

Catalogue and keys of the Acridomorpha (Insecta, Orthoptera) from north West Africa

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ABSTRACT

A computerized update of the diversity of locusts and grasshoppers has been achieved for Morocco, Algeria, Tunisia, and Western Sahara. 241 species were recorded belonging to five families: Charilaidae Dirsh, 1953, Pamphagidae Burmeister, 1840, Pyrgomorphidae Brunner von Wattenwyl, 1882, Acrididae MacLeay, 1821 and Dericorythidae Jacobson & Bianchi, 1905. Diagnosis is provided for species, genera and families, together with identification tools, by means of a computer-assisted identification procedure, using the software Xper2. Descriptive sheets of each taxon include nomenclatural data, diagnostic characters, and distributional maps, together with photographs of male and female specimens. This base is located on the website “Muséum des Scientifiques” of the Muséum national d’Histoire naturelle, Paris, at the following address <http://acrinwafrica.mnhn.fr>.

KEY WORDS
photos species online,
Xper2 assisted-
identification.

RÉSUMÉ

Catalogue et clés des Acridomorpha (Insecta, Orthoptera) du nord de l’Afrique de l’Ouest.

Un bilan actualisé de la diversité des acridiens a été réalisé pour le Maroc, l’Algérie, la Tunisie et le Sahara Occidental. Les 241 espèces recensées appartiennent à cinq familles : Charilaidae Dirsh, 1953, Pamphagidae Burmeister, 1840, Pyrgomorphidae Brunner von Wattenwyl, 1882, Acrididae MacLeay, 1821 and Dericorythidae Jacobson & Bianchi, 1905. Une diagnose est fournie pour les

MOTS CLÉS
 photos d'espèces en
 ligne,
 Xper2 identification
 assistée.

espèces, les genres et les familles, et des outils d'identification sont proposés avec le logiciel Xper2 d'identification assistée par ordinateur. La fiche descriptive de chaque taxon présente sa nomenclature, des caractères de diagnose, et des cartes de répartition, en plus de photographies de spécimens mâle et femelle. La base de connaissances est hébergée dans la rubrique « Muséum des Scientifiques » du site internet du Muséum national d'Histoire naturelle, Paris, à l'adresse <http://acrinwafrica.mnhn.fr>.

INTRODUCTION

The African region from 22°N latitude to the Mediterranean Sea and to eastern Tunisia constitutes a remarkable mosaic of ecosystems and phylogeographic entity (TARRIER & DELACRE 2008; HABEL *et al.* 2008). Its biodiversity is not only high, but also original, and it deserves being taken into account for academic purposes as well as conservation studies (TARRIER & DELACRE 2008). A first step however is to identify the species present with a reasonable certainty. For orthopteroid insects, the last systematic synthesis was performed by CHOPARD (1943), who proposed identification keys for genera and species, and gathered available data about the distribution and biology of the species. Because of the rapidly growing taxonomic information, CHOPARD'S book is now out of date. If an updated list of species has been recently proposed for Ensifera CHOPARD, 1921 (MOHAMED SAHNOUN *et al.* 2010), nothing exists to facilitate studies of Caelifera ANDER, 1939, even though they include several potentially invasive species (Centre for Overseas Pest Research 1982). Here, we describe an updated assessment of the diversity of the locusts and grasshoppers in north West Africa, which is now available on internet. We listed 241 species of Orthoptera Acridomorpha DIRSH, 1975 for Morocco, Algeria, Tunisia and Western Sahara, distributed in five families (Table 1). The systematic and distribution of many species are far from being satisfactorily known, stressing the need for more taxonomical and ecological studies (Default 1994; Song 2010).

We intend to provide an easy access to relevant information about Acridomorpha for anyone interested in this group of insects or by the region under investigation, i.e. mainly professionals in species conservation and natural environments, anti-locusts staffs eager to preserve the non-target fauna, students in entomology and ecologists who are looking for taxonomic, photographic and bibliographic information.

