

REVISION OF HEMARTHRIA (GRAMINEAE–ANDROPOGONEAE–ROTTBOELLIINAE)

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SUMMARY

A taxonomic revision is given of *Hemarthria* R.Br. (Gramineae–Andropogoneae–Rottboelliinae) occurring in the warm to tropical areas of the Old World (mainly in SE Asia), with one introduced in the New. Fourteen taxa are recognised, including a variety and a new species from Vietnam proposed here. A neotype for the lectotype species had to be designated.

Key words: *Hemarthria*, Gramineae, Rottboelliinae.

INTRODUCTION

Hemarthria R.Br. is a small Old World, mainly SE Asian genus of 14 taxa of scant economic interest which may account for the fact that no recent revision exists. The present study started out as a survey of the Thai and Malesian taxa but was later extended to cover the whole genus. This accounts for the emphasis on Thai and Malesian material and distributions.

Many species of *Hemarthria* were described first in *Rottboellia* L.f., long a dustbin for species with inflorescences composed of one or more terete spikes of a 'rat-tail'-like appearance with sessile, appressed spikelets, more or less easily disarticulating in joints with a spikelet attached, but sometimes remaining intact. The spikelets lack a true awn, but the glumes may be drawn out into a (bi-)caudate apex. Gradually it was realised that this assemblage was extremely heterogeneous and unnatural and it became dismembered. However, some authors persisted to include the core of *Hemarthria* in *Rottboellia*, e.g. Hackel (1889) in his monumental treatment of the Andropogoneae and Hooker f. (1896). For want of any better sources these authors were followed by many for a long time; Schmid (1958) and Roberty (1960) apparently were the last agrostologists still to maintain *Rottboellia* in a wide concept that included *Hemarthria*.

Some authors (e.g. Steudel, 1841; Jackson, 1894) cite as an older generic name *Sanguinella* Gleichen with two species, *S. thunbergii* and *S. tripsacoides* which would belong to *Hemarthria*. This is a mystery: the plate and description clearly represent *Digitaria sanguinalis* (L.) Scop. and there are no other species mentioned (Veldkamp, 1973).

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CHRONOLOGICAL HISTORY OF THE SPECIES

Linné f. (1782) described the first species, *Rottboellia compressa*, “Rottbölla spica compressa subulata, gluma calycina lanceolata plana indivisa. Habitat in Indiis”, which was more or less verbatim copied by later authors. Hackel later remarked (1889: 286) “An revera planta Linnaei non satis liquet”, i.e. “Whether (this is) actually the plant of Linnaeus is insufficiently evident”. Traditionally the name has been applied to a *Hemarthria* species, but as there seems to be no type specimen its actual application cannot be ascertained. The name being the lectotype of the genus obviously has to be maintained, and a neotype is proposed below.

Rottboellia compressa was used by Retzius (1783) for a collection by Tranchell from China without reference to Linné f. This has always been thought to represent the same species, although Gmelin (1791) regarded them as possibly distinct and coined the combination *R. tranchellii* for Retzius' later homonym [see notes under *H. sibirica* (Gand.) Ohwi, and nomina dubia vel excludenda].

Poiret (1789) described *R. altissima* from N Africa, which for some reason Lamarck (1792) and Desfontaines (1798) renamed to *R. fasciculata*. Probably because of the prestige of these works this epithet has remained in use in numerous later publications. Stapf & Hubbard (1934) were the first to use the correct combination *H. altissima*, while in the same year Hitchcock (1934) adopted it in *Manisuris*.

Brown (1810) was the first to recognise that *R. compressa* represented a genus distinct from *Rottboellia* and proposed the name *Hemarthria*. The name is derived from the Greek hemi = partly, half, arthron = joint, i.e. the imperfectly articulating inflorescence axis (Backer, 1936). Brown made the combination *H. compressa* (L.f.) R.Br., but his material belongs to *H. uncinata* R.Br., a second species from Australia simultaneously described by him. *Hemarthria compressa* has been indirectly selected as the lectotype by Trinius (1820, see below). Later, more explicit lectotypifications with the same name were made by Nash (1909), Hitchcock (1920), and Keng (1939).

Beauvois (1812), although he had seen the Poiret and Desfontaines collections, to the surprise of Poiret (1816, 1824) separated the two over two genera reducing the Poiret one to *Ophiuros cylindricus* (Willd.) P. Beauv. [now the totally different *Monerma cylindrica* (Willd.) Coss. & Durieu], and that of Desfontaines to a new genus, *Lodicularia* P. Beauv., because of the extra-ordinarily large lodicules. The epithet was erroneously written as ‘fastigiata’, obviously a misprint (of so many) for ‘fasciculata’ and attributed to Desfontaines, and not to Lamarck (see also Chase, 1925). Hackel (1889: 287) said Beauvois' plate represents a species unknown to him, but that the specimen he saw in the Kunth herbarium (B, olim) was indeed *R. fasciculata*. More likely it is just a bad drawing. Brown's *Hemarthria* he doubtfully retained in *Rottboellia*.

Some later combinations in *Lodicularia* have been attributed to Jackson (1894), but they are invalid as he regarded them as synonyms under *Hemarthria*.

Roxburgh (1814, 1820) described *R. glabra* from India, which because of the confusion in identification then already existing, actually represented the old Linnean *H. compressa* while his version of *R. compressa*, renamed by Steudel (1854) to *H. coromandelina* Steud., actually is *Ophiuros exaltatus* (L.) Kuntze (see Hubbard's comments cited by Blatter & McCann, 1929).

Trinius (1820), because of the structure of inflorescence and spikelets, placed *Lodicularia fasciculata* (Lam.) P. Beauv. in *Lepturus* R.Br., and recognised *Hemarthria*

for *H. compressa*, only, thereby lectotypifying the genus by exclusion (Art. 52.2.e; he apparently did not mention *H. uncinata* anywhere).

Kunth (1829) added *H. perforata* (Roxb.) Kunth (as anomalous) and *H. rugosa* (Nutt.) Kunth (with a query), which caution has proved to be correct, as at present these are regarded as species of *Mnesithea* Kunth (Veldkamp et al., 1986).

Trinius (1832) recognised only four species, adding a new one from the Cape, *H. capensis*, which is now regarded as identical with *H. altissima*.

Meyen (1834) mentioned the name of a new species from Peru, *Lodicularia peruviana* Meyen, which was the same as *L. fasciculata* (Nees, 1843), i.e. *H. altissima*, apparently introduced in S America in early times.

In 1854 Buse (February) and Steudel (July) described *H. vaginata* Buse from Java and *H. protensa* Steud. from NE India (Khasia), respectively, which were later discovered to be identical.

Steudel increased the genus to 12 species by adding 6 new ones, of which only one is accepted here, *H. hamiltoniana* from the Upper Gangetic Plains of India [but not mentioned by Raizada et al. (1961)]. The other five are now synonyms: *H. caudiculata* Steud. (= *H. altissima*), *H. coromandelina* (= *Ophiuros exaltatus*), *H. foliata* Steud. (= *H. uncinata*), *H. guyanensis* Steud. (= *H. altissima*), and *H. laxa* Steud. (= *H. compressa*).

Hackel (1889), as said, maintained *Hemarthria* in *Rottboellia* as a subgenus and distinguished only *R. protensa* and *R. compressa* with 6 varieties.

Balansa (1890) added *R. pratensis* Balansa from Vietnam. This one appeared so odd to Camus (1921) that she created a separate subgenus *Neobalansaea* under *Coelorrachis* Brongn. for it. The differentiating characters she mentioned (oblique articulation of the rachis, adnate pedicels, fertile pedicelled spikelets) are quite usual for *Hemarthria*. This species has a remarkable, very disjunct distribution, for we agree with Clayton (1970) that *H. subulata* Reeder from the Western Province of Papua New Guinea is identical with this.

Hooker f. (1896) reduced *Hemarthria* to a section of *Rottboellia* and described a new species from Burma, *R. longiflora*. Like Hackel he regarded *H. hamiltoniana* as a variety, but now of *R. protensa*.

Domin (1915) distinguished a curious form of *R. compressa* with expanded leaf sheaths as var. *spathacea*. It actually is a form of *H. uncinata* and has a more northern distribution in Australia than the typical form.

Stapf (1917) described a floating species from Nyassaland (now Malawi) and Madagascar, *H. natans*, now known to occur from Angola, Zaire, Malawi to Ethiopia, and Madagascar (fide Stapf). However, Madagascar was not cited by Clayton & Renvoize (1982) and likewise we have seen no specimens. Bosser (1969) mentioned *H. altissima* as the only species there and regarded references to *H. natans* as misidentifications (Morat, in litt.).

Camus (1919) among collections by Balansa and Mouret from Tonkin (now N Vietnam) discovered *R. tonkinensis* which she soon after (1922) regarded as a variety ('or perhaps a subspecies') of *H. longiflora* (Hook. f.) A. Camus. It is here reduced to a synonym of that.

Gandoger (1920) described *R. heterochroa* and *R. sibirica*. The first is identical with *H. altissima*, the latter is now *H. sibirica*.

Keng (1933) distinguished *H. humilis* from China (Guangdong). It has been reduced to *H. protensa* by B. S. Sun et al. (1997) who stated that the type has 3 stamens, not 2, as said by Keng and observed by us, and that both taxa agree in all other characters as well. Based on the description and an isotype there seem to be sufficient differences (see keys and note under the species) to maintain it as distinct for the present.

Reeder (1948) recognised *H. subulata* from Papua New Guinea, which has turned out to be *H. pratensis*, see above.

Schmid (1958) noted a *Hemarthria* from Dalat, Vietnam, which he could put no name to and which is here described as *H. depressa*. It was not mentioned by Hô (1993).

Roberty (1960) [like Hooker f. (1896) before him] regarded *Hemarthria* as a section of *Rottboellia* and recognised only a single species, *R. compressa*, with no less than 11 subvarieties. It may be noted that all his new intraspecific combinations are invalid being in contradiction with Art. 4 and 5 of the Code (Greuter, 2000) as he stated (p. 25) (! by us): “we have adopted an intraspecific hierarchy in which the usual terms have been maintained ... but with a new meaning (!). According to the number of characters necessary to analyse the variation, each species can be divided: in subspecies when there is a single character; in varieties when there are two; in subvarieties when there are four. Subspecies, varieties, subvarieties therefore become temporary groups of incompletely defined forms, not successively subordinated (!), but allied by the degree of division presently visible in the species concerned”.

Bor (1965) described two new species from SE Thailand (Chanthaburi): *H. debilis* and *H. stolonifera*.

DISTRIBUTION

As can be seen from the distributions about 50% of the taxa occur in Thailand and about 40% in China, so it seems as if at least a secondary radiation of speciation has taken place in SE Asia.

By lack of satisfactory outgroups nothing can be said about the possible origin of the genus and its subsequent historical biogeography. Similar to many grass genera its wide distribution over Australia, India (incl. Sri Lanka), Madagascar, and Africa (and America for other genera) would suggest a Gondwana origin, were it not that Jacobs et al. (1999) have shown that C_4 grasses to which most of today's panicoids (incl. *Hemarthria*) belong did not occur until the late Middle Miocene (12.5 Mya) to become dominant as late as the Late Miocene (between 5–8 Mya, depending on the continent), much too late to assume a Gondwana derived distribution.

MORPHOLOGY

As in most grasses the internodes are hollow, in several genera or species of the Andropogoneae, however, they are solid, e.g. in *Mnesithea*, *Rottboellia*, and *Saccharum* L. The taxonomic value of this character needs further exploration. Out of the 34 genera of the Rottboelliinae C. Presl found by DELTA in the files of Watson & Dallwitz (1996) 19 have solid culms, only in *Hemarthria* they are certainly hollow.

For *Robynsiochloa* Jacq.-Fél. (= *Rottboellia*) they were scored as hollow, but we could not check this. If indeed hollow, it would support generic distinction as in *Rottboellia cochinchinensis* (Lour.) Clayton and others they are solid. For the 14 remaining the status was not marked.

The inflorescence is a more or less complex system of branches and specialised bracts (spathes, the ultimate one under the terminal inflorescence a spatheole). A thorough analysis of *H. altissima* has been made by Vegetti (1993).

The spikelets are arranged in pairs, one sessile, and one pedicelled, as is usual in what are considered the more advanced Andropogoneae. In the Rottboelliinae the rhachis usually falls apart in fragments consisting of this pair and the superposed internode or 'joint'. The plane of abscission is generally transverse and perpendicular. In *Hemarthria* the rhachis is rather tenacious or disjoints at a late stage with an oblique abscission (transverse in *H. sibirica*). Such tardily (transversally) disarticulating rhachis are also found in *Phacelurus* Griseb. and *Vossia* Wall. & Griff. which are considered as closely related by Clayton & Renvoize (1986). Several genera of the Rottboelliinae have a 'plug' or 'elaiosome' at the base of the joint. Its absence in *Hemarthria* seems a plesiomorphy. In *Phacelurus* species with and without a plug occur.

Free pedicels are the plesiomorphy in the Andropogoneae. In *Hemarthria* the pedicel of the pedicelled spikelet is adnate to the joint. Its value as a synapomorphy is dubious; however, as it has been shown to be of little value in related genera such as *Mnesithea* and *Rottboellia*, where free and adnate pedicels may occur within a species, sometimes even within the same inflorescence (Veldkamp et al., 1986).

