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A REVISION OF ANTHOXANTHUM INCLUDING HIEROCHLOË (GRAMINEAE) IN MALESIA AND THAILAND

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SUMMARY

A revision is given of the taxa in Malesia and Thailand usually included in *Anthoxanthum* L. and *Hierochloë* R. Br. (Gramineae). There are two species, *A. horsfieldii* (Bennett) Reeder with 7 varieties in Malesia and 1 in Thailand, and *A. redolens* (Vahl) Royen with 2 varieties in New Guinea. A survey of the characters generally employed to distinguish the genera is given and briefly discussed to show that these give an untenable separation. Some new combinations in *Anthoxanthum* are proposed.

INTRODUCTION

In nearly all temperate and sub(ant)arctic areas of the world and in some mountains of the tropics there occur grasses that are generally considered to belong to either *Anthoxanthum* L. or *Hierochloë* R. Br. They are distinguished by the usual presence of coumarine which gives a pleasant fragrance when freshly mown and spikelets of three florets which drop from the persistent glumes as a unit. The rachilla is not produced beyond the third floret. The then apparently terminal floret is usually bisexual and protogynous, generally with 2, occasionally with 3 anthers, but in South America and New Zealand there are species that have a female terminal floret with two staminodes (De Paula, 1975; Zotov, 1973). During our research it has been found that at least in *Hierochloë redolens* (Vahl) R. & S., which occurs in those areas and in New Guinea, this is an inconstant feature: the two floral types may occur even in the same inflorescence!

The north temperate and South American species have been studied more or less extensively, elsewhere there are local accounts. In the first areas two extreme types of development of the lower two florets are represented, whereby two genera have been distinguished, which has influenced the treatment of species occurring in other areas. A considerable number of these is intermediate in a varying degree, whereby they have been included in either genus in a rather haphazard way, but usually in *Hierochloë*. The generic concepts of authors of local treatments must be deduced from their keys or from the inclusion of certain species and it then becomes apparent that the following, European-style circumscriptions are employed:

Anthoxanthum: lower two florets epaleate, sterile, lemmas awned, lodicules absent in all florets, basic chromosome number 5.

Hierochloë: lower two florets paleate with three fertile anthers, lemmas muticous or shortly aristate, lodicules present in all florets, basic chromosome number 7.

SURVEY OF THE TAXA

The first to mention an intermediary form was R. Brown (1823), who, mentioning a Horsfield-collection from Java, created the genus *Ataxia* without making a specific combination. Here the lowest floret is paleate and male, the second epaleate and sterile, the first lemma is aristate, the second geniculately awned, lodicules are completely absent, while the chromosome number is still unknown. Gradually more and more species have been described and it can now be observed that there is a whole range of forms that lies somewhere in between the two extremes defined above whereby the distinction between the classical concept just evaporates.

It is remarkable to note that the reduction from the *Hierochloë*-type of lower florets begins with the second one and not with the lowermost one as might be expected from the tendency shown in the Panicoideae or with the uppermost (third) floret as is usual in the Pooideae in which the genera are usually included. No explanation can be given for this.

Some stages in the reduction moreover occur within a single species, and occasionally even within a single inflorescence!

Bennett & Brown (1838) already remarked that the distinction between *Anthoxanthum, Ataxia* and *Hierochloë* might be artificial, but their cautious warning has largely remained unheeded and subsequent authors have accepted *Ataxia* (e.g. Kunth, 1829; Trinius, 1839; Steudel, 1853; Buse, 1854) or included the intermediary species in either *Hierochloë* (Nees, 1841; Bentham, 1881; Hackel, 1887; Backer, 1928; Bews, 1929; Hitchcock, 1930; Roshevits, 1937; Chase, 1943; Jansen, 1953; Pilger, 1954; Monod de Froideville, 1968, although he very much doubted the correctness of this during discussions and in some notes he left; De Paula, 1975) or *Anthoxanthum* (Stapf, 1899; Reeder, 1950; Bor, 1960; Ohwi, 1965; Jain & Pal, 1975), at most regarding it as a subgenus (Nees) or a section (Bentham, Hackel, Stapf). The resulting generic definitions therefore overlap considerably or do not cover the species actually included. As a last resort some have (possibly in desperation) used the presumed basic chromosome number as the ultimate criterium. An obvious example was Pohl (1972), who, when describing *Hierochloë davidsei*, remarked that it resembled the species in the strict circumscription of the genus *Anthoxanthum*, but nevertheless placed it in *Hierochloë* because 56 chromosomes had been counted.

Jansen (1951) casually remarked that *Anthoxanthum* passes into *Hierochloë* through *Ataxia* but kept the first two separate in 1953 and in his manuscript treatment of the grasses for the Flora Malesiana. The first to unite the genera formally appears to have been Van Royen (1968), who saw his suspicions confirmed during informal discussions at the Rijksherbarium while this study was in progress.

For a better understanding of the situation we will give a summary of the 56 species more or less accepted in the contemporary literature. It must be well-realised that the aim of the present study was a local revision, not a worldwide one. For many of the characters of the 'foreign' species we by necessity had to depend on existing literature (e.g. for the chromosome numbers). Whenever possible we have of course examined representative specimens.

Species attributable to *Hierochloë* with a known chromosome number are *H. alpina* (Willd.) R. & S. [incl. *H. monticola* (Bigelow) Löve & Löve, non Mez, also known as *H. orthantha* Sørensen, 2n = 56, 58, 63, 64, 66, 68, 71, 74–78], *H. australis* (Schrad.) R. & S. (2n = 14), *H. glabra* Trin. [2n = 28, s.s., probably incl. *H. kamschatica* (Probat.) Probat., 2n = 42, *H. ochotensis* Probat., *H. sibirica* (Tzvelev) Czer., both with 2n = 56], *H. hirta* (Schrank) Borbas (2n = 56), *H. occidentalis* Buckl. (incl. *H. macrophylla* Boland., 2n = 42), *H. odorata* (L.) Beauv. [incl. *H. dahurica* Trin., *H. sachalinensis* (Printz) Worosch., 2n = 28, 42, 56, 70 (!)], *H. pauciflora* R. Br. (2n = 28), *H. redolens* (Vahl) R. & S. [2n = 56, once counted for a specimen from New Guinea with a bisexual terminal floret (Borgman, 1964), once for one from the Falkland Islands presumably with a female terminal floret (Moore, 1967), see under the species], *H. repens* (Host.) Beauv. (2n = 28 + 0–2B) and *H. wendelboi* Weimarck (2n = 28).

'Typical' species of *Anthoxanthum* for which chromosome numbers have been counted are *A. aethiopicum* I. Hedb. (2n = 20, possibly only a form of *A. nivale* K. Schum., however, see below), *A. amarum* Brot. (2n = 80, 90), *A. aristatum* Boiss. (incl. *A. puellii* Lecoq & Lamotte, 2n = 10 + 0–3B), *A. japonicum* (Maxim.) Matsum. [described by Maximowicz as a *Hierochloë*, placed by Bentham & Hooker (1883) in *Ataxia*, by Honda (1930) in a monotypic section *Pseudanthoxanthum*, but quite a 'normal' *Anthoxanthum* except for its chromosome number of 2n = 70 reported by Tateoka (1967), which might be a multiple of both 5 and 7. Tateoka (in litt.) could not decide the basic number], *A. nivale* [2n = 20, 60; Clayton (1970) suggested that it might merge into *A. ecklonii*; Phillips (in litt.) thought it likely that it will prove to be indistinct from *A. aethiopicum*], *A. odoratum* L. [incl. *A. alpinum* Löve & Löve, *A. nipponicum* Honda, both perhaps identical and possibly distinct as either subsp. *nipponicum* (Honda) Tsvelev or var. *glaberrima* Schur; 2n = 10 + 0–1B, 20 + 0–1B] and *A. ovatum* Lag. (2n = 10).

Morphologically apparently indistinguishable from *Anthoxanthum* by their spikelets but with a reported '*Hierochloë*-number' are *H. khasiana* Hook. f. (2n = 42) and *H. davidsei* Pohl (2n = 56) (and perhaps *A. japonicum* with 2n = 70 mentioned above).

For all but one, *A. borii* Jain & Pal, of the remaining taxa the chromosome numbers are unknown. The following forms exist:

'Typical' *Hierochloë*: *H. brunonis* Hook. f., *H. bungeana* Trin. (also called *H. odorata* var. *sachalinensis* Printz), *H. flexuosa* Hook. f., *H. fraseri* Hook. f. (n.v.), *H. fusca* Zotov (n.v.), *H. laxa* Hook. f., *H. novaezelandiae* Gandog. (n.v.), *H. pluriflora* Koidz. [incl. *H. intermedia* (Hackel) Kawano, n.v.], *H. rariflora* Hook. f., *H. stepporum* Smirn., *H. submutica* F.v.M. and *H. tibetica* Bor (n.v.).

'Typical' *Anthoxanthum: A. brevifolium* Stapf (n.v.), *A. formosanum* Honda (n.v.; from its descriptions very reminiscent of *A. horsfieldii*, especially var. *luzoniense*), *A. gracile* Riv. (sometimes included in *A. aristatum*), *A. horsfieldii* [var. *borneense* (paleas much reduced in both lower florets), var. *celebicum*, var. *ceramense*, var. *luzoniense*], *A. madagascariense* Stapf, *A. pallidum* (Hand.-Mazz.) Keng (n.v.), *A. pauciflorum* Adamović (n.v.) and *A. sikkimense* (Maxim.) Ohwi.

A relatively large group resembles *Hierochloë*, but the lower lemmas are usually awned and the upper floret is generally female with 2 abortive anthers; the species occur in South America and in New Zealand. One of these is *A. redolens*, which is found in New Guinea, also. They have been revised by De Paula (1975) and Zotov (1973), respectively, and their treatments have been followed here, although we have some reservations about several of their conclusions, as will be seen. The species are *H. altissima* Steudel, *H. cuprea* Zotov (n.v.), *H. equiseta* Zotov (n.v.), *H. gunckelii* Parodi (second lemma aristate), *H. juncifolia* (Hackel) Parodi (n.v.), *H. moorei* De Paula (see below; n.v.), *H. pusilla* Dusén [lower lemmas muticous, presumably with lodicules (Moore, 1983); n.v.], *H. recurvata* Zotov (n.v.), *A. redolens* (but see the notes under that species), *H. sorianoi* De Paula (see below; lower lemma aristate), *H. spicata* Parodi (lower lemmas aristate, presence of lodicules not recorded; n.v.) and *H. utriculata* (R. & P.) Kunth (lower lemmas aristate).

In one collection of *H. sorianoi* De Paula (1975) saw a bisexual upper floret. Moore & Doggett (1975) in an extensive analysis of *H. moorei* and *H. sorianoi* concluded that these could not be distinguished from *A. redolens*. Moore (1968 and in litt.) observed that at least in the Falkland Islands and Terra del Fuego the terminal floret may be either bisexual or female, which agrees with our own observations for New Guinea material.

Resembling *Hierochloë* but with the second floret neuter or male are *A. dregeanum* (Trin.) Stapf (but second lemma long-awned and lodicules absent in all florets) and *A. redolens* var. *longifolium* (which may have the various stages between sterile lower florets to all male even within the same inflorescence, and lodicules present or not depending on the stage of development of the floret).

Species strictly with a lower male and second neuter and paleate floret have not been encountered; this stage does occur together with others as mentioned above and below.

Taxa of the '*Ataxia*'-type, i.e. with a lower male floret, a sterile, epaleate second one with a long-awned lemma and no lodicules anywhere are *H. elongata* Hand.-Mazz., *A. horsfieldii* [var. *horsfieldii:* second floret occasionally with a more or less developed palea, once male and paleate; var. *siamense:* second floret with a vestigial palea; possibly incl. *A. clarkei* (Hook. f.) Ohwi, see note sub var. *horsfieldii*] and *A. mexicanum* (Fourn.) Mez (lower floret sometimes also neuter and epaleate?).

Closest to *Anthoxanthum* are those species that have a first floret ranging from male to sterile, with or without a palea and an awned second lemma without a palea: *A. borii* Jain & Pal (1975: this is the only taxon of the morphological intermediates with a known chromosome number, n = 28, i.e. a multiple of the *Hierochloë* basic number; see also our remarks on its possible conspecificity with *A. horsfieldii* under

that species), *A. ecklonii* (Trin.) Stapf [the specimens seen had sometimes a sterile, epaleate lower floret and sometimes lodicules in the third one; Clayton (1970) has suggested great affinity with *A. nivale*], *A. hookeri* (Griseb.) Rendle (three specimens of the isotype in L were all different from each other: the first floret ranged from male and paleate to neuter and epaleate with lodicules present or not depending on the stage of reduction), *A. horsfieldii* var. *angustum*, var. *sumatranum* and *A. tongo* (usually male and paleate, lodicules were reported by Nees (1841) for the lower floret, but none were seen by Trinius (1839), Stapf (1899) (Smook, Pretoria, in litt.) and ourselves.

