

BROMUS (GRAMINEAE) IN MALESIA

J. F. VELDKAMP, M. ERIKS & S. S. SMIT

Rijksherbarium/Hortus Botanicus, Leiden, The Netherlands

SUMMARY

Bromus L. (Gramineae) has 9 species in Malesia, two are introduced (*B. catharticus* Vahl, *B. diandrus* Roth, incl. *B. rigidus* Roth), one is newly described (*B. timorensis*), one is given a new combination (*B. kinabaluensis*), and *B. morrisonensis* Honda is a new record (Luzon) one is given a new combination.

INTRODUCTION

Bromus L. (Gramineae) is the largest genus of the small pooid tribe Bromeae, and is especially distinct by the margins of the leaf sheath, which are at least partly connate, the usually subapical awns, glabrous lodicules, the hairy apical appendages of the ovary, and the simple, rounded starch grains. Such grains are otherwise only found in the Brachypodieae and Triticeae. Serologically it is distinct from the Brachypodieae, but close to the Festuceae and Triticeae (Smith, 1969; see also Macfarlane & Watson, 1982). With the Triticeae it also is said (Clayton & Renvoize, 1986) to share its mode of germination: the mesocotyl, the internode below the coleoptile whose elongation pushes the seedling above the ground, would be absent here, and emergence is accomplished by elongation above the coleoptile node. Harberd (1972), however, noted that the expression of elongation varied from absent to well-developed in two *Festuca* species, while Hoshikawa (1969) reported elongation in all 5 species of *Bromus* studied by him.

Belval & Cugnac (1941, cited by Macfarlane & Watson, 1982) found a glucoside in the vegetative parts of *Bromus* which resembled one found elsewhere only in the Triticeae.

More or less extensive discussions of the taxonomic position are given by Wagnon (1952), Hilu & Wright (1982), and Macfarlane & Watson (1982).

Stebbins (1981) on karyological data has suggested an origin in the early Tertiary in Eurasia. The genus now occurs all over the world in temperate climates, but mainly in the North. Some of its species are important forage grasses, e.g. *B. catharticus* Vahl (Bor, 1960; Ambasta, 1988; Matthei, 1988), others are widespread weeds, e.g. *B. diandrus* Roth (Matthei, 1986), the pungent callus and rough awn of which may cause injury to livestock by penetrating mouth, eyes, or intestines. One, *B. mango* Desv., long-lost but recently rediscovered (Matthei, 1986; Reid, 1988), was an important cereal in Chili until it was superseded by European crops.

Bromus s.l. may be divided into 6–10 sections or subgenera depending on the author's views. Occasionally some have been regarded as so distantly related that

they have been distinguished as separate genera. Differences are to be found in the life cycle, nervature of the glumes and lemmas, shape of the lemmas, shape, relative length and place of insertion of its awns, caryopses, karyology, etc. (cf. Smith, 1970, 1980; Stebbins, 1981; Tzvelev, 1976). An extensive discussion on the application of names at various ranks is given by Smith (1970), and we follow his advice to distinguish sections. Representatives of three of these occur in Malesia.

The Malesian species are clearly much related to *B. ramosus* Huds., a Eurasian species, to which *B. remotiflorus* (Steud.) Ohwi from China, Korea, and Japan is also very close. In fact the species are so similar, that we for a while contemplated to reduce all to infra-specific taxa of *B. ramosus*, but have ultimately refrained from doing so, as the variability of the Eurasian species should be resolved first, which was far beyond the scope of this study.

Honda (1930) has regarded *Bromus remotiflorus* to represent a distinct section in *Festuca*, section *Stenofestuca* Honda, which Nakai (1950) even elevated to the generic level. There seems to be no good reason for such a distinction, and *B. ramosus*, *B. remotiflorus*, and other species belong to section *Bromopsis* Dum. (incl. sect. *Pnigma* Dum.). This contains perennial species with terete, parallel-sided spikelets with 1(–3)-nerved lower and 3(–5)-nerved upper glumes, and dorsally rounded lemmas distinctly longer than their simple, \pm straight awns.

The sectional name *Pnigma* has been used for this, e.g. by Soderstrom & Beaman (1968), as under a former Rule (Art. 21.3) no sectional name was allowed to end in ‘-opsis’. This Rule has now been abandoned and as the equally old name *Bromopsis* was already chosen by Hitchcock in 1935, followed by Wagnon (1952), this one must be regarded as the correct name.

Of the introduced species *B. catharticus* Vahl belongs to the section *Ceratochloa* (Beauv.) Griseb., which has perennial species with strongly compressed, parallel-sided spikelets with 3–5-nerved lower and 5–11-nerved upper glumes, and dorsally keeled lemmas, awns when present, simple, straight, short.

Bromus diandrus Roth (incl. *B. rigidus* Roth) belongs to the section *Genea* Dum. which contains annual species with many-flowered, cuneate spikelets with 1-nerved lower and 3-nerved upper glumes, and dorsally rounded lemmas, 0.5–1 times as long as their simple, straight, often rough awns.

ACKNOWLEDGEMENTS

This study was started by the two junior authors (ME and SSS) during a course in Advanced Angiosperm Taxonomy at the Rijksherbarium under the guidance of the senior author (JFV), who subsequently finished the manuscript. It was therefore based mainly on the material available at L. The Directors of LISC and W are thanked for the loan of some additional specimens, and the Keepers of M and PR for a photocopy of the type specimen of *B. pallens*, and the actual type specimen of *B. luzonensis*, respectively.

