp. **nitidifolia** (Teschner) Soó, *Bot. Jour Linn. Soc.* **76**: 368 (1978): (*O. patens* subsp. *nitidifolia* Teschner): Leaves shining. Outer perianth-segments greenish inside, sometimes with red spots, pale pink at the margin. Spur slender but widened at base, curved or directed downwards. $2n=40$. ● *Kriti.*

18. O. mascula (L.) L., *Fl. Suec.* ed. 2, 310 (1755). Tubers subglobose or ellipsoid. Stem 20–60 cm, erect, with 3–5 leaves in lower half and with sheaths above. Leaves oblong-oblanceolate to narrowly oblong, sometimes with purple spots. Spike ovoid or cylindrical. Bracts lanceolate, 1- to 3-veined, usually as long as ovary. Flowers purple to pink. Outer perianth-segments 6–8 mm, ovate or oblong-lanceolate, the 2 lateral deflexed, the median more or less erect; inner obliquely ovate-lanceolate.

Labellum 8–15 mm, somewhat longer than wide, broadly ovate to obovate, 3-lobed; lateral lobes ovate or orbicular, obtuse, crenulate towards the apex; middle lobe almost square, truncate to 2-lobed, crenulate. Spur cylindrical, patent. $2n=42$. *Much of Europe, but absent from E. Fennoscandia and the E. half of U.S.S.R.* All except Az Cr Is Rs (N, E) Sb.

1 Spur longer than ovary; lateral lobes of labellum deflexed **(d)** subsp. **olbiensis**
1 Spur shorter than to about as long as ovary; lateral lobes of labellum not deflexed
2 Perianth-segments aristate-acuminate; middle lobe of labellum up to twice as long as lateral lobes **(c)** subsp. **signifera**
2 Perianth-segments obtuse to shortly acuminate; middle lobe of labellum not more than 1½ times as long as lateral lobes
3 Perianth-segments erecto-patent, obtuse; labellum with small protuberances **(e)** subsp. **hispanica**
3 Perianth-segments deflexed; labellum without protuberances
4 Perianth-segments obtuse, lilac, the outer with brownish-purple veins; spur shorter than ovary; spike lax, few-flowered **(b)** subsp. **wanjkowii**
4 Perianth-segments obtuse, acute or shortly acuminate, usually purple; spur usually as long as ovary; spike dense, many-flowered **(a)** subsp. **mascula**

(a) Subsp. **mascula** (incl. subsp. *occidentalis* O. Schwarz, var. *obtusifolia* Koch): Spike dense, many-flowered. Perianth-segments usually purple, obtuse, acute or shortly acuminate. Lateral lobes of labellum not deflexed; middle lobe up to 1½ times as long as the lateral. Spur usually as long as ovary. *Mainly W. & W.C. Europe.*

(b) Subsp. **wanjkowii** (Wulf) Soó in R. Keller, Schlechter & Soó, *Monogr. Icon. Orchid. Eur.* **2**: 170 (1932): Spike lax, few-flowered. Perianth-segments lilac, the outer with brownish-purple veins, obtuse. Lateral lobes of labellum not deflexed; middle lobe up to 1½ times as long as the lateral. Spur shorter than ovary. ● *Krym.*

(c) Subsp. **signifera** (Vest) Soó, *Feddes Repert.* **24**: 28 (1927): Spike dense, many-flowered. Perianth-segments purple, aristate-acuminate, the outer often deflexed at apex. Lateral lobes of labellum not deflexed; middle lobe up to twice as long as the lateral. Spur as long as ovary. $2n=42$. *C., S. & E. Europe.*

(d) Subsp. **olbiensis** (Reuter ex Grenier) Ascherson & Graebner, *Syn. Mitteleur. Fl.* **3**: 703 (1907): Spike lax, few-flowered. Perianth-segments pale pink or reddish, obtuse. Lateral lobes of labellum deflexed; middle lobe up to 1½ times as long as the lateral. Spur longer than ovary. *W. Mediterranean region.*

(e) Subsp. **hispanica** (A. & C. Nieschalk) Soó, *Jahresb. Naturw. Ver. Wuppertal* **25**: 45 (1972): Spike lax, many-flowered. Perianth-segments obtuse, purple. Lateral lobes of labellum not deflexed; middle lobe slightly longer than the lateral. Spur shorter than to as long as ovary. *C. Pyrenees and mountains of S.W. Spain.*

19. O. pallens L., *Mantissa Alt.* 292 (1771). Tubers subglobose or ovoid, more or less stipitate. Stem 15–35 cm, erect, with leaves in lower half and sheaths above, naked in the uppermost part. Leaves oblong or oblong-obovate, gradually narrowed towards the base. Spike ovoid or oblong, dense. Bracts lanceolate, 1-veined, as long as or longer than ovary. Flowers pale yellow, with odour of *Sambucus nigra*. Outer perianth-segments 7–9 mm, ovate-oblong, obtuse, the 2 lateral deflexed, the median erect; inner perianth-segments obliquely oblong. Labellum 6–8 × 6–8 mm, suborbicular-rhombic, 3-lobed; lateral lobes orbicular, obtuse; middle lobe almost square, truncate or emarginate. Spur cylindrical, patent, slightly shorter than ovary. $2n=40$. *C. & S.E. Europe, extending to the S.W. Alps and C. Appennini.* Al Au Bu Cz Ga Ge Gr He Hu It Ju Po Rm Rs (K).

20. O. provincialis Balbis, *Mém. Acad. Sci. (Turin)* **1805–1808**: 20 (1806). Tubers subglobose or ovoid. Stem 15–35 cm, erect, with 2–5 leaves at the base and sheaths above. Leaves lanceolate or oblong-lanceolate. Spike cylindrical. Bracts lanceolate, 1- to 3-veined, at least as long as ovary. Flowers pale yellow, or white with deep yellow labellum, with slight odour. Outer perianth-segments 9–11 mm, ovate-oblong, obtuse, the 2 lateral deflexed, the median erect; inner smaller, obliquely oblong. Labellum suborbicular, 3-lobed; lateral lobes rounded; middle lobe small, orbicular-truncate, scarcely longer than the lateral. Spur cylindrical, patent, as long as or longer than ovary. $2n=42$. *S. Europe.* Al Bu Co Cr Ga Gr He Hs It Ju Rs (K) Sa Si.

(a) Subsp. **provincialis**: Leaves usually with dark spots. Spike dense, with 5–20 flowers. Labellum 8–12 × 8–12 mm. *Almost throughout the range of the species.*

(b) Subsp. **pauciflora** (Ten.) Camus, *Monogr. Orchid. Europ.* 160 (1908): Leaves usually without spots. Spike lax, with 3–7 flowers. Labellum 13–15 × 13–15 mm. *Balkan peninsula and E. & C. Mediterranean region.*

21. O. anatolica Boiss., *Diagn. Pl. Or. Nov.* **1(5)**: 56 (1844). Tubers subglobose or ovoid, sessile or shortly stipitate. Stem 15–40 cm, erect or slightly flexuous, with a basal rosette of 2–5 leaves and with sheaths above, naked in upper part. Leaves lanceolate or oblong, gradually narrowed towards the base. Spike ovoid, lax, few-flowered. Bracts lanceolate or linear-lanceolate, 1- to 3-veined, usually somewhat shorter than ovary. Flowers purple or pale pink. Outer perianth-segments 8–10 mm, oblong-ovate or -lanceolate, obtuse, the 2 lateral patent, the median oblong-lanceolate, directed downward or recurved; inner perianth-segments oblong-ovate, subobtuse. Labellum 10–14 (–17) × 10–14(–17) mm, obovate, 3-lobed; lateral lobes rhombic, truncate; middle lobe squarish, truncate or excised, longer than the lateral. Spur linear-conical, widened towards the mouth, longer than ovary. *Islands of S. Aegean region.* Cr Gr. (*S.W. Asia.*)

Plants from Kriti, with larger, greenish-violet flowers, an elongated labellum and the spur conspicuously curved upwards, have been named subsp. **sitiaca** Renz, *Feddes Repert.* **30**: 100 (1932). Their status requires investigation.

22. O. quadripunctata Cyr. ex Ten., *Fl. Nap.* **1**, *Prodr.* 53 (1811). Tubers subglobose or ovoid. Stem 10–30 cm, erect or slightly flexuous, with a basal rosette of 2–4 leaves and with sheaths above, naked in upper part. Leaves oblong-lanceolate or -linear. Spike ovoid or cylindrical, many-flowered. Bracts lanceolate, 1- to 3-veined, shorter than to as long as ovary. Flowers purple-violet or pinkish. Outer perianth-segments 3–5 mm, patent, ovate, obtuse, the median oblong to ovate, recurved; inner 2–5 mm, obliquely ovate, obtuse. Labellum orbicular or rhombic, white at the base, with purple spots, 3-lobed (rarely entire); lateral lobes 4–7 mm, convergent, cruciform or divergent, oblong, ovate or rhombic; middle lobe oblong or squarish, truncate. Spur filiform, not widened towards the mouth, about as long as ovary. *Mediterranean region, from Sardegna eastwards.* Al Cr Gr It Ju Sa Si.

23. O. laxiflora Lam., *Fl. Fr.* **3**: 504 (1779). Tubers subglobose or ellipsoid, subsessile or shortly stipitate. Stem 30–80 cm, erect or slightly flexuous, with 3–8 patent leaves. Leaves linear or lanceolate. Spike ovoid or cylindrical, lax. Bracts lanceolate, 3- to 7-veined, shorter to longer than ovary. Flowers purple. Outer perianth-segments 7–10 mm, oblong, obtuse, the 2 lateral deflexed, the median more or less erect; inner shorter, obliquely oblong. Labellum 6–12 × 8–12 mm, suborbicular, obovate or

triangular-obovate, cuneate at the base; lateral lobes oblong or oblong-orbicular, deflexed after anthesis; middle lobe entire to shallowly 2-lobed. Spur cylindrical. *W., C. & S. Europe, extending northwards to Gotland and eastwards to S. Russia.* Al Au Be Bl Bu Co Cr Cz Ga Ge Gr He Hs Hu It Ju Lu Po Rm Rs (C, W, E) Sa Si Su Tu.

1 Labellum subentire or indistinctly 3-lobed; leaves 1·5–2·5 cm wide (c) subsp. **elegans**
1 Labellum distinctly 3-lobed; leaves usually 1–2 cm wide
2 Middle lobe of labellum usually shorter than the lateral; spur widened at apex (a) subsp. **laxiflora**
2 Middle lobe of labellum as long as or longer than the lateral; spur usually narrowed at apex or of uniform width (b) subsp. **palustris**

(a) Subsp. **laxiflora**: Labellum up to 7(–10) mm, distinctly 3-lobed; middle lobe usually shorter than the lateral. Spur widened at apex, ⅓–½ as long as ovary. $2n=36$. *W. & S. Europe.*

(b) Subsp. **palustris** (Jacq.) Bonnier & Layens, *Fl. Fr.* 311 (1894) (*O. palustris* Jacq.): Labellum up to 10 mm, distinctly 3-lobed; middle lobe at least as long as the lateral. Spur narrowed at apex or of uniform width, rarely widened at apex, slightly to much shorter than ovary. $2n=42$. *Mainly in the northern and western parts of the range of the species.*

(c) Subsp. **elegans** (Heuffel) Soó, *Notizbl. Bot. Gart. Berlin* **9**: 910 (1926) (*O. pseudolaxiflora* Czerniakovska pro parte): Labellum up to 12 mm, subentire or indistinctly 3-lobed; middle lobe at least as long as the lateral. Spur narrowed at apex, shorter than to almost as long as ovary. *E. & E.C. Europe.*

25. Aceras R. Br.[1]

Tubers 2, ovoid to subglobose, entire. Stem with numerous leaves. Flowers in a dense spike. Perianth-segments all connivent to form a semi-globose galea over the column. Labellum shaped like a man, with linear lateral lobes at base and a long middle lobe distally divided into two slender segments. Spur absent. Column very short. Rostellum minute. Viscidia 2, more or less globose, often coherent, in one simple bursicle.

1. A. anthropophorum (L.) Aiton fil., *Epit. Hort. Kew.* 281 (1814). Stem 10–40(–60) cm, glabrous, with brownish, sheathing basal scales. Lower leaves 5–12 cm, oblong to oblong-lanceolate, obtuse, canaliculate, erect, later erecto-patent, the upper smaller or bract-like. Spike narrowly cylindrical, many-flowered; bracts membranous. Flowers greenish-yellow, often with reddish streaks and margins. Outer perianth-segments 6–7 mm, ovate-lanceolate, obtuse, the inner shorter and narrower. Labellum 12–15 mm, pendent, yellowish, often reddish-brown; lateral lobes *c.* ½ as long as the middle. $2n=42$. *Grassland, rarely scrub; calcicole. Mediterranean region and W. Europe, northwards to C. England and the Netherlands.* Be Bl Br Co Cr Ga Ge Gr He Ho Hs It Ju Lu Sa Si.

Frequently hybridizes with species of *Orchis*, especially *O. militaris*, *O. purpurea* and *O. simia*.

26. Himantoglossum Koch[1]

Tubers 2, ovoid to subglobose, entire. Stem with numerous leaves, clothed with brownish fibres at base. Flowers in a long spike. Bracts equalling or shorter than flowers. Outer perianth-segments connivent with inner lateral to form a galea. Labellum 3-lobed, much exceeding other perianth-segments, the middle lobe much exceeding the lateral and spirally twisted. Spur present. Column rather short. Rostellum prominent, beak-like. Viscidium solitary, hemispherical or ellipsoid, bearing 2 pollinia bursicle simple.

Literature: H. Sundermann, *Acta Bot. Acad. Sci. Hung.* **19**: 367–374 (1973).

1. H. hircinum (L.) Sprengel, *Syst. Veg.* **3**: 694 (1826) (*Loroglossum hircinum* (L.) L. C. M. Richard, *Orchis hircina* (L.) Crantz). Stem 20–90 cm, stout, glabrous, with indistinct purplish blotches. Lower leaves 4–6, 5–15 × 3–5 cm, elliptic-oblong, obtuse, the upper smaller, acute, amplexicaul. Spike 10–30(–50) cm, cylindrical, rather lax. Flowers large, with a strong odour. Perianth-segments 7–10 mm, subequal, pale green, with purplish spots and streaks, the outer ovate, obtuse, the inner linear. Labellum 30–50 mm, whitish, with purple spots and papillose towards base, darker green and smooth distally; lateral lobes linear, acute, curled, often purplish; middle lobe *c.* 2 mm wide, lorate, somewhat undulate; spur obtuse, slightly curved downwards. $2n=$?24, 36. *Grassland, scrub and open woods; usually calcicole. S., S.C. & W. Europe, northwards to C. England and the Netherlands.* Au Be Br Bu ?Co Cr Cz Ga Ge Gr He Ho Hs Hu It Ju Rm Rs (K) ?Sa Si Tu.

1 Middle lobe of labellum deeply divided into 2 apical lobules *c.* 15 mm; galea ovoid (c) subsp. **caprinum**
1 Middle lobe of labellum shallowly emarginate or 2- to 4-dentate; galea subglobose
2 Lateral lobes of labellum 5–10 mm; spur *c.* 4 mm, conical (a) subsp. **hircinum**
2 Lateral lobes of labellum 12–20 mm; spur 7–12 mm, subcylindrical (b) subsp. **calcaratum**

(a) Subsp. **hircinum**: Tubers ovoid to subglobose. Spike 15- to 80-flowered; bracts linear-lanceolate. Galea subglobose. Labellum distinctly papillose towards base; lateral lobes 5–10 mm, the middle truncate and shallowly emarginate or 2- to 4-dentate; spur *c.* 4 mm, conical. *Throughout the range of the species except for parts of the south-east.*

(b) Subsp. **calcaratum** (G. Beck) Soó, *Bot. Arch.* (*Berlin*) **23**: 90 (1928): Like subsp. (a) but lateral lobes of labellum 12–20 mm; spur 7–12 mm, subcylindrical. *S.E. Europe.*

(c) Subsp. **caprinum** (Bieb.) Sundermann, *Acta Bot. Acad. Sci. Hung.* **19**: 373 (1973): Like subsp. (a) but tubers ellipsoid; spike (9–)15- to 20(–24)-flowered, with linear bracts; galea ovoid; labellum minutely papillose at base, the middle lobe deeply divided into 2 apical lobules *c.* 15 mm. ● *Krym.*

27. Barlia Parl.[1]

Like *Himantoglossum* but bracts exceeding flowers; outer perianth-segments erecto-patent, not connivent to form a galea; labellum not more than twice as long as other perianth-segments.

1. B. robertiana (Loisel.) W. Greuter, *Boissiera* **13**: 192 (1967) (*Aceras longibracteatum* Reichenb. fil., *Loroglossum longibracteatum* Moris ex Ardoino, *Orchis longibracteata* Biv., non F. W. Schmidt). Tubers ovoid. Stem 25–50(–80) cm, stout, glabrous. Lower leaves 8–25 × 4–10 cm, ovate to oblong or elliptical, obtuse to subacute, mucronate, the upper smaller or bract-like. Spike 8–20 cm, ovoid, becoming cylindrical, dense, many-flowered. Flowers fragrant. Outer perianth-segments 20–25 mm, elliptical to ovate, concave, obtuse, purple; inner lateral connivent, slightly shorter than the outer, linear-lanceolate, obtuse, green with purplish spots. Labellum up to 20 mm, crenulate, pinkish-violet, greenish or white, with purple spots in centre; lateral lobes linear, falcate; middle lobe 1½–2 times as long as the lateral, divided to *c.* ½-way into 2 diverging, obtuse

[1] By D. M. Moore.

lobules, often with a small tooth in the sinus. Spur short, stout, conical. $2n=36$. *Grassland, open woodland and scrub. Mediterranean region, Portugal.* Bl Co Cr Ga Gr Hs It Ju Lu Sa Si.

28. Anacamptis L. C. M. Richard[1]

Tubers usually 2, ovoid or subglobose, entire. Stem with numerous leaves. Flowers in a dense spike. Outer lateral perianth-segments patent, the outer median connivent with the inner lateral to form a galea. Labellum deeply 3-lobed, with 2 longitudinal ridges at the base. Spur long, directed downwards. Column short. Rostellum small. Viscidium solitary, transversely elongate, bearing 2 pollinia; bursicle simple.

1. A. pyramidalis (L.) L. C. M. Richard, *Orchid. Eur. Annot.* 33 (1817) (*Orchis pyramidalis* L.). Stem 20–60(–75) cm, slender, with 2–3 brownish, sheathing basal scales. Lower leaves 8–25 cm, linear- to oblong-lanceolate, acute, canaliculate, entire, the upper smaller, or bract-like. Spike 2–8 cm, conical to shortly cylindrical, many-flowered; bracts linear-lanceolate. Flowers purplish-red, rarely pink or white. Perianth-segments 4–6 mm, subequal, broadly lanceolate, the outer median elliptic-ovate, concave. Labellum 6–8(–9) mm, broadly cuneate, the lobes *c.* 4 mm, subequal, oblong, more or less entire. Spur 12–14 mm, filiform, acute. $2n=36$. *Grassland and scrub; calcicole. W., C. & S. Europe, extending northwards to the Baltic islands and eastwards to C. Ukraine.* All except Az Fa Fe Is No Rs (N, E) Sb.

Plants with small leaves and short spikes, from mountainous regions of the E. Mediterranean region, have been named var. *brachystachys* (D'Urv.) Boiss.

29. Serapias L.[1]

Tubers 2–5, ovoid to globose, entire. Leaves narrow, canaliculate, acute, entire, usually shiny. Flowers in a spike. Outer perianth-segments ovate-lanceolate, acute, partially connate, connivent with the linear-lanceolate, acuminate inner lateral to form a galea. Labellum large, constricted into basal hypochile, with two indistinct lateral lobes, and prominent, pendent epichile. Spur absent. Column long. Rostellum small. Viscidium solitary; bursicle simple.

Literature: P. Christian, *Quart. Bull. Alp. Gard. Soc.* **43**: 189–198 (1975). P. Gölz & H. R. Reinhard, *Orchidee* **28**: 108–116 (1977). E. Nelson, *Monographie und Ikonographie der Orchidaceen-Gattungen* Serapias, Aceras, Loroglossum, Barlia. Chernez-Montreux. 1968.

All species appear to hybridize readily with each other and with species of *Anacamptis*, *Dactylorhiza*, *Ophrys* and *Orchis*.

1 Epichile of labellum usually cordate, at least as wide as hypochile
2 Labellum with 2 divergent ridges at base; lateral lobes of hypochile *c.* ⅓ as wide as epichile; bracts shorter than flowers **1. cordigera**
2 Labellum with 2 parallel ridges at base; lateral lobes of hypochile *c.* ½ as wide as epichile; bracts equalling or exceeding flowers
3 Epichile directed ±downwards **3. vomeracea**
3 Epichile directed ±upwards or forwards **2. neglecta**
1 Epichile of labellum narrowed towards base, narrower than hypochile
4 Bracts much exceeding flowers; lateral lobes of labellum reddish, black distally **3. vomeracea**
4 Bracts equalling or slightly exceeding flowers; lateral lobes of labellum black or dark purple
5 Labellum with solitary black ridge at base, violet to reddish; tubers 2–5, 1 sessile, the others on stolons **4. lingua**
5 Labellum with 2 ridges at base, brownish-red; tubers 2(–3), sessile **5. parviflora**

1. S. cordigera L., *Sp. Pl.* ed. 2, 1345 (1763). Tubers 2–3, 1 sessile, the other(s) on stolons, ovoid to globose. Stem 15–50 cm, with purplish, usually spotted basal sheaths. Spike short, ovoid, dense, 2- to 10-flowered; bracts shorter than flowers, purplish. Flowers 20–35 mm; outer perianth-segments subequal, ovate-lanceolate, acuminate, free at apex, purple, rarely white; inner lateral about as long as the outer. Labellum twice as long as the other segments, with two deep purple to black divergent ridges at base; lateral lobes purplish-black, rarely pink or white, rounded, partly hidden by galea; epichile as wide as hypochile, acuminate, hairy, reddish-purple, with darker veins, rarely yellowish. $2n=36$. *Open woodland and scrub, grassland and stream-margins. S. & W. Europe, northwards to N.W. France.* Al Au Az Bl Co Ga Gr Hs It Ju Lu Sa Si Tu.

S. azorica Schlechter, *Feddes Repert.* **19**: 44 (1923), described from Açores (San Miguel), is said to differ from **1** in having the epichile distinctly wider than the hypochile and smaller flowers in a shorter spike. These characters are found in high altitude variants of **1** in the Açores, plants at lower elevations having larger flowers; they do not merit formal recognition above varietal status.

2. S. neglecta De Not., *Repert. Fl. Ligust.* 423 (1844). Tubers 2, sessile, ovoid to globose. Stem 10–30 cm, with green, unspotted basal sheaths. Spike short, dense, 2- to 8-flowered; bracts equalling or slightly exceeding flowers, green, often tinged with purple. Flowers 25–40 mm; outer perianth-segments ovate-lanceolate, acuminate, concave, free at apex, lilac; inner lateral slightly shorter than the outer. Labellum *c.* 3 times as long as the other segments, with two dark purple parallel ridges at base; lateral lobes rounded, red or purplish, partly hidden by galea; epichile as wide as hypochile, cordate, acuminate, hairy, pale to deep yellow, rarely orange. *Damp grassland, on sandy soils, usually coastal. C. Mediterranean region.* Co Ga Gr It Ju Sa ?Si.

3. S. vomeracea (Burm.) Briq., *Prodr. Fl. Corse* **1**: 378 (1910) (*S. longipetala* (Ten.) Pollini, *S. pseudocordigera* Moric.). Tubers 2, ovoid, sessile. Stem (5–)10–55 cm, with green, unspotted basal sheaths. Spike 2- to 10-flowered; bracts pale red, with darker veins. Flowers 15–30 mm; perianth-segments subequal, pale red, with darker veins, the outer lanceolate, acuminate, free at apex, the inner ovate-lanceolate. Labellum 1½ times as long as the other segments, with 2 pale, slightly divergent ridges at base; lateral lobes rounded, sometimes erect, reddish, black distally, partly hidden by galea; epichile triangular-lanceolate, acute, narrowed at base, narrower than hypochile, hairy, reddish or brownish, rarely white. $2n=36$. *Woodland, scrub and grassland. S. Europe.* Al Bl Bu Co Cr Ga Gr He Hs It Ju Lu Sa Si Tu.

(a) Subsp. **vomeracea**: Stem up to 55 cm. Spike elongate, lax, 3- to 10-flowered. Bracts much exceeding flowers. Outer median perianth-segments directed upwards. Labellum with middle lobe 9–11 mm wide. *Throughout the range of the species except for parts of the south-east.*

(b) Subsp. **orientalis** W. Greuter, *Florist. Rep. Cretan Area* 19 (1972): Stem not more than 25(–30) cm. Spike short, rather dense, (2–)3- to 4(–6)-flowered. Bracts equalling or slightly exceeding flowers. Outer median perianth-segments horizontal.

[1] By D. M. Moore.

Labellum with middle lobe 11–23 mm wide. *E. Mediterranean region.*

Plants from the E. Mediterranean region, here included in subsp. (a), have been distinguished as subsp. **laxiflora** (Soó) Gölz & Reinhard, *Orchidee* **28**: 114 (1977) (*S. parviflora* subsp. *laxiflora* Soó, *S. columnae* (Ascherson & Graebner) Fleischm., *S. hellenica* Renz), on account of their shorter perianth-segments and labellum, narrower hypochile and often reflexed epichile.

4. S. lingua L., *Sp. Pl.* 950 (1753). Tubers 2–5, 1 sessile, the others on stolons, ovoid to subglobose. Stem 10–25(–60) cm, with green, unspotted basal sheaths. Spike elongate, 2- to 9-flowered; bracts equalling flowers, purple, rarely greenish. Flowers 15–25 mm; outer perianth-segments ovate-lanceolate, acute, concave, free at apex, violet or purple, rarely white, sometimes with greenish markings; inner lateral slightly shorter than the outer. Labellum about twice as long as the other segments, with solitary black ridge at base; lateral lobes rounded, dark purple, hidden by galea; epichile ovate-lanceolate, acuminate, narrowed at base, narrower than hypochile, sometimes directed forwards, violet to reddish, rarely yellow or white. *Damp grassland, marshes and maritime sands. Mediterranean region and S.W. Europe.* Al Bl Co Cr Ga Gr Hs It Ju Lu Sa Si.

5. S. parviflora Parl., *Gior. Sci. Sic.* **59**: 66 (1837) (*S. occultata* Gay). Tubers 2(–3), sessile, ovoid. Stem 10–35 cm, with green, frequently spotted basal sheaths. Spike elongate, 3- to 10(–12)-flowered; bracts equalling or slightly exceeding flowers, red to reddish-green, usually with dark purple veins. Flowers 15–20 mm; perianth-segments subequal; outer linear-lanceolate, acute, free except at base, lilac; inner lateral ovate-lanceolate, greenish or reddish. Labellum about as long as the other segments, with 2 dark purple parallel ridges at base; lateral lobes rounded, sometimes erect, blackish, partly hidden by galea; epichile lanceolate, acute, narrowed at base, narrower than hypochile, brownish-red, rarely white. $2n = 36$. *Grassland and maritime sands. Mediterranean region, C. & S. Portugal.* Al Bl Co Cr Ga Gr Hs It Ju Lu Sa Si Tu.

S. olbia Verguin, *Bull. Soc. Bot. Fr.* **54**: 599 (1908) (*S. gregaria* Godfery), which occurs on maritime sands and lake-margins in S.E. France (Var), is probably a hybrid between **4** and **5**. It has 3–4 tubers, 1 sessile, the others on stolons, a short, 2- to 6-flowered, pale violet to purple, dark-veined spike, with bracts equalling or slightly exceeding the flowers. The outer perianth-segments are as in **5** but are pale violet to purple, while the labellum is as in **5** except that it is about twice as long as the other segments and has a hairy, dull red to purple epichile.

30. Ophrys L.[1]

Tubers 2(–3), globose or ovoid, entire. Leaves usually in a basal rosette, sometimes also present on stem. Perianth-segments more or less patent, unequal; outer oblong or ovate, obtuse; inner lateral smaller, often hairy. Labellum entire to 3-lobed, often convex and gibbous, sometimes with an apical appendage which is often deflexed, glabrous or velutinous, variably marked, with usually glabrous central area (speculum); spur absent. Rostellum minute. Viscidia in 2 simple bursicles.

Many species of *Ophrys* can cross to produce hybrids, which are often fertile, and most interspecific combinations have been reported, although generally not as often as might be expected from the frequency with which 2 or more species occur sympatrically. This has been attributed to the high fidelity to particular *Ophrys* species of the pollinating bees and wasps. Nevertheless, certain species, especially **1–6** and **15–20**, seem to hybridize more than others and there is clear evidence that some crosses (**3 × 4**, **6 × 9**, **15 × 16**) can give rise to fertile hybrid swarms and even stabilized hybrid segregates, sometimes involving introgression, which are eco-geographically and reproductively differentiated from their parents.

Literature: H. Baumann, *Orchidee* **26**: 132–140, 222–230 (1975). O. & E. Danesch, Ophrys-*Hybriden*. Bern. 1972. O. & E. Danesch, F. & K. Ehrendorfer, *Pl. Syst. Evol.* **124**: 79–123 (1975). P. Gölz & H. Reinard, *Ber. Schweiz. Bot. Ges.* **85**: 31–56 (1975). E. Nelson, *Gestaltwandel und Artbildung, erötert am Beispiel der Orchidaceen Europas und der Mittelmeerländer mit einer Monographie und Ikonographie der Gattung* Ophrys. Chernex-Montreux. 1962. R. von Soó, *Acta Bot. Acad. Sci. Hung.* **5**: 437–471 (1959); **16**: 373–392 (1970); **18**: 379–384 (1973). H. Sundermann, *Jahresb. Naturw. Ver. Wuppertal* **19**: 9–17, 63–70 (1964). W. Vöth & F. Ehrendorfer, *Pl. Syst. Evol.* **124**: 279–290 (1976).

1 Anther-connective obtuse
2 Inner perianth-segments white, yellowish or green
3 Labellum with flat margin, and a yellow, glabrous or hairy marginal zone **3. lutea**
3 Labellum with ± deflexed margin, and a velutinous, sometimes yellow, marginal zone
4 Inner perianth-segments green; labellum 13–23 mm **4. fusca**
4 Inner perianth-segments white to pale green; labellum 7–9 mm **5. pallida**
2 Inner perianth-segments purplish or blackish-violet, at least at base
5 Labellum deeply 3-lobed, the lateral lobes gibbous and deflexed so that the labellum appears globose-inflated **20. bombyliflora**
5 Labellum entire to deeply 3-lobed, the lateral lobes not gibbous or deflexed
6 Outer perianth-segments purplish; labellum entire, rarely slightly 3-lobed **18. tenthredinifera**
6 Outer perianth-segments green or yellowish; labellum distinctly 3-lobed
7 Inner perianth-segments linear, velutinous; middle lobe of labellum deeply emarginate or 2-lobed; speculum small, pale bluish-violet **1. insectifera**
7 Inner perianth-segments ovate to lanceolate, hairy; middle lobe of labellum entire or slightly emarginate; speculum large, blue, with yellow margin **2. speculum**
1 Anther-connective acute or acuminate
8 Lateral lobes of labellum with basal protuberances; speculum usually with a whitish or yellowish margin
9 Outer perianth-segments green
10 Labellum entire
11 Speculum without a coloured margin; inner perianth-segments at least ½ as long as the outer **6. sphegodes**
11 Speculum with a whitish, yellowish or greenish margin; inner perianth-segments ⅓–½ as long as the outer **16. fuciflora**
10 Labellum 3-lobed
12 Lateral lobes of labellum glabrous
13 Speculum without a marginal zone; labellum 5–15(–17) mm **6. sphegodes**
13 Speculum with a white marginal zone; labellum 10–13 (–15) mm **7. spruneri**
12 Lateral lobes of labellum hairy
14 Labellum blackish-purple; speculum H-shaped, scutelliform or of small spots, white or bluish, with white margin **13. cretica**
14 Labellum brown; speculum scutelliform, blue or dark brownish-violet, with yellow margin **14. carmeli**
9 Outer perianth-segments pink or purplish

[1] By R. de Soó.

15 Inner perianth-segments ⅔ as long as the outer; speculum crescentic, without a coloured margin **10. lunulata**
15 Inner perianth-segments usually up to ½ as long as the outer; speculum not crescentic, with a whitish or yellowish margin
16 Labellum entire or subentire
17 Basal protuberances of the labellum up to 3 mm; appendage of the labellum large, 3-dentate **16. fuciflora**
17 Basal protuberances of the labellum short, inconspicuous; appendage of the labellum small **17. arachnitiformis**
16 Labellum 3-lobed
18 Outer perianth-segments (8–)10–15 mm; appendage of labellum long or absent; margin of speculum yellow **19. apifera**
18 Outer perianth-segments 8–10(–12) mm; appendage of labellum short
19 Inner perianth-segments ½ as long as the outer; margin of speculum white **13. cretica**
19 Inner perianth-segments ⅓–½ as long as the outer; margin of speculum whitish or yellow **15. scolopax**
8 Lateral lobes of labellum without basal protuberances; speculum with or without a coloured margin
20 Labellum entire
21 Outer perianth-segments green
22 Speculum with whitish, greenish or yellow margin **16. fuciflora**
22 Speculum without a coloured margin
23 Labellum 5–15(–17) mm, without appendage; speculum usually H-shaped **6. sphegodes**
23 Labellum 10–12 mm, with appendage; speculum horseshoe-shaped, scutelliform or of 2 parallel lines **8. ferrum-equinum**
21 Outer perianth-segments pinkish or purplish
24 Speculum without coloured margin
25 Speculum horseshoe-shaped, scutelliform or of 2 parallel lines; labellum not curved upwards anteriorly **8. ferrum-equinum**
25 Speculum usually scutelliform; labellum ±curved upwards anteriorly **9. bertolonii**
24 Speculum with whitish, greenish or yellow margin
26 Inner perianth-segments at least ½ as long as the outer; labellum suborbicular to ovate **11. argolica**
26 Inner perianth-segments ⅕–⅓ as long as the outer; labellum ovate to transversely elliptical **16. fuciflora**
20 Labellum 3-lobed
27 Inner perianth-segments at least ⅔ as long as the outer; speculum crescentic **10. lunulata**
27 Inner perianth-segments *c.* ½ as long as the outer; speculum not crescentic
28 Inner perianth-segments glabrous or papillose
29 Speculum with white margin **7. spruneri**
29 Speculum without white margin
30 Basal leaves obtuse; inner perianth-segments greenish or brownish-red; labellum usually without an appendage **6. sphegodes**
30 Basal leaves acute; inner perianth-segments purple or pink; labellum with an appendage **8. ferrum-equinum**
28 Inner perianth-segments hairy
31 Speculum of 2 thick, comma-shaped lines and 2 spots **12. reinholdii**
31 Speculum H-shaped (the cross-line sometimes absent), scutelliform or of 1 line or spot
32 Outer perianth-segments purple or lilac; speculum with white margin **11. argolica**
32 Outer perianth-segments green or greenish-purple
33 Speculum without white margin **6. sphegodes**
33 Speculum with white margin **7. spruneri**

1. O. insectifera L., *Sp. Pl.* 948 (1753) (*O. muscifera* Hudson). Plant up to 60 cm. Basal leaves linear-lanceolate, erect, acute. Spike 3- to 14-flowered, lax. Outer perianth-segments 6–8 mm, oblong-ovate, green, glabrous, the lateral patent, the median suberect, more or less concave; inner perianth-segments 4–6 mm, linear, revolute, blackish-violet, velutinous. Labellum 9–10 × 6–7 mm, deflexed, blackish-violet or -purple, paler at apex, papillose, 3-lobed, not globose-inflated; lateral lobes patent, obtuse; middle lobe flat or concave, ovate, wider and longer than the lateral, deeply emarginate or 2-lobed, sometimes with a tooth in the sinus; speculum reniform or square, shiny, pale blue-violet. Connective obtuse. $2n=36$. ● *Much of Europe, but absent from the south-east and rare in the extreme south and much of the north.* Au Be Br Cz Da Fe Ga Ge Hb He Ho Hs Hu It Ju No Po Rm Rs (N, B, C, W) Su.

2. O. speculum Link in Schrader, *Jour. für die Bot.* **1799(2)**: 324 (1800). Basal leaves oblong, subobtuse, the cauline lanceolate, acute. Outer perianth-segments 6–8 mm, oblong-ovate, green or yellowish, often brown-striate, glabrous, the lateral patent, the median erect, cucullate; inner ¼–⅓ as long as the outer, ovate to lanceolate, dark purple, rarely greenish, densely hairy. Labellum up to 13 × 15 mm, dark purple, villous with coloured hairs at margin, deeply 3-lobed, not globose-inflated; lateral lobes patent, obtuse, yellowish in the centre and with darker lines; middle lobe often slightly emarginate, with revolute margin, rarely convex; speculum large, shiny, blue, yellow at margin, sometimes 3-lobed. Connective obtuse. $2n=36$. *Mediterranean region, C. & S. Portugal.* Bl Co ?Cr Ga Gr Hs It Lu Sa Si Tu.

(a) Subsp. **speculum**: Stem not more than 35 cm. Inflorescence 2- to 10-flowered. Inner perianth-segments dark purple. Middle lobe of labellum orbicular-triangular or suborbicular; speculum with wide, yellow margin, the marginal hairs brown or blackish-purple. *Throughout the range of the species.*

(b) Subsp. **lusitanica** O. & A. Danesch, *Orchidee* **20**: 21 (1969): Stem up to 50 cm. Inflorescence up to 15-flowered. Inner perianth-segments greenish. Middle lobe of labellum oblong; speculum with narrow, deep yellow margin, the marginal hairs dark yellow or brownish-red. ● *W.C. Portugal.*

3. O. lutea (Gouan) Cav., *Icon. Descr.* **2**: 46 (1793). Plant 7–30 cm. Basal leaves ovate, acute. Spike 2- to 7-flowered, lax. Perianth-segments subglabrous or papillose at margin; outer *c.* 10 mm, oblong-ovate, obtuse, green, the lateral sub-patent, the median incurved; inner perianth-segments ⅓–½ as long as the outer, linear-oblong, green or yellowish. Labellum 9–18 mm, suborbicular or oblong, with flat margin, dark brown or blackish-purple, with yellow or greenish marginal zone, papillose, 3-lobed, not globose-inflated; lateral lobes ovate, obtuse; middle lobe reniform, often incised; speculum entire or 2-lobed, grey or bluish-grey. Connective obtuse. *Mediterranean region, C. & S. Portugal.* Bl Co Cr Ga Gr Hs It Ju Lu Sa Si Tu.

1 Labellum 12–18 mm, the lobes subequal or the middle lobe larger, with marginal zone 2–3 mm wide (a) subsp. **lutea**
1 Labellum 9–12 mm, the lobes subequal or the middle lobe smaller, with marginal zone 1–2 mm wide
2 Marginal zone of labellum with blackish-purple hairs, the rest of the labellum (except the speculum) blackish-purple (c) subsp. **melena**
2 Marginal zone of labellum glabrous, the rest of the labellum (except the speculum) dark brown (b) subsp. **murbeckii**

(a) Subsp. **lutea**: Labellum 12–18 mm, the lobes subequal or the middle lobe larger, with glabrous marginal zone 2–3 mm wide, papillose (except the marginal zone and speculum); speculum 2-lobed, narrow in relation to labellum. $2n=36$. *C. & E. Mediterranean region.*

(b) Subsp. **murbeckii** (Fleischm.) Soó, *Feddes Repert.* **24**: 25 (1927): Labellum 9–12 mm, the lobes subequal or the middle lobe smaller, with glabrous marginal zone 1–2 mm wide, dark brown (except the marginal zone and speculum); speculum entire or

2-lobed, wide in relation to labellum. *Throughout most of the range of the species.*

(c) Subsp. **melena** Renz, *Feddes Repert.* **25**: 264 (1928): Labellum 9–12 mm, the lobes subequal or the middle lobe smaller, with marginal zone 1–2 mm wide with blackish-purple hairs, blackish-purple (except the marginal zone and speculum); speculum 2-lobed, wide in relation to labellum. ● *Greece.*

Subspp. (b) and (c) are perhaps of hybrid origin.

4. O. fusca Link in Schrader, *Jour. für die Bot.* **1799(2)**: 324 (1800). Plant 10–40 cm. Basal leaves oblong-lanceolate, obtuse, mucronate, the cauline 1–2, lanceolate, acute. Spike 1- to 9-flowered, lax. Perianth-segments subglabrous or papillose; outer 9–11 mm, oblong or ovate, green, rarely pinkish; inner perianth-segments 6–8 mm, at least ½ as long as outer, linear to linear-oblong, green. Labellum 13–23 × 9–21 mm, with margins more or less deflexed, obovate, purplish or yellowish-brown, velutinous, 3-lobed with broadly rounded lobes, not globose-inflated; lateral lobes oblong-ovate, obtuse; middle lobe reniform, obcordate or ovate, usually emarginate; speculum 2-partite, blue, bluish-violet or brown, often with white or yellow margin, sometimes with white or pale yellow lines. Connective obtuse. $2n=c.$ 73. *Mediterranean region, C. & S. Portugal; S.W. Romania.* Al Bl Co Cr Ga Gr Hs It Ju Lu Rm Sa Si Tu.

1 Lateral lobes of labellum almost as long as the middle; inner perianth-segments as long as the outer **(a) subsp. durieui**
1 Lateral lobes of labellum very short; inner perianth-segments ~~½–⅔~~ as long as the outer
2 Labellum geniculately deflexed at base; speculum entire, with white margin and with ω-shaped mark **(d) subsp. omegaifera**
2 Labellum horizontal or inclined downwards, incised at base; speculum usually divided into 2 parts without ω-shaped mark
3 Labellum not more than 15 × 12 mm, with narrow yellow margin; speculum greyish-blue or bluish-violet **(b) subsp. fusca**
3 Labellum up to 25 × 21 mm, without yellow margin; speculum shining blue **(c) subsp. iricolor**

(a) Subsp. **durieui** (Reichenb. fil.) Soó, *Feddes Repert.* **24**: 26 (1927): Flowers 1–2(4). Inner perianth-segments papillose. Labellum up to 30 mm, purplish-violet or dark red, long-villous-velutinous, more or less concave in the middle, curved upwards at the apex. Speculum shining, metallic blue. *S. Spain.*

(b) Subsp. **fusca**: Flowers 3–8. Inner perianth-segments subglabrous. Labellum 13–15 × 9–12 mm. Speculum greyish-blue or bluish-violet. $2n=72(76)$. *Throughout most of the range of the species.*

(c) Subsp. **iricolor** (Desf.) O. Schwarz, *Feddes Repert.* **36**: 77 (1934) (*O. fleischmannii* auct., non Hayek): Flowers 1–4. Inner perianth-segments often papillose. Labellum up to 25 × 21 mm. Speculum shining blue. $2n=36$. *C. & E. Mediterranean region.*

(d) Subsp. **omegaifera** (Fleischm.) E. Nelson, *Gestaltwandel* 209 (1962) (*O. omegaifera* Fleischm., *O. fleischmannii* Hayek): Flowers 2–6. Inner perianth-segments papillose. Labellum up to 20 mm, without yellow margin. Speculum red-brown to brownish-violet, with white or pale yellow margin, and with ω-shaped mark. *C. & E. Mediterranean region.*

The distribution of subsp. (c) is uncertain because of confusion, perhaps resulting from introgressive hybridization, with subsp. (b) in the W. Mediterranean region.

5. O. pallida Rafin., *Caratt.* 87 (1810). Like **4** but inner perianth-segments white to pale greenish, papillose; labellum 7–9 mm, geniculately deflexed at base, the middle lobe reniform or ovate, sometimes emarginate or shallowly 3-lobed. *Sicilia.* ?Sa Si.