Because of this bewildering array of intermediary or extraordinary forms the delimitation between the classical concepts of *Anthoxanthum* and *Hierochloë* are impossible to maintain and at the present stage of knowledge there seems to be no other way to distinguish the supposed genera in any plausible way. Thus we can do nothing else but unite the two while *Ataxia* is a fiction altogether as its original author already suggested in 1838.

TAXONOMIC POSITION OF ANTHOXANTHUM

By nearly all its morphological and anatomical features *Anthoxanthum* clearly belongs to the Pooideae. In this subfamily and elsewhere in the Gramineae it seems aberrant by the composition of the spikelet: three florets without a visible extension of the rachilla beyond the uppermost one, which thereby appears terminal suggesting that the spikelet would be determinate. Moreover the reduction within the spikelet starts apparently with the second (middle) floret and not with the apical or basal one as is the general rule elsewhere.

When both the lower florets are reduced to the lemmas the composition is reminiscent of that found in *Phalaris* L. Holt (1954) [cited by Anderson (1961, p.12)] and Szabó (1981) have observed that the terminal floret in *P. arundinacea* L. is not really terminal, but lateral: the axis above the third floret is reduced to an inconspicuous tissue at the base of its palea. In *Anthoxanthum* this rarely is developed into a fourth floret, which then resembles the third one (Weimarck, 1970: *A. alpina*; observed by us in *A. redolens* var. *longifolium*). Riecken (1929) gave an extensive discussion of the spikelet morphology of *Phalaris*, *Anthoxanthum* and *Hierochloë* (*'Torresia'*) and also concluded that the spikelets of these genera must be regarded as indeterminate: reduction takes place from above downward, a Pooid feature. It would seem that the florets underwent different types of further reduction. The uppermost one became relatively smaller, with a different shape and texture of lemma and palea, the lemma lost its indument and awn (only rarely still more or less developed) and the number of anthers decreased, a process that in a number of antarctic species culminated in a female floret with 2 staminodes. The reduction of the second and first floret primarily affected the sexuality and with the anthers gone, also the presence of lodicules and paleas. The various stages have already been noted above.

There is in general little doubt that *Anthoxanthum*, *Hierochloë* and *Phalaris* are related and in most literature the three have been placed in the Phalarideae. At present there is a general tendency to include them in the Agrostideae (incl. Aveneae) from which the genera do indeed not seem to differ much except for their curious line in reduction of the spikelet. Because of that at least the distinction of a separate tribe seems warranted.

There used to be some doubt as to the correctness of the name Phalarideae for this tribe and its authorship, which has caused Conert (1983) to use the name Anthoxantheae Link for it. According to Butzin (1973) the name Phalarideae was first published by Adanson (1763), but it is invalid there, as the latter called it a section (Art. 33.4) and used the French, not the Latin or Greek word '*Phalarides*' (Art. 19.6). Link (1827) has also been cited as the author, but because of his confusing terminology the supra-generic names proposed by him are all invalid (Anthoxantheae therefore also). In the case of Phalarideae he mentioned it as distinct on p. 62, but on p. 269 he included most of its genera, including *Phalaris*, in the Phleodeae. On p. 233, however, he enumerated *Phalaris* under the Anthoxantheae, and, finally, on p. 271 *Phalaris* is the only genus of the Phalarideae ....

Kunth (1829) is the correct author to be cited. Although he included a hodgepodge of genera among which *Phleum* Linné, Phalarideae Kunth is not a superfluous name for Phleae Dumortier (1827). According to the new wording in Art. 63.3 of the Sydney Code (1981) the name was superfluous when published, but when *Phleum* is excluded, as has generally been done now for a long time, it has become legitimate as it is based on the stem of *Phalaris*, a legitimate generic name, and so is correct for the present tribe. In fact the Code is here in conflict with itself (viz. Art. 7.10 versus 7.11), for *Phalaris* must be regarded as the type, and not *Phleum*.

INTERSPECIFIC DELIMITATIONS

This chapter deals of course with the taxa under study only. A number of species have been distinguished for Malesia and Thailand in the past, but after an exhaustive study of sometimes minute details, e.g. shape and size of the rachilla internodes, relative insertions of the awns, relative sizes of the parts of the floret especially compared to the third one, it is concluded that there are only two species: one with a circum-Antarctic distribution, occurring with two varieties in New Guinea (*A. redolens*), the other Asiatic with seven allopatric varieties in Malesia, one of these perhaps also found in Assam and North Burma and a distinct variety in Thailand. It cannot be ruled out that it occurs elsewhere in continental Asia as well under other names, e.g. *A. borii* and *A. formosanum* [for *A. clarkei* (Hook. f.) Ohwi see remark under *A. horsfieldii* var. *horsfieldii*!]. The descriptions and depictions of *A. formosanum* very much resemble var. *luzoniense*, but unfortunately no authoritative material of these taxa could be obtained. The epithet '*horsfieldii*' seems fairly safe to use, however, because of its early publication (1838).

Anthoxanthum horsfieldii is a species of the mountains and thus there is a number of isolated populations, which, as might be expected, differ in a varying degree from

each other. Especially close are for instance the populations of North Sumatra and New Guinea. It is therefore not surprising that a keen observer as Reeder (1950) thought them to be identical. The abundant material of var. *angustum* and the few but rich collections of var. *sumatranum* differ mainly in quantitative characters caused especially by the size of the third floret. The distribution of these two is reminiscent of that of *Agrostis rigida* Steudel, where a variety mainly found in Sumatra and New Guinea clasps the ones on the islands in between (Veldkamp, 1982, map), while the pattern is similar to that of *Danthonia oreoboloides* (F.v.M.) Stapf (in Sumatra also restricted to the Mt Leusir complex, but not found outside Malesia and not in Java and without apparent local races). In the present case it seemed at first unnecessary to distinguish the Sumatran and New Guinean populations at all, but as the other populations differ in an increasing way, it was finally decided to regard them all as varieties. There seemed to be little profit to express the various degrees of dissimilarity by the use of terms as subspecies, varieties, subvarieties and formae, as a cumbersome hierarchy of names would be produced with an unwieldy nomenclature, which must remain speculative, anyway, as the phylogenetic background can only be guessed at. Why does it seem as if a taxon can 'jump' from New Guinea to Sumatra and is then, once there, apparently unable to disperse further south along the Bukit Barisan? A similar distribution pattern is found also in *Centrolepis fascicularis* Labill. (Centrolepidaceae), *Patersonia lowii* Stapf (Iridaceae) and, from Asia, *Geranium nepalense* Sweet (Geraniaceae).

The descriptions of the varieties given here are diagnostic in regard to the typical varieties, var. *horsfieldii* and var. *redolens* and by their length they may appear to be considerably different; a closer comparison will show that they consist of mainly overlapping characters and few discrete ones.

The only two sympatric varieties of one species are those of *A. redolens* which apparently may grow close to one another, because of the eight collections of var. *longifolium* seen two were mixed, one of which is even the type. The two seem distinct in a few characters only. This might suggest that they are not different at all, just as Moore & Doggett (1975) showed that *A. redolens* and *H. moorei* could not be distinguished by the insertion of the awn on the second lemma ('upper floret'). Contrary to their observations, however, we have seen no intermediate forms, while it must be realised that the plants usually have a single flowering culm only and grow often rather dispersed in the subalpine vegetation. A collector wanting to make a fair number of duplicates may thus inadvertently collect a mixture.

Because of the emphasis placed on the sexuality of the florets both in supposedly generic and specific delimitations it was surprising to have to admit in the end that at least in Malesia it is of little value. Within *A. redolens* var. *longifolium* the lower florets are only slightly more often paleate and male than paleate and sterile or epaleate and sterile, which condition may occur even within the same inflorescence. In *A. redolens* var. *redolens* the third floret was bisexual in about half the collections studied. The other half showed that either within the same population or even within the same inflorescence it may be either bisexual or female with staminodes. This was rather surprising, as according to the literature the South American plants would have a female

floret and the New Zealand and Australian ones a bisexual one. Especially in the latter areas a renewed survey seems necessary since Moore (1968, and in litt.) found both forms often in the same population in the Falkland Islands and Tierra del Fuego, too! As will be explained under the species this has confusing consequences for the typification of the epithet *'redolens'*.

Weimarck (1970) reported spikelets of *A. alpinum* with all the florets bisexual (once) or with a bisexual second (!) and third floret (a few instances), the first agreeing with the hypothetically most plesiomorphic phase, the second rather surprising in view of the usual process of reduction.

NOMENCLATURE

The choice of the generic name fortunately causes no problems. *Anthoxanthum* is the oldest name and although *Hierochloë* is conserved, it is not protected against *Anthoxanthum*, which is perhaps even the better known of the two.

Although we think to have presented a convincing case arguing that *Hierochloë* cannot be maintained as a genus, the text in the International Code of Botanical Nomenclature needs an emendation because for procedural reasons the name will remain in the list of nomina conservanda.

De Labillardière (1806) based *Disarrenum* on *D. antarcticum* giving an excellent description and plate of *Anthoxanthum redolens* (the form with a bisexual floret). He stated that he *suspected* that *Aira antarctica* Forst. f. (1786; *'Arista antarctica'*) might be the same as far as he could tell from Forster's too meagre description. If by this remark Forster's combination is to be regarded as the basionym of that of Labillardière, as is now stated in the Code, *Disarrenum* ought to be deleted here, for it has already long been known that it represents *Trisetum antarcticum* (Forst. f.) Trin. and thus *Trisetum* Pers. (1805) (see also R. Brown, 1810; Schweickerdt, 1937; Zotov, 1973; Veldkamp, 1983; Veldkamp & Van der Have, 1983). On the other hand, if *Disarrenum* is typified with De Labillardière's actual material, the reference to Forster must be deleted (cf. Art. 10.4, Sydney Code).

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ANTHOXANTHUM

Anthoxanthum Linné, Sp. Pl. 1 (1753) 28; Gen. Pl. ed. 5 (1754) 17; Hackel in E. & P., Nat. Pfl. Fam. II, 2 (1887) 43; Hitchc., U.S. Dept. Agric. 772 (1920) 201; Jansen, Reinwardtia 2 (1953) 227; Henty, Bot. Bull., Lae 1 (1960) 28; Conert in Hegi, Ill. Fl. Mitt. Eur. ed. 3, I, 3 (1983) 158. – *Flavia* Heist. ex Fabr., Enum. Meth. Pl. (1759) 206, nom. superfl. – *Xanthonanthus* St. Lager, Ann. Soc. Bot. Lyon 7 (1880) 119, superfl. orth. var. – Lectotype: *A. odoratum* L.

Hierochloë Gmelin [Fl. Sibir. 1 (1747) 100] ex R. Br., Prod. 1 (1810) 208, nom. cons., but not against *Anthoxanthum*; Hook. f., Fl. Nov. Zel. (1853) 300; Steudel, Syn. 1 (1853) 13; Benth., Fl. Austr. 7 (1878) 557; Tateoka, J. Jap. Bot. 40 (1955) 220, map; Monod de Froid. in Backer & Bakh. f., Fl. Java 3 (1968) 529; Henty, Bot. Bull., Lae 1 (1969) 109; Zotov, New Zeal. J. Bot. 11 (1973) 563; Vickery, Fl. N. S. W. 19, 2 (1975) 277; De Paula, Darwiniana 19 (1975) 429. – Lectotype: *H. odorata* (L.) Beauv. [= *Anthoxanthum nitens* (Weber) Y. Schouten & Veldk.].

Savastana Schrank, Baier. Fl. 1 (1789) 100, 337, nom. rej. against *Hierochloë*. – Type: *S. hirta* Schrank [= *Anthoxanthum hirtum* (Schrank) Y. Schouten & Veldk.].

Torresia R. & P., Fl. Peruv. & Chil. Prod. (1794) 125, nom. rej. against *Hierochloë*. – Type: *T. utriculata* R. & P. [= *Anthoxanthum utriculatum* (R. & P.) Y. Schouten & Veldk.].

Disarrenum Labill., Nov. Holl. Pl. Sp. 2 (1806) 82, t. 232, nom. rej. against *Hierochloë*. – Type: *D. antarcticum* Labill. [= *Anthoxanthum redolens* (Vahl) Royen], see Introduction.

Dimesia Raf., Amer. Monthly Mag. 1 (1817) 332. – Lectotype: *D. fragrans* (Willd.) Raf. [= *Anthoxanthum nitens* (Weber) Y. Schouten & Veldk.].

Ataxia R. Br., Chloris Melv. (1823) 35; in Bennett, Pl. Jav. Rar. (1838) 8; Buse in Miq., Pl. Jungh. (1854) 346; Miq., Fl. Ind. Bat. 3 (1857) 429. – *Hierochloë* R. Br. sect. *Ataxia* [Nees, Fl. Afr. Austr. (1841) 7, sine statu; Benth., J. Linn. Soc. Lond., Bot. 19 (1881) 77; Benth. & Hook. f., Gen. Pl. 3 (1883) 1139, comb. not made] Hackel in E. & P., Nat. Pfl. Fam. II, 2 (1887) 44. – *Anthoxanthum* Linné sect. *Ataxia* Stapf, Fl. Cap. 7 (1899) 466. – Type: *A. horsfieldii* Kunth [= *Anthoxanthum horsfieldii* (Bennett) Reeder].

