Australian Grasses

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Herba perennis, dichotome ramosa; caulis ramique praeter lineas duas tenues pubescentes glabri, ad nodos paulo incrassati. *Folia* oblongo-elliptica vel superiora anguste oblonga vel sublinearia, utrinque acuta, integra, 3-7 cm. longa, 0.7-1.7 cm. lata, supra obscure viridia, in sicco cystolithis numerosissimis albo-striolulata, costa albo-pubescente, praeterea sparse pilosula, subtus pallidiora, in nervis laxè pubescentia, nervis tenuibus; petioli tenues, foliorum intermediarum 6-10 mm. longi, summorum multo breviores. *Inflorescentiae* terminales et ex foliorum summorum axillis, sub anthesi capituliformes, deinde elongatae, densae; bractae late obovatae, apice rotundatae, basi cuneatim attenuatae, 8 mm. longae, ad 6 mm. latae, supra sparse pilosae, subtus dense minute glanduloso-pubescentes, circumcirca longe ciliatae; bracteolae oblanceolatae, bracteis fere aequilongae, indumento simili indutae. *Calyx* ad basin 5-partitus, segmentis lineari-lanceolatis acutis 5 mm. longis apice tantum pubescentibus marginibus anguste hyalinis. *Corolla* extus puberula, tubo angusto albido 12-14 mm. longo, limbo purpureo-violaceo; labium superum 4-5 mm. longum, minute bilobum; labium inferum 6-7 mm. longum, profunde 3-lobum, lobis divaricatis, lateralibus quam intermedio paulo angustioribus, hoc in fundo maculo albo-pinnato ornato. *Antherae* ad medium labii superioris adscendentes, albae, connectivo latiusculo, thecis inaequaliter affixis, inferiore basi acuta. *Stigma* breviter 2-lobum. *Capsula* clavata, mucronato-acuta, 8 mm. longa, medio in stipitem latiusculum contracta. *Semina* 4, discoidea, minute granulosa, fusca, 1.5-1.7 mm. diametro. *Radicula* leviter curvata, cotyledonibus apposita.

TROPICAL AMERICA. Locality unknown. Raised at Kew from seed received from the Jardin des Plantes, Paris, in 1903.

IV.—AUSTRALIAN GRASSES.

Mr. Fred. Turner, F.L.S., has contributed several interesting articles on Australian plants of economic interest to the *Sydney Morning Herald* during the past year. With the object of making them more generally known, two of them, dealing with the native grasses of Australia, are reprinted here by kind permission of the proprietors of the *Herald* (Sir James Fairfax and Sons). The first article was published on May 28th and the second in the issue of June 13th, 1907.

AUSTRALIAN GRASSES.—I.

Recovery of Native Pastures.—Before the breaking of the last disastrous drought several pastoralists, with much experience of the western country, expressed to me their fears that many of the indigenous grasses had disappeared for ever, and that the grazing areas would in consequence always remain in an indifferent condition, as any plants that survived such unprecedented dry weather would never recover sufficiently to provide valuable pasture herbage for stock. That was the verdict given about much of the

ordinary class of pastoral country, whereas the areas from which the loose surface soil had been blown by wind storms were regarded as irreclaimable "miniature Saharas," as it was asserted that both grass roots and grass seeds had been removed with the soil. At that time I reminded those stock-owners of the wonderful recuperative powers of Australian grasses, of the remarkable vitality of their seeds, and of the depth to which they naturally penetrate the soil, and predicted that after the land had received a good soaking rain the plants would recover, and if they did not regain their pristine vigour, would certainly, with careful and judicious grazing, eventually produce valuable pasture herbage, which would support millions of sheep and other herbivora. My ideas were considered too optimistic then, when it was the fashion to indulge in so much pessimistic talk.