6. O. sphegodes Miller, *Gard. Dict.* ed. 8, no. 8 (1768) (*O. aranifera* Hudson). Plant 10–45 cm. Basal leaves ovate-lanceolate, obtuse, usually mucronate. Spike 2- to 10-flowered, lax. Perianth-segments glabrous, rarely papillose; outer 6–10(–12) mm, oblong-ovate to -lanceolate, more or less obtuse, green, rarely purplish or whitish, the median usually narrower; inner perianth-segments 4–8 mm, at least ½ as long as the outer and usually narrower, oblong-triangular to -lanceolate, green, greenish-purple or brownish-red, 1- to 3-veined, usually with undulate margin. Labellum with margins deflexed or flattened, orbicular to ovate, velutinous, rarely with a small appendage, not globose-inflated; speculum usually H-shaped (the cross-line sometimes absent), rarely scutelliform, bluish-violet or blackish-purple. Connective acute. *W., C. & S. Europe, northwards to S. England and C. Germany and eastwards to Krym.* Al Au Be Bl Br Bu Co Cr Cz Ga Ge Gr He Hs Hu It Ju Lu Rm Rs (K) Sa Si Tu.

1 Labellum with velutinous speculum **(g) subsp. helenae**
1 Labellum with glabrous speculum
2 Labellum wider than long **(l) subsp. aesculapii**
2 Labellum at least as long as wide
3 Labellum 8–15(–17) × 8–14(-17) mm, blackish-brown or -purple, with large basal protuberances
4 Inner perianth-segments wide, ± obtuse; labellum densely long-villous-velutinous; speculum H-shaped or U-shaped, rarely scutelliform, often extending to the protuberances **(d) subsp. atrata**
4 Inner perianth-segments narrow, rather acute; labellum shortly velutinous; speculum H-shaped or with the cross-line absent **(e) subsp. mammosa**
3 Labellum 5–12 × 5–12 mm, pale to dark brown, rarely blackish-brown or yellowish, with or without basal protuberances
5 Labellum (8–)10–12 × 8–12 mm **(a) subsp. sphegodes**
5 Labellum 5–10 × 5–10 mm
6 Flowers usually 6–10, rarely fewer; inner perianth-segments 1-veined **(b) subsp. litigiosa**
6 Flowers usually 3–5, rarely more; inner perianth-segments 3-veined **(c) subsp. tommasinii**

(a) Subsp. **sphegodes**: Outer perianth-segments green. Labellum (8–)10–12 × 8–12 mm, with or without large basal protuberances, brown or dark brown, velutinous, entire, rarely indistinctly 3-lobed; speculum usually H-shaped, rarely with the cross line absent, glabrous. $2n=36$. *Throughout the range of the species except parts of the south-east.*

(b) Subsp. **litigiosa** (Camus) Becherer, *Beitr. Pflanzengeogr. Nordschweiz* 46 (1925) (*O. litigiosa* Camus): Flowers usually 6–10, rarely fewer. Inner perianth-segments 1-veined. Labellum 5–8 × 5–8 mm, usually without basal protuberances, pale- or blackish-brown, rarely yellowish, papillose-velutinous, entire, rarely indistinctly 3-lobed; speculum irregularly H-shaped or scutelliform, glabrous. $2n=36$. *S. & S.C. Europe.*

(c) Subsp. **tommasinii** (Vis.) Soó, *Acta Bot. Acad. Sci. Hung.* **16**: 382 (1970) (*O. tommasinii* Vis.): Flowers usually 3–5, rarely more. Inner perianth-segments 3-veined. Labellum 6–10 × 6–10 mm, with basal protuberances, pale brown, papillose-subvillous; speculum U-shaped, scutelliform, glabrous. ● *Coasts of W. Jugoslavia and N.W. Greece.*

(d) Subsp. **atrata** (Lindley) E. Mayer, *Sezn. Prapr. Cvet. Slov.* 387 (1952) (*O. atrata* Lindley): Inner perianth-segments wide, more or less obtuse. Labellum 8–12(–13) × 8–12(–13) mm, with large basal protuberances, blackish-brown or -purple, densely long-villous-velutinous, often emarginate; speculum H-shaped or U-shaped, rarely scutelliform, often extending to the protuber-

ances, glabrous. $2n=36$. ● *Mediterranean region, Portugal; ?Bulgaria.*

(e) Subsp. **mammosa** (Desf.) Soó ex E. Nelson, *Gestaltwandel* 184 (1962) (*O. taurica* (Aggeenko) Nevski): Inner perianth-segments narrow, rather acute. Labellum 10–15(–17) × 8–14(–17) mm, with large basal protuberances, blackish-brown or -purple, shortly velutinous, entire, rarely indistinctly 3-lobed; speculum H-shaped or with the cross-line absent, glabrous. *S.E. Europe.*

(f) Subsp. **aesculapii** (Renz) Soó, *Acta Bot. Acad. Sci. Hung.* **16**: 383 (1970): Perianth-segments pale olive-green. Labellum 10–14 × 12–18 mm, entire, without basal protuberances, blackish-brown, shortly velutinous, with wide, glabrous yellowish margin; speculum H-shaped, glabrous. *Greece.*

(g) Subsp. **helenae** (Renz) Soó & D. Moresby Moore, *Bot. Jour. Linn. Soc.* **76**: 367 (1978) (*O. helenae* Renz): Perianth-segments dark green. Labellum 11–13 × 16–19 mm, without basal protuberances, brown to reddish or violet, irregularly spotted, shortly velutinous; speculum indistinct, velutinous. ● *N.W. Greece.*

Variants of **6** from Greece and Kriti with the labellum more or less 3-lobed, without or with only small basal protuberances, blackish-brown or purple and often with a white or yellowish margin, and speculum variously shaped, have been called subsp. **parnassica** (Vierh.) Soó, *Acta Bot. Acad. Sci. Hung.* **5**: 444 (1959) (*O. sphaciotica* Fleischm.); they are intermediate between **6** and **7** and are probably of hybrid origin. **O. doerfleri** Fleischm., *Österr. Bot. Zeitschr.* **74**: 185 (1925), is perhaps of similar origin.

Variants of subsp. (a) from France, Spain and Italy, with pinkish outer perianth-segments, the labellum up to 12 × 16 mm and a large speculum which often covers the labellum, have been named **O. garganica** (E. Nelson) O. & E. Danesch, *Pl. Syst. Evol.* **124**: 94 (1975). Variants from S. Italy and Sicilia, with a dense 10- to 15-flowered spike, white to violet outer perianth-segments and the labellum up to 15 mm, have been named subsp. **sicula** E. Nelson ex Soó, *Bot. Jour. Linn. Soc.* **76**: 367 (1978).

7. O. spruneri Nyman, *Consp.* 698 (1882). Plant 10–30 cm. Basal leaves 3–6, oblong-lanceolate, acute. Spike 2- to 4-flowered, lax. Perianth-segments green or greenish-purple, rarely white, pink or purple; outer 8–10 mm, oblong-ovate to -lanceolate; inner 5–8 mm, at least ½ as long as the outer, lanceolate or oblong, subobtuse to acute, glabrous or hairy. Labellum 10–13(–15) × 10–13(–15) mm, orbicular, ovate or obovate, blackish-brown or -purple, 3-lobed, very rarely subentire; lateral lobes ovate, convex, deflexed, rarely almost patent; middle lobe much longer than the lateral, semi-orbicular, reniform or oblong, the margin usually strongly deflexed; speculum bluish-violet, with white margin. Connective acute. ● *Greece and Aegean region; Sicilia.* Cr Gr Si.

(a) Subsp. **spruneri**: Outer perianth-segments green or greenish-purple. Labellum with an appendage, without or with small basal protuberances; lateral lobes deflexed; speculum H-shaped, or the cross-line missing. *Greece and Aegean region.*

(b) Subsp. **panormitana** (Tod.) Soó, *Acta Bot. Acad. Sci. Hung.* **16**: 383 (1970): Outer perianth-segments white or pale pink. Labellum without an appendage, usually without basal protuberances; lateral lobes scarcely deflexed; speculum H-shaped. *Sicilia.*

Subsp. (b) is transitional to **6(a)**.

8. O. ferrum-equinum Desf., *Ann. Mus. Hist. Nat. (Paris)* **10**: 226 (1807). Plant 10–35 cm. Basal leaves lanceolate, acute, the cauline 1–2, similar or smaller. Spike 2- to 5-flowered, lax. Outer perianth-segments 8–10 mm, oblong-ovate to orbicular, purple, pink, green, greenish-purple or whitish; inner 6–8 mm, at least ½ as long as the outer, linear-lanceolate, purple or pink, glabrous. Labellum 10–12 × 8–12 mm, orbicular to obovate, velutinous, without basal protuberances, with an appendage, dark purple, rarely brown; speculum horseshoe-shaped, scutelliform, or of 2 parallel lines, in the anterior part of the labellum. Connective acute. *Greece and Aegean region.* ?Al Gr.

(a) Subsp. **ferrum-equinum**: Outer perianth-segments purple or pink, rarely greenish. Labellum entire, rarely indistinctly 3-lobed. *Throughout the range of the species.*

(b) Subsp. **gottfriediana** (Renz) E. Nelson, *Gestaltwandel* 141 (1962) (*O. gottfriediana* Renz): Outer perianth-segments green, greenish-purple or whitish. Labellum 3-lobed, rarely indistinctly so. ● *N.W. Greece (Ionioi Nisoi).*

Subsp. (b) is transitional to **7**.

9. O. bertolonii Moretti, *Pl. Ital.* **6**: 9 (1823) (incl. *O. flavicans* Vis.). Plant 25–45 cm. Basal leaves lanceolate, acute. Spike 3- to 8-flowered. Outer perianth-segments 10–12 mm, broadly ovate or oblong-ovate, lilac or purple; inner 6–8 mm, at least ½ as long as the outer, linear-lanceolate to lanceolate, purple or lilac, glabrous or papillose, with flat margin. Labellum 10–15 × 10–13 mm, orbicular- to oblong-ovate, entire, rarely indistinctly 3-lobed, curved upwards and more or less concave anteriorly, blackish-purple, villous-velutinous with a very narrow, glabrous marginal zone, without basal protuberances, with a conspicuous appendage, deeply emarginate at apex; speculum usually scutelliform, violet. Connective acute. $2n=36$. ● *W. & C. Mediterranean region.* Al ?Bl Co Ga Hs It Ju ?Sa Si.

Plants of hybrid origin between **9** and **6(d)** have been called **O. bertoloniiformis** O. & E. Danesch, *Orchidee* **22**: 117 (1971); they differ from **9** chiefly in being 15–25 cm high, in having both the inner and outer perianth-segments greenish and more or less undulate, and the labellum 10–12 × 9–11 mm, scarcely curved upwards and without or with an inconspicuous appendage. They have $2n=36$. Because of frequent confusion between this and **9** the distribution given above refers to both these taxa. *O. bertholoniiformis* is probably the more widespread, and **9** is perhaps confined to the E. part of the range. **O. promontorii** O. & E. Danesch, *op. cit.* 258 (1971), described from S.E. Italy (Mte Gargano), is probably of hybrid origin between **9** and *O. garganica* (vide **6**). It has $2n=36, 37, 38$.

10. O. lunulata Parl., *Gior. Sci. Sic.* **62**: 4 (1838). Plant up to 25 cm. Basal leaves 4–6, oblong-lanceolate. Spike 4- to 7-flowered, lax. Perianth-segments lilac, rarely whitish; outer 10–13 mm, ovate to oblong, obtuse, the lateral close to the labellum and deflexed-patent; inner ⅔ as long as or almost as long as the outer, linear-lanceolate. Labellum 10–12 mm, ovate, 3-lobed, the lateral lobes narrow, without or with small basal protuberances, strongly deflexed, the middle lobe with strongly deflexed margin, brown, rarely blackish-purple, with glabrous, greenish or yellow marginal zone, emarginate at apex, with small appendage; speculum crescentic, whitish or lilac to brown in the centre. Connective acute. ● *Islands of C. Mediterranean region.* It Sa Si.

11. O. argolica Fleischm., *Verh. Zool.-Bot. Ges. Wien* **69**: 295 (1919). Plant 15–35 cm. Basal leaves lanceolate, acute, the cauline similar, smaller. Spike (1–)4- to 6-flowered. Outer perianth-segments 8–12 mm, oblong to oblong-ovate, purple or lilac, rarely whitish or greenish, the median sometimes linear-lanceolate; inner at least ½ as long as the outer, lanceolate, ovate or triangular, purple or lilac, velutinous. Labellum 10–12 mm, entire and suborbicular to ovate, or 3-lobed, slightly convex or flat, reddish-brown or brown, papillose, with a small appendage,

the margin often with a narrow, glabrous yellowish zone; lateral lobes, if present, without basal protuberances, white- or yellowish-hairy; speculum small, semicircular, transversely linear, H-shaped, horsehoe-shaped or of a single line or spot, violet, with white margin. Connective shortly acuminate. ● *S. Greece, Karpathos.* Cr Gr.

12. O. reinholdii Spruner ex Fleischm., *Österr. Bot. Zeitschr.* **57**: 5, 74 (1908). Like **11** but outer perianth-segments lilac, whitish, green or greenish-purple, the inner green, brown or lilac; labellum distinctly 3-lobed, brown or blackish-purple, with narrow, strongly deflexed lateral lobes; speculum of 2 thick, comma-shaped lines or of 2 separate or connected spots, white or pale violet; connective acute. *Greece and N. Aegean region.* Gr. (*Anatolia, Syria.*)

13. O. cretica (Vierh.) E. Nelson, *Gestaltwandel* 146 (1962). Plant 20–30 cm. Basal leaves oblong-lanceolate, acute. Spike 3- to 8-flowered. Perianth-segments green, purplish or brown; outer 8–10 mm, ovate to oblong; inner ½ as long as the outer, linear-lanceolate to triangular, velutinous. Labellum 11–14 mm, distinctly 3-lobed, blackish-purple, with strongly deflexed margins; lateral lobes elliptical, convex, with small basal protuberances, purplish- or blackish-hairy; middle lobe oblong to ovate, with small appendage; speculum of 2 sometimes interconnected lines and H-shaped or scutelliform, or of small spots, white, or bluish with white margin. Connective acute. ● *S. Greece and S. Aegean region.* Cr Gr.

14. O. carmeli Fleischm. & Bornm., *Ann. Naturh. Mus. (Wien)* **36**: 7 (1923). Plant 15–35 cm. Basal leaves linear-lanceolate. Spike (3–)5- to 8-flowered, rather dense. Outer perianth-segments 6–10 mm, ovate, green, rarely whitish, the median usually incurved; inner ⅓–½ as long as the outer, lanceolate or triangular, green, rarely whitish or purplish, hairy. Labellum 6–10 mm, ovate or oblong, widest towards the apex, distinctly 3-lobed, rarely subentire, with an appendage, strongly deflexed, brown or dark brown, papillose with glabrous marginal zone; lateral lobes patent or deflexed, elliptical, dark brownish-hairy, with basal protuberances *c.* 3 mm; speculum scutelliform, blue or dark brownish-violet, with yellow margin, often brown-velutinous with glabrous margin. Connective acute. *Greece, Turkey-in-Europe.* Gr Tu.

15. O. scolopax Cav., *Icon. Descr.* **2**: 46 (1793). Plant 15–45 cm. Basal leaves lanceolate, acute. Spike 3- to 12-flowered. Perianth-segments pink or purplish-violet, rarely whitish or greenish; outer 8–10(–12) mm, oblong-ovate, glabrous, the median not incurved; inner ⅓–½ as long as the outer, lanceolate or triangular, hairy. Labellum suborbicular, ovate, or obovate, distinctly 3-lobed, rarely subentire, widest at or below the middle, strongly deflexed, brownish- or blackish-purple, velutinous, glabrous towards the margin, with an often 3-dentate appendage; lateral lobes ovate to triangular, deflexed, gibbous, dark brownish-hairy; speculum scutelliform, annular or H-shaped, large, violet or blue with yellow or whitish margin, the spots often somewhat dark brownish-velutinous with glabrous margin. Connective acute. *S. Europe.* Al Bl Bu Co Cr Ga Gr Hs Hu It Ju Lu Rm Rs (K) Sa ?Si Tu.

1 Labellum 13–15 mm — (d) subsp. **heldreichii**
1 Labellum 8–12 mm
2 Middle lobe of labellum wider than long, with wide marginal zone — (b) subsp. **oestrifera**
2 Middle lobe of labellum as long as or longer than wide
3 Middle lobe of labellum with papillose, very narrow, glabrous marginal zone; basal protuberances small, wide, obtuse — (a) subsp. **scolopax**
3 Middle lobe of labellum with wide, glabrous marginal zone; basal protuberances up to 10 mm, conical, acute — (c) subsp. **cornuta**

(a) Subsp. **scolopax**: Labellum 8–12 mm; lateral lobes with small, wide, obtuse basal protuberances; middle lobe suborbicular, ovate or obovate, as long as or longer than wide, with papillose, very narrow, glabrous marginal zone. $2n=36$ (38, 40). *W. & C. Mediterranean region, Portugal.*

(b) Subsp. **oestrifera** (Bieb.) Soó, *Acta Bot. Acad. Sci. Hung.* **16**: 386 (1970): Labellum 8–12 mm; lateral lobes with small or medium basal protuberances; middle lobe ovate-rectangular, wider than long, with wide, glabrous marginal zone. *Krym. (Caucasus.)*

(c) Subsp. **cornuta** (Steven) Camus, *Monogr. Orchid. Eur.* 270 (1908): Labellum 8–12 mm; lateral lobes with conical, acute, basal protuberances up to 10 mm; middle lobe suborbicular, ovate or obovate, as long as or longer than wide, with wide, glabrous marginal zone. $2n=36$. *E.C. & S.E. Europe and C. Mediterranean region.*

(d) Subsp. **heldreichii** (Schlechter) E. Nelson, *Gestaltwandel* 160 (1962) (*O. oestrifera* subsp. *heldreichii* (Schlechter) Hayek): Labellum 13–15 mm; lateral lobes with basal protuberances up to 5 mm; middle lobe suborbicular to elliptic-ovate, as long as or longer than wide, with wide, glabrous marginal zone. *Greece and Aegean region; ?S.E. Italy.*

16. O. fuciflora (F. W. Schmidt) Moench, *Meth., Suppl.* 311 (1802) (*Orchis fuciflora* F. W. Schmidt, *Ophrys arachnites* (L.) Reichard). Plant 15–55 cm. Basal leaves ovate-oblong, obtuse, the cauline narrower, acute. Spike 2- to 6(–14)-flowered, lax. Perianth-segments pink, pale pinkish, whitish or green; outer 9–13 mm, ovate-oblong, obtuse, glabrous, the median concave; inner triangular, rarely linear-lanceolate, hairy. Labellum 9–13 (–16) mm, ovate, suborbicular or transversely elliptical, entire, rarely 3-lobed, brown or dark brownish-purple, velutinous, papillose in the centre, sometimes with a yellowish marginal zone, usually with basal protuberances up to 3 mm, with a wide, often 3-dentate, usually upcurved appendage; speculum variable, large. Connective acute. $2n=36$. *S., W. & C. Europe, northwards to S. England and C. Czechoslovakia.* Al Au Be Bl Br Co Cr Cz Ga Ge Gr He Hs Hu It Ju Rm Sa ?Si Tu.

1 Perianth-segments green; labellum with very indistinct basal protuberances
2 Inner perianth-segments ⅛–⅓ as long as the outer — (c) subsp. **oxyrrhynchos**
2 Inner perianth-segments at least ½ as long as the outer — (d) subsp. **exaltata**
1 Perianth-segments pink, pale purplish or whitish; labellum with distinct basal protuberances
3 Speculum scutelliform, brown or violet-brown, with wide whitish or yellowish margin; inner perianth-segments ½ as long as the outer — (b) subsp. **candica**
3 Speculum variable, violet or blue, with narrow yellow or greenish margin; inner perianth-segments usually ⅓–⅔ as long as the outer — (a) subsp. **fuciflora**

(a) Subsp. **fuciflora**: Perianth-segments pink, pale purplish or whitish, the inner usually ⅓–⅔ as long as the outer. Labellum with distinct basal protuberances; speculum violet or blue, with narrow, yellow or greenish margin. $2n=36$ (37, 38). *Throughout the range of the species.*

(b) Subsp. **candica** E. Nelson ex Soó, *Bot. Jour. Linn. Soc.* **76**: 368 (1978): Perianth-segments pink, pale purplish or whitish, the inner ½ as long as the outer. Labellum with distinct basal pro-

tuberances; speculum scutelliform, brown or violet-brown, with wide, whitish or yellowish margin. *Greece, Kriti; S.E. Italy.*

(c) Subsp. **oxyrrhynchos** (Tod.) Soó, *Feddes Repert.* **24**: 26 (1927): Perianth-segments green, the inner $\frac{1}{3}$–$\frac{1}{2}$ as long as the outer. Labellum with indistinct basal protuberances; speculum often reduced or H-shaped, brownish, with yellowish margin. ● *Sicilia, Sardegna.*

(d) Subsp. **exaltata** (Ten.) E. Nelson, *Gestaltwandel* 169 (1962): Perianth-segments green, the inner $\frac{1}{3}$–$\frac{1}{2}$(–$\frac{2}{3}$) as long as the outer. Labellum with indistinct basal protuberances, with a usually deflexed appendage; speculum reduced, often H-shaped or of lines or spots. ● *C. Mediterranean region.*

A variant from S.E. Italy (Monte Gargano), with the outer perianth-segments white or pink, the inner red, and the labellum dark brown or brownish-purple with a minute appendage, has been named subsp. **sundermannii** Soó, *Acta Bot. Acad. Sci. Hung.* **16**: 392 (1970). It has $2n=36$.

Variants from S. Italy, with flowers 25–35 mm and inner perianth-segments $\frac{1}{2}$–$\frac{3}{4}$ as long as the outer, have been named subsp. **apulica** O. & E. Danesch, *Orchidee* **21**: 20 (1970).

17. O. arachnitiformis Gren. & Philippe, *Mém. Soc. Émul. Doubs* ser. 3, **4**: 399 (1859). Plant 15–40 cm. Basal leaves ovate-lanceolate, obtuse, the cauline bract-like. Spike 2- to 9-flowered, lax. Perianth-segments usually pink, rarely purplish-violet, whitish or pale greenish; lateral outer perianth-segments *c.* 10 mm, oblong-ovate, obtuse, the median outer oblong-elliptical or -lanceolate; inner perianth-segments 6–7 mm, oblong-, triangular- or linear-lanceolate, more intensely coloured than the outer, glabrous, papillose or densely hairy. Labellum 8–10 mm, suborbicular, obovate or somewhat square, subentire, rarely indistinctly 3-lobed, velutinous, with broadly conical, short, inconspicuous basal protuberances, sometimes with a narrow, yellow, glabrous marginal zone, usually with a small appendage; speculum annular or square, usually H-shaped, blue or dark purplish, with whitish or yellow margin. Connective acute. $2n=36$, 38. *W. Mediterranean region.* Ga Hs It Sa Si.

Very variable; probably a hybrid between **6** and **16.**

18. O. tenthredinifera Willd., *Sp. Pl.* **4**: 67 (1805). Plant 10–45 cm. Basal leaves ovate to lanceolate, subobtuse or acute, the cauline similar, acute. Spike 3- to 8-flowered, lax. Perianth-segments purplish or purplish-violet, rarely whitish; outer 6–12 mm, broadly ovate, obtuse, glabrous, concave; inner usually $\frac{1}{3}$ as long as the outer, broadly triangular, papillose-velutinous. Labellum (8–)11–14 × 11–14 mm, obovate, square or flabelliform, convex, entire, rarely oblong and emarginate or indistinctly 3-lobed, purplish-brown, velutinous, usually with a wide, yellow, densely hairy marginal zone, with a glabrous appendage, with short, inconspicuous basal protuberances; speculum reduced, often 2-fid, rarely scutelliform, composed of brown spots. Connective obtuse. $2n=36$. *Mediterranean region, C. & S. Portugal.* Bl Co Cr Ga Gr Hs It Lu Sa Si Tu.

19. O. apifera Hudson, *Fl. Angl.* 340 (1762). Plant 15–50 cm. Basal leaves lanceolate to ovate, obtuse, the cauline similar, acute. Spike 2- to 7(–11)-flowered, lax. Outer perianth-segments (8–)10–15 mm, oblong-ovate, patent or deflexed, purplish or purplish-violet, rarely whitish, green-striate; inner triangular to linear-lanceolate, green or purplish. Labellum 10–13 mm, broadly ovate, strongly convex, brownish- or blackish-purple, rarely yellowish-green or bicolorous, partly papillose, partly villous, with long, yellow, deflexed appendage, or appendage absent; lateral lobes triangular-ovate, deflexed, with externally hairy basal protuberances up to 3 mm; speculum scutelliform at the base, violet or reddish-brown, with a yellow margin, with clear yellow spots towards apex. Connective long-acuminate. $2n=36$. *S., W. & C. Europe, northwards to N. Ireland.* Al Au Be Bl Br Co Cr Cz Ga Ge Gr Hb He Ho Hs Hu It Ju Lu Rm Rs (K) Sa Si Tu.

(a) Subsp. **apifera**: Inner perianth-segments less than half as long as the outer, hairy. Labellum 3-lobed, with an appendage. *Throughout the range of the species.*

(b) Subsp. **jurana** Ruppert, *Allgem. Bot. Zeitschr.* **17**: 2 (1911): Inner perianth-segments almost $\frac{2}{3}$ as long as the outer, glabrous or papillose. Labellum 3-lobed or indistinctly 5-lobed, with or without an appendage. *Mainly in W.C. Europe; also locally in S. Europe.*

20. O. bombyliflora Link in Schrader, *Jour. für die Bot.* **1799(2)**: 325 (1800) (*O. oestrifera* subsp. *umbilicata* (Desf.) Hayek). Plant 7–25 cm. Basal leaves oblong-lanceolate, acute, patent, the cauline erect, slightly sheathing. Spike 1- to 5-flowered, lax. Outer perianth-segments 9–12 mm, ovate, obtuse, green, sometimes whitish, concave, the lateral patent or deflexed; inner *c.* $\frac{1}{2}$ as long as the outer, triangular, purplish at base, greenish towards apex, velutinous. Labellum 8(–10) mm, deeply 3-lobed, the lobes gibbous, deflexed so that the labellum appears globose-inflated, brown or dark brown, partly papillose, partly glabrous, without an appendage; lateral lobes oblong, convex, villous, glabrous towards apex, with externally hairy basal protuberances; middle lobe transversely ovate or oblong; speculum scutelliform or 2-partite, bluish-violet, with paler margin. Connective obtuse. $2n=36$. *Mediterranean region, C. & S. Portugal.* ?Al Bl Co Cr Ga Gr Hs It Ju Lu Sa Si.

31. **Corallorhiza** Chatel.[1]

Brownish saprophytes with much-branched, fleshy, coralloid rhizome; roots absent. Stems with a few sheathing scales. Green leaves absent. Flowers pendent in a spike-like raceme. Perianth-segments more or less patent, free, the outer median and inner lateral somewhat convergent. Labellum entire or 3-lobed, the lateral lobes very small or absent. Spur very short or absent. Column long. Rostellum small. Viscidia 2, distinct; bursicles absent.

1. C. trifida Chatel., *Sp. Inaug. Corall.* 8 (1760) (*C. innata* R. Br.). Stems 7–30 cm, erect, glabrous, yellowish-green, with 2–4 scales up to half as long as stem. Spike lax, 2- to 12-flowered. Outer perianth-segments *c.* 5 mm, greenish, the lateral linear-lanceolate, with incurved margins, the median ovate-lanceolate; inner perianth-segments narrower, greenish or yellowish with reddish margins or spots. Labellum about as long as other perianth-segments, oblong, whitish with red lines or blotches, with 2 wide longitudinal ridges near the base. $2n=42$. *Damp woods, rarely on moist coastal sands. Europe, southwards to the Pyrenees, S. Appennini, N.W. Greece and Krym, but only on mountains in the south.* Al Au Be Br Bu Cz Da Fe Ga Ge Gr He †Ho Hs Hu Is It Ju No Po Rm Rs (N, B, C, W, K) Su.

32. **Calypso** Salisb.[1]

Pseudobulb solitary, bearing a single leaf. Flower solitary. Perianth-segments connate at base, patent. Labellum large, inflated, slipper-shaped. Spur absent. Column petaloid, ovate. Rostellum small, 3-dentate. Viscidia 2, distinct; bursicles absent.

1. C. bulbosa (L.) Oakes in Z. Thompson, *Hist. Vermont.* **1**:

[1] By D. M. Moore.

200 (1842). Pseudobulb ovoid. Stem 10–20 cm, slender, with few leaf-sheaths towards base. Leaf 3–5 cm, elliptic-oblong, shortly petiolate, distinctly veined. Flower in axil of a linear bract. Perianth-segments 1–2 cm, pinkish-purple, linear-lanceolate. Labellum 1–2 cm, whitish, with pinkish or yellowish spots or blotches. *Marshes and wet coniferous woods. Fennoscandia and N. Russia, southwards to* 57° *N. and westwards to* 14° *E.* Fe Rs (N, B, C) Su.

33. Liparis L. C. M. Richard[1]

Stock stout, with 2 ellipsoid pseudobulbs joined by a short horizontal stolon; parent pseudobulb enveloped in old leaf-bases, the daughter pseudobulb at base of the current year's stems. Leaves 2. Perianth-segments free, narrow, patent. Labellum usually pointing upwards, entire. Spur absent. Column long, slender. Anther caducous. Rostellum minute. Viscidia 2, small; bursicles absent.

1. L. loeselii (L.) L. C. M. Richard, *Orchid. Eur. Annot.* 38 (1817) (*Malaxis loeselii* (L.) Swartz, *Pseudorchis loeselii* (L.) S. F. Gray). Glabrous. Stem 6–20 cm, 3(–5)-angled above, with 2–3 basal scales enclosing developing daughter pseudobulb. Leaves subopposite, about half as long as stem, oblong-elliptical to ovate-lanceolate, acute. Flowers 3–8(–18), in a lax spike. Perianth-segments yellowish-green, the outer linear-lanceolate, the inner shorter and narrower. Labellum equalling outer perianth-segments, oblong-obovate, undulate or somewhat crenate. $2n=32$. *Bogs, fens and other wet places. From S. Wales and S. Fennoscandia southwards to S.W. France, S. Romania and S. Russia.* Au Be Br ?Bu Cz Da Fe Ga Ge He Ho Hu It Ju No Po Rm Rs (B, C, W, E) Su.

34. Microstylis (Nutt.) A. Eaton[1]

Like *Liparis* but pseudobulbs borne one above the other, the youngest uppermost; leaf usually solitary; flowers twisted through 360° so that labellum points upwards; column short.

[1] By D. M. Moore.

1. M. monophyllos (L.) Lindley, *Gen. Sp. Orchid.* 19 (1830) (*Malaxis monophyllos* (L.) Swartz). Stem (8–)10–30 cm; basal pseudobulb surrounded by old leaf-sheaths. Leaf solitary, rarely 2, 3–6 cm, ovate to elliptical. Flowers numerous, in a rather lax, spike-like raceme 3–15 cm. Perianth-segments 2–2·7 mm, greenish; outer ovate to ovate-lanceolate, the lateral erect, the median pointed downwards; inner linear, directed downwards, slightly recurved. Labellum broadly lanceolate-ovate, acuminate, slightly incurved, thickened and densely tuberculate beneath towards apex, as long as other perianth-segments. Sphagnum-*bogs, wet meadows and scrub. N., C. & E. Europe, westwards to C. Norway and C. Switzerland, and southwards to N. Italy and S. Russia.* Au Cz Fe Ge He †Hu It Ju No Po Rm Rs (N, B, C, W) Su.

35. Hammarbya O. Kuntze[1]

Like *Liparis* but pseudobulbs borne one above the other, the youngest uppermost; leaves 2–5; flowers twisted through 360° so that labellum points upwards; column very short; anther persistent.

1. H. paludosa (L.) O. Kuntze, *Revis. Gen.* **2**: 665 (1891). Glabrous. Stem 3–12 cm, slender, 3- to 5-angled above. Leaves 0·5–1 cm, concave, broadly rounded at apex, sheathing at base, enclosing daughter pseudobulbs, usually with marginal bulbils towards apex, the lower 1–2 leaves often reduced to sheaths. Flowers numerous in a rather dense, later lax spike 1·5–5 cm. Perianth-segments greenish-yellow; outer 2·5–3 mm, ovate-lanceolate, the lateral erect, the median pointed downwards and rather larger; inner *c.* 1·5 mm, linear-lanceolate, patent, deflexed at apex. Labellum lanceolate, acute, erect, shorter than outer perianth-segments. $2n=28$. *Acid bogs, usually in* Sphagnum. *N. & C. Europe; U.S.S.R. except the south-east.* Au Be Br Cz Da Fa Fe Ga Ge Hb He Ho ?Hu Ju No Po Rm Rs (N, B, C, W, E) Su.

NOTE TO APPENDICES I–III

Considerable variation is found in the orthography of the names of many authors, especially of the earlier ones and of those whose names are transliterated from Cyrillic script. Variant spellings are given here only if they are likely to give rise to doubts about identity.

The initials used by some authors vary according to whether the vernacular or latinized form of a Christian name is used (e.g. *Karl* or *Carolus*); the form most frequently used by the author is adopted in these lists.

The dates given for books and periodicals indicate, as far as can be ascertained, the date of effective publication; where this differs from dates on the title-page or elsewhere in the work itself, there is usually a reference to explain the dates given.

Certain publications are of a character intermediate between books and periodicals (e.g. seed-lists, *schedae*). The assignment of these to Appendix II or Appendix III is inevitably somewhat arbitrary.

In Appendix III there is normally no attempt made to indicate whether one periodical is a continuation of another, unless there is some continuity between them in the numbering of the volumes or series.

APPENDIX I

KEY TO THE ABBREVIATIONS OF AUTHORS' NAMES

Abromeit J. Abromeit (1857–1946)
Acht. B. Achtarov (1885–1959)
Adamović L. Adamović (1864–1935)
Adams M. F. Adams (J. F. Adam) (1780–1838)
Adamson R. S. Adamson (1885–1965)
Adanson M. Adanson (1727–1806)
Ade A. Ade (1876–1968)
Aellen P. Aellen (1896–1973)
Afan., C. C. S. Afanasiev (1905–1960)
Afzelius A. Afzelius (1750–1837)
Agardh C. A. Agardh (1785–1859)
Agardh, J. J. G. Agardh (1813–1901)
Aggeenko V. N. Aggeenko (Ageenko) (1860–1907)
Ahlfvengren F. E. Ahlfvengren (1862–1921)
Ahti T. T. Ahti (b. 1934)
Aichele D. Aichele (b. 1928)
Airy Shaw H. K. Airy Shaw (b. 1902)
Aiton W. Aiton (1731–1793)
Aiton fil. W. T. Aiton (1766–1849)
Alavi S. A. Alavi (b. 1934)
Albert A. Albert (1836–1909)
Albov N. M. Albov (Alboff) (1866–1897)
Alechin V. V. Alechin (1884–1946)
Alef. F. G. C. Alefeld (1820–1872)
Alexeenko M. I. Alexeenko (Alexejenko) (b. 1905)
Alexeev E. B. Alexeev (b. 1946)
All. C. Allioni (1728–1804)
Allan H. H. B. Allan (1882–1957)
Alleiz. C. d'Alleizette (1884–1967)
Allman G. J. Allman (1812–1898)
Almq. S. O. I. Almquist (1844–1923)
Alpers F. Alpers (1841–1912)
Alston A. H. G. Alston (1902–1958)
Ambrosi F. Ambrosi (1821–1897)
Ames O. Ames (1875–1950)
Amo Mariano del Amo y Mora (1809–1894)
Andersen J. C. Andersen (b. 1873)
Anderson, E. E. S. Anderson (1897–1969)
Anderson, G. G. Anderson (d. 1817)
Andersson, N. J. N. J. Andersson (1821–1880)
Andrae C. J. Andrae (1816–1885)
Andrasovszky J. Andrasovszky (1889–1943)
Andreas C. H. Andreas (b. 1898)
Andrews H. C. Andrews (d. 1830)
Andrz. A. L. Andrzejowski (1785–1868)
Angelis, M. M. von Angelis (1805–1894)
Ångström J. Ångström (1813–1879)
Antoine F. Antoine (1815–1886)
Appel O. Appel (1867–1952)
Arcangeli G. Arcangeli (1840–1921)
Ard. P. Arduino (1728–1805)
Ardoino H. J. P. Ardoino (1819–1874)
Arènes, J. J. Arènes (1898–1960)
Aresch., F. F. W. C. Areschoug (1830–1908)
Armstrong J. B. Armstrong (1850–1926)
Arnold (possibly a pseudonym; fl. 1785)
Arnott G. A. W. Arnott (1799–1868)
Arrh., A. J. I. A. Arrhenius (1858–1950)
Arrigoni P. V. Arrigoni (b. 1932)
Arrondeau E. T. Arrondeau (d. 1882)
Artemczuk I. V. Artemczuk (1898–1973)
Artiush. Z. T. Artiushenko (b. 1916)
Arvat A. Arvat (1890–1950)
Arvet-Touvet J. M. C. Arvet-Touvet (1841–1913)
Ascherson P. F. A. Ascherson (1834–1913)
Aspegren G. C. Aspegren (1791–1828)
Asso I. J. de Asso y del Río (1742–1814)
Aublet J. B. C. F. Aublet (1720–1778)
Aucher P. M. R. Aucher-Eloy (1792–1838)
Auquier P. Auquier (b. 1939)
Ausserdorfer A. Ausserdorfer (1836–1884)
Avé-Lall. J. L. E. Avé-Lallemant (1803–1867)
Avr. N. A. Avrorin (b. 1906)
Aznav. G. V. Aznavour (1861–1920)
Baagöe J. S. Baagöe (1838–1905)
Bab. C. C. Babington (1808–1895)
Babcock E. B. Babcock (1877–1954)
Backh. J. Backhouse (1825–1890)
Badaro G. B. Badaro (1793–1831)
Baenitz K. G. Baenitz (1837–1913)
Baer K. R. E. von Baer (1792–1876)
Bagnall J. E. Bagnall (1830–1918)
Bailey, L. H. L. H. Bailey (1858–1954)
Baillet C. Baillet (fl. 1862)
Baillon H. E. Baillon (1827–1895)
Bailly E. Bailly (1829–1894)
Baker J. G. Baker (1834–1920)
Baker fil. E. G. Baker (1864–1949)
Bakker, D. D. Bakker (b. 1917)
Baksay L. Baksay (b. 1915)
Balansa B. Balansa (1825–1891)
Balbis G. B. Balbis (1765–1831)
Bald. A. Baldacci (1867–1950)
Balf. J. H. Balfour (1808–1884)
Balk. B. E. Balkovsky (b. 1899)
Ball J. Ball (1818–1889)
Ball, P. W. P. W. Ball (b. 1932)
Banks J. Banks (1743–1820)
Barbarich A. I. Barbarich (b. 1903)
Barbaz. F. Barbazita (fl. 1826)
Barbero M. Barbero (b. 1940)
Barbey, C. C. Barbey-Boissier (1847–1919)
Barbey, W. W. Barbey-Boissier (1842–1914)
Barc. F. Barceló y Combis (1820–1889)
Barkley, F. A. F. A. Barkley (b. 1908)
Barkoudah Y. I. Barkoudah (b. 1933)
Barn. F. M. Barnéoud (b. 1821)
Barnades M. Barnades (d. 1771)
Barrandon A. Barrandon (1814–1897)
Barratte J. F. G. Barratte (1857–1920)
Bartal. B. Bartalini (1746–1822)
Bartl. F. G. Bartling (1798–1875)
Bartlett H. H. Bartlett (1886–1960)
Barton, W. W. P. G. Barton (1786–1856)
Basil. N. A. Basilevskaja (Bazilevskaja) (b. 1902)
Basiner T. F. J. Basiner (1817–1862)

Bassi F. Bassi (1710–1774)
Bässler M. Bässler (b. 1935)
Bast. T. Bastard (1784–1846)
Batsch A. J. G. C. Batsch (1761–1802)
Batt. J. A. Battandier (1848–1922)
Baudo F. Baudo (fl. 1843)
Baum B. R. Baum (b. 1937)
Baumann, E. E. Baumann (1868–1933)
Baumg. J. C. G. Baumgarten (1765–1843)
Baxter W. Baxter (1787–1871)
Bean W. J. Bean (1863–1947)
Beauv. A. M. F. J. Palisot de Beauvois (1752–1820)
Beauverd G. Beauverd (1867–1942)
Beccari O. Beccari (1843–1920)
Becherer A. Becherer (1897–1977)
Bechst. J. M. Bechstein (1757–1822)
Beck, G. G. Beck von Mannagetta (1856–1931)
Becker, A. A. Becker (1818–1901)
Becker, J. J. Becker (1769–1833)
Becker, W. W. Becker (1874–1928)
Beeby W. H. Beeby (1849–1910)
Beetle A. A. Beetle (b. 1913)
Beger H. K. E. Beger (b. 1889)
Béguinot A. Béguinot (1875–1940)
Behrendsen W. Behrendsen (d. 1923)
Beldie A. Beldie (b. 1912)
Bellardi C. A. L. Bellardi (1741–1826)
Belli S. C. Belli (1852–1919)
Bellot F. Bellot Rodríguez (b. 1911)
Bell Salter T. Bell Salter (1814–1858)
Beltrán F. Beltrán Bigorra (1886–1962)
Benj. L. Benjamin (b. 1825)
Benn., A. W. A. W. Bennett (1833–1902)
Benn., Ar. Arthur Bennett (1843–1929)
Benson, L. L. D. Benson (b. 1909)
Bentham G. Bentham (1800–1884)
Bentzer B. Bentzer (b. 1942)
Benz R. Benz von Albkron (1863–1921)
Berchtold F. von Berchtold (1781–1876)
Berdau F. Berdau (1826–1895)
Berger, A. A. Berger (1871–1931)
Bergeret, G. G. Bergeret (fl. 1909)
Bergeret, J. P. J. P. Bergeret (1751–1813)
Berggren, Jakob Jakob Berggren (1790–1868)
Berggren, S. S. Berggren (1837–1917)
Bergius P. J. Bergius (1730–1790)
Bergmans J. Bergmans (b. 1892)
Berlin J. A. Berlin (1851–1910)
Bernard P. F. Bernard (1749–1825)
Bernh. J. J. Bernhardi (1774–1850)
Bernis F. Bernis (fl. 1955)
Berth. S. Berthelot (1794–1880)
Bertol. A. Bertoloni (1775–1869)
Bertram F. W. W. Bertram (1835–1899)
Bertsch, F. F. Bertsch (1910–1944)
Bertsch, K. K. Bertsch (1878–1965)
Besse F. M. Besse (1864–1924)
Besser W. S. J. G. von Besser (1784–1842)
Betcke E. F. Betcke (1815–1865)
Beurl. P. J. Beurling (1800–1866)
Beyer R. Beyer (1852–1932)
Beyrich H. C. Beyrich (1796–1834)
Bianca G. Bianca (1801–1883)
Biasol. B. Biasoletto (1793–1858)
Biatzovsky J. Biatzovsky (*c.* 1802–1863)
Bicchi C. Bicchi (1822–1906)
Bich. J. E. Bicheno (1785–1851)
Bicknell, C. C. Bicknell (1842–1918)
Bicknell, E. P. E. P. Bicknell (1859–1925)
Bieb. F. A. Marschall von Bieberstein (1768–1826)
Bigelow J. Bigelow (1787–1879)
Bihari J. Bihari (b. 1889)
Billot P. C. Billot (1796–1863)
Bilyk G. I. Bilyk (b. 1904)
Binz A. Binz (1870–1963)
Biria J. A. J. Biria (b. 1889)
Biroli G. Biroli (1772–1825)
Bischoff G. W. Bischoff (1797–1854)
Bisse J. Bisse (b. 1935)
Bitter F. A. G. Bitter (1873–1927)
Biv. A. de Bivona-Bernardi (1774–1837)
Biv. fil. A. de Bivona-Bernardi (fl. 1838)
Blaise S. Blaise (fl. 1970)
Blake, S. F. S. F. Blake (1892–1959)
Blakelock R. A. Blakelock (1915–1963)
Blakeslee A. F. Blakeslee (1874–1954)
Blanc — Blanc (fl. 1866)
Blanche E. Blanche (1824–1908)
Blanco F. M. Blanco (1778–1845)
Blečić V. Blečić (b. 1911)
Błocki B. Błocki (1857–1919)
Błoński F. Błoński (1867–1910)
Bloxam A. Bloxam (1801–1878)
Bluff M. J. Bluff (1805–1837)
Blume C. L. von Blume (1796–1862)
Blytt M. N. Blytt (1789–1862)
Bobrov E. G. Bobrov (b. 1902)
Böcher T. W. Böcher (b. 1909)
Bodard P. H. H. Bodard (fl. 1798–1810)
Boeckeler J. O. Boeckeler (1803–1899)
Boedijn K. B. Boedijn (b. 1893)
Boehmer G. R. Boehmer (1723–1803)
Boenn. C. M. F. von Boenninghausen (1785–1864)
Bogenh. C. Bogenhard (1811–?1853)
Boguslaw I. A. Boguslaw (fl. 1846)
Boiss. P. E. Boissier (1810–1885)
Boisson. J. Boissonade (1831–1897)
Boivin J. R. B. Boivin (b. 1916)
Bojko H. Bojko (b. 1892)
Boll E. F. A. Boll (1817–1868)
Bolle, F. F. Bolle (b. 1905)
Bolós, A. A. de Bolós (1889–1975)
Bolós, O. O. de Bolós (b. 1924)
Bolton J. Bolton (*c.* 1758–1799)
Bolus, L. L. H. M. Bolus (Mrs F. Bolus) (1877–1970)
Bong. H. G. von Bongard (1786–1839)
Bonjean J. L. Bonjean (1780–1846)
Bonnet E. Bonnet (1848–1922)
Bonnier G. E. M. Bonnier (1853–1922)
Bonpl. A. J. A. Bonpland (1773–1858)
Boos, J. J. Boos (1794–1879)
Boott F. Boott (1792–1863)
Bor N. L. Bor (1893–1972)
Borbás V. von Borbás (1844–1905)
Bord. H. Bordère (1825–1889)
Bordzil. E. I. Bordzilowski (1875–1949)
Boreau A. Boreau (1803–1875)
Borgvall T. Borgvall (b. 1884)
Borhidi A. Borhidi (b. 1932)
Boriss. A. G. Borissova-Bekrjaševa (1903–1970)
Borja J. Borja Carbonell (b. 1903)
Borkh. M. B. Borkhausen (Borckhausen) (1760–1806)