SEXUALITY OF THE SPIKELETS

According to the analyses by Veldkamp et al. (1986) the sexuality of the florets may be of importance at the generic level. This is rather surprising, as reduction in sexuality within the spikelet is rampant in otherwise more or less well-defined and generally accepted panicoid genera, but it seemed the best solution in an attempt to analyse the subtribe. In principle the florets are bisexual, and there is a gradual cline of reduction in the panicoids mainly involving the lower floret of the sessile spikelet and the florets of the pedicelled ones, which usually are a step ahead of the sessile ones. Bisexual florets are reduced to male ones, then to empty paleas accompanied by a simultaneous loss of the lodicules, followed by the disappearance of the palea, and finally of the lemma as well.

The upper floret of both spikelets in *Hemarthria* is bisexual as is shown by the examination of immature ones; in many instances they appear to be female because the stamens already have dropped out. This bisexuality of the upper floret especially in the pedicelled spikelet is a plesiomorphy. Backer (1928) erroneously said there would be only 1 anther or none in the pedicelled spikelets of *H. vaginata*. Reports (e.g. Hubbard & Vaughan, 1940) that the upper floret would be male are certainly mistaken: in immature flowers the stamens obscure the minute ovary and small stigmas.

In the other genera of the alliance the pedicelled spikelets are quite variable, and may range from being 2-flowered with a bisexual upper floret, as here, to reduced to a single small scale, or even totally absent, as in *Ophiuros exaltatus* (L.) Kuntze.

CHROMOSOME NUMBER

Ten is thought to be the basic number in the Rottboelliinae (Clayton & Renvoize, 1986: 361) and is found in several genera, e.g. *Phacelurus* which they considered as the basal group in the subtribe. This and more usually 9 have been reported for *Hemarthria*, but counts for only 5 species are known:

$n = 17$ for *Hemarthria longiflora*, Kalia (1978) fide B.S. Sun et al. (1997: 263), misprint for 27?

$2n =$ usually 18, 36, also 20, 54 for *Hemarthria compressa*

$2n = 18$ for *Hemarthria sibirica*

$2n = 20, 36$, once 16 for *Hemarthria altissima*

$2n = 54$ for *Hemarthria vaginata*

Christopher (1986) has studied a few species of this alliance and has suggested that the karyotype would be primitive showing close relationship with the 'Maydeae' Harv. (incl. *Coix* L.). See, however, below under 'intergeneric taxonomic relationships'.

INTRAGENERIC RELATIONSHIPS

Time, opportunity, and material available were insufficient to perform a cladistic analysis. Also, satisfactory outgroups are at present uncertain and can only be selected when an analysis at generic level has been performed, something far beyond our mandate. A simple analysis of the 93 morphological data used in the DELTA files by the diagnose command of INTKEY showed that *H. altissima* is apparently pivotal in the phenetic similarity: 10 out of the 13 other taxa appeared to be more similar to this than to others. *Hemarthria altissima* (and *H. stolonifera*) are most like *H. sibirica*. *Hemarthria debilis*, *H. depressa*, and *H. humilis* bear the greatest resemblance to *H. longiflora*. The latter again agrees most with *H. altissima* and only slightly less with *H. vaginata*. It has come to mind that *H. altissima*, and to a lesser degree *H. longiflora* and *H. sibirica* may have the most plesiomorphic features and that the other taxa have descended from them. These similarities on one hand, and the many differences on the other, possibly suggest that the speciation event has been some time ago after which there has been considerable genetic drift.

INTERGENERIC TAXONOMIC RELATIONSHIPS

Hemarthria belongs to the Panicoideae–Andropogoneae and has generally been regarded as closely related to *Rottboellia* L.f., if not part of it as a subgenus (Hackel, 1889) or a section (Hooker f., 1896; Roberty, 1960).

In a numerical study of the awnless Andropogoneae or Rottboelliinae, Clayton (1973) distinguished 5 informal groups, of which the following are pertinent here:

Coelorachidastrae: *Coelorachis* Brongn., *Mnesithea* Kunth s.s., *Rhytachne* Desv., etc.

Rottboelliastrae: *Hackelochloa* Kuntze, *Hemarthria*, *Heteropholis* C.E. Hubb., *Manisuris* L. s.l. (incl. *Glyphochloa* Clayton), *Rottboellia*, *Thaumastochloa* C.E. Hubb., etc.

Vossiastrae: *Phacelurus* Griseb., *Vossia* Wall. & Griff., etc.

Clayton found that *Hemarthria* was closest to *Hackelochloa*, and then to *Heteropholis*, two genera that are now considered to be part of a much expanded *Mnesithea* (Veldkamp et al., 1986). Later, Clayton & Renvoize (1986) thought *Hemarthria* was "more closely related to *Phacelurus* than to *Heteropholis*". In their schematic diagram of relationships (l.c.: 355) they, however, placed *Vossia* in between, thus suggesting a place in the Vossiastrae.

An analysis with DELTA of the macro-morphological data of the 'Grass genera of the world' (Watson & Dallwitz, 1996) gave as most similar in descending order the genera *Manisuris* s.s., *Thaumastochloa*, *Glyphochloa*, *Mnesithea* s.s., *Rhytachne* Desv., and *Phacelurus*. When all data were used the range of similarity was *Manisuris* s.s., *Glyphochloa*, *Rhytachne*, and *Mnesithea* s.s. These results can hardly be believed, as these genera all have very much derived inflorescences and spikelets. The apparent similarity to *Rhytachne* is curious, as in Clayton's analysis (1973) this genus was fairly remote. In both cases *Vossia* was quite distant.

Based on the same data Kellogg & Birchler (1993) made a cladistic, phylogenetic study and found as sequence (((*Hemarthria*, *Ophiuros*) *Thaumastochloa*) *Hackelochloa*)). These formed an unresolved clade with the *Tripsacinae* Dumort. ('*Maydeae*'), *Heteropholis*, and *Rottboellia*. Sister to this is a small clade with *Coelorachis* and *Mnesithea* s.s. The genera *Phacelurus*, *Rhytachne*, and *Vossia* branch off some way below this and there is no support for the Vossiastrae.

It must be noted that analyses based on the Watson & Dallwitz data are to be treated with great caution, for by necessity these are based on literature and in cases of unknown character states all possibilities are accepted (as with hollow or solid culms, mentioned above). To find *Hemarthria* next to *Ophiuros* is surprising, as the latter has a very derived inflorescence, e.g. totally lacking pedicelled spikelets, and joints with a basal plug. The genus seems more like a stage beyond *Mnesithea*.

An example of the unreliability of these data is the circumscription of the '*Maydeae*' which is based mainly on the presence of unisexual spikelets in different parts of the inflorescence or plant. This specialisation causes a polyphyletic assemblage: the unisexual inflorescences are not a synapomorphy but a convergence. Clayton & Renvoize (1986) suggested a more realistic view and distinguished 3 subtribes, the Asian Coicinae Reichenb. and Chionachninae Clayton, and the American Tripsacinae Dumort.

T.A. Jannink & Veldkamp (L, unpubl.) revised the Chionachninae and concluded that it appears to be derived from the Rottboelliinae. Especially the inflorescences of the Old World *Rottboellia cochinchinensis* (Lour.) Clayton and some species of *Chionachne* R.Br. have a surprising, surely not coincidental similarity. The origin of the Tripsacinae (incl. *Tripsacum* L. and *Zea* L.) must be sought from among *Mnesithea*-like ancestors of the New World. The derivation of *Coix* is still unresolved. Clayton & Renvoize (1986) very tentatively have suggested a relationship with *Apluda* L. of the Ischaeminae C. Presl, but the two seem rather remote, e.g. *Apluda* having awned spikelets and *Coix* never, and the latter also has a curious prophyll in the inflorescence.

HEMARTHRIA

Hemarthria R. Br., Prodr. (1810) 207. — *Rottboellia* L.f. subg. *Hemarthria* Hack. in A. DC., Monogr. Phan. 6 (1889) 284. — *Rottboellia* L.f. sect. *Hemarthria* Hack. ex Hook.f., Fl. Brit. India 7 (1896) 152; Roberty, Boissiera 9 (1960) 60, isonym. — Lectotype species: *Hemarthria compressa* (L.f.) R. Br., designated by Trinius (1832), Nash (1909), Hitchcock (1920), and Keng (1939).
Lodicularia P. Beauv., Ess. Agrostogr. (1812) 108, 166, 176, t. 21, f. 6 ('*fastigiata*'). — Type species: *Lodicularia fasciculata* (Lam., 'Desf.') P. Beauv., nom. superfl. [= *Hemarthria altissima* (Poir.) Stapf & C.E. Hubb.].
Coelorachis Brongn. subg. *Neobalansaea* A. Camus, Ann. Soc. Linn., Lyon 68 (1921) 198. — Type species: *Coelorachis pratensis* (Balansa) A. Camus [= *Hemarthria pratensis* (Balansa) Clayton].

Annuals or perennials. Culms hollow. Ligule collar-shaped, membranous. Racemes solitary in a spatheate inflorescence, rachis corky, tenacious to tardily obliquely disarticulating, articles ('joints') without a basal 'plug' ('elaiosome'). Spikelets paired, one sessile, one pedicelled, slightly heteromorphous, dorsoventrally compressed. Glumes more or less equal; lower glume indurated, 2-keeled, apex indistinctly winged, obtuse to caudate (rarely 2-aristate in *H. debilis*), relatively smooth; upper glume 3–7-nerved, mucronate, sometimes aristate. Lower floret sterile, epaleate, exceeding the upper, 0-nerved. Upper floret bisexual. Sessile spikelet more or less sunken into the rachis. Callus cuneate to truncate, glabrous. Upper floret: lemma mucicous, palea conspicuous, short. Pedicels discernible, fused with the rachis. Pedicelled spikelets without a callus, base truncate. x = 9, 10, rarely 8, 17.

Distribution — 14 (sub)tropical Old World taxa, especially in SE Asia, 1 introduced in the New World.

KEY TO THE TAXA

- 1a. Sessile spikelets about twice as long as the joints 2
- b. Sessile spikelets less than twice as long as the joints 3
- 2a. Culms tufted, erect or ascending, not rooting from the lower nodes, decumbent part brownish. Each raceme included in a sheath-like bract. Rachis subtetragonous. Sessile spikelets: lower glume linear to lanceolate, 7.8–14.5 mm long, caudate; upper glume somewhat thinner than the first glume, caudate. Pedicelled spikelets: lower glume linear to lanceolate, caudate **7. *H. longiflora***
- b. Culms decumbent, often floating, rooting from the lower nodes, decumbent part reddish. Racemes scarcely exerted from the axillary sheath. Rachis flattened. Sessile spikelets: lower glume elliptic-oblong, 3.6–6.8 mm long; upper glume membranous, except at the hardened tip. Pedicelled spikelets: lower glume elliptic-oblong **8. *H. natans***
- 3a. Rachis smooth. Sessile spikelets: glumes obtuse to long acuminate, sometimes uncinata. Pedicelled spikelets: lower glume linear to lanceolate, shortly bidentate, or acuminate to long acuminate 4
- b. Rachis scabrous. Sessile spikelets: lower glume caudate, bifid; upper glume caudate. Pedicelled spikelets: lower glume oblong to elliptic, caudate, bifid **3. *H. debilis***