A short time after the breaking of the drought I was botanising in the western country, and saw, as I had previously predicted, millions of acres covered with beautiful verdure that gladdened the heart of the stock-owner. On those at one time almost desert-like tracks the grasses were three feet high or more, and most of the country resembled a magnificent wheat-field just coming into ear. One pastoralist remarked, "It is seven years since I saw a blade of kangaroo grass (*Anthistiria ciliata**), and look at it now." Some of the plants which I measured were four feet three inches high. Another observant grazier in a different part of the West pointed out to me seven species of grass which he had never before seen growing on his station during the fourteen years he had been in possession; and several other stock-owners in various parts of the West gave similar information, and thought the occurrence very remarkable. Those are practical proofs of the wonderful vitality of Australian grass seeds. The seeds must have lain dormant for many years, and when the earth and atmospheric conditions were favourable germinated, and subsequently developed into such fine plants as to make them conspicuous objects in the pastures, and easily recognisable by pastoralists as distinct from those they had been accustomed to see. For some months after the breaking of the drought I received for identification scores of specimens of grasses, especially from those parts where heavy rain had fallen, and many were marked "never observed before" or "never previously seen," and were thought to be quite new to the country. If all such specimens had been unknown to botanists I should have had to name and describe a number of new species, and add them to the already rich and unique indigenous flora of the West. The above facts are very suggestive, and clearly prove the truth of my remarks made at the beginning of this article.

Many Australian grasses have bulbous or thick, knotty bases, which no doubt are provided by nature for storing up food to sustain the plants during very dry weather, and to preserve them from extinction. In adverse seasons, and during prolonged droughts, when every vestige of grass foliage has disappeared, these swollen bases, which are generally enveloped in a woolly substance to prevent evaporation, and their strong, long fibrous roots,

* Probably *A. imberbis* Retz. (*Themeda Fors.-Kali*, Hack.) Ed.

which penetrate deeply into the earth, remain alive but dormant until the condition of the soil and weather are favourable for them to again put forth green leaves. In January after a heavy fall of rain, I have seen the dormant, woolly, swollen bases of the "tall oat-grass" (*Anthistiria avenacea*) develop leaves, and in four months plants more than six feet high, producing a remarkable amount of rich succulent herbage. This occurred on some of the country west of the Darling River, but on the black soil plains near Moree I have seen that fine grass nearly nine feet high, and that wonderful growth was made in less than five months after heavy summer rain followed by favourable weather. Several species, peculiar to the black country, of the genus *Eragrostis* have large bulbous bases from which a quantity of leafy herbage develops after rainfall, no matter how prolonged the previous dry weather may have been. *Eragrostis eriopoda* and *E. laniflora* are very remarkable plants in that particular. An allied species *E. lacunaria*, is popularly called "never fail" by stockmen, on account of the phenomenal amount of dry weather it can endure. One of the "mulga" grasses, *Danthonia bipartita*, has a large bulbous base and strong fibrous roots, which enable the plant to withstand the torrid heat of Central Australia. After rain quite a number of growths, generally not more than one foot and rarely exceeding two feet in height, are produced from its base and remain vividly green for a considerable time, even if a long period of dry weather ensues. The Mitchell grasses, *Astrelba* spp., which occupy large tracts of country in the interior, have thick, knotty bases, which together with their strong wiry roots, which penetrate deeply into the ground, remain in a dormant condition during protracted droughts, but readily start into growth after a good rainfall. These valuable pasture grasses, more particularly *Astrelba elymoides*, have a branching habit, and in an ordinary season a good shower of rain, such as results from a thunderstorm, will cause new growth to sprout prolifically from the joints of the stems, which are soon covered with a mass of green, nutritious herbage. The above are only a very few of the many instances which could be given to illustrate the wonderful recuperative powers of indigenous grasses.

Vitality of Grass Seeds.—Most Australian grasses, when allowed to grow undisturbed for a time, produce an abundance of seeds which, when mature and kept in contact with dry earth, retain their germinating power for a lengthy period. Several species produce seeds which are comparatively large, when judged by the size of those of cultivated cereals, and which at one time formed an important article of food for the aborigines. The ripe seeds of many indigenous grasses are enclosed in very hard coverings with the lower portions prolonged into points, some being very sharp, notably those of the species of the genera *Aristida* and *Stipa*, popularly called "three-awned spear" and "spear" grass respectively. When these mature seeds fall perpendicularly, which they frequently do, to the ground, they penetrate it, and gradually descend several inches, especially if it is deep and loose. The sharp, pointed seeds, of the "tall oat-grass" have been found nearly a foot below the surface, so that it will be easily understood that although a few inches of surface soil may be removed by