REFERENCES

- AMBASTA, S.P. 1988. Wealth of India, ed. 2, 2: 299, t. 1. New Delhi.
 BELVAL, H., & A. DE CUGNAC. 1941. Le contenu glucidiques des bromes et des fétuques et la classification. Bull. Soc. Chim. Biol. 23: 74–77.
 BOR, N.L. 1960. The grasses of Burma, Ceylon, India and Pakistan: 456. Oxford, etc.

- CLAYTON, W.D., & S.A. RENVOIZE. 1986. Genera graminum: 144–145. London.
- HARBERD, D.J. 1972. A note on the relevance of the mesocotyl in the systematics of the Gramineae. *Ann. Bot.* 36: 599–603.
- HILU, K.W., & K. WRIGHT. 1982. Systematics of Gramineae: a cluster analysis. *Taxon* 31: 9–36
- HITCHCOCK, A.S. 1935. Manual of the grasses of the United States. U.S. Dept. Agric. Misc. Publ. 200: 31, 32, 38.
- HONDA, M. 1930. Monographia Poacearum Japonicarum, Bambusoideis exclusis. *J. Fac. Sc. Imp. Univ. Tokyo* III, 3: 44, 54–55.
- HOSHIKAWA, K. 1969. Underground organs of the seedlings and systematics of the Gramineae. *Bot. Gaz.* 130: 192–203.
- MACFARLANE, T.D., & L. WATSON. 1982. The classification of Poaceae subfamily Pooideae. *Taxon* 31: 178–203
- MATTHEI, O. 1986. El genero *Bromus* L. (Poaceae) en Chile. *Gayana, Bot.* 43: 54, 70, 84, with fig.
- NAKAI, T. 1950. Classes, ordines, familiae, subfamiliae, tribus, genera nova quae attinent ad plantas Koreanas (Supplementum). *J. Jap. Bot.* 25: 6.
- REID, R. 1988. 'Extinct' cereal rediscovered. *Threatened Pl. Newsl.* 19: 6, fig.
- SMITH, P. 1969. Serological relationships and taxonomy in certain tribes of the Gramineae. *Ann. Bot.* 33: 591–613.
- 1970. Taxonomy and nomenclature of the brome-grasses (*Bromus* L. s.l.). *Notes Roy. Bot. Gard., Edinburgh* 30: 361–375.
- 1980. *Fl. Europaea* 5: 182–189. Cambridge, etc.
- STEBBINS, G.L. 1981. Chromosomes and the genus *Bromus* (Gramineae). *Bot. Jb.* 102: 359–379.
- TZVELEV, N.N. 1976. *Zlaki S.S.S.R.* 1: 207–235. Leningrad. (Grasses of the Soviet Union 1, 1983, 298–343, Washington, New Delhi).
- WAGNON, H.K. 1952. A revision of the genus *Bromus*, section *Bromopsis*, of North America. *Brittonia* 7: 415–480.

BROMUS

- Brömus* L., *Sp. Pl.* 1 (1753) 76; Pénczes, *Bot. Közlem.* 33 (1936) 98; Parodi, *Rev. Argent. Agron.* 14 (1947) 1; Bor, *Grasses* (1960) 452; Tournay, *Bull. Jard. Bot. Brux.* 31 (1961) 289; Soderstrom & Beaman, *Biol. Ser. Publ. Mus. Mich. State Univ.* 3 (1968) 469; Rumbell, *New Zeal. J. Agr. Res.* 11 (1968) 277; Covas & Iria, *Bol. Soc. Argent. Bot.* 12 (1968) 113; P.M. Smith, *Notes Roy. Bot. Gard., Edinburgh* 30 (1970) 361; Stebbins, *Bot. Jb.* 102 (1981) 359; Matthei, *Gayana, Bot.* 43 (1987) 47. — *L e c t o t y p e*: *Bromus secalinus* L. (Smith, 1970: 366) not *B. arvensis* L. [Wagnon, *Brittonia* 7 (1952) 421, followed by Pinto-Escobar, *Bot. Jb.* 102 (1981) 447.]
- Festuca* L. subg. *Stenofestuca* Honda, *J. Fac. Sc., Imp. Univ. Tokyo* III, 3 (1930) 44, 54. — *Stenofestuca* Nakai, *J. Jap. Bot.* 25 (1950) 6. — *T y p e*: *Festuca pauciflora* Thunb. [= *Bromus remotiflorus* (Steudel) Ohwi].

The extensive synonymy of *Bromus* has been summarized by Smith (1970) and is therefore not repeated here.

Annuals to perennials. Culms hollow. Sheaths with connate margins. Ligules scarious. Inflorescences paniculate. Spikelets breaking up above the glumes. Florets several, bisexual. Glumes shorter than the lemmas, persistent, 1–several-nerved. Lemmas dorsally rounded to keeled, 3–13-nerved, muticous or with usually subapical, rarely apical awns. Anthers 1–3. Lodicules entire, glabrous. Ovary apically with a hairy appendage on which the styles are laterally inserted. Caryopsis strongly clasped by the lemma, usually adnate to the palea; hilum linear, longer than half the grain length; starch grains simple, rounded.

C h r o m o s o m e s. $x = 7$ (Smith, 1970).