- 4a. Nodes pilose or glabrous. Callus of the spikelets glabrous 5
 b. Nodes with glossy hairs. Callus of the spikelets with glossy hairs. — Sessile spikelets: upper glume acuminate. Pedicelled spikelets: upper glume long acuminate **5. H. hamiltoniana**
- 5a. Sessile spikelets: upper glume long acuminate. Pedicelled spikelets: upper glume distinctly caudate 6
 b. Sessile spikelets: upper glume acute to acuminate, or uncinata. Pedicelled spikelets: upper glume acuminate to long acuminate or uncinata 7
- 6a. Culms 0.2–0.8 m tall, ascending or decumbent, stout, nodes many, conspicuous, dark. Blades 3–8 mm wide, margins scabrous. Each raceme included in a sheath-like bract. Sessile spikelets: callus distinct, triangular. Lower glume coriaceous. Pedicelled spikelets: callus distinct. Lower glume linear to lanceolate, coriaceous, smooth; upper glume somewhat thinner than the first glume. Second lemma 2.8–3.9 mm long. Anthers 1.2–3 mm long **13. H. vaginata**
- b. Culms 0.14–0.18 m tall, erect or geniculate at lower nodes, slender, nodes few, inconspicuous. Blades 1–2 mm wide, margins smooth. Racemes included in sheath at the base. Sessile spikelets: callus obscure. Lower glume chartaceous. Pedicelled spikelets: callus obscure. Lower glume narrowly lanceolate, chartaceous, scabrous; upper glume similar to the first glume. Second lemma 1.7–1.8 mm long. Anthers 0.7–0.8 mm long **6. H. humilis**
- 7a. Leaf blades not deciduous. Joints not long cuneate 8
 b. Leaf blades deciduous. Joints long cuneate. — Racemes and spikelets dorsoventrally compressed. Sessile spikelets: callus triangular **9. H. pratensis**
- 8a. Racemes and spikelets dorsoventrally compressed. Sessile spikelets: callus obscure or obtriangular to long-triangular 9
 b. Racemes and spikelets subterete. Sessile spikelets: callus transverse **10. H. sibirica**
- 9a. Culms erect to decumbent. Blades apex acute. Sessile spikelets: callus obtriangular to long-triangular; lower glume oblong to linear, acute, acuminate, or distally indistinctly winged 10
 b. Culms creeping. Leaf blades strictly linear, apex retuse. Sessile spikelets: callus obscure; lower glume elliptic-oblong, obtuse. — Sessile spikelets: upper glume acute. Pedicelled spikelets: upper glume acuminate, never uncinata **11. H. stolonifera**
- 10a. Sessile spikelets: upper glume acute to acuminate. Pedicelled spikelets: upper glume shortly bidentate, acute to long acuminate, never uncinata 11
 b. Sessile spikelets: upper glume acuminate or sometimes uncinata. Pedicelled spikelets: upper glume acuminate to long acuminate and at least some of the spikelets uncinata 12
- 11a. Blades base subcordate. Sessile spikelets 5–9 mm long. Lower glume distally scabrous along the edges; upper glume 4–7 mm long, acuminate. First lemma 3.5–5.2 mm long. Pedicelled spikelets 5.1–8 mm long **1. H. altissima**
- b. Blades base gradually narrowed. Sessile spikelets 3.2–5 mm long. Lower glume distally smooth along the edges; upper glume 2.8–4.1 mm long, acute. First lemma 2.4–3.3 mm long. Pedicelled spikelets 2.4–4.9 mm long **2. H. compressa**

- 12a. Culms ascending. Ligule more or less triangular. Rhachis tardily disarticulating. Sessile spikelets: callus obtriangular to triangular. Lower glume coriaceous, smooth, dorsally subconvex. Caryopsis 2.2–2.6 mm long. Pedicelled spikelets: lower glume coriaceous, subconvex. Caryopsis c. 2.5 mm long 13
- b. Culms erect. Ligule collar-shaped. Rhachis tenacious. Sessile spikelets: callus triangular to long-triangular. Lower glume subcoriaceous, scabrous, dorsally somewhat depressed. Caryopsis c. 2 mm long. Pedicelled spikelets: lower glume subcoriaceous, somewhat depressed. Caryopsis c. 2 mm long . 4. **H. depressa**
- 13a. Culms 0.28–0.55 m tall, nodes inconspicuous. Sheaths longer than the internodes, compressed, keeled, loose, folded. Inflorescence terminal, racemes not included in the sheath at the base. Sessile spikelets: upper glume concave. Pedicelled spikelets: lower glume smooth 12a. **H. uncinata** var. **uncinata**
- b. Culms 0.75–0.87 m tall, nodes conspicuous, dark. Sheaths shorter than the internodes, not compressed, not keeled, expanded. Inflorescence axillary, racemes included in the sheath at the base. Sessile spikelets: upper glume boat-shaped. Pedicelled spikelets: lower glume scabrous 12b. **H. uncinata** var. **spathacea**

1. *Hemarthria altissima* (Poir.) Stapf & C.E. Hubb.

Hemarthria altissima (Poir.) Stapf & C.E. Hubb., Bull. Misc. Inform. (1934) 109. — *Rottboellia altissima* Poir., Voy. Barb. 2 (1789) 105 ('*Rottboella*'); in Lam., Encycl., Suppl. 4 (1816) 718; Hist. Philos. Pl. Eur. 2 (1824) 455. — *Rottboellia fasciculata* Lam., Tabl. Encycl. 1 (1792) 204 ('*Rottbolla*'), nom. superfl.; Desf., Fl. Atlant. 1 (1798) 110, t. 36 ('*Rottbolla*'), isonym. — *Lodicularia fasciculata* P. Beauv., Ess. Agrostogr. (1812) 108, 166, 176, t. 21, f. 6 ('*fastigiata*'), nom. superfl. — *Lepturus fasciculatus* Trin., Fund. Agrost. (1820) 123, nom. superfl. — [*Loglierella fasciculata*] Ten., Fl. Napol. 3 (1824–1829) 104, vernacular name!]. — *Andropogon altissimus* Raspail, Ann. Sci. Nat. (Paris) 5 (1825) 307. — *Andropogon fasciculatus* Raspail, Ann. Sci. Nat. (Paris) 5 (1825) 307, non L. (1753). — *Hemarthria fasciculata* Kunth, Révis. Gramin. 1 (1829) 153, nom. superfl. — *Rottboellia compressa* L.f. var. *fasciculata* Hack. in A.DC., Monogr. Phan. 6 (1889) 286. — *Manisuris fasciculata* Hitchc., Amer. J. Bot. 2 (1915) 299, nom. superfl. — *Manisuris altissima* Hitchc., J. Wash. Acad. Sci. 24 (1934) 292. — *Hemarthria compressa* (L.f.) R.Br. subsp. *altissima* Maire & Weiller, Fl. Afr. Nord 1 (1952) 261. — *Hemarthria compressa* (L.f.) R.Br. var. *fasciculata* Keng, Contr. Biol. Lab. Chin. Assoc. Advancem. Sci., Bot. 10 (1936) 202. — *Hemarthria fasciculata* (Lam.) Kunth subsp. *altissima* Maire ex Zángh., Fl. Ital. 1 (1976) 907, nom. superfl. — [*Rottboellia compressa* L.f. subvar. *fasciculata* Roberty, Boissiera 9 (1960) 60, comb. inval.] — Type: *Poiret s.n.* (holo P; fragm., fotogr. US).

Rottboellia spathacea Ten., Fl. Napol. 1 (1811–1815) xi, 322; 3 (1824–1829) 104 (in syn. sub '*Loglierella fasciculata*', see above). — Type: *Tenore s.n.* [holo NAP; K, L 908.90-618 (lower specimen), *Herb. Persoon* L 908.90-595].

Hemarthria capensis Trin., Mém. Acad. Imp. Sci. St. Pétersbourg, VI, Sci. Math. 2 (1832) 248. — *Lodicularia capensis* Trin. ex Nees, Fl. Afr. Austr. (1841) 128. — [*Rottboellia compressa* L.f. subvar. *capensis* Roberty, Boissiera 9 (1960) 60, comb. inval.]. — Lectotype: *Bergius in Herb. Trinius* 124.2 (holo LE, IDC microfiche BT-16/1), designated here.

[*Lodicularia peruviana* Meyen, Reise Erde 2 (1834) 71, nomen; Nees in Meyen, Nova Acta Phys.-Med. Acad. Caes. Leop.-Carol. Nat. Cur. 19, Suppl. 1 (1841, preprint) 61; 19, Suppl. 1 (1843) 140 (in syn.). — *Hemarthria peruviana* Steud., Nom. Bot., ed. 2, 1 (1840) 748 (nomen); 2 (1841) 64, in syn. (names not in Syn. Pl. Glumac., 1854). — Voucher: *Meyen s.n.* (B†; fragm. *Herb. Trinius* 123.1 LE, IDC microfiche BT-16/1). These names were not validly published, but are included here as they are occasionally cited].

Hemarthria caudiculata Steud., Syn. Pl. Glumac. 1 (1854) 359. — Type: *Herb. Deloche s.n.* (holo P).

Hemarthria guyanensis Steud., Syn. Pl. Glumac. 1 (1854) 359. — Type: *Leprieur s.n.* (holo L 908.90-647) [name not in Amshoff & Henrard in Pulle, Fl. Suriname 1 (1948); Judz., Fl. Guianas 187 (1990)].

Hemarthria fasciculata (Lam.) Kunth var. *gracilis* Balansa, Bull. Soc. Bot. France 21 (1874) 11; Boiss., Fl. Orient. 5 (1884) 467, isonym. — [*Rotboellia compressa* L.f. subvar. *gracilis* Roberty, Boissiera 9 (1960) 60, comb. inval.]. — Type: *Balansa Sept. 1866* (holo P; L 908.94-808).

Rotboellia heterochroa Gand., Bull. Soc. Bot. France 66 (1920, '1919') 302. — Type: *Schlechter 6906* (holo LY; K).

Hemarthria compressa auct. non R.Br.

Hemarthria natans auct. non Stapf.

Plants usually perennial. *Culms* loosely tufted or stoloniferous, 0.05–1.7 m tall, decumbent, slender to stout, compressed, internodes glabrous, usually rooting from the lower nodes. Nodes many, glabrous. *Leaf sheaths* usually shorter than the internodes, compressed, keeled, loose, lower leaf sheaths glabrous or pubescent on outside and sheath margins ciliate, of the upper leaves glabrous or the margins ciliate towards the mouth. Ligule more or less triangular, 0.4–1 mm long, truncate to acute, ciliate. *Blades* not deciduous, flat to folded, linear, 5–22 cm by 2–5.5 mm, margins scabrous, glabrous or with some bulbous-based bristles near mouth, apex acute. *Inflorescences* one to several per node, axillary and terminal. Racemes not or slightly included in the sheath at the base, dorsally compressed, 3–11 cm long. Rhachis smooth, tardily disarticulating. Joints flattened, 4–5(–6) mm long. Spikelets dorsoventrally compressed. *Sessile spikelets* longer than the joints, 5–8.5(–9) mm long. Callus obtriangular to triangular, glabrous, 0.8–2(–2.5) mm long. Lower glume linear to oblong, 4–7.4 mm long, coriaceous, 9–11(–many)-nerved, acute to acuminate or distally indistinctly winged, apex slightly scabrous, dorsally flattened to subconvex; upper glume concave to boat-shaped, 4–7 mm long, somewhat thinner than the lower glume, adnate to the rhachis, 3-nerved, acuminate. First lemma 3.5–5.2 mm long; second lemma 3.2–4.6 mm long. Stamens 3. Anthers 1–2.8 mm long. Caryopsis 1.6–3 mm long. Pedicels as long as or sometimes slightly shorter than the joints. *Pedicelled spikelets* 5.1–8 mm long. Callus obtriangular or short transverse, 0.1–0.2 mm long, glabrous. Lower glume linear to lanceolate, 5–7.6 mm long, subcoriaceous to coriaceous, 7–11(–many)-nerved, scabrous, dorsally flattened to subconvex, apex acuminate to long acuminate or sometimes shortly bidentate; upper glume concave, 5.2–7.6 mm long, somewhat thinner than the lower glume, 5–9-nerved, distally scabrous, apex acuminate to long-acuminate. First lemma 3–5 mm long; second lemma 2.5–4 mm long. Stamens 3. Anthers 1.2–2.4 mm long. Caryopsis 1.3–2.5 mm long. $2n = 20, 36$, once 16.

Distribution — Madagascar, Réunion, Mauritius, S and E Africa to Egypt, Saudi Arabia, Chad, Algeria, Tunisia, Canary Isl., S Spain, Balears, C Italy, Sicily, Crete, Rhodes, Turkey (W, NE), Lebanon ('Syria'), Georgia (Adzharskaya), Caucasus, then in S India (Tamil Nadu), S Burma, N Thailand (Chiangmai), S Vietnam (Can-Tho). *Malesia*: Borneo (Kalimantan). Introduced in America in the 19th century (or before?) and now widespread: Argentine, Bolivia, Brazil, El Salvador, Guyanas, Honduras, Jamaica, Mexico, Nicaragua, Peru, Puerto Rico, Uruguay, USA (Florida, ? Pennsylvania, Texas); also introduced, persistent, but not spreading in New Zealand [Edgar & Connor, Fl. New Zeal. 5 (2000) 613].

Habitat — Moist meadows and other places, e.g. riverbanks, marshes, scrub, also in sandy dunes, beaches (salt resistant), savannahs, roadsides, weedy in (rice) fields and plantations, locally common, sometimes vegetation forming, 0–2000 m altitude.

Field notes — Tufted annual or perennial, culms geniculate, spreading to sprawling, or forming mats, rooting at the nodes. Inflorescence inconspicuous. Glumes green tinged with red, brown, or base with a pale green band.

Vernacular names — Batavian quick grass, limpo grass, snake grass, swamp couch (Engl.).

Uses — Regarded by some as of little use as being too coarse for good fodder, by others as excellent (Burkart, 1969). Resistant to heavy grazing.

Notes — For an extensive discussion on the branching system of the inflorescence, see Vegetti (1993).

Judziewicz [Fl. Guyanas 187 (1990) 253] has equated this with *Rottboellia compressa* L.f. while erroneously maintaining the present name over it.

Similar to and easily confused with *H. sibirica*:

- Culms decumbent. Racemes dorsally compressed. Spikelets dorsoventrally compressed. Sessile spikelet articulating obliquely, callus obtriangular to triangular. — Africa to S Vietnam, with a 'southern' distribution, America . . . **H. altissima**
- Culms ascending to erect. Racemes terete. Spikelets terete. Sessile spikelet articulating transversally, callus transverse. — N Pakistan to Korea, with a 'northern' distribution **H. sibirica**

2. *Hemarthria compressa* (L.f.) R.Br.