strong winds, the lower stratum or subsoil is often thickly studded with seeds of various species of grass. This method of sowing grass seed is one of the many devices Dame Nature adopts for perpetuating plants under adverse climatic conditions. When good rains fall on those naturally-sown areas, and genial weather ensues, the seeds germinate quickly, and the resulting grass grows rapidly, and soon clothes apparently useless tracts of country with beautiful verdure. Those areas, however, which have a substratum or subsoil of a hard or strong clayey nature, and from which the surface soil has been removed by wind, do not quickly become covered with grass after rain and congenial weather for the seeds, however sharp the points of their coverings may be cannot penetrate that as easily as the more porous earth; consequently there are few, if any, naturally-sown seeds to germinate. Such areas often remain destitute of grass for a considerable time, and in the interior are generally called "scalded plains." After the sun and weather have ameliorated the surface, and made it congenial to plant life, vegetation gradually reasserts itself on those areas, which eventually become covered with beautiful green grass and other herbage.

Distribution of Grass Seeds.—The distribution of Australian grass seeds by natural and artificial means is a most interesting study, and anyone with a little leisure can occupy himself in a most delightful way by noting how the matured seeds are often disseminated. The plumose awns (hairy tufts) surmounting the coverings of the seeds of such species of the genus *Pappophorum* as *P. avenaceum* and *P. nigricans* are wafted hither and thither by the wind in the same way as the fruitlets, with their adherent pappus, of some Composites, and are often deposited some distance from the plants that bore them. Many grass seeds, especially those whose coverings are clothed with clinging hairs, and those whose flowering glumes have long awns, are often distributed far and wide by various agencies, particularly by travelling stock, which, when camped, sometimes unconsciously bury the seeds in the ground, where they lie until rain falls in sufficient quantities to cause them to germinate. I know of an instance where the seeds of one of the "mulga" grasses (*Neurachne Mitchelliana*) were carried by cattle several hundred miles, and deposited in deep, soft soil on the camping-ground, where they germinated after heavy rain, and grew luxuriantly amongst the surrounding dissimilar vegetation. It is not generally known that the vitality of many grass seeds is not impaired by the process of digestion; indeed, the germination of many of the hard-coated ones is facilitated.

The grasses referred to in this article are only typical of a number of others, for it must be obvious that interesting particulars about all the native grasses, or even a small percentage of them, could not be mentioned in the space at disposal.

AUSTRALIAN GRASSES.—II.

Economic Value in the Pastures.—As far as is at present known, there are 367 species and many well-defined varieties of grass indigenous to Australia, and they are fairly well distributed over

the continent, quite a number occurring on the so-called desert tracts of Central Australia. All these grasses are not endemic, for many of them are found growing in other warm countries, and several are widely distributed in various parts of the globe. The endemic grasses have a unique position among the vegetable products of the earth, for, in addition to many of them possessing singular characteristics, they include one of the dwarfiest and one of the tallest species in the world. The former (*Micraira subulifolia*), which I found on the Glass House Mountains in Queensland, where it forms a dense carpet on the shelving rocks, has very narrow leaves, usually about a quarter, but rarely half, an inch long, and thread-like flowering stems from one inch to two inches high, while the latter, popularly called the "climbing bamboo," has stems more than 200 feet long, which ascend to the tops of the highest trees in tropical Australia. Several indigenous grasses, such as *Festuca divesa*, *Heteropogon insignis*,* *Panicum crus-galli*, *Rottboellia exaltata*, *Sorghum fulvum*,† etc., attain a height of from 8 feet to 12 feet or more, but by far the greater number grow, under normal conditions, from 1 foot to 4 feet high. Together with the famous saltbushes, nutritious herbs, and the many shrubs and trees producing edible and palatable foliage, all of which will be referred to in subsequent articles, they are the most valuable assets on this continent. Without that rich and varied vegetation, it would be practically impossible to feed the millions of sheep, cattle, and horses now depastured in this country. Commercial men frequently make the remark, "What would Australia do without its wool?" But very few ever pause to think what Australia would do without the indigenous herbage which is really the principal factor in creating this valuable staple product. When it is taken into consideration that the pastoral industry is worth about £250,000,000, and yearly increases in value, being the most important one in Australia, and the one from which the population derives its greatest wealth, it is a matter of national importance that more attention should be paid to the valuable indigenous herbage and to the means of saving it from deteriorating in places and of preserving some of it from extinction. Having travelled more than 50,000 miles in Australia, and critically examined much of the indigenous vegetation in all the States of the Commonwealth and in other countries, and having cultivated upwards of one hundred species of Australian grasses in conjunction with those of Europe, Asia, Africa, and America, to test their qualities by comparison, I can conscientiously say that no part of the world possesses richer and more varied pastoral vegetation than Australia, but careful attention and judicious stocking are required in order to obtain the best results.