[*Foenodorum* E.H.L. Krause, Naturw. Wochenschr. n. S. 10 (1911) 220, nom. inval., no generic descr. – Type: not indicated.]

Perennials, rarely annuals, with a usually distinct fragrance (coumarine), branching extra- and intra-vaginally at base. Cataphylls when present usually membranous. Ligules membranous to pergamentaceous. *Blades* usually flat. Panicle contracted and spike-like to effuse and secund. *Spikelets* laterally compressed, 3-flowered, articulating above the glumes and above the lower two lemmas; lower two florets reduced, from both male with 3 anthers (*'Hierochloë'*), or the lowest male with 3 anthers and the second sterile and paleate or epaleate (*'Ataxia'*), or both sterile and epaleate (*'Anthoxanthum s.s.'*); upper floret usually bisexual and protandrous, usually with 2, sometimes with 3 fertile anthers, rarely female with 2 staminodes (*'Torresia'*). *Glumes* ± unequal, slightly longer to slightly shorter than the lemmas, the lower smallest, 1- (or 3-)nerved, the upper 3- (or 5-)nerved. Rachilla usually with a distinct bend between the lower two florets, straight between the upper two, not produced beyond the third. *Lemmas* ± laterally compressed, the lower two subequal, shed together clasping the third one, chartaceous, usually scarious towards the bifid apex, 5-nerved; first lemma muticous or aristate to geniculately awned in or below the sinus; second lemma usually with a longer arista or awn, rarely muticous, variously inserted from subbasal to subapical in or below the sinus; third lemma involute, pergamentaceous, translucent, indistinctly 5- (or 7-)nerved, apex usually retuse to incised, muticous, rarely mucronate, exceptionally awned. Lower two *paleas* present to absent, scarious, 2-nerved, apex 2-lobed; third palea scarious, 1- (or 2-)nerved, apex usually obtuse, sometimes retuse. Lodicules when present ± triangular-oblong, scarious, apparently not nerved, apically with 1 or 2 hairs. Styles apical, free at base; stigmas terminally exserted. Caryopsis terete, not furrowed; hilum subbasal, elliptic to oblong; embryo 0.2–0.5 times as long as the caryopsis.

Distribution. About 57 species ranging from (Ant)arctica to the mountains in the tropics. Two species in Malesia with a variety of one in Thailand and perhaps in Meghalaya, and Tamil Nadu in India. Not included are *Anthoxanthum odoratum* L. and *A. puellii* Lecoq & Lamotte (= *A. aristatum* Boiss.), which have been cultivated in East Java, but have never been collected [cf. Buysman, Teysmannia 23 (1912) 768].

KEY TO THE TAXA

1a. Third floret with the lemma scabrous to puberulous in the upper part, lodicules present, anthers 0.5–1.8 mm long, sometimes staminodial. – Second floret usually paleate with staminodia or fertile anthers and at least then with lodicules; anthers and lodicules occasionally totally absent. New Guinea 2

b. Third floret with the lemma smooth, glabrous, lodicules absent, anthers usually longer than 1.8 mm, rarely only 1.6 mm long, always fertile. – Second floret nearly always epaleate, without lodicules or stamens 3

2a. Awn of the first lemma inserted above 0.85th, of the second lemma above 0.75th, 3–4.6 mm long, straight . . . . . **2a. A. redolens** var. **redolens**

b. Awn of the first lemma inserted at 0.6–0.75th, of the second lemma at 0.5–0.65th, 5.2–8.5 mm long, usually geniculate . . **2b. A. redolens** var. **longifolium**

3a. First floret paleate, anthers fertile, rarely staminodial 4
b. First floret epaleate, sterile (some florets exceptionally paleate and with staminodia) 5
4a. Blades with glabrous margins. Branches of the inflorescence hairy. Awn inserted at 0.65–0.85th on the first lemma, at 0.25–0.5th on the second lemma. – Java . . . . . **1a. A. horsfieldii var. horsfieldii**
b. Blades with ciliate margins. Branches of the inflorescence glabrous (pedicels hairy). Awn inserted at 0.6–0.67th on the first lemma, at 0.15–0.25th on the second lemma. – Thailand . . . . . **1g. A. horsfieldii var. siamense**
5a. Branches of the inflorescence glabrous (pedicels sometimes hairy) 6
b. Branches of the inflorescence hairy 8
6a. Panicle 5–10.5 by 1–3 cm diam. Spikelets 5.9–6.7 mm long. Lower glume 1.8–2.6 mm wide. Awn of second lemma 4.3–6.8 mm long 7
b. Panicle 3.5–4.5 by 0.4–0.7 cm diam. Spikelets 5.3–5.8 mm long. Lower glume 2.6–3 mm wide. Awn of second lemma 7.1–7.5 mm long. – Celebes **1d. A. horsfieldii var. celebicum**
7a. Lower glume 1.8–2.2 mm wide. Upper glume acute. Awn of second lemma inserted at 0.45–0.55th. Third lemma 3–3.2 mm long, 0.67–0.8 times as long as the lower glume, 0.55–0.6 times as long as the second lemma. – Ceram **1e. A. horsfieldii var. ceramense**
b. Lower glume 2.2–2.6 mm wide. Upper glume acuminate. Awn of second lemma inserted at 0.29–0.4th. Third lemma 2.2–3 mm long, 0.6–0.67 times as long as the lower glume, 0.6–0.75 times as long as the second lemma. – Luzon **1f. A. horsfieldii var. luzoniense**
8a. Upper glume acuminate. Rachilla between first and second lemma curved . . . 9
b. Upper glume acute. Rachilla between first and second lemma straight. – Sabah **1c. A. horsfieldii var. borneense**
9a. Lower glume 0.67–0.9 times as long as the upper one. First lemma shorter to at most 0.1 mm longer than the lower glume. Third lemma up to 0.75 mm diam., 0.35–0.5 times as long as the lower glume, 0.3–0.4 times as long as the upper one. – New Guinea . . . . . **1b. A. horsfieldii var. angustum**
b. Lower glume 0.5–0.7 times as long as the upper one. First lemma 0.1–1.8 mm longer than the lower glume. Third lemma 0.8–1.2 mm diam., 0.55–0.9 times as long as the lower glume, 0.4–0.6 times as long as the upper one. – Aceh **1h. A. horsfieldii var. sumatranum**

1. Anthoxanthum horsfieldii (Kunth ex Bennett) Mez ex Reeder

For the synonymy see under the varieties.

In the descriptions of the non-typical varieties only the overlapping and different characters are given.

a. var. horsfieldii

Ataxia horsfieldii Kunth [Rév. Gram. 1 (1829) 22; Enum. Pl. 1 (1833) 39, nom. nud.] ex Bennett, Pl. Jav. Rar. (1838) 8, t. 3; Jungh., Java ed. 2, 1 (1853) 533, 598; vol. 2: 236; Buse in Miq., Pl. Jungh. (1854) 346; Miq., Fl. Ind. Bat. 3 (1857) 429. – *Hierochloë horsfieldii* Maxim., Diagn. Pl. Nov. As. 7 (1888) 930; Koord., Exk. Fl. Java 1 (1911) 143, f. 13; Backer, Handb. Fl. Java 2 (1928) 199; Heyne, Nutt. Pl. Indon. 1 (1950) 258; Jansen, Reinwardtia 2 (1953) 278; Monod de Froid. in Backer & Bakh. f., Fl. Java 3 (1968) 529; Veldk. in Steen., Mt. Fl. Java (1972) t. 22, f. 16. – *Anthoxanthum horsfieldii* Mez [in Fedde, Repert. 17 (1921) 291, nomen, see note] ex Reeder, J. Arn. Arbor. 24 (1950) 325, 327; Royen, Alp. Fl. New Guinea 2 (1980) 1188, p.p., f. 383 of type! – Type: *Horsfield 339* (BM, holo, K, P), Java.

[*Ataxia javanica* R. Br. ex Hassk., Cat. Pl. Hort. Bog. ed. 2 (1844) 16, nomen.]

? Hierochloë clarkei Hook. f., Fl. Br. Ind. 7 (1896) 223; Bor, Fl. Assam 5 (1940) 167. – *Anthoxanthum clarkei* Ohwi, Bull. Tokyo Sc. Mus. 18 (1947) 8; Bor, Grasses (1960) 431; Jain & Pal, J. Bombay Nat. Hist. Soc. 72 (1975) 94. – Type: *C.B. Clarke s.n.* (K, holo, n.v.), India, Meghalaya, Khasya Hills, Lailan Kote, 1675 m. See note.

Anthoxanthum neesii Mez in Fedde, Repert. 17 (1921) 291. – Type: *Junghuhn s.n.* (B, holo, extant?; L sub no. 903.342-124, -176), Java, summit Mt Cerimai, 2440 m, 16 Aug. 1837.

Perennial up to 105 cm high with a creeping and branching rhizome. Cataphylls ovate to oblong, 4.5–11 by 1.5–4.5 mm, obtuse, membranous, furrowed, smooth, glabrous. *Culms* simple or branched, glabrous, smooth. Sheaths glabrous, upwards sometimes slightly to strongly puberulous, smooth, margins usually ciliate. Ligule collar-shaped, 0.7–2 mm high, scarious, usually glabrous, margin usually ciliate. *Blades* ± flaccid, flat, up to 32 cm by 10 mm, at base sometimes sparsely to densely puberulous, otherwise glabrous, smooth, margins glabrous, rarely ciliate at base, midrib usually inconspicuous. Panicle contracted to lobed, erect, 3.5–13.5 by 0.7–2.2 cm diam., axis glabrous, smooth, branches sparsely pubescent, smooth, basal branches (1 or) 2 (or 3) together, the longest 1.5–5.4 cm long, 5–28-spikeled, naked in the lower 0.2–0.55th, pedicels patently pilose. *Spikelets* obliquely obtriangular-oblong, 4.5–7.4 by 1.3–2.5 mm diam., greenish, sometimes with purple. *Glumes* usually with a few hairs on the midrib; lower glumes ± ovate, 2.7–5.1 by 1.8–2.8 mm, 0.6–0.8 times as long as the upper glume, 1-nerved, obtuse to acute; upper glume ± obovate, 4.4–7.3 by 2.2–4 mm, 3-nerved, acuminate. First floret paleate and male, sometimes reduced and epaleate and sterile; second floret ± paleate, sterile (once male). First rachilla joint curved, c. 0.3 mm long, second joint straight, 0.4–0.6(–0.7) mm long. Lower two *lemmas* oblong-lanceolate, rather densely patently pubescent in the lower 0.67th, above indument shorter, apical lobes obtuse, 0.15–0.25 times as long as the lemma, margins and apex ciliate; first lemma 3.7–6.4 by 1.2–2.2 mm, 0.4–1.8 mm longer than the lower glume, awn inserted at (0.6–)0.65–0.85th, 0.4–2.75 mm long, not or barely exserted; second lemma 3.6–5.8 by 1–1.4 mm, awn inserted at 0.25–0.5th, geniculate, 4–9.2 mm long, column contorted, 1.7–3.8 mm long, glabrous, brownish black, rarely paler, subule 2.3–5.4 mm long, antrorsely scabrous, yellowish; third lemma lanceolate, 2.3–3.5 by 0.6–1 mm diam., 0.6–0.85 times as long as the lower glume, 0.45–0.6 times as long as the upper glume, 0.5–0.65 times as long as the first lemma, 0.55–0.75(–0.95) times as long as the

second lemma, indistinctly 5-nerved, pergamentaceous, apex obtuse-retuse, sometimes with a few hairs, otherwise glabrous, smooth, mucro in the sinus when present up to 3.5 mm long. First *palea* ± linear-lanceolate, sometimes reduced to absent, 2.3–5.9 by 0.25–0.7 mm, nerves distally ciliolate, apex obtuse, ciliolate, otherwise glabrous, smooth; second palea when present usually reduced, obtuse, smooth, up to 0.5 by 0.15 mm, glabrous, rarely up to 3.8 by 0.5 mm and apex ciliolate; third palea ± linear-lanceolate, 2–3.4 by 0.2–0.55 mm, smooth, apex slightly emarginate, sometimes ciliolate, otherwise glabrous. Lodicules absent. Anthers usually 3 in the first floret, sometimes absent or staminodial, second floret sterile (once with 3 anthers), third floret with 2 (or 3?) anthers (see note); anthers when normally developed 1.8–3.6 mm long. Caryopsis oblong to ± lanceolate, 1.6–2.2 by 0.45–0.9 mm diam.

Distribution. Java, from Mt Gedeh eastward on all high mountains [since Backer (1928) also from Mt Lawu, but not yet from Mt Wilis]; ? Burma (Naga Hills), ? India (Meghalaya, Tamil Nadu), see note.