Hemarthria compressa (L.f.) R.Br., Prodr. (1810) 207, pro comb. — *Rottboellia compressa* L.f., Suppl. (1782) 114. — [*Rottboellia compressa* L.f. var. *genuina* Hack. in A. DC., Monogr. Phan. 6 (1889) 286, nom. inval.]. — *Manisuris compressa* Kuntze, Rev. Gen. Pl. 2 (1891) 779. — Type: 'in Indiis' (not extant). Neotype: *Wallich 8871-E* (holo L; K, P, W?), designated here.

Rottboellia glabra Roxb., [Hort. Beng. (1814) 8, nomen], Fl. Ind. 1 (1820) 353. — *Hemarthria glabra* Blatt. & McCann, J. Bombay Nat. Hist. Soc. 32 (1927) 27; 33 (1929) 775 (reduced to *H. compressa*); nom. superfl. — Type: *Roxburgh s.n.* [holo BM; G (*Icon. Ined.* 1332), K (*Roxburgh in Herb. Wallich 8871-A*, microfiche IDC 7394)].

Hemarthria laxa Nees ex Steud., Syn. Pl. Glumac. 1 (1854) 358. — [*Rottboellia compressa* L.f. subvar. *laxa* Roberty, Boissiera 9 (1960) 60, comb. inval.] — Type: *Herb. Wallich 8871* [holo P; K (*Herb. Wallich*, microfiche IDC 7394) L, NY] (see note).

Rottboellia tripsacoides auct. non Lam.

Plants perennial. *Culms* stoloniferous or sometimes loosely tufted, 0.35–1.5(–6) m tall, decumbent, slender to stout, compressed, internodes glabrous, rooting from the lower nodes. Nodes glabrous, many, usually conspicuous, dark. *Leaf sheath* shorter than the internodes, compressed, keeled, loose; lower leaf sheaths glabrous or glabrous but margins ciliate or ciliate towards the mouth only or pubescent on outside; upper leaves glabrous or margins ciliate towards the mouth. Ligule more or less triangular, 0.3–1 mm long, truncate to acute, ciliate. Leaf blades flat to folded, linear, 2.5–21 cm by 2–5.5 mm, not deciduous, margins scabrous, glabrous or with some bulbous-based bristles near mouth or sparsely pubescent on the upper side, smooth. *Inflorescences* one to several per node, axillary or sometimes terminal. Racemes dorsally compressed, solitary or somewhat fascicled, not included to included in the sheath at the base, 3–8 cm long. Rhachis smooth, tardily disarticulating. Joints flattened, 2.5–4.5 mm long. Spikelets dorsoventrally compressed. *Sessile spikelets* (slightly) longer than the joints, 3.2–5 mm long. Callus obtriangular to triangular, glabrous, 0.5–1 mm long. Lower

glume linear to oblong, 2.6–4.9 mm long, coriaceous, (5–)7–11(–many)-nerved, acute to acuminate or indistinctly winged above, smooth, dorsally flattened to subconvex. Upper glume boat-shaped, 2.8–4.1 mm long, somewhat thinner than the first glume adnate to the rachis, 3-nerved, acute. First lemma 2.4–3.3 mm long. Second lemma 2.1–3.2 mm long. Stamens 3. Anthers 1.1–2.2 mm long. Caryopsis c. 2 mm long. Pedicels as long as or sometimes slightly shorter than the joints. *Pedicelled spikelets* 2.4–4.9 mm long. Callus short, transverse, glabrous, 0.1–0.2 mm long. Lower glume linear to lanceolate, 2–4.5 mm long, subcoriaceous, 5–7(–9)-nerved, acuminate, scabrous, dorsally flattened to subconvex. Upper glume concave, 2–4.9 mm long, somewhat thinner than the first glume, 3–7-nerved, acuminate, scabrous at the apex. First lemma 2–3.1 mm long. Second lemma 1.4–2.8 mm long. Stamens 3. Anthers 0.6–1.5 mm long. Caryopsis c. 2 mm long. $2n =$ usually 18, 36, also 20, 54.

Distribution — Iraq (Kirkuk), W Afghanistan (Jalalabad), Sri Lanka (Trincomalee), Pakistan, Nepal, Sikkim, Bhutan, India (said to be widespread, e.g. Andhra Pradesh, Assam, W Bengal, Bihar, Gujarat, Kashmir, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Nagaland, Orissa, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, but not common and the genus absent in many local floras), N Burma (Kachin State), Thailand (N: Chiangmai, Mae Hong Son; C: Bangkok), Vietnam (N: Hai Phong, Hanoi; S: Can-Tho), to China (Fujian, Guangdong, Guangxi, Hainan, Hong Kong, Sichuan, Yunnan), Taiwan, Japan (Kyushu), Ryukyu Isl. (Iriomote); *Malesia*: Peninsular Malaysia (Kedah), Borneo (Sabah: Kinabatangan; Kalimantan: Banjarmasin).

Habitat — Moist places along roads, water courses, rice fields, also along the sea coast, locally common, 0–1350 m altitude.

Field notes — Rhizomatous, caespitose perennial, culms decumbent to prostrate, sometimes climbing, according to Roxburgh up to 6 m long! Spikes several, fleshy. Spikelets purple.

Vernacular name — Whip grass (Engl.).

Uses — Esteemed as a moist pasture grass [Ambasta, Useful Pl. India (1986) 262].

Note — Most similar to *H. altissima*, for differences see the key.

3. *Hemarthria debilis* Bor

Hemarthria debilis Bor, Dansk Bot. Ark. 23 (1965) 162. — Type: *Larsen 10117* (holo K; C, L).

Terrestrial annual. *Culms* tufted, 0.2–0.6 cm tall, erect, slender, compressed, internodes glabrous, not rooting from the lower nodes. Nodes pilose, few, inconspicuous. *Leaf sheaths* longer than the internodes, compressed, keeled, loose, lower leaves pubescent on outside and sheath margins ciliate, upper leaves glabrous, but sheath margins (sometimes) ciliate towards the mouth. Ligule more or less triangular, c. 1 mm long, truncate, ciliate. *Blades* folded, linear, 1–3.5 cm by 1–3.5 mm, not deciduous, margins scabrous, glabrous. *Inflorescences* several per node, terminal. Racemes dorsally compressed, solitary, not included to included in the sheath at the base, 10–15 cm long. Rachis scabrous, tenacious. Joints flattened, 10–11 mm long. Spikelets dorsoventrally compressed. *Sessile spikelets* shorter than the joints, 9–10 mm long. Callus obscure, glabrous. Lower glume oblong to elliptic, 8.5–10 mm long, coriaceous, 5–9-nerved, caudate, bifid, scabrous, dorsally flattened. Upper glume concave, 7–8.5 mm long, somewhat thinner than the first glume, 3-nerved, caudate. First lemma 3.2–5.2 mm

long. Second lemma 2.9–4.8 mm long. Stamens 3. Anthers 2–2.3 mm long. Caryopsis c. 1.4 mm long. Pedicels shorter than the joints. *Pedicelled spikelets* 8.3–8.6 mm long. Callus obscure, glabrous. Lower glume elliptic to oblong, 8–8.2 mm long, chartaceous to subcoriaceous, 7-nerved, caudate, bifid, scabrous, dorsally flattened. Upper glume concave, 8–8.2 mm long, somewhat thinner than the first glume, 3–5-nerved, caudate, scabrous. First lemma 3–4.9 mm long. Second lemma 2.6–4 mm long. Stamens 3. Anthers c. 1.5 mm long. Caryopsis c. 1.8 mm long.

Distribution — N Burma (Kachin State), Thailand (SE: Chanthaburi).

Habitat — Marsh, submerged clayey sandy soil, c. 50 m altitude.

Note — Most resembling *H. longiflora*:

- Plants annual. Culms slender. Blades base gradually narrowed. Rhachis scabrous. Joints 10–11 mm long. Sessile spikelets slightly shorter than the joints, 9–10 mm long. Lower glume elliptic to oblong. Pedicelled spikelets: lower glume elliptic to oblong, 7-nerved. — N Burma, SE Thailand **H. debilis**
- Plants perennial. Culms stout. Blades base subcordate. Rhachis smooth. Joints 3–8.5 mm long. Sessile spikelets 8–17 mm long, about twice as long as the joints. Lower glume lanceolate to linear. Pedicelled spikelets: lower glume lanceolate to linear, 9–15-nerved **H. longiflora**

4. *Hemarthria depressa* Heuvel, *spec. nov.*

Differt a congeneribus in culmis erectis 0.4–0.7 m longis, nodis inconspicuis inferioribus eradicantibus, ligula collariformi, laminis c. 25 cm longis, racemis dorsaliter compressis basi in vagina non inclusis, rhachide tenacea, spiculis dorsoventraliter compressis, spiculis sessilibus articulis aequilongis ad longioribus, callo triangulari ad longe triangulari 1.5–4 mm longo, gluma inferiore subcoriacea dorsaliter plusminusve depressa, antheris 2.7–3.8 m longis, carinis scabris, spiculis pedicellatis lemmate superiore 5–6.2 mm longo. — Typus: *Schmid s. n.*, 9 June 1960 (holo P).

Hemarthria sp.: Schmid, Agron. Trop. (Nogent-sur-Mame) 13 (1958) 189.

Plants perennial. *Culms* 0.4–0.7 m tall, erect, slender to stout, compressed, internodes glabrous or sparsely pubescent, not rooting from the lower nodes. Nodes glabrous, many to few, inconspicuous. *Leaf sheaths* longer than the internodes, compressed, keeled, loose and sometimes involute, lower leaves pubescent on outside and sheath margins ciliate, upper leaves glabrous or (sparsely) pubescent on the outside or along the margins of the sheath. Ligule collar-shaped, 0.5–1.5 mm long, truncate, ciliate. *Blades* folded, narrow linear, 5–25 cm by 1–3 mm, not deciduous, scabrous, lower ones glabrous or pubescent on the upper side or puberulous on both sides, upper ones glabrous or (sparsely) pubescent on underside or sometimes sparsely pubescent on the upper side or puberulous on both sides, smooth. Inflorescence one per node, terminal. Racemes dorsally compressed, solitary, usually not included in the sheath at the base, 10–18 cm long. Rhachis smooth, tenacious. Joints flattened, 7–8 mm long. Spikelets dorsoventrally compressed. *Sessile spikelets* as long as or slightly longer than the joints, 8.9–12 mm long. Callus triangular to long-triangular, glabrous, 1.5–4 mm long. Lower glume linear to lanceolate, 6.9–9 mm long, subcoriaceous, (9–)11–13(–15)-nerved, acute to acuminate, keels scabrous, dorsally somewhat depressed; upper glume concave, 6.8–9.2 mm long, somewhat thinner than the lower glume,

3–5-nerved, acuminate. First lemma 5.2–7.5 mm long. Second lemma 4.4–6 mm long. Stamens 3. Anthers 2.7–3.8 mm long. Caryopsis c. 2 mm long. Pedicels shorter than the joints, adnate to the joints. *Pedicelled spikelets* 7.7–10.3 mm long. Callus short transverse, glabrous, 0.1–0.2 mm long. Lower glume linear to lanceolate, 7–10 mm long, subcoriaceous, 11–13-nerved, acuminate, keel scabrous, dorsally somewhat depressed. Upper glume concave and lanceolate, 7.6–10.3 mm long, somewhat thinner than the first glume, 7–11-nerved, acuminate or uncinata, keel scabrous. First lemma 5.8–7.6 mm long. Second lemma 5–6.2 mm long. Stamens 3. Anthers 2.7–3.8 mm long. Caryopsis c. 2 mm long.

Distribution — Laos (Xieng Khouang), Vietnam (S: Dalat).

Habitat — Moist peaty meadows and marshes, c. 1500 m altitude.

Note — Most similar to *H. longiflora*:

- Ligule collar-shaped. Blades base gradually narrowed. Racemes base not included in the sheath. Glumes somewhat depressed. Anthers 2.7–3.8 mm long. Sessile spikelets longer than the joints. Callus distinct. Lower glume subcoriaceous. Pedicelled spikelets: second lemma 5–6.2 mm long. — Laos, S Vietnam **H. depressa**
- Ligule more or less triangular. Blades base subcordate. Racemes base included in the sheath. Glumes dorsally flattened. Anthers 0.6–2 mm long. Sessile spikelets about twice as long as the joints. Callus inconspicuous. Lower glume coriaceous. Pedicelled spikelets: second lemma 1.8–3.5 mm long **H. longiflora**

5. *Hemarthria hamiltoniana* Nees ex Steud.

Hemarthria hamiltoniana Nees ex Steud., Syn. Pl. Glumac. 1 (1854) 358. — [*Rottboellia hamiltonii* Trin. ex Steud., Nom. Bot., ed. 2, 2 (1841) 474, nomen ('*hamiltoni*')]. — *Rottboellia compressa* L.f. var. *hamiltoniana* Hack. in A.D.C., Monogr. Phan. 6 (1889) 288. — *Rottboellia protensa* (Steud.) Hack. var. *hamiltoniana* Hook.f., Fl. Brit. India 7 (1896) 154. — Type: *Herb. Wallich 8870-C* ['*Rottboellia compressa*'] [iso K (*Herb. Wallich*, microfiche IDC 7394); fragm. L; not found in *Herb. Trinius*, microfiche IDC BT-16/1, nor in *Herb. Willdenow*, microfiche IDC 7440].