Early appreciation.—Australian grasses attracted the attention of the discoverers and earliest settlers of this continent, and different views were entertained regarding their economic value. Sir Joseph Banks, to whom Australia is so much indebted for its early settlement, and for the development of its vegetable resources, remarked in one of his papers:—"The herbage of the colony is

* *Festuca dives* (= *Glyceria dives* of Fl. Austral.), probably a *Poa*; *Heteropogon insignis* (= *Andropogon triticus* R. Br. of Hackel's monograph).—ED.

† *Andropogon serratus* of Hackel's monograph.—ED.

by no means so well adapted to sheep farming as that of Europe, and, therefore, the progress of the flocks will be slow." This opinion, however, was soon controverted, for Captain Waterhouse, in writing to Captain Macarthur in the early part of the last century, mentioned that he had kept sheep, and found them do well on the natural pasturage, and he believed that good pasturage would be found for any number of sheep that might be raised. He therefore ridiculed the idea of artificial grasses being necessary. The opinions entertained by Captain Waterhouse one hundred years ago have been amply verified by subsequent experience. Australian explorers always took much interest in the indigenous grasses which, when abundant, relieved them of much anxiety in providing ample feed for their horses and the stock that travelled with them. Sir Thomas Mitchell, exploring in the interior, collected specimens of grasses, and afterwards wrote an interesting account of the manner in which the aborigines gathered the Australian millet (*Panicum decompositum*), the seeds of which formed for them an important article of food. He writes, *inter alia* :—"The grass had been pulled up to a very great extent and piled in hay-ricks, so that the aspect of the desert was softened into the agreeable semblance of a hay field. The grass was beautifully green beneath the heaps, and full of seeds, and our cattle were very fond of this hay." This native millet is found in greater or less abundance over the whole of Australia. On the margins of rivers and creeks it attains sometimes a height of four feet, but on the plains in the interior it rarely exceeds two feet. It yields a most nutritious herbage, of which stock of all kinds are remarkably fond, and on which they fatten. When brought under cultivation, the Australian millet is a most productive grass, and has yielded three tons of excellent hay per acre. There are 56 known indigenous species of the genus *Panicum* widely distributed, and most of them form a good percentage of the pasture-herbage, and are most valuable forage plants. Many of these grasses withstand a phenomenal amount of dry weather, and are amongst the first to develop new growth after rain.

Blue grass.—Pastoralists call several species "blue grass," and one of the best and most nutritious is *Andropogon sericeus*, which often grows so abundantly on the fertile plains in the interior as to give quite a bluish appearance to large tracts of country. With the exception of the "Mitchell grasses," this species is perhaps the most favourably known of all the western indigenous *Gramineæ* to stockmen, and they have formed a high opinion of its virtue as a forage plant. It is essentially a summer grass, and usually attains a height of two feet, but occasionally it is taller. In an ordinary season it yields a great amount of herbage, on which all herbivora thrive and fatten readily. If cut when the flower stems first appear it can be made into excellent hay. There is a very fine, robust variety (var. *polystachyus*) of this species found only on rich soils in the warmest portions of the continent, where it often grows five feet high or more. It is popularly called "tassel blue grass," and is excellent feed for horses and cattle. There are 15 indigenous species of *Andropogon*, which occur in many districts from the coast to the back country, and most of them are excellent pasture grasses. The inflorescence of *A.*