KEY TO THE MALESIAN TAXA

- 1a. Awn from an obtuse to acuminate apex, up to 1 cm long, shorter than the lemma 2
 b. Awn from a bi-aristulate apex, c. 5 cm long, longer than the lemma (Timor)
- 3. Bromus diandrus**
- 2a. Lower glumes 1–5-nerved; upper glumes 3–7-nerved. Lemma with a 4.5–9 mm long awn 3
 b. Lower glumes 5- or 7-nerved; upper glumes 9- or 11-nerved. Lemma with a 0–3.5 mm long awn. — Lemma 7–11-nerved (Java)
- 1. Bromus catharticus**
- 3a. Culms puberulous under the panicle. Anthers 3–4 mm long. — Ligules collar-shaped, 0.5–2 mm long 4
 b. Culms glabrous under the panicle. Anthers 1.5–2.8 mm long. — Ligules collar-shaped to triangular, 0.9–3.5 mm long 5
- 4a. Ligules 2.25–3.5 mm long. Lower glumes 3(–5)-nerved. Upper glumes abruptly apiculate to mucronate, 5(–7)-nerved. First lemmas lanceolate, 12.5–13 by 3.5–4 mm, awns 5–6.5 mm long (E Java) **8. Bromus sundaicus**
 b. Ligules 0.9–2 mm long. Lower glumes 1-nerved. Upper glumes gradually acute to mucronate, 3-nerved. First lemmas linear-lanceolate, 13–14.5 by 2–2.5 mm, awns 6.5–8.5 mm long. (Timor) **9. Bromus timorensis**
- 5a. Blades 10–19 cm long. Panicles 8–12 cm long 6
 b. Blades 20–40 cm long. Panicles 13–30 cm long 7
- 6a. Blades patently white pilose. Spikelets 17–20 mm long (without the awns). Lower glumes 5–5.5 mm long, acuminate. Upper glumes 3-nerved. First lemmas 8–9 mm long, awns 4–6 mm long. Anthers 1.5–2 mm long (Ceram)
- 2. Bromus ceramicus**
- b. Blades subglabrous to sparsely pilose. Spikelets 22–30 mm long (without the awns). Lower glumes 6–8.5 mm long, mucronate. Upper glumes 5-nerved. First lemmas 11–13.5 mm long, awns 6–8 mm long. Anthers 2–2.8 mm long (New Guinea) **7. Bromus scopulorum**
- 7a. Ligules 0.5 mm long. Lower glumes 6–10.5 mm long. Upper glumes 8.5–13 mm long. Anthers 2–3 mm long 8
 b. Ligules 1–2 mm long. Lower glumes 4.5–5.5 mm long. Upper glumes 5.75–6.5 mm long. Anthers 2–2.5 mm long (Luzon) **6. Bromus morrisonensis**
- 8a. Blades 27–40 cm long, sparsely to densely pubescent above. Panicle 18.5–30 cm long, lowermost branches 4 or 5, the longest 11.5–20 cm long with 5–8 (–16) spikelets. Lower glumes 6–7 mm long, mucronate. Upper glumes 8.5–9.5 by 1–2 mm, mucronate. First lemmas 9–11 by 2.5–3 mm (Java)
- 4. Bromus insignis**
- b. Blades 20–27 cm long, subglabrous above. Panicle 15–17 cm long, lowermost branches 1 or 2, the longest 2.8–7 cm long with 1 or 2 spikelets. Lower glumes 8–10.5 mm long, acute to slightly acuminate. Upper glumes 10–13 by 3–3.5 mm, acuminate. First lemmas 11–15 by 4–5 mm (Sabah)
- 5. Bromus kinabaluensis**