Börner C. J. B. Börner (b. 1880)
Bornm. J. F. N. Bornmüller (1862–1948)
Boros Á. Boros (1900–1973)
Borrer W. Borrer (1781–1862)
Borrill M. Borrill (b. 1924)
Borsos O. Borsos (O. Sz.-Borsos) (b. 1926)
Bory J. B. G. M. Bory de Saint-Vincent (1778–1846)
Borza A. Borza (1887–1971)
Borzi A. Borzi (1852–1911)
Bosc L. A. G. Bosc (1759–1828)
Bošnjak K. Bošnjak (1866–1953)
Bosse J. F. W. Bosse (1788–1864)
Bothmer S. R. von Bothmer (b. 1943)
Botsch. V. P. Botschantzev (b. 1910)
Bouché C. D. Bouché (1809–1881)
Boulay N. J. Boulay (1837–1905)
Bourgeau E. Bourgeau (1813–1877)
Bout. J. F. D. Boutigny (1820–1884)
Boutelou E. Boutelou (1776–1813)
Bouvet G. Bouvet (1874–1929)
Bowden W. M. Bowden (b. 1914)
Bowles E. A. Bowles (1865–1954)
Br., A. A. Brown (1830–1913)
Br., N. E. N. E. Brown (1849–1934)
Br., R. R. Brown (1773–1858)
Brackenr. W. D. Brackenridge (1810–1893)
Bradshaw, M. E. M. E. Bradshaw (b. 1926)
Brainerd E. Brainerd (1844–1924)
Brand A. Brand (1863–1931)
Brandt, J. P. J. P. Brandt (1921–1963)
Brandza D. Brandza (1846–1895)
Braun, A. A. C. H. Braun (1805–1877)
Braun, G. G. Braun (1821–1882)
Braun, H. H. Braun (1851–1920)
Braun, J. J. Braun (later J. Braun-Blanquet) (b. 1884)
Br.-Bl. J. Braun-Blanquet (b. 1884)
Bréb. L. A. de Brébisson (1798–1872)
Breistr. M. Breistroffer (b. 1910)
Brenan J. P. M. Brenan (b. 1917)
Brenner M. M. W. Brenner (1843–1930)
Brewer W. H. Brewer (1828–1910)
Brickell, C. D. C. D. Brickell (b. 1932)
Briganti V. Briganti (1766–1836)
Brign. G. de Brignoli di Brunnhoff (1774–1857)
Briot P. L. Briot (1804–1888)
Briq. J. I. Briquet (1870–1931)
Britten J. Britten (1846–1924)
Brittinger C. C. Brittinger (1795–1869)
Britton N. L. Britton (1859–1934)
Britton, C. E. C. E. Britton (1872–1944)
Brocchi G. B. Brocchi (1772–1826)
Broddeson O. E. Broddeson (1880–1957)
Bromf. W. A. Bromfield (1801–1851)
Brongn. A. T. Brongniart (1801–1876)
Brot. F. Avellar Brotero (1744–1828)
Brouss. P. M. A. Broussonet (1761–1807)
Browicz K. Browicz (b. 1925)
Browne P. Browne (1720–1790)
Brügger C. G. Brügger (1833–1899)
Brumh. P. Brumhard (b. 1879)
Brummitt R. K. Brummitt (b. 1937)
Brunerye L. J. L. Brunerye (b. 1939)
Bruno — Bruno (fl. 1760)
Bruun H. G. Bruun (b. 1897)
Bubani P. Bubani (1806–1888)
Buch C. L. von Buch (1774–1853)
Buchanan-White F. Buchanan-White (1842–1894)
Buchegger J. Buchegger (b. 1886)
Buchenau F. G. P. Buchenau (1831–1906)
Buchholz J. T. Buchholz (1888–1951)
Buchinger J. D. Buchinger (1803–1888)
Buckn. C. Bucknall (1849–1921)
Buffon G. L. L. de Buffon (1707–1788)
Buhse F. A. Buhse (1821–1898)
Buia A. Buia (1911–1964)
Bunge A. A. von Bunge (1803–1890)
Burbidge F. W. T. Burbidge (1847–1905)
Burgsd. F. A. L. von Burgsdorff (1747–1802)
Burm. fil. N. L. Burman (N. L. Burmannus) (1734–1793)
Burnat E. Burnat (1828–1920)
Burollet P.-A. Burollet (fl. 1927)
Burtt, B. L. B. L. Burtt (b. 1913)
Busch, N. N. A. Busch (1869–1941)
Buschm. A. Buschmann (b. 1908)
Buser R. Buser (1857–1931)
Bush B. F. Bush (1858–1937)
Butcher R. W. Butcher (1897–1971)
Butkov A. Y. Butkov (b. 1911)
Caballero, A. A. Caballero (1877–1949)
Cabrera A. L. Cabrera (b. 1908)
Cadevall J. Cadevall i Diars (1846–1910)
Cajander A. K. Cajander (1879–1943)
Caldesi L. Caldesi (1821–1884)
Calestani V. Calestani (b. 1882)
Camb. J. Cambessedes (1799–1863)
Campd. F. Campderá (1793–1862)
Campo P. del Campo (fl. 1855)
Camus, A. A. Camus (1879–1965)
Camus E. G. Camus (1852–1915)
Candargy, P. P. C. Candargy (b. 1870)
Cañigueral J. Cañigueral Cid (b. 1912)
Cannon J. F. M. Cannon (b. 1930)
Carano E. Carano (1877–1943)
Carey, J. J. Carey (1797–1880)
Cariot A. Cariot (1820–1883)
Carrière E. A. Carrière (1818–1896)
Cartier D. Cartier (b. 1935)
Caruano Gatto Alfredo Caruano Gatto (b. 1868)
Caruel T. Caruel (1830–1898)
Casas F. J. Fernández Casas (b. 1945)
Casav. J. Ruíz Casaviella (1835–1897)
Caspary J. X. R. Caspary (1818–1887)
Casper S. J. Casper (b. 1929)
Cass. A. H. G. Cassini (1781–1832)
Cast. J. L. M. Castagne (1785–1858)
Cav. A. J. Cavanilles (1745–1804)
Cavara F. Cavara (1857–1929)
Cavillier F. G. Cavillier (1868–1953)
Cavol. F. Cavolini (1756–1810)
Ceballos L. Ceballos Fernández de Córdoba (1896–1967)
Čelak. L. J. Čelakovský (1834–1902)
Černjavski P. Černjavski (1892–1969)
Cesati V. de Cesati (1806–1883)
Češchm. I. V. Češchmedžiev (Češmedžiev) (b. 1930)
Chab. A. C. Chabert (1836–1916)
Chab., P. P. Chabert (1796–1867)
Chabaud B. Chabaud (1833–1915)
Chaix D. Chaix (1730–1799)
Cham. L. A. von Chamisso (L.C.A. Chamisseau de Boncourt) (1781–1838)
Chapp. P. Chappellier (1820–1919)
Charadze A. L. Charadze (b. 1905)

Charrel L. Charrel ('Abd-ur-Raḥmān-Nadji) (fl. 1888)
Chase M. A. Chase (1869–1963)
Chassagne M. Chassagne (fl. 1904–1960)
Chatel. J. J. Chatelain (1736–1822)
Chater A. O. Chater (b. 1933)
Chaub. L. A. Chaubard (1785–1854)
Chav. E. L. Chavannes (1805–1861)
Chaytor D. A. Chaytor (fl. 1937)
Chaz. L. M. Chazelles de Prizy (fl. 1790)
Chenevard P. Chenevard (1839–1919)
Cheval., A. A. J. B. Chevalier (1873–1956)
Cheval., E. E. Chevalier (1826–1914)
Chevall. F. F. Chevallier (1796–1840)
Chiaje S. delle Chiaje (1794–1860)
Chiarugi A. Chiarugi (1901–1960)
Ching, R.-C. Ren-Chang Ching (Jên-ch'ang Ch'in) (b. 1899)
Chiov. E. Chiovenda (1871–1940)
Chitrowo V. N. Chitrowo (1879–1949)
Chmelitschek H. Chmelitschek (b. 1948)
Chodat R. H. Chodat (1865–1934)
Choisy J. D. Choisy (1799–1859)
Chopinet R. Chopinet (b. 1914)
Chouard P. Chouard (fl. 1921–1970)
Chowdhuri P. K. Chowdhuri (b. 1923)
Chr., C. C. F. A. Christensen (1872–1942)
Christ H. Christ (1833–1933)
Christener C. Christener (1810–1872)
Christiansen, M. P. M. P. Christiansen (1889–1975)
Christm. G. F. Christmann (b. 1752)
Chrshan. V. G. Chrshanovski (b. 1912)
Chrtek J. Chrtek (b. 1930)
Church G. L. Church (b. 1903)
Ciferri R. Ciferri (1895–1964)
Claire C. Claire (?1867–1931)
Clairv. J. P. de Clairville (1742–1830)
Clapham A. R. Clapham (b. 1904)
Clarion ?J. Clarion (1776–1844)
Clarke, C. B. C. B. Clarke (1832–1906)
Clarke, E. D. E. D. Clarke (1779–1822)
Clarke, G. C. S. G. C. S. Clarke (b. 1944)
Claus K. Claus (1796–1864)
Clauson T. Clauson (1817–1860)
Clavaud A. Clavaud (1828–1890)
Clayton, W. D. W. D. Clayton (b. 1926)
Cleland R. E. Cleland (1892–1971)
Clemente S. de Rojas Clemente y Rubio (1777–1827)
Clementi, G. C. G. C. Clementi (1812–1873)
Clements F. E. Clements (1874–1945)
Clerc O. E. Clerc (1845–1920)
Clos D. Clos (1821–1908)
Cockayne L. Cockayne (1855–1934)
Coincy A. de Coincy (1837–1903)
Colasante M. A. Colasante (b. 1944)
Coleman W. H. Coleman (?1816–1863)
Coleman, J. R. J. R. Coleman (b. 1934)
Colla L. A. Colla (1766–1848)
Collett H. Collett (1836–1901)
Colmeiro M. Colmeiro y Penido (1816–1901)
Commerson P. Commerson (1727–1773)
Comolli G. Comolli (1780–1859)
Conert H. J. Conert (b. 1929)
Conr. P. Conrath (b. 1892)
Constance L. Constance (b. 1909)
Contandr. J. Contandriopoulos (b. 1922)
Conti, P. P. Conti (1874–1898)
Coombe, D. E. D. E. Coombe (b. 1927)
Copel. E. B. Copeland (1873–1964)
Corb. L. Corbière (1850–1941)
Cornaz E. Cornaz (1825–1911)
Corr. C. F. J. E. Correns (1864–1933)
Cosent. F. Cosentini (1769–1840)
Cosson E. S. C. Cosson (1819–1889)
Costa A. C. Costa y Cuxart (1817–1886)
Coste H. J. Coste (1858–1924)
Cothenius C. A. von Cothenius (1708–1789)
Cotton, R. R. Cotton (b. 1948)
Coulter T. Coulter (1793–1843)
Coulter, J. M. J. M. Coulter (1851–1928)
Court. R. J. Courtois (1806–1835)
Coust. P. Cousturier (d. 1921)
Coutinho A. X. Pereira Coutinho (1851–1939)
Covas G. Covas (b. 1915)
Coville F. V. Coville (1867–1937)
Craib W. G. Craib (1882–1933)
Crantz H. J. N. von Crantz (1722–1799)
Crépin F. Crépin (1830–1903)
Cristofolini G. Cristofolini (b. 1939)
Crome G. E. W. Crome (1780–1813)
Cronq. A. J. Cronquist (b. 1919)
Csapody V. Csapody (b. 1890)
Csűrös I. Csűrös (b. 1914)
Cuatrec. J. Cuatrecasas (b. 1903)
Cuf. G. Cufodontis (1896–1974)
Cugnac A. de Cugnac (b. 1898)
Cullen J. Cullen (b. 1936)
Cunn., A. A. Cunningham (1791–1839)
Cunn., R. R. Cunningham (1793–1835)
Curtis W. Curtis (1746–1799)
Curtis, M. A. M. A. Curtis (1808–1872)
Curtiss C. C. Curtiss (1862–1945)
Cusson P. Cusson (1727–1783)
Custer J. L. Custer (1755–1828)
Cutanda V. Cutanda (1804–1865)
Cyr. D. Cyrillo (1739–1799)
Czakó K. Czakó (1843–1895)
Czecz. H. Czeczott (b. 1888)
Czefr. Z. V. Czefranova (b. 1923)
Czerep. S. K. Czerepanov (b. 1921)
Czern. V. M. Czernajew (Czernjaew) (1796–1871)
Czerniakovska E. G. Czerniakovska (b. 1892)
Czernov E. G. Czernov (b. 1908)
Czernova N. M. Czernova (b. 1901)
Czetz A. Czetz (1801–1865)
Dahl, O. C. O. C. Dahl (1862–1940)
Dahlst. H. G. A. Dahlstedt (1856–1934)
Dalby D. H. Dalby (b. 1930)
Dalla Torre K. W. von Dalla Torre (1850–1928)
Damanti P. Damanti (b. 1858)
Damboldt J. Damboldt (1937–1978)
Dammer C. L. U. Dammer (1860–1920)
Dandy J. E. Dandy (1903–1976)
Danesch, E. E. Danesch (b. 1922)
Danesch, O. O. Danesch (b. 1919)
Danilov A. D. Danilov (b. 1903)
Danser B. H. Danser (1891–1943)
Dansereau P. Dansereau (b. 1911)
Danth. E. Danthoine (fl. 1788)
Darlington, W. W. Darlington (1782–1863)
Darracq U. Darracq (d. 1872)
Daveau J. A. Daveau (1852–1929)
Davey F. H. Davey (1868–1915)
Davidov B. Davidov (1870–1927)

Davies H. Davies (1739–1821)
Davies, E. W. E. W. Davies (b. 1924)
Davis, P. H. P. H. Davis (b. 1918)
DC. A. P. de Candolle (1778–1841)
DC., A. A. L. P. P. de Candolle (1806–1893)
DC., C. A. C. P. de Candolle (1836–1918)
De Bary H. A. de Bary (1831–1888)
Debeaux J. O. Debeaux (1826–1910)
Déchy M. Déchy (b. 1851)
Decken C. C. von der Decken (1833–1865)
Decker P. Decker (b. 1867)
Decne J. Decaisne (1807–1882)
DeFilipps R. A. DeFilipps (b. 1939)
Degen A. von Degen (1866–1934)
Degl. J. V. Y. Degland (1773–1841)
Dehnh. F. Dehnhardt (1787–1870)
De Langhe J. E. de Langhe (b. 1907)
De Laramb. de Larambergue
Delarbre A. Delarbre (1724–1813)
Delaroche D. Delaroche (1743–1812)
Delaroche, F. F. Delaroche (1780–1813)
De la Soie G. A. de la Soie (1818–1877)
Delastre C. J. L. Delastre (1792–1859)
De Lengyel, B. B. de Lengyel (fl. 1936)
De Lens — De Lens (fl. 1828)
Delile A. R. Delile (1778–1850)
Delip. D. D. Delipavlov (b. 1919)
Delponte G. B. Delponte (1812–1884)
Dematra Dematra (1742–1824)
Demjan. O. N. Demjanenko (b. 1894)
Dennst. A. W. Dennstedt (1776–1826)
De Noé F. de Noé (fl. 1855)
De Not. G. de Notaris (1805–1877)
De Retz B. G. G. de Retz (b. 1910)
Derganc L. Derganc (fl. 1897)
Déséglise P. A. Déséglise (1823–1883)
Des Etangs N. S. C. des Etangs (1801–1876)
Desf. R. L. Desfontaines (*c.* 1751–1833)
Desmoulins C. Desmoulins (1797–1875)
Desportes N. H. F. Desportes (1776–1856)
Desr. L. A. J. Desrousseaux (1753–1838)
Desv. A. N. Desvaux (1784–1856)
Dettm., U. U. Dettmann (b. 1933)
Deville L. Deville (fl. 1859)
De Vos M. P. de Vos (b. 1912)
Dewey C. Dewey (1784–1867)
De Wild. É. de Wildeman (1866–1947)
De Winter B. de Winter (b. 1924)
Deyl M. Deyl (b. 1906)
Dickson J. Dickson (1738–1822)
Didr. D. F. Didrichsen (1814–1887)
Diels F. L. E. Diels (1874–1945)
Dierbach J. H. Dierbach (1788–1845)
Dietr., A. A. Dietrich (1795–1856)
Dietr., D. D. N. F. Dietrich (1800–1888)
Dietr., F. G. F. G. Dietrich (1768–1850)
Dietr., W. W. Dietrich (b. 1938)
Dihoru G. Dihoru (b. 1933)
Dingler H. Dingler (1846–1935)
Dingwall I. Dingwall (b. 1945)
Dippel L. Dippel (1827–1914)
Dittrich M. Dittrich (b. 1934)
Dobrescu C. Dobrescu (b. 1912)
Dobrocz. D. N. Dobroczaeva-Kovalczuk (b. 1916)
Dode L. A. Dode (1875–1943)
Döll J. C. Döll (1808–1885)
Dolliner G. Dolliner (1794–1872)
Domac R. Domac (b. 1918)
Domin K. Domin (1882–1953)
Domokos J. Domokos (b. 1904)
Don, D. D. Don (1799–1841)
Don, G. G. Don (1764–1814)
Don fil., G. G. Don (1798–1856)
Donadille P. Donadille (b. 1936)
Donn J. Donn (1758–1813)
Dörfler I. Dörfler (1866–1950)
Dorner J. Dorner (1808–1873)
Dorthes J. A. Dorthes (1759–1794)
Dostál J. Dostál (b. 1903)
Douglas D. Douglas (1798–1834)
Downar N. V. Downar (fl. 1855–1862)
Drejer S. T. N. Drejer (1813–1842)
Drenk. R. Drenkovski (b. 1932)
Drenowski A. K. Drenowski (Drenovsky) (1879–1967)
Dreves J. F. P. Dreves (1772–1816)
Drobov V. P. Drobov (1885–1956)
Druce G. C. Druce (1850–1932)
Drude C. G. O. Drude (1852–1933)
Dryander J. C. Dryander (1748–1810)
Düben M. W. von Düben (1814–1845)
Dubjansky V. A. Dubjansky (1877–1962)
Dubois, F. F. N. A. Dubois (1752–1824)
Dubovik O. N. Dubovik (b. 1935)
Duby J. E. Duby (1798–1885)
Duchartre P. E. S. Duchartre (1811–1894)
Duchesne A. N. Duchesne (1747–1827)
Ducommun J. C. Ducommun (fl. 1869)
Ducros — Ducros (fl. ?1828)
Dudley, T. R. T. R. Dudley (b. 1936)
Dufour J.-M. L. Dufour (1780–1865)
Dufresne P. Dufresne (1786–1836)
Duh. H. L. Duhamel de Monceau (1700–1781)
Dulac J. Dulac (fl. 1867–1885)
Düll R. Düll (b. 1932)
Dumbadze T. A. Dumbadze (b. 1902)
Dum.-Courset G. L. M. Dumont de Courset (1746–1824)
Dumort. B. C. J. Dumortier (1797–1878)
Dunal M. F. Dunal (1789–1856)
Duperrey L.-I. Duperrey (1786–1865)
Dupont — Dupont (fl. 1825)
Dur.-Duq. J. V. Durand-Duquesney (1785–1862)
Durand, B. B. M. Durand (b. 1928)
Durand, E. E.-M. (later E.) Durand (1794–1873)
Durand, T. T. A. Durand (1855–1912)
Durande J. F. Durande (1732–1794)
Durieu M. C. Durieu de Maisonneuve (1796–1878)
Duroi J. P. Duroi (1741–1785)
D'Urv. J. S. C. D. D'Urville (1790–1842)
Duthie J. F. Duthie (1845–1922)
Du Tour — Du Tour de Salvert (fl. 1803–1815)
Duval-Jouve J. Duval-Jouve (1810–1883)
Dvořáková M. Dvořáková (b. 1940)
Dyer W. T. Thiselton-Dyer (1843–1928)
Dykes W. R. Dykes (1877–1925)
Eaton, A. A. Eaton (1776–1842)
Ebel P. W. S. E. Ebel (1815–1884)
Ecklon C. F. Ecklon (1795–1868)
Edgew. M. P. Edgeworth (1812–1881)
Edmondson, J. R. J. R. Edmondson (b. 1948)
Edmondston T. Edmondston (1825–1846)
Egorova T. V. Egorova (fl. 1975)
Ehrenb. C. G. Ehrenberg (1795–1876)

Ehrend. F. Ehrendorfer (b. 1927)
Ehrh. J. F. Ehrhart (1742–1795)
Eichw. K. E. von Eichwald (1794–1876)
Eig A. Eig (1894–1938)
Eklund O. A. Eklund (1899–1946)
Ekman, E. L. E. L. Ekman (1883–1931)
Ekman, Elis. H. M. E. A. E. Ekman (1862–1936)
Elfstr. M. Elfstrand (1859–1927)
Elias Frère H. Elias (fl. 1907–1944)
Elkan L. Elkan (1815–1851)
Elliott S. Elliott (1771–1830)
Emberger L. Emberger (1897–1969)
Enander S. J. Enander (1847–1928)
Endl. S. L. Endlicher (1804–1849)
Endtmann J. Endtmann (b. 1938)
Engelm. G. Engelmann (1809–1884)
Engler H. G. A. Engler (1844–1930)
Engler, V. V. Engler (1885–1917)
Ern H. Ern (b. 1935)
Eshbaugh W. H. Eshbaugh (b. 1936)
Eschsch. J. F. G. von Eschscholz (1793–1831)
Esteve F. Esteve Chueca (b. 1919)
Etlinger A. E. Etlinger (fl. 1777)
Eugène R. P. Eugène (fl. 1868)
Evers G. Evers (?1837–?1916)
Ewart A. J. Ewart (1872–1937)
Exell A. W. Exell (b. 1901)
Fabr. P. C. Fabricius (1714–1774)
Fabre E. Fabre (fl. 1850)
Facch. F. Facchini (1788–1852)
Farwell O. A. Farwell (1867–1944)
Fasano A. Fasano (fl. 1787)
Fauché M. Fauché (fl. 1832)
Fauconnet C. I. Fauconnet (1811–1876)
Favarger C. P. E. Favarger (b. 1913)
Favrat L. Favrat (1827–1893)
Fedde F. K. G. Fedde (1873–1942)
Fedorov An. A. Fedorov (b. 1908)
Fedtsch., B. B. A. Fedtschenko (1872–1947)
Fedtsch., O. O. A. Fedtschenko (1845–1921)
Fée A. L. A. Fée (1789–1874)
Feer H. Feer (1857–1892)
Feinbrun N. Feinbrun (b. 1900)
Fenzl E. Fenzl (1808–1879)
Feráková V. Feráková (b. 1938)
Ferguson, I. K. I. K. Ferguson (b. 1938)
Fernald M. L. Fernald (1873–1950)
Fernandes, A. A. Fernandes (b. 1906)
Fernandes, R. R. Fernandes (b. 1916)
Ferrarini E. Ferrarini (b. 1919)
Fiala F. Fiala (1861–1898)
Ficalho F. M. de Mello Breyner de Ficalho (1837–1903)
Fieber F. X. Fieber (1807–1872)
Fieschi V. Fieschi (b. *c.* 1910)
Fil. N. Filarszky (1858–1941)
Finch R. A. Finch (b. 1939)
Fingerh. K. A. Fingerhuth (1802–1876)
Fiori A. Fiori (1865–1950)
Fischer F. E. L. von Fischer (1782–1854)
Fischer, G. G. Fischer (d. 1941)
Fischer, M. M. Fischer (b. 1942)
Fischer von Wald. A. A. Fischer von Waldheim (1803–1884)
Fisher T. R. Fisher (b. 1921)
Fitschen J. Fitschen (1869–1947)
Flaksberger C. A. Flaksberger (1880–1942)
Flatt K. Flatt von Alföld (K. Alföldi Flatt) (1853–1906)
Fleischm. A. Fleischmann (1805–1867)
Flerow A. F. Flerow (1872–1960)
Fletcher H. R. Fletcher (1907–1978)
Flod., B. B. G. O. Floderus (1867–1941)
Floerke H.-G. Floerke (1764–1835)
Florström B. L. Florström (1879–1914)
Flügge J. Flügge (1775–1816)
Focke W. O. Focke (1834–1922)
Foggitt W. Foggitt (1835–1917)
Fomin A. V. Fomin (1869–1935)
Font Quer P. Font Quer (1888–1964)
Forest. — de Forestier (fl. 1853)
Form. E. Formánek (1845–1900)
Forrest G. Forrest (1873–1932)
Forselles J. H. af Forselles (1785–1855)
Forskål P. Forskål (1732–1763)
Forster, E. E. Forster (1765–1849)
Forster, G. J. G. A. Forster (1754–1794)
Forster, J. R. J. R. Forster (1729–1798)
Forster, T. F. T. F. Forster (1761–1825)
Fortune R. Fortune (1812–1880)
Foster M. Foster (1836–1907)
Fouc. J. Foucaud (1847–1904)
Foug. A. D. Fougeroux de Bondaroy (1732–1789)
Fourn., E. E. P. N. Fournier (1834–1884)
Fourn., P. P.-V. Fournier (1877–1964)
Fourr. J. P. Fourreau (1844–1871)
Fox-Str. W. T. H. Fox-Strangways (1795–1865)
Franchet A. R. Franchet (1834–1900)
Franco J. do Amaral Franco (b. 1921)
Franklin J. Franklin (1786–1847)
Fraser, Neill P. Neill Fraser (1830–1905)
Freitag H. Freitag (b. 1932)
Fresen. J. B. G. W. Fresenius (1806–1866)
Freyc. L. C. Desaulses de Freycinet (1779–1842)
Freyer H. Freyer (1802–1866)
Freyn J. F. Freyn (1845–1903)
Frickh. C. A. Frickhinger (1818–1907)
Frid. K. N. Friderichsen (1853–1932)
Friedrich H. Friedrich (b. 1925)
Friedrichsthal E. von Friedrichsthal (1809–1842)
Fries E. M. Fries (1794–1878)
Fries, T. C. E. T. C. E. Fries (1886–1930)
Fries, Th. T. M. Fries (1832–1913)
Fristedt R. F. Fristedt (1832–1893)
Fritsch K. Fritsch (1864–1934)
Fritze R. Fritze (fl. 1870)
Friv. E. Frivaldszky von Frivald (I. Frivaldszky) (1799–1870)
Frodin D. G. Frodin (b. 1940)
Froelich J. A. von Froelich (1766–1841)
Fröhlich, A. A. Fröhlich (1882–1969)
Fröhner S. E. Fröhner (b. 1941)
Fryer A. Fryer (1826–1912)
Fuchs, A. A. Fuchs (1872–1927)
Fuchs, H. P. H. P. Fuchs (b. 1928)
Funck H. C. Funck (1771–1839)
Fürnrohr A. E. Fürnrohr (1804–1861)
Fuss M. Fuss (1814–1883)
Gaertner J. Gaertner (1732–1791)
Gaertner fil. C. F. von Gaertner (1772–1850)
Gaertner, P. P. G. Gaertner (1754–1825)
Gagnebin A. Gagnebin (1707–1800)
Gaill. C. Gaillardot (1814–1883)
Gale, S. S. Gale (b. 1915)
Galeotti H. G. Galeotti (1814–1858)
Gamajun. A. P. Gamajunova (b. 1904)

Gamble J. S. Gamble (1847–1925)
Gamisans J. Gamisans (b. 1944)
Gams H. Gams (1893–1976)
Gand. M. Gandoger (1850–1926)
Ganeschin S. S. Ganeschin (1879–1930)
Garbari F. Garbari (b. 1937)
García J. G. García (1904–1971)
Garcias Font L. Garcias Font (1885–1975)
Garcke F. A. Garcke (1819–1904)
Gariod C. H. Gariod (1836–1892)
Gars. F. A. de Garsault (1691–1776)
Gartner, H. H. Gartner (fl. 1939)
Gasparr. G. Gasparrini (1804–1866)
Gaterau — Gaterau (fl. 1789)
Gauckler K. Gauckler (b. 1898)
Gaud.-Beaup. C. Gaudichaud-Beaupré (1789–1854)
Gaudin J. F. A. T. G. P. Gaudin (1766–1833)
Gaussen H. Gaussen (b. 1891)
Gaut. G. Gautier (1841–1911)
Gavioli O. Gavioli (1871–1944)
Gawłowska M. J. Gawłowska (b. 1910)
Gay J. E. Gay (1786–1864)
Gay, C. C. Gay (1800–1873)
Gáyer G. Gáyer (1883–1932)
Geiger P. L. Geiger (1785–1836)
Geil. G. Geilinger (1881–1955)
Gelert O. C. L. Gelert (1862–1899)
Genev. L. G. Genevier (1830–1880)
Genn. P. Gennari (1820–1897)
Genty P. A. Genty (1861–1955)
Georgescu C. C. Georgescu (1898–1968)
Georgi J. G. Georgi (1729–1802)
Georgiev T. Georgiev (b. 1883)
Gérard L. Gérard (1733–1819)
Gerbino X. Gerbino (fl. 1845)
Germ. J. N. E. Germain de Saint-Pierre (1815–1882)
Gerstlauer L. Gerstlauer (1863–1949)
Gervais C. Gervais (b. 1933)
Getliffe F. M. Getliffe (b. 1941)
Geuns S. J. van Geuns (1767–1795)
Gheorghieff S. Gheorghieff (1859–1900)
Giacomini V. Giacomini (b. 1914)
Gibbs, P. P. E. Gibbs (b. 1938)
Gibelli G. Gibelli (1831–1898)
Gibson G. S. Gibson (1818–1883)
Gilib. J. E. Gilibert (1741–1814)
Gill J. Gill (b. 1936)
Gillet C. C. Gillet (1806–1896)
Gilli A. Gilli (b. 1903)
Gillies J. Gillies (1792–1834)
Gillot F. X. Gillot (1842–1910)
Gilmour J. S. L. Gilmour (b. 1906)
Gilomen H. Gilomen (fl. 1937)
Ging. F. C. J. Gingins de Lassaraz (1790–1863)
Ginzberger A. Ginzberger (1873–1940)
Girard F. de Girard (fl. 1844)
Giraud. L. Giraudias (1848–1922)
Giroux M. Giroux (fl. 1933)
Gled. J. G. Gleditsch (1714–1786)
Gloxin B. P. Gloxin (fl. 1785)
Glück C. M. H. Glück (1868–1940)
Gmelin, C. C. C. C. Gmelin (1762–1837)
Gmelin, J. F. J. F. Gmelin (1748–1804)
Gmelin, J. G. J. G. Gmelin (1709–1755)
Gmelin, S. G. S. G. Gmelin (1744 or 1745–1774)
Goaty E. L. H. Goaty (1830–1890)
Gochnat F. C. Gochnat (d. 1816)
Godet C. H. Godet (1797–1879)
Godfery M. J. Godfery (1856–1945)
Godman F. Du Cane Godman (1834–1919)
Godron D. A. Godron (1807–1880)
Goebel K. C. T. F. Goebel (1794–1851)
Goffart J. Goffart (1864–1954)
Goiran A. Goiran (1835–1909)
Gola G. Gola (1877–1956)
Goldb. L. F. Goldbach (1793–1824)
Goldie J. Goldie (1793–1886)
Golitsin S. V. Golitsin (1897–1968)
Gölz P. Gölz (b. 1935)
Gontsch. N. F. Gontscharov (1900–1942)
González, F. F. González (fl. 1877)
González-Albo J. González-Albo (fl. 1935)
Goodding L. N. Goodding (b. 1880)
Good. S. Goodenough (1743–1827)
Gordon G. Gordon (1806–1879)
Gorodkov B. N. Gorodkov (1890–1953)
Gorschk. S. G. Gorschkova (1889–1972)
Gorski S. B. Gorski (1802–1864)
Görz, R. R. Görz (1879–1935)
Gottl.-Tann. P. von Gottlieb-Tannenhain (b. 1879)
Gouan A. Gouan (1733–1821)
Gould F. W. Gould (b. 1913)
Goulimy C. N. Goulimy (Goulimis) (1886–1963)
Goupil C. J. Goupil (1784–1858)
Govoruchin V. S. Govoruchin (1903–1970)
Grab. H. E. Grabowski (1792–1842)
Gradstein S. R. Gradstein (b. 1943)
Graebner K. O. P. P. Graebner (1871–1933)
Graells M. de la P. Graells (1809–1898)
Graf ?S. Graf (1801–1838)
Graham, R. A. R. A. Graham (1915–1958)
Graham, R. C. R. C. Graham (1786–1845)
Gram, K. K. J. A. Gram (1897–1961)
Grande L. Grande (1878–1965)
Grau H. R. J. Grau (b. 1937)
Grauer S. Grauer (1758–1820)
Gray, A. A. Gray (1810–1888)
Gray, S. F. S. F. Gray (1766–1828)
Grec. D. Grecescu (1841–1910)
Gredilla A. F. Gredilla y Gauna (1859–1919)
Greene, E. L. E. L. Greene (1843–1915)
Greenman J. M. Greenman (1867–1951)
Gregory, E. S. E. S. Gregory (1840–1932)
Gremblich J. Gremblich (1851–1905)
Gremli A. Gremli (1833–1899)
Gren. J. C. M. Grenier (1808–1875)
Greuter, W. W. R. Greuter (b. 1938)
Grev. R. K. Greville (1794–1866)
Griesselich L. Griesselich (1804–1848)
Grigoriev J. S. Grigoriev (b. 1905)
Grimm J. F. K. Grimm (1737–1821)
Grinț., G. G. P. Grinţescu (1870–1947)
Grinț., I. I. Grinţescu (1874–1964)
Griseb. A. H. R. Grisebach (1814–1879)
Gröntved J. Gröntved (1882–1956)
Gross, H. H. Gross (b. 1888)
Grosser W. C. H. Grosser (b. 1869)
Grosset H. E. Grosset (b. 1903)
Grossh. A. A. Grossheim (1888–1948)
Groves H. Groves (1835–1891)
Groves, J. J. Groves (1858–1933)
Gruner L. F. Gruner (b. 1838)

Grynj F. A. Grynj (b. 1902)
Gueldenst. J. A. von Gueldenstaedt (1745–1781)
Guépin J. P. Guépin (1779–1858)
Guérin J. X. B. Guérin (1775–1850)
Guersent L. B. Guersent (1776–1848)
Guett. J. E. Guettard (1715–1786)
Gugler W. Gugler (1874–1909)
Guicc. G. Guicciardi (fl. 1855)
Guimar. J. de Ascensão Guimarães (1862–1922)
Guimpel F. Guimpel (1774–1839)
Guinea E. Guinea López (b. 1907)
Guinier P. Guinier (1876–1962)
Guinochet M. Guinochet (b. 1909)
Guirão A. Guirão y Navarro (d. 1890)
Guittonneau G. Guittonneau (b. 1934)
Gulia G. Gulia (1835–1889)
Gumprecht R. Gumprecht (b. 1900)
Gunnarsson J. G. Gunnarsson (1866–1944)
Gunnerus J. E. Gunnerus (1718–1773)
Günther C. C. Günther (1769–1833)
Gürke A. R. L. M. Gürke (1854–1911)
Guss. G. Gussone (1787–1866)
Gustafsson M. Å. Gustafsson (b. 1941)
Guşuleac M. Guşuleac (1887–1960)
Guterm. W. Gutermann (b. 1935)
Guthnick H. J. Guthnick (1800–1870)
Győrffy I. Győrffy (1880–1959)
Habl. C. von Hablitz (1752–1821)
Hackel E. Hackel (1850–1926)
Hacq. B. A. Hacquet (1739–1815)
Hadač E. Hadač (b. 1914)
Haenke T. Haenke (1761–1816)
Haenseler F. Haenseler (1766–1841)
Hagendijk A. Hagendijk (b. 1942)
Hagerup O. Hagerup (1889–1961)
Hagl., G. G. E. Haglund (1900–1955)
Hagström J. O. Hagström (1860–1922)
Hahne A. Hahne (1873–1942)
Halácsy E. von Halácsy (1842–1913)
Hall, A. D. A. D. Hall (1864–1942)
Hall, H. M. H. M. Hall (1874–1932)
Hall, W. W. Hall (1743–1800)
Haller A. von Haller (1708–1777)
Haller fil. A. von Haller (1758–1823)
Halliday G. Halliday (b. 1933)
Hallier E. Hallier (1831–1904)
Hamet Raymond-Hamet (1890–1972)
Hämet-Ahti L. Hämet-Ahti (b. 1931)
Hamilton, A. P. A. P. Hamilton (b. 1939
Hampe G. E. Hampe (1795–1880)
Hanb., F. J. F. J. Hanbury (1851–1938)
Hand.-Mazz. H. von Handel-Mazzetti (1882–1940)
Hanelt P. Hanelt (b. 1930)
Hanry H. Hanry (1807–1893)
Hara H. Hara (b. 1911)
Hard. L. Hardouin (1800–1858)
Harley R. M. Harley (b. 1936)
Harms H. A. T. Harms (1870–1942)
Harrison, H.- J. Heslop-Harrison (b. 1920)
Hartig H. J. A. R. Hartig (1839–1901)
Hartinger A. Hartinger (1806–1890)
Hartl D. Hartl (fl. 1955)
Hartman C. J. Hartman (1790–1849)
Hartman fil. C. Hartman (1824–1884)
Hartman, R. R. W. Hartman (1827–1891)
Hartmann, F. X. F. X. von Hartmann (1737–1791)
Hartweg K. T. Hartweg (1812–1871)
Hartwiss N. von Hartwiss (1791–1860)
Harvey W. H. Harvey (1811–1866)
Harz, C. O. C. O. Harz (1842–1906)
Hasselq. F. Hasselquist (1722–1752)
Hassk. J. C. Hasskarl (1811–1894)
Hauman L. Hauman (1880–1965)
Hausm. F. von Hausmann (1810–1878)
Hausskn. H. K. Haussknecht (1838–1903)
Haw. A. H. Haworth (1768–1833)
Hayek A. von Hayek (1871–1928)
Haynald S. F. L. Haynald (1816–1891)
Hayne F. G. Hayne (1763–1832)
Häyrén E. F. Häyrén (1878–1957)
Hayward W. R. Hayward (fl. 1868–1895)
Hazsl. F. A. Hazslinszky von Hazslin (1818–1896)
Hedberg K. O. Hedberg (b. 1923)
Hedl. J. T. Hedlund (1861–1953)
Hedley G. W. Hedley (1871–1941)
Hedwig fil. R. A. Hedwig (1772–1806)
Heer O. Heer (1809–1883)
Hegelm. C. F. Hegelmaier (1834–1906)
Hegetschw. J. J. Hegetschweiler (1789–1839)
Hegi G. Hegi (1876–1932)
Heimans J. Heimans (b. 1889)
Heimerl A. Heimerl (1857–1942)
Heine, R. O. R. Heine (b. 1920)
Heister L. Heister (1683–1758)
Heldr. T. von Heldreich (1822–1902)
Heller F. X. Heller (1775–1840)
Helm G. F. Helm (fl. 1809–1828)
Hemsley W. B. Hemsley (1843–1924)
Henckel L. V. F. Henckel von Donnersmarck (1785–1861)
Henderson, A. A. Henderson (fl. 1860)
Henderson, E. G. E. G. Henderson (1782–1876)
Hendrych R. Hendrych (b. 1926)
Hénon J. L. Hénon (1802–1872)
Henrard J. T. Henrard (b. 1881)
Henriq. J. A. Henriques (1838–1928)
Henry, A. A. Henry (1857–1930)
Henry, A. N. A. N. Henry (b. 1936)
Henry, Louis Louis Henry (1853–1913)
Hepper F. N. Hepper (b. 1929)
Herbert W. Herbert (1778–1847)
Herbich F. Herbich (1791–1865)
Herder F. G. T. M. von Herder (1828–1896)
Hermann, F. F. Hermann (1873–1967)
Herrmann, J. J. Herrmann (1738–1800)
Herter W. G. Herter (1884–1958)
Hertsch H. Hertsch (1819–1856)
Hervier J. Hervier-Basson (1846–1900)
Heslot H. Heslot (fl. 1953)
Hess, H. H. E. Hess (b. 1920)
Heuffel J. Heuffel (1800–1857)
Heukels H. Heukels (1854–1936)
Heynh. G. Heynhold (fl. 1828–1850)
Heywood V. H. Heywood (b. 1927)
Hicken C. M. Hicken (1875–1933)
Hiern W. P. Hiern (1839–1925)
Hieron. G. H. E. Hieronymus (1846–1921)
Hiitonen H. I. A. Hiitonen (b. 1898)
Hildebr. F. H. G. Hildebrand (1835–1915)
Hill J. Hill (1716–1775)
Hill, A. W. A. W. Hill (1875–1941)
Hilliard O. M. Hilliard (b. 1925)
Hitchc., A. S. A. S. Hitchcock (1865–1935)