MATERIAL AND METHODS

STUDIED MATERIAL

Our work is based mostly on the Caelifera collections of the Muséum national d'Histoire naturelle (MNHN). These collections are particularly diverse and plentiful for North Africa, as they were gathered by P. H. Lucas, A. Finot, L. Chopard and M. Descamps, among other orthopterists, who performed both intensive field work and systematic studies.

INFORMATION PROVIDED FOR EACH SPECIES

To update CHOPARD'S synthesis "Orthopteroids fauna of North Africa" (1943) our studies were oriented in three directions:

Nomenclatural data and type specimens

We did a bibliographic compilation up to the original publication to check authors, dates, nomenclatural changes and synonymies. Whenever possible, we indicate the repository of species type specimens. The following museums were solicited: the Natural

History Museum (previously British Museum of Natural History), London; Museo Nacional de Ciencias Naturales, Madrid; Musée d'Histoire naturelle de Genève, Geneva; Muséum national d'Histoire naturelle, Paris.

We consulted SYSTAX databank of the University of Ulm (Hoppe *et al.* 2012) and Thunberg (Uppsala University; <http://www.evolutionsmuseet.uu.se/samling/index.html>) and of La Greca (Castellani 2004).

Geographic information and species data

We checked longitude/latitude coordinates location of the specimens referenced in the MNHN collection and the ones published in taxonomic studies. The following web sites were also used geographical names (http://www.geographic.org/geographic_names/ last retrieval 14.IX.2012) and Google Earth and Google Map. Road maps of Institut géographique national (IGN) (1/750 000) and ancient maps were also useful to locate old names no more in use. Because location mentioned on the specimen label is not always accurate, may have homonyms, or be wrongly spelled, about twenty percent of the specimen localities could not be reported on maps. For these reasons, the accuracy of the distribution maps is at the department level (i.e. wilaya in local terms). Localities indicated in species inventories but not associated with voucher specimens were separated on maps by a different color code.

Species descriptions

Diagnoses are based on the original descriptions of the species, or taxonomic revisions. The morphometric descriptions given in size range are based on the latest bibliographic data available. We tried to use mostly identification criteria useful for field studies. Consequently we did not use genitalic structures in the first place, as these criteria were used as a basic tool by the authors to separate and identify the species.

PHOTOGRAPHIC DOCUMENTATION

Male and female specimens, whenever possible types or paratypes, were photographed with a size scale. About 800 photographs were taken with specimens in lateral and dorsal view. All are from the

TABLE 1. — Species richness of Acridoidea MacLeay, 1821 and Acridomorpha Dirsh, 1975 in north West Africa.

	Genera	Species
Charilaidae	1	1
Pamphagidae		
Pamphaginae	14	76
Trinchinae	2	7
Pyrgomorphidae		
Pyrgomorphinae	5	10
Acrididae		
Acridinae	3	5
Calliptaminae	2	8
Catantopinae	2	2
Cyrtacanthacridinae	3	4
Egnatiinae	2	6
Eremogryllinae	2	6
Eyprepocnemidinae	2	8
Gomphocerinae	10	33
Oedipodinae	19	61
Tropidopolinae	1	1
Dericorythidae		
Dericorythinae	4	13
Total	72	241

collection of the MNHN. Macro or proxy photos were performed on a bench with a Nikon D90 camera and lens Micro-Nikkor, 105 mm, f2.8 VR. In post-production we used CombineZ5 software for a maximum depth of field and Photoshop CS2.

All these data were compiled into descriptive sheets in HTML and integrated into a computer-assisted identification software.

ACRIDOMORPHA CLASSIFICATION

The classification of the Acridomorpha group has been significantly modified since Dirsh (1965) and Jago (1971). We use the families and subfamilies followed in the *Orthoptera Species File Online*, with five families in the region: Charilaidae Dirsh, 1953, Pamphagidae Burmeister, 1840, Pyrgomorphidae Brunner von Wattenwyl, 1882, Acrididae MacLeay, 1821 and Dericorythidae Jacobson & Bianchi, 1905 (Rowell & Flook 1998; Eades *et al.* 2011; Table 1).