1. *Bromus catharticus* Vahl

- Bromus catharticus* Vahl, Symb. Bot. 2 (1791) 22; Backer in Heyne, Nutt. Pl. Indon. 1 (1950) 280; Maw, Kew Bull. 29 (1974) 431; Matthei, Gayana, Bot. 43 (1986) 86, fig. 11; Pinto-Escobar, Caldasia 15 (1986) 22, t. 3. — *Ceratochloa cathartica* Herter, Rev. Sudamer. Bot. 6 (1940) 144; Henr., Blumea 4 (1941) 498, pro comb. nov. — *Bromus catharticus* var. *catharticus*: Pinto-Escobar, Caldasia 15 (1986) 22, t. 3. — Lectotype: *Dombey s.n.* (P-JU, holo), Peru, Lima.
- Festuca uniolooides* Willd., Hort. Berol. 1 (1803) t. 3. — *Ceratochloa festucooides* Beauv., Agrost. (1812) 158, nom. superfl. — *Ceratochloa uniolooides* Beauv., Agrost., Atlas (1812) t. 15, f. 7; Tzvel., Zlaki S.S.S.R. 1 (1976) 208. — *Bromus uniolooides* Rasp., Ann. Sc. Nat., Paris, Bot. 5 (1825) 439; Raven, Brittonia 12 (1960) 219; non Kunth, 1816. — *Bromus willdenowii* Kunth, Rév. Gram. (1829) 134; Raven, Brittonia 12 (1960) 219; P.M. Smith, Fl. Eur. 5 (1980) 189. — *Tragus uniolooides* Panz. ex Jacks., Ind. Kew 2 (1895) 1099. — Type: *Hb. Willdenow 2103* (B, holo), cult. in Hort. Berol. from seed from Carolina.
- Bromus uniolooides* Kunth in H.B.K., Nov. Gen. Sp. 1 (1816) 151; Buysman, Teysmannia 23 (1912) 770; Backer, Handb. Fl. Java 2 (1928) 253; Backer in Heyne, Nutt. Pl. Indon. (1950) 280; C.E. Hubb., Fl. Lusit. Comm. 9 (1956) 7; Bor, Grasses (1960) 456; Soderstrom & Beaman, Biol. Ser. Publ. Mus. Mich. State Univ. Biol. Ser. 3 (1968) 486; Fernandes & Quiros, Bol. Soc. Brot. II, 43 (1970) 46, t. 20 c-f. — *Schedonorus uniolooides* R. & S., Syst. Veg. 2 (1817) 708. — *Zerna uniolooides* Lindm., Svensk Fanerogamfl. (1918) 101. — Type: *Humboldt & Bonpland 2286* (P, holo, US, fragm.), Ecuador, Quito, prope Chillo, Conocoto et Sangolqui, c. 400 m alt.
- Ceratochloa haenkeana* Presl, Rel. Haenk. 1 (1830) 285. — *Bromus haenkeanus* Kunth, Enum. Pl. 1 (1833) 416. — *Bromus uniolooides* Kunth forma *haenkeanus* Shear, Bull. U.S. Dept. Agric., Div. Agrost. 23 (1900) 52. — Synonyms: *Haenke s.n.* (PR), Chili, Peru.
- Ceratochloa secunda* Presl, Rel. Haenk. 1 (1830) 285. — *Bromus preslii* Kunth, Enum. Pl. 1 (1833) 416, 545 ('preslei'); Rév. Gram. 1, Suppl. (1834) xxxii; non *B. secundus* Presl (1830). — Type: *Haenke s.n.* (PR, holo), Peru.
- Bromus strictus* Brongn. in Duperrey, Voy. Coquille, Phan. (1831) 45, non Scop., 1772. — *Bromus brongniartii* Kunth, Enum. Pl. 1 (1833) 421. — Type: *d'Urville s.n.* (P, holo), Brazil, Santa Catarina, 1825.
- Ceratochloa pendula* Schrad., Linnaea 6, Litt. (1831) 72. — *Bromus schraderi* Kunth, Enum. Pl. 1 (1833) 416, nom. superfl. — Type: *Hb. Schrad.* (PH?, iso), grown in Göttingen from seed from Carolina.
- Ceratochloa breviaristata* Hook., Fl. Bor. Am. 2 (1840) 253, t. 234. — *Bromus breviaristatus* Thurb. in Wilkes, U.S. Expl. Bot. 17/2 (1874) 493, non Buckl., 1862. — *Forasaccus breviaristatus* Lunell, Am. Midl. Nat. 4 (1915) 225. — Synonym: *Douglas s.n.* (K), U.S.A., Lewis and Clark River, near sources of Columbia River, 1826.
- Bromus mathewsii* Steudel, Syn. 1 (1854) 323. — Type: *Mathews in Hb. Lindley 54* (P?, BM, CGE), Peru.
- Bromus angustatus* Pilger, Bot. Jb. 25 (1898) 719. — Type: *Stübel 60c* (B, holo), Bolivia, Titicaca Lake.

Tufted perennial (elsewhere sometimes annual or biennial), branching intra-vaginally at base. Culms erect, up to 55(–84) cm tall, unbranched, 2–6-noded. Nodes dark brown, sometimes constricted, glabrous. *Sheaths* densely soft hairy, hairs patent to retrorse. Ligules truncate, 1–3(–4) mm long, erose, outside ± retrorsely ciliate. Blades 8–17(–25) cm by 3–4(–6) mm, smooth to scaberulous. *Panicle* ± erect, contracted, ± dense, 8–22.5(–32) by 2.5–8.5(–17) cm diam.; axis becoming scaberulous upward, lowermost branches 2–5 together, longest branch 3.5–8.5

(-16.5) cm long, with 2-4 spikelets, naked in the lower 0.3-0.65 part, scaberulous. Pedicels unequal, the lateral ones 1-2(-5), the others 6-8(-21) mm long. *Spikelets* (2-)4-6(-10)-flowered, cleistogamous, 1.7-2(-3) cm by 3-6 mm. *Glumes* glabrous, keeled, keel scaberulous, apex cucullate; lower glumes oblong to lanceolate, 6-14.5 by 2-2.5 mm, 0.5-0.7 times as long as the first lemma, 5-7-nerved, upper glumes lanceolate, 8-16.5 by 2-3 mm, 9-11-nerved. *Lemmas* stiffly imbricate; first lemma lanceolate, 13-20 by 3-4 mm, 6-10 times as long as the node, scaberulous, especially on the keel, nerves 7-11, apex acute, mucro subapical, 0-3.5 mm long. Callus glabrous, oblique, scar rounded, c. 0.25 mm diam. *First palea* 7-11.5 by 2.5-3 mm, keels scabrous, apex with 2 mucros. Lower node \pm flattened, upwards becoming wider, \pm triangular, 1.5-2.5 mm long, scaberulous; rachilla process 0.5-1.5 mm long. Anthers 3, 0.5-0.75(-1) mm long, yellowish (i.s.). No ripe caryopses seen.

Distribution. Originally from South America, widely cultivated and introduced; in Malesia: Java: Tengger complex, Hyang Plateau.