Hitchc., E. E. Hitchcock (1793–1864)
Hladnik F. Hladnik (1773–1844)
Hochreutiner B. P. G. Hochreutiner (1873–1959)
Hochst. C. F. Hochstetter (1787–1860)
Hoffm. G. F. Hoffmann (1761–1826)
Hoffm., O. O. Hoffmann (1853–1909)
Hoffmanns. J. C. von Hofmannsegg (1766–1849)
Hofmann, E. E. Hofmann (fl. 1839–1856)
Hofmann, H. H. Hofmann (d. 1923)
Hohen. R. F. Hohenacker (1798–1874)
Holandre J. J. J. Holandre (1773–1857)
Holl F. Holl (fl. 1820–1842)
Holm T. Holm (1880–1943)
Holmberg O. R. Holmberg (1874–1930)
Holmboe J. Holmboe (1880–1943)
Holmen K. A. Holmen (1921–1974)
Holmgren B. Holmgren (1872–1946)
Holub, J. J. Holub (b. 1930)
Holuby J. L. Holuby (1836–1923)
Holzm. T. Holzmann (b. 1843)
Honckeny G. A. Honckeny (1724–1805)
Hooker W. J. Hooker (1785–1865)
Hooker fil. J. D. Hooker (1817–1911)
Hope J. Hope (1725–1786)
Hoppe D. H. Hoppe (1760–1846)
Höppner H. Höppner (1873–1946)
Horák B. Horák (1877–1942)
Horkel J. Horkel (1769–1846)
Hormuzaki K. Hormuzaki (1863–1937)
Horn af Rantzien H. Horn af Rantzien (1922–1960)
Hornem. J. W. Hornemann (1770–1841)
Hornsch. C. F. Hornschuch (1793–1850)
Hornung E. G. Hornung (1795–1862)
Horvat, I. I. Horvat (1897–1963)
Horvat, M. M. Horvat (b. 1909)
Horvatić S. Horvatić (1899–1975)
Horvátovszky S. Horvátovszky (fl. 1770)
Hose, J. A. C. J. A. C. Hose (d. 1800)
Hossain M. Hossain (b. 1928)
Host N. T. Host (1761–1834)
House H. D. House (1878–1949)
Houtt. M. Houttuyn (1720–1798)
Houtzagers G. Houtzagers (1888–1957)
Howard H. W. Howard (b. 1913)
Howell T. J. Howell (1842–1912)
Hruby J. Hruby (1882–1964)
Hubbard, C. E. C. E. Hubbard (b. 1900)
Hubbard, F. T. F. T. Hubbard (1875–1962)
Huber, J. A. J. A. Huber (1867–1914)
Huber-Morath A. Huber-Morath (b. 1901)
Hudson W. Hudson (1734–1793)
Hudziok G. W. Hudziok (b. 1929)
Huet A. Huet du Pavillon (1829–1907)
Hughes, W. E. W. E. Hughes (b. 1948)
Hull J. Hull (1761–1843)
Hülphers K. A. Hülphers (1882–1948)
Hülsen R. Hülsen (1837–1912)
Hultén E. O. G. Hultén (b. 1894)
Humb. F. H. A. von Humboldt (1769–1859)
Humphries C. J. Humphries (b. 1947)
Hunt, P. F. P. F. Hunt (b. 1936)
Husnot P. T. Husnot (1840–1929)
Hussenot L. C. S. L. Hussenot (1809–1845)
Huter R. Huter (1834–1909)
Huth E. Huth (1845–1897)
Huxley A. J. Huxley (b. 1920)
Hy F. C. Hy (1853–1918)
Hyl. N. Hylander (1904–1970)
Iljin M. M. Iljin (Ilyin) (1889–1967)
Iljinsky, A. A. P. Iljinsky (1885–1945)
Illarionova N. B. Illarionova (fl. 1957)
Ingram C. Ingram (b. 1880)
Insenga G. Insenga (1815 or 1816–1887)
Ionescu M. A. Ionescu (b. 1900)
Irmisch J. F. T. Irmisch (1816–1879)
Irmscher E. Irmscher (1887–1968)
Itz. H. Itzigsohn (1814–1878)
Ivanina L. I. Ivanina (b. 1917)
Ivaschin D. S. Ivaschin (b. 1912)
Iversen J. Iversen (1904–1971)
Ives E. Ives (1779–1861)
Jackson, A. B. A. B. Jackson (1876–1947)
Jackson, A. K. A. K. Jackson (b. 1914)
Jackson, B. D. B. D. Jackson (1846–1927)
Jacq. N. J. von Jacquin (1727–1817)
Jacq. fil. J. F. von Jacquin (1766–1839)
Jaeger H. Jaeger (1815–1890)
Jäggi J. Jäggi (1829–1894)
Jahandiez E. Jahandiez (1876–1938)
Jakowatz A. Jakowatz (b. 1872)
Jalas J. Jalas (b. 1920)
Jameson W. Jameson (1796–1873)
Jan G. Jan (1791–1866)
Janchen E. Janchen (1882–1970)
Jancz. E. Janczewski von Glinka (1846–1918)
Janisch. D. E. Janischewsky (1875–1944)
Janka V. Janka von Bulcs (1837–1890)
Jansen P. Jansen (1882–1955)
Jaquet F. Jaquet (1858–1933)
Jardine, N. N. Jardine (b. 1943)
Jasiewicz A. Jasiewicz (b. 1928)
Jaub. H. F. Jaubert (1798–1874)
Jáv. S. Jávorka (1883–1961)
Jeanb. E. M. J. Jeanbernat (1835–1888)
Jedwabn. Jedwabnick (fl. 1924)
Jensen, G. J. G. K. Jensen (1818–1886)
Jermy A. C. Jermy (b. 1932)
Jessen K. F. W. Jessen (1821–1889)
Jessen, K. K. Jessen (1884–1971)
Jílek B. Jílek (1905–1972)
Jirásek V. Jirásek (b. 1906)
Jirasek, J. J. Jirasek (1754–1797)
Joerg. E. H. Joergensen (1863–1938)
Joh., K. K. Johansson (1856–1928)
Johnston, I. M. I. M. Johnston (1898–1960)
Jones, B. M. G. B. M. G. Jones (b. 1933)
Jonsell B. E. Jonsell (b. 1936)
Jónsson H. Jónsson (1867–1925)
Jordan A. Jordan (1814–1897)
Jordanov D. Jordanov (b. 1893)
Jovet P. A. Jovet (b. 1896)
Jundz. S. B. Jundzill (1761–1847)
Junge P. Junge (1881–1919)
Junger E. Junger (fl. 1891)
Juratzka J. Juratzka (1821–1878)
Jurišić Z. J. Jurišić (1863–1921)
Jurtzev B. A. Jurtzev (b. 1932)
Juss. A. L. de Jussieu (1748–1836)
Juss., A. A. H. L. de Jussieu (1797–1853)
Juxip A. J. Juxip (Üksip) (1886–1966)
Juz. S. V. Juzepczuk (1893–1959)
Kabath H. Kabath (1816–1888)

Kaeser F. Kaeser (1853–1915)
Kalchbr. K. Kalchbrenner (1807–1886)
Kalela A. Kalela (1908–1977)
Kalenicz. J. O. Kaleniczenko (1805–1876)
Kalm P. Kalm (1716–1779)
Kaltenb. J. H. Kaltenbach (1807–1876)
Kanitz Á. Kanitz (1843–1896)
Kar. G. S. Karelin (1801–1872)
Kárpáti Z. E. Kárpáti (1909–1972)
Karsch A. Karsch (1822–1892)
Karsten G. K. W. H. Karsten (1817–1908)
Karwinski W. F. Karwinski von Karwin (1780–1855)
Kasakewicz L. I. Kasakewicz (b. 1893)
Kaschm., B. B. F. Kaschmensky (d. 1909)
Kästner A. Kästner (b. 1936)
Kauffm. N. N. Kauffmann (Kaufman) (1834–1870)
Kaulfuss G. F. Kaulfuss (1786–1830)
Kazim. T. Kazimierski (b. 1924)
Kazmi S. M. A. Kazmi (b. 1926)
Keissler K. von Keissler (1872–1965)
Keld E. Keld (1867–1945)
Kelhofer E. Kelhofer (1877–1917)
Keller, B. A. B. A. Keller (1874–1945)
Keller, J. B. J. B. von Keller (1841–1897)
Keller, R. R. Keller (1854–1939)
Kellerer, J. J. Kellerer (fl. 1905)
Kem.-Nat. L. M. Kemularia-Nathadze (b. 1891)
Keng Y. L. Keng (b. 1897)
Kenyon W. Kenyon (fl. 1847)
Ker-Gawler J. B. Ker (J. Gawler) (1764–1842)
Kerguélen M. F.-J. Kerguélen (b. 1928)
Kern J. H. Kern (1903–1974)
Kerner, A. A. J. Kerner von Marilaun (1831–1898)
Kerner, J. J. Kerner (1829–1906)
Kiffm. R. Kiffmann (fl. 1952)
Kihlman A. O. Kihlman (Kairamo) (1858–1938)
Kindb. N. C. Kindberg (1832–1910)
Kir. I. P. Kirilow (1821 or 1822–1842)
Kirby M. Kirby (1817–1893)
Kirchner G. Kirchner (1837–1885)
Kirp. M. E. Kirpicznikov (b. 1913)
Kirschleger F. R. Kirschleger (1804–1869)
Kiss Á. Kiss (1889–1968)
Kit. P. Kitaibel (1757–1817)
Kitagawa M. Kitagawa (b. 1909)
Kitanov B. Kitanov (b. 1912)
Kittel M. B. Kittel (1798–1885)
Klásková, A. A. Klásková (later A. Skalická) (b. 1932)
Klášt. I. Klášterský (b. 1901)
Klatt F. W. Klatt (1825–1897)
Klebahn H. Klebahn (1859–1942)
Kleopow J. D. Kleopow (1902–1942)
Klett G. T. Klett (d. 1827)
Klika J. Klika (1888–1957)
Klinge J. C. Klinge (1851–1902)
Klinggr. K. J. von Klinggraeff (1809–1879)
Klink. M. Klinkowski (1904–1971)
Kliphius E. Kliphius (b. 1924)
Klokov M. V. Klokov (b. 1896)
Klotzsch J. F. Klotzsch (1805–1860)
Kluk K. Kluk (1739–1796)
Knaben G. Knaben (b. 1911)
Knaf J. Knaf (1801–1865)
Knaf fil. K. Knaf (1852–1878)
Knapp R. Knapp (b. 1917)
Knerr E. B. Knerr (1861–1942)
Kneucker J. A. Kneucker (1862–1946)
Knight J. Knight (1781–1855)
Knobl. E. F. Knoblauch (1864–1936)
Knoche H. Knoche (1870–1945)
Knowles G. B. Knowles (fl. 1829–1852)
Knuth, R. R. G. P. Knuth (1874–1957)
Koch W. D. J. Koch (G. D. I. Koch) (1771–1849)
Koch, C. C. H. E. Koch (1809–1879)
Koch, H. P. G. H. P. G. Koch (1807–1883)
Koch, L. L. K. A. Koch (b. 1850)
Koch, Walo Walo Koch (1896–1956)
Koczwara M. Koczwara (1893–1970)
Koehler J. C. G. Koehler (1759–1833)
Koehne B. A. E. Koehne (1848–1918)
Koeler G. L. Koeler (1765–1807)
Koelle J. L. C. Koelle (1763–1797)
Koelliker R. A. von Koelliker (1817–1905)
Koenig J. G. Koenig (1728–1785)
Koernicke F. A. Koernicke (1828–1908)
Koerte F. Koerte (1782–1845)
Kohts F. Kohts (1853 –after 1872)
Komarov V. L. Komarov (1869–1945)
Kondrat. E. N. Kondratjuk (b. 1914)
Konig, C. C. Konig (K. D. E. König) (1774–1851)
König, D. D. König (b. 1909)
Korcz. A. A. Korczagin (b. 1900)
Korsh. S. I. Korshinsky (1861–1900)
Košanin N. Košanin (1874–1934)
Koshewn. D. A. Koshewnikow (1858–1882)
Kos.-Pol. B. M. Koso-Poliansky (1890–1957)
Kossko I. N. Kossko (1924–1956)
Kossych V. M. Kossych (b. 1931)
Kostel. V. F. Kosteletzky (1801–1887)
Kotejowa, E. E. Kotejowa (fl. 1963)
Kotov M. I. Kotov (b. 1896)
Kotschy T. Kotschy (1813–1866)
Kotula, A. A. Kotula (1822–1891)
Kovanda M. Kovanda (b. 1936)
Kováts J. Kováts von Szentlelek (1815–1873)
Kováts, F. F. Kováts (1873–1956)
Kovatschev I. G. Kovatschev (Kovačev) (b. 1927)
Koyama, T. T. M. Koyama (b. 1933)
Kožuharov S. I. Kožuharov (b. 1933)
Krajina V. J. Krajina (b. 1905)
Kralik J. L. Kralik (1813–1892)
Krašan F. Krašan (1840–1907)
Krasch. H. M. Krascheninnikov (1884–1947)
Krause E. Krause (d. 1858)
Krause, E. H. L. E. H. L. Krause (1859–1942)
Krause, K. K. Krause (1883–1963)
Krecz., V. V. I. Kreczetowicz (1901–1942)
Krendl F. Krendl (b. 1926)
Kress A. A. H. L. Kress (b. 1932)
Kreutzer K. J. Kreutzer (1809–1866)
Kreyer G. K. Kreyer (1887–1942)
Křisa B. Křisa (b. 1936)
Krocker A. J. Krocker (1744–1823)
Krok T. O. B. N. Krok (1834–1921)
Krösche E. Krösche (fl. 1912)
Krylov P. N. Krylov (1850–1931)
Krysht. A. N. Kryshtofovicz (1885–1953)
Kucowa I. Kucowa (b. 1912)
Kühlew. P. E. Kühlewein (1798–1870)
Kuhn M. F. A. Kuhn (1842–1894)
Kük. G. Kükenthal (1864–1955)
Kulcz. S. Kulczyński (b. 1895)

Kummer F. Kummer (1820–1870)
Kümmerle J. B. Kümmerle (1876–1931)
Kunth C. S. Kunth (1788–1850)
Kuntze, O. K. E. O. Kuntze (1843–1907)
Kunz, H. H. Kunz (b. 1904)
Kunze, G. G. Kunze (1793–1851)
Kupcsok S. Kupcsok (1850–1914)
Kupffer K. R. Kupffer (1872–1935)
Kuprian. L. A. Kuprianova (b. 1914)
Kurtz, F. F. Kurtz (1854–1920)
Kurz S. Kurz (1834–1878)
Kusn. N. I. Kusnezow (Kuznetzov) (1864–1932)
Kuthath. S. I. Kuthatheladze (b. 1905)
Kütz. F. T. Kützing (1807–1893)
Kuzen. O. I. Kuzeneva (b. 1887)
Kuzinský P. A. von Kuzinský (fl. 1889)
Kuzmanov B. A. Kuzmanov (b. 1934)
L. C. von Linné (C. Linnaeus) (1707–1778)
L. fil. C. von Linné (1741–1783)
Labill. J. J. H. de Labillardière (1755–1834)
Lacaita C. C. Lacaita (1853–1933)
Ladizinsky G. Ladizinsky (b. 1936)
Laest. L. L. Laestadius (1800–1861)
Laffitte C. Laffitte (1811–1895)
Lag. M. Lagasca y Segura (1776–1839)
Lagerh. N. G. von Lagerheim (1860–1926)
Lagger F. Lagger (1799–1870)
Lagrèze-Fossat A. R. A. Lagrèze-Fossat (1818–1874)
Laharpe J. J. C. de Laharpe (b. 1802)
Laicharding J. N. von Laicharding (1754–1797)
Laínz M. Laínz (b. 1923)
Laínz, J. M. J. M. Laínz (b. 1900)
Lakon — Lakon (fl. 1907)
Lam. J. B. A. P. Monnet de la Marck (1744–1829)
Lamb. A. B. Lambert (1761–1842)
Lamotte M. Lamotte (1820–1883)
Landolt E. Landolt (b. 1926)
Láng, A. F. A. F. Láng (1795–1863)
Lang, K. H. K. H. Lang (1800–1843)
Lang, O. F. O. F. Lang (1817–1847)
Lange J. M. C. Lange (1818–1898)
Lange, Th. T. A. Lange (1872–1957)
Langsd. G. H. von Langsdorff (1774–1852)
Lanza D. Lanza (1868–1940)
Lapeyr. P. Picot de Lapeyrouse (1744–1818)
Lapierre J. M. Lapierre (1754–1834)
La Pylaie A. J. M. B. de la Pylaie (1786–1856)
Larsen, K. K. Larsen (b. 1926)
Lasch W. G. Lasch (1787–1863)
Lasebna A. M. Lasebna (b. 1922)
Laterrade J. F. Laterrade (1784–1858)
Latour-Marliac J. (B.) Latour-Marliac (b. 1830)
Latourr. M. A. L. Claret de Latourrette (1729–1793)
Latzel A. Latzel (1859–1950)
Lauche W. Lauche (1827–1882)
Lauth T. Lauth (1758–1826)
Lauth, G. G. Lauth (1793–1817)
Lavrenko E. M. Lavrenko (b. 1900)
Lawalrée A. Lawalrée (b. 1921)
Lawrance M. Lawrance (fl. 1790–1831)
Lawrence G. H. M. Lawrence (1910–1978)
Lawson, C. C. Lawson (1794–1873)
Lawson, P. P. Lawson (d. 1820)
Laxm. E. Laxmann (1737–1796)
Layens G. de Layens (1834–1897)
Laza M. Laza Palacios (b. 1901)
Lazar J. Lazar (b. 1903)
Láz.-Ibiza Blas Lázaro–Ibiza (1858–1921)
Lebel J. E. Lebel (1801–1878)
Lecoq H. Lecoq (1802–1871)
Lecoyer C.-J. Lecoyer (1835–1899)
Ledeb. C. F. von Ledebour (1785–1851)
Leers J. D. Leers (1727–1774)
Lees E. Lees (1800–1887)
Lefèvre L. V. Lefèvre (b. 1810)
Le Gall N. J. M. le Gall (1787–*c.* 1860)
Le Grand A. le Grand (1839–1905)
Lehaie J. Houzeau de Lehaie (1867–1959)
Lehm. J. G. C. Lehmann (1792–1860)
Lehm., C. B. C. B. Lehmann (fl. 1860)
Lehm., J. F. J. F. Lehmann (fl. 1809)
Leichtlin M. Leichtlin (1831–1910)
Leighton, F. M. F. M. Leighton (1909–1936)
Leins P. Leins (b. 1937)
Lej. A. L. S. Lejeune (1779–1858)
Le Jolis A. F. le Jolis (1823–1904)
Lemaire C. A. Lemaire (1801–1871)
Léman D. S. Léman (1781–1829)
Lemke W. Lemke (b. 1893)
Lemoine V. Lemoine (1823–1911)
Lengyel G. Lengyel (1884–1965)
Leonova T. G. Leonova (b. 1930)
Lepechin I. I. Lepechin (1737 or 1740–1802)
Leresche L. Leresche (1808–1885)
Lesp. G. Lespinasse (1807–1876)
Less. C. F. Lessing (1810–1862)
Lester-Garland L. V. Lester-Garland (1860–1944)
Lestib. T. G. Lestiboudois (1797–1876)
Letendre J. B. P. Letendre (1828–1886)
Léveillé A. A. H. Léveillé (1863–1918)
Levier E. Levier (1838–1911)
Levyns M. R. B. Levyns (1890–1975)
Lewis, P. P. Lewis (b. 1924)
Ley, A. A. Ley (1842–1911)
Leybold F. Leybold (1827–1879)
Leysser F. W. von Leysser (1731–1815)
L'Hér. C. L. L'Héritier de Brutelle (1746–1800)
Libert M. A. Libert (1782–1865)
Lid J. Lid (1886–1971)
Liebl. F. K. Lieblein (1744–1810)
Liebm. F. M. Liebmann (1813–1856)
Lightf. J. Lightfoot (1735–1788)
Liljeblad S. Liljeblad (1761–1815)
Liljefors A. W. Liljefors (b. 1904)
Lincz. I. A. Linczevsky (b. 1908)
Lindb. fil., H. H. Lindberg (1871–1963)
Lindblad M. A. Lindblad (1821–1899)
Lindblom A. E. Lindblom (1807–1853)
Lindeb. C. J. Lindeberg (1815–1900)
Lindem. E. von Lindemann (1825–1900)
Linden, J. J. J. Linden (1817–1898)
Lindgren S. J. Lindgren (1810–1849)
Lindley J. Lindley (1799–1865)
Lindman C. A. M. Lindman (1856–1928)
Lindström, A. A. A. Lindström (1864–1946)
Lindt. V. H. Lindtner (1904–1965)
Lingelsh. A. von Lingelsheim (1874–1937)
Link J. H. F. Link (1767–1851)
Linton, E. F. E. F. Linton (1848–1928)
Linton, W. R. W. R. Linton (1850–1908)
Lipsch. S. J. Lipschitz (b. 1905)
Lipsky V. I. Lipsky (1863–1937)

Liro J. I. Liro (1872–1943)
List ?F. L. List (fl. 1828–1837)
Litard. R. V. de Litardière (1888–1957)
Litv. D. I. Litvinov (Litwinow) (1854–1929)
Lloyd J. Lloyd (1810–1896)
Loddiges G. Loddiges (1784–1846)
Loefl. P. Loefling (1729–1756)
Loesener L. E. T. Loesener (1865–1941)
Loesener fil. O. Loesener (fl. 1927)
Loisel, R. R. J. Loisel (b. 1938)
Loisel. J. L. A. Loiseleur-Deslongchamps (1774–1849)
Lojac. M. Lojacono-Pojero (1853–1919)
Lona F. Lona (fl. 1949)
Londes F. W. Londes (1780–1807)
Longo, B. B. Longo (1872–1950)
Lönnr. K. J. Lönnroth (1826–1885)
Lonsing A. Lonsing (fl. 1939)
Lorent J. A. von Lorent (1812–1884)
Loret H. Loret (1810–1888)
Losa M. Losa España (1893–1965)
Loscos F. Loscos y Bernál (1823–1886)
Losinsk. A. S. Losina-Losinskaya (1903–1958)
Loudon J. C. Loudon (1783–1843)
Loudon, J. W. J. W. Loudon (1807–1858)
Lour. J. de Loureiro (1717–1791)
Löve, Á. Á. Löve (b. 1916)
Löve, D. D. Löve (b. 1918)
Lovrić A. Ž. Lovrić (b. 1943)
Löw, U. U. Löw (b. 1922)
Lowe R. T. Lowe (1802–1874)
Lübeck H. G. Lübeck (1809–1900)
Lucand J.-L. Lucand (1821–1896)
Lucé J. W. L. von Lucé (fl. 1823)
Luckwill L. C. Luckwill (b. 1914)
Lüdi W. Lüdi (1888–1968)
Ludwig C. G. Ludwig (1709–1773)
Ludwig, W. W. Ludwig (b. 1923)
Luerssen C. Luerssen (1843–1916)
Luizet D. Luizet (1851–1930)
Lumn. S. I. Lumnitzer (1750–1806)
Lund, N. N. Lund (1814–1847)
Lundevall C.-F. Lundevall (b. 1921)
Lundström A. N. Lundström (1847–1905)
Lundström, E. E. Lundström (b. 1882)
Lyka K. Lyka (1869–1965)
Lynch R. I. Lynch (1850–1924)
Lynge B. A. Lynge (1884–1942)
Lyons I. Lyons (1739–1775)
Maack R. K. Maack (1825–1886)
Mabille P. Mabille (1835–1923)
Macbride J. F. Macbride (1892–1976)
Macchiati L. Macchiati (1852–1921)
Macfadyen J. Macfadyen (1798–1850)
Mach.-Laur. B. Machatschki-Laurich (fl. 1926)
Machule M. Machule (b. 1899)
Mackay J. T. Mackay (1775–1862)
Mackenzie K. K. Mackenzie (1877–1934)
MacOwan P. MacOwan (1830–1909)
Magne J. H. Magne (1804–1885)
Magnier C. Magnier (fl. 1883)
Magnus P. W. Magnus (1844–1914)
Maguire B. Maguire (b. 1904)
Maillefer A. Maillefer (b. 1880)
Maire R. C. J. E. Maire (1878–1949)
Majevski P. F. Majevski (1851–1892)
Major C. J. F. Major (1843–1923)
Májovský J. Májovský (fl. 1975)
Makino T. Makino (1862–1957)
Malagarriga Hermano Teodoro (Ramón de Peñafort Malagarriga) (b. 1904)
Malbr. A. F. Malbranche (1818–1888)
Malinovski E. Malinovski (b. 1885)
Malinv. L. J. E. Malinvaud (1836–1913)
Malladra A. Malladra (1865–1944)
Malme G. O. A. Malme (1864–1937)
Malmgren A. J. Malmgren (1834–1897)
Malte M. O. Malte (1880–1933)
Maly, F. F. de Paula Maly (1823–1891)
Maly, J. Joseph Karl Maly (1797–1866)
Malý, K. Karl Malý (1874–1951)
Malyschev L. I. Malyschev (b. 1931)
Malzev A. I. Malzev (1879–1948)
Manden. I. P. Mandenova (b. 1907)
Mandon, E. E. Mandon (fl. 1898)
Mann W. B. Mann (1799–1839)
Mansfeld R. Mansfeld (1901–1960)
Manton I. Manton (b. 1904)
Marais W. Marais (b. 1929)
Maratti G. F. Maratti (1723–1777)
Marchesetti C. de Marchesetti (1850–1926)
Marc. B. B. Marcowicz (V. V. Markovicz) (1865–1942)
Marcos A. Marcos Pascual (b. 1900)
Marès P. Marès (1826–1900)
Margot H. Margot (fl. 1838)
Marie-Victorin Frère Marie-Victorin (C. Kirouac) (1885–1944)
Mariz J. de Mariz (1847–1916)
Marjollet J. M. Marjollet (1823–1894)
Markgraf F. Markgraf (b. 1897)
Markgr.-Dannenb. I. Markgraf-Dannenberg (b. 1911)
Marklund G. G. Marklund (1892–1964)
Marsden-Jones E. M. Marsden-Jones (1887–1960)
Marshall H. Marshall (1722–1801)
Marshall, E. S. E. S. Marshall (1858–1919)
Marsson T. F. Marsson (1816–1892)
Mart., C. F. P. C. F. P. von Martius (1794–1868)
Mart., H. H. von Martius (1781–1831)
Martelli, U. U. Martelli (1860–1934)
Martens, M. M. Martens (1797–1863)
Martens G. M. von Martens (1788–1872)
Martin, B. B. A. Martin (1813–1897)
Martin, F. F. Martin (fl. 1804)
Martínez M. Martínez Martínez (1907–1936)
Martinoli, G. G. Martinoli (1911–1970)
Martrin-Donos J. V. de Martrin-Donos (1801–1870)
Martinovský J. O. Martinovský (b. 1903)
Martyn T. Martyn (1736–1825)
Marzell H. Marzell (1885–1970)
Massara G. F. Massara (1792–1839)
Masson F. Masson (1741–1805)
Masters M. T. Masters (1833–1907)
Máthé I. Máthé (b. 1911)
Mathew B. F. Mathew (b. 1936)
Matouschek F. Matouschek (b. 1871)
Mattei G. E. Mattei (1865–1943)
Mattf. J. Mattfeld (1895–1951)
Mattir. O. Mattirolo (1856–1947)
Mattuschka H. G. von Mattuschka (1734–1779)
Matuszk. W. Matuszkiewicz (b. 1921)
Maurer W. Maurer (b. 1926)
Mauri E. Mauri (1791–1836)
Mauricio Frère Mauricio (H. Mauricio) (fl. 1933)
Maw G. Maw (1832–1912)

Maxim. K. J. Maximowicz (1827–1891)
Maxon W. R. Maxon (1877–1948)
Mayer, E. E. Mayer (b. 1920)
Mayer, J. J. C. A. Mayer (1747–1801)
Mazuc E. Mazuc (fl. 1854)
Mazzuc. G. Mazzucato (1787–1814)
McClell. J. McClelland (1805–1883)
McMillan C. McMillan (1867–1929)
McNeill J. McNeill (b. 1933)
Medicus F. C. Medicus (Medikus) (1736–1808)
Medv. J. S. Medvedev (1847–1923)
Meerb. N. Meerburgh (1734–1814)
Meikle R. D. Meikle (b. 1923)
Meinsh. K. K. Meinshausen (1819–1899)
Meissner C. F. Meissner (1800–1874)
Mela A. J. Mela (1846–1904)
Melderis A. Melderis (b. 1909)
Melville R. Melville (b. 1903)
Melzer H. Melzer (b. 1922)
Mendes E. J. S. M. Mendes (b. 1924)
Mendonça F. de Ascensão Mendonça (b. 1889)
Menéndez Amor J. Menéndez Amor (b. 1916)
Menyh. L. Menyhárth (1849–1897)
Mérat F. V. Mérat (1780–1851)
Merc. E. Mercier (1802–1863)
Merino P. B. Merino y Román (1845–1917)
Merlet G. E. Merlet de la Boulaye (1736–1807)
Merr. E. D. Merrill (1876–1956)
Mert. F. K. Mertens (1764–1831)
Merxm. H. Merxmüller (b. 1920)
Metsch J. C. Metsch (1796–1856)
Mett. G. H. Mettenius (1823–1866)
Metzel. A. Metzelová-Kropáčová (b. 1922)
Metzger J. Metzger (1789–1852)
Meusel H. Meusel (b. 1909)
Meyen F. J. F. Meyen (1804–1840)
Meyer, B. B. Meyer (1767–1836)
Meyer, C. A. C. A. von Meyer (1795–1855)
Meyer, D. E. D. E. Meyer (b. 1926)
Meyer, E. H. F. E. H. F. Meyer (1791–1858)
Meyer, G. F. W. G. F. W. Meyer (1782–1856)
Mez C. C. Mez (1866–1944)
Michalet E. Michalet (1829–1862)
Micheletti L. Micheletti (1844–1912)
Micheli, M. M. Micheli (1844–1902)
Michx A. Michaux (1746–1802)
Michx fil. F. A. Michaux (1770–1855)
Middendorff A. T. von Middendorff (1815–1894)
Mieg A. Mieg (1731–1799)
Miégeville Abbé Miégeville (1814–1901)
Miers J. Miers (1789–1879)
Mikan J. C. Mikan (1743–1814)
Mikan fil. J. C. Mikan (1769–1844)
Milde C. A. J. Milde (1824–1871)
Miller P. Miller (1691–1771)
Miller, J. J. M. Miller (d. 1796)
Millsp. C. F. Millspaugh (1854–1923)
Min. N. A. Miniaev (b. 1909)
Minder. E. V. Minderova (fl. 1957)
Miq. F. A. W. Miquel (1811–1871)
Mirbel C. F. B. Mirbel (1776–1854)
Miscz. P. I. Misczenko (1869–1938)
Mitf. A. B. Freeman-Mitford (1837–1916)
Mitterp. L. Mitterpacher (1734–1818)
Moench C. Moench (1744–1805)
Moessler J. C. Moessler (fl. 1805–1815)
Moesz G. Moesz (1873–1946)
Mohr D. M. H. Mohr (1779–1808)
Moldenke H. N. Moldenke (b. 1909)
Molina J. I. Molina (1740–1829)
Molinier R. Molinier (b. 1899)
Moll K. M. E. von Moll (1760–1838)
Monnard J. P. Monnard (b. 1791)
Monnier A. Monnier (fl. 1829)
Monnier, P. P. C. J. Monnier (b. 1922)
Montandon P. J. Montandon (fl. 1856)
Montbret G. Coquebert de Montbret (1805–1837)
Montell J. E. Montell (1869–1954)
Montelucci G. Montelucci (b. 1899)
Monts., P. P. Montserrat Recoder (b. 1920)
Moore, C. C. Moore (1820–1905)
Moore, D. Moresby D. Moresby Moore (b. 1933)
Moore, S. S. Le Marchant Moore (1850–1931)
Moq. C. H. B. A. Moquin-Tandon (1804–1863)
Morariu I. Morariu (b. 1905)
Moravec J. Moravec (b. 1929)
Mordant J. C. M. Mordant de Launay (*c.* 1750–1816)
More A. G. More (1830–1895)
Moretti G. Moretti (1782–1853)
Mori A. Mori (1847–1902)
Moric. M. E. Moricand (1779–1854)
Moris G. G. Moris (1796–1869)
Moritzi A. Moritzi (1806–1850)
Morot M. L. Morot (fl. 1885)
Morren C. J. E. Morren (1833–1886)
Morton, C. V. C. V. Morton (1905–1972)
Möschl W. Möschl (b. 1906)
Moss C. E. Moss (1872–1930)
Mössler J. C. Mössler (fl. 1814–1835)
Motelay L. Motelay (1831–1917)
Mouillefert P. Mouillefert (1845–1903)
Mueller, F. F. H. J. von Mueller (1825–1896)
Mueller, O. F. O. F. Mueller (1730–1784)
Mueller, P. J. P. J. Mueller (1832–1889)
Muenchh. O. Muenchhausen (1716–1774)
Muhl. G. H. E. Muhlenberg (1753–1815)
Müller Arg. J. Müller of Aargau (Argoviensis) (1828–1896)
Müller, H. H. Müller (1829–1883)
Munby G. Munby (1812–1876)
Münch E. Münch (1876–1946)
Muñoz Medina J. M. Muñoz Medina (b. 1895)
Munro W. Munro (1818–1889)
Munz P. A. Munz (1892–1974)
Murb. S. S. Murbeck (1859–1946)
Muret J. Muret (1799–1877)
Murith L. J. Murith (1742–1816 or 1818)
Murr, J. J. Murr (1864–1932)
Murray J. A. Murray (1740–1791)
Murray, A. A. Murray (*c.* 1798–1838)
Murray, E. A. E. Murray (b. 1935)
Murray, R. P. R. P. Murray (1842–1908)
Muschler R. Muschler (b. 1883)
Mussin A. A. Mussin-Puschkin (1760–1805)
Mutel A. Mutel (1795–1847)
Mutis J. C. Mutis (1732–1808)
Mygind F. Mygind (1710–1789)
Nadji Abd-Ur-Bahman Nadji (fl. 1892)
Naegeli C. W. von Naegeli (1817–1891)
Naggi A. Naggi (fl. 1905)
Nakai T. Nakai (1882–1952)
Nannf. J. A. F. Nannfeldt (b. 1904)
Nasarow M. I. Nasarow (1882–1942)

Nath. A. G. Nathorst (1850–1921)
Naudin C. V. Naudin (1815–1899)
Necker N. J. de Necker (1730–1793)
Nees C. G. D. Nees von Esenbeck (1776–1858)
Nees, T. T. F. L. Nees von Esenbeck (1787–1837)
Neilr. A. Neilreich (1803–1871)
Nejc. I. Nejceff (1870–1913)
Nelmes E. Nelmes (1895–1959)
Nelson, A. A. Nelson (1859–1952)
Nelson, E. E. Nelson (b. 1897)
Nendtvich K. M. Nendtvich (1811–1892)
Nenukow S. S. Nenukow (1906–1942)
Nestler C. G. Nestler (1778–1832)
Nestler, A. A. Nestler (fl. 1812)
Neuman L. M. Neuman (1852–1922)
Neumann, A. A. Neumann (fl. 1960)
Neumayer, H. H. Neumayer (1887–1945)
Neves, J. J. de Barros Neves (b. 1914)
Nevski S. A. Nevski (1908–1938)
Newbould W. W. Newbould (1819–1886)
Newman E. Newman (1801–1876)
Neygenf. F. W. Neygenfind (fl. 1821)
Nicholson G. Nicholson (1847–1908)
Ničić D. Ničić (1856–1920)
Nicotra L. Nicotra (1846–1940)
Niedenzu F. J. Niedenzu (1857–1937)
Nieschalk, A. A. Nieschalk (b. 1904)
Nieschalk, C. C. Nieschalk (b. 1913)
Nikif. N. B. Nikiforova (b. 1912)
Nikitin, S. S. A. Nikitin (fl. 1937)
Nobre A. Nobre (b. 1865)
Nocca D. Nocca (1758–1841)
Noë W. Noë (d. 1858)
Nogueira I. M. S. Nogueira (b. 1935)
Nolte E. F. Nolte (1791–1875)
Nordborg G. Nordborg (b. 1931)
Nordenstam B. Nordenstam (b. 1936)
Nordh. R. Nordhagen (b. 1894)
Nordm. A. von Nordmann (1803–1866)
Nordstedt C. F. O. Nordstedt (1838–1924)
Norlindh, T. T. Norlindh (b. 1906)
Noronha F. Noronha (*c.* 1748–1787)
Norrlin J. P. Norrlin (1842–1917)
Norton J. B. Norton (1877–1938)
Notø A. Notø (1865–1948)
Noulet J. B. Noulet (1802–1890)
Novák F. A. Novák (1892–1964)
Novikov, V. V. S. Novikov (b. 1940)
Novopokr. I. V. Novopokrovsky (1880–1951)
Nowacki E. K. Nowacki (b. 1930)
Nutt. T. Nuttall (1786–1859)
Nyárády, A. A. Nyárády (b. 1920)
Nyárády, E. I. E. I. Nyárády (1881–1966)
Nyl., F. F. Nylander (1820–1880)
Nyl., W. W. Nylander (1822–1899)
Nyman C. F. Nyman (1820–1893)
Oakes W. Oakes (1799–1848)
Oborny A. Oborny (1840–1924)
Ockendon D. J. Ockendon (b. 1940)
Oeder G. C. Oeder (1728–1791)
Oett. H. von Oettingen (fl. 1925)
Ohle H. Ohle (b. 1937)
Ohlsén, R. R. Ohlsén (fl. 1934)
Ohwi J. Ohwi (1905–1977)
Oken L. Oken (1779–1851)
Olin J. H. Olin (1769–1824)
Oliver D. Oliver (1830–1916)
Olivier G. A. Olivier (1756–1814)
Olofsson P. Olofsson (b. 1896)
Omang S. O. F. Omang (1867–1953)
Omelczuk T. J. Omelczuk (fl. 1962)
Onno M. Onno (b. 1903)
Opiz P. M. Opiz (1787–1858)
Opperman P. A. Opperman (d. 1942)
Orlova N. I. Orlova (b. 1921)
Ormonde J. E. M. Ormonde (b. 1943)
Orph. T. G. Orphanides (1817–1886)
Örsted A. S. Örsted (1816–1872)
Ortega C. Gómez Ortega (1740–1818)
Ortmann J. Ortmann (1814–1890)
Osbeck P. Osbeck (1723–1805)
Óskarsson I. Óskarsson (b. 1892)
Ostenf. C. E. H. Ostenfeld (1873–1931)
Osvačil. V. Osvačilová (b. 1924)
Otth K. A. Otth (1803–1839)
Otto C. F. Otto (1783–1856)
Ovcz. P. N. Ovczinnikov (b. 1903)
Oxner A. N. Oxner (1898–1973)
Özhatay, N. N. Özhatay (b. 1947)
Pacher D. Pacher (1817–1902)
Pacz. I. K. Paczoski (1864–1942)
Padmore P. A. Padmore (b. 1929)
Paegle B. Paegle (fl. 1927)
Paiva J. A. Rodrigues de Paiva (b. 1933)
Palassou P. B. Palassou (1745–1830)
Palau P. Palau i Ferrer (1881–1956)
Palhinha R. T. Palhinha (1871–1957)
Palitz R. Palitz (fl. 1935)
Palla E. Palla (1864–1922)
Pallas P. S. Pallas (1741–1811)
Palmgren A. Palmgren (1880–1960)
Pamp. R. Pampanini (1875–1949)
Pančić J. Pančić (1814–1888)
Pangalo K. I. Pangalo (1883–1965)
Panizzi F. Panizzi-Savio (1817–1893)
Panov P. P. Panov (b. 1932)
Pant. J. Pantocsek (1846–1916)
Panţu Z. C. Panţu (1866–1934)
Panzer G. W. F. Panzer (1755–1829)
Paol. G. Paoletti (1865–1941)
Papaf. D. Papafava (fl. 1847)
Pappe K. W. L. Pappe (1803–1862)
Pardo J. Pardo y Sastrón (1822–1909)
Parl. F. Parlatore (1816–1877)
Parnell R. Parnell (1810–1882)
Parodi L. R. Parodi (1895–1966)
Parris B. S. Parris (b. 1945)
Parry W. E. Parry (1790–1855)
Pascher A. A. Pascher (1881–1945)
Pasquale, C. A. C. (G.) A. Pasquale (1820–1893)
Passer. G. Passerini (1816–1893)
Patrin E. L. M. Patrin (1742–1815)
Patzak A. Patzak (b. 1930)
Patze C. A. Patze (1808–1892)
Patzke E. Patzke (b. 1929)
Pau C. Pau (1857–1937)
Paucă A. M. Paucă (1907–1963)
Paul, H. H. K. G. Paul (1876–1964)
Paulin A. Paulin (1853–1942)
Paulsen O. V. Paulsen (1874–1947)
Paun M. Paun (b. 1924)
Paunero E. Paunero (b. 1906)