Compared to Chopard (1943), the Acridinae, which used to include 17 genera are nowadays restricted to *Acrida* Linnaeus, 1758, *Calephorus* Fieber, 1853 and *Truxalis* Fabricius, 1775 (Jago 1996; Chapco & Contreras 2011), the remaining 14 genera being distributed between the Gompho-

Base Publier Options Aide

Genres [fr] Réinitialiser

Descripteurs Description en cours

Descripteurs : 26

Filtrer par groupe Tous les groupes

Meilleur descripteur ?

Fastigium
Sillon fastigial
Espace mésosternal
Processus prosternal
Tête
Tegmina
Système stridulatoire tegmino-fémoral
Antennes
Pronotum
Carène médiane du pronotum
Carènes latérales du pronotum
Sillons transverses du pronotum
Bord antérieur du pronotum
Bord postérieur du pronotum
Plaque sous-génitale (mâles)
Cercques des mâles
Dimorphisme sexuel (taille)
Fémurs postérieurs
Lobe basal inférieur du fémur postérieur
Carène supérieure des fémurs postérieurs
Carène inférieure des fémurs postérieurs
Tibias des pattes postérieures
Pattes moyennes
Corps
Téguments
Carène dorsale de l'abdomen des mâles

Etats : 4

Validier OR

très allongé, très en avant des yeux, apex obtus ou arrondi (2)
en avant des yeux, aréoles fastigiales à l'apex (4)
court, caréné ou arrondi (63)
triangulaire coupé par le sillon fastigial (2)

Définition

Fastigium

Partie antérieure du vertex plus ou moins proéminente en avant des yeux, coupée ou non par un sillon médian.

Illustrations

1. Aréoles fastigi... 2. Aréoles fastigi... 3. Très en avant...
4. Très en avant... 5. Fastigium court 6. Fastigium court
7. Court, caréné 8. Triangulaire 9. Triangulaire

Titre Aréoles fastigiales apicales

Pyrgomorpha conica femelle

Description

Item(s) candidat(s) : 71

viewXper

Acanthacris (Cyrtacanthacridinae)
Acinipe (Pamphaginae)
Acrida (Acridinae)
Acrotylus (Oedipodinae)
Aiolopus (Oedipodinae)
Amisimizia (Catantopinae)
Anacridium (Cyrtacanthacridinae)
Anamesacris (Dericorythinae)
Arcyptera s/g. Paracyptera (Gomphocerinae)
Bolivaremia (Dericorythinae)
Calephorus (Acridinae)
Calliptamus (Calliptaminae)
Chorthippus (Gomphocerinae)
Dericorys (Dericorythinae)
Dociostaurus (Gomphocerinae)
Duronella (Oedipodinae)
Egnatella (Egnatinae)
Egnatoides (Egnatinae)
Eremogryllus (Eremogryllinae)
Euchorthippus (Gomphocerinae)
Eunapiodes (Pamphaginae)
Eurypryphes (Pamphaginae)
Eyreprocnemis (Eyreprocnemidinae)
Finotia (Pamphaginae)
Clauia (Pamphaginae)
Clauvarovia (Pamphaginae)
Helioscirtus (Oedipodinae)
Heteracris (Eyreprocnemidinae)
Hilethera (Oedipodinae)
Hyalorhipis (Oedipodinae)
Lepta (Pyrgomorphae)
Leptopternis (Oedipodinae)
Locusta (Oedipodinae)
Macrolepta (Pyrgomorphae)
Mioscirtus (Oedipodinae)
Morphacris (Oedipodinae)
Notopleura (Eremogryllinae)

Item(s) éliminé(s) : 0

viewXper

Fig. 1. — Identification page of Xper2: the descriptors with their states are in the left, with definitions and illustrations in the middle. Discarded taxa and remaining taxa during the polling are listed in the right.