Habitat. Grassy roadsides, dry slopes, along fields, forest paths, as a weed in a *Paspalum dilatatum* plantation; 1500-2300 m altitude.

Chromosomes. $2n = 28, 42$ (e.g. Lloret & Cardona, Orsis 3, 1988, 41, fig. 1, 2).

Palyndology. Melham et al. (Hoehnea 10, 1983, 9).

Pollination. Tanaka (J. Jap. Bot. 49, 1974, 22, t. 1-c) observed that the flowers were usually cleistogamous, and if the anthers did emerge, the stigmas did not. The palea is apparently functional in the opening of the floret, as in cleistogamous ones it is relatively much shorter.

Vernacular names. Prairie grass, Rescue grass (E).

Uses. A valuable foddergrass (Bor, 1960; Ambasta, Wealth of India, ed. 2, 1988, 299, t. 1; Matthei, Gayana, Bot. 43, 1986, 54); cause of hay fever (Melham et al., 1983); a purgative (Ambasta, l.c.).

Notes. The nomenclature of this species has been very confusing, not in the least due to the fact that some authors [see summaries by Grossmann (Gött. Fl. Rundbr. 7, 1973, 13) and Pinto-Escobar (Caldasia 11, 1976, 15, t. 4; Bot. Jb. 102, 1981, 445; Caldasia 14, 1985, 185, t. 1, 2) have maintained that there would be two species involved, *B. catharticus* s.s. [incl. *B. unioloides* (Willd.) Rasp.] and *B. unioloides* Kunth (note the homonyms!). We agree with Maw (Kew Bull. 29, 1974, 431) and Pinto-Escobar that the two cannot be separated (see also Matthei, Gayana, Bot. 43, 1986, 86, fig. 11). In fact the Malesian material consists of material showing such mixtures of the so-called differences, that we would not know which of the two 'species' would then occur in Java. When taken together the correct name is *B. catharticus*.

Kloos (Ned. Kruidk. Arch. 27, 1918, 157) may be noted for his extensive discussion on the variability of *B. unioloides*, and the creation of a great number of infra-specific taxa in it.

The first collections made in Java seem to have been by Hochreutiner in two different localities on the Tengger on 15 January 1905 (Chase, Candollea 6, 1936, 421).

2. *Bromus ceramicus* Ohwi

Bromus ceramicus Ohwi, Bull. Tokyo Sc. Mus. 18 (1947) 11. — *Bromus insignis* Buse var. *ceramicus* Jansen, Reinwardtia 2 (1953) 245. — T y p e: *Eyma 2246* (BO, holo), Ceram, G. Ueimpoku, 3000 m, 24–25 Nov. 1937.

Tufted perennial. Culms 40–60 cm tall, glabrous, with 3 or 4 nodes. *Sheaths* patently pubescent. Ligules collar-shaped, rounded to subtruncate, c. 1 mm long. Blades 10–15 cm by 2–3.5 mm, on both sides patently white long-hairy. *Panicle* drooping, lax, 8–12 cm long, with 6–12 spikelets. Branches 2 or 3 together, 1- or 2-spikeled, scabrous. *Spikelets* 7- or 8-flowered, 17–20 mm long. *Glumes* with acuminate apex; lower glumes linear-lanceolate, 5–5.5 mm long, presumably c. 0.6 times as long as the lower lemma, 1-nerved; upper glumes c. 7 mm long, 3-nerved. *First lemma* 8–9 mm long, sparsely white hairy, 5-nerved, apex entire, awn 4–6 mm long. Callus glabrous. *First palea* c. 7 mm long (presumably 0.78–0.87 times as long as the lemma), keels above base sparsely ciliate. Lower rachilla nodes 1.5–2 mm long, abaxially ciliolate. Anthers 3, 1.5–2 mm long. Caryopsis incl. apical rostrum c. 7 mm long.

D i s t r i b u t i o n. Ceram, only known from the type.

H a b i t a t. Not recorded, probably subalpine grasslands; 3000 m altitude.

N o t e. As no material was available, the description given above is based on Ohwi (1947) and Jansen's manuscript.

3. *Bromus diandrus* Roth

Bromus diandrus Roth, Bot. Abh. (1787) 44; De Castro, Garcia de Orta 12 (1964) 60; P.M. Smith, Fl. Eur. 5 (1980) 183. — *Anisantha diandra* Tutin in Clapham et al., Fl. Br. Isl., ed. 2 (1962) 1149; Tzvel., Zlaki S.S.S.R. 1 (1976) 223 (subsp. *diandra* created by implication). — T y p e: Roth: "Hort. Bot. Nürnberg e seminibus inter passulas majores (raisins!) lecta", "October".

Bromus rigidus Roth in Roemer & Ust., Mag. Bot. 4/10 (1790) 21. — *Bromus rubens* L. var. *rigidus* Mutel, Fl. Franç. 4 (1837) 133. — *Genea rigida* Dumort., Etud. Agrost. Michelaria Class. Gram. (1868) 30. — *Bromus madritensis* L. var. *rigidus* Bab. ex Syme in Sowerby, Engl. Bot., ed. 3, 11 (1873) 161. — *Bromus villosus* Forssk. var. *rigidus* Asch. & Gr., Syn. Mitteleur. Fl. 2/1 (1901) 596, comb. incor. — *Bromus gussonei* Parl. var. *rigidus* Lindb., Acta Soc. Sc. Fenn., n.s. B, 1, 2 (1932) 15, comb. illeg. — *Anisantha rigida* Hyl., Uppsal. Univ. Årsskr. 7 (1945) 32. — *Anisantha diandra* Tzvel. subsp. *rigida* Tzvel., Zlaki S.S.S.R. 1 (1976) 223. — *Bromus diandrus* Roth subsp. *rigidus* De Bolòs et al., Coll. Bot. 17 (1987) 96. — T y p e: Roth: "Europe".