Culms more than 0.32 m tall (incomplete), slender to stout, compressed, internodes glabrous. Nodes with glossy hairs, many to few, inconspicuous. *Leaf sheaths* shorter than the internodes, compressed, keeled, loose, lower leaves not seen, upper leaves glabrous, but sheath margins ciliate towards the mouth. Ligule more or less triangular, 0.5–1 mm long, truncate to acute, ciliate. Upper blades flat, linear, 16–20 cm by 4–6 mm, not deciduous, margins scabrous, glabrous, but some bulbous-based bristles near mouth, smooth. *Inflorescences* one to several per node, axillary and terminal. Racemes dorsally compressed, solitary or somewhat fascicled, not included to included in the sheath at the base, 9–15 cm long. Rhachis subtetragonous, smooth, tardily disarticulating. Joints flattened, 4.5–5 mm long. Spikelets dorsoventrally compressed. *Sessile spikelets* slightly shorter than the joints 5.5–6 mm long. Callus obtriangular, with glossy hairs, 0.5–0.6 mm long. Lower glume linear to oblong, 4.9–5.4 mm long, coriaceous, 9-nerved, acute to acuminate or indistinctly winged above, smooth, dorsally flattened to subconvex. Upper glume concave, 4.1–4.3 mm long, somewhat thinner than the first glume, 3-nerved, acuminate. First lemma c. 4 mm long. Second lemma c. 3.3 mm long. Stamens 3. Anthers 2–2.3 mm long. Caryopsis not seen. Pedicels as

long as the joints. *Pedicelled spikelets* 6.8–9 mm long. Callus short, transverse with glossy hairs, 0.1–0.2 mm long. Lower glume linear to lanceolate, 5.8–6.1 mm long, coriaceous, 9-nerved, long acuminate, margins scabrous, dorsally flattened to sub-convex. Upper glume lanceolate, 7.8–8 mm long, somewhat thinner than the first glume, 5-nerved, caudate, scabrous. First lemma c. 3.8 mm long. Second lemma c. 3.2 mm long. Stamens 3. Anthers c. 2.2 mm long. Caryopsis not seen.

Distribution — N India (Uttar Pradesh: Nathpur).

Habitat — Not recorded.

Note — Only 2 incomplete specimens were available. Apparently most similar to *H. altissima*:

- Culm nodes and spikelet callus glabrous. Sessile spikelets 5–8.5(–9) mm long, slightly to distinctly longer than the joints, callus 0.8–2.5 mm long. Pedicelled spikelets: upper glume 5.2–7.6 mm long, acuminate to long acuminate
 **H. altissima**
- Culm nodes and spikelet callus with glossy hairs. Sessile spikelets 5.5–6 mm long, slightly shorter than the joints, callus 0.5–0.6 mm long. Pedicelled spikelets: upper glume 7.8–8 mm long, caudate. — Uttar Pradesh **H. hamiltoniana**

6. *Hemarthria humilis* Keng

Hemarthria humilis Keng, Sunyatsenia 1 (1933) 128. — Type: *Y. Tsiang 2401* (holo SYS; NY).

Plants perennial. *Culms* tufted, 0.14–0.18 m tall, erect or geniculate at the lower nodes, slender, compressed, not rooting from the lower nodes. Nodes glabrous, 2–5-noded, inconspicuous. Internodes glabrous. *Leaf sheaths* longer than the internodes, compressed, keeled, loose, glabrous. Ligule more or less triangular, c. 0.5 mm long, truncate, ciliate. *Blades* flat to folded, narrow, linear, 1–6 cm by 1–2 mm, not deciduous, glabrous. *Inflorescences* one or several per node, axillary (?). Racemes slender, dorsally compressed, solitary or somewhat fascicled, straight or slightly curved, included in the sheath at the base, 5–10 cm long. Rhachis smooth, tenacious. Joints flattened, 3–7 mm long. Spikelets dorsoventrally compressed. *Sessile spikelets* longer than the joints or the lower ones shorter than the joints, 3–7.5 mm long. Callus obscure, glabrous. Lower glume lanceolate, 3–7 mm long, chartaceous, 7–13–many (finely)-nerved, acuminate to long acuminate or (sometimes) shortly bidentate, smooth, dorsally flattened. Upper glume concave, 4–7.5 mm long, somewhat thinner than the first glume, adnate to rhachis, 3-nerved, long acuminate. First lemma 2–3 mm long. Second lemma 1.7–2.8 mm long. Stamens 2 or 3. Anthers 0.7–0.8 mm long. Caryopsis c. 2 mm long. Pedicels usually shorter than the joints, adnate to the joints. *Pedicelled spikelets* narrower than the sessile spikelet, 7–12 mm long. Callus obscure, glabrous. Lower glume narrowly lanceolate, 3.5–7 mm long, chartaceous, 11–many (finely)-nerved, long acuminate, keel minutely scabrous, dorsally flattened. Upper glume concave, 7–12 mm long, similar to the first glume, 5-nerved, caudate, much exceeding the first glume, keel minutely scabrous. First lemma 2–3 mm long. Second lemma 1.7–1.8 mm long. Stamens 2 or 3. Anthers 0.7–0.8 mm long. Caryopsis c. 2 mm long.

Distribution — China (Guangdong).

Habitat — Open marsh, altitude not recorded.

Notes — Only the isotype from NY was available in which there were two stamens to a floret, as originally described. B.S. Sun et al. (1997) reported that the holotype (SYS) has three and otherwise did not differ from *H. protensa* (= *H. vaginata*). This seems incorrect:

- Culms slender, 0.14–0.18 m tall, nodes inconspicuous. Blades 1–2 mm wide, base gradually narrowed, margin smooth. Lower glume chartaceous. Sessile spikelets: callus inconspicuous; upper glume apex long acuminate. Pedicelled spikelets: lower glume edges distally scabrous; second lemma 1.7–1.8 mm long. — Guangdong **H. humilis**
- Culms stout, 0.2–0.8 m tall, nodes conspicuous, dark. Blades 3–8 mm wide, base subcordate, margin scabrous. Lower glume coriaceous. Sessile spikelets: callus distinct; upper glume apex caudate. Pedicelled spikelets: lower glume edges distally smooth; second lemma 2.8–3.9 mm long. — Nepal to Guangdong **H. vaginata**

More similar seems *H. longiflora*:

- Culms slender. Ligule c. 0.5 mm long. Blades base gradually narrowed, margin smooth. Glumes chartaceous. Sessile spikelets 3–7.5 mm long, the lower ones shorter to longer than the joints; lower glume 3–7 mm long, distally smooth along the edges. — Guangdong **H. humilis**
- Culms stout. Ligule 0.8–2 mm long. Blades base subcordate, margin scabrous. Glumes (sub)coriaceous. Sessile spikelets 8–17 mm long, about twice as long as the joints; lower glume 7.8–14.5 mm long, distally scabrous along the edges. — NE India to Yunnan **H. longiflora**

7. *Hemarthria longiflora* (Hook. f.) A. Camus

Hemarthria longiflora (Hook. f.) A. Camus, Fl. Gén. Indo-Chine 7 (1922) 380. — *Rottboellia longiflora* Hook. f., Fl. Brit. India 7 (1896) 154. — Lectotype: Griffith KD 1009 (holo K), designated here.

Rottboellia tonkinensis A. Camus, Bull. Mus. Hist. Nat. (Paris) 25 (1919) 369. — *Hemarthria longiflora* (Hook. f.) A. Camus var. *tonkinensis* A. Camus, Fl. Gén. Indo-Chine 7 (1922) 379. — Lectotype: Balansa 1783 (holo P; L 908.90-622), here designated.

Hemarthria protensa auct. non Steud.

Rottboellia protensa auct. non Hack.

Plants perennial. *Culms* tufted, 0.05–1.1 m tall, erect to ascending, stout, compressed, internodes glabrous, not rooting from the lower nodes. Nodes glabrous or pilose, many to few. *Leaf sheaths* longer than the internodes, compressed, keeled, loose; glabrous or margins ciliate only towards the mouth or margins ciliate or pubescent on outside. Ligule more or less triangular, 0.8–2 mm long, truncate, ciliate. *Blades* flat or folded, linear, subcordate at the base, 1.5–25 cm by 0.8–8 mm, not deciduous, margins scabrous, lower ones glabrous or glabrous with some bulbous-based bristles near mouth or margins ciliate or puberulous on one or both sides. *Inflorescences* one to several per node, axillary to terminal. Racemes dorsally compressed, solitary or fascicled, each raceme included in a sheath-like bract, 4–21 cm long. Rhachis subtetragonous, smooth, tardily disarticulating or (sometimes) tenacious. Joints flattened, 3–8.5 mm long. Spikelets dorsoventrally compressed. *Sessile spikelets* twice as long

as the joints, 8–17 mm long; callus obscure or triangular to long-triangular, glabrous, 0.1–0.6 mm long. Lower glume linear to lanceolate, 7.8–14.5 mm long, coriaceous, 9–13(–many)-nerved, acuminate and caudate, margins scabrous, dorsally flattened. Upper glume concave, 5.8–13.5 mm long, somewhat thinner than the first glume, not adnate to the rhachis, 3-nerved, acuminate and caudate. First lemma 3–7.2 mm long. Second lemma 2.2–6 mm long. Stamens 3. Anthers 0.6–2 mm long. Caryopsis 1.6–2.6 mm long. Pedicels as long as or sometimes slightly shorter than the joints. *Pedicelled spikelets* 7.5–20 mm long. Callus obscure to short transverse, glabrous, 0.1–0.2 mm long. Lower glume linear to lanceolate, 7–15.5 mm long, subcoriaceous to coriaceous, 9–15(–many)-nerved, acuminate and caudate, scabrous, flattened. Upper glume concave, 7.5–19.5 mm long, somewhat thinner than the first glume, 3–7-nerved, acuminate and caudate, scabrous. First lemma 2.4–6 mm long. Second lemma 1.8–3.5 mm long. Stamens 3. Anthers 0.7–1.6 mm long. Caryopsis 1.1–2.2 mm long. n = 17.

Distribution — NE India (Assam), Bangladesh, Burma, Thailand (N: Chiangmai; C: Bangkok; E: Nakhon Ratchasima; SE: Chanthaburi), Vietnam [N to S, fide Schmid [Agron. Trop. (Nogent-sur-Marne) 13 (1958) 189], S China (Hainan, Yunnan). *Malesia*: Peninsular Malaysia (Kedah, Kelantan), Borneo (Banjarmasin).

Habitat — Dry rice fields, most places, riverbank, c. 150 m altitude.

Notes — Extremely variable in size. Especially robust specimens resemble similar forms of *H. vaginata*. In the present species the two glumes of both spikelets are long-awned, and the sessile spikelets are twice as long as the joints.

Camus (1919: 369) has suggested that the spikelets are not shed at maturity and dispersal would take place by water.

Apparently most similar to *H. altissima* (but see also partial keys sub *H. debilis*, *H. depressa*, and *H. humilis*):

- Culms rooting from the lower nodes. Sessile spikelets 5–8.5(–9) mm long, longer than the 4–5(–6) mm long joints; callus distinct; lower glume 4–7.4 mm long **H. altissima**
- Culms not rooting from the lower nodes. Sessile spikelets 8–17 mm long, about twice as long as the 3–8.5 mm long joints; callus inconspicuous; lower glume 7.8–14.5 mm long **H. longiflora**

8. Hemarthria natans Stapf

Hemarthria natans Stapf in Prain, Fl. Trop. Afr. 9 (1917) 56. — [*Rottboellia compressa* L.f. subvar. *natans* Roberty, Boissiera 9 (1960) 60, comb. inval.]. — Lectotype: *Buchanan 1310* (holo K), here designated (see note).

Plants semi-aquatic to terrestrial perennial. *Culms* often floating, 0.5–2.4 m tall, decumbent, slender to stout, compressed, internodes glabrous, rooting from the lower nodes, decumbent part reddish. Nodes glabrous, many, inconspicuous. *Leaf sheaths* longer than the internodes or sometimes shorter, compressed, keeled, loose, lower leaves glabrous, but sheath margins ciliate towards the mouth or pubescent on outside and sheath margins ciliate, upper leaves glabrous, but sheath margins ciliate or pubescent on the inside or along the margins of the sheath. Ligule more or less triangular, 0.9–

2 mm long, truncate, ciliate. *Blades* distinct from the sheath, flat to folded (sometimes), linear and subcordate at the base, 4.5–20 cm by 3–6 mm, not deciduous, margins scabrous, glabrous or with some bulbous-based bristles near mouth or margins ciliate or pubescent on one or on both sides. *Inflorescences* one to several per node, axillary and terminal. Racemes dorsally compressed, solitary, scarcely exerted from the axillary sheath, 4–7 cm long. Rhachis flattened, smooth, tenacious. Joints flattened, 2.5–3 mm long. Spikelets dorsoventrally compressed. *Sessile spikelets* twice as long as the joints, 5–8.6 mm long. Callus triangular to long-triangular, glabrous, 0.8–2.1 mm long. Lower glume elliptic-oblong, 3.6–6.8 mm long, coriaceous, 7–13(–many)-nerved acuminate, scabrous or smooth, dorsally flattened to subconvex. Upper glume concave, 3–6 mm long, membranous except at the hardened tip, adnate to the rhachis, 3-nerved, acuminate. First lemma 2.1–3.9 mm long. Second lemma 2.1–3.6 mm long. Stamens 3. Anthers 0.8–1.8 mm long. Caryopsis 1.3–1.8 mm long. Pedicels as long as the joints. *Pedicelled spikelets* 5.2–8.2 mm long. Callus short transverse, glabrous, 0.2–0.7 mm long. Lower glume elliptic-oblong, 4.2–7.8 mm long, coriaceous, (11–)13(–many)-nerved, long acuminate or acuminate or sometimes shortly bidentate, scabrous, flattened to subconvex. Upper glume lanceolate to oblong, 5–10 mm long, somewhat thinner than the first glume, 5–7(–11)-nerved, long acuminate to caudate, scabrous. First lemma 2.3–3.8 mm long. Second lemma 2.1–3.5 mm long. Stamens 3. Anthers 0.8–1.6 mm long. Caryopsis 1.7–1.9 mm long.