bombycinus is copiously covered with silvery white hairs, which give the plant when in flower a remarkable appearance. This grass grows very plentifully in some parts of the interior, and when in bloom gives one, at first sight, the impression that snow has fallen. "Early spring grass" (*Eriochloa punctata*) is another plant with bluish leaves, which give quite a feature to many grazing areas, both east and west of the Dividing Range. This valuable perennial species attains a height of from two to three feet, and generally grows on rich land, where it produces a great amount of nutritious succulent herbage much sought by all herbivora, which thrive and fatten on it.

The "kangaroo grass" (*Anthistiria ciliata*)* is one of the most widely distributed plants on the Australian continent, but is more abundant in the coastal districts than in the interior. On country that is not heavily stocked it sometimes grows six feet high in good seasons, but generally it does not exceed four feet. In the warmer parts it grows more or less all the year round, but south of latitude 32 deg. it is essentially a summer grass, for it seldom makes much growth before October or November, and remains beautifully green during the hot months. Soon after the flowering stems have developed the leaves turn slightly brown when its nutritive qualities are considered at their highest. All herbivora are fond of and do well on the "kangaroo grass," and horses and bullocks when allowed to graze in pastures where it is growing plentifully can be worked very hard, and still keep in good condition—a practical proof of its value for feeding purposes. Analysis has shown that this grass has a high feeding value. Unfortunately it does not mature as much seed as some of its congeners, consequently it is not as plentiful in many places as formerly. Two other perennial and one annual species of this genus occur in many parts of the continent. The last-named *Anthistiria membranacea* (= *Iseilema Mitchellii* Anderss.), popularly called "Barcoo," "Landsborough" and "Red Gulf" grass, generally grows on rich soils, and covers large tracts of country in the north, and in the interior, including Central Australia. Its seeds germinate readily after the spring and early summer rains, and the resulting grass grows throughout the hottest period of the year. It is generally seen growing in small tufts, but in favourable seasons the weak stems lengthen very much, and form an entangled mass of herbage, often two feet deep. The "Barcoo" grass assumes a reddish tint—hence one of its popular names—and thus gives a singular appearance to large areas of country. It is a most nutritious grass, and in autumn often gets so exceedingly dry and brittle that it breaks up into innumerable pieces, but stock are so fond of it that even then they lick the broken stems and leaves from the ground.

Mitchell grass.—*Astrelba triticoides* is one of three species of the same genus bearing the common name of "Mitchell grass." These famous grasses are found on the fertile plains over a great part of the interior, and many pastoralists and stockmen regard them as the best of all the native grasses, both for their drought-enduring qualities and for their fattening properties. All of them

* This is *A. imberbis* (*Themeda Forskali* of Hackel's monograph). *A. ciliata* is an annual.—ED.

have a branching habit, and under ordinary conditions produce a great amount of nutritious herbage, which is greedily eaten by all herbivora. When these grasses become so dry that the stems and leaves break to pieces, stock may often be seen licking them off the ground, and they seem to do well on this feed, notwithstanding its uninviting appearance. Experienced drovers assert that stock travel farther and keep in better condition when fed on these than on any other grasses in Australia—a practical proof of their high feeding value. *Astrelba triticoides* is the tallest and most vigorous of the Mitchell grasses, and may frequently be seen growing from four to five feet high, and forming large tussocks. Its strong, wiry roots penetrate deeply into the earth, and enable the grass to withstand a phenomenal amount of dry weather. The seeds, when ripe, are like small grains of wheat, and at one time formed an important article of food for the aborigines. There is a variety (var. *lap-pacea*), of this grass, with ears often more than six inches long, somewhat like big wheat ears, and larger seeds than the species, and they separate easily from the chaff-like grains of wheat. Where wheat would not grow, owing to the great heat, that variety might, after a few years of thorough cultivation and careful selection, be found an excellent substitute, for, according to the best authorities, the wheat plant developed from much less promising material.