Ecology. Sunny, dry places, in *Casuarina*-forest, *Festuca*-grasslands, etc., (1400–) 2000–3300 m.

Collectors' notes. Rhizomatous, with a delightful fragrance which increases with the altitude and may widely pervade the air (Junghuhn, 1853). Protogynous, stigmas dirty white.

Uses. Horsfield, cited by Bennett (1838), reported that in some districts, e.g. Surakarta, this species was the exclusive property of the souvereign and that no subject was allowed to collect it for his own use. The grass was mixed in small portions with the usual fodder of the favourite horses of the Sultan and was supposed to contribute to their vigour and spirit. A similar use as an appetiser is made of *A. odoratum* in Europe, but in general it seems not to be very palatable to stock (Heyne, 1950). Junghuhn, however, said that rhinoceros found it a delicacy and that in places it was about their only food.

An extract of the roots would be a panacea against all internal diseases, but in large quantities coumarin may be poisonous. See also De Paula's remarks on *A. utriculata* (1975, p. 428).

Vernacular names. Kalamenja, kolonjani, -no, (suket) mlalan, s. mlelan, s. sulanjana, surenjono (halus), surijana (halus) (Jav.).

Notes. When R. Brown (1823) described *Ataxia* he merely mentioned a collection by Horsfield from Java without making a specific combination. Kunth (1829, 1833) copied the generic description mentioning as the only species *A. horsfieldii* without a description and as the genus was then not new anymore, this may not be regarded as a descriptio generico-specifica, and although it is obvious what is intended, the combination is invalid. The first to validate it was then Bennett (1838) as was already observed by Chase (1943) although she thought that Horsfield himself would be the original author.

Maximowicz (1888) in making *Hierochloë horsfieldii* fortunately cited both Kunth and Bennett and his combination is therefore valid.

Mez, however, in 1921 proposing *Anthoxanthum horsfieldii* merely referred to Kunth for his basionym and this combination was then invalid. The first to validate it

seems to have been Reeder (1950), who through his reference to Chase indirectly cited Bennett. The correct authorship of the combination must therefore be '(Kunth ex Bennett) Mez ex Reeder'.

Bennett described the third floret as diandrous, but Buse said that he had studied more than 30 florets and invariably found three anthers. We have no explanation for this as even in Buse's original material we invariably found two anthers, as is the case in other specimens which he could not have seen.

The first floret is usually male and paleate, rarely sterile and with at most a reduced palea. Such a form was the base of *A. neesii* Mez.

A representative specimen of *A. clarkei* Hook.f. was seen (*Bor 6767*, K), which except for the shorter hairs on the pedicels and the more acute lower two lemmas could not really be distinguished from the present variety. In view of the distribution of the various forms one would have expected it to resemble var. *siamense* more, instead. The taxon was originally described as having a paleate neuter floret and Bor (1940, 1960) and Jain & Pal (1975) have repeated this. *Bor 6767*, however, has a male lower floret and this may well be the actual situation, but once the anthers have been shed the extremely fine filaments easily escape detection in a wet condition; when dried again they are much easier to see. Because of the dimensions of the parts of the spikelet this specimen curiously enough keys out to what Bor (1960) called *Anthoxanthum sp.* and Jain & Pal *A. borii*. Another investigation in which *A. horsfieldii, A. clarkei* and *A. borii* are carefully compared using ample material seems in order and it might then well turn out that *A. horsfieldii* s.l. occurs in the Khasya and Pulni Hills, or, another possibility, that they are indeed distinct, but that there are two taxa in the first area. *Helictotrichon virescens* (Steudel) Henr. has a somewhat similar distribution as *A. horsfieldii*; if the first suggestion turns out to be correct, no doubt there are other instances.

b. var. **angustum** (Hitchc.) Y. Schouten, *comb. nov.*

Hierochloë angusta Hitchc., Brittonia 2 (1936) 118. – *A. angustum* Ohwi, Bull. Tokyo Sc. Mus. 18 (1947) 8; Reeder, J. Arn. Arbor. 31 (1950) 324; Jansen, Reinwardtia 2 (1953) 227; Henty, Bot. Bull., Lae 1 (1969) 28, f. 3A. – Type: *Brass 4412* (NY, holo; BM, BO, US), New Guinea, Central Dist., Mt Albert Edward, 3680 m, 5 July 1933.

A. papuanum Jansen, Reinwardtia 2 (1953) 228, f. 1; Henty, Bot. Bull., Lae 1 (1969) 28; Royen, Alp. Fl. New Guinea 2 (1980) 1193, f. 385. – Type: *McGregor s.n.* (MEL, holo), New Guinea, Mt Victoria.

A. horsfieldii auct. non Reeder: Royen, Alp. Fl. New Guinea 2 (1980) 1188, pro specim., excl. *Hoogland & Schodde 7059.*

Hierochloë horsfieldii auct. non Maxim.: Chase, J. Arn. Arbor. 24 (1943) 84, pro specim., excl. *Brass 9049.*

Trisetum spicatum auct. non Richter: Henty, Bot. Bull., Lae 1 (1969) 189.

Trisetum subspicatum auct. non Beauv.: Ridley, J. Linn. Soc. Lond., Bot. 9 (1916) 250.

Cataphylls triangular to ovate-oblong, 1.1–6.2 by 0.5–3 mm, nerves sometimes ciliate. *Culms* solitary or in small tufts, simple, glabrous to densely retrorsely pubescent, smooth to scaberulous. Sheaths glabrous to strongly retrorsely pubescent,

smooth to scabrous, margins usually ciliate. Ligule 0.5–4.4 mm high, outside glabrous to puberulous, margins glabrous to ciliate. *Blades* ± stiffly erect, at least partly involute, up to 49 cm by 7 mm when flattened out, glabrous to densely puberulous, smooth to scabrous, margin usually ciliate, midrib conspicuous or not. Panicle contracted, erect, 3.9–15.5 by 0.6–1.7 cm diam., axis smooth to scabrous, glabrous, rarely densely puberulous, branches smooth to scabrous, sparsely puberulous, basal branches 2 together, the longest 1.5–5.7 cm long, 4–34-spikeled, naked in the lower 0.2–0.4th part. *Spikelets* 5.4–8.8 by 1.2–2.6 mm diam., usually green-purplish. *Glumes* oblong to obovate-oblong; lower glume 4.2–7.4 by 1.6–3 mm, 0.67–0.9 times as long as the upper one, 1(–3)-nerved, acute to acuminate; upper glume 5.5–8.8 by 2.2–3.8 mm, 3(–5)-nerved, acuminate. First floret usually epaleate, sterile, rarely paleate, once with three anthers; second floret epaleate, palea exceptionally developed. First rachilla joint 0.2–0.3 mm long, the second one (0.1–)0.2(–0.3) mm long. Lower two *lemmas* oblong, upper 0.33th sometimes glabrous, apical lobes 0.2–0.4 times as long as the lemma; first lemma 4–5.8 by 1.2–1.8 mm, (1.6–)1 mm shorter to 0.1(–0.4) mm longer than the lower glume; awn inserted at 0.45–0.65th, 1.5–4.2 mm long, usually slightly exserted; second lemma 3.6–5.8 by 1–1.4 mm, awn inserted at (0.15–)0.2–0.33(–0.4)th, 7–8.7(–9.3) mm long, column 2.2–3.7 mm long, subule 4.5–6.5 mm long; third lemma 1.5–2.9 by 0.4–0.75 mm diam., 0.35–0.5 times as long as the lower glume, 0.3–0.4 times as long as the upper glume, 0.4–0.55(–0.6) times as long as the first lemma, 0.4–0.6 times as long as the second lemma, apex obtuse, glabrous, mucro in the sinus when present up to 1.4 mm long, exceptionally with a geniculate up to 6.3 mm long awn. First *palea* when present up to 3.1 by 0.4 mm with a sparsely ciliolate apex, second palea (once seen) 0.9 by 0.1 mm; third palea 1.3–2.2 by 0.1–0.4 mm, lobes sometimes with 1 hair. Anthers once seen in the first floret, 1–1.6 mm long, in the third floret 2.5–3.3 mm long. Caryopsis 1.1–1.9 by 0.4–0.8 mm diam.

Distribution. New Guinea: Irian Jaya (Mt Carstensz, Mt Doorman, Lake Habbema, Oranje Meer); Papua New Guinea: West Sepik (Star Mountains), Enga (Mt Burgers), Western Highlands (Mt Kegum, Mt Kinkain, Tubongas), Southern Highlands (Mt Ambua, Mt Kerewa, Mt Giluwe), Chimbu (Mt Wilhelm), Eastern Highlands (Mt Kerigomna, Mt Piora), Madang (Mt Bangeta, Mt Amungwiwa, Sarawakets), Central (Mt Strong, Mt Albert Edward, Mt Scratchley, Mt Victoria, Lake Myola), Milne Bay (Mt Suckling, Mt Dayman).

Ecology. Swampy or moist subalpine short-grassland or open scrub, usually above 3000 m, rarely as low as 1800 m (Lake Myola), up to 4110 m (Mt Bangeta, Mt Carstensz).

Collectors' notes. Small tufts to solitary, occasionally 'bushy'. Leaves semi-gloss midgreen to pale greyish green. Panicle green to purplish. Anthers white to pale yellow. Stigmas white. No remark on fragrance in the field (I cannot remember it having any, it is very faint to absent in the herbarium. JFV).

Vernacular names. Kubrin, tini (Mendi), muasuakwil (Chimbu: Masul), undi (Laiagam), warenajuwa (Mairi: Mondo).

Notes. Reeder (1950) and Jansen (1953) have already pointed out that Hitchcock

mistakenly described the lower two florets as male; as can be seen we agree that *A. horsfieldii* with which Ms. Chase (1943) and Van Royen (1980) equated it is distinct. Only a few times was the presence of a first palea observed and only once a male floret (*Kalkman 5141*). As can be seen from the description the insertion of the awn is more variable than Reeder thought, while the leaves are not significantly narrower, nor the panicles more contracted. *Anthoxanthum horsfieldii* s.s. tends to be somewhat more robust with flaccid leaves, but besides the sexuality of the first floret differs only in a number of rather subtle characters, e.g. the ratios between the third lemma and the other parts of the spikelet, suggesting an infraspecific status for both taxa. The Sumatran plants mentioned by Reeder are even more similar, cf. var. *sumatranum*.

Chase's observations were possibly obscured by the fact that *Brass 9049* cited by her is a mixture of *A. redolens* var. *redolens* and var. *longifolium*.

Anthoxanthum papuanum is not distinct for the main delimiting character, the presence of a perfectly geniculate awn on the third lemma is shown by a few lemmas in the inflorescence of the type, only; the others are, as usual, muticous, or, sometimes, aristate.

c. var. borneense (Jansen) Y. Schouten, *comb. nov.*

A. angustum (Hitchc.) Ohwi var. *borneense* Ohwi ex Jansen, Reinwardtia 2 (1953) 227. – Type: *Clemens 29176* (BO, holo, sheet 26609, not 26639; A, K, L, NY, SING, UC), Sabah, Upper Mt Kinabalu, 1830–4115 m, 28 March 1932.

Cataphylls 1.5 by 0.5–2 mm. *Culms* simple, scaberulous. Sheaths puberulous, glabrescent, usually scaberulous, margins ciliate. Ligule 1.7–4 mm high, outside puberulous, margin ciliate. *Blades* ± stiffly erect, involute, up to 14 cm by 4 mm diam., glabrous, smooth, midrib distinct at base. Panicle contracted, erect, 4.5–8 by 0.7–1.3 cm diam., axis and branches smooth to ± puberulous, branches sparsely pilose, basal branch solitary, 2.7–3 cm long, 6–8-spikeled, naked in the lower 0.2–0.3th parth. *Spikelets* 6.4–8.7 by 1.6–3.1 mm diam. Lower *glume* oblong to ovate-oblong, 4.8–7.4 by 1.6–2.6 mm, 0.67–0.95 times as long as the upper one, 1–3-nerved, acute; upper glume ovate to ovate-oblong, 6.2–8.5 by 3–3.8 mm, 3-nerved, acute. Lower two florets sterile, palea much reduced. First rachilla joint straight, 0.1–0.2 mm long, second joint 0.2–0.4 mm long. Apical lobes of lower two *lemmas* up to 0.4 times as long as the lemma; first lemma 4.8–5.8 by 1.8–2.2 mm, from 1.7 mm shorter to 0.1 mm longer than the lower glume, awn inserted at (0.5–)0.55–0.67th, 2.3–4.4 mm long, exserted; second lemma 4.4–5.9 by 1.4–2 mm, awn inserted at 0.25–0.4th, 7.5–11.5 mm long, column 2.9–4.7 mm long, subule 3.5–7.5 mm long; third lemma 2–3.2 by 0.6–0.9 mm diam., (0.35–)0.4–0.6 times as long as the lower glume, 0.3–0.45 times as long as the upper glume, 0.35–0.6 times as long as the lemmas, indistinctly 5–7-nerved, mucro when present up to 2.4(–2.9) mm long. First *palea* up to 1.8 by 0.4 mm; second palea up to 1.1 by 0.1 mm; third palea 2.2–2.8 by 0.2–0.4 mm. Anthers 1.7–2.3 mm long. Caryopsis 1.7–2.1 by 0.5–0.9 mm diam.