Distribution — C Africa: Angola, Burundi, S and C Ethiopia, Kenya, Malawi, Rwanda, Tanzania, Uganda, Zaïre, ? Madagascar (see notes).

Habitat — Shallow water along the edge and beds of lakes and streams, on rocks in the water, marshy places, gallery scrub, waste land, locally common, 700–1850 m altitude.

Field notes — (Semi-)aquatic (in *Aeschynomene*, *Leersia* floats) to terrestrial perennial, distinct for being tinged with red. Culms prostrate to geniculate, scrambling, fleshy and succulent, thick, branched, rooting at the nodes, up to 2.4 m high. Spikes slightly curved, several (often 3) at the upper joints. Spikelets green with purple markings.

Notes — The *Du Petit Thouars* syntype (which could not be found in K) is the only collection reported for Madagascar. Bosser [Mém. ORSTOM 35 (1969) 203] regarded *H. altissima* as the only species there (confirmed again by Bosser via Morat, in litt.).

In *Lewalle 2269* (GENT, K) a pedicelled spikelet had an upper glume with a small hook resembling that found in *H. uncinata*, otherwise the collection is *H. natans*.

Most similar to *H. altissima*:

- Culms decumbent part brownish (i.s.); sheaths shorter than the internodes; blades not distinct from the sheath. Rhachis tardily disarticulating; joints 4–6 mm long. Sessile spikelets longer than the 4–5(–6) mm long joints; callus (ob)triangular; lower glume oblong to linear. Pedicelled spikelets: the lower glume lanceolate to linear **H. altissima**
- Culms decumbent part reddish (i.s.); sheaths longer than the internodes; blades distinct from the sheath. Rhachis tenacious; joints 2.5–3 mm long. Sessile spikelets about twice as long as the 2.5–3 mm long joints; callus triangular to long-triangular; lower glume elliptic-oblong. Pedicelled spikelets: the lower glume elliptic to oblong. — C Africa **H. natans**

9. *Hemarthria pratensis* (Balansa) Clayton

Hemarthria pratensis (Balansa) Clayton, Kew Bull. 24 (1970) 314. — *Rottboellia pratensis* Balansa, J. Bot. (Morot) 4 (1890) 110. — *Coelorachis pratensis* A. Camus, Ann. Soc. Linn., Lyon 68 (1921) 198. — Type: *Balansa 1786* (holo L 908.94-1216; iso K, L 908.94-1215, P).

Hemarthria subulata Reeder, J. Arnold Arbor. 29 (1948) 350, t. 5c–e. — Type: *Brass 7552* (holo US; A, L).

Manisuris protensa auct. non Hitchc.

Plants perennial. *Culms* tufted, 0.6–1.2 m tall, erect, tufted, slender to stout, compressed, internodes glabrous, not rooting from the lower nodes. Nodes glabrous, few, conspicuous, dark. *Leaf sheaths* longer than the internodes, compressed, slightly keeled, somewhat loose, lower leaves pubescent on outside and sheath margins ciliate, upper leaves glabrous. Ligule more or less triangular, 0.8–1.5 mm long, truncate, ciliate. *Blades* folded, linear and elongated, 21–60 cm by 2–3 mm, deciduous, margins scabrous, lower ones glabrous, with some bulbous-based bristles near mouth or margins ciliate or pubescent on the upper side or on both sides. *Inflorescences* one to several per node, axillary to terminal. Racemes dorsally compressed, solitary, slender, not included in the sheath at the base, 8.5–21 cm long. Rhachis smooth, tardily disarticulating. Joints long-cuneate, 6–10 mm long. Spikelets dorsoventrally compressed. *Sessile spikelets* shorter than or slightly longer than the joints, 5.4–9 mm long. Callus triangular, glabrous, 1.5–1.6 mm long. Lower glume linear, 5–7.4 mm long, coriaceous, 7(–many)-nerved acute to acuminate, or sometimes narrowly winged above, smooth, dorsally flattened. Upper glume concave, 4.6–6.8 mm long, somewhat thinner than the first glume, 3-nerved, acute to acuminate. First lemma 3.5–4.8 mm long. Second lemma 3–4.6 mm long. Stamens 3. Anthers 2.1–3.1 mm long. Caryopsis c. 2.2 mm long. Pedicels shorter than the joints. *Pedicelled spikelets* 5.1–7.5 mm long. Callus short, transverse, glabrous, c. 0.2 mm long. Lower glume linear, 5.1–6.9 mm long, coriaceous, 7–9-nerved, acuminate, keel scabrous, flattened. Upper glume boat-shaped, with a narrowly winged keel, 5–7.2 mm long, somewhat thinner than the first glume, 5-nerved, acuminate, keel scabrous. First lemma 3.6–5 mm long. Second lemma 3.1–4.5 mm long. Stamens 3. Anthers 2.6–3.1 mm long. Caryopsis c. 2 mm long.

Distribution — Thailand (NE: Nakhon Phanom), Vietnam (N: Vinh Phu). *Malesia*: Papua New Guinea (Western Prov.).

Habitat — Savannahs and marshy plains, margin of swamp, locally common, altitude 0–1300 m.

Field note — Very pale, stems compressed.

Notes — We agree with Clayton (l.c.) that *H. subulata* is identical with *H. pratensis*. This is another example of a disjunct Indo-Chinese/New Guinea distribution as found in *Germainia capitata* Balansa & Poitr., which occurs from Thailand to S China, and then, very rarely, in the Aru Islands and mainland New Guinea. Another instance, even more remarkable, is the temperate species *Trisetum bifidum* (Thunb.) Ohwi var. *bifidum* from China, Korea, Japan and also occurring above 2660 m near Lake Habbe-ma in Irian Jaya, in the Star Mts on the border of Irian Jaya and Papua New Guinea, and in the eastern Central Province on Mt Victoria.

Hemarthria pratensis is the only species where the leaf blades articulate just above the ligule. At the base of the erect culm a tuft of leafless sheaths is found, the apices of which are sometimes blackened from burning. The species grows in savannahs, and is apparently fire-resistant, developing new shoots after the fire.

Most similar to *H. altissima*:

- Culms rooting from the lower nodes; sheaths shorter than the internodes; blades not deciduous, base subcordate. Sessile spikelets: lower glume 9–11-nerved, scabrous distally along the edges. Pedicelled spikelets: anthers 1.2–2.4 mm long
..... **H. altissima**
- Culms not rooting from the lower nodes; sheaths longer than the internodes; blades deciduous, base gradually narrowed. Sessile spikelets: lower glume 7-nerved, smooth distally along the edges. Pedicelled spikelets: anthers 2.6–3.1 mm long.
— NE Thailand, N Vietnam, Papua New Guinea **H. pratensis**

10. *Hemarthria sibirica* (Gand.) Ohwi

Hemarthria sibirica (Gand.) Ohwi, Bull. Tokyo Sci. Mus. 18 (1947) 1. — *Rottboellia sibirica* Gand., Bull. Soc. Bot. France 66 (1920, '1919') 302. — [*Rottboellia compressa* L.f. subvar. *sibirica* Roberty, Boissiera 9 (1960) 60, comb. inval.]. — Type: *Desoulavy in Herb. Fl. Ross.* 2392 (holo LY, photo K; LE).

Rottboellia compressa L.f. var. *japonica* Hack. in A.DC., Monogr. Phan. 6 (1889) 288. — *Rottboellia japonica* Honda, Bot. Mag. (Tokyo) 41 (1927) 8. — *Hemarthria japonica* [Stapf ex J.C. Liu, Bull. Peking Soc. Nat. Hist. 2, 3 (1928) 65, nomen] Roshev. in Kom., Fl. URSS 2 (1934) 13, t. 1, f. 8a. — *Hemarthria compressa* R.Br. var. *japonica* [Ohwi, Acta Phytotax. Geobot. 11 (1942) 177, nom. inval.] Y.N. Lee, Man. Korean Grasses (1966) 77. — [*Rottboellia compressa* L.f. subvar. *japonica* Roberty, Boissiera 9 (1960) 60, comb. inval.]. — Type: *Naumann s.n.* (holo B, extant?; fragm. L, W?).

Hemarthria altissima auct. non Stapf & C.E. Hubb.

Hemarthria compressa auct. non R.Br.

Manisuris fasciculata auct. non Hitchc.

Rottboellia compressa L.f. var. *fasciculata* auct. non Hack.

Plants perennial. *Culms* stoloniferous, 0.4–1.15 m tall, erect to ascending, slender to stout, compressed, internodes glabrous, sometimes rooting from the lower nodes. Nodes glabrous, many, conspicuous, dark. *Leaf sheaths* shorter to longer than the internodes, compressed, slightly keeled, loose, lower leaves glabrous or glabrous with margins ciliate towards the mouth or pubescent on outside and sheath margins ciliate, upper leaves glabrous but margins ciliate only towards the mouth or margins ciliate. Ligule more or less triangular, 0.5–1.5 mm long, truncate, ciliate. *Blades* flat to sometimes folded, linear to lanceolate, acute, sometimes subcordate at the base, 9–30 cm by 2–7 mm, not deciduous, margins scabrous, lower ones glabrous or glabrous with some bulbous-based bristles near mouth or puberulous on both sides, smooth, upper leaves glabrous or with some bulbous-based bristles near mouth. *Inflorescences* one to several per node, axillary and terminal. Racemes terete, solitary, not or slightly included in sheath at the base, 5.1–12 cm long. Rhachis smooth, tardily disarticulating or tenacious. Joints flattened, 4–7 mm long. Spikelets terete. *Sessile spikelets* slightly longer than the joints, 5–7.8 mm long. Callus transverse, glabrous, 0.4–0.8 mm long. Lower glume linear or linear to oblong, 4.5–7.3 mm long, coriaceous, 7–11-nerved, acute or acuminate and shortly bidentate or sometimes indistinctly winged above, keel slightly scabrous, dorsally flattened to subconvex. Upper glume boat-shaped, 4–6.9 mm long, somewhat thinner than the first glume, fused with the joints, 3-nerved, acuminate. First lemma 3.4–5.2 mm long. Second lemma 3.4–4.3 mm long. Stamens 3. Anthers 1.8–3.6 mm long. Caryopsis 1.9–2 mm long. Pedicels as long as or slightly shorter

than the joints. *Pedicelled spikelets* 5.3–9.4 mm long. Callus short transverse, glabrous, 0.2–0.3 mm long. Lower glume linear or linear to lanceolate, 5.2–9 mm long, coriaceous, (5–)7–9(–11)-nerved, acuminate to long acuminate, keel scabrous, flattened. Upper glume concave, 5.3–9.2 mm long, somewhat thinner than the first glume, 5–7(–9)-nerved, acuminate to long acuminate, scabrous. First lemma 3.5–6.4 mm long. Second lemma 3–5.1 mm long. Stamens 3. Anthers 1.8–3 mm long. Caryopsis c. 2 mm long. $2n = 18$.

Distribution — N Pakistan, E Siberia (Ussuri, Zee-Bureya), China (widespread, e.g. NE: Beijing, Shandong; SE: Guangdong, Hong Kong, Hubei, Jiangsu, Jiangxi), Japan (Honshu, Kyushu, Shikoku), Korea (N to S).

Habitat — Along ditches, roads, in marshes, locally common, 0–130 m altitude.

Uses — Regarded as of little use as being too coarse to good fodder.

Notes — It is possible that the correct name for this species should be a combination based on *Rottboellia tranchellii* J.F. Gmel. See under *Nomina dubia vel excludenda: Rottboellia compressa* Retz. (1783), non L.f. (1782).

Hemarthria sibirica very much resembles *H. altissima*, see the key there.

11. *Hemarthria stolonifera* Bor

Hemarthria stolonifera Bor, Dansk Bot. Ark. 23 (1965) 163. — Type: *Larsen 10033* (holo K; C).