The “star” or “windmill” grass (*Chloris truncata*) occurs both east and west of the Dividing Range, and generally on the richest soils. It is abundant on some of the inland plains, and forms a good percentage of many of the pastures in the coastal areas. The “star” grass is very variable as regards its height and the size of its inflorescence. It generally grows from two to three feet high, with the inflorescence 15 inches in diameter; but west of the Darling River there is a form which rarely exceeds a foot, being sometimes only six inches high, with the flower spikes only four inches across. On the country bordering the Macquarie River there is a form which has its flower spikes superimposed in whorls on the stem, and they are singularly attractive. On loose soils the grass tillers well and in many places forms a dense turf. Notwithstanding its variations, it yields a rich, succulent herbage, which is much liked by all herbivora, sheep being particularly fond of it, and fattening on it. There are nine species and several varieties of the genus *Chloris* indigenous to Australia, and they are widely distributed. Most of them are excellent forage grasses, having a high reputation with stockowners, who know them as “blue star grass” and “dog’s tooth star grass,” as well as by the popular names already mentioned.

Sugar grasses.—*Pollinia fulva** is known to pastoralists as “sugar grass” on account of the sweetness of its young stems and leaves. It sometimes attains a height of four feet, and may be easily recognised, when in flower, amongst other vegetation, by its rich, brown, silky inflorescence; hence it is sometimes called “brown top.” This very superior pasture grass is generally found on fertile soils both in the coastal districts and in the interior, but

* *P. fulva* = *P. Cumingii*, var. *fulva* of Hackel’s Monograph.

is much more common in the latter. During the summer months, in an ordinary season, it yields a great bulk of sweet nutritious herbage, much relished by all herbivora which fatten on it. Four other species of the genus *Pollinia* occur in the tropical parts of Australia, but none of them is so valuable a pasture grass as the one referred to.

Wallaby.—No other grass in Australia grows under more varied conditions of soil and climate than “wallaby grass” (*Danthonia semiannularis*). It is plentiful on some of the high mountain ranges where snow falls occasionally, and common both in the coastal areas and in the interior. In the coldest districts it grows only six inches high, but under more favourable climatic conditions it attains a height of three feet or more. Although the “wallaby grass” is not particular as to soil and situation, for it may as frequently be seen growing on dry ridges as on the better classes of soils, still it produces a larger quantity of superior herbage on moderately strong, rich, deep land. It is one of the most valuable Australian grasses, and, unlike most of its congeners, grows more or less all the year round. All kinds of stock are remarkably fond of it, sheep particularly so, and thrive on its rich, succulent herbage. There are eleven species and several varieties of the genus *Danthonia* indigenous in Australia most of them widely distributed, and all are excellent forage grasses. The tallest and most remarkable species is *D. robusta* popularly called “ribbon grass,” which occurs on the southern mountains, where it forms large tussocks of coarse but nutritious herbage. It usually grows from four to five feet high, but occasionally it is taller and affords shelter for such slender grasses as many species of the genera *Agrostis* and *Deyeuxia*, and other sub-alpine flora.

The grasses mentioned are only a small percentage of the valuable ones indigenous to Australia, but the brief descriptions will suffice to illustrate the great economic value of an important part of the pastoral herbage of this large southern continent.

FRED. TURNER.

V.—THE PRICKLY-FRUITED SPECIES OF EUONYMUS.

T. A. SPRAGUE.

About 100 species of *Euonymus* are known, and of these twelve possess prickly fruits. The latter, however, do not appear to constitute a very natural group, though, for convenience, they may be treated together. Two species have pentamerous flowers and are natives of North America, whilst the remaining ten, which have tetramerous flowers, inhabit eastern and southern Asia. The Asiatic species with prickly fruits might perhaps be regarded as forming a natural group if certain others with scaly fruit, such as *E. vagans*, Wall., are included; but phylogenetic speculation seems premature at the present time. As characters for classification, the length of the petioles, the shape and venation of the leaves, and the prickles of the fruit have been found useful. The practical value of the flowers as a guide to