Bromus maximus Desf., Fl. Atl. 1 (1798) 95, t. 26; non Gilib., 1792. — *Bromus madritensis* L. var. *maximus* St-Amans, Fl. Agen. (1821) 45. — *Bromus villosus* Forssk. var. *maximus* Asch. & Gr., Syn. Mitteleur. Fl. 2/1 (1901) 595, comb. incor. — *Forasaccus maximus* Bubani, Fl. Pyr. 4 (1901) 382. — *Bromus rigidus* L. subsp. *maximus* Rothm. & Silva, Agron. Lusit. 1 (1939) 248. — S y n t y p e s: *Desfontaines s.n.* (Hb. Desf. & Labill., FI), Europe, Tunisia and Algeria.

Bromus gussonei Parl., Rar. Pl. Sic. 2 (1840) 8. — *Bromus maximus* Desf. var. *gussonei* Parl., Fl. Ital. 1 (1848) 407, comb. incor. — *Bromus rigidus* Roth var. *gussonei* Coss. & Dur., Expl. Sc. Alger. 2 (1855) 159. — *Bromus villosus* Forssk. var. *gussonei* Asch. & Gr., Syn. Mitteleur. Fl. 2, 1 (1901) 595. — *Anisantha gussonei* Nevski, Tr. Sredneaz. Univ. VIIIIC, 17 (1934) 20. — *Bromus rigidus* L. subsp. *gussonei* Maire in Jahand. & Maire, Cat. Maroc. (1934) 865. — *Zerna gussonei* Grossh., Akad. Nauk. S.S.S.R. Bot. Inst. Tr. Azerb. Fil. 8 (1939) 305. — S y n t y p e s: *Gussone s.n.* (FI, NAP, PAL, PI), Sicilia.

Bromus villosus Forssk., Fl. Aegypt.-Arab. (1775) 23; non Scop., 1772. — Type: *Hb. Forsskål* (C?, LE?), Egypt, 'Alexandriae', 'April'.

Description based on Malesian material.

Tufted annuals branching intra-vaginally at base. Culms erect, up to 55 cm tall, unbranched, c. 3-noded. Nodes brown, sometimes constricted, glabrous. *Sheaths* retrorsely hairy. Ligules \pm triangular, 2.5–4 mm long, fissured, glabrous. Blades 11.5–15 cm by 2–3 mm, smooth, puberulous. *Panicle* \pm erect, loosely contracted, \pm secund, 12–15 by c. 5 cm diam. (incl. awns); axis antrorsely puberulous, lowermost branches 1–5 together, longest branch up to 6 cm long, with 1 or 2 spikelets, scaberulous. Pedicels 2–3 cm long. *Spikelets* 8–11-flowered, cleistogamous, 5–5.5 cm by 8–10 mm (excl. awns). *Glumes* lanceolate, glabrous, keeled, keel sometimes scaberulous, apex acuminate; lower glumes 16–18 by 1.5–2 mm, 0.55–0.7 times as long as the first lemma, 3-nerved, margins narrowly scarious; upper glumes 23–27 by c. 4 mm, 5-nerved. *Lemmas* stiffly imbricate; first lemma lanceolate, 28–30 by 4–5 mm, 6–7 times as long as the rachilla node, scaberulous on the nerves, 7-nerved, apex bidentate, teeth c. 5 mm long, awn subapical, 3.5–5 cm long, canaliculate, 1.2–1.7 times as long as the lemma, antrorsely scaberulous. Callus glabrous, oblique, scar \pm subrotund, c. 0.5 mm long. *First palea* lanceolate, c. 17 by 2 mm, scarious, keels smooth, remotely hispid upward, apex obtuse. Lodicules not seen. Lower rachilla node \pm flattened, upwards becoming wider, 4–4.5 mm long, densely antrorsely scaberulous. Anthers 2, c. 1 mm long, brownish (i.s.). Caryopsis longitudinally folded, adaxial furrow deep, laterally flattened, \pm linear, c. 15 by 1.5 mm.

Distribution. Originally from the Mediterranean, S and Central W Europe, introduced elsewhere: in Malesia: Timor (Huato-Builico, on the slopes of the G. Tamailau).

Habitat. Roadsides, potato fields, c. 1800 m altitude.

Chromosomes. $2n = 42, 56$ (Esnault & Huon, Bull. Soc. Linn., Provence 37, 1986, 69; Bull. Soc. Bot., France 134, 1987, 299; Sánchez Anta et al., Acta Bot. Barc. 37, 1988, 335).

Uses. Weed. The pungent callus and rough awn may cause injury to livestock by penetrating mouth, eyes, or intestines.

Anatomy. Blade (Sánchez Anta et al., 1988).

Vernacular name. Rippgut (E).