Distribution. Sabah: Ranau Dist. (Mt Kinabalu).

Ecology. Open grasslands and low heaths, disturbed areas, moist slopes, 3300–4335 m.

Collectors' notes. Tufted. Anthers dirty yellow. Stigmas white. Locally frequent.

Note. Jansen (1953) included this in *A. angustum* to which it indeed seems close, differing mainly by the first rachilla joint, the width of the first lemma, length of the third and that of the anthers. The number of the sheet in BO is *26609*, not *26639*.

d. var. **celebicum** Y. Schouten, *var. nov.*

A. luzoniense auct. non Merr.: Jansen, Reinwardtia 2 (1953) 227, p.p.

Varietas varietate *angusto* proxima, inflorescentiae ramis glabris, imo longissimo solum 1–3 spiculis, lemmatis secundis arista breviore, antheris paulo brevioribus differt. – Typus: *J.M.B. Smith 667* (L, holo), Celebes, Mt Rantemario, 2250 m, 10 Feb. 1981.

Cataphylls c. 4.6 by 1.5 mm. *Culms* up to 35 cm high, simple, glabrous. Sheaths tight, puberulous. Ligule 0.8–2.1 mm high, puberulous outside. *Blades* ± stiffly erect, involute, up to 6.5 cm by 2 mm diam., puberulous, margins usually ciliate, midrib distinct. Panicle contracted, erect, 3.5–4.5(–6.5) by 0.6–1.2(–2) cm diam., branches glabrous, the basal solitary (or 2 together, longest) 1.3–1.7 cm long, 1–3-spikeled, naked in the lower 0.25–0.4th. *Spikelets* 5.3–5.8 by 1.8–2.3 mm diam. *Glumes* sometimes puberulous in the upper part; lower glume ovate to obovate, 4–4.7 by 2.6–3 mm, 0.75–0.85 times as long as the upper one, (2- or) 3-nerved, acute; upper glume elliptic to obovate, 5.3–5.8 by 3.6–4 mm, 3–5-nerved. First and second floret sterile, epaleate. Second rachilla joint 0.1–0.15 mm long. Apical lobes of lower two *lemmas* up to 0.3 times as long as the lemmas; first lemma 4.2–4.7 by 1.6–2.2 mm, from 0.4 mm shorter to 0.2 mm longer than the lower glume, awn inserted at 0.5–0.75th, 1.1–2.2 mm long, not or slightly exserted; second lemma 4.2–4.7 by 1.4–2 mm, awn inserted at 0.25–0.3th, (4–)7.1–7.5 mm long, column 2–4 mm long, subule 3.5–4.3 mm long; third lemma ± ovate-oblong, 2–2.3 by 0.7–0.9 mm diam., 0.45–0.55 times as long as the lower glume, 0.35–0.45 times as long as the upper one, 0.45–0.55 times as long as the lemmas. Third *palea* 1.5–1.6 by 0.2–0.3 mm diam. Anthers c. 2.3 mm long. Caryopsis 1–1.6 by 0.3–0.8 mm diam.

Distribution. SW. Celebes (Latimojong Mts).

Ecology. Open scrubland, 3000–3400 m.

Note. Especially close to var. *angustum*. The lower two paleas are sometimes represented by minute white calli.

e. var. **ceramense** Y. Schouten, *var. nov.*

A. luzoniense auct. non Merr.: Jansen, Reinwardtia 2 (1953) 227, p.p. ('Celebes').

Varietas varietate *angusto* propinqua, inflorescentiae ramis glabris, arista secunda breviore superiore inserta, lemmate paleaque tertio majore rationes spiculae partium hinc discrepatae,

quoque gluma superiore acuta et rachillae internodiis longioribus differt. – Typus: *Eyma 2272* (BO, holo), Moluccas, Ceram, Binaya Mts, Mt Ueimpuku, 3000 m, 24/25 Nov. 1937.

Cataphylls 5–11.5 by 1.3–4 mm. *Culms* up to 55 cm high, simple. Sheaths glabrous. Ligule 2.3–5 mm high, outside puberulous, glabrescent. *Blades* ± flat at base, slightly involute upward, 7–13 cm by 3–6 mm diam., glabrous, midrib distinct. Panicle contracted to lobed, somewhat nodding, 6–10.5 by 1.5–3 cm diam., branches and pedicels glabrous, basal branches (1 or) 2 together, the longest up to 6 cm long (see note). *Spikelets* 6–6.7 by 2.3–3.7 mm diam. Lower *glume* 3.9–4.5 by 1.8–2.2 mm, 0.67–0.7 times as long as the upper one, acute; upper glume 5.8–6.5 by 2.6–3 mm, acute. Lower two florets sterile, epaleate. First rachilla joint c. 0.5 mm long, the second 0.5–1 mm long. Apical lobes of the lower two *lemmas* up to 0.3 times as long as the lemmas, obtuse to acute; first lemma 4.9–5.5 by 1.4–1.6 mm, 0.8–1.3 mm longer than the lower glume, awn inserted at (0.5–)0.6–0.75th, 1.7–2.5 mm long, not or hardly exserted; second lemma 5.1–5.7 by 1.4–1.8 mm, awn inserted at 0.45–0.55th, 4.3–5.5 mm long, column 2–3 mm long, subule 2.3–3 mm long; third lemma 3–3.2 by 0.7–1 mm diam., 0.67–0.8 times as long as the lower glume, 0.45–0.55 times as long as the upper one, 0.55–0.6 times as long as the lower two lemmas, once with a c. 0.2 mm long mucro. Third *palea* 2.2–2.4 by 0.25–0.3 mm. Anthers not seen. Caryopsis 1.1–2 by 0.6–0.7 mm diam.

Distribution. Moluccas: Ceram (Binaya Mts, Mt Ueimpuku).

Ecology. 3000 m altitude.

Notes. The above description is unfortunately not entirely complete, e.g. the composition of the longest, lowest branch of the inflorescence is not noted, because the only collection known was inadvertently prematurely returned to BO.

The variety seems close to var. *angustum* differing in some characters as shown by the diagnose, the value of which cannot be exactly estimated through ignorance of the actual variability of the Moluccan population.

Jansen (1953) incorrectly gave the provenance of the type as Celebes.

f. var. **luzoniense** (Merr.) Y. Schouten, *comb. nov.*

A. luzoniense Merr., Philip. J. Sc. 1 (1906) Suppl. 178; Enum. Philip. Fl. Pl. 1 (1923) 78; Jansen, Reinwardtia 2 (1953) 227. – Type: *Merrill 4713* (PNH, lost, n.v.), Philippines, Luzon, Benguet Prov., Pauai, 2100 m, 8 Nov. 1905.

Cataphylls 2.4–6 by 1.5–3 mm. *Culms* up to 85 cm high, simple. Sheaths tight, sparsely puberulous upward, glabrescent, smooth to scaberulous. Ligule 1.1–6 mm high. *Blades* up to 32 cm by 9 mm, puberulous, glabrescent, scaberulous, margins ciliate. Panicle 5–12.5 by 1–1.8 cm diam., branches glabrous, basal branches (1 or) 2 together, the longest up to 6 cm long, naked in the lower 0.15–0.4th, 5–14-spikeled, pedicels glabrous. *Spikelets* 5.9–6.7 by 1.5–3.2 mm diam. *Glumes* glabrous; lower glume (3.2–)3.9–5.2 by 2.2–2.6 mm, 0.67–0.8(–0.85) times as long as the upper one, (1–)3-nerved, acute; upper glume (4.8–)5.6–6.6 by 2.6–3.2 mm. Lower two florets sterile, epaleate. First rachilla joint 0.3(–0.5) mm long, the second 0.15–

0.25(–0.3) mm long. First *lemma* (3.4–)4.5–5.2 by 1.4–1.8 mm (from 0.5 mm shorter to) 0.2–0.5(–1.1) mm longer than the lower glume, awn inserted at 0.6–0.7 (–0.75)th, 1.1–2.6 mm long, not or hardly exserted; second lemma (3.2–)4.1–4.7 by (0.8–)1.2–1.6 mm, awn inserted at 0.3–0.4th, 5–6.8 mm long, column 2.1–3 mm long, subule 2.8–3.8 mm long; third lemma 2.2–3 by 0.5–0.9 mm diam., 0.6–0.67(–0.85) times as long as the lower glume, 0.4–0.5(–0.55) times as long as the upper glume, 0.55–0.65 times as long as the first lemma, 0.6–0.75 times as long as the second lemma, mucro rarely present, up to 0.6 mm long. Third *palea* 2–2.6 by 0.2–0.35 mm, apex sometimes ciliolate. Anthers 1.6–2.5 mm long. Caryopsis 1.1–1.9 by 0.35–0.8 mm diam.

Distribution. Philippines: Luzon (Mt Pulog).

Ecology. Open grasslands, in forest edges, 2000–2880 m altitude.

Collectors' notes. Very fragrant in drying.

Notes. Only 4 collections were seen, but not the type, which seems to have been lost. Jansen included specimens from Celebes (and Ceram), which are here distinguished as the varieties *celebicum* and *ceramense*. Two collections, *Jacobs 7204 & 7253* were distributed as *Calamagrostis*: they are mixed with *Deyeuxia stenophylla* Jansen var. *stenophylla* sometimes included in *Calamagrostis* as *C. filifolia* Merr.

Merrill on the authority of Hackel (isotype presumed to be in W was not received) suggested that it might be close to *A. clarkei*, a species not seen, but apparently immediately different by a paleate first floret, a longer second lemma bifid to below the middle with a much longer awn and a longer third lemma [fide Hook. f., Fl. Br. India 7 (1896) 223; Bor, Grasses (1960) 431; see also sub var. *horsfieldii*]. From the description of it *A. formosanum* seems much more related, it might be another variety of *A. horsfieldii*, perhaps, but according to Hsu [Taiwan Grasses (1975) 253, f. 21; Fl. Taiwan 5 (1978) 405, f. 1378] this has stiffer leaves and smaller spikelets with the awn of the first lemma inserted at c. 0.33th.

g. var. siamense (Bor) Y. Schouten, *comb. nov.*

A. siamense Bor, J. Ind. Bot. Soc. 42A (1963) 10, f. 1. – Type: *Smitinand & Asterlund 6668* (K, holo; BKF, n.v.), Thailand, Northern Prov., Chiang Mai Dist., Doi Intanon, 2580 m alt., 15 April 1960.

Cataphylls 2–11 by 1.2–8 mm. *Culms* up to 1 m, simple. Sheaths lax. Ligule 1.3–4.8 mm high, outside usually puberulous. *Blades* stiff, ± involute, smooth to scabrous, margin ciliate, midrib distinct in the lower half. Panicle ± contracted, laxly lobed, 3.5–14.5 by 0.6–2.5 cm diam., branches glabrous, the basal ones 1 or 2 together, longest up to 7.5 cm long, 3–21-spikeled, naked in the lower 0.2–0.45th. *Spikelets* 5.7–8.4 by 1.8–3.4 mm diam. *Glumes* glabrous; lower glume 3.6–5.4 by 2–2.8 mm, 0.6–0.75 times as long as the upper one, acute, 1- or 2-nerved; upper glume 5.6–8.3 by 3–3.8 mm. First flower paleate, male, second flower sterile, palea minute. Second rachilla joint 0.2–0.3 mm long. Apical lobes of the lower two *lemmas* up to 0.4 times as long as the lemmas; first lemma 4.9–6.6 by 1.6–2 mm,

1–1.6(–1.9) mm longer than the lower glume, awn inserted at 0.6–0.67(–0.75)th, 0.6–3.1 mm long, not or hardly exserted; second lemma 4.6–6.1 by 1.2–1.4 mm, awn inserted at 0.15–0.25(–0.3)th, 7.7–12.1 mm long, column 3–4.7 mm long, subule 3.7–7.5 mm long; third lemma 2.5–3.5 by 0.7–1 mm diam., 0.55–0.8 times as long as the lower glume, 0.35–0.55 times as long as the upper glume, 0.45–0.6 times as long as the lower lemmas, apex bifid, glabrous, mucro rarely present, up to 3 mm long. First *palea* 4.2–5.2 by 0.5–0.8 mm, apex sometimes with a few cilia; second palea 0.1(–0.2) mm long; third palea 2–3.5 by 0.25–0.5 mm diam. Anthers of first floret 2.4–2.6 mm long, of the third 2.5–4.1 mm long. Caryopsis c. 1.9 by 0.8–1 mm diam.

Distribution. Thailand: Northern Prov., Chang Mai Dist., Doi Intanon.

Ecology. Burned grasslands, in *Sphagnum* bogs, 1800–2580 m altitude.

Collectors' notes. Tufted. Glumes green to pinkish with green nerves. Awns reddish. Anthers light ochre yellow. Stigmas white.