Plants perennial. *Culms* stoloniferous, 0.25–0.3 m tall (?), creeping, slender to stout, compressed, the internodes glabrous, rooting from the lower nodes, branching intravaginally at base. Nodes glabrous, many to few, inconspicuous. *Leaf sheaths* shorter to longer than the internodes, compressed, keeled, involute or the lower ones widely spread, lower leaves pubescent on outside and sheath margins ciliate, upper leaves glabrous, but sheath margins ciliate. Ligule more or less triangular, 0.8 mm long, truncate, ciliate. *Blades* flat, linear, 3–20 cm by 1.5–3 mm, not deciduous, margins scabrous, apex retuse; glabrous, but some bulbous-based bristles near the mouth. Inflorescence one per node, terminal. Racemes dorsally compressed, solitary, straight or slightly curved, not included in the sheath at the base, up to 13 cm long. Rhachis smooth, tenacious. Joints flattened, 5.2–6 mm long. Spikelets dorsoventrally compressed. *Sessile spikelets* slightly longer than the joints, c. 6 mm long. Callus obscure, glabrous, 0.9–1 mm long. Lower glume elliptic-oblong, 5.8–6.1 mm long, coriaceous, 11-nerved, obtuse, smooth, dorsally flattened. Upper glume boat-shaped, c. 6 mm long, somewhat thinner than the first glume, 3-nerved, acute. First lemma c. 4.6 mm long. Second lemma c. 3.9 mm long. Stamens 3. Anthers 2.9–3.1 mm long. Caryopsis not seen. Pedicels shorter than the joints. *Pedicelled spikelets* c. 7.2 mm long. Callus transverse, glabrous, c. 0.1 mm long. Lower glume linear to lanceolate, 6.4–6.7 mm long, coriaceous, 11–13-nerved, acuminate, flattened. Upper glume boat-shaped, 7–7.2 mm long, somewhat thinner than the first glume, 9-nerved, acuminate, keel scabrous. First lemma c. 4.6 mm long. Second lemma c. 3.9 mm long. Stamens 3. Anthers c. 3 mm long. Caryopsis not seen.

Distribution — Thailand (SE: Chanthaburi).

Habitat — Pond, c. 50 m altitude.

Notes — Only the type was available for study.

Bor described the innovations as extra-vaginal; however, they are intra-vaginal.

The species seems unique for its stoloniferous habit: in the type there are no less than seven erect culms which arise at a more or less regular distance of 3–4 cm from the rooting nodes of the decumbent stolon. Only *Jones & Jones 5899* (NY) of *H. altissima* had a similar growth, but *H. stolonifera* differs by its solitary, longer, and slightly curved spikes, few nodes, indistinct callus, and blunt apex of the lower glumes. It is the only *Hemarthria* with linear leaves and a retuse apex.

Otherwise most similar to *H. sibirica*:

- Culms ascending to erect, nodes conspicuous, dark. Blades apex acute. Racemes and spikelets terete. Sessile spikelet articulating transversally, callus 0.4–0.8 mm long; lower glume oblong to linear, acute to acuminate; upper glume acuminate. Pedicelled spikelets: callus 0.2–0.3 mm long **H. sibirica**
- Culms creeping, nodes inconspicuous. Blades apex retuse. Racemes and spikelets dorsally compressed. Sessile spikelet articulating obliquely, callus 0.9–1 mm long; lower glume elliptic-oblong, obtuse; upper glume acute. Pedicelled spikelets: callus c. 0.7 mm long **H. stolonifera**

12. *Hemarthria uncinata* R. Br.

Hemarthria uncinata R. Br., Prodr. (1810) 207. — *Rottboellia uncinata* Spreng., Syst. Veg. 1 (1824, '1825') 299. — *Rottboellia compressa* L. f. var. *uncinata* Hack. in A. DC., Monogr. Phan. 6 (1889) 288. — [*Rottboellia compressa* L. f. subvar. *uncinata* Roberty, Boissiera 9 (1960) 61, comb. inval.]. — Type: *R. Brown 6160* [holo BM; photo BI, K, K (probably also *Herb. Trinius 125.1*, IDC microfiche BT-16/1)].

Hemarthria foliata Steud., Syn. Pl. Glumac. 1 (1854) 359. — Type: *Drummond IV*, 385 (holo P; BM, K).

[*Hemarthria compressa* auct. non R. Br.: R. Br., Prodr. (1810) 207, pro specim.]. — *Rottboellia compressa* L. f. var. *australis* Hack. in A. DC., Monogr. Phan. 6 (1889) 288. — [*Rottboellia compressa* L. f. subvar. *australis* Roberty, Boissiera 9 (1960) 60, comb. inval.]. — Lectotype: *R. Brown 6161* (holo BM; photo BRI), designated here.

Hemarthria compressa auct. non R. Br.

Rottboellia compressa auct. non L. f.

Plants perennial. *Culms* tufted to stoloniferous, 0.3–0.87 cm tall, ascending, slender to stout, compressed, internodes glabrous, sometimes rooting from the lower nodes. Nodes glabrous, few to many, inconspicuous to conspicuous and dark. *Leaf sheaths* shorter to longer than the internodes, compressed, slightly keeled, folded to expanded, lower leaves glabrous to pubescent on the outside and sheath margins ciliate, upper leaves glabrous to sheath margins ciliate towards the mouth. Ligule more or less triangular, 0.2–0.6 mm long, truncate, ciliate. *Blades* folded, narrow, linear, 5–20 cm by 1–3 mm, not deciduous, margins scabrous, lower ones glabrous, or with some bulbous-based bristles near mouth or margins ciliate or pubescent on the upper side or puberulous on both sides, upper ones glabrous, or with some bulbous-based bristles near mouth or margins ciliate or sometimes puberulous on both sides, smooth. Inflorescence one per node, terminal and/or axillary. Racemes dorsally compressed, solitary, base included in the sheath or not, 7–11 cm long. Rhachis smooth, tardily disarticulating. Joints flattened, 4–7 mm long. Spikelets dorsoventrally compressed. *Sessile spikelets* longer than the joints, 5.3–10 mm long. Callus obtriangular to triangular, glabrous,

1–2 mm long. Lower glume linear or linear to oblong, 4.8–8.4 mm long, coriaceous, 9–11(–many)-nerved, acuminate, sometimes narrowly winged above, smooth, dorsally subconvex. Upper glume concave to boat-shaped, 4.8–8.8 mm long, somewhat thinner than the first glume, adnate to the joints, 3-nerved, acuminate and usually uncinata. First lemma 4–6 mm long. Second lemma 3.6–5.2 mm long. Stamens 3. Anthers 2–3.8 mm long. Caryopsis 2.2–2.6 mm long. Pedicels as long as or slightly shorter than the joints. *Pedicelled spikelets* 5.4–12 mm long. Callus short, transverse, glabrous, 0.2–0.3 mm long. Lower glume linear to lanceolate, 5.2–9.3 mm long, coriaceous, (7–)9–11(–many)-nerved, acuminate to long acuminate, sometimes uncinata, smooth to scabrous, subconvex. Upper glume concave, 5.2–11.2 mm long, somewhat thinner than the first glume, 5–7(–9)-nerved, acuminate or long acuminate and often uncinata, smooth to scabrous. First lemma 3.8–7.4 mm long. Second lemma 3.2–6.2 mm long. Stamens 3. Anthers 2–3.8 mm long. Caryopsis c. 2.5 mm long.

a. var. uncinata

Culms 0.28–0.55 m tall, nodes inconspicuous. Sheaths longer than the internodes, compressed, keeled, loose, folded. Inflorescence terminal, racemes not included in the sheath at the base. *Sessile spikelets*: upper glume concave. *Pedicelled spikelets*: lower glume smooth.

Distribution — Australia: SE Queensland (Rockhampton area S to) New South Wales, Victoria, Tasmania, S and W Australia.

Habitat — Moist places, banks of rivers, (salty) marshes, roadsides, clearings in forest, waste land, 0–1060 m altitude.

Field notes — Rhizomatous. Dense green tufts. Glaucous, green. Culms erect, spreading, geniculate, to rigid. Inflorescences green to pale or red brown.

Vernacular name — Matgrass (Engl.).

Uses — Eaten readily by cattle and sheep, rarely in sufficient quantity to be important. As it is resistant to trampling it is useful as a soil binder.

Notes — Brown (1810) made the combination *H. compressa* (L.f.) R.Br., but his material is the present species [see also Vickery, Contr. New South Wales Natl. Herb., Fl. Ser. 19, 1 (1961) 18].

The name is derived from the uncinata hooks on the upper glume of the pedicelled spikelet, sporadically also of the sessile spikelet. Such hooks are rare among grasses and are, e.g., found in *Australopyrum uncinatum* Veldk., *Deyeuxia uncinoides* (S.T. Blake) P. Royen & Veldk. of New Guinea, and *Muhlenbergia cleefii* Laegaard in Colombia, South America.

Most similar to *H. altissima*:

- Culms decumbent, rooting from the lower nodes, 0.6–1.7 m tall; sheaths shorter than the internodes. Blades base subcordate. Lower glumes distally scabrous along the edges. — Not in Australia **H. altissima**
- Culms ascending, not rooting from the lower nodes, 0.3–0.55 m tall; sheaths longer than the internodes. Blades base gradually narrowed. Lower glumes distally smooth along the edges. — Australia **H. uncinata var. uncinata**

b. var. *spathacea* (Domin) Vickery

Hemarthria uncinata R.Br. var. *spathacea* (Domin) Vickery, Contr. New South Wales Natl. Herb. 3 (1961) 83. — *Rottboellia compressa* L.f. var. *spathacea* Domin, Biblioth. Bot. 85 (1915) 261, t. 62. — Type: *Domin s.n.*, Dec. 1909 (holo PR; photo BRI, K; fragm. NSW).

Culms 0.75–0.87 m tall, nodes conspicuous, dark. Sheaths shorter than the internodes, not compressed, not keeled, expanded. Inflorescence axillary, racemes included in the sheath at the base. *Sessile spikelets*: upper glume boat-shaped. *Pedicelled spikelets*: lower glume scabrous.

Distribution — Australia: Queensland (N Kennedy) to New South Wales (North Coast).

Habitat — Light, sandy shrubbery, wet places in paddocks, railways, 5–10 m altitude.

Field note — Erect or ascending from a prostrate base, forming a dense mass about 1.5 m high, culms more or less branched in the upper part, sometimes rooting from the upper nodes.

Note — Only three collections were available for study (*S.T. Blake 18479, Hubbard & Winders 6899, Simon & Everist 2474*). When more can be compared the total differences with the typical variety will probably become less, but some real differences more apparent. The var. *spathacea* is especially distinct by the expanded leaf sheaths and a more restricted distribution. Vickery (1961) has suggested that it is possibly a habitat form, something which needs further observation. In the herbarium the sheaths are often not (all) clearly expanded, and the form is then difficult to recognise. The var. *uncinata* has a wider and more southerly distribution than var. *spathacea*: they only occur together in SE Queensland and the North Coast of New South Wales (J.R. Clarkson, MBA; B.K. Simon, BRI; in litt.).

13. *Hemarthria vaginata* Buse

Hemarthria vaginata Buse, in Miq., Pl. Jungh. 3 (Feb. 1854) preprint: 14; (Aug. 1854) 354. — *Rottboellia vaginata* Backer in K. Heyne, Nutt. Pl. Ned.-Ind. 1, ed. 2 (1927) 121; Handb. Fl. Java 2 (1928) 65. — Type: *Junghuhn s.n.* (holo L 903.342-454; iso L 908.90-1126).

Hemarthria protensa Nees ex Steud., Syn. Pl. Glumac. 1 (July 1854) 359; Hack. ex Balansa, J. Bot. (Morot) 4 (1890) 110, isonym. — *Rottboellia protensa* Hack. in A.DC., Monogr. Phan. 6 (1889) 289. — *Manisuris protensa* Hitchc., Brittonia 2 (1936) 127. — [*Rottboellia compressa* L.f. subvar. *protensa* Roberty, Boissiera 9 (1960) 60, comb. inval.]. — Type: *Gomez Marks in Herb. Wallich 8872* [holo P; K (*Herb. Wallich*, microfiche IDC 7394), fragm. L].