Notes. In most floras *B. diandrus* and *B. rigidus* are distinguished. According to P.M. Smith (Fl. Eur. 5, 1980, 183) *B. diandrus* (incl. *B. gussonei*) would have a loose panicle, 2–4 pedicels per node, each with a single, 50–70 mm long spikelet (probably measured incl. the awns), and an almost round callus scar, glumes and lemmas relatively long, the lower glumes 15–25 mm long, the upper ones 20–35 mm long, lemmas 20–35 mm long. Anthers 2 or 3, 1–5 mm long.

Bromus rigidus would have a contracted panicle, pedicels shorter than the spikelets, shorter spikelets, 25–35 mm long (probably measured without the awns), and a more or less elliptical callus scar, glumes and lemmas relatively short, the lower glumes 15–18 mm long, the upper ones 20–25 mm long, lemmas 20–25 mm long. Anthers 2, up to 1 mm long.

Tzvelev [Zlaki S.S.S.R. 1 (1976) 223] and De Bolòs et al. [Coll. Bot. 17 (1987) 96] regarded the two as subspecies of what the first called *Anisantha diandra*. He said that subsp. *rigida* "always has dense panicles with branches up to 2(-2.5) cm long and smaller anthers (0.5-0.7 mm long)." (Panicles usually somewhat lax, rarely compressed, anthers usually 2, 0.8-1.6 mm long in subsp. *diandra*, according to his key, p. 223.)

However, as can be observed from the synonymy, others have not found it so easy to distinguish between the two and have reduced the taxa as subspecies or varieties under several names. In our studies we did find the various shapes and dimensions used by Smith and Tzvelev among our material, but failed to observe any correlation. On the contrary, any theoretically possible combination was encountered. Esnault & Huon (1986, 1987) remarked that the two 'taxa' occur within the same populations and can only be recognized by their chromosome numbers: *B. rigidus* has $2n = 42$, *B. diandrus* $2n = 56$. The Timor material resembles the '*rigidus*' form most, but its chromosome number is of course unknown. As an indication of the confusion between the 'taxa' it may be remarked that Jansen labeled one sheet '*B. gussonii*'.

Sánchez Anta et al. (1988) reported that there were some slight quantitative anatomical differences in Spanish material, where the hexaploid (*B. rigidus*) had more stomata on the adaxial side of the blade than on the abaxial side, while in the octoploid (*B. diandrus*) the number was \pm the same. The sheath of the hexaploid abaxially also had a greater number of short cells.

4. *Bromus insignis* Buse

Bromus insignis Buse in Miq., Pl. Jungh. 3 (1854) 347; Miq., Fl. Ind. Bat. 3 (1857) 398; Koord., Exk. Fl. Java 1 (1911) 162; Bünнемeyer, Trop. Nat. 7 (1918) 44, t. 1; Backer, Handb. Fl. Java 2 (1928) 253; Backer in Heyne, Nutt. Pl. Indon. (1950) 279; Jansen, Reinwardtia 2 (1953) 243, t. 2; Monod de Froideville in Backer & Bakh. f., Fl. Java 3 (1969) 517. — *Zerna insignis* Henr., Blumea 4 (1941) 498. — Type: *Junghuhn s.n.* (L, holo, no. 904.84-98), Java, Dieng, March.

Tufted perennial branching extra-vaginally at base. Culms few, erect, often geniculate at base, simple, up to 180 cm tall, unbranched, 3- or more-noded, glabrous. Nodes glabrous to rather densely, patently to retrorsely pubescent. *Sheaths* glabrous to retrorsely puberulous. Ligules collar-shaped, truncate, 1(-2) mm long, glabrous. Blades flat, flaccid, 27-37(-41) cm by (3-)5-10 mm, usually scaberulous on both sides, above sparsely to rather densely pubescent, below glabrous to sparsely pubescent; auricles present. *Panicle* drooping, lax, 18.5-30 by 4-6(-19) cm diam.; axis scaberulous upward, lowermost branches 3-5 together, longest branch 11.5-20 cm long, with 5-8(-16) spikelets, naked in the lower 0.25-0.4th part. *Spikelets* 5-7-flowered, chasmogamous, 1.7-2.5(-3) cm by 4-6(-8) mm. *Glumes* glabrous, keeled, keel \pm smooth to scaberulous, apex mucronate; lower glumes lanceolate, 6-7 by 1-2.5 mm, 0.6-0.65 times as long as the first lemma, mucro 0.5-1 mm long, 1-nerved; upper glumes lanceolate to linear-lanceolate, 8.5-9.5 by 1-2 mm, mucro 1-1.75 mm long, 3- or 5-nerved. *First lemma* lanceolate, 9-11(-11.5) by 2.5-3 mm, 5.5-7.5 times as long as the rachilla node, glabrous to ciliate on the

base of the lateral nerves, 5–7(–11)-nerved, awn subapical, 6–10 mm long. Callus apically ciliate, oblique, scar \pm rounded, c. 0.25 mm diam. *First palea* linear-lanceolate, 7–8.5 by 1–1.5 mm, about 0.75 times as long as the lemma, keels setulose. Lower rachilla node \pm terete, 1.5–2 mm long, abaxially densely ciliolate. Anthers 3, 2–3 mm long, orange-yellowish (i. s.). Caryopsis linear-lanceolate, 8.5–9 mm long.

Distribution. Java (Papandayan, Slamet, Diyeng). Specimens seen: *Docters van Leeuwen-Reijnvaan 13347*; *van Steenis 4927, 6790, 11628*; *Wiriosapoetro 52*.