Notes. Only slightly different from var. *horsfieldii*: branches of the inflorescence glabrous, spikelets slightly larger and awn of the second lemma lower inserted. Very similar also to var. *angustum* from which aside from the male, paleate lower floret it differs by the glabrous branches, the somewhat more exserted first lemma, the lower insertion of the awn of the first lemma and the relative lengths of the third lemma and glumes.

Bor described the third floret with 3 anthers. In the few instances that stamens (or the filaments) were still present, only 2 were seen.

h. var. **sumatranum** (Jansen) Y. Schouten, *comb. nov.*

A. sumatranum Jansen, Reinwardtia 2 (1953) 227. – Type: *van Steenis 9588* (L, holo; BO, K, NY, SING; A, PNH, n.v.), Sumatra, Aceh, Mt Kemiri, 2900–3315 m, 7 March 1937.
A. angustum auct. non Ohwi: Reeder, J. Arn. Arbor. 31 (1950) 325.

Cataphylls 7–35 by 2.1–6 mm, acute to obtuse, glabrous, sometimes densely puberulous. *Culms* up to 110 cm high, densely puberulous, glabrescent, usually scabrous. Sheaths tight, puberulous, glabrescent, usually scabrous, margins sometimes ciliate. Ligule 0.2–2.7(–3.8) mm high, outside sometimes puberulous, margin ciliate. *Blades* stiffly erect, involute, up to 26 cm by 3 mm diam., densely puberulous mixed with some longer hairs above, glabrous to puberulous below, scaberulous, margins ciliate, midrib usually inconspicuous. Panicle erect, contracted, sometimes lobed, 5.5–13.5 by 0.5–1.8 cm diam., axis usually subglabrous, smooth or scaberulous near the base, branches and pedicels more or less pilose, basal branches 1 or 2 together, longest 1.8–5.6 cm long, 5–many-spikeled, naked in the lower 0.1–0.6th. *Spikelets* 5.5–7.7 by 1.2–2.2 mm diam. *Glumes* sometimes with a puberulous midrib; lower glume 3.2–5.3 by 1.6–2.8 mm, 0.5–0.7(–0.8) times as long as the upper one, 1-(or 2-)nerved, acute; upper glume 5.4–7.7 by 3–4.2 mm, margin sometimes puberulous. First floret sterile, epaleate, occasionally male, paleate; second floret sterile, epaleate, rarely paleate. Second rachilla joint 0.1–0.2(–0.3) mm long. Lower two

lemmas glabrous to shortly puberulous in the upper 0.33th, apical lobes up to 0.3 times as long as the lemmas; first lemma 4.2–6 by 1.4–2 mm, 0.1–1.8 mm longer than the lower glume, awn inserted at 0.4–0.85th, 0.9–4.1 mm long, exserted or not; second lemma 3.7–6 by 1.2–2 mm, awn inserted at 0.2–0.4(–0.5)th, (3.9–) 5.6–8.8 mm long, column (1.7–)2–3.8 mm long, subule 3.4–5.7 mm long; third lemma 2.6–3.7 by 0.8–1.2 mm diam., 0.55–0.9(–1) times as long as the lower glume, (0.35–)0.4–0.6 times as long as the upper glume, 0.5–0.67 times as long as the first lemma, 0.5–0.7(–0.85) times as long as the second lemma, obtuse to bifid, mucro when present up to 2.3 mm long. First *palea* when present up to 3.4 by 0.5 mm, then apex ciliolate; second lemma when present up to 2.2 by 0.3 mm, glabrous; third palea 2–4.2 by 0.25–0.4 mm diam. Anthers of the first flower absent, or abortive, or fertile, up to 1.4 mm long, of third flower 1.7–3.9 mm long. Caryopsis c. 1.7 by 0.6 mm diam.

Distribution. Sumatra: Aceh (Mt Leusir-complex: Mt Kemiri, Mt Leusir).

Ecology. Infertile, stony areas, fire-disturbed grasslands, marshy places ('blangs'), 2700–3500 m.

Collectors' notes. Small, loose tussocks. Inflorescence greenish to purplish brown. Anthers pale yellow. Stigmas whitish.

Notes. Especially close to var. *angustum* differing mainly by the more unequal glumes, the larger third lemma, whereby the ratios of the parts of the spikelet become different. It is therefore not surprising that Reeder (1950) equated the two. The occasional presence of a male, paleate first floret again shows the unreliability of this feature to base specific if not generic delimitations on the sexuality of the florets. In the latter form it then comes also close to var. *siamense* from which it differs mainly by the pilose branches of the inflorescence, the generally more unequal glumes, the higher insertion of the somewhat shorter awn of the second lemma.

2. Anthoxanthum redolens (Vahl) Royen

For the synonymy see under the varieties.

a. var. redolens

Holcus redolens Vahl, Symb. Bot. 2 (1791) 102; R. Br., Prod. (1810) 209. – *Avena redolens* Pers., Syn. Pl. 1 (1805) 100. – *Hierochloë redolens* R. & S., Syst. Veg. 2 (1817) 514; Benth., Fl. Austr. 7 (1878) 558; Buchanan, Man. New Zeal. Grasses (1880) 11, f. 6; Hitchc., Brittonia 2 (1936) 119; Parodi, Rev. Mus. La Plata n.s. 3 (1941) 189, f. 1, map (pro var. *typica* Parodi, nom. inval.); Chase, J. Arn. Arbor. 24 (1943) 84; Borgmann, Zeitschr. Bot. 52 (1964) 141; Moore, Br. Antarct. Surv. Bull. 14 (1967) 73, 80, f. 6g; Br. Antarct. Surv. Sc. Rep. 60 (1968) 166, f. 20j; Henty, Bot. Bull., Lae 1 (1969) 109; De Paula, Darwiniana 19 (1975) 442, f. 5a–g (pro var. *redolens*); Moore & Doggett, Bull. Soc. Argent. Bot. 19 (1975) 390; Vickery, Fl. N. S. W. 19, 2 (1975) 278. – *Hierochloë antarctica* (Labill.) R. Br. var. *redolens* Rasp., Ann. Sc. Obs. 1 (1829) 83 (n.v.); Brongn. in Duperrey, Voy. Coquille, Bot., Phan. (1833) 144, t. 23; comb. illeg., because of priority the epithets should have been the other way around. – *A. redolens* Royen, Alp. Fl. New Guinea 2 (1980) 1185, f. 382. – Type: *Forster s.n.* (C, holo, in Herb. Fabricius, P; BM, K; FI, n.v.), Terra del Fuego (see note).

Holcus redolens [Soland. ex G. Forster, Prod. (1786) 92, nomen] G. Forster ex R. Br., Prod. (1810) 209, non Vahl (see note). – *Torresia redolens* R. & S., Syst. Veg. 2 (1817) 516. – *Hierochloë redolens* R. Br. ex Hook. f., Fl. Antarct. 1 (1844) 91; vol. 2 (1846) 375; Fl. Nov. Zel. 1 (1853) 300; vol. 2 (1855) 337; Zotov, New Zeal. J. Bot. 11 (1973) 574, f. 1-5, 2-5, 3-5; non R. & S. – *Hierochloë banksiana* Endl., Ann. Wien. Mus. Naturgesch. 1 (1836) 156. – Lectotype: *Banks & Solander s.n.* ('*Holcus dioneus* Soland.') (BM, holo; WELT, n.v.), New Zealand.

Melica magellanica Desr. in Lamk., Encycl. Méth. 4 (1797) 72. – *Torresia magellanica* Beauv., Agrost. (1812) 63, 179, based on '*Aira magellanica* Lamk.', a name not mentioned by Lamarck, but possibly a mistake for '*Melica*'; R. & S., Syst. Veg. 2 (1817) 516, there superfluous. – *Hierochloë magellanica* Hook. f., Fl. Antarct. [1 (1844) 92, nomen;] vol. 2 (1846) 375, nom. superfl.; Steudel, Syn. 1 (1853) 14 (legitimate under Art. 63.3). – *Hierochloë redolens* (Vahl) R. & S. var. *magellanica* Mackloskie ex Scott, Rept. Princeton Univ. Exp. Patagonia 1896–99, 8, Bot. (1904) 167. – Type: *Commerson s.n.* (P, holo, in Herb. Jussieu 2329; BAA, fragm., n.v., depicted by Parodi, 1941, f. 1 sub *H. redolens* R. & S.), Strait of Magellan, 1766–67.

Disarrenum antarcticum Labill., Nov. Holl. Pl. 2 (1806) 83, f. 232. – *Hierochloë antarctica* R. Br., Prod. (1810) 209; Kunth, Enum. Pl. 1 (1833) 37; Rév. Gram. 3 (1834) t. 203 (n.v.); Hook. f., Fl. Antarct. 1 (1844) 92; (1845) 94; vol. 2 (1846) 375; Fl. Nov. Zel. 1 (1853) 300; vol. 2 (1855) 337; Parodi, Rev. Mus. La Plata n.s. 3 (1941) 185, 196; De Paula, Darwiniana 19 (1975) 425, 426. – *Torresia antarctica* Beauv., Agrost. (1812) 63, 160, 164, 179. – *Savastana antarctica* Spegaz., An. Mus. Nac. Buenos Aires 7 (1902) 184. – Type: *De Labillardière s.n.* (FI, holo; G), Tasmania, anno 1792.

Hierochloë arenaria Steudel, Syn. 1 (1854) 416; Zotov, New Zeal. J. Bot. 11 (1973) 563, 579, nom. prov. – Type: *Lechler 1138*, p.p. [P, holo, G, L, MPU, W; K & BAA, fragm., belong to *H. sorianoi*, cf. De Paula, Bol. Soc. Argent. Bot. 15 (1974) 396], Strait Magellan, Sandy Point, Dec. 1850–53.

A. longifolium auct. non Royen: Royen, Alp. Fl. New Guinea 2 (1980) pro fig. 384.

Hierochloë moorei De Paula, Bol. Soc. Argent. Bot. 15 (1974) 393, f. 1; Darwiniana 19 (1975) 433, f. 2; Moore & Doggett, Bol. Soc. Argent. Bot. 16 (1975) 390, in syn. – Type: *Moore 2064* (BAA, holo, LTR, n.v.), Tierra del Fuego, Dep. Ushaia, Isla de los Estados, Bahía Colnett.

Hierochloë sorianoi De Paula, Bol. Soc. Argent. Bot. 15 (1974) 396, f. 2; Darwiniana 19 (1975) 448, f. 6; Moore & Doggett, Bol. Soc. Argent. Bot. 16 (1975) 390, in syn. – Type: *Soriano 4172* (BAA, holo), Argentine, Chubut, Dep. Futaleufú, Lago Futalaufquen.

Perennial, stoloniferous, tufted or culms ± solitary, up to 150 cm high. Cataphylls round to linear, up to 35 by 5 mm, obtuse, membranous, furrowed, smooth, glabrous. *Culms* simple, glabrous, smooth. Sheaths somewhat loose upward, smooth to scabrous, glabrous, margins not ciliate. Ligule collar-shaped to trapezoid-triangular, 1.8–12 mm high, truncate to obtuse, membranous to pergamentaceous, outside scabrous to puberulous. *Blades* involute and stiffly erect to flat and flaccid, 10–53 cm by 4–12 mm, glabrous, usually scabrous above, smooth below, margins ciliate, midrib sometimes distinct at base. Panicle loosely lobed to effuse, drooping, secund, 9–13 by 1.5–10 cm diam., axis and branches smooth, axis glabrous, branches glabrous to sparsely pilose, the lowermost 1 or 2 together, the longest 6–14 cm long, 13–many-spikeled, naked in the lower 0.3–0.6th; pedicels slightly pilose upward. *Spikelets* usually obliquely obtriangular, 6–8.5 by 3–6 mm diam., greenish with purple. Lower *glume* elliptic to (ovate-)oblong, 4.5–8 by 2–3.4 mm, 0.75–1 times as long as the upper one, 1(–3)-nerved, acute to obtuse; upper glume ovate- to obovate-oblong, 5.9–8.5 by 3–4.4 mm, 3-nerved, acute, sometimes obtuse or acuminate. All florets paleate and with lodicules, the upper in Malesia usually bisexual,

less often female with staminodes (see note). Lower rachilla joint straight to curved, 0.3–0.8 mm long, the upper one straight, 0.5–0.9 mm long. Lower two *lemmas* ± oblong, scabrous, upper half spiculate, midrib sometimes puberulous in lower half, margin and sometimes apex ciliate, apical lobes obtuse to truncate; first lemma 4.9–7.2 by 2.2–3 mm, from 1.8 mm shorter to 1.4 mm longer than the lower glume, apical lobes up to 0.15 times as long as the lemma, awn straight, inserted above 0.85th, 1.5–3 mm long; second lemma 4.5–6.7 by 2–2.6 mm, apical lobes up to 0.15 times as long as the lemma, awn straight, inserted above (0.7–)0.75th, 3–4.6 mm long; third lemma ± ovate-lanceolate, 3.3–5 by 0.9–1.3 mm diam., (0.5–)0.6–0.8(–0.9) times as long as the lower glume, 0.5–0.7(–0.75) times as long as the upper glume, 0.6–0.8 times as long as the first lemma, 0.7–0.85 times as long as the second lemma, upper half puberulous and scaberulous to entirely scaberulous, margin ciliate, midrib sometimes puberulous in lower half, pergamentaceous, indistinctly 5-nerved, obtuse, sometimes retuse or truncate or acuminate, mucro when present subapical, up to 0.6 mm long. *Paleas* linear-lanceolate, upper half scabrous to puberulous, especially on the nerves, apex erose to ciliate; first palea 3.8–6.5 by 0.5–0.6 mm; second palea 3.8–6 by 0.4–0.6 mm; third palea 3–4.8 by 0.45–0.7 mm. Lodicules usually with an apical hair, in the lower florets 0.6–1.8 mm long, in the third one 0.4–1.2 mm. Anthers of the lower florets three, 0.7–3 mm long, of the third floret two (exceptionally three), usually fertile, (0.6–)0.75–1.7(–1.8) mm long, less often staminodial, 0.5–1(–1.1) mm long (in Malesia) (see note). Caryopsis oblong to lanceolate, 1.5–3 by 0.4–0.8 mm diam.