Plants perennial. *Culms* loosely tufted or sometimes stoloniferous, 0.2–0.8 m tall, ascending to decumbent, stout, compressed, the internodes glabrous or sometimes pubescent, sometimes rooting from the lower nodes. Nodes glabrous or pilose with white hairs, many, conspicuous, dark. *Leaf sheaths* usually longer than the internodes, compressed, keeled, loose, blades leaves glabrous to sparsely bulbous-based bristled below. Ligule more or less triangular, 0.5–2 mm long, truncate, ciliate. *Blades* flat or folded, linear and subcordate at the base, 3–28 cm by 3–8 mm, not deciduous, margins scabrous, glabrous or with some bulbous-based bristles near the mouth or (sparsely) pubescent at the upper side or puberulous on both sides. *Inflorescences* one to several

per node, axillary to terminal. Racemes dorsally compressed, solitary (each raceme included in a sheath-like bract), flowering from almost all the nodes, 8–18 cm long. Rhachis subtetragonous, smooth, tenacious. Joints flattened, 4.5–7 mm long. Spikelets dorsoventrally compressed. *Sessile spikelets* somewhat longer than the joints, 6.5–11 mm long. Callus triangular to acute, glabrous, 1.5–4 mm long. Lower glume linear to lanceolate, 5–8 mm long, coriaceous, 9–13(–many)-nerved, long acuminate and narrowly winged above, smooth, dorsally flattened. Upper glume concave, 4.8–7 mm long, somewhat thinner than the first glume, fused with the joints, 3–5-nerved, long acuminate. First lemma 3–4.8 mm long. Second lemma 2.5–4.2 mm long. Stamens 3. Anthers 0.8–2.6 mm long. Caryopsis 1.6–2.5 mm long. Pedicels shorter than the joints, strongly adnate to the joints. *Pedicelled spikelets* 8–12.5 mm long. Callus short, transverse, glabrous, c. 0.2 mm long. Lower glume linear to lanceolate, 4.8–7 mm long, coriaceous, 5–13-nerved, long acuminate, smooth, flattened. Upper glume concave and lanceolate, 7.6–12.2 mm long, somewhat thinner than the first glume, 3–5-nerved, distinctly caudate, keel lightly scabrous. First lemma 3–4.6 mm long. Second lemma 2.8–3.9 mm long. Stamens 3. Anthers 1.2–3 mm long. Caryopsis 1.5–2 mm long. n = 27.

Distribution — Nepal, Bhutan, NE India (Arunachal Pradesh, Assam, W Bengal, C Bihar, Meghalaya, Nagaland), Bangladesh, Burma, Thailand (N: Chiang Mai; NE: Nakhon Phanom), Vietnam (N: Hanoi, Lang Son), China (Guangdong, Guangxi, Yunnan). *Malesia*: Sumatra (Tapanuli: Padang Panjang, West Coast without locality: *Sohns* 63; E Coast: Kabanjahe), Java [Bogor (Campea, Cibogo), Priangan (Bandung), Wuryantoro, Banyumas, Pasuruan]. See notes.

Habitat — Moist meadows, rice fields, shallow pools, ditches, shores, locally common, often together with *H. compressa*, 0–900 m altitude in Java, up to 1525 m in E India.

Uses — Relished by cattle, remains alive under water during the monsoons and grows luxuriantly [Ambasta, Useful Pl. India (1986) 262].

Notes — Hackel obviously had an isotype of *H. vaginata*, but included the name with a query under *H. protensa*.

Dr. S. Tjitrosoedirdjo (BIOT) reported (in litt.) the species for S Sumatra (Musi Banyuasin) and S Celebes (Wajo, Sedenreng) but as the specimens have not been seen the correctness of their identifications could not be verified.

Sometimes the internodes are not elongated and the plant has a compact robust habit much resembling *H. longiflora*. It usually differs from this by the awned upper glume of the sessile spikelet. An extreme form is depicted by Hô (1993).

Hackel (1889: 289) and A. Camus (1919) have remarked that the fruiting spikelets are not shed and that distribution possibly takes place with the entire spike as a diaspore.

Most similar to *H. altissima*:

- Sheaths shorter than the internodes. Rhachis tardily disarticulating. Sessile spikelets: glumes acuminate, distally scabrous along the edges, not winged. Pedicelled spikelets: upper glume apex acuminate to long acuminate **H. altissima**
- Sheaths longer than the internodes. Rhachis tenacious. Sessile spikelets: glumes long acuminate to caudate, sometimes distally narrowly winged, smooth along the edges. Pedicelled spikelets: upper glume apex caudate **H. vaginata**

NOMINA DUBIA VEL EXCLUDENDA

1. *Hemarthria coromandelina* Steud., Syn. Pl. Glumac. 1 (1854) 358. — *Rottboellia compressa* auct. non L.f.: Roxb., Pl. Coromandel 2 (1805) 42, t. 181. — Type: *Roxburgh's plate*. Epitype: *Roxburgh s.n.* [holo BM; K (*Icon. Ined.* 861)], here designated. = *Ophiuros exaltatus* (L.) Kuntze.

Note — Roxburgh's beautiful plate shows the solitary, alternating sessile spikelets, absent pedicelled ones, and the lower male floret typical for this species.

2. *Rottboellia compressa* Retz., Observ. Bot. 3 (1783) 12, non L.f. (1782). — *Rottboellia tranchellii* J.F. Gmel., Syst. Veg. 1 (1791) 197 ('*tranchellii*'). — Type: '*Tranchell, China*' (holo LD, not found).

Note — There is a specimen (LD 99034-0898, photo in K) annotated *Rottboellia compressa* by Retzius in LD, but without provenance, collector, or date. It was identified as *H. japonica* [now *Hemarthria sibirica* (Gand.) Ohwi] by Hubbard in 1956. Although it seems likely that this is the *Tranchell* specimen, this cannot be proven.

3. *Hemarthria perforata* (Roxb.) Kunth, Révis. Gramin. 1 (1829) 153. — *Rottboellia perforata* Roxb., Pl. Coromandel 2 (1805) 43, t. 182. — *Ophiuros perforatus* Trin., Mém. Acad. Imp. Sci. St. Pétersbourg, VI, Sci. Math. 2 (1832) 246. — Type: *Herb. Roxburgh s.n.* (holo BM; K [*Icon. Ined.* 862, *Herb. Wallich 8873-A*, microfiche IDC 7394]). = *Mnesithea laevis* (Retz.) Kunth.

4. *Hemarthria rugosa* (Nutt.) Kunth, Révis. Gramin. 1 (1829) 153. — *Rottboellia rugosa* Nutt., Gen. N. Amer. Pl. 1 (1818) 84. — *Manisuris rugosa* Kuntze, Rev. Gen. Pl. 2 (1891) 780. — *Coelorachis rugosa* Nash in Britton, N. Amer. Fl. 17 (1909) 86; A. Camus, Ann. Soc. Linn., Lyon 68 (1921) 198, isonym. — *Mnesithea rugosa* de Koning & Sosef in Veldkamp et al., Blumea 31 (1986) 291. — Type: *Baldwin s.n.* (holo PH?), Florida.

Rottboellia corrugata Baldwin, Amer. J. Sci. 1 (1819) 355. — *Manisuris corrugata* Kuntze, Rev. Gen. Pl. 2 (1891) 779. — *Coelorachis corrugata* A. Camus, Ann. Soc. Linn., Lyon 68 (1921) 197. — Type: *Baldwin s.n.* (holo PH?; A 00023921, LE *Herb. Trinius 111.1*, IDC microfiche BT-16/1), Georgia.

Rottboellia rugosa Nutt. var. *chapmanii* Hack. in A. DC., Monogr. Phan. 6 (1889) 308 ('*chapmani*'). — *Manisuris rugosa* Kuntze var. *chapmanii* Scribn., Mem. Torrey Bot. Club 5 (1894) 28 ('*chapmani*'). — *Manisuris chapmanii* Nash in Small, Fl. S.E. U.S. (1903) 56 ('*chapmani*'). — Lectotype: *Chapman 3220-a* (holo W; fragm. L), designated here. = *Mnesithea rugosa* (Nutt.) de Koning & Sosef.

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INDEX TO SPECIMENS

(T) = type material; identities between brackets taken from literature and correspondence.

alt	=	<i>H. altissima</i>	nat	=	<i>H. natans</i>
com	=	<i>H. compressa</i>	pra	=	<i>H. pratensis</i>
deb	=	<i>H. debilis</i>	sib	=	<i>H. sibirica</i>
dep	=	<i>H. depressa</i>	sto	=	<i>H. stolonifera</i>
ham	=	<i>H. hamiltoniana</i>	unc	=	<i>H. uncinata</i>
hum	=	<i>H. humilis</i>	usp	=	<i>H. uncinata</i> var. <i>spathacea</i>
lon	=	<i>H. longiflora</i>	vag	=	<i>H. vaginata</i>

- Aitchison 429: com — Anderson 2910: (unc) — Andrews 1228: unc — Angus 2952: alt — Arechavaleta 5596: alt — d'Argy Aug. 1870: sib.
- Backer 5140: vag — F.M. Bailey Nov. 1888: unc — Bakalov 1686: alt — Balansa Sept. 1855: alt; Sept. 1857: alt; Sept. 1866 (T): alt; 10 Aug. 1886: com; 14: alt; 289: alt; 502: com; 646: alt; 1781: com; 1782: vag; 1783 (T): lon; 1784 (T): lon; 1786 (T): pra; 4393 (T): lon; 4696 (T): lon; 4773 (T): lon — Bancroft 1913: (usp) — Bates 4815: (unc) — Batianoff et al. 9208189: (unc) — Bean 8482: (unc) — Beaglehole 62672: (unc); 76229: (unc) — Belcher 44: com — Bidgood & Vollesen 3163: nat — Blake 132: (usp); 4516: unc; 7286: (unc); 7412: (unc); 7419: (unc); 7567: (unc); 7822: (usp); 13909: (unc); 14304: (usp); 18479: usp; 19969: (usp); 20093: (usp); 23069: (usp); 23080: unc — Blanche Herb. Syr. 49: alt — Bolles Ao 1854: alt — Bolus 536: alt — Bor 1117: com; 2606: vag — Bourgeau 1052: alt — Bourlier 497: alt — Bouxin 1511: nat — Bouxin & Radoux 505: nat — Brass 6001: pra; 7552 (T): pra — Breedlove & Davidse 54791: alt — L.J. Brown 17 May 1961: (unc) — R. Brown 6160 (T): unc; 6161 (T): unc — BS 10873 (Merrill): com — Buchanan 74: alt; 198: alt; 1310 (T): nat — Bullock 2396: nat — Burbidge 2784: unc — Burchell 686: alt; 815: alt; 7510: alt — Burkart 990: alt; 21641: alt; 22138: alt; 25274: alt — Burkart & Bacyalupo 21052: alt — Burkart et al. 26827: alt; 26827-b: alt — Burns 694: unc — Bushedge 2784: unc — But 22: com; 50: com; 76: com; 179: com.
- Cabrera 2775: alt — Camfield July 1902; unc; 15097; unc — Carr 11416: pra — Castillon 8311: alt — CCC 10295 (McClure): com — Chanet 470: sib — Charp 7889: alt — H.G. Cheo 36: sib — Chesterfield 2706: (unc) — Chevalier 10169: alt — C.Y. Chiao 2858: sib; 3010: sib — R.C. Ching 6609: com — H.H. Chung 6752: com — J.A. Clark 1: (usp) — C.B. Clarke 6893: vag; 8872: vag; 17341-B: com; 23387: com — Cleland Nov. 1916: (usp) — Clemens 1573-c: sib — Clifford 27 Feb. 1961: (unc) — Coleman 35: alt — Collenette 3641: alt — Constable 16575: unc — Cook 20 March 1966: (unc) — Corway 21: sib — Cotte 10 Oct. 1920: alt — Coveny et al. 4075: (unc); 11426: (unc) — Cowdry 1800: sib — CP 3254 (Thwaites): com — Craven 1511: unc — Cullimore 261: (unc) — Curtis 108: unc; 224: unc.

- Davies BAS 82: unc — De Winter & Marais 4146: alt — De Winter & Wiss 4126: alt; 4421: alt — Desoulavy Herb. Fl. Ross. 2392 (T): sib — Dieterlen 7021: alt — Dietrich 2482: unc — Dodd 2350: alt — Domin Dec. 1909 (T): sup — S. Dransfield 770: com — J. Drummond 152: unc; IV, 385 (T): unc — J.R. Drummond 21045: com — Dunn 4126: sib; 9257: com — Durango 16 Sept. 1853: alt — Durieu de Maissonnaire 20 Nov. 1840: alt — Durrington et al. 1432: (usp). Encarnacion 26341: alt.
- Faber 290: sib — Faurie 1165: sib; 1167: com; 1723: sib — Feng & Kao 4947: com — Fensham 2549: (usp) — Fernandez Casa & Suzanna 8601: alt — Filgueiras 826: alt; 829: alt; 834: alt — Fink et al. 32162: (unc) — Fiori & Béguinot 2002: alt — Fleischer Aug. 1827: alt — Foot 10 Feb. 1960: (usp) — Forbes Aug. 1872: sib; 399: sib — Fosberg 37948: com — H. Fung 20446: com.
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- Hackenberg 10 Jan. 1941: vag — Haines 1844: com — Hatschbach 15788: alt — Hay 16 Nov. 1961: (usp) — Heezen 41: unc — Henderson 549: unc — Henry 1896: com; 10169: com — Hinton et al. 6031: alt — Hooek 383: alt — Hooker f. & T. Thomson 30 May 1850: vag — Hsu 29 Oct. 1960: com; 402: com; 485: com; 502: com; 819: com; 1217: com; 4712: com — Hubbard 2268: unc; 2587: unc; 5316: unc; 8052: (usp) — Hubbard & Winders 6899: usp — Hutton 13 Feb. 1960: (unc).
- Ibarrola 2469: alt — IFRL 587: alt; 603: unc; 628: sib — Ikeda 629: sib — Innes 605: vag.
- J. Jackson 549: alt — Jeswiet 214: vag — Job 667: alt; 720: alt — Jones & Jones 5899: alt — Juhas 2: (usp) — Junghuhn 136: vag.
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