cerinae Fieber, 1853, Oedipodinae Walker, 1871 and Eremogryllinae Dirsh, 1956. The subfamily Dericorythinae Jacobson & Bianchi, 1905 has been reintegrated into the family rank (Eades 2000). According to Storozhenko & Paik (2011), the genera *Tmethis* Fieber, 1853 and *Tuarega* Uvarov, 1943, initially in the subfamily of Batrachotetriginae Kirby, 1910, have been removed from Akicerinae Bolivar, 1916 and Prionotropisinae Zhang, Yin & Yin, 2003, and would now be considered as belonging to the Trinchinae Stål, 1876 (Storozhenko & Paik 2011). Pamphaginae Burmeister, 1840 have been enhanced of seven new genera and they gained 30 new species and a few subspecies. The genus *Sphingonotus* Fieber, 1852 has been recently separated into three

subgenera, *Sphingonotus* (*Sphingonotus*) Fieber, 1852, *Sphingonotus* (*Neosphingonotus*) Benediktov, 1998 and *Sphingonotus* (*Parasphingonotus*) Benediktov & Husemann, 2009 (Husemann *et al.* 2011).

INTRODUCTION TO THE KNOWLEDGE BASE

The knowledge base is hosted at the “Muséum des Scientifiques” of the Muséum national d’Histoire naturelle, Paris (MNHN). It is compatible with Windows and Mac OS X and optimized for Mozilla Firefox. It requires the most recent version of Java software to run Xper2, a computer-aided

Identifier
Consulter

Pamphaginae

Euryparyphes laetus



Auteur : (Bolivar, 1907)
Localité type : Maroc, Mogador (Essaouira)
Dépôt type : MNCN, ST m f
Spécimens observés : m, MNHN-EO-CAELIF225
 f, MNHN-EO-CAELIF226



Eunapius laetus Bolivar, 1907
Euryparyphes laetus - Johnston 1956


Synonymies :
Eunapius laetus mazaganicus Bolivar, 1907
Euryparyphes laetus fezanus Uvarov, 1929
Euryparyphes septentrionalis Werner, 1932

Identification

Espèce la plus polymorphe du genre. Tête presque lisse. Corps épais et verruqueux. Coloration générale brune ou verdâtre plus ou moins sombre variée de blanc. Pronotum granuleux, convexe et carène médiane coupée par un sillon transverse ; bord postérieur festonné de granules épineux caractéristiques; carènes latérales pas toujours nettes. Tubercule prosternal fortement bidenté. Fémurs postérieurs à carène supérieure et inférieures dilatées, irrégulièrement serrulées; face interne avec une tache brun foncé ou noire et la face inférieure rouge jamais bleue (mâles). Face interne des tibias postérieurs noir violacé ; épines internes noires, externes ochracées. Tegmina ovales élargis au milieu, aire dorsale claire traversée d'une ligne brune (La Greca, 1993a).



Mâle et femelle: Maroc, Bab Azhar [Taza]

Habitat

Milieux herbacés, friches pâturées et milieux ouverts à *Cistes*, *Chamaerops humilis* et asphodèles (Default, 1994).

Taille (mm)

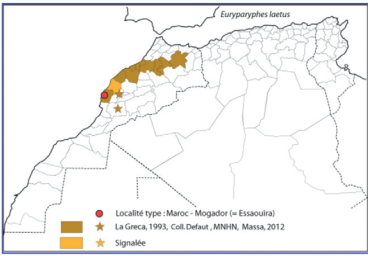
D'après Default, 1987c			
	n	Corps	Fém. post.
Mâle	22	26 - 29.5	11 - 14
Femelle	10	39 - 48	16 - 19

Répartition géographique

Euryparyphes qui a la répartition la plus méridionale, jusqu'au Souss (Massa, 2012).