Pauquy C. L. C. Pauquy (1800–1854)
Pavlov N. V. Pavlov (1893–1971)
Pavón J. Pavón (1750–1844)
Pawł. B. Pawłowski (1898–1971)
Pawł., S. S. Pawłowska (b. 1905)
Pax F. A. Pax (1858–1942)
Paxton J. Paxton (1803–1865)
Pedersen, A. A. Pedersen (b. 1920)
Pedro, G. J. G. Pedro (b. 1915)
Penev I. N. Penev (b. 1915)
Pennell F. W. Pennell (1886–1952)
Pénzes A. Pénzes (b. 1895)
Peola P. Peola (b. 1869)
Pérard M. Pérard (1835–1887)
Pereda J. M. de Pereda Sáez (1909–1972)
Pérez Lara J. M. Pérez Lara (1841–1918)
Perf. I. A. Perfiljew (1882–1942)
Pernh. G. von Pernhoffer (1831–1899)
Perpenti C. Lena-Perpenti (1764–1846)
Perr. E. Perrier de la Bâthie (1825–1916)
Perring, F. H. F. H. Perring (b. 1927)
Pers. C. H. Persoon (*c.* 1762–1836)
Personnat V. Personnat (fl. 1854–1870)
Persson, H. N. P. H. Persson (b. 1893)
Persson, K. K. M. Persson (b. 1938)
Petagna V. Petagna (1734–1810)
Péteaux J. C. J. Péteaux (1840–1896)
Peter G. A. Peter (1853–1937)
Péterfi M. Péterfi (1875–1922)
Peterm. W. L. Petermann (1806–1855)
Petif C. Petif (fl. 1830)
Petit A. Petit (d. 1843)
Petitmengin M. G. C. Petitmengin (1881–1908)
Petrak F. Petrak (1886–1973)
Petri F. Petri (1837–1896)
Petrov V. A. Petrov (1896–1955)
Petrović S. Petrović (1839–1889)
Petunnikov A. N. Petunnikov (1842–1919)
Petzold C. E. A. Petzold (1815–1891)
Peyer — Peyer (fl. 1829)
Philcox D. Philcox (b. 1926)
Philippe X. Philippe (1802–1866)
Philippi R. A. Philippi (1808–1904)
Phillips, E. P. E. P. Phillips (1884–1967)
Phipps, C. J. C. J. Phipps (1744–1792)
Phitos D. Phitos (b. 1930)
Pierrat D. Pierrat (1835–1895)
Pignatti S. Pignatti (b. 1930)
Pilger R. K. F. Pilger (1876–1953)
Piller M. Piller (1733–1788)
Pinzger P. Pinzger (fl. 1868)
Pio G. B. Pio (fl. 1813)
Piper C. V. Piper (1867–1926)
Piré L. A. H. J. Piré (1827–1887)
Pires de Lima A. Pires de Lima (b. 1886)
Pirona G. A. Pirona (1822–1895)
Pissjauk. V. V. Pissjaukowa (b. 1906)
Pitard C. J. Pitard (1873–1927)
Planchon J. E. Planchon (1823–1888)
Planellas J. Planellas Giralt (1821–1888)
Pleijel C. G. V. Pleijel (1866–1937)
Pobed. E. G. Pobedimova (1898–1973)
Podl. D. Podlech (b. 1931)
Podp. J. Podpěra (1878–1954)
Poech J. Poech (1816–1846)
Poeverlein H. Poeverlein (1874–1957)
Poggenb. J. F. Poggenburg (1840–1893)
Pohl J. B. E. Pohl (1782–1834)
Pohle R. R. Pohle (1869–1926)
Poiret J. L. M. Poiret (1755–1834)
Poirion L. P. Poirion (b. 1901)
Poiteau P. A. Poiteau (1766–1854)
Pojark. A. I. Pojarkova (b. 1897)
Pojark., H. H. I. Pojarkova (E. I. Pojarkova) (fl. 1965)
Polatschek A. Polatschek (b. 1932)
Polgár S. Polgár (1876–1944 or 1945)
Pollacci — Pollacci (fl. 1908)
Pollich J. A. Pollich (1740–1780)
Pollini C. Pollini (1782–1833)
Polunin N. V. Polunin (b. 1909)
Pomel A. Pomel (1821–1898)
Pons A. Pons (1838–1893)
Popl. G. I. Poplavskaja (Poplawska) (1885–1956)
Popov, M. M. G. Popov (1893–1955)
Popov, T. T. I. Popov (fl. 1927)
Porc. F. Porcius (1816–1907)
Porsch O. Porsch (1875–1959)
Porsild, A. E. A. E. Porsild (1901–1977)
Porta P. Porta (1832–1923)
Portenschl. F. E. von Portenschlag-Ledermayer (1772–1822)
Porter T. C. Porter (1822–1901)
Pospichal E. Pospichal (1838–1905)
Post G. E. Post (1838–1909)
Postr. S. A. Postrigan (b. 1891)
Pott J. F. Pott (1738–1805)
Potztal E. H. I. Potztal (b. 1924)
Pourret P. A. Pourret de Figeac (1754–1818)
Pouzar Z. Pouzar (b. 1932)
Pouzolz P. C. M. de Pouzolz (1785–1858)
Pozd. N. G. Pozdeeva (b. 1913)
Praeger R. L. Praeger (1865–1953)
Prantl K. A. E. Prantl (1849–1893)
Prat H. Prat (b. 1902)
Préaubert E. Préaubert (b. 1852)
Presl, C. C. (K.) B. Presl (1794–1852)
Presl, J. J. S. Presl (1791–1849)
Price W. R. Price (1886–1975)
Prime C. T. Prime (b. 1909)
Printz K. H. O. Printz (b. 1888)
Pritchard N. M. Pritchard (b. 1933)
Pritzel, G. A. G. A. Pritzel (1815–1874)
Privalova L. A. Privalova (b. 1919)
Proctor, M. C. F. M. C. F. Proctor (b. 1929)
Prodan J. Prodan (1875–1959)
Progel A. Progel (1829–1889)
Prokh. J. I. Prokhanov (1902–1964)
Prokudin J. N. Prokudin (b. 1911)
Prolongo P. Prolongo y García (1806–1885)
Proskorj. E. I. Proskorjakov (b. 1895)
Puel T. Puel (1812–1890)
Puget F. Puget (1829–1880)
Pugsley H. W. Pugsley (1868–1947)
Pulević V. Pulević (b. 1938)
Pulliat V. Pulliat (1827–1866)
Puolanne M. E. Puolanne (1877–1941)
Purchas W. H. Purchas (1823–1903)
Puring N. Puring (1865–1904)
Purkyně E. Purkyně (1831–1882)
Pursh F. T. Pursh (1774–1820)
Putterlick A. Putterlick (1810–1845)
Quézel P. Quézel (b. 1926)
Raab W. Raab (fl. 1819)

Rabenh. G. L. Rabenhorst (1806–1881)
Racib. M. Raciborski (1864–1917)
Raddi G. Raddi (1770–1829)
Radius J. W. M. Radius (1797–1884)
Raeuschel E. A. Raeuschel (fl. 1772–1797)
Rafin. C. S. Rafinesque-Schmaltz (1783–1840)
Rafn C. G. Rafn (1769–1808)
Ramat. T. A. J. d'Audibert de Ramatuelle (1750–1794)
Ramond L. F. E. Ramond de Carbonnières (1753–1827)
Rand E. L. Rand (1859–1924)
Rapaics R. Rapaics (1885–1953)
Rapin D. Rapin (1799–1882)
Rasmussen R. Rasmussen (1871–1962)
Raspail F. V. Raspail (1794–1878)
Rau A. Rau (1784–1830)
Raulin V. F. Raulin (1815 or 1819–1905)
Raunk. C. Raunkiær (1860–1938)
Rauschert S. Rauschert (b. 1931)
Răvărut M. Răvărut (b. 1907)
Ravaud L. C. M. Ravaud (1822–1898)
Raven, J. E. J. E. Raven (b. 1914)
Raven, P. H. P. H. Raven (b. 1936)
Ravnik V. Ravnik (b. 1924)
Raymond L. M. Raymond (1915–1972)
Rayss T. Rayss (1890–1965)
Re, G. F. G. F. Re (1772–1833)
Rebr. O. V. Rebristaya (b. 1930)
Reboul E. de Reboul (1781–1851)
Rech. K. Rechinger (1867–1952)
Rech. fil. K. H. Rechinger (b. 1906)
Redf. J. H. Redfield (1815–1895)
Redouté P. J. Redouté (1759–1840)
Rees A. Rees (1743–1825)
Regel E. A. von Regel (1815–1892)
Regel, C. C. von Regel (1890–1970)
Rehder A. Rehder (1863–1949)
Rehmann A. Rehmann (1840–1917)
Reichard J. J. Reichard (1743–1782)
Reichenb. H. G. L. Reichenbach (1793–1879)
Reichenb. fil. H. G. Reichenbach (1824–1889)
Reichg. T. J. Reichgelt (1903–1966)
Reinhard H. R. Reinhard (b. 1919)
Rendle A. B. Rendle (1865–1938)
Renner O. Renner (1883–1960)
Renz J. Renz (b. 1907)
Req. E. Requien (1788–1851)
Resvoll, T. T. R. Resvoll (1871–1948)
Resvoll-Holmsen H. Resvoll-Holmsen (1873–1943)
Retz. A. J. Retzius (1742–1821)
Reuss, G. G. Reuss (1818–1861)
Reuter G. F. Reuter (1805–1872)
Revel J. Revel (1811–1887)
Reverchon E. Reverchon (1835–1914)
Reverdatto V. V. Reverdatto (1891–1969)
Reyn. A. Reynier (1845–1932)
Reynolds G. W. Reynolds (*c.* 1895–1967)
Ricci A. M. Ricci (1777–1850)
Ricci, I. I. Ricci (b. 1922)
Richard, A. A. Richard (1794–1852)
Richard, L. C. M. L. C. M. Richard (1754–1821)
Richards, A. J. A. J. Richards (b. 1943)
Richardson J. Richardson (1787–1865)
Richardson, I. B. K. I. B. K. Richardson (b. 1940)
Richter H. E. F. Richter (1808–1876)
Richter, J. J.-A. Richter (1821–1910)
Richter, K. K. Richter (1855–1891)
Riddelsd. H. J. Riddelsdell (1866–1941)
Riedl H. Riedl (b. 1936)
Ridley H. N. Ridley (1855–1956)
Rigo G. Rigo (1841–1922)
Rikli M. A. Rikli (1868–1951)
Rink H. J. Rink (1819–1893)
Ripart J. B. M. J. S. E. Ripart (1814–1878)
Risso J. A. Risso (1777–1845)
Rittener T. Rittener (fl. 1887)
Rivas Goday S. Rivas Goday (b. 1905)
Rivas Martínez S. Rivas Martínez (b. 1935)
Rivas Ponce M. A. Rivas Ponce (b. 1941)
Rivière, A. M. A. Rivière (1821–1877)
Rivière, C. C. M. Rivière (b. 1845)
Rix E. M. Rix (b. 1943)
Robert — Robert (fl. 1838)
Roberts, J. J. Roberts (1912–1960)
Roberts, R. H. R. H. Roberts (b. 1910)
Roberty G. E. Roberty (1907–1971)
Robill. L. M. A. Robillard d'Argentelle (d. 1828)
Robinson B. L. Robinson (1864–1935)
Robson E. Robson (1763–1813)
Robson, N. K. B. N. K. B. Robson (b. 1928)
Robyns W. Robyns (b. 1901)
Rocha Afonso M. da Luz de Oliveira Tavares Monteiro da Rocha Afonso (b. 1925)
Rochel A. Rochel (1770–1847)
Rodin L. E. Rodin (1907–1966)
Rodr. J. D. Rodriguez (1780–1846)
Rodr., J. J. J. J. Rodríguez y Femenías (1839–1905)
Roemer J. J. Roemer (1763–1819)
Roemer, M. J. M. J. Roemer (*c.* 1791–1849)
Roemer, R. de R. de Roemer (fl. 1852)
Roffey J. Roffey (1860–1927)
Rogow. A. S. Rogowicz (1812–1878)
Rohde M. Rohde (1782–1812)
Rohlena J. Rohlena (1874–1944)
Röhling J. C. Röhling (1757–1813)
Rohrb. P. Rohrbach (1847–1871)
Roman N. Roman (b. 1927)
Ronniger K. Ronniger (1871–1954)
Rönning O. I. Rönning (b. 1924)
Rose J. N. Rose (1862–1928)
Rosellini ?F. Rosellini (1817–1873)
Rosén J. P. Rosén (1788–1825 or later)
Rosenvinge J. L. A. K. Rosenvinge (1858–1939)
Roshev. R. J. Roshevitz (1882–1949)
Ross, J. J. Ross (1777–1856)
Ross, R. R. Ross (b. 1912)
Rosser E. M. Rosser (b. 1923)
Rossi M. L. Rossi (1850–1932)
Rössler W. Rössler (b. 1909)
Rostański K. Rostański (b. 1930)
Rostk. F. W. T. Rostkovius (F. W. G. Rostkov) (1770–1848)
Rostock M. Rostock (fl. 1884)
Rostrup F. G. E. Rostrup (1831–1907)
Roth A. W. Roth (1757–1834)
Rothm. W. Rothmaler (1908–1962)
Rottb. C. F. Rottboell (Rottbøll) (1727–1797)
Rouleau E. Rouleau (b. 1916)
Roussine N. Roussine (formerly N. A. Schostenko) (1889–1968)
Rouy G. C. C. Rouy (1851–1924)
Rowley G. D. Rowley (b. 1921)
Roxb. W. Roxburgh (1751–1815)
Royle J. F. Royle (1779–1858)
Rozan. M. A. Rozanova (1885–1957)

Rozeira A. D. F. Rozeira (b. 1912)
Rudolph, J. H. J. H. Rudolph (1744–1809)
Rudolphi K. A. Rudolphi (1771–1832)
Ruhmer G. F. Ruhmer (1853–1883)
Ruiz H. Ruiz López (1754–1815)
Ruiz Rejón M. Ruiz Rejón (b. 1950)
Rune O. Rune (b. 1919)
Runemark H. Runemark (b. 1927)
Ruppert J. Ruppert (1864–1935)
Rupr. F. J. Ruprecht (1814–1870)
Russell, A. A. Russell (?1715–1768)
Russell, P. P. G. Russell (1889–1963)
Ruthe J. F. Ruthe (1788–1859)
Rydb. P. A. Rydberg (1860–1931)
Rylands T. G. Rylands (1818–1900)
Sa'ad F. Sa'ad (b. 1925)
Saarson B. Saarson (later B. Saarsoo) (1899–1969)
Sabine J. Sabine (1770–1837)
Sabr. H. Sabransky (1864–1916)
Sadler J. Sadler (1791–1849)
Saelan A. T. Saelan (1834–1921)
Sageret A. Sageret (1763–1851)
Sagorski E. Sagorski (1847–1929)
Sakalo D. I. Sakalo (1904–1965)
Salis C. Ulysses von Salis-Marschlins (1760–?1818)
Salisb. R. A. Salisbury (1761–1829)
Salm-Dyck J. F. M. A. H. I. zu Salm-Reifferscheid-Dyck (1773–1861)
Salmon C. E. Salmon (1872–1930)
Såltin H. Såltin (1912–1969)
Salzm. P. Salzmann (1781–1851)
Sam. G. Samuelsson (1885–1944)
Sambuk F. V. Sambuk (1900–1942)
Samp. G. A. da Silva Ferreira Sampaio (1865–1937)
Sanadze K. S. Sanadze (fl. 1946)
Sándor I. Sándor (b. 1853)
Sandwith N. Y. Sandwith (1901–1965)
Sanguinetti P. Sanguinetti (1802–1868)
Santi, G. G. Santi (1746–1822)
Sapjegin A. A. Sapjegin (1883–1946)
Sarato C. Sarato (1830–1893)
Sarg. C. S. Sargent (1841–1927)
Sarnth. L. von Sarnthein (1861–1914)
Sart. G. B. Sartorelli (1780–1853)
Sauer F. W. H. Sauer (1803–1873)
Sauer, W. W. Sauer (b. 1935)
Saunders W. W. Saunders (1809–1879)
Sauter A. E. Sauter (1800–1881)
Sauvage C. P. F. Sauvage (b. 1909)
Sauzé C. Sauzé (1815–1889)
Savi G. Savi (1769–1844)
Savi fil. P. Savi (1798–1871)
Savigny M. J. C. Lelorgne de Savigny (1777–1851)
Săvul. T. Săvulescu (1889–1963)
Scaling W. Scaling (fl. 1863–1882)
Schaeffer J. C. Schaeffer (1718–1790)
Schaeftlein H. Schaeftlein (b. 1886)
Schaffner W. Schaffner (d. 1882)
Schagerström J. A. Schagerström (1818–1867)
Schauer J. K. Schauer (1813–1848)
Schchian A. S. Schchian (b. 1905)
Scheele G. H. A. Scheele (1808–1864)
Scheffer, J. J. Scheffer (1903–1949)
Schellm. C. Schellmann (fl. 1938)
Schenk J. A. Schenk (1815–1891)
Schenk, E. E. Schenk (b. 1880)
Scherb. J. Scherbius (1769–1813)
Scheutz N. J. W. Scheutz (1836–1889)
Schiede C. J. W. Schiede (1798–1836)
Schieman E. Schieman (1881–1972)
Schiffner V. F. Schiffner (1862–1944)
Schimper, C. C. F. Schimper (1803–1867)
Schindler J. Schindler (b. 1881)
Schinz H. Schinz (1858–1941)
Schipcz. N. V. Schipczinski (1886–1955)
Schischkin B. K. Schischkin (1886–1963)
Schkuhr C. Schkuhr (1741–1811)
Schlecht. D. F. L. von Schlechtendal (1794–1866)
Schlechter F. R. R. Schlechter (1872–1925)
Schleicher J. C. Schleicher (1768–1834)
Schleiden M. J. Schleiden (1804–1881)
Schlickum A. Schlickum (b. 1867)
Schljakov R. N. Schljakov (b. 1912)
Schlosser J. C. Schlosser (1808–1882)
Schmalh. I. F. Schmalhausen (1849–1894)
Schmeil O. Schmeil (1860–1943)
Schmid, E. E. Schmid (b. 1891)
Schmidel C. C. Schmidel (1718–1792)
Schmidely A. I. S. Schmidely (1838–1918)
Schmidt, A. A. Schmidt (b. 1932)
Schmidt, Franz Franz Schmidt (1751–1834)
Schmidt, F. W. Franz Willibald Schmidt (1764–1796)
Schmidt, W. L. E. W. L. E. Schmidt (1804–1843)
Schmidt Petrop., Friedrich Friedrich Schmidt of St Petersburg (1832–1908)
Schneider, C. K. C. K. Schneider (1876–1951)
Schneider, G. G. Schneider (1834–1900)
Schneider, U. U. Schneider (b. 1936)
Schnittspahn G. F. Schnittspahn (1810–1865)
Schnizlein A. C. F. H. C. Schnizlein (1814–1868)
Scholander P. F. Scholander (b. 1905)
Scholler F. A. Scholler (1718–1785)
Scholz, H. H. Scholz (b. 1928)
Scholz, J. B. J. B. Scholz (fl. 1900)
Schönheit F. C. H. Schönheit (1789–1870)
Schönl. S. Schönland (1860–1940)
Schost. N. A. Schostenko (Desjatova-Schostenko) (later N. Roussine) (1889–1968)
Schotsman H. D. Schotsman (b. 1921)
Schott H. W. Schott (1794–1865)
Schousboe P. K. A. Schousboe (1766–1832)
Schouw J. F. Schouw (1789–1852)
Schrader H. A. Schrader (1767–1836)
Schrank F. von Paula von Schrank (1747–1835)
Schreber J. C. D. von Schreber (1739–1810)
Schrenk A. G. von Schrenk (1816–1876)
Schrödinger R. Schrödinger (1857–1919)
Schroeter C. Schroeter (1855–1939)
Schübler G. Schübler (1787–1834)
Schultes J. A. Schultes (1773–1831)
Schultes fil. J. H. Schultes (1804–1840)
Schultz, C. F. C. F. Schultz (1765–1837)
Schultz, F. W. F. W. Schultz (1804–1876)
Schultz, G. E. G. E. Schultz (fl. 1960)
Schultz Bip. C. H Schultz (Schultz Bipontinus) (1805–1867)
Schultze, W. W. Schultze (fl. 1894)
Schulz, A. A. A. H. Schulz (1862–1922)
Schulz, O. E. O. E. Schulz (1874–1936)
Schulz, R. R. Schulz (b. 1904)
Schulze, M. C. T. M. Schulze (1841–1915)
Schultze-Motel W. Schultze-Motel (b. 1934)
Schumacher H. C. F. Schumacher (1757–1830)

Schum., K. K. M. Schumann (1851–1904)
Schummel T. E. Schummel (1785–1848)
Schur P. J. F. Schur (1799–1878)
Schuster R. Schuster (b. 1935)
Schwantes G. Schwantes (1881–1960)
Schwarz, A. A. Schwarz (1852–1915)
Schwarz, O. O. Schwarz (b. 1900)
Schwarzová T. Schwarzová (b. 1938)
Schwegler H. W. Schwegler (b. 1929)
Schweigger A. F. Schweigger (1783–1821)
Schweinf. G. A. Schweinfurth (1836–1925)
Schweinitz L. D. von Schweinitz (1780–1834)
Schwertschl. J. Schwertschleger (1853–1924)
Schwimmer J. Schwimmer (1879–1958)
Scop. G. A. Scopoli (1723–1788)
Scribner F. L. Scribner (1851–1938)
Sealy J. R. Sealy (b. 1907)
Sebastiani A. Sebastiani (1782–1821)
Sebeók A. Sebeók de Szent-Miklós (fl. 1780)
Seem. B. C. Seemann (1825–1871)
Seemen K. O. von Seemen (1838–1910)
Seenus J. von Seenus (fl. 1805)
Séguier J. F. Séguier (1703–1784)
Seidl W. B. Seidl (1773–1842)
Selander N. S. E. Selander (1891–1957)
Selin G. Selin (1813–1862)
Sell, P. D. P. D. Sell (b. 1929)
Semen., N. N. Z. Semenova-Tjan-Schanskaja (1906–1960)
Semler C. Semler (1875–1955)
Sendtner O. Sendtner (1813–1859)
Senghas K. Senghas (b. 1928)
Senjan.-Korcz. M. V. Senjaninova-Korczagina (1900–1966)
Sennen Frère Sennen (E. M. Grenier-Blanc) (1861–1937)
Ser. N. C. Seringe (1776–1858)
Şerbănescu I. Şerbănescu (b. 1903)
Serg. L. P. Sergievskaja (1897–1970)
Serg., E. E. V. Sergievskaja (C. V. Sergievskaja) (b. 1926)
Sernander J. R. Sernander (1866–1944)
Serres J. J. Serres (d. 1858)
Sesler L. Sesler (d. 1785)
Seub. M. A. Seubert (1818–1878)
Seymann W. Seymann (1887–1915)
Sheppard — Sheppard (fl. ?1824)
Sherff E. E. Sherff (1886–1966)
Shibata K. Shibata (1877–1949)
Shinners L. H. Shinners (1918–1971)
Shivas M. G. Shivas (b. 1926)
Shull G. H. Shull (1874–1954)
Shuttlew., R. J. R. J. Shuttleworth (1810–1874)
Sibth. J. Sibthorp (1758–1796)
Sieber F. W. Sieber (1789–1844)
Siebert A. Siebert (1854–1923)
Siebold P. F. von Siebold (1796–1866)
Siegfr. H. Siegfried (1837–1903)
Sievers J. Sievers (d. 1795)
Sikura J. J. Sikura (fl. 1960)
Silliman B. Silliman (1779–1864)
Silva, M. M. da Silva (b. 1916)
Silva, P. A. R. Pinto da Silva (b. 1912)
Sim, R. R. Sim (1791–1878)
Simkovics L. Simkovics (later L. von Simonkai) (1851–1910)
Simmler G. Simmler (b. 1884)
Simmons H. G. Simmons (1866–1943)
Simon primus, E. E. Simon (1848–1924)
Simon secundus, E. E. Simon (1871–1967)
Simon, T. T. Simon (b. 1926)
Simonet M. Simonet (1899–1965)
Simonkai L. von Simonkai (1851–1910)
Sims J. Sims (1749–1831)
Sint. P. E. E. Sintenis (1847–1907)
Širj. G. I. Širjaev (Schirjaev) (1882–1954)
Sjöstrand M. G. Sjöstrand (1807–1880)
Skalická A. Skalická (b. 1932)
Skalický V. Skalický (b. 1930)
Skalińska M. Skalińska (b. 1890)
Skeels H. C. Skeels (1873–1934)
Skvortsov, A. A. K. Skvortsov (b. 1920)
Slavíková Z. Slavíková (b. 1935)
Sljussarenko L. P. Sljussarenko (fl. 1963)
Slosson M. Slosson (b. 1873)
Sm. J. E. Smith (1759–1828)
Sm., A. R. A. R. Smith (b. 1938)
Sm., C. C. Smith (1785–1816)
Sm., G. E. G. E. Smith (1805–1881)
Sm., H. K. A. H. Smith (b. 1889)
Sm., P. M. P. M. Smith (b. 1941)
Sm., W. W. W. W. Smith (1875–1956)
Small J. K. Small (1869–1938)
Smejkal M. Smejkal (b. 1927)
Smirnov, P. P. A. Smirnov (b. 1896)
Smolj. L. A. Smoljaninova (b. 1904)
Smythies B. E. Smythies (b. 1912)
Snogerup S. E. Snogerup (b. 1929)
Sobol. G. F. Sobolewski (1741–1807)
Soczava V. B. Soczava (b. 1905)
Soják J. Soják (b. 1936)
Solac. T. Solacolu (1876–1940)
Solander D. C. Solander (1733–1782)
Sole W. Sole (1741–1802)
Solemacher J. V. L. A. G. Solemacher-Antweiler (b. 1889)
Solms-Laub. H. M. C. L. F. Solms-Laubach (1842–1915)
Soltok. M. Soltoković (fl. 1901)
Sommer. I. Sommerauer (d. 1854)
Sommerf. S. C. Sommerfelt (1794–1838)
Sommier C. P. S. Sommier (1848–1922)
Sonder O. W. Sonder (1812–1881)
Song. A. Songeon (1826–1905)
Soó R. de Soó (b. 1903)
Sørensen T. J. Sørensen (1902–1973)
Soška T. Soška (1876–1948)
Sosn., D. D. I. Sosnowsky (1885–1952)
Soulié J. A. Soulié (1868–1930)
Šourek J. Šourek (1891–1968)
Sowerby J. Sowerby (1757–1822)
Soyer-Willemet H. F. Soyer-Willemet (1791–1867)
Spach E. Spach (1801–1879)
Speg. C. Spegazzini (1858–1926)
Spenner F. K. L. Spenner (1798–1841)
Speta F. Speta (b. 1941)
Spitzner V. Spitzner (1852–1907)
Sprague T. A. Sprague (1877–1958)
Spreitz. G. C. Spreitzenhofer (d. 1883)
Sprengel K. P. J. Sprengel (1766–1833)
Spribille F. J. Spribille (1841–1921)
Spring F. A. Spring (1814–1872)
Spruner W. von Spruner (1805–1874)
Sprygin I. I. Sprygin (1873–1942)
Stace C. A. Stace (b. 1938)
Stadlm. J. Stadlmann (b. 1881)
St-Amans J. F. B. de Saint-Amans (1748–1831)
Standley P. C. Standley (1884–1963)
Stankov S. S. Stankov (1892–1962)

Stapf O. Stapf (1857–1933)
Stearn W. T. Stearn (b. 1911)
Stebbins G. L. Stebbins (b. 1906)
Stebler F. G. Stebler (b. 1852)
Stechm. J. P. Stechmann (fl. 1775)
Steele W. E. Steele (1816–1883)
Stefani C. de Stefani (1851–1924)
Stefanov B. Stefanov (b. 1894)
Stefánsson S. Stefánsson (1863–1921)
Steinb. E. I. Steinberg (1884–1963)
Steinh. A. Steinheil (1810–1839)
Steininger H. Steininger (1856–1891)
Stenström K. O. E. Stenström (1858–1901)
Stephan C. F. Stephan (1757–1814)
Stephenson, T. T. Stephenson (1865–1948)
Stephenson, T. A. T. A. Stephenson (1898–1961)
Stern, F. C. F. C. Stern (1884–1967)
Sternb. C. M. von Sternberg (1761–1838)
Sterneck J. von Sterneck (1864–1941)
Sterner K. R. Sterner (1891–1956)
Sterns, E. E. E. E. Sterns (1846–1926)
Steudel E. G. von Steudel (1783–1856)
Steven C. Steven (1781–1863)
St-Hil. A. C. F. P. de Saint-Hilaire (1779–1853)
Steifelhagen H. Steifelhagen (fl. 1910)
St John H. St John (b. 1892)
St-Lager J. B. Saint-Lager (1825–1912)
Stocks J. E. Stocks (1822–1854)
Stohr G. Stohr (b. 1928)
Stoj. N. Stojanov (1883–1968)
Stoker F. Stoker (1878–1943)
Stokes J. Stokes (1755–1831)
Störk A. Störk (1741–1803)
Strail C. A. Strail (1808–1893)
Strempel J. K. F. Strempel (1800–1872)
Strobl P. G. Strobl (1846–1910)
Stroh G. Stroh (b. 1864)
Strömfelt H. F. G. Strömfelt (1861–1890)
Stuart D. C. Stuart (b. 1940)
Stur D. Stur (1827–1893)
Sturm J. Sturm (1771–1848)
St-Yves A. St-Yves (1855–1933)
Suard V. Suard (fl. 1839)
Suckow, G. G. A. Suckow (d. 1867)
Sudre H. Sudre (1862–1918)
Sudworth G. B. Sudworth (1864–1927)
Suess. K. Suessenguth (1893–1955)
Suffren F. P. de Suffren (1753–1824)
Suk. V. N. Sukaczev (Sukatschew) (1880–1967)
Suksdorf W. N. Suksdorf (1850–1932)
Summerhayes V. S. Summerhayes (1897–1974)
Sumnev. G. P. Sumnevicz (1909–1947)
Sünd. F. Sündermann (1864–1946)
Sundermann H. Sundermann (fl. 1973)
Suter J. R. Suter (1766–1827)
Sutton C. Sutton (1756–1846)
Sutulov A. N. Sutulov (fl. 1914)
Suza J. Suza (1890–1951)
Svob. P. Svoboda (b. 1908)
Swallen J. R. Swallen (b. 1903)
Swartz O. P. Swartz (1760–1818)
Sweet R. Sweet (1783–1835)
Swingle W. T. Swingle (1871–1952)
Syme J. T. I. Boswell Syme (formerly Boswell) (1822–1888)
Symons J. Symons (1778–1851)
Syreistschikov D. P. Syreistschikov (1868–1932)
Szabó Z. Szabó (1882–1944)
Szafer W. Szafer (1886–1970)
Szov. A. J. Szovits (d. 1830)
Szysz. I. Szyszylowicz (1857–1910)
Tab. Mor. A. A. Taborda de Morais (1900–1959)
Tacik, T. T. Tacik (b. 1926)
Talavera S. Talavera Lozano (b. 1945)
Talbot W. H. F. Talbot (1800–1877)
Taliev V. I. Taliev (1872–1932)
Tamamsch. S. G. Tamamschian (b. 1900)
Tanfani E. Tanfani (1848–1892)
Tappeiner F. von Tappeiner (1816–1902)
Taranto E. Taranto Rosso (fl. 1845)
Tarasov ?R. P. Tarasov
Tardieu-Blot M. L. Tardieu-Blot (b. 1902)
Targ.-Tozz. O. Targioni-Tozzetti (1755–1829)
Taubert P. H. W. Taubert (1862–1897)
Tausch I. F. Tausch (1793–1848)
Taylor, G. G. Taylor (b. 1904)
Taylor, P. P. G. Taylor (b. 1926)
Temesy E. Temesy (E. Schönbeck-Temesy) (b. 1930)
Ten. M. Tenore (1780–1861)
Tepl. F. A. Teplouchow (1845–1905)
Terechov A. F. Terechov (b. 1890)
Terpó A. Terpó (b. 1925)
Terracc., A. A. Terracciano (1862–1917)
Terracc., N. N. Terracciano (1837–1921)
Teschner W. P. Teschner (b. 1927)
Tesseron Y.-A. Tesseron (1831–1925)
Texidor J. Texidor y Cos (1836–1885)
Teyber A. Teyber (1846–1913)
Thaisz L. Thaisz (1867–1937)
Thell. A. Thellung (1881–1928)
Thév. A. V. Théveneau (1815–1876)
Thib. ?E. Thibaud (fl. 1785)
Thiéb., J. M.-J. Thiébaut (fl. 1921–1955)
Thielens A. Thielens (1833–1874)
Thomas E. Thomas (1788–1859)
Thomas, C. C. Thomas (fl. 1938–1973)
Thommen E. Thommen (1880–1961)
Thompson, Z. Z. Thompson (1796–1856)
Thomson T. Thomson (1817–1878)
Thore J. Thore (1762–1823)
Thouars L. M. A. Aubert du Petit-Thouars (1758–1831)
Thouin A. Thouin (1747–1824)
Thuill. J. L. Thuillier (1757–1822)
Thunb. C. P. Thunberg (1743–1828)
Thuret G. A. Thuret (1817–1875)
Thwaites G. H. K. Thwaites (1812–1882)
Timb.-Lagr. P. M. E. Timbal-Lagrave (1819–1888)
Timm J. C. Timm (1734–1805)
Tineo V. Tineo (1791–1856)
Tiss. P. G. Tissière (1828–1868)
Tocl K. (C.) Tocl (1870–1910)
Tod. A. Todaro (1818–1892)
Tolm. A. I. Tolmatchev (b. 1903)
Toman, J. J. Toman (b. 1933)
Tommasini M. G. S. de Tommasini (1794–1879)
Top. S. Topali (1900–1944)
Ţopa E. Ţopa (b. 1900)
Topitz A. Topitz (b. 1857)
Torges K. E. W. Torges (1831–1917)
Torrey J. Torrey (1796–1873)
Tourlet E.-H. Tourlet (1843–1907)
Tournay R. L. J. A. Tournay (1925–1972)
Touton K. Touton (1858–1934)

Townsend F. Townsend (1822–1905)
Trabut L. Trabut (1853–1929)
Tracey R. Tracey (R. Schreiner) (b. 1951)
Tratt. L. Trattinick (1764–1849)
Traub H. P. Traub (b. 1890)
Trautv. E. R. von Trautvetter (1809–1889)
Travis W. G. Travis (1877–1958)
Trelease W. Trelease (1857–1945)
Trev. L. C. Treviranus (1779–1864)
Trevisan V. B. A. Trevisan de Saint-Léon (1817–1897)
Trew C. J. Trew (1695–1769)
Trimen H. Trimen (1843–1896)
Trin. K. B. von Trinius (1778–1844)
Tropea C. Tropea (fl. 1910)
Trotter A. Trotter (1874–1967)
Trotzky P. Kornuch-Trotzky (1803–1877)
Truchaleva N. A. Truchaleva (b. 1927)
Tryon jun., R. M. R. M. Tryon jun. (b. 1916)
Tubilla T. Andrés y Tubilla (1859–1882)
Tuckerman E. Tuckerman (1817–1886)
Tuntas B. Tuntas (b. 1871)
Turcz. N. S. Turczaninow (1796–1864)
Turesson G. W. Turesson (1892–1970)
Turner, D. D. Turner (1775–1858)
Turpin P. J. F. Turpin (1775–1840)
Turra A. Turra (1730–1796)
Turrill W. B. Turrill (1890–1961)
Tutin T. G. Tutin (b. 1908)
Tuzson J. Tuzson (1870–1941)
Tzvelev N. N. Tzvelev (b. 1925)
Ucria Bernadino da Ucria (Michelangelo Aurifici) (1739–1796)
Uechtr. R. F. C. von Uechtritz (1838–1886)
Ugr. K. A. Ugrinsky (fl. 1920)
Uhrová A. Hrabětová-Uhrová (b. 1900)
Ujhelyi J. Ujhelyi (b. 1910)
Ulbr. E. Ulbrich (1879–1952)
Underw. J. Underwood (d. 1834)
Unger F. J. A. N. Unger (1800–1870)
Ung. Sternb. F. Ungern-Sternberg (1808–1885)
Urban I. Urban (1848–1931)
Urum. I. K. Urumoff (1856–1937)
Utinet — Utinet (fl. 1839)
Utkin L. A. Utkin (b. 1884)
Vaarama O. A. Vaarama (1912–1975)
Vacc. L. Vaccari (1873–1951)
Vahl M. H. Vahl (1749–1804)
Vahl, J. J. L. M. Vahl (1796–1854)
Valck.-Suringar J. Valckenier-Suringar (1865–1932)
Valdés B. Valdés Castrillón (b. 1942)
Valentine D. H. Valentine (b. 1912)
Valsecchi F. Valsecchi (b. 1931)
Vandas K. Vandas (1861–1923)
Vandelli D. Vandelli (1735–1816)
Van den Bosch R. B. van den Bosch (1810–1862)
Van Hall H. C. van Hall (1801–1874)
Van Houtte L. B. van Houtte (1810–1876)
Vaniot E. Vaniot (d. 1913)
Van Ooststr. S. J. van Ooststroom (b. 1906)
Van Soest J. L. van Soest (b. 1898)
Vanucchi — Vanucchi (fl. 1838)
Vasc. J. de Carvalho e Vasconcellos (1897–1972)
Vasinger A. V. Vasinger (1892–*c.* 1944)
Vassil., V. V. N. Vassiliev (b. 1890)
Vassilcz. I. T. Vassilczenko (b. 1903)
Vatke G. K. W. Vatke (1849–1889)
Vaucher J. P. E. Vaucher (1763–1841)
Vavilov N. I. Vavilov (1887–1943)
Vayr. E. Vayreda y Vila (1848–1901)
Velen. J. Velenovský (1858–1949)
Velloso J. M. de Conceição Velloso (Vellozo) (1742–1811)
Vendr. X. Vendrely (fl. 1895)
Vent. E. P. Ventenat (1757–1808)
Vent, W. W. Vent (b. 1920)
Verdcourt B. Verdcourt (b. 1925)
Verguin L. Verguin (1868–1936)
Verlot J.-B. Verlot (1825–1891)
Verlot, B. P. B. L. Verlot (1836–1897)
Vermeulen P. Vermeulen (b. 1899)
Vest L. C. von Vest (1776–1840)
Vestergren J. T. C. Vestergren (1875–1930)
Vetter J. Vetter (1865–1945)
Vicioso, B. B. Vicioso (1850–1929)
Vicioso, C. M. C. Vicioso Martínez (1897–1968)
Vidal L. M. Vidal
Vierh. F. Vierhapper (1876–1932)
Vig. L. G. A. Viguier (1790–1867)
Vigineix G. Vigineix (d. 1877)
Vigo J. Vigo Bonada (b. 1937)
Vill. D. Villars (Villar) (1745–1814)
Villar, H. del E. Huguet del Villar (1871–1951)
Villar, L. L. Villar Perez (b. 1946)
Vilmorin P. L. F. L. de Vilmorin (1816–1860)
Vilmorin, R. de R.-P.-V. de Vilmorin (b. 1905)
Vindt J. Vindt (b. 1915)
Vines S. H. Vines (1849–1934)
Vis. R. de Visiani (1800–1878)
Vitman F. Vitman (1728–1806)
Viv. D. Viviani (1772–1840)
Vogel B. C. Vogel (1745–1825)
Vogel, T. J. R. T. Vogel (1812–1841)
Vogler J. A. Vogler (1746–1816)
Voigt J. O. Voigt (1798–1843)
Volk. A. Volkart (1873–1951)
Vollmann F. Vollmann (1858–1917)
Vorosch. V. N. Voroschilov (b. 1908)
Voss A. Voss (1857–1924)
Vuk. L. F. Vukotinović (1813–1893)
Vved. A. I. Vvedensky (b. 1898)
Wachter W. H. Wachter (1882–1946)
Wagenitz G. Wagenitz (b. 1927)
Wagner, H. J. Wagner (H. Wagner) (1870–1955)
Wagner, R. R. Wagner (fl. 1887)
Wahlberg P. F. Wahlberg (1800–1877)
Wahlenb. G. Wahlenberg (1780–1851)
Wainio E. A. Wainio (later Vainio) (1853–1929)
Waisb. A. Waisbecker (1835–1916)
Waldst. F. A. von Waldstein-Wartemberg (1759–1823)
Wale R. S. Wale (d. 1952)
Walker, S. S. Walker (b. 1924)
Wall. N. Wallich (1786–1854)
Wallr. K. F. W. Wallroth (1792–1857)
Walpers W. G. Walpers (1816–1853)
Walsh R. Walsh (1772–1852)
Walter T. Walter (1740–1789)
Walters S. M. Walters (b. 1920)
Walther E. Walther (b. 1912)
Wangenh. F. A. J. von Wangenheim (1747–1800)
Wangerin W. L. Wangerin (1884–1938)
Warburg O. Warburg (1859–1938)
Warburg, E. F. E. F. Warburg (1908–1966)
Warming J. E. B. Warming (1841–1924)
Wartm. F. B. Wartmann (1830–1902)

Watson, H. C. H. C. Watson (1804–1881)
Watson, S. S. Watson (1826–1892)
Watson, W. C. R. W. C. R. Watson (1885–1954)
Watt D. A. P. Watt (1830–1917)
Watzl B. Watzl (1886–1945)
Weatherby C. A. Weatherby (1875–1949)
Webb P. B. Webb (1793–1854)
Webb, D. A. D. A. Webb (b. 1912)
Weber G. H. Weber (1752–1828)
Weber fil. F. Weber (1781–1823)
Weberling F. Weberling (b. 1926)
Webster A. D. Webster (fl. 1886–1920)
Weddell H. A. Weddell (1819–1877)
Weevers T. Weevers (1875–1952)
Wehrli — Wehrli
Weigel C. E. von Weigel (1748–1831)
Weihe K. E. A. Weihe (1779–1834)
Weiller M. Weiller (1880–1945)
Weim., G. K. G. H. Weimarck (b. 1936)
Wein, K. K. Wein (1883–1968)
Weinm. J. A. Weinmann (1782–1858)
Weiss E. Weiss (1837–1870)
Welden F. L. von Welden (1782–1853)
Welw. F. Welwitsch (1806–1872)
Wendelberger G. Wendelberger (b. 1915)
Wendelbo P. E. B. Wendelbo (b. 1927)
Wenderoth G. W. F. Wenderoth (1774–1861)
Wendl. J. C. Wendland (1755–1828)
Wendl., H. A. H. A. Wendland (1825–1903)
Wendl. fil. H. L. Wendland (1792–1869)
Wenzig T. Wenzig (1824–1892)
Werner H. Werner (b. 1839)
Werner, K. K. Werner (b. 1928)
Wesmael, A. A. Wesmael (1832–1905)
Wessely I. Wessely (fl. 1960)
West, C. C. West (b. 1887)
Westcott F. Westcott (d. 1861)
Weston R. Weston (1733–1806)
Wettst. R. von Wettstein (1863–1931)
Wettst., F. F. von Wettstein (1895–1945)
Wheldon J. A. Wheldon (1862–1924)
White J. White (*c.* 1750–1832)
Whitehead F. H. Whitehead (b. 1913)
Wibel A. W. E. C. Wibel (1775–1814)
Wibiral E. Wibiral (1878–1950)
Wichura M. E. Wichura (1817–1866)
Wickens G. E. Wickens (b. 1927)
Widder F. Widder (1892–1974)
Widmer E. Widmer (1862–1952)
Wieg. K. McK. Wiegand (1873–1942)
Wierzb. P. Wierzbicki (1794–1847)
Wiesb. J. Wiesbaur (1836–1906)
Wiggers F. H. Wiggers (1746–1811)
Wight R. Wight (1796–1872)
Wiinst. K. J. F. Wiinstedt (1878–1964)
Wikström J. E. Wikström (1789–1856)
Wilce J. H. Wilce (b. 1931)
Wilczek E. Wilczek (1867–1948)
Wildhaber O. J. Wildhaber (1908–1976)
Wilensky D. G. Wilensky (1892–1959)
Willd. C. L. Willdenow (1765–1812)
Willemet P. R. Willemet (1735–1807)
Williams, F. N. F. N. Williams (1862–1923)
Willk. H. M. Willkomm (1821–1895)
Wilmott A. J. Wilmott (1888–1950)
Wilson, E. H. E. H. Wilson (1876–1930)
Wilson, W. M. W. M. Wilson (1799–1871)
Wimmer C. F. H. Wimmer (1803–1868)
Winge Ö. Winge (1886–1964)
Winkler M. Winkler (1812–1889)
Winter, F. F. B. Winter (1795–1869)
Winter, N. N. A. Winter (1898–1934)
Winterl J. J. Winterl (1739–1809)
Wirsing A. L. Wirsing (1734–1797)
Wirtgen P. W. Wirtgen (1806–1870)
Wissjul. E. D. Wissjulina (1898–1972)
Witasek J. Witasek (1865–1910)
With. W. Withering (1741–1799)
Wittm. M. C. L. Wittmack (1839–1929)
Wittrock V. B. Wittrock (1839–1914)
Wohlf. R. Wohlfahrt (1830–1888)
Wolf (recte **J. P. Wolff**)
Wolf, F. O. F. O. Wolf (1838–1905)
Wolf, N. M. N. M. von Wolf (1724–1784)
Wolf, T. F. T. Wolf (1841–1921)
Wolff, D. (recte **J. P. Wolff**)
Wolff, H. H. Wolff (1866–1929)
Wolff, J. P. J. P. Wolff (Wolf, Wolfius, Wolffius) (*c.* 1743–1825)
Wolfg. J. F. Wolfgang (1776–1859)
Wolfner W. Wolfner (fl. 1858)
Wollaston G. B. Wollaston (1814–1899)
Wolley-Dod A. H. Wolley-Dod (1861–1948)
Wolny A. R. Wolny (d. ?1829)
Wołoszczak E. Wołoszczak (1835–1918)
Wood, D. D. Wood (b. 1939)
Wood, W. W. Wood (1745–1808)
Woods, J. J. Woods (1776–1864)
Woodson R. E. Woodson (1904–1963)
Wormsk. M. Wormskiold (1783–1845)
Woronow J. N. Woronow (Voronov) (1874–1931)
Woynar H. K. Woynar (1865–1917)
Wulf E. V. Wulf (E. W. Wulff, E. V. Vul'f) (1855–1941)
Wulfen F. X. von Wulfen (1728–1805)
Wünsche J. G. Wünsche (fl. 1804)
Yavin Z. Ovadiahu-Yavin (b. 1936)
Yeo P. F. Yeo (b. 1929)
Young, D. P. D. P. Young (1917–1972)
Yuncker T. G. Yuncker (1891–1964)
Zabel H. Zabel (1832–1912)
Zadoks J. C. Zadoks (fl. 1955)
Zaffran J. Zaffran (b. 1935)
Zahar. C. Zahariadi (b. 1901)
Zahlbr. J. Zahlbruckner (1782–1851)
Zahn K. H. Zahn (1865–1940)
Zalessky K. M. Zalessky (b. 1890)
Zamels A. Zamels (Zamelis) (1897–1943)
Zanted. G. Zantedeschi (1773–1846)
Zapał. H. Zapałowicz (1852–1917)
Zauschner J. B. J. Zauschner (1737–1799)
Zawadzki A. Zawadzki (1798–1868)
Zefirov B. M. Zefirov (1915–1957)
Zelen. N. M. Zelenetzky (1859–1923)
Zenari S. Zenari (1895–1956)
Zerafa S. Zerafa (Zerapha) (1791–1871)
Zerov D. K. Zerov (1895–1971)
Žertová A. Chrtková-Žertová (b. 1930)
Zett., J. W. J. W. Zetterstedt (1785–1874)
Zevenbergen H. A. Zevenbergen (b. 1943)
Zeyher C. L. P. Zeyher (1799–1858)
Zhuk. P. M. Zhukovsky (1888–1975)
Zielonk. W. Zielonkowski (b. 1940)
Zimm., W. W. Zimmermann (b. 1892)

Zimmeter A. Zimmeter (1848–1897)
Zinger, N. N. Zinger (1866–1923)
Zinger, V. V. J. Zinger (1836–1907)
Zinn J. G. Zinn (1727–1759)
Zinserl. Y. D. Zinserling (1894–1938)
Ziz J. B. Ziz (1779–1829)
Zodda G. Zodda (1877–1968)
Zoega J. Zoega (1742–1788)
Zohary M. Zohary (b. 1898)
Zotov V. D. Zotov (1908–1977)
Zoz I. G. Zoz (b. 1903)
Zsák Z. Zsák (1880–1966)
Zucc. J. G. Zuccarini (1797–1848)
Zuccagni A. Zuccagni (1754–1807)

APPENDIX II

KEY TO THE ABBREVIATIONS OF TITLES OF BOOKS CITED IN VOLUME 5

Aiton, *Hort. Kew.*
W. Aiton, *Hortus kewensis, or a Catalogue of the Plants cultivated in the Royal Botanic Garden at Kew*. Ed. 1. London. 1789. (**1–3** in 1789.) Ed. 2, by W. T. Aiton. London. 1810–1813. (**1** in 1810; **2** & **3** in 1811; **4** in 1812; **5** in 1813. Cf. F. A. Stafleu & R. S. Cowan, *Taxonomic Literature* ed. 2, **1**: 25–26 (1976).)