Distribution. South America (see Parodi, 1941, map): Ecuador, Chile, Argentine, Falkland Islands; New Zealand (Zotov, 1973, map), Chatham Islands, Australia: Tasmania, Victoria, New South Wales; Malesia: New Guinea: Irian Jaya (Mt Carstensz, Mt Wilhelmina, Lake Habbema, Mt Hubrecht), Papua New Guinea: West Sepik (Star Mts), Western (Mt Karoma), Western Highlands (Mt Kegum), Southern Highlands (Mt Ambua, Mt Kerewa, Mt Giluwe), Chimbu (Mt Wilhelm), Eastern Highlands (Mt Kerigomna, Mt Michael), Madang (Mt Abilala), Morobe Dist. (Sarawaket-complex), Northern (Mt Kenive), Central (Mt Albert Edward).

Ecology. (In Malesia) Moist places in subalpine grasslands, low scrub, *Cyathea*-vegetation, on hummocks, in *Blechnum*-heaths, etc., (2400–)2960–4450 m to the snow-line.

Collectors' notes. Vanilla-scented. Culms ± solitary to in stoloniferous tussocks. Basal sheaths reddish to purple. Blades dark, shiny, slightly glaucous, mottled with purple. Inflorescences drooping, secund, silvery to purple. Anthers white to yellow. Stigmas white.

Uses. Said to be a good fodder grass (Buchanan, 1880; De Paula, 1975, p. 428), but in view of the latter's remarks on *A. utriculatum* this must be doubted.

Vernacular names. Es (Mendi: 'grass'), hinanupa (Asaro, Kefamo), kugl, minikul (Chimbu, Masul: 'grass'), monojuwa (Mairi, Mondo).

Chromosome number. 2n = 56 (Borgmann, 1964, of a plant with a bisexual third floret from New Guinea; Moore, 1967, of a plant presumably with a female third floret, Falkland Islands).

Notes. In the concept presented here only one species occurs from South America to New Guinea and there is no difficulty in the application of the basionym *Holcus redolens* Vahl, wherever it might have come from. Many authors have attempted to distinguish the South American representatives from those from the Old World and then the provenance of the original material is of importance in the application of the epithet. Extensive discussions have been given by De Paula (1975), who claimed it came from Terra del Fuego and so called the South American plants *Hierochloë redolens* and the Australian ones *H. antarctica*; Zotov (1973) on the other hand maintained that the type must have come from New Zealand and by lack of anything better provisorily called the South American forms *H. arenaria*; it should have been *H. magellanica* (Desr.) Hook. f. emend. Steudel.

The undisputed type was collected by Forster, who collected both in South America and in New Zealand and it cannot be ruled out that he obtained *A. redolens* in both areas. His duplicates have been dispersed over many herbaria. The various authors have studied different ones in their attempt to clarify the situation but no one has ever brought all the material together again for a close comparison. Forster distributed his specimens as *Holcus redolens*; he published that name invalidly in 1786 stating that the species came from New Zealand.

We have seen the duplicates present in BM, C and K. The one in C was the base for *Holcus redolens* Vahl (1791). Vahl described the specimen as having 'subhermaphrodite' flowers with sterile anthers in the upper one giving Tierra del Fuego as its provenance. Such a 'female' specimen labeled 'Tierra del Fuego' is also present in BM. The collection in K was obtained from LIV, no provenance is given. It consists of a tuft of leaves with an inflorescence and two loose inflorescences. The first and one loose culm are 'female', but the other loose culm is 'bisexual'. We have seen no collection with New Zealand as its provenance.

Robert Brown created an immense confusion when he distinguished three species of *Hierochloë* in 1810. He recognised *Hierochloë antarctica* based on his own collections (*Brown 6164*, BM) and the plate and description of *Disarrenum antarcticum* Labill., which last name we have discussed elsewhere. He then proceeded to describe two other species, calling both *Holcus redolens*, one in Forster's sense, the other in Vahl's. The first would have a contracted panicle, rather small spikelets and glumes with a smooth midrib, the other species would have a panicle, larger spikelets and glumes with a sparsely scaberulous midrib.

The specimens on which Robert Brown based himself are still present in BM. In his opinion *Holcus redolens* Forster sensu R. Br. seems to be represented by three Banks & Solander collections from New Zealand (upper floret bisexual) named *Holcus dioneus* by Solander and one Forster collection from Tierra del Fuego (as said above with a 'female' upper floret). Three other sheets were collected by Banks & Solander in Tierra del Fuego (upper floret 'female'). On one Solander has written '*Holcus redolens*', on another R. Brown wrote '*Holcus redolens* Vahl nec Forster'. This last remark is definitely curious because the Forster-specimen excluded by R. Brown could very well be a duplicate of the one seen by Vahl.

Robert Brown moreover has said that Forster had taken the epithet '*redolens*'

from Solander, i.e. the Banks & Solander collections. One would therefore have expected that R. Brown would have regarded the base of the epithet and Forster's subsequent application of it as referring to a single species, but he apparently thought that Forster had misapplied it. Instead he seems to have relied mainly on outward appearances, which have turned out to be of little actual value. The shape of the panicle is related to its age, spikelets are very variable in size, while the scabridity of the glume is quite variable as well.

The provenance of the collections regarded as *Holcus redolens* Forster sensu R. Br. was apparently of no importance to Brown, because he did not remark upon them in the Prodromus. Obviously influenced by his writings authors of recent revisions for South America and New Zealand have thought that two vicarious species were involved, each arguing that in the area of his or her interest the 'true' *Holcus redolens* had been found and that one of their species should be called *Hierochloë redolens.* In our opinion no difference can be seen between the populations of either area and the actual provenance of Forster's material must remain a mystery. He may very well have collected the species in both areas!

Parodi (1941) thought he could distinguish the South American plants by the glumes that would be longer than the florets, while in New Zealand plants they would be equally long to shorter than these. Vickery (1975) and Moore & Doggett (1975) have shown that these relative lengths are much more variable than Parodi thought and that any distinction based on this is untenable. The latter also mentioned the place of insertion of the awn on the lemmas, supposedly subapical in New Zealand and 0.5–1.5 mm below the apex in South America, but again this is more variable in both areas than he suspected.

Zotov stated that there was an 'appreciable distinction' between material of both areas but unfortunately neglected to explain what it was, unless it was by the absolute and relative lengths of the glumes. We do realise, of course, that an expert may 'see' a difference, but may be unable to express in words what exactly is the cause of this. The trained 'taxonomic eye' may be very acute.

In Zotov's description of *Hierochloë redolens* it is said that the upper floret would be bisexual, while in other species in New Zealand it may be 'female'. Taking him at his word the holotype with its 'subhermaphroditic' ones with sterile anthers can then not belong to his concept of that species. In fact Vahl's specimen (see also Moore & Doggett's table 1 for some of its dimensions) can only with some juggling be keyed out to *H. redolens* in his key, which is at least partly due to its unfortunate construction.

De Paula's (1975) choice, therefore, to regard the specimen as coming from South America, where but for two collections according to her all plants would have 'female' terminal florets, would appear more plausible.

The situation, however, is different from that suggested by her. Moore (1968, and in litt.) has reported that both forms occur together in the Falkland Islands and Tierra del Fuego. He, too, did not find any associated characters whereby they might be distinguished otherwise. This agrees with our own observations. Not only is the Forster-collection in K a mixture of both forms, but that could be ascribed to a later mix-up, either by Forster himself of collections from South America and New Zea-

land, or later in mounting, but we have observed a similar mixture in the New Guinea collections. About half of the specimens from there had bisexual terminal florets, about 10% had 'female' ones, about 20% had both forms among the duplicates and/or dissociated culms mounted on the sheets, but, most surprisingly, no less than about 20% had such a mixture *within the same panicle* and even within the same floret: one anther being well-developed, the other one aborted! This then has made us very wary of Zotov's species in New Zealand, which are among other things characterised by having one form or the other. His fears as expressed in the first paragraph of his revision that another revision of the New Zealand taxa might be in order seems unfortunately to have come true.

It may be remarked that another collection in K possibly also collected by Forster has bisexual third florets.

Because of tradition we have here assumed that Forster's collections, at least the one studied by Vahl, did come from South America, and as we have assumed that only a single species is involved, its origin is of little importance to us. Those, however, who persist to distinguish the Old World specimens as a distinct species (but how?) should call it *A. antarcticum*, a combination of course not proposed here.

As far as the latter epithet is concerned the Code errs in its citation (see the preceding chapter on nomenclature).

Parodi (1941) and De Paula (1975) distinguished three varieties apparently based on the size of the plant and the lengths of the spikelets and their glumes. At least the var. *micrantha* seems to fall entirely within the variability shown by New Guinea material, while Vahl's type of *H. redolens* var. *redolens* would seem to belong to it, too! Not having seen any authentic material we have not included any of their varieties in the synonymy here (except pro comb., of course).

b. var. longifolium (Reeder) Y. Schouten, *comb. nov.*

Hierochloë longifolia Reeder, J. Arn. Arbor. 31 (1950) 325; Henty, Bot. Bull., Lae 1 (1969) 109. – *A. longifolium* Royen, Alp. Fl. New Guinea 2 (1980) 1191, excl. fig. – Type: *Brass 9461*, p.p. (YU, holo, n.v.; A, L), New Guinea, Irian Jaya, Lake Habbema, 3225 m, Aug. 1938.
Hierochloë horsfieldii auct., non Mez: Chase, J. Arn. Arbor. 24 (1943) 84, pro *Brass 9049*, p.p.
A. angustum auct. non Ohwi: Johns & Stevens, Bot. Bull., Lae 6 (1971) 10, pro *ANU 7448.*
Hierochloë redolens auct. non R. & S.: Johns & Stevens, Bot. Bull., Lae 6 (1971) 11, pro *ANU 7434*, p.p., *Brass 29812, Robbins 713.*

Description diagnostic against the typical variety.

Culms up to 135 cm high, glabrous to densely puberulous. Sheaths usually loose, the basal sometimes densely puberulous, margins scabrous to ciliate. Ligule 1.2–9 mm long. *Blades* ± stiffly erect, usually involute, 4.5–70 cm by 4–13 mm, smooth to scabrous below. Panicle loosely lobed, ± contracted, erect to slightly nodding, 13–23 by 1.5–5 cm diam., branches sparsely to moderately pilose, especially the pedicels, basal branches 2–5 together, the longest 3–10 cm long, 13–more than 60-spikeled, naked in the lower 0.1–0.5th. *Spikelets* 5.1–8.7 by 1.8–4.1 mm diam. Lower *glume* 4.2–6.9 by 2.6–3.2 mm, (0.65–)0.75–0.9 times as long as the upper

one; upper glume 5.9–8.7 by 3.4–4.2 mm, usually acuminate. Lower two florets usually paleate and male, often anthers staminodial or absent in the second or both florets, paleas then much reduced and lodicules absent, upper floret bisexual, always with lodicules. Lower rachilla joint curved, 0.25–0.4 mm long, upper one 0.4–0.8 mm long. Lower two *lemmas* usually pubescent in the lower 0.67th, upper part scabrous to scabrous all over, apical lobes up to 0.2 times as long as the lemma; first lemma 4.8–7.2 by 2–2.8 mm, from 0.6 mm shorter to 0.3(–0.9) mm longer than the lower glume, awn inserted at 0.6–0.75th, 2.9–3.8 mm long, exserted; second lemma 4.3–6.6 by 1.6–2.6 mm, awn straight to geniculate, inserted at (0.45–) 0.5–0.65th, 5.2–8.5 mm long, column when distinct 1.5–3.6 mm long, subule then 3.2–6.5 mm long; third lemma 3.1–4.5 by 0.8–1.1 mm diam., 0.5–0.65 times as long as the lower glume, 0.45–0.55 times as long as the upper glume, 0.5–0.7 times as long as the first lemma, 0.55–0.75 times as long as the second lemma, antrorsely scabrous to puberulous in the upper 0.25–0.33(–0.5)th, mucro when present up to 2.8 mm long. First *palea* 1.5–4.9 by 0.4–0.9 mm; second palea 1.2–4.9 by 0.3–0.9 mm; third palea 2.5–4.1 by 0.4–0.5 mm. Lodicules of the lower two florets present when paleas are well-developed, up to 0.9 mm long, always present in the upper floret, 0.3–0.6 mm long. Anthers of the lower two florets staminodial to fertile, up to 2.1 mm long, of the upper floret 2 (once 3), fertile, 0.6–1.8 mm long. Caryopsis not seen.