Maroc

Région côtière: de Essaouira à Ksar el Kebir [Larache] (Massa, 2012) ; Skhirate, Souk el Arba des Sehoul (forêt) et Sidi Yahia des Zaer [Rabat-Salé], Mechra Ben Abbou [Settat], Ben Slimane ; Oualidia et Azemmour [El Jadida] (La Greca, 1993a ; Default, 1987b) ; Cap Beddouza [Safi], Ouezzane [Sidi Kacem] (Chopard, 1936).
 Maaziz [Khemisset] (Default, 1994) ; Rommani et Tedders [Khemisset] Sefrou et Jb. Zalagh [Fès], Causse de El Hajeb et Sidi Slimane [Meknès] (Default, 1987b ; La Greca, 1993a) ; Kasba Tadla [Beni Mellal] (Chopard, 1936).
 En altitude au Moyen Atlas, jusqu'à 1100 m: Ito et Imouzzer [Ifrane], Ahermoumou (La Greca, 1993a ; Massa, 2012).
 Haut Atlas : Amismiz (Default, 1987b).
 Région de Taza: Aïn Behira (Werner, 1932a) ; Ahermoumou, Bab Azhar (MNHN).
 Souss: Tazert (Massa, 2012).



Répartition de *Euryparyphes laetus*

Note

Mis en synonymie avec *E. septentrionalis* par Massa (2012).

FIG. 2. — Example of a species descriptive sheet, with nomenclatural data on the top banner, diagnostic features, ecological observations and distributional data. The map shows the type locality, and separates localities associated (dark color) or not (light color) with voucher specimens.

identification tool, developed by the Laboratoire d'Informatique and de Systematique (LIS, UMR 7207, Université Pierre et Marie Curie, France) (see Vigne & Lebbe 2012) (Fig. 1). Identification keys and description of the knowledge base are in French only. The menus of the website are also available in English. Menus of Xper2 are available in French, English, Spanish, Chinese and Portuguese, as an option in the status bar of Xper2.

Identifications can be done using two complementary options in the menus: the first option is a help to identify a specimen. The process progresses as a list of questions/multiple choice answers. Identification descriptors are not organized into a hierarchy, contrary to conventional dichotomous keys, and responses can be modulated by the logical operators AND, OR, NOT. The ever-present help menu shows photos, drawings and definitions. In the final diagnosis, all used descriptors with their chosen state are listed and a link leads back to the full description sheet of the proposed species. The second option is to call species description sheets, using an index of the current name in use, synonyms or species names no longer valid.

Species sheets include a list of diagnostic key features, photos, size array, a distribution map and main bibliography (Fig. 2). Nomenclatural data are on the top banner of the sheet; they include the current name, the author, the repository of the type, synonyms and changes in status.

A click on text illustrations enlarge them at their full size, 800 pixels wide, with a resolution of 92 ppi. All photographed specimens are located in the MNHN Caelifera collection. For a more detailed examination of type or paratype specimens, photos are available in a larger size (2500 pixels wide and 92 ppi resolution) in the MNHN collection database for terrestrial arthropods (<http://coldb.mnhn.fr>).

DISCUSSION

One conclusion of our work is that about one third of the Chopard's 1943 synthesis is out of

date, either because the status of the taxa has been modified, or because new species and sub-species have been described. Also, available data are clearly insufficient in the region, stressing the need for more taxonomical and ecological studies (Defaut 1994; Song 2010).

Our understanding of the species distribution remains patchy and did not progress as much as it could have. The presence of some European species has not been confirmed in north West Africa. 18 out of 35 species known in 1943 by their type locality only are not better known today, and 92 out of the 241 species recorded are cited in five or less localities. This situation is due to priority for a control of the locust plagues, the grasshoppers being considered of minor interest. More, nowadays the geopolitical situation in the region limits access to the field and slows down research output. Another major difficulty encountered by students and researchers of the Maghreb is the limited number of institutional collections to keep and make available reference material. More generally, information on North African Acridomorpha are scattered and difficult to update. Our knowledge base provides an access to part of relevant information by means of free internet, following previous initiatives in this direction (Ingrisch *et al.* 2004; Mestre & Chiffaud 2006), including taxonomic reference data bases (OSF2, DORSA). In the next future, the present knowledge base will provide pdf or links to taxonomic papers, be incremented by additional distributional data based on voucher specimens, and be translated in additional languages.

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