Aiton fil., *Epit. Hort. Kew.*
W. T. Aiton, *An Epitome of the second Edition of* Hortus kewensis *for the use of practical Gardeners*. London. 1814.

All., *Auct. Fl. Pedem.*
C. Allioni, *Auctarium ad Floram pedemontanam cum Notis et Emendationibus*. Augustae Taurinorum. 1789.

All., *Auct. Syn. Stirp. Horti Taur.*
C. Allioni, *Auctarium ad Synopsim methodicam Stirpium Horti reg. taurinensis*. [Torino.] 1773. (Cf. J. E. Dandy, *Taxon* **19**: 617–626 (1970) and F. A. Stafleu & R. S. Cowan, *Taxonomic Literature* ed. 2, **1**: 35 (1976).)

All., *Fl. Pedem.*
C. Allioni, *Flora pedemontana, sive Enumeratio methodica Stirpium indigenarum Pedemontii*. Augustae Taurinorum. 1785. (**1–3** in 1785.)

Ames, *Orchidaceae*
O. Ames, *Orchidaceae: Illustrations and Studies of the Family Orchidaceae*. Boston & New York. 1905–1922. (**1** & **2**, Boston & New York; **3–7**, Boston. **1** in 1905; **2** & **3** in 1908; **4** in 1910; **5** in 1915; **6** in 1920; **7** in 1922).

Amo, *Fl. Iber.*
Mariano del Amo y Mora, *Flora fanerogámica de la Península ibérica ó Descripción de las Plantas cotyledóneas que crecen en España y Portugal*. Granada. 1871–1873. (**1** & **2** in 1871; **3** & **4** in 1872; **5** & **6** in 1873.)

Andersson, N. J., *Gram. Scand.*
N. J. Andersson, *Gramineae Scandinaviae in Dania, Suecia, Norvegia et Fennia sponte crescentes, descriptae et delineatae*. Holmiae. 1852. (Comprises *Fasciculus secundus* of N. J. Andersson, *Plantae Scandinaviae Descriptionibus et Figuris analyticis adumbratae*. Holmiae. 1849–1852.)

Andrews, *Bot. Reposit.*
H. C. Andrews, *The Botanist's Repository*. Ed. 1. London. 1797–1815. (**1–10**. For dates cf. F. A. Stafleu & R. S. Cowan, *Taxonomic Literature* ed. 2, **1**: 50–51 (1976).) Ed. 2. London. 1816.

Arcangeli, *Comp. Fl. Ital.*
G. Arcangeli, *Compendio della Flora italiana, ossia Manuale per la Determinazione delle Piante che trovansi selvatiche od inselvatichite nell'Italia e nelle Isole adiacenti*. Ed. 1. Torino. 1882. Ed. 2. Torino & Roma. 1894.

Ardoino, *Fl. Alp. Marit.*
H. J. P. Ardoino, *Flore analytique du Département des Alpes-maritimes*. Ed. 1. Menton. 1867. Ed. 2. Menton & Nice. 1879.

Ard., *Animadv. Bot. Spec. Alt.*
P. Arduino, *Animadversionum botanicarum Specimen alterum*. Venetiis. 1763.

Ascherson & Graebner, *Syn. Mitteleur. Fl.*
P. F. A. Ascherson & K. O. P. P. Graebner, *Synopsis der mitteleuropäischen Flora*. Ed. 1. Leipzig. 1896–1938. (**1**: pp. 1–160 in 1896; pp. 161–416 in 1897; **2(1)**: pp. 1–64 in 1898; pp. 65–304 in 1899; pp. 305–544 in 1900; pp. 545–704 in 1901; pp. 705–796 in 1902; **2(2)**: pp. 1–144 in 1902; pp. 145–224 in 1903; pp. 225–530 in 1904; **3**: pp. 1–320 in 1905; pp. 321–560 in 1906; pp. 561–934 in 1907; **4**: pp. 1–80 in 1908; pp. 81–320 in 1909; pp. 321–400 in 1910; pp. 401–640 in 1911; pp. 641–800 in 1912; pp. 801–886 in 1913; **5(1)**: pp. 1–224 in 1913; pp. 225–400 in 1914; pp. 401–480 in 1915; pp. 481–544 in 1916; pp. 545–624 in 1917; pp. 625–784 in 1918; pp. 785–948 in 1919; **5(2)**: pp. 1–160 in 1920; pp. 161–400 in 1921; pp. 401–480 in 1922; pp. 481–560 in 1923; pp. 561–640 in 1926; pp. 641–812 in 1929; **5(3)**: pp. 1–98 in 1935; **5(4)**: pp. 1–160 in 1936; pp. 161–252 in 1938; **6(1)**: pp. 1–64 in 1900; pp. 65–240 in 1901; pp. 241–560 in 1902; pp. 561–640 in 1903; pp. 641–800 in 1904; pp. 801–896 in 1905; **6(2)**: pp. 1–160 in 1906; pp. 161–496 in 1907; pp. 497–688 in 1908; pp. 689–1008 in 1909; pp. 1009–1094 in 1910; **7**: pp. 1–80 in 1913; pp. 81–240 in 1914; pp. 241–320 in 1915; pp. 321–400 in 1916; pp. 401–480 in 1917; **12(1)**: pp. 1–80 in 1922; pp. 81–160 in 1924; pp. 161–400 in 1929; pp. 401–492 in 1930; **12(2)**: pp. 1–160 in 1930; pp. 161–480 in 1931; pp. 481–640 in 1934; pp. 641–790 in 1935; **12(3)**: pp. 1–320 in 1936; pp. 321–480 in 1937; pp. 481–708 in 1938.) Ed. 2. Leipzig. 1912–1920. (**1**: pp. 1–480 in 1912; pp. 481–630 in 1913; **2(1)**: pp. 1–80 in 1919; pp. 81–160 in 1920.)

Asso, *Syn. Stirp. Arag.*
I. J. de Asso y del Rio, *Synopsis Stirpium indigenarum Aragoniae*. Massiliae. 1779.

Baillon, *Hist. Pl.*
H. E. Baillon, *Histoire des Plantes*. Paris. 1866–1895. (**1**: pp. 1–88 in 1866; pp. 89–288 in 1868; pp. 289–488, i–xi in 1869; **2**: pp. 1–71 in 1869; pp. 73–428 in 1870; pp. 429–512 in 1872; **3**: pp. 1–292 in 1871; pp. 293–545 in 1872; **4**: pp. 1–264 in 1872; pp. 265–520 in 1873; **5**: pp. 1–256 in 1874; pp. 257–516 in 1874 or 1875; **6**: pp. 1–92 in 1875; pp. 93–216 in 1875 or 1876; pp. 217–304 in 1876; pp. 305–523 in 1877; **7**: pp. 1–256 in 1879; pp. 257–546 in 1880; **8**: pp. 1–316 in 1882; pp. 317–515 in 1885; **9**: pp. 1–80 in 1886; pp. 81–224 in 1887; pp. 225–491 in 1888; **10**: pp. 1–112 in 1888; pp. 113–220 in 1889; pp. 221–402 in 1890; pp. 403–476 in 1891; **11**: pp. 1–304 in 1891; pp. 305–494 in 1892; **12**: pp. 1–134 in 1892; pp. 135–334 in 1893; pp. 335–611 in 1894; **13**: pp. 1–244 in 1894; pp. 245–523 in 1895. Cf. F. A. Stafleu & R. S. Cowan, *Taxonomic Literature* ed. 2, **1**: 97–99 (1976).)

Baker, *Handb. Amaryll.*
J. G. Baker, *Handbook of the* Amaryllideae, *including the* Alstroemeriae *and* Agaveae. London. 1888.

Balbis, *Elenco*
G. B. Balbis, *Elenco delle Piante crescenti ne' Contorni di Torino*. Torino. 1801. (This includes (pp. 83–102) *Additamentum ad Floram pedemontanam*.)

Barbey, C. & W., *Herb. Levant*
C. & W. Barbey-Boissier, *Herborisations au Levant*. Lausanne. 1882.

Barbey, W., *Fl. Sard. Comp.*
W. Barbey-Boissier, *Florae Sardoae Compendium. Catalogue raisonné des Végétaux observés dans l'Île de Sardaigne.* Lausanne. 1885. Cf. F. A. Stafleu & R. S. Cowan, *Taxonomic Literature* ed. 2, **1**: 119 (1976).

Bast., *Essai Fl. Maine Loire*
T. Bastard, *Essai sur la Flore du Département de Maine et Loire.* Angers. 1809.

Beauv., *Agrost.*
A. M. F. J. Palisot de Beauvois, *Essai d'une nouvelle Agrostographie.* Paris. 1812.

Becherer, *Beitr. Pflanzengeogr. Nordschweiz*
A. Becherer, *Beiträge zur Pflanzengeographie der Nordschweiz, mit besonderer Berücksichtigung der oberrheinischen Florenstrahlungen.* Colmar. 1925.

Bellardi, *App. Fl. Pedem.*
C. A. L. Bellardi, *Appendix Ludovici Bellardi ad Floram pedemontanam.* Augustae Taurinorum. 1792. (Reprinted as *Mém. Acad. Sci. Turin* **10**: 209–286 (1793).)

Berchtold & Opiz, *Ökon.-Techn. Fl. Böhm.*
F. von Berchtold & P. M. Opiz, *Ökonomisch-technische Flora Böhmens.* Prag. 1836–1843. (**1** in 1836; **2(1)** in 1838; **2(2)** in 1839; **3(1)** in 1841; **3(2)** in 1843.) **1** by F. von Berchtold & W. B. Seidl.

Bertol., *Fl. Ital.*
A. Bertoloni, *Flora italica, sistens Plantas in Italia et Insulis circumstantibus sponte nascentes.* Bononiae. 1833–1854. (**1–10**; for dates cf. F. A. Stafleu & R. S. Cowan, *Taxonomic Literature* ed. 2, **1**: 203–205 (1976).)

Besser, *Prim. Fl. Galic.*
W. S. J. G. von Besser, *Primitiae Florae Galiciae austriacae utriusque.* Viennae. 1809. (**1** & **2** in 1809.)

Besser, *Enum. Pl. Volhyn.*
W. S. J. G. von Besser, *Enumeratio Plantarum hucusque in Volhynia, Podolia, Gub. kiioviensi, Bessarabia cis-tyraica et circa Odessam collectarum, simul cum Observationibus in Primitias Florae Galiciae austriacae.* Vilnae. 1822.

Bieb., *Beschr. Länd. Terek Casp.*
F. A. Marschall von Bieberstein, *Beschreibung der Länder zwischen den Flüssen Terek und Kur am caspischen Meere. Mit einem botanischen Anhang.* Frankfurt. 1800.

Bieb., *Fl. Taur.-Cauc.*
F. A. Marschall von Bieberstein, *Flora taurico-caucasica, exhibens Stirpes phaenogamas in Chersoneso taurica et Regionibus caucasicis sponte crescentes.* Charkoviae. 1808–1819. (**1** & **2** in 1808; **3**, *Supplementum*, in 1819.)

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K. F. W. Wallroth, *Erster Beitrag zur Flora hercynica*. Halle. 1840.

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P. B. Webb & S. Berthelot, *Phytographia canariensis*. (Vol. **3(2)** of *Histoire naturelle des Îles Canaries*.) Paris. 1836–1850. (For dates cf. F. A. Stafleu, *Taxonomic Literature* 495 (1967).)

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G. H. Weber, *Supplementum Florae holsaticae*. Kilonii. 1787.

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F. Weber & D. M. H. Mohr, *Beiträge zur Naturkunde*. Kiel. 1805–1810. (**1** in 1805–1806; **2** in 1810. Cf. F. A. Stafleu, *Taxonomic Literature* 496 (1967).)

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C. E. von Weigel, *Observationes botanicae*. Gryphiswaldiae. 1772.

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R. Weston, *Botanicus universalis et Hortulanus./The universal Botanist and Nurseryman*. London. 1770–1777. (**1** in 1770; **2** in 1771; **3** in 1772; **4** in 1777.)

Willd., *Enum. Pl. Horti Berol.*
C. L. Willdenow, *Enumeratio Plantarum Horti regii botanici berolinensis*. Berolini. 1809. ***Suppl.***, *Supplementum* by D. F. von Schlechtendal. Berolini. 1814. (For dates cf. W. T. Stearn, *Jour. Bot. (London)* **75**: 234 (1937).)

Willd., *Sp. Pl.*
C. L. Willdenow, ed. 4 of C. von Linné, *Species Plantarum*. Berolini. 1797–1806. (**1(1)**: pp. 1–495 in 1797; **1(2)**: pp. 496–1968 in 1798; **2(1 & 2)** in 1799; **3(1)**: pp. 1–847 in 1800; **3(2)**: pp. 848–1474 in 1802; **3(3)**: pp. 1475–2409 in 1803; **4(1)**: pp. 1–629 in 1805; **4(2)**: pp. 630–1157 in 1806. Cf. F. A. Stafleu, *Taxonomic Literature* 503–504 (1967).)

Willk., *Ill. Fl. Hisp.*
H. M. Willkomm, *Illustrationes Florae Hispaniae Insularumque Balearium*. Stuttgart. 1881–1892. (**1(1)**: pp. 1–12, tt. 1–9 in 1881; **1(2)**: pp. 13–28, tt. 10–18 in 1881; **1(3)**: pp. 29–40, tt. 19–28 in 1881; **1(4–6)**: pp. 44–88, tt. 29–56 in 1882; **1(7 & 8)**: pp. 89–120, tt. 57–74 in 1883; **1(9)**: pp. 121–136, tt. 75–83 in 1884; **1(10)**: pp. i–vii, 137–157, tt. 84–92 in 1885; **2(11)**: pp. 1–16, tt. 98–101 in 1886; **2(12)**: pp. 17–32, tt. 102–110 in 1886; **2(13)**: pp. 33–48, tt. 111–119 in 1887; **2(14)**: pp. 49–64, tt. 120–127 in 1888; **2(15 & 16)**: pp. 65–98, tt. 128–146 in 1889; **2(17)**: pp. 99–112, tt. 147–155 in 1890; **2(18)**: pp. 113–126, tt. 156–164 in 1891; **2(19)**: pp. 127–140, tt. 165–173 in 1892; **2(20)**: pp. i–vii, 141–156, tt. 174–183 in 1892. Cf. F. A. Stafleu, *Taxonomic Literature* 506 (1967).)

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H. M. Wilkomm, *Supplementum Prodromi Florae hispanicae*. Stuttgartiae. 1893.

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C. F. H. Wimmer, *Flora von Schlesien*. Ed. 1. Berlin. 1832. Ed. 2. Breslau. 1841. *Ergänzungsband*. Breslau. 1845. Ed. 3. Breslau. 1857.

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W. Withering, *A botanical Arrangement of all the Vegetables naturally growing in Great Britain, with Descriptions of the Genera and Species*. Ed. 1. Birmingham & London. 1776. Ed. 2, titled *A botanical Arrangement of British Plants*. Birmingham & London. 1787–1792. (**1** & **2** in 1787; **3**(**1**) in 1789; 3(**2**) in 1792.) Ed. 3, titled *An Arrangement of British Plants* by J. Stokes. London. 1796. Ed. 4, titled *A systematic Arrangement of British Plants* by W. Withering fil. London. 1801. Ed. 5. Birmingham. 1812. Ed. 6, titled *An Arrangement of British Plants*. London. 1818. Ed. 7. London. 1830.

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E. V. Wulf, Флора Крыма [*Flora Kryma*]./*Flora taurica*. Jalta. 1927–1969. (**1**(**1**) in 1927; **1**(**2**) in 1929; **1**(3) in 1930; **1**(**4**) in 1951; **2**(**1**) in 1947; **2**(**2**) in 1960; **2**(3) in 1953; **3**(**1**) in 1957; 3(**2**) in 1966; 3(3) in 1969.) **1**(**2**–**3**), Leningrad; **1**(**4**), **2**(**2**–**3**) & **3**(**1**–**2**), Moskva; **2**(**1**), Moskva & Leningrad. Дополнения к I Тому "Флоры Крыма" [*Dopolnenija k I Tomu 'Flory Kryma'*]./*Addenda et Corrigenda ad Vol. I 'Florae tauricae'* Jalta. 1959.

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H. Zapałowicz, *Conspectus Florae Galiciae criticus./Krytyczny Przegląd Roślinności Galicyi*. Kraków. 1906–1911. (**1** in 1906; **2** in 1908; **3** in 1911.)

APPENDIX III

KEY TO THE ABBREVIATIONS OF TITLES OF PERIODICALS AND ANONYMOUS WORKS CITED IN VOLUME 5

Abh. Akad. Wiss. (München)
Abhandlungen der mathemat.-physikalischen Classe der königlich-bayerischen Akademie der Wissenschaften. München. **1–30.** 1832–1926. (Minor variations of title occur.) Nov. ser. **1** → 1929 → titled *Abhandlungen der bayerischen Akademie der Wissenschaften, mathematisch-naturwissenschaftliche Abteilung.*

Abh. Böhm. Ges. Wiss.
Abhandlungen des böhmischen Gesellschaft der Wissenschaften. Prag. Ser. 1, **1–4,** 1786–1789. Ser. 2, titled *Neuere Abhandlungen der k. böhmischen Gesellschaft der Wissenschaften,* **1–3,** 1791–1798. Ser. 3, titled *Abhandlungen der königlichen böhmischen Gesellschaft der Wissenschaften,* **1–8,** 1804–1823. Ser. 4, **1–5,** 1817–1837. Ser. 5, **1–14,** 1838–1867. Ser. 6, **1–12,** 1867–1884. Ser. 7, **1–4,** 1885–1891. (Ser. 6, **11–12,** 1881–1884, also titled *Pojedáni královské české Společnosti Nauk*; ser. 7 also titled *Rozpravy královské Společnosti Nauk.*)

Abh. Naturw. Ver. Bremen
Abhandlungen herausgegeben vom naturwissenschaftlichen Verein zu Bremen. Bremen. 1868 →.

Abh. Ver. Naturk. Kassel
Jahresbericht über die Thätigkeit des Vereins für Naturkunde in Cassel. Cassel. **1–11,** 1837–1847; titled *Bericht . . . ,* **12,** 1860; titled *Bericht des Vereins (Vereines) für Naturkunde zu Cassel (Kassel),* **13–39,** 1863–1894; *Abhandlungen und Berichte des Vereins für Naturkunde zu Kassel,* **40–58,** 1895–1936; later titled *Abhandlungen des Vereins für Naturkunde zu Kassel.*

Abh. Zool.-Bot. Ges. Wien
Abhandlungen der kaiserlich-königliche zoologisch-botanischen Gesellschaft in Wien. Wien. 1901 →.

Acta Acad. Theod.-Pal.
Acta Academiae theodoro-palatinae. Mannheimii. **1–7,** 1766–1794.

Acta Agric. Suec.
Acta Agriculturae suecana. Stockholm. **1** →, 1945 →.

Acta Arct.
Acta arctica. København. **1** →, 1943 →.

Acta Biol. Acad. Sci. Hung.
Acta biologica Academiae Scientiarum hungaricae. Budapest. **1** →, 1950 →.

Acta Bot. Acad. Sci. Hung.
Acta botanica Academiae Scientiarum hungaricae. Budapest. **1** →, 1954 →.

Acta Bot. Bohem.
Acta botanica bohemica. Praha. 1922–1947.

Acta Bot. Croat.
Cf. *Acta Bot. Inst. Bot. Univ. Zagreb.*

Acta Bot. Inst. Bot. Univ. Zagreb.
Acta botanica Instituti botanici Universitatis zagrebensis. / Izvješća botaničkog Zavoda Sveučilišta u Zagrebu. Zagreb. **1–15,** 1925–1956 (in **5–15,** 1930–1956, Serbo-Croat title reads *Izvješća botaničkog Instituta Univerziteta u Zagrebu*); titled ***Acta Bot. Croat.,*** *Acta botanica croatica,* **16** →, 1957 →.

Acta Bot. Neerl.
Acta botanica neerlandica. Amsterdam. 1952 →.

Acta Fac. Rer. Nat. Univ. Comen. Bot.
Acta Facultatis Rerum naturalium Universitatis comenianae. Botanica. Bratislava. 1 → , 1956 → .

Acta Horti Bot. Prag.
Acta Horti botanici pragensis. Praga. 1962 → .

Acta Horti Bot. Univ. Jurjev.
Труды ботаническаго Сада имп. Юрьевскаго Университета [*Trudy botaničeskago Sada imp. Jur'evskago Universiteta*]. *Acta Horti botanici Universitatis imp. Jurjevensis.* Jurjev. 1900–1914.

Acta Horti Gothob.
Acta Horti gothoburgensis [*gotoburgensis*]./ *Meddelanden från Göteborgs botaniska Trädgård.* Göteborg. 1924 → .

Acta Horti Petrop.
Acta Horti petropolitani. Peterburgi. **1–43,** 1871–1931. (With alternative title Труды имп. С.-Петербургскаго ботаническаго Сада [*Trudy imp. S.-Peterburgskago botaničeskago Sada*] 1871–1918, and Труды главнаго ботаническаго Сада [*Trudy glavnago botaničeskago Sada*] 1918–1931.)

Acta Inst. Bot. Acad. Sci. URSS (Ser. I)
Труды ботаническаго Института Академии Наук СССР. Серия 1. Флора и Систематика высших Растений [*Trudy botaničeskago Instituta Akademii Nauk SSSR. Serija 1. Flora i Sistematika vysšikh Rastenij*]./*Acta Instituti botanici Academiae Scientiarum URSS. Ser. 1.* Leningrad & Mosqua. 1933 → .

Acta Mus. Nation. Prag.
Sborník národního Musea v Praze. B (Přírodovědný)./Acta Musei nationalis Pragae. B (Scientiae naturales). Pragae. **1** → , 1938 → .

Acta Phytotax. Geobot. (Kyoto)
Acta phytotaxonomica et geobotanica. Kyoto. **1** → , 1932 → .

Acta Soc. Bot. Polon.
Acta Societatis Botanicorum Poloniae. Warszawa. **1** →, 1923 →.

Acta Soc. Fauna Fl. Fenn.
Acta Societatis pro Fauna et Flora fennica. Helsingforsiae. 1875 → .

Acta Soc. Sci. Fenn.
Acta Societatis Scientiarum fennicae. Helsingforsiae. Ser. 1, **1–50,** 1840–1926. Nov. ser., B, **1** → , 1931 → .

Acta Univ. As. Med.
Труды средне-азиатского государственного Университета [*Trudy sredne-aziatskogo gosudarstvennogo Universiteta*]./*Acta Universitatis Asiae mediae.* Taschkent. **1–35,** 1928–1937.

Acta Univ. Carol. (Biol.)
Acta Universitatis carolinae. Biologica. Praha. 1954 → .

Agric. Colon.
L'Agricoltura coloniale. Firenze. **1–38,** 1907–1944. Titled *Revista di Agricoltura tropicale e subtropicale,* **39** → , 1945 → .

Agric. Rec. (Tel-Aviv)
Agricultural Records. Agricultural Experiment Station, Institute of Agriculture and natural History. Tel-Aviv. **1** → , 1927 → .

Agron. Lusit.
Agronomia lusitana. Sacavém. 1939 → . (**25** → , 1966 → , at Oeiras.)

Allgem. Bot. Zeitschr.
Allgemeine botanische Zeitschrift für Systematik, Floristik, Pflanzen-geographie. Karlsruhe. 1895–1927.

***Alpina* (*Winterthur*)**
Alpina. Winterthur. **1–4**, 1806–1809.

Amer. Jour. Sci. Arts
American Journal of Science and Arts. New Haven, Connecticut. 1818 → .

Anal. Ci. Nat.
Anales de Historia natural. Madrid. **1–2**, 1799–1800; titled *Anales de Ciencias naturales*, **3–7**, 1801–1804.

Anal. Inst. Bot. Cavanilles
Anales del Jardín botánico de Madrid. Madrid. **1–9**, 1941–1950; titled *Anales del Instituto botánico A. J. Cavanilles*, **10** → , 1950 → .

***Anal. Inst. Forest. Invest. Exper.* (*Madrid*)**
Anales. Instituto Forestal de Investigaciones y Experiencias. Madrid. **1** → , 1956 → .

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Analele ştiinţifice ale Universitaţii "Al. I. Cuza" din Iaşi. Iaşi. **1** → , 1955 → .

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Suomalaisen Tiedeakatemian Toimituksia. Sarja A./Annales Academiae Scientiarum fennicae. Ser. A. Helsinki. **1** → , 1909 → . From **61** → , 1961 → , Latin title only is used.

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Landbrukshögskolans Annaler./Annals of the agricultural College of Sweden./Annalen der landwirtschaftlichen Hochschule Schwedens./Annales de l'École supérieure d'Agriculture de la Suède. Uppsala. **1** → , 1933 → . With minor changes of title.

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Annals of Botany. Editors, Charles Konig, F.L.S. and John Sims, M.D., F.L.S. London. **1–2**, 1804–1806.

Ann. Bot. Fenn.
Annales botanici fennici. Helsinki. 1964 → .

***Ann. Bot.* (*Roma*)**
Annali di Botanica. Roma. 1903 → .

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Suomalaisen eläin- ja kasvitieteellisen Seuran Vanamon kasvitietetellisiä Julkaisuja. / Annales botanici Societatis zoologicae-botanicae fennicae 'Vanamo'. Helsinki. **1–35**, 1931–1964.

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Annalen der Botanik. Herausgegeben von P. Usteri. Zürich. **1–24**, 1791–1800. (**14–24**, 1795–1800, at Leipzig.)

Ann. Hist.-Nat. Mus. Hung.
Annales historico-naturales Musei nationalis hungarici. / A Magyar nemzeti Muzeum természetrajzi Osztályainak Folyóirata. Budapest. Ser 1, **1–41**, 1903–1948. (**33** → , 1940 → , Hungarian title reads *Az országos magyar természettudományi Muzeum Folyóirata*.) Nov. ser., **1–9**, 1951–1958. Vol. nos. then revert to ser. 1, **51** → , 1959 → . (With several variations of Hungarian title.)

Ann. Lyc. New York
Annals of the Lyceum of Natural History of New York. New York. **1–11**, 1824–1886.

Ann. Mus. Firenze
Annali del Museo imperiale di Fisica e Storia naturale di Firenze. Firenze. Ser. **1**, **1–2**, 1808–1810. Nov. ser., titled *Annali del r. Museo di Fisica e Storia naturale di Firenze*, **1**, 1866.

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Annales Musei Goulandris. / Ἐπετηρὶς Μουσείου Γουλάνδρη. Kifissia. 1973 → .

***Ann. Mus. Hist. Nat.* (*Paris*)**
Annales du Muséum d'Histoire naturelle. Paris. **1–20**, 1802–1813.

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Annals of natural History; or, Magazine of Zoology, Botany, and Geology. London. Ser. 1, **1–5**, 1838–1840; titled *The Annals and Magazine of natural History, including Zoology, Botany and Geology*, **6–20**, 1841–1842. Ser. 2, **1–20**, 1843–1857. Ser. 3, **1–20**, 1858–1867. Many later series.

***Ann. Naturh. Mus.* (*Wien*)**
Annalen des k.k. naturhistorischen Hofmuseums. Wien. **1–31**, 1886–1917; titled *Annalen des naturhistorischen Hofmuseums*, **32**, 1918; titled *Annalen des naturhistorischen Museums in Wien*, **33** → , 1919 → .

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Annual Report. Missouri Botanical Garden. St Louis, Missouri. **1–23**, 1890–1912.

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Annales des Sciences naturelles. Paris. Ser. 1, **1–30**, 1824–1833. Ser. 2, **1–20**, 1834–1843. Ser. 3, **1–20**, 1844–1853. Ser. 4, **1–20**, 1854–1863. Ser. 5, **1–20**, 1864–1874. Ser. 6, **1–20**, 1875–1885. Ser. 7, **1–20**, 1885–1895. Ser. 8, **1–20**, 1895–1904. Ser. 9, **1–20**, 1905–1917. Ser. 10, **1–20**, 1919–1938. Ser. 11, **1–20**, 1939–1959. Ser. 12. **1** → , 1960 → . (Ser. 2–10, *Botanique*. Ser. 11 → , *Botanique et Biologie végétale*.)

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Annales des Sciences d'Observation. Paris. **1–4**, 1829–1830.

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The Annals of Scottish Natural History. Edinburgh. 1892–1911.

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Annales de la Société linnéenne de Lyon. Lyon. Ser. 1, **1836–1850/52**, 1836–1852. Nov. ser., **1–80**, 1853–1937.

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Annuaire du Conservatoire et du Jardin botaniques de Genève. Genève. **1–21**, 1897–1922.

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Archives de Biologie végétale pure et appliquée. Athènes. **1**–?, 1901–?.

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Archives de Botanique. Bulletin mensuel. Caen. **1–4**, 1927–1930.

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Archiv für die Botanik. (*Herausgegeben von D. Johann Jacob Römer.*) Leipzig. **1–3**, 1796–1805.

Arch. Hydrobiol.
Archiv für Hydrobiologie. Stuttgart. **1** → , 1906 → .

***Arch. Inst. G.-D. Luxemb.* (*Sci. Nat.*)**
Archives. Institut grand-ducal Luxembourg. Section des Sciences naturelles, physiques et mathématiques. Luxembourg.

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Arkiv för Botanik. Uppsala. Ser. 1, **1–33**, 1903–1949. Ser. 2, **1** → , 1949 → .

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Atti del Congresso internazionale botanico tenuto in Firenze nel Mese di Maggio 1874. Firenze. 1876.

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Le Bambou, son Étude, sa Culture, son Emploi. Mons. 1906–1908. (**1**: pp. 1–170 in 1906; **2**: pp. 171–222 in 1907; pp. 223–295 in 1908.)

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Beihefte zum botanischen Centralblatt. Cassel, Jena & Dresden. 1891–1943.

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Beiträge zur geobotanischen Landesaufnahme. Zürich & Leipzig. **1–15**, 1916–1927. Titled *Beiträge zur geobotanischen Landesaufnahme der Schweiz*, **16** → , 1930 → .

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Матеріалы къ ближайшему Познанію Прозябаемости Россійской Имперіи [*Materialy k bližajšemu Poznaniju Prozjabaemosti Rossijskoj Imperii*]./ *Beiträge zur Pflanzenkunde des russischen Reiches.* St Petersburg. **1–11**, 1844–1859.

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Berichte der bayerischen botanischen Gesellschaft zur Erforschung der heimischen Flora. München. 1891 → .

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Bericht über das geobotanische Forschungsinstitut Rübel in Zürich. Zürich. **1931–1958**, 1929–1959; titled *Berichte des geobotanischen Institutes der eidg. techn. Hochschule Stiftung Rübel*, **31** → , 1960 → .

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Bibliotheca botanica. Abhandlungen aus dem Gesammtgebiete der Botanik. Cassel. 1886 → . (**29** → , 1894 → , at Stuttgart.)

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Biblioth. Univ. Genève
Bibliothèque universelle des Sciences, Belles-lettres, et Arts, faisant suite à la Bibliothèque britannique. Partie des Sciences. Genève. Ser. 1, **1–60**, 1816–1835. Ser. 2, **1–60**, 1836–1845.

Biol. Gallo-Hellen.
Biologia gallo-hellenica. Kéramou. **1** → , 1967 → .

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Biologisches Zentralblatt (Centralblatt). Erlangen. **1** → , 1881 →. Later volumes mostly published at Leipzig.

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Бюллетень Общества Естествоиспытателей при Воронежском государственном Университете [*Bjulleten' Obščestva Estestvoispytatelej pri Voronežskom gosudarstvennom Universitete*]./ *Bulletin de la Société des Naturalistes de Voronèje.* Voronež. **1–9**, 1925–1955.

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Boissiera. Genève. 1936 → . (Supplement of *Candollea.*)

Bol. Inst. Estud. Astur. (Supl. Ci.)
Boletín del Instituto de Estudios asturianos (Suplemento de Ciencias). Oviedo. 1960 → .

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Boletín de la Sociedad aragonesa de Ciencias naturales. Zaragoza. **1–17**, 1902–1918; titled ***Bol. Soc. Ibér. Ci. Nat.***, *Boletín de la Sociedad ibérica de Ciencias naturales*, **18–33**, 1919–1934.

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Bolletino della Società di Scienze naturali ed economiche di Palermo. Palermo. 1877– ?.

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Boston Journal of natural History. Boston. **1–7**, 1837–1863.

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Botanisches Archiv. Berlin, Königsberg & Leipzig. 1922 → .

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Cf. *Bot. Arch. (Berlin)*

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Botanisches Centralblatt. Jena & Dresden. 1880 → .

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Botanical Bulletin. Hanover, Indiana, etc. **1**, 1875–1876; titled *Botanical Gazette*, **2** → , 1876 → . (**22** → , 1896 → , at Chicago, Illinois.)

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Botanische Jahrbücher für Systematik, Pflanzengeschichte und Pflanzengeographie. Leipzig. 1880 → . (**69** → , 1938 → , at Stuttgart.)

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Cf. *Jour. Linn. Soc. London (Bot.).*

Bot. Közl.
Cf. *Növ. Közl.*

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The botanical Magazine or Curtis's botanical Magazine. London. 1793 →. (For publication dates of **1–6** cf. F. A. Stafleu & R. S. Cowan, *Taxonomic Literature* ed. 2, **1**: 578–584 (1976).) Continuous volume numbers are used in citations and series are ignored.

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The botanical Magazine. Tokyo. **1–19**, 1887–1905; titled *The botanical Magazine published by the Tokyo botanical Society*, **20–45**, 1906–1931; titled *The botanical Magazine published by the botanical Society of Japan*, **46** → . 1932 → . (**68** → , 1955 → , also titled *The botanical Magazine, Tokyo.*)

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Botanisches Magazin. Magazin für die Botanik. Herausgegeben von Joh. Jacob Römer und Paulus Usteri. Zürich. **1–4**, 1787–1790.

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Botaniska Notiser. Lund. 1839 → .

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The botanical Register. London. **1–14**, 1815–1829; titled *Edwards's botanical Register*, **15–33**, 1829–1847. (For dates of publication cf. F. A. Stafleu & R. S. Cowan, *Taxonomic Literature* ed. 2, **1**: 724–725 (1976).)

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The botanical Review, interpreting botanical Progress. Lancaster, Pennsylvania. 1935 → .

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Botanisches Taschenbuch für die Anfänger dieser Wissenschaft und der Apothekerkunst. Regensburg. 1790–1811.

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Botanisk Tidsskrift. Kjøbenhavn. 1866 → .

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Botanische Zeitung. Berlin. **1–68**, 1843–1910. (**14–68**, 1856–1910, at Leipzig.)

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Журналъ Русскаго ботаническаго Общества [*Žurnal Russkago botaničeskago Obščestva*]./*Journal de la Société botanique de Russie*. Petrograd. **1–16**, 1916–1931; titled Ботанический Журнал СССР [*Botaničeskij Žurnal SSSR*]./*Journal botanique de l'URSS*, Leningrad, Moscou, **17–32**, 1932–1947; titled Ботанический Журнал Акад. Наук СССР [*Botaničeskij Žurnal Akad. Nauk SSSR*], Leningrad, **33**→, 1948→.

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Bulletin of the Alpine Garden Society. London etc. **1–2(1)**, 1930–1933; titled ***Quart. Bull. Alp. Gard. Soc.***, *Quarterly Bulletin of the Alpine Garden Society*, **2(2)**→, 1933→.

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Труды по прикладной Ботанике (Генетике) и Селекции [*Trudy po prikladnoj Botanike* (*Genetike*) *i Selekcii*]. / *Bulletin of applied Botany and Plant Breeding*. Leningrad. 1922–1929. Several concurrent series.

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Труды Бюро по прикладной Ботаникѣ [*Trudy Bjuro po prikladnoj Botanike*]./*Bulletin of applied Botany*./*Bulletin des Bureau für angewandte Botanik*. S.-Peterburg. **1–10**, 1908–1917. English and German titles are not used in all volumes.

Bull. Brit. Mus. (Bot.)
Bulletin of the British Museum (*Natural History*). *Botany*. London. 1951→.

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Bulletin du Centre d'Études et de Recherches scientifiques Biarritz. Biarritz. **1**→, 1956→.

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Buletinul de Informaţii al Grădinii botanice şi al Muzeului botanic dela Universitatea din Cluj./Bulletin d'Informations du Jardin et du Musée botanique de l'Université de Cluj, Roumanie. Cluj. **1–5**, 1921–1925; titled *Buletinual Grădinii botanice şi al Muzeului botanic de la Universitatea din Cluj./Bulletin du Jardin et du Musée botaniques de l'Université de Cluj, Roumanie*, **6–28**, 1926–1948. With minor changes of title.

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Известия на ботаническия Институт [*Izvestija na botaničeskija Institut*]./*Bulletin de l'Institut botanique*. Sofia. 1950→.

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Bulletin des Institutions royales d'Histoire naturelle. Sofia. 1928–1943.

Bull. Int. Acad. Sci. Cracovie
Bulletin international de l'Académie des Sciences de Cracovie. Classe des Sciences mathématiques et naturelles. Série B: Sciences naturelles./Anzeiger der Akademie der Wissenschaften in Krakau. Mathematisch-naturwissenschaftliche Klasse. Reihe B: Biologische Wissenschaften. Cracovie. 1889–1919. Dates are used as vol. nos. Continued as *Bulletin international de l'Académie polonaise des Sciences et des Lettres*. 1920–1953.

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Bulletin du Jardin botanique de l'État à Bruxelles. Bruxelles. **1–36**, 1920–1966. (**15–36**, 1938–1966, with alternative title *Bulletin van den* [*de*] *Rijksplantentuin Brussel*); titled ***Bull. Jard. Bot. Nat. Belg.***, *Bulletin du Jardin botanique national de Belgique./Bulletin van de nationale Plantentuin van Belge*, **37**→, 1967→.

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Bulletin du Jardin botanique de Kieff./Вісник Київського ботанічного Саду [*Visnyk Kyjivs'kogo botaničnogo Sadu*]. Kieff. 1924–1934.

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Cf. *Bull. Jard. Bot. Bruxelles*.

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Bulletin du Jardin impérial botanique de St.-Pétersbourg. / Извѣстія императорскаго С.-Петербургскаго ботаническаго Сада [*Izvěstija imperatorskago S.-Peterburgskago botaničeskago Sada*]. S.-Peterburg. **1–12**, 1901–1912; titled *Bulletin du Jardin impérial botanique de Pierre le Grand.* / Извѣстія императорскаго ботаническаго Сада Петра Великаго [*Izvěstija imperatorskago botaničeskago Sada Petra Velikago*], **13–17**, 1912–1917; titled ***Bull. Jard. Bot. URSS***, *Bulletin du principal Jardin botanique de la République Russe.*/ Известия главного ботанического Сада Р.С.Ф.С.Р. [*Izvestija glavnogo botaničeskogo Sada R.S.F.S.R.*], **18–22**, 1918–1923; titled *Bulletin du Jardin botanique principal de la République Russe.*/[Russian title as before], **23–24**, 1924–1925; titled *Bulletin du Jardin botanique principal de l'U.R.S.S.* / Известия главного ботанического Сада С.С.С.Р. [*Izvestija glavnogo botaničeskogo Sada S.S.S.R.*], **25–30**, 1926–1932.

Bull. Jard. Bot. URSS
Cf. *Bull. Jard. Bot. Pétersb.*

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Bulletin bi-mensuel de la Société linnéenne de Lyon. Lyon. **1–10**, 1922–1931. Continued as *Bulletin mensuel de la Société linnéenne de Lyon*, **1**→, 1932→.

Bull. Mus. Nat. Hist. Nat. (Paris)
Bulletin du Muséum d'Histoire naturelle. Paris. **1–12**, 1895–1906; titled *Bulletin du Muséum national d'Histoire naturelle*, **13**→, 1907→.

Bull. Nat. Mus. Canada
Bulletin. Victoria Memorial Museum. Geological Survey. Ottawa. **1**, 1913; titled *Museum Bulletin. Geological Survey*, **2–49**, 1914–1928; titled *Bulletin. National Museum of Canada*. **50**→, 1928→.

Bull. New York Bot. Gard.
Bulletin of the New York Botanical Garden. New York. 1896–1932.

Bull. Orto Bot. Napoli
Bullettino dell'Orto botanico della R. Università di Napoli. Napoli. **1–17**, 1899–1947.

Bull. Res. Counc. Israel
Bulletin of the Research Council of Israel. Jerusalem. **1–11** (from **5** onwards *Botany* in *Section D*), 1951–1963; titled ***Israel Jour. Bot.***, *Israel Journal of Botany*, **12**→, 1963→.