Distribution. New Guinea: Irian Jaya (Lake Habbema), Papua New Guinea: Engga (Sugarloaf), Chimbu (Mt Wilhelm), Morobe (Sarawaket-complex).

Ecology. Subalpine well-drained tussock-grassland, sometimes in *Cyathea*-vegetation, 2820–3810 m.

Vernacular name. Pa'u (Engga, Poio: 'grass').

Notes. Apparently growing in the same vegetation as the typical variety, as several collections, including that of the type, are a mixture of both. In view of the distinction in South America by De Paula between *H. moorei* and *H. redolens* based on somewhat similar characters, which Moore & Doggett have shown to be fictitious, it cannot be ruled out that in New Guinea, too, only a single species is involved. We have, however, not found the intermediate forms and thus it would seem that two taxa are involved. As was said in the introduction it does not seem difficult to make mixed collections if the two would occur more or less in the same surroundings.

In this variety the upper floret is usually bisexual: of the 14 collections checked, only one (*Brass 9049*, US) had both bisexual and 'female' florets, and only one (*Brass 9049-B*, BO) was strictly 'female'.

ANU 7448 (Wade) (L) had an occasional fourth floret.

NON-MALESIAN TAXA: SOME NEW COMBINATIONS AND NOTES

For about half the species presently recognised in recent revisions combinations in *Anthoxanthum* have been made at some time or another. For the remainder the necessary ones are proposed here except for those from New Zealand as we feel that another revision of the material is needed. For an easy survey the taxa are alphabetically listed by their names in *Hierochloë*.

Hierochloë alpina (Sw. ex Willd.) R. & S., Syst. Veg. 2 (1817) 515; Hitchc., Manual Gr. U.S. ed. 2 (1951) 883 for further synonymy. – Non *Anthoxanthum alpinum* Löve & Löve (1948). – Type: *Swartz in Herb. Willdenow 18699* (B, holo, n.v.; microfiche in IDC 7440), Lapland.

Holcus monticola Bigelow, New Engl. J. Med. & Surg. 5 (1816) 334. – *Dimesia monticola* Raf., Am. Month. Mag. 1 (1817) 442. – *Hierochloë monticola* Löve & Löve, Taxon 13 (1964) 201, non Mez (1921). – Type: *Bigelow s.n.* (GH, holo?, n.v.), U.S.A., New Hampshire, White Hills, Mt Washington.

= **Anthoxanthum monticolum** (Bigelow) Veldk., *comb. nov.*

This species is exceedingly variable in its chromosome numbers: 2n = 56 (usually), 58, 63, 64, 66, 68, 71, 72, 74–78. Löve & Löve implied that Bigelow's type would have 63, a form often called *H. orthantha* Sørensen [Meddel. Grønl. 136, 8 (1954) 3, f. 1, 2].

Hierochloë altissima Steudel, Syn. 1 (1853) 13. – Type: *Lechler 246* (P, holo, L; K, n.v.), Chile, near Arique and Valdivia, Nov.–Dec.

= **Anthoxanthum altissimum** (Steudel) Veldk., *comb. nov.*

Hierochloë australis (Schrader) R. & S., Syst. Veg. 2 (1817) 514. – *Holcus australis* Schrader, Fl. Germ. 1 (1806) 253. – Lectotype: *Hoppe s.n.* (M, holo, n.v.), Germany, Regensburg, Schwabelweisbergen, 11 April.

= **Anthoxanthum australe** (Schrader) Veldk., *comb. nov.*

Hierochloë davidsei Pohl, Iowa State J. Res. 47 (1972) 71. – Type: *Pohl & Davidse 11004* (ISC, holo, CR, F, US, n.v.), Costa Rica, Prov. San José, Carretera Interamericana km. 86, 3030 m, 23 Aug. 1968.

= **Anthoxanthum davidsei** (Pohl) Veldk., *comb. nov.*

Hierochloë elongata Hand.-Mazz., Symb. Sin. 7, 5 (1936) 1299. – Type: *Handel-Mazzetti 4967* (W, holo, n.v.; L), China, Yunnan, east of Dsolin-ho River, on the ridge between Dsaodjidjing and Hwadung, 2600 m, 8 Sep. 1914.

= **Anthoxanthum elongatum** (Hand.-Mazz.) Veldk., *comb. nov.*

Hierochloë flexuosa Hook. f., Fl. Br. India 7 (1896) 222. – Type: *King's collector s.n.* (K, holo, n.v.), Sikkim, Bijean.

= **Anthoxanthum flexuosum** (Hook. f.) Veldk., *comb. nov.*

Hierochloë glabra Trin. in Spreng., Neue Entd. 2 (1821) 66. – Type: *Herb. Trin.* (LE, holo, n.v.), Siberia, Dahurica.

= **Anthoxanthum glabrum** (Trin.) Veldk., *comb. nov.*

Hierochloë gunckelii Parodi, Rev. Mus. La Plata n.s. 3, 14 (1941) 197, f. 5, 6. – Type: *Gunckel in Herb. Parodi 13643* (BAA, holo, n.v.), cultivated from *Gunckel s.n.* from Chile, Dept. Valdivia, Corral (Amargos).

= **Anthoxanthum gunckelii** (Parodi) Veldk., *comb. nov.*

Hierochloë hirta (Schrank) Borbás, Balaton Fl. (1900) 315. – *Savastana hirta* Schrank, Beir. Fl. 1 (1789) 337. – Type: *Held s.n.* (ubi?), Germany, Bavaria, island in Isar River near Harlaching. – Neotype: *Wollmann s.n.* (M, holo, n.v.), Germany, Bavaria, Isarauen near Föhring, north of München, early May 1906 [Weimarck, Bot. Notis. 124 (1971) 146, f. 12–17].

= **Anthoxanthum hirtum** (Schrank) Y. Schouten & Veldk., *comb. nov.*

Hierochloë juncifolia (Hackel) Parodi, Not. Mus. La Plata n.s. 3, 17 (1938) 27. – *Hierochloë utriculata* (R. & P.) Kunth var. *juncifolia* Hackel in Stuckert, An. Mus. Nac. Buenos Aires 21 (1911) 64. – Type: *Illin 222 = Stuckert 17997* (W, holo, BAA, BAF, LPS, SI, n.v.), Argentina, Chubut, Languiñeo, Río Corcovado, valle de Ávilas, 20 March 1901.

= **Anthoxanthum juncifolium** (Hackel) Veldk., *comb. nov.*

Hierochloë laxa R. Br. ex Hook. f., Fl. Br. India 7 (1896) 222. – Lectotype: *Thomson s.n.* (K, holo, n.v.; L), NW. Himalaya, temperate region, 3050–3960 m.

= **Anthoxanthum laxum** (Hook. f.) Veldk., *comb. nov.*

Hierochloë occidentalis Buckl., Ac. Nat. Sc. Philadelphia Proc. (1862) 100. – Type: *Nuttall s.n.* (PH, holo?, n.v.), U.S.A., Oregon, Columbia woods.

= **Anthoxanthum occidentale** (Buckl.) Veldk., *comb. nov.*

Hierochloë odorata (Linné) Beauv., Agrost. (1812) 64, 164, 165, pl. 12, f. 5. – *Holcus odoratus* Linné, Sp. Pl. 1 (1753) 1048. – Non *Anthoxanthum odoratum* Linné (1753). – Lectotype: *Herb. Linné 1212-14*, second specimen from the left (LINN, n.v.; microfiche!), Europe [Weimarck, Bot. Notis. 124 (1971) 136].

Poa nitens Weber, Prim. Fl. Hols., Suppl. (1787) 2, no. 6. – Type: not indicated (ubi?), Germany, Schleswig-Holstein, Düsternbrook.

= **Anthoxanthum nitens** (Weber) Y. Schouten & Veldk., *comb. nov.*

As author of *Hierochloë odorata* Wahlenberg [Fl. Upsal. (1829) 32] is usually cited (viz. the Code!), but Beauvois made it earlier. Whether the latter's material is this species or not is nomenclaturally irrelevant.

Although Weber's material could not be traced the application of the epithet seems certain as there is only one species of '*Hierochloë*' in Schleswig-Holstein.

Hierochloë pauciflora R. Br., Chlor. Melv. (1823) 35. – Non *Anthoxanthum pauciflorum* Adamović (1904). – Type: *Parry s.n.* (BM, holo, n.v.), Canada, Melville I., anno 1820 [cf. Hook., Fl. Bor.-Am. 2 (1839) 234].

= **Anthoxanthum arcticum** Veldk., *nom. nov.*

Hierochloë pluriflora Koidz., Bot. Mag. Tokyo 31 (1917) 136. – Type: *Koidzumi s.n.* (KYO, holo, n.v.), Japan, Hokkaido, Prov. Ishikari, Mt Yubaridake, anno 1916.

= **Anthoxanthum pluriflorum** (Koidz.) Veldk., *comb. nov.*

Hierochloë pusilla Hackel ex Dusén, Ark. Bot. 7, 2 (1907) 4, t. 1, 7. – Type: *Dusén 5999* (S, holo, BAA, n.v.), Argentina, Santa Cruz, Río Chico, Río Fosiles, 900 m alt.

= **Anthoxanthum pusillum** (Dusén) Veldk., *comb. nov.*

Hierochloë rariflora Hook. f., Fl. Antarct. 1 (1844) 93. – Type: *Hooker f. s.n.* (K, holo, n.v.), Australia, said to be from West Australia, King George's Sound, but Bentham [Fl. Austr. 7 (1878) 559] suggested 'coast of Victoria'. The species is not mentioned by Gardner [Fl. W. Austr. 1 (1952)].

= **Anthoxanthum rariflorum** (Hook. f.) Veldk., *comb. nov.*

Hierochloë repens (Host) Beauv., Agrost. (1812) 62, 164, 165. – *Holcus repens* Host, Icon. Gram. Austr. 3 (1805) 3. – Lectotype: *Host 2386* (W, holo, n.v.), Austria, Pannonia [cf. Weimarck, Bot. Notis. 124 (1971) 154].

= **Anthoxanthum repens** (Host) Veldk., *comb. nov.*

Hierochloë spicata Parodi, Rev. Mus. La Plata n.s. 3, 14 (1941) 196, f. 4. – Type *Philippi s.n. in Herb. Parodi 13646* (BAA, holo, n.v.), Chile, Magellanes.

= **Anthoxanthum spicatum** (Parodi) Veldk., *comb. nov.*

Hierochloë stepporum Smirn., Bull. Soc. Moscou II, 63, 5 (1958) 81. – Type: *Smirnov s.n.* (MW, holo, n.v.), SE. Russia, Prov. Volgograd, Dist. Ssirotinskii, source of the *'Coerulae flum(inis)'*, 16 May 1938.

= **Anthoxanthum stepporum** (Smirn.) Veldk., *comb. nov.*

Hierochloë submutica F.v.M., Trans. & Proc. Vict. Inst. (1855) 48. – Type: *Herb. F.v. Mueller s.n.* (MEL, holo, K, n.v.), Australia, Victoria, Cobberas Mts.

= **Anthoxanthum submuticum** (F.v.M.) Veldk., *comb. nov.*

Hierochloë tibetica Bor, Kew Bull. 8 (1953) 271. – Type: *Ludlow, Sheriff & Taylor 5188* (BM, holo, n.v.), Tibet, Kongbo Prov., Pero La, 5000 m, 19 July 1935.

= **Anthoxanthum tibeticum** (Bor) Veldk., *comb. nov.*

Hierochloë utriculata (R. & P.) Kunth, Rév. Gram. 1 (1829) 139, t. 8. – *Torresia utriculata* R. & P., Syst. Veg. (1798) 251. – Type: *Ruiz & Pavon s.n.* (Dombey?) (MA, holo, BAA, fragm., perhaps Dombey in Herb. Jussieu 2297, P, fragm. in BAA), Chile, Prov. Concepción.

= **Anthoxanthum utriculatum** (R. & P.) Y. Schouten & Veldk., *comb. nov.*

Hierochloë wendelboi Weimarck, Publ. Cairo Univ. Herb. 7 & 8 (1977) 299. – Type: *Wendelbo & Ekberg W 9669* (GB, holo, n.v.), Afghanistan, Laghman, Alishang, 2900–3200 m, 15 July 1969.

= **Anthoxanthum wendelboi** (Weimarck) Veldk., *comb. nov.*

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