Habitat. Sandy, dry soil, 2000–2800 m altitude, in ditches, locally common (see Bünnemeijer's account).

Collector's note. Dark green, suffused with sepia.

Vernacular name. Pari kesit (Jav.).

5. *Bromus kinabaluensis* (Jansen) Veldk., *comb. nov.*

[*Bromus kinabaluensis* Jansen ex Meijer, Symp. Ecol. Res. Humid Trop. Veg. (1963) 342, nomen ('Jansen'). — *Bromus insignis* Buse var. *kinabaluensis* Jansen, Reinwardtia 2 (1953) 245. — Type: *Clemens 29174* (L, holo), Sabah, Upper Kinabalu, 26 March 1932.

Tufted perennial branching extra-vaginally at base. Culms few, erect, often geniculate at base, simple, up to 64 cm tall, unbranched, c. 4-noded, glabrous. Nodes glabrous. *Sheaths* usually glabrous sometimes sparsely pubescent. Ligules collar-shaped, truncate, 1–2 mm long, glabrous. Blades flat, flaccid, 20–27 cm by 3.5–6 mm, smooth, above (sub)glabrous, below glabrous; auricles present. *Panicle* drooping, lax, 15–17 by 1.5–2 cm diam.; axis smooth, lowermost branches 1 or 2 together, longest branch 2.8–7 cm long, with 1 or 2 spikelets, naked for the greater part. *Spikelets* up to 11-flowered, c. 2.5 cm by 8 mm. *Glumes* glabrous, keeled, keel \pm smooth to scaberulous; lower glumes lanceolate, 8–10.5 by 1.8–2 mm, 0.65–0.72 times as long as the first lemma, apex acute to slightly acuminate, 1- or 3-nerved; upper glumes oblong to lanceolate, 10–13 by 3–3.5 mm, apex acuminate, 3- or 5-nerved. *First lemma* oblong, 11–15 by 4–5 mm, 5–6.2 times as long as the rachilla node, puberulous in the lower part in the marginal zones, smooth, 5-nerved, awn subapical, 4–7 mm long. Callus glabrous to apically ciliate, oblique, scar \pm rounded, c. 0.25 mm diam. *First palea* linear-lanceolate, 10–12 by c. 2 mm, 0.8–0.9 times as long as the lemma, keels setulose. Lower rachilla node \pm terete, 1.75–3 mm long, adaxially hairy. Anthers 3, 2.5–3 mm long, orange-yellowish (i. s.). Caryopsis not seen.

Distribution. Sabah (Mt Kinabalu). Specimens seen: *Clemens 29174, 30134, 30134-bis*; *Smith 554*.

Habitat. Low heath on rubbly scree, c. 4020 m altitude.

Collector's notes. Tufted. Raceme drooping, purple.

6. *Bromus morrisonensis* Honda

Bromus morrisonensis Honda, Bot. Mag., Tokyo 42 (1928) 137; J. Fac. Sc., Univ. Tokyo III, 3 (1930) 39; Hsu, Fl. Taiwan 5 (1978) 430, t. 1388; Koyama, Gr. Japan (1987) 35, 493. — Type: *Kawakami & Sasaki s.n.* (TI, holo), Taiwan, Chiayi Co., Mt Morrison, 1909.

? *Bromus remotiflorus* Ohwi var. *piananensis* Ohwi, Acta Phytotax. Geobot. 10 (1941) 106; Hsu, Taiw. Gr. (1975) 301, 819, t. 45; Fl. Taiwan 5 (1978) 430. — Type: *Ohwi 4258* (KYO, holo), Taiwan, Ilan Co., Ssu-yuen-ya-kou, between Pianan-ambu and Shikikun (see note).

Bromus pauciflorus auct., non Hack.: Merr., Philipp. J. Sc. 1, Suppl. (1906) 386, p.p.; Enum. Philipp. Fl. Pl. 1 (1923) 92, p.p.

Bromus remotiflorus auct., non Ohwi: Jansen, Reinwardtia 2 (1953) 242.

Description based on *Merrill 4714* (W).

Tufted perennial branching extra-vaginally at base. Culms few, erect, often geniculate at base, simple, at least 50 cm tall, unbranched, glabrous. Nodes glabrous. *Sheaths* glabrous. Ligules collar-shaped, truncate, c. 0.5 mm long, glabrous. Blades flat, flaccid, 21–22.5 cm by 3–3.5 mm, above scaberulous, underneath ± smooth, glabrous; auricles present. *Panicle* drooping, lax, 13–16 by 2.5–3 cm diam.; axis scaberulous; lowermost branches 3 together, longest branch c. 7 cm long, with 3 spikelets, naked for the lower half. *Spikelets* 5–7-flowered, chasmogamous, 1.8–2.3 cm by 5–8 mm. *Glumes* glabrous, keeled, keel smooth; lower glumes linear-lanceolate, 4.5–5.5 by c. 1 mm, 0.47–0.55 times as long as the first lemma, apex acuminate, 1-nerved; upper glumes oblong, 5.75–6.5 by c. 2 mm, apex with a 0.4–0.85 mm long mucro, 3-nerved. *First lemma* lanceolate, 9–10 by 2–3 mm, 3.8–4 times as long as the rachilla node, ± smooth, appressed puberulous in the