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Bulletin scientifique publié par l'Académie impériale des Sciences de Saint-Pétersbourg. Saint-Pétersbourg & Leipzig. **1–10**, 1836–1842.

Bull. Sci. Nat. Geol.
Bulletin des Sciences naturelles et de Géologie. Paris. **1–26**, 1823–1832.

Bull. Soc. Acclim. (Paris)
Bulletin de la Société zoologique d'Acclimatation. Paris. Ser. 1, **1–10**, 1854–1863. Ser. 2, **1–7**, 1864–1870; titled *Bulletin de la Société d'Acclimatation*, **8–10** 1871–1873. Ser. 3, **1–8**, 1874–1881. With several minor changes of title; other series and titles follow.

Bull. Soc. Bot. Belg.
Bulletin de la Société royale de Botanique de Belgique. Bruxelles. 1862→.

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Известия на българското ботаническо Дружество [*Izvěstija na bălgarskoto botaničesko Družestvo*]. / *Bulletin de la Société botanique de Bulgarie*. Sofija. **1–9**, 1926–1943.

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Bulletin de la Société botanique de France. Paris. 1854→.

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Bulletin des Travaux de la Société botanique de Genève. Genève. Ser. 1, **1–11**, 1879–1905. Ser. 2, titled *Bulletin de la Société botanique de Genève*, **1–43**, 1909–1952.

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Bullettino della Società botanica italiana. Firenze. **1892–1926**, 1892–1926.

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Bulletin de la Société d'Études scientifiques d'Angers. Angers. **1–89** (= nov. ser., **2**), 1871–1960; titled *Bulletin de la Société d'Études scientifiques d'Anjou*, **90** (= nov. ser., **3**)→, 1962→.

Bull. Soc. Hist. Nat. Afr. Nord
Bulletin de la Société d'Histoire naturelle de l'Afrique du Nord. Alger. 1909→.

Bull. Soc. Hist. Nat. Toulouse
Bulletin de la Société d'Histoire naturelle de Toulouse. Toulouse. 1867→.

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Bulletin de la Société d'Horticulture pratique du Département du Rhône. Lyon. 1841→.

Bull. Soc. Industr. Angers
Bulletin de la Société industrielle d'Angers et du Département de Maine et Loire. Angers. **1**→, 1830→. With parallel numbering in series, and several minor changes of title.

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Bulletin de la Société impériale des Naturalistes de Moscou. Section biologique. Moscou. Ser. 1, **1–62**, 1829–1886. Nov. ser., **1**→, 1887→. (Nov. ser., **31**→, 1922→, with alternative title in Russian Бюллетень Московскаго Общества испытателей Природы [*Bjulleten' Moskovskago Obščestva ispytatelej Prirody*]. Nov. ser., **52(5)**→, 1947→, with Russian title only.)

Bull. Soc. Neuchâtel. Sci. Nat.
Cf. *Bull. Soc. Sci. Nat. Neuchâtel.*

Bull. Soc. Philom. Paris
Bulletin de la Société philomathique de Paris. Paris. 1791–1936. With many series and minor changes of title.

Bull. Soc. Sci. Dauph.
Bulletin de la Société de Statistiques des Sciences naturelles et des Arts industriels du Département de l'Isère. Grenoble. Ser. 1, **1–4**, 1838 or 1840–1846 or 1848. Ser. 2, **1–7**, 1851–1864. Ser. 3, **1–15**, 1892–1920. Titled *Bulletin de la Société scientifique de l'Isère, ancienne Société de Statistique des Sciences naturelles et des Arts industriels*, **42**(ser. 5, **1**)–**45**(ser. 5, **4**), 1921–1924. Titled *Bulletin de la Société scientifique de l'Isère, ancienne Société de Statistique des Sciences naturelles et des Arts industriels du Département de l'Isère*, **46** (ser. 5, **5**)–**60** (ser. 5, **18**) 1925–1944; **61**→ (ser. 6, **1**–), 1945→.

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Bulletin de la Société des Sciences naturelles de Neuchâtel. Neuchâtel. **1–25**, 1847–1897; titled ***Bull. Soc. Neuchâtel. Sci. Nat.***, *Bulletin. Société neuchâteloise des Sciences naturelles*, **26**→, 1898→.

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Bulletin de la Société des Sciences physiques & naturelles de Toulouse. Toulouse. **1–8**, 1872–1889.

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Гласник скопског научног Друштва [*Glasnik skopskog naučnog Društva*]./*Bulletin de la Société scientifique de Skoplje.* Skoplje. **1**→, 1925→.

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Bulletin of the Torrey botanical Club. New York. 1870→. (**73–78**, 1946–1951, titled *Bulletin of the Torrey botanical Club and Torreya.*)

Bull. Trav. Soc. Agric. Sci. Agen
Bulletin des Travaux de la Société d'Agriculture, Sciences et Belles-Lettres d'Agen. Agen. **1**, 1804. Continued under other titles with several series.

Bull. Trav. Soc. Pharm. Bordeaux
Bulletin des Travaux de la Société de Pharmacie de Bordeaux. Bordeaux. **1**→?, 1860–?1968.

Bull. Univ. Asie Centr.
Bulletin de l'Université de l'Asie centrale (*Tachkent*)./Бюллетень средне-азиатского Государственного Университета [*Bjulleten' sredne-aziatskogo Gosudarstvennogo Universiteta*]. Taškent. 1923–1945.

Butll. Inst. Catalana Hist. Nat.
Butlletí de la Institució catalana d'Història natural. Barcelona. 1901→.

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The Cactus Journal. London etc. **1**→, 1932→. (**8(3)**→, 1946→, titled *The Cactus and Succulent Journal.*)

Canad. Jour. Bot.
Canadian Journal of Botany. Ottawa. **29**→, 1951→. (Formerly *Canadian Journal of Research, Sect. C, Botanical Sciences.*)

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Candollea. Organe du Conservatoire et du Jardin botaniques de la Ville de Genève. Genève. 1922→.

Caryologia
Caryologia. Pisis. **1**→, 1948→. (**6**→, 1954→, Florentiae.)

Cavanillesia
Cavanillesia. Rerum botanicarum Acta. Barcinone. **1–8**, 1928–1938.

Collect. Bot. (Barcelona)
Collectanea botanica a barcinonensi botanico Instituto edita. Barcinone. 1946→.

Comment. Biol.
Commentationes biologicae. Helsinki. **1**→, 1924→.

Compt. Rend. Acad. Bulg. Sci.
Comptes rendus de l'Académie bulgare des Sciences. Sofia. **1**→, 1948→. (**3**→, 1951→, also titled Доклады болгарской Академии Наук [*Dokladi bolgarskoj Akademii Nauk*].)

Compt. Rend. Acad. (Paris)
Compte rendu hebdomadaire des Séances de l'Académie des Sciences. Paris. 1835→.

Comun. Inst. Nac. Invest. Agrar. Ser. Recurs. Nat. (Madrid)
Comunicaciones. Instituto nacional de Investigaciones agrarias. Serie: Recursos naturales. Madrid.

Contr. Bot. (Cluj)
Contribuţiuni botanice din Cluj./Contributions botaniques de Cluj, Roumanie. Cluj. **1–2**, 1921–1937. Titled *Contribuţii botanice*, **1960**→, 1960→.

Contr. Gray Herb.
Contributions from the Gray Herbarium of Harvard University. Cambridge, Massachusetts. Nov. ser., **1**→, 1891→.

Contr. U.S. Nat. Herb.
Contributions from the United States National Herbarium. Washington. 1890→.

Cuad. Ci. Biol. (Granada)
Cuadernos de Ciencias biologicas. Granada. **1**→, 1971→.

Daff. Tulip Year Book
Daffodil Year-Book. London. **1–11**, 1913–1941. Continued as *Daffodil and Tulip Year Book*, **12**→, 1946→.

Darwiniana
Darwiniana. Buenos Aires. 1922→.

Decheniana
Verhandlungen des naturhistorischen Vereines der preussischen Rheinlande. Bonn. **1–90**, 1844–1933. With minor changes of title. Titled *Decheniana. Verhandlungen des naturhistorischen Vereins der Rheinlande und Westfalens*, **91**→, 1935→.

Denkschr. Akad. Wiss. Math.-Nat. Kl. (Wien)
Denkschriften der kaiserlichen Akademie der Wissenschaften. Mathematisch-naturwissenschaftliche Classe. Wien. **1–95,** 1850–1918; titled *Denkschriften. Akademie der Wissenschaften in Wien. Mathematisch-naturwissenschaftliche Klasse,* **96–107,** 1919–1943; titled *Denkschriften. Österreichische Akademie der Wissenschaften. Mathematisch-naturwissenschaftliche Klasse,* **108→**, 1947→.

Denkschr. Schweiz. Naturf. Ges.
Cf. *Neue Denkschr. Schweiz. Ges. Naturw.*

Dnevn. Vseross. S"ezda Russk. Bot.
Дневник всероссийского Съезда русских Ботаников [*Dnevnik vserossijskogo S"ezda russkikh Botanikov*]. Petrograd. **1**, 1921.

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Documents phytosociologiques. Lille & Bailleul. **1→**, 1972→.

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Euphytica. Netherlands Journal of Plant Breeding. Wageningen. **1→**, 1952→.

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Facultad de Filosofía y Letras de la Universidad Nacional de Buenos Aires. Publicaciones de la Sección Geografía. Ser. A. **1–5,** 1917–1921. Ser. B. **2–4,** 1930–1952. Titled *Publicaciones del Instituto de Investigaciones geográficas,* **6–13,** 1924–1930. Titled *Publicaciones del Instituto de Geografía,* in several series, **14→**, 1950→.

Feddes Repert.
Repertorium novarum Specierum Regni vegetabilis. Berlin. **1–8**: p. 144, 1905–1910; titled *Repertorium Specierum novarum Regni vegetabilis,* **8**: p. 145–**51,** 1910–1942; titled *Feddes Repertorium Specierum novarum Regni vegetabilis,* **52→**, 1943→. (This work includes *Repertorium europaeum et mediterraneum,* indicated by dual pagination.) ***Beih.,*** *Beihefte.* Berlin. **1→**, 1914→.

Fl. Fenn.
Flora fennica. Helsinki. **1→**, 1923→.

Flora (Regensb.)
Flora, oder allgemeine botanische Zeitung. Regensburg. 1818→. (**72–95**, Marburg; **96→**, Jena.)

Földműv. Érdek.
Földművelési Érdekeink. Budapest. **1–22,** 1873–1894.

Folia Geobot. Phytotax. (Praha)
Folia geobotanica & phytotaxonomica bohemoslovaca. Praha. 1966→.

Gard. Chron.
Gardeners' Chronicle and agricultural Gazette. London. Ser. 1, **1841–1873,** 1841–1873. Ser. 2, titled *The Gardeners' Chronicle. A weekly illustrated Journal of Horticulture and allied Subjects,* **1–26,** 1874–1886. Ser. 3, **1→**, 1887. (**140–154,** 1956–1963, titled *Gardeners' Chronicle and Gardening illustrated*; **155–159(15)**, 1964–1966, titled *Gardeners' Chronicle, Gardening illustrated and the Greenhouse*; **159(16)→**, 1966→, titled *Gardeners' Chronicle,* with various subtitles.)

Gartenfl.
Gartenflora. Monatsschrift für deutsche und schweizerische Garten- und Blumenkunde. Erlangen. **1–87,** 1852–1938. With minor changes of title. (**24–34,** 1875–1885, at Stuttgart; **35–87,** 1886–1938, at Berlin.)

Gentes Herb.
Gentes Herbarum. Occasional Papers on the Kinds of Plants. Ithaca, N.Y. 1920→.

Ges. Naturf. Freunde Berlin Mag.
Der Gesellschaft naturforschender Freunde zu Berlin, Magazin für die neuesten Entdeckungen in der gesammten Naturkunde. Berlin. **1–8,** 1807–1818.

Ges. Naturf. Freunde Berlin Neue Schr.
Der Gesellschaft naturforschender Freunde zu Berlin, neue Schriften. Berlin. 1795–1803.

Gior. Bot. Ital.
Giornale botanico italiano. Firenze. **1–2,** 1844–1852; titled *Nuovo Gior. Bot. Ital., Nuovo Giornale botanico italiano.* Ser. 1, **1–25,** 1869–1893. Nov. ser., **1–68,** 1894–1961; titled ***Gior. Bot. Ital.,*** *Giornale botanico italiano,* **69–73,** 1962–1966. Volumes then revert to original numbering as **101→**, 1967→.

Gior. Sci. Sic.
Giornale di Scienze, Lettere ed Arti per la Sicilia. Palermo. **1–79,** 1823–1842.

Glas. Rep. Zavoda Zašt. Prir. (Titograd)
Glasnik Republičkog Zavoda za Zaštitu Prirode i Prirodnjačke Zbirke u Titogradu. Titograd. **1→**, 1968→.

Glas Srpske Kralj. Akad.
Глас Српске Краљевске Академије [*Glas Srpske Kraljevske Akademije*]. Beograd. 1888–1941.

God. Biol. Inst. (Sarajevo)
Godišnjak biološkog Instituta u Sarajevu. Sarajevo. **1–10,** 1948–1957. **5,** 1953 & **10,** 1957, also titled *Jahrbuch des biologischen Institutes in Sarajevo./Annuaire de l'Institut biologique à Sarajevo.*

Hannover. Mag.
Hannoverisches Magazin. Hannover. 1764–1820. Several series; often with many volumes published in the same year.

Herbertia
Herbertia. Orlando, Florida. **1–15,** 1934–1948. (**10,** 1944, at Salinas, California; **11–14,** 1946–1948, at Stanford, California; **15**–?, 1959–?, at La Jolla, California. Later merged with *Plant Life.*)

Hercynia
Hercynia. Abhandlungen der botanischen Vereinigung Mitteldeutschlands. Halle. 1937→.

Hereditas
Hereditas. Genetiskt Arkiv. Lund. 1920→.

Hook. Ic.
Hooker's Icones Plantarum. London. 1836→.

Ind. Forest.
The Indian Forester. Calcutta, etc. **1→**, 1875→.

Irish Nat. Jour.
Irish Naturalists' Journal. Belfast. **1→**, 1925→.

Isis
Isis, oder encyclopädische Zeitung von Oken. Jena. 1817–1819; titled *Isis von Oken.* 1820–1827. (1828–1848, at Leipzig.)

Israel Jour. Bot.
Cf. *Bull. Res. Counc. Israel.*

Izv. Bot. Inst. (Sofia)
Известия на ботаническия Институт [*Izvestija na botaničeskija Institut*]./*Bulletin de l'Institut botanique.* Sofia. 1950→. (From **8,** 1961, alternative title is *Mitteilungen des botanischen Instituts.*)

Izv. Saratovsk. Opyt. Stan.
Избестия саратовской сельско-хозяйственной опытной Станции [*Izvestija saratovskoj sel'sko-khozjajstvennoj opytnoj Stancii*]. Saratov.

Izv. Tadžik. Bazy Bot.
Известия Таджикистанской Базы Ботаники [*Izvestija tadžikistanskoj Bazy Botaniki*]. Leningrad. **1→**, 1933→.

Jahresb. Naturf. Ges. Graubündens
Jahresbericht der naturforschenden Gesellschaft Graubündens. Neue Folge. Chur. 1956→. The first series appeared in the *Bündnerische Volksblatt.*

Jahresb. Naturw. Ver. Wuppertal
Jahres-Berichte des naturwissenschaftlichen Vereins von Elberfeld und Barmen. Elberfeld. **1–16,** 1851–1935. With minor

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Jahreskatalog der wiener botanischen Tauschanstalt. Wien.

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Journal of the Arnold Arboretum. Cambridge, Massachusetts. 1919 →. (**2(3)–13**, 1921–1932, at Lancaster, Pennsylvania; **14–26(2–3)**, 1933–1955, at Jamaica Plain, Massachusetts.)

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The Journal of Botany, being a second Series of the Botanical Miscellany...by W. J. Hooker. London. **1–4**, 1834–1842.

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The Journal of Botany, British and foreign. London. **1–80**, 1863–1942.

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Journal de Botanique. Paris. Ser. 1, **1–20**, 1887–1906. Ser. 2, **1–3**, 1907–1925.

Jour. Ecol.
The Journal of Ecology. Cambridge. 1913 →. (**44** →, 1956 →, at Oxford.)

Jour. Fac. Sci. Tokyo Univ. (Bot.)
Journal of the Faculty of Science, Tokyo Imperial University. Sect. 3. *Botany*. Tokyo. 1925 →.

Jour. Hort. Soc. London
The Journal of the Horticultural Society of London. London. **1–9**, 1846–1855.

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The Journal of the Proceedings of the Linnean Society. Botany. London. **1–7**, 1856–1864; titled *The Journal of the Linnean Society. Botany*, **8–46**, 1865–1924; titled *The Journal of the Linnean Society of London. Botany*, **47–61**, 1925–1968; titled ***Bot. Jour. Linn. Soc.***, *Botanical Journal of the Linnean Society*, **62** →, 1969 →.

Jour. Roy. Hort. Soc.
The Journal of the Royal Horticultural Society of London. London. **1–3**, 1865–1872; titled *Journal of the Royal Horticultural Society*, **4–100(4)**, 1879–1975; titled *The Garden. Journal of the Royal Horticultural Society*, **100(5)** →, 1975 →.

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Journal of South African Botany. Cape Town. 1935 →.

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The Journal of Science and the Arts. London. **1–6**, 1816–1819. Titled *The Quarterly Journal of Science, Literature and the Arts*, **7–29**, 1819–1830.

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Bulletin of miscellaneous Information. Royal Gardens, Kew. London. **1887–1941**, 1887–1942; titled *Kew Bulletin*, **1** →, 1946 →.

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Kirkia. *Journal of the Federal Herbarium, Salisbury, Rhodesia and Nyasaland*. Salisbury. **1** →, 1960 →. With minor changes of title.

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Cf. *Skr. Kiøbenhavnske Selsk. Laerd. Vid.*

Kong. Norske Vid. Selsk. Skr. (Trondhjem)
Kongelige norske Videnskabers Selskabs Skrifter. Trondhjem. Year and part number are used as volume number.

Kosmos (Lwów)
Kosmos. Lwów. **1–64**, 1876–1939.

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Die Kulturpflanze. Berlin. **1** →, 1953 →.

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Kongl. svenska Vetenskaps Academiens Handlingar. Stockholm. Ser. 1, **1–40**, 1739–1779 (*svenska* omitted after 1755). Nov. ser., titled *Kongl. Vetenskaps Academiens nya Handlingar*, **1–33**, 1780–1812; titled *Kongl. Vetenskaps Academiens Handlingar*, **1813–1844**, 1813–1846; titled *Kongl. Vetenskaps-Akademiens Handlingar*, **1845–1855**, 1846–1855. Nov. ser., titled *Kongliga svenska Vetenskaps-Akademiens Handlingar. Ny Följd*, **1–35**, 1855–1902; titled *Kungliga svenska Vetenskaps-Akademiens Handlingar*, **36–63**, 1902–1923. Ser. 3, **1–25**, 1924–1948. Ser. 4, **1** →, 1951 →.

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Lily Year-Book. London. **1** →, 1932 →. Later titled *The Lily Year Book*.

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Linnaea. Ein Journal für die Botanik in ihrem ganzen Umfange. Berlin. **1–43**, 1826–1882. (**9–34**, 1834–1866, at Halle. For dates cf. F. A. Stafleu, *Taxonomic Literature* 419–424 (1967).)

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Linnéska Institutets Skrifter. Uppsala. **1**, 1807.

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Cf. *Mitt. Bot. Arbeitsgem. Oberösterr. Landesmus. Linz.*

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Lunds Universitets Årsskrift. / Acta Universitatis lundensis. Lund. Ser. 1, **1–40**, 1864–1902. Nov. ser., **1–59**, 1905–1963. *Sectio* 2, *Medica, Mathematica, Scientiae Rerum naturalium*, **1** →, 1964 →.

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Madroño. Journal of the California botanical Society. Berkeley, California. **1–2**, 1916–1934; titled *Madroño. A West American Journal of Botany*, **3** →, 1935 →.

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Magyar botanikai Lapok. / Ungarische botanische Blätter. Budapest. **1–33**, 1902–1934.

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Malpighia. Rassegna mensuale di Botanica. Messina. **1–34**, 1886–1937. (**3–23**, 1889–1909, at Genova; **24–29**, 1911–1923, at Catania; **30–31**, 1927–1928, at Palermo; **32–34**, 1932–1937, at Bologna.)

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Med. Reposit. (New York)
The medical Repository. New York. Ser. 1, **1–15**, 1797–1812. Nov. ser., **1–15**, 1812–1826.

Meddel. Grønl.
Meddelelser om Grønland, af Kommissionen for Ledelsen af de geologiske og geographiske Undersøgelsen in Grønland. København. 1879 →.

Mém. Acad. Sci. Pétersb.
Записки имп. Академіи Наукъ (по физико-математическому Отдѣленію) [*Zapiski imp. Akademii Nauk (po fiziko-matematičeskomu Otděleniju)*]. / *Mémoires de l'Académie impériale des Sciences de St. Pétersbourg (Classe des Sciences physiques et mathématiques)*. St. Pétersbourg. Ser. 5, **1–11**, 1809–1830, Ser. 6, **1–10**, 1831–1859. Ser. 7, **1–42**, 1859–1897.

Mém. Acad. Sci. Toulouse
Histoire et Mémoires de l'Académie royale des Sciences, Inscriptions et Belles-lettres de Toulouse. Toulouse. Ser. 1, **1–4**, 1782–1792. Ser. 2, **1–6**, 1827–1843. Ser. 3, titled *Mémoires de l'Académie royale des Sciences, Inscriptions et Belles-lettres de Toulouse*, **1–6**, 1844–1850. A further 9 series, with numerous minor changes of title, follow.

Mém. Acad. Sci. (Turin)
Mémoires de l'Académie royale des Sciences. Turin. Ser. 1, **1–22**, 1784–1816; titled ***Mem. Accad. Sci. Torino***, *Memorie*

della reale Accademia delle Scienze di Torino, **23–40**, 1818–1838 (each volume contains different classes, etc.). Ser. 2, **1**→, 1839→.

Mem. Ist. Veneto
Memorie dell' i. r. Istituto Veneto di Scienze, Lettere ed Arti. Venezia. **1–13**, 1843–1866; titled *Memorie del reale Istituto Veneto di Scienze, Lettere ed Arti*, **14**→, 1868→.

Mem. New York Bot. Gard.
Memoirs of the New York Botanic Garden. New York. **1**→, 1900→.

Mém. Sav. Étr. Pétersb.
Mémoires des Savants étrangers. Mémoires présentés à l'Académie impériale des Sciences de St. Pétersbourg par divers Savants et lus dans ses Assemblées. St. Pétersbourg. **1–9**, 1831–1859.

Mém. Soc. Bot. Fr.
Mémoires de la Société botanique de France. Paris. 1905→.

Mem. Soc. Brot.
Memórias da Sociedade broteriana. Coimbra. 1930→.

Mém. Soc. Émul. Doubs
Mémoires et Comptes rendus de la Société d'Émulation du Doubs (with minor variations of title). Besançon. Ser. 1, **1–3**, 1841–1849. Ser. 2, titled *Mémoires de la Société libre d'Émulation du Doubs*, **1–5**, 1850–1854; titled *Mémoires de la Société d'Émulation du Département du Doubs*, **6–8**, 1855–1857. Ser. 3, titled *Mémoires de la Société d'Émulation du Département du Doubs*, **1–7**, 1856–1864; titled *Mémoires de la Société d'Émulation du Doubs*, **8–10**, 1864–1869. Ser. 4, with same title, **1–10**, 1866–1876. Ser. **5**, **1–10**, 1877–1886. Ser. 6, **1–10**, 1887–1896. Ser. 7, **1–10**, 1897–1906. Ser. 8, **1–10**, 1907–1920. Ser. 9, **1–10**, 1922–1931. Ser. 10, **1–8**, 1931–1939).

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Memoranda Societatis pro Fauna et Flora fennica. Helsingforsiae. 1927→.

Mém. Soc. Hist. Nat. Paris
Mémoires de la Société d'Histoire naturelle de Paris. Paris. **1799**, 1799; **1–5**, 1823–1834.

Mém. Soc. Linn. Paris
Mémoires de la Société linnéenne de Paris. Paris. **1–6**, 1822–1828.

Mém. Soc. Nat. Moscou
Mémoires de la Société impériale des Naturalistes de l'Université de Moscou. Moscou. **1–6**, 1806–1823.

Mem. Torrey Bot. Club
Memoirs of the Torrey botanical Club. New York. 1889→. (**18–19**, 1931–1941, at Menasha, Wisconsin; **20**, 1943–1954, at Lancaster, Pennsylvania; **21**→, 1958→, at Durham, North Carolina.)

Mem. Valdarn.
Memorie valdarnesi. Pisa. **1–4**, 1835–1855.

Mitt. Bad. Landesver. Naturk. Natursch. Freiburg
Mitteilungen des botanischen Vereins für den Kreis Freiburg und das Land Baden. Freiburg im Breisgau. Ser. **1**, **1**, 1882–1888; titled *Mitteilungen des badischen botanischen Vereins*, **2–5**, 1888–1910; titled *Mitteilungen des badischen Landesvereins für Naturkunde und Naturschutz in Freiburg im Breisgau*, **6**, 1911–1915. Nov. ser., **1**→, 1919→.

Mitt. Bot. Arbeitsgem. Oberösterr. Landesmus. Linz
Mitteilungen der botanischen Arbeitsgemeinschaft am Oberösterreichischen Landesmuseum Linz. Linz. **1–6**, 1969–1975. Titled ***Linzer Biol. Beitr.***, *Linzer biologische Beiträge*, **7**→, 1975→.

Mitt. Bot. Staatssamm. (München)
Mitteilungen aus der botanischen Staatssammlung. München. 1950→.

Mitt. Naturf. Ges. Bern
Mittheilungen der naturforschenden Gesellschaft in Bern. Bern. Ser. **1**, 1843–1919. Titled *Mitteilungen der naturforschenden Gesellschaft Bern*, 1920–1942. Nov. ser., **1**→, 1944→.

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Mitteilungen des naturwissenschaftlichen Vereins für Steiermark. Graz. 1863→.

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Mitteilungen der thüringischen botanischen Gesellschaft. Weimar. **1–2**, 1949–1960.

Mitt. Thür. Bot. Ver.
Mitteilungen des thüringischen botanischen Vereins. Weimar. Ser. 1, **1–9**, 1882–1890. Nov. ser., **1–51**, 1891–1944.

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Le Monde des Plantes. Revue mensuelle de Botanique. Organe de l'Académie internationale de Géographie botanique. Le Mans. **1–8**: p. 56, 1891–1898. Continued as *Le Monde des Plantes*, **1**→, 1899→ (later published elsewhere). Also continued as ***Bull. Acad. Int. Géogr. Bot. (Le Mans)***, *Bulletin de l'Académie internationale de Géographie botanique*, **8**: p. 47 [57]–**19**, 1899–1910; titled *Bulletin de Géographie botanique. Organe mensuel de l'Académie internationale de Botanique*, **21–27**, 1911–1919. (**16–20** at Paris.)

Monit. Jard. Bot. Tiflis
Вѣстникъ Тифлисскаго ботаническаго Сада [*Věstnik Tiflisskago botaničeskago Sada*]. / *Moniteur du Jardin botanique de Tiflis.* Tiflis. Ser. 1, **1–32**, 1905–1914. Nov. ser., **1–5**, 1923–1931.

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Museum senckenbergianum. Abhandlungen aus dem Gebiete der beschreibenden Naturgeschichte. Frankfurt am Main. **1–3**, 1833–1845.

Naturk. Jahrb. Stadt Linz
Naturkundliches Jahrbuch der Stadt Linz. Linz. 1955→.

Naučni Trud. Agron. Fak. Plovdiv
Научни Трудове. Агрономически Факултет. Висш селскостопански Институт [*Naučni Trudove. Agronomičeski Fakultet. Visš selskostopanski Institut*]. Plovdiv. **1**→, 1952→.

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Neue Denkschriften der allgemeinen schweizerischen Gesellschaft für die gesammten Naturwissenschaften. / Nouveaux Mémoires de la Société helvétique des Sciences naturelles. Neuchâtel. **1–40**, 1837–1906; titled ***Neue Denkschr. Schweiz. Naturw. Ges.***, *Neue Denkschriften der schweizerischen naturforschenden Gesellschaft*, same French title, **41–54**, 1906–1918; titled ***Denkschr. Schweiz. Naturf. Ges.***, *Denkschriften der schweizerischen naturforschenden Gesellschaft. / Mémoires de la Société helvétique des Sciences naturelles*, **55**→, 1920→. (**8–9**, 1847, at Neuenburg; **10**, 1849, at Neuchâtel; **11**→, 1850→, at Zürich.)

Not. Syst. (Leningrad)
Ботанические Материалы Гербария главного ботанического Сада Р.С.Ф.С.Р. [*Botaničeskie Materialy Gerbarija glavnogo botaničeskogo Sada R.S.F.S.R.*]. / *Notulae systematicae ex Herbario Horti botanici petropolitani.* Mosqua & Leningrad. **1–4**, 1919–1923; titled the same in Russian and *Notulae systematicae ex Herbario Horti botanici Reipublicae rossicae*, **5**, 1924; titled Ботанические Материалы Гербария главного ботанического Сада СССР [*Botaničeskie Materialy Gerbarija glavnogo botaničeskogo Sada SSSR*]. / *Notulae systematicae ex Herbario Horti botanici URSS*, **6**, 1926; titled Ботанические Материалы Гербария ботанического Института Академии Наук СССР [*Botaničeskie Materialy Gerbarija botaničeskogo Instituta Akademii Nauk SSSR*]. / *Notulae systematicae ex Herbario Instituti botanici Academiae Scientiarum URSS*, **7–8(3)**, 1937–1938; titled Ботанические Материалы Гербария ботанического Института Имени В. Л. Комарова Акалемии Наук

CCCP [*Botaničeskie Materialy Gerbarija botaničeskogo Instituta Imeni V. L. Komarova Akademii Nauk SSSR*]. / *Notulae systematicae ex Herbario Instituti botanici nomine V. L. Komarovii Academiae Scientiarum U.R.S.S.*, **8(4)–22**, 1940–1963.

Notes Roy. Bot. Gard. Edinb.
Notes from the Royal Botanic Garden, Edinburgh. Edinburgh. 1900→.

Notizbl. Bot. Gart. Berlin
Notizblatt des königl. botanischen Gartens und Museums zu Berlin. Leipzig. **1–15**, 1895–1944; with minor changes of title, becoming *Notizblatt des botanischen Gartens und Museums zu Berlin-Dahlem* from 1920 to 1944. (**6–7**, 1913–1920, at Leipzig & Berlin; **8–15**, 1921–1944, at Berlin-Dahlem.)

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Nouveaux Mémoires de la Société impériale des Naturalistes de Moscou. Moscou. 1829→.

Növ. Közl.
Növénytani Közlemények. Budapest. **1–7**, 1902–1908; titled ***Bot. Közl.***, *Botanikai Közlemények*, **8**→, 1909→.

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Новости систематики высших Растений [*Novosti sistematiki vysšikh Rastenij*]. / *Novitates systematicae Plantarum vascularium*. Moskva & Leningrad. 1964→.

Nova Acta Acad. Sci. Petrop.
Nova Acta Academiae Scientiarum imperialis petropolitana. Petropoli. **1–15**, 1787–1806.

Nova Acta Reg. Soc. Sci. Upsal.
Nova Acta regiae Societatis Scientiarum upsaliensis. Upsaliae. **1–14**, 1773–1850. Ser. 3, **1–20**, 1851–1899. Ser. 4, **1**→, 1905→.

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Novi Commentarii Academiae Scientiarum imperialis petropolitanae. Petropoli. **1–20**, 1750–1776.

Novit. Bot. Horti Bot. Univ. Carol. Prag.
Novitates botanicae et Delectus Seminum, Fructuum, Sporarumque Anno...collectorum, quae Praefectus Horti botanici Universitatis carolinae pragensis libentissime pro mutua Commutatione offert. Praga. 1960→. (With minor variations of title up to 1964, but thereafter titled ***Novit. Bot. Inst. Bot. Univ. Carol. Prag.***, *Novitates botanicae cum Delectu Seminum, Fructuum, Sporarum Plantarumque quas Institutum botanicum et Hortus botanicus Universitatis carolinae pragensis in Anno... libentissime pro mutua Commutatione offert*.)

Nuovo Gior. Bot. Ital.
Cf. *Gior. Bot. Ital.*

Öfvers. Finska Vet.-Soc. Förhandl.
Öfversigt af finska Vetenskaps-Societetens Förhandlingar. Helsingfors. **1–64**, 1838–1922.

Öfvers. Kongl. Vet.-Akad. Förhandl.
Öfversigt af kongl. Vetenskaps-Akademiens Förhandlingar. Stockholm. **1–63**, 1844–1921.

Op. Bot. Čech.
Opera botanica čechica. Praha. **1–6**, 1939–1948.

Op. Bot. (Lund)
Opera botanica. A Societate botanica lundensi in Supplementum Seriei Botaniska Notiser *edita*. Stockholm. 1953→. (**13**→, 1967→, at Lund.)

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The Orchid Review. London, etc. **1**→, 1893.

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Die Orchidee. Hamburg. **1**→, 1949→. (**16–24**, 1965–1973, at Hannover; **25**→, 1974→, at Hildesheim.)

Österr. Bot. Wochenbl.
Österreichisches botanisches Wochenblatt. Wien. **1–7**, 1851–1857; titled ***Österr. Bot. Zeitschr.***, *Österreichische botanische Zeitschrift*, **8–122**, 1858–1974 (**92–93**, 1943–1944, titled *Wiener botanische Zeitschrift*); titled ***Pl. Syst. Evol.***, *Plant Systematics and Evolution. / Entwicklungsgeschichte und Systematik der Pflanzen*, **123**→, 1975→.

Österr. Bot. Zeitschr.
Cf. *Österr. Bot. Wochenbl.*

Palest. Jour. Bot. (Jerusalem)
Palestine Journal of Botany. Jerusalem Series. Jerusalem. **1–6**, 1935–1955.

Paxton's Mag. Bot.
Paxton's Magazine of Botany. London. **1–16**, 1841–1849.

Period. Biol. (Zagreb)
Glasnik biološke Sekcije./Periodicum Biologorum. **1–7**, 1947–1954. Titled *Biološki Glasnik./Periodicum Biologorum*, **8–21**, 1955–1969. Titled *Periodicum Biologorum*, **72** [= **22**]→, 1970→.

Pharm. Jour.
Pharmaceutical Journal and Transactions. London. **1–54**, 1841–1895. Titled *Pharmaceutical Journal*, **55**→, 1895→. Up to 1965, a parallel numbering of volumes, in 4 series, was also used.

Philippine Jour. Sci. (Bot.)
Philippine Journal of Science. Series C. Botany. Manila. **1–13**, 1906→, 1918.

Philos. Mag.
The Philosophical Magazine. London. 1→, 1798→. With many series and several minor changes of title.

Philos. Trans. Roy. Soc. London
Philosophical Transactions of the Royal Society of London. London. 1665–1884. *Series B. Biological Sciences*. London. 1885→.

Phyton (Austria)
Phyton. Annales Rei botanicae. Horn, Austria. 1948→.

Pittonia
Pittonia. A Series of Papers relating to Botany and Botanists. Berkeley, California. **1–5**, 1887–1905. (**3–5**, 1896–1905, at Washington, D.C.)

Pl. Syst. Evol.
Cf. *Österr. Bot. Wochenbl.*

Plant Life
Plant Life. Stanford, California. **1**→, 1945→

Portug. Acta Biol.
Portugaliae Acta biologica. Lisboa. 1944→.

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Preslia. Věstník české botanické Společnosti. Praha. **1**, 1914; titled *Preslia. Věstník československé botanické Společnosti. / Bulletin de la Société botanique tchécoslovaque à Prague. / Reports of the Czechoslovak botanical Society of Prague*. **2–15**, 1923–1936; titled *Preslia. Věstník čs. botanické Společnosti. /Bulletin de la Société botanique tchéque à Prague. / Reports of the Czech botanical Society of Prague*, **16–17**, 1939; titled *Preslia. Věstník české botanické Společnosti*, **18–21**, 1940–1942; titled *Preslia. Věstník československé botanické Společnosti v Praze*, **22–23**, 1948; titled *Preslia. Časopis československé botanické Společnosti*, **24**→, 1952→.

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Proceedings of the Biological Society of Washington. Washington. **1**→, 1882→.

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Procès-verbaux de la Société dauphinoise d'Études biologiques et de Protection de la Nature. Grenoble.

Provence Agric.
La Provence agricole et horticole. Toulon. **1**→, 1881→.

Publ. Fac. Sci. Univ. Masaryk
Publications de la Faculté des Sciences de l'Université Masaryk. / Spisy vydávané přírodovědeckou Fakultou Masarykovy University. Brno. 1921–1958. (1950→ with additional title Труды естественно-исторического Факультета Университета

им. Т. Г. Масарика [*Trudy estestvenno-istoričeskogo Fakul'teta Universiteta im. T. G. Masarika*].)

Quart. Bull. Alp. Gard. Soc.
Cf. *Bull. Alp. Gard. Soc.*

Rep. Bot. Exch. Club Brit. Is.
Report of the botanical Society and Exchange Club of the British Isles. Manchester. **1–13**, 1867–1947. (**2(1903)–3(4)**, 1904–1913, at Oxford; **3(5)–13**, 1913–1947, at Arbroath.) With minor changes of title.

Rep. Dept. Agric. Univ. Inst. Appl. Sci. (Reykjavik)
Reports. Department of Agriculture, University Institute of applied Sciences. / Rit Landbúnaðardeildar, Atvinnudeild Háskólans. Reykjavik. **1** →, 1943 →.

Rev. Biol. (Bucarest)
Revue de Biologie. Bucarest. **1–8**, 1954–1963; titled ***Rev. Roum. Biol.***, *Revue Roumaine de Biologie. Série de Botanique*, **9** →, 1964 →.

Rev. Cytol. Biol. Végét.
Revue de Cytologie et de Cytophysiologie végétales. Paris. **1–10**, 1934–1943. Titled *Revue de Cytologie et de Biologie végétales*, **11** →, 1945 →.

Rev. Hort. (Paris)
Revue horticole. Paris **1**, 1829–1832. Ser. 1, **1–3**, 1832–1841. Ser. 2, **1–5**, 1841–1846. Ser. 3, **1–5**, 1847–1851. Ser. 4, **1–5**, 1852–1856. Then **1857–1865**, 1857–1865. Then **37** →, 1866 →.

Rev. Roum. Biol.
Cf. *Rev. Biol.* (*Bucarest*).

Rhodora
Rhodora. Journal of the New England botanical Club. Boston, Massachusetts. 1899 →.

Rozpr. Uniw. Mik. Kopernika (Toruń)
Rozprawy. Uniwersytet Mikolaja Kopernika w Toruniu. Toruń.

Sborn. Bălg. Akad. Nauk.
Сборникъ на Българската Академия на Наукитѣ [*Sbornik na Bălgarskata Akademija na Naukitě*]. Sofija. 1911 →.

Sched. Herb. Fl. Ross.
Schedae ad Herbarium Florae rossicae, a Sectione botanica Societatis imp. petropolitanae Naturae Curiosorum editum. / Список Растений Гербария Русской Флоры [*Spisok Rastenij Gerbarija Russkoj Flory*]. Peterburg. **1–8**, 1898–1922. (**1** in 1898; **2** in 1900; **3** in 1901; **4** in 1902; **5** in 1905; **6** in 1908; **7** in 1911; **8** in 1922.) Titled ***Sched. Herb. Fl. URSS,*** *Schedae ad Herbarium Florae URSS. /* Список Растений Гербария Флоры СССР [*Spisok Rastenij Gerbarija Flory SSSR*]. **9** →, 1932 → (**9** in 1932; **10** in 1936; **11** in 1949; **12** in 1953; **13** in 1955; **14** in 1957; **15** in 1963; **16** in 1966; **17** in 1967; **18** in 1970; **19** in 1972.) **12** & **13** lack Latin title and are abbreviated as ***Spisok Rast. Gerb. Fl. SSSR.***

Sched. Herb. Fl. URSS
Cf. *Sched. Herb. Fl. Ross.*

Scott. Bot. Rev.
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Sitzungsberichte der Gesellschaft naturforschender Freunde zu Berlin. Berlin. Ser. 1, 1839–1943. Nov. ser., 1961 →.

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Skrifter som udi det Kiøbenhavnske Selskab af Laerdoms og Videnskabers Elskere. København. **1–12**, 1745–1779. (**11** & **12** titled *Skrifter som udi det kongelige Videnskabers Selskab.*) Continued as ***Kong. Danske Vid. Selsk. Biol. Skr.,*** *Nye Samling af det kongelige danske Videnskabers Selskabs Skrifter*. Kiøbenhavn. **1–5**, 1781–1799. Continued as *Det kongelige danske Videnskabers-Selskabs Skrivter*, Ser. 3, **1–7**, 1800–1818. Several later series.

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Transactions of the botanical Society. Edinburgh. **1–11**, 1844–1873; titled *Transactions and Proceedings of the Botanical Society*, **12–19**, 1873–1893; titled *Transactions and Proceedings of the botanical Society of Edinburgh*, **20→**, 1894→.

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Verhandlungen und Mitteilungen des siebenbürgischen Vereins für Naturwissenschaften in Hermannstadt. Hermannstadt. 1850–1938.

Verh. Naturf. Ver. Brünn
Verhandlungen des naturforschenden Vereines in Brünn. Brünn. **1–75**, 1862–1944.

Verh. Zool.-Bot. Ges. Wien
Verhandlungen des k.k. zoologisch-botanischen Vereins in Wien. Wien. 1852→. From 1858, *Verein* is replaced by *Gesellschaft*.

Veröff. Geobot. Inst. Rübel (Zürich)
Veröffentlichungen des geobotanischen Institutes Rübel. Zürich. 1924→.

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Videnskabelige Meddelelser fra den naturhistoriske Forening i Kjöbenhavn. Kjöbenhavn. **1–63**, 1849–1912; titled *Videnskabelige Meddelelser fra dansk naturhistorisk Forening i Kjøbenhavn*, **64→**, 1913→. Years used as vol. nos. until 1912.

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Журнал русскаго ботаническаго Общества [*Žurnal russkago botaničeskago Obščestva./Journal de la Société botanique de Russie*. Petrograd. **1–16**, 1916–1931.

APPENDIX IV

GLOSSARY OF TECHNICAL TERMS

The number of technical terms used in *Flora Europaea* has been kept as low as is consistent with a reasonable standard of accuracy and brevity. Most of them are used in well-established traditional senses, and their meanings may be ascertained by reference to glossaries such as H. I. Featherly, *Taxonomic Terminology of the Higher Plants* (Ames, Iowa, U.S.A., 1954). No term is used in a sense inconsistent with that given by Featherly.

Experience has shown, however, that some useful terms are liable to misinterpretation, and others, which can be used in a wider sense, are used in a restricted sense in *Flora Europaea*. This glossary is intended simply to indicate without ambiguity the sense in which these potentially ambiguous terms are employed.

Certain technical terms, which are restricted to descriptions in particular families or genera, are explained under the family or genus concerned.

ABOVE Used to indicate both the upper surface of a normally horizontal organ and the upper part of an organ or of the whole plant.

ACHENE A small, dry, 1-seeded, indehiscent fruit, whether derived from a superior or from an inferior ovary.

ALTERNATE Arising singly at a node; includes regularly spiral, as well as distichous arrangements.

ANNUAL Completing its life-cycle from seed to seed in less than 12 months; includes 'overwintering' annuals, which germinate in autumn and flower the following year.

BELOW Used to indicate the basal part of a plant, stem or inflorescence; cf. *beneath*.

BENEATH Used to indicate the lower surface of a normally horizontal organ; cf. *below*.

BIDENTATE With two teeth.

BISERRATE Serrate, with the teeth themselves serrate.

CADUCOUS Falling unusually early.

CILIATE With hairs on the margin.

DECIDUOUS Of leaves: falling in autumn; of other organs: falling before the majority of adjacent or associated organs.

ERECTO-PATENT Diverging at an angle of 15–45° from the axis on which the structure is borne.

FLOCCOSE Clothed with woolly hairs, which are disposed in tufts or tend to rub off and adhere in small masses.

GLABRESCENT Becoming glabrous with increasing age or maturity. For structures very slightly but persistently hairy the term *subglabrous* is used.

HIRSUTE Covered with long, moderately stiff and not interwoven hairs.

HISPID Covered with stiff hairs or bristles.

LANATE Covered with soft, flexuous, intertwined hairs.

PELTATE Denotes an organ of which the stalk is attached to a more or less flat surface, and not to the margin; the attachment is not, however, necessarily central.

PUBERULENT With very short hairs.

PUBESCENT With soft, short hairs.

PYRENE A small stone, consisting of one or few seeds with a hard covering, enclosed in fleshy tissue, e.g. *Arctostaphylos*, *Corema*.

SEMI-PATENT Between patent and appressed.

SERICEOUS With silky, appressed hairs.

SETOSE Covered with stout, rigid bristles.

SIMPLE HAIR Indicates an unbranched hair; it may or may not bear a gland.

STOCK The persistent, usually somewhat woody base of an otherwise herbaceous perennial.

STOLON A short-lived, horizontal stem, either above or below the surface of the ground, rooting at one or more nodes.

STRIGOSE With stiff, appressed, straight hairs.

TERETE More or less cylindrical, without grooves or ridges.

TOMENTOSE With hairs compacted into a felty mass.

TUBERCULATE Covered with smooth, knob-like elevations.

VELUTINOUS With a dense indumentum of fine, soft, straight hairs.

VERRUCOSE Covered with rough, wart-like elevations.

VILLOUS Covered with long, soft, straight hairs.

APPENDIX V

VOCABULARIUM ANGLO-LATINUM

IN USUM LECTORUM LINGUAE ANGLICAE MINUS PERITORUM CONFECTUM

N.B. Plurimi termini ad descriptionem botanicam in lingua anglica usurpati aequipollentibus latinis persimiles sunt, e.g. *ovate* (ovatus), *inflorescence* (inflorescentia). Talia verba omnia sunt omissa.

above insuper, supra, super
all omnes
almost fere, paene
always semper
arable fields arva
around circum
arranged dispositus
attached affixus
awn arista
back dorsum
backward(s) retro
bank ripa
barbed pilis hamatis obsitus
bare nudus
bark cortex
basin-shaped pelviformis
beak rostrum
bearded barbatus
become fieri
below infra, sub
beneath infra, subtus
bent inflexus
berry bacca
between inter
bind colligare, firmare
bitter amarus
black niger, ater
bloom pruina
blotch macula
blue caeruleus
boat navicula
border margo
borne prolatus
branch ramus
breadth latitudo
bright laete
bristle seta
broad latus
bronze aeneus
brown fuscus, brunneus
bud gemma
bundle fasciculus
bushy spisse et iteratim ramosus
casual fortuitus
catkin amentum
chaffy paleaceus
chamber loculus
chequered cancellatus
chestnut castaneus
chief principalis
claw unguis
cliff rupes
climbing scandens
close propinquus, affinis
closed clausus
clothed vestitus
cluster glomerulus
coarse crassus, grossus
coast litus, ora
coat tunica
common vulgaris
completely omnino, ex toto
compound compositus
cone strobilus
corner angulus
cornfield seges
covered obtectus
cream ochroleucus, albido-flavescens
crest crista
crevice fissura
crimson kermesinus, sanguineus; ut flos *Paeoniae officinalis* coloratus
crowded confertus
cultivated cultus, sativus
curled crispus
cushion pulvinus
damp humidus
dark obscure
dead emortuus
decay dissolutio
deep profundus; intense
developed evolutus
die mori
docks navalia
downwards deorsum
downy lanuginosus
dry siccus
dull opace; impolitus
dwarf nanus
early prius, mox, praecoce
eastern orientalis
eastwards orientem versus
edge margo
edible edulis
either...or aut...aut
end pars terminalis
enlarge crescere, augere
entire integer
entirely omnino
equal aequalis, aequans
escape evadere; planta ex horto elapsa
established subspontaneus
evening vesper
evergreen sempervirens
exceeding superans
face facies
fan-shaped flabellatus
feebly debiliter, perleviter
female femineus, pistillatus
few pauci
finely subtiliter
first primus
flap valva, ligula
flat planus
flattened compressus, applanatus
flax *Linum usitatissimum*
flesh-coloured carneus, pallide et opace roseus
fleshy carnosus
floating natans
flooded inundatus
flower flos
fodder bestiarum pabulum
fold plica
following sequens
food cibus
forest silva magna
forwards porro
free liber
fringe fimbriae
fruit fructus
furnished munitus
furrow sulcus
garden hortus
glossy nitidus
golden aureus
grassy graminosus
gravelly glareosus

APPENDIX V

graze pascere
green viridis
grey cinereus
grooved canaliculatus, sulcatus
ground solum
group grex
grow crescere, habitare
hair pilum
hairy pilis munitus
half dimidium
hard durus
head caput, capitulum
heath ericetum, callunetum
hedge saepes
helmet galea
hill collis
hoary incanus
hollow fistulosus, cavus; cavum, excavatio
hood cucullus
hooked uncinatus
inner interior, internus
inside intus, intra; pagina vel pars interior
introduced inquilinus, allatus
jagged argutus
jointed articulatus
juice succus
keel carina
key clavis
lake lacus
late sero
later postea
leaf folium
leafless foliis carens
leaflet foliolum
length longitudo
less minus
level altitudo, gradus
lid operculum
light clare
limestone calx
lip labium
locally hic inde
low humilis, pusillus
lower inferior
lowland campestris, planitiem incolens
main principalis
male masculus, stamineus
many multi
marbled marmoratus
marsh palus
mat stratum e ramulis procumbentibus intertextis compositum
mauve malvinus
meadow pratum
mealy farinosus
medicinal officinalis
middle pars centralis; medius
midrib costa, folii nervus principalis
milky lacteus
mistake error
more plus, magis
most plerique, pars major
mountain mons
mouth os
much multo, multum
naked nudus
narrow angustus
native indigenus
naturalized inquilinus
near prope
nearly paene, fere
neither...nor nec...nec
net reticulum
never numquam
nodding nutans, cernuus
none nulli
northern borealis
northwards septentrionem versus
notch incisio
nut nux
often saepe
oil oleum
old vetus, antiquus
open apertus
orange aurantiacus
ornament decus
other alius, alter
otherwise aliter
outer exterior, externus
outside extra; pagina vel pars exterior
overlapping imbricatus
pale pallidus
papery chartaceus
pasture pascuum
patch macula
peat-bog turbarium
pink roseus
pitted foveolatus
planted cultus
point acumen
pond stagnum
pool stagnum
poor egens
prickle aculeus
prickle aculeolus
purple purpureus
quarter pars quarta
rank ordo
rarely raro
ray radius
red ruber
related affinis
remains reliquiae
rest ceteri
rib costa
rice-field oryzetum
rich abundans
ridge carina
rind fructus cortex
ring anulus
ripe maturus
river flumen
road via
rock saxum, rupes
root radix
rosette rosula
rough asper
rounded rotundatus
rust-coloured ferrugineus
salt-marsh palus salsa
sand arena
scale squama
scanty exiguus
scar cicatrix
scarcely vix
scarlet laete et clare ruber, paullulo aurantiaco affectus; ut flos *Salviae splendentis* coloratus
scattered sparsus
scented fragrans
scree clivus alpestris, saxis deorsum conjectis coopertus
scrub dumetum, fruticetum
sea mare
seed semen
seldom raro
several nonnulli, complures
shady umbrosus
shallow haud profundus
shape forma
sharply acute
sheath vagina
shelter tegmen contra ventum
shingle glarea maritima vel fluviatilis
shiny nitidus
shoot caudiculus, surculus
shore litus, ora
short brevis
shoulder angulus obtusus
shrub frutex
side latus, pagina
silky sericeus
silvery argenteus
slender tenuis, gracilis
slightly leviter, paullo
slipper calceolus
slit rima, foramen longum sed angustum
slope clivus, declivitas
small parvus
smell odor
smooth laevis
snow-patch locus in montibus ubi nix sero perdurat
soft mollis
soil solum
sometimes interdum
southern australis
southwards meridiem versus

APPENDIX V

spikelet spicula
spot punctum, macula
spreading patens, divaricatus
spring ver
spur calcar
square quadratus
stalk stipes
standard vexillum
stem caulis
stiff rigidus
stock caudex
stony lapidosus
stout crassus, robustus
straight rectus
streak linea
stream rivulus
stripe vitta
strong robustus, validus
suddenly abrupte
summer aestas
sunk(en) immersus
surface superficies, pagina
sweet dulcis
swollen tumidus, inflatus
tall altus
taste sapor
tawny fulvus
teeth dentes
thick crassus, densus, spissus
thicket dumetum
thin tenuis
third pars tertia
timber materia; lignum ad usum hominum aptum
tinged suffusus
tip apex
tipped ad apicem munitus vel tinctus
tooth dens
top vertex
tough lentus
tree arbor
true verus
tufted in fasciculos dispositus, caespitosus
twice bis
twig ramulus, virga
twining volubilis
twisted contortus
unarmed inermis
uncertain incertus, dubius
undivided indivisus
unequal inaequalis
united conjunctus, connatus
upper superior
uppermost supremus
upwards sursum
usually plerumque
vegetable olus
veil velum
vein nervus
velvety velutinus
vessel vas
violet violaceus
wart verruca
waste incultus
weak debilis, flaccidus
well bene
western occidentalis
westwards occidentem versus
wet madidus
white albus, candidus
whorled verticillatus
wide latus
widespread late diffusus
width latitudo
wing ala
winter hiems
wiry filo ferreo similis
withered marcidus
without sine
wood silva; lignum
woody lignosus
woolly lanatus
wrinkled rugosus
yellow flavus, luteus
young juvenis

INDEX

This index is intended to serve two purposes: to enable the reader to find the page on which any plant is mentioned, and to cite and explain names relegated to synonymy which occur in 'Standard Floras', but are not in sufficiently wide currency to justify their citation in the text (see p. xxv).

Generic names adopted in *Flora Europaea* are printed in **bold-faced** type; specific and subspecific epithets adopted are printed in ordinary type. (This applies not only to numbered species and genera, but also to those mentioned incidentally in observations, or in the introductory descriptions of families or genera.) All synonyms are printed in *italic* type, and are followed by a page-reference (also in *italics*); for those not cited in the text the page number is followed by a further number or numbers in parentheses to indicate the species (and, where necessary, subspecies, genus and family) on that page to which the synonym is referable. Among these numbers roman numerals denote the family, arabic numerals in ordinary type the genus, arabic numerals in **bold-faced** type the species, and a small letter (also in **bold-faced** type) following the species number the sub-species. Thus,

Iris

mangaliae Prodan, *90* (**19**)

indicates that the name is regarded as a synonym (partial or complete) of the species on p. 90 which is numbered **19**, namely **I. variegata**. Similarly,

Rhodostachys

pitcairniifolia (Verlot) Baker, *116* (CXC, 1, **1**)

indicates that this name is regarded as a synonym of species **1** (**pitcairniifolia**) in genus 1 (**Fascicularia**) of family CXC (**BROMELIACEAE**) on p. 116; because more than one family and genus are treated on the page, citation of genus and family is necessary to avoid ambiguity.

Synonyms of taxa mentioned in notes following a numbered species are indexed as being synonyms of that species. In cases where this procedure would be ambiguous or misleading, the synonym in question has been inserted in the text.

Some names of hybrids are similarly indexed with page and number references to their parent species.

All infraspecific taxa are arranged alphabetically, regardless of rank, under the species with which they are combined.

INDEX

TO FAMILIES AND GENERA OF VOLUMES 1—5

This index enables the reader to find the page on which family and generic names are to be found in the text of all five volumes, and to indicate in which volume synonyms mentioned in the index but not in the text occur.

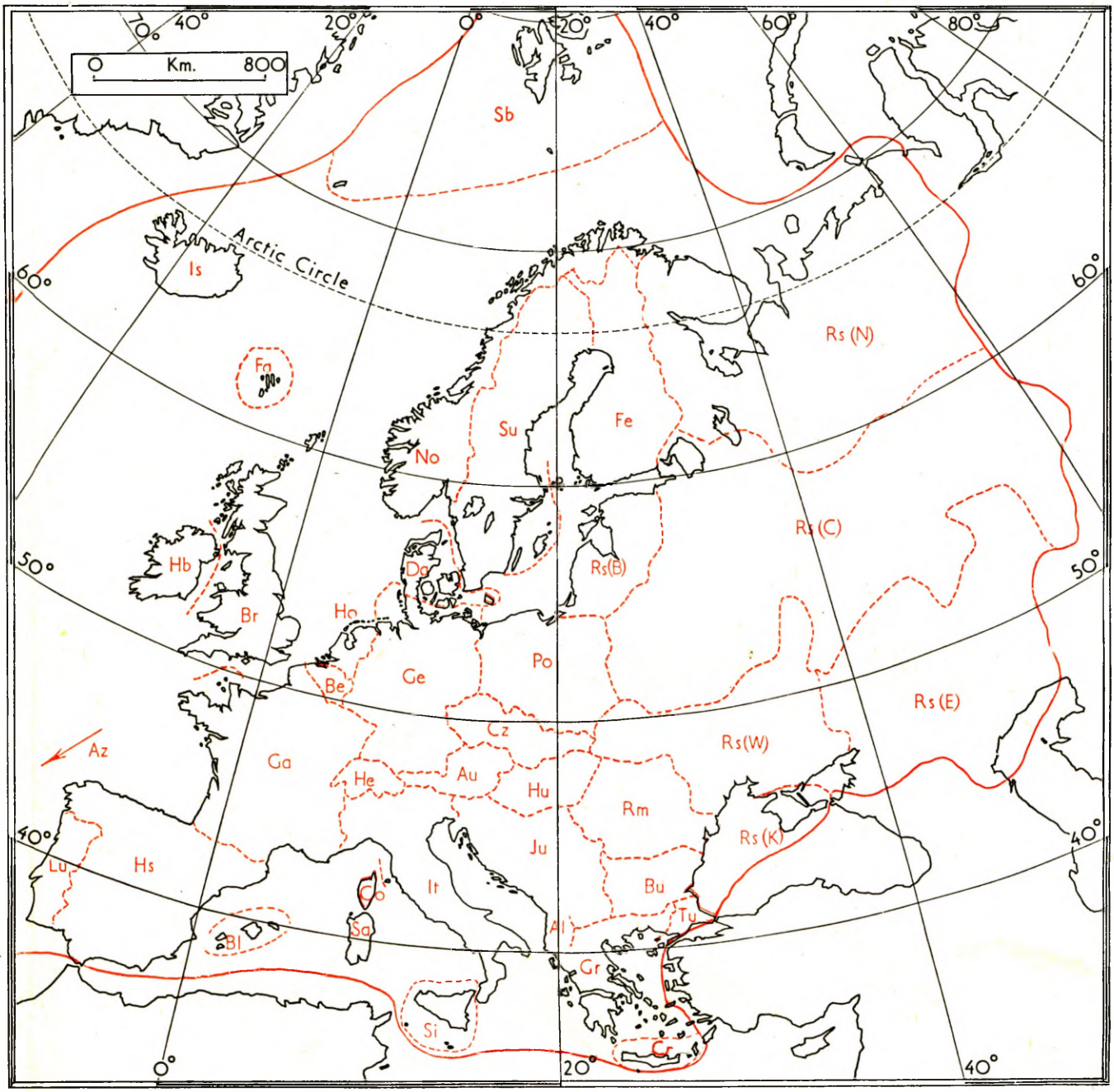
All names are followed by the volume number in **bold-faced** type. Family names adopted are in **bold-faced** capitals with the page number in ordinary type. Family synonyms are in *italic* capitals with the page number in *italics*. Generic names adopted are in ordinary type followed by the page number in ordinary type. Generic synonyms are in *italics*, those in the text being followed by the page number in *italics*. Generic names that are in the index but not in the text are followed only by the volume number in which they occur.

MAP I

To illustrate the boundaries of Europe for the purposes of *Flora Europaea*, and its division into 'territories' which are indicated by two-letter abbreviations after the summary of geographical distribution for each species. These abbreviations are derived from the Latin name of the territory concerned.

Al Albania
Au Austria, with Liechtenstein
Az Açores
Be Belgium, with Luxembourg
Bl Islas Baleares
Br Britain, including Orkneys, Zetland and Isle of Man; excluding Channel Islands and Northern Ireland
Bu Bulgaria
Co Corse
Cr Kriti (*Creta*), with Karpathos, Kasos and Gavdhos
Cz Czechoslovakia
Da Denmark (*Dania*), including Bornholm
Fa Færöer
Fe Finland (*Fennia*), including Ahvenanmaa (Aaland Islands)
Ga France (*Gallia*), with the Channel Islands (Îles Normandes) and Monaco; excluding Corse
Ge Germany (both eastern and western republics)
Gr Greece, excluding those islands included under Kriti (*supra*) and those which are outside Europe as defined for *Flora Europaea*
Hb Ireland (*Hibernia*); both the republic and Northern Ireland
He Switzerland (*Helvetia*)
Ho Netherlands (*Hollandia*)
Hs Spain (*Hispania*), with Gibraltar and Andorra; excluding Islas Baleares
Hu Hungary
Is Iceland (*Islandia*)
It Italy, including the Arcipelago Toscano; excluding Sardegna and Sicilia as defined *infra*
Ju Jugoslavia
Lu Portugal (*Lusitania*)
No Norway
Po Poland
Rm Romania
Rs U.S.S.R. (*Rossia*). This has been subdivided as follows, using the floristic divisions of Komarov's *Flora U.R.S.S.*; in a few places, however, our boundaries deviate slightly from those of Komarov.*
Rs (N) *Northern division:* Arctic Europe, Karelo-Lapland, Dvina-Pečora
Rs (B) *Baltic division:* Estonia, Latvia, Lithuania, Kaliningradskaja Oblast'
Rs (C) *Central division:* Ladoga-Ilmen, Upper Volga, Volga-Kama, Upper Dnepr, Volga-Don, Ural
Rs (W) *South-western division:* Moldavia, Middle Dnepr, Black Sea, Upper Dnestr
Rs (K) *Krym* (*Crimea*)
Rs (E) *South-eastern division:* Lower Don, Lower Volga, Transvolga
White Russia falls entirely within Rs (C). Ukraine is largely in Rs (W), but partly in Rs (K), Rs (C) and Rs (E). The European part of Kazakhstan is in Rs (E)
Sa Sardegna
Sb Svalbard, comprising Spitsbergen, Björnöya (Bear Island) and Jan Mayen
Si Sicilia, with Pantelleria, Isole Pelagie, Isole Lipari and Ustica; also the Malta archipelago
Su Sweden (*Suecia*), including Öland and Gotland
Tu Turkey (European part), including Imroz

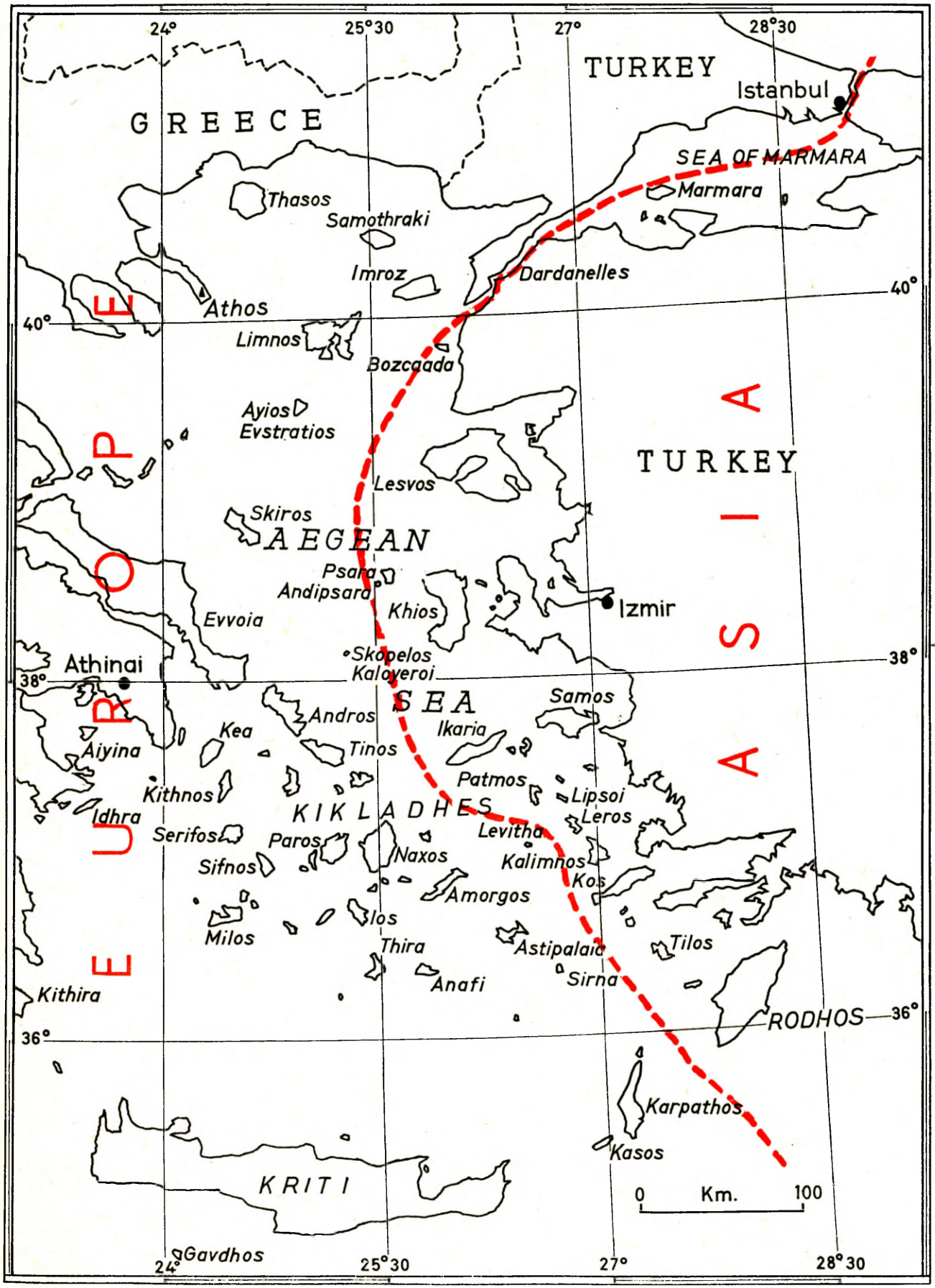
* For the relation of these subdivisions to those used in Fedorov's *Flora Partis Europaeae URSS*, see Introduction (p. xxiii)


0 Km. 800
Arctic Circle
Sb
Is
Fa
No
Su
Fe
Rs (N)
Rs (C)
Rs(B)
Hb
Br
Ho
Da
Ge
Po
Be
Cz
Rs(W)
Rs (E)
Az
Ga
He
Au
Hu
Rm
Rs (K)
Lu
Hs
Ju
Co
It
Bu
Tu
Sa
Al
Bl
Gr
Si
Cr
70°
40°
20°
0°
20°
40°
60°
80°
60°
50°
40°
0°
20°
40°

MAP II

To illustrate the boundary between Europe and Asia in the Aegean region.

The boundary is based largely on the proposals of K. H. Rechinger, 'Grundzüge der Pflanzenverbreitung in der Aegäis', *Vegetatio* **2**: 55 (1949). His northern, western and Kikladhes divisions are regarded as entirely in Europe and his eastern division as entirely in Asia; it was, however, necessary to divide his southern and north-eastern divisions.


24°
25°30
27°
28°30
TURKEY
Istanbul
GREECE
SEA OF MARMARA
Marmara
Thasos
Samothraki
Imroz
Dardanelles
40°
Athos
Limnos
Bozcaada
Ayios Evstratios
EUROPE
ASIA
TURKEY
Lesvos
Skiros
AEGEAN
Psara
Andipsara
Khios
Izmir
Evvoia
Athinai
Skopelos
Kalogeroi
38°
SEA
Samos
Andros
Ikaria
Kea
Aiyina
Tinos
Patmos
Lipsoi
Leros
Kithnos
Idhra
KIKLADHES
Serifos
Paros
Levitha
Naxos
Kalimnos
Kos
Sifnos
Amorgos
Ios
Milos
Thira
Astipalaia
Tilos
Anafi
Sirna
Kithira
RODHOS
36°
Karpathos
Kasos
KRITI
0 Km. 100
Gavdhos

MAP III

To illustrate the boundary between Europe and Asia in the southern part of the U.S.S.R.

The southern boundary of Europe between the Caspian and Black Seas is defined for *Flora Europaea* as running up the Terek River westwards to 45° E.; thence along the eastern and northern boundaries of the Stavropol'skij Kraj (as marked in *The Times Atlas*) to meet the Kuban River a short distance east of Kropotkin; thence down the Kuban River to its more southerly mouth.

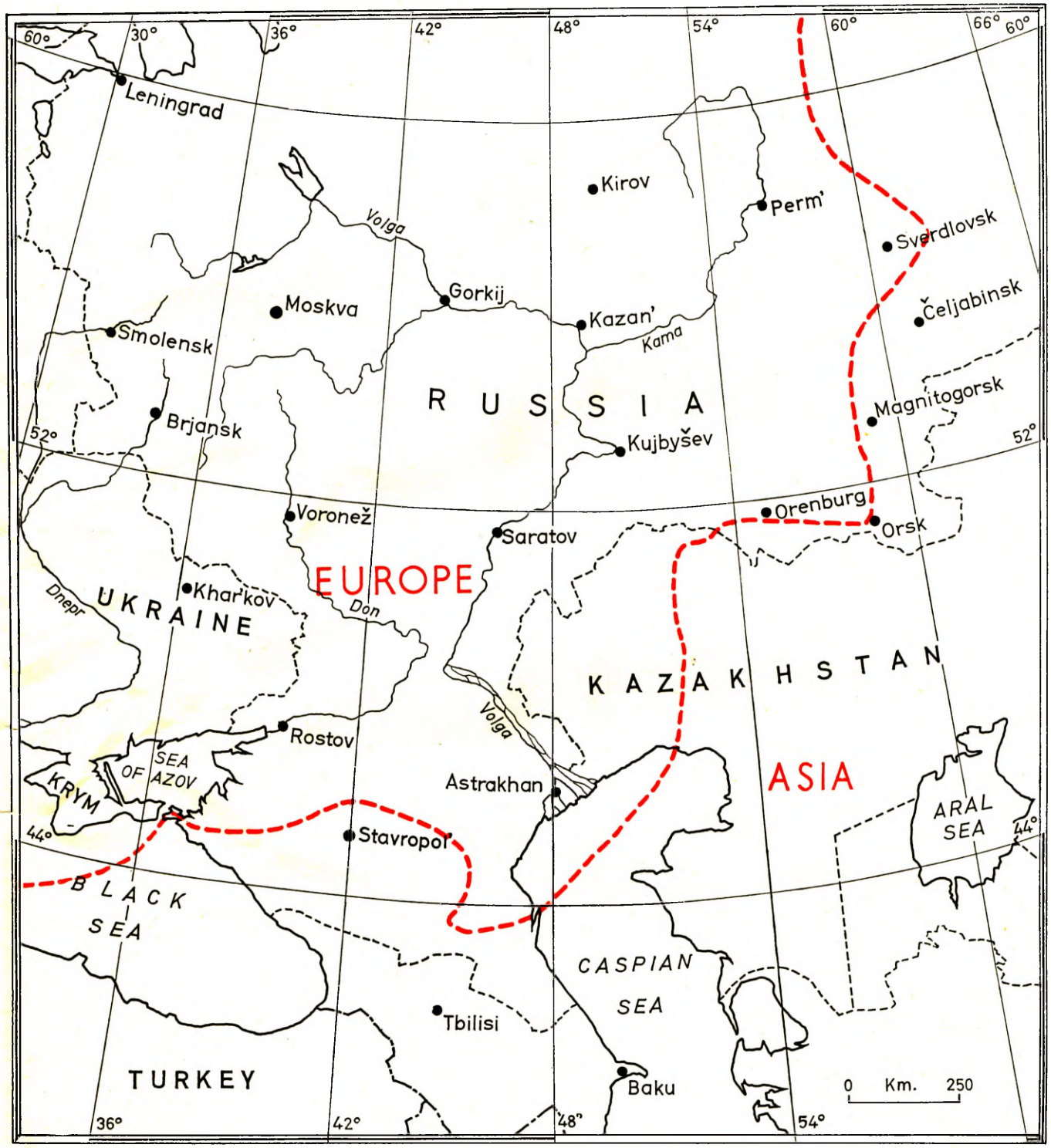
The eastern boundary of Europe is defined as running in the Arctic Ocean between Novaja Zemlja and Vajgač; up the Kara River to 68° N.; thence along the crest of the Ural Mountains (following the administrative boundaries) to 58° 30′ N.; thence by an arbitrary straight line to a point 50 km E. of Sverdlovsk, and by another arbitrary straight line to the head-waters of the Ural River (S. of Zlatoust); thence along the Ural River to the Caspian Sea.

The following administrative districts of the Russian S.F.S.R. near the eastern or southern boundary of Europe are regarded as entirely in Europe:

Arkhangel'skaja Obl.
Komi A.S.S.R.
Permskaja Obl.
Kujbyševskaja Obl.
Saratovskaja Obl.
Volgogradskaja Obl.
Astrakhanskaja Obl.
Kalmyckaja A.S.S.R.
Rostovskaja Obl.

The following are regarded as partly in Europe, partly in Asia:

Russian S.F.S.R.
Sverdlovskaja Obl.
Čeljabinskaja Obl.
Baškirskaja A.S.S.R. (only the extreme N.E. corner being in Asia)
Orenburgskaja Obl.
Dagestanskaja A.S.S.R.
Čečeno-Inguškaja A.S.S.R.
Krasnodarskij Kraj
Kazakhstan
Zapadno-Kazakhstanskaja Obl.
Gur'jevskaja Obl.


60°
30°
36°
42°
48°
54°
60°
66°
60°
Leningrad
Kirov
Perm'
Sverdlovsk
Volga
Gorkij
Moskva
Kazan'
Čeljabinsk
Smolensk
Kama
RUSSIA
Magnitogorsk
Brjansk
52°
Kujbyšev
52°
Orenburg
Voronež
Saratov
Orsk
EUROPE
Kharkov
Dnepr
UKRAINE
Don
KAZAKHSTAN
Volga
Rostov
SEA OF AZOV
ASIA
KRYM
Astrakhan
ARAL SEA
44°
Stavropol'
44°
BLACK SEA
CASPIAN SEA
Tbilisi
TURKEY
Baku
0 Km. 250
36°
42°
48°
54°

MAP IV

To illustrate the meaning to be attached to certain phrases used in summaries of geographical distribution.

W. Europe: Açores, Portugal, Spain, Islas Baleares, France, Ireland, Britain, Færöer, Iceland, S.W. Norway, Netherlands, Belgium, N.W. Germany, W. Denmark (Jylland), Corse, Sardegna, and small parts of N.W. Italy and W. Switzerland

E. Europe: N.E. Greece and the Aegean islands, Bulgaria, S. & E. Romania, Finland, U.S.S.R.

N. Europe: Svalbard, Iceland, Færöer, Ireland, Britain (excluding S. England), Denmark, Fennoscandia, U.S.S.R. north of a line running through Minsk–Tula–Penza–Orsk

S. Europe: Europe south of a line running through Bordeaux–Chambéry–Aosta–Locarno–Riva–Udine–Zagreb–Beograd–Ploesti–Odessa–Rostov–Astrakhan'.

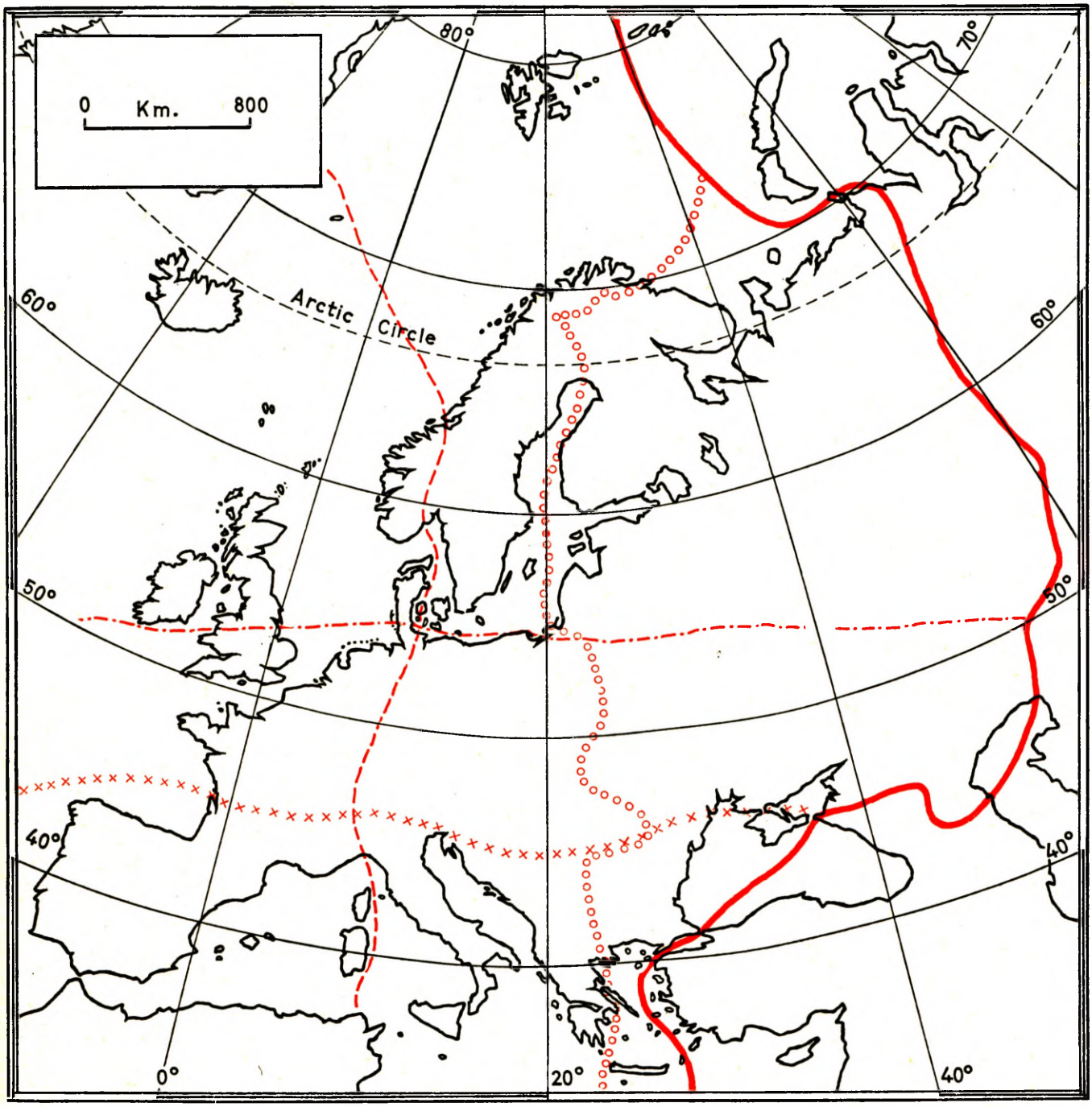
– – – – – – – – eastern boundary of *W. Europe*

– · – · – · – · – southern boundary of *N. Europe*

○ ○ ○ ○ ○ ○ western boundary of *E. Europe*

× × × × × northern boundary of *S. Europe*

For the definition and illustration of the meaning of S.W., N.W., S.E., N.E. and C. Europe, and of certain other geographical phrases, see map v.


0 Km. 800
80°
70°
60°
Arctic Circle
60°
50°
50°
40°
40°
0°
20°
40°

MAP V

To illustrate the meaning to be attached to certain phrases used in summaries of geographical distribution.

S.W. Europe: Açores, Portugal, Spain, Islas Baleares, Corse, Sardegna, S. France, N.W. Italy

N.W. Europe: Iceland, Færöer, Britain, N. France, Belgium, Netherlands, N.W. Germany, W. Denmark (Jylland), Norway

S.E. Europe: The Balkan peninsula, Aegean islands, S.E. Italy, S. & E. Romania, U.S.S.R. south of about 48° N.

N.E. Europe: U.S.S.R. north of a line from Vilnius to Sverdlovsk, Finland, E. Sweden, a small part of N.E. Norway.

C. Europe: Alsace and Lorraine, Germany, Switzerland, Austria, the Italian Alps from Monte Bianco eastwards, Hungary, Czechoslovakia, Poland, the Ukrainian Carpathians, N., W. & C. Romania, Jugoslavia north of the Danube–Sava–Kupa line.

Maps IV and V are intended merely to give precision to certain geographical phrases which are commonly used, but used in various senses in different parts of Europe. They do not purport to divide Europe into phytogeographical regions, as is apparent from the fact that along parts of their boundaries these regions overlap, and along other parts they are not contiguous.

Certain other phrases used in the summaries of geographical distribution, but not illustrated in the maps, may be briefly defined as follows:

Alps: Separated from the Appennini at 8° 15′ E. (above Savona); bounded on the east by the line Semmering–Graz–Maribor–Ljubljana–Trieste. Divided into three major divisions: *eastern*, *central*, and *south-western*, by the lines Arlberg–St Moritz–Chiavenna–Como and Genève–Chamonix–Aosta–Ivrea.

Arctic: This term is used to designate all territories north of the Arctic Circle, and is not restricted to those which have only 'arctic' vegetation.

Extreme north: Arctic Europe, together with Iceland, and Fennoscandia and Russia northwards from approximately 64° N.

Carpathians: Divided into *western*, *eastern* and *southern* divisions at the pass of Łupków (22° E.) and the Oituz Pass (46° 05′ N.). The western division is in Czechoslovakia and Poland, the southern entirely in Romania, the eastern extends from Czechoslovakia and Poland through Ukraine to Romania.

Pyrenees: Includes the subsidiary chains within 50 km of the main watershed, and extends westwards to Bilbao and Vitoria. Divided into *eastern*, *central* and *western* divisions at the Pont du Roi (0° 45′ E.) and the Col du Somport (0° 30′ W.).

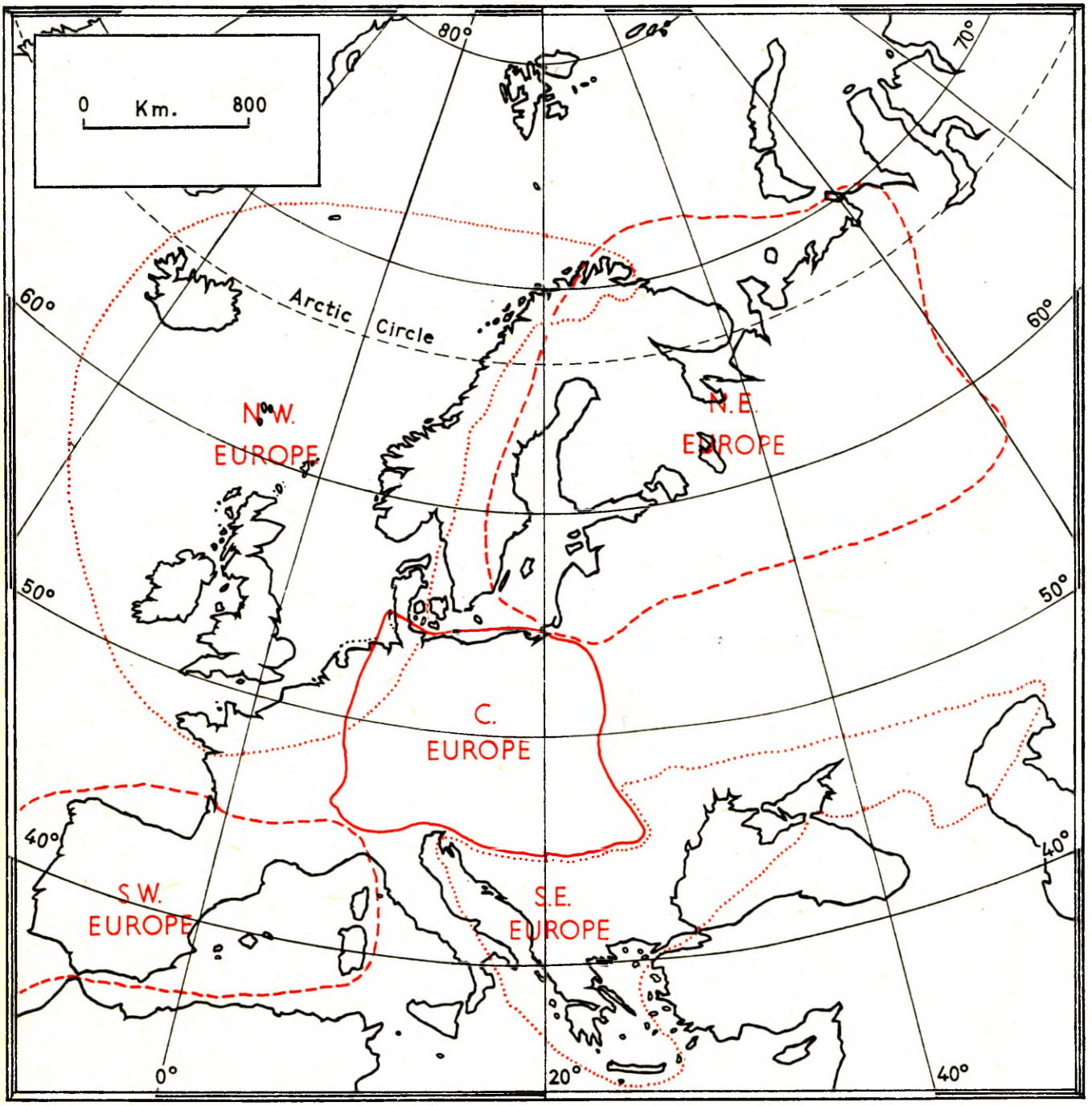
Balkan peninsula: Jugoslavia south of the Danube–Sava–Kupa line, Bulgaria, Albania, Greece (including islands close to the mainland) and Turkey-in-Europe.

Fennoscandia: Norway, Sweden, Finland and part of N.W. Russia (Murmanskaja Oblast' and Karelskaja A.S.S.R.).

Mediterranean region: All European territories within 100 km of the Mediterranean Sea (including the Adriatic, but not the Black Sea), and including also all Italy except the Alpine region and all Spain except the west and north-west. It is divided into *eastern* and *western* divisions by a line following the main watershed of Italy and running east of Sicilia. *Central Mediterranean* indicates the region between 8° E. and 20° E.

Aegean region: All islands in the Aegean Sea which come within the scope of the *Flora*, and those parts of Greece and Turkey-in-Europe which drain into the Aegean Sea or the Dardanelles.

Macedonia: Comprises the Jugoslav republic of Makedonija, the Greek province of Makedhonia, and the Bulgarian province of Blagoevgrad.


0 Km. 800
80°
70°
60°
60°
Arctic Circle
N.W.
EUROPE
N.E.
EUROPE
50°
50°
C.
EUROPE
40°
40°
S.W.
EUROPE
S.E.
EUROPE
0°
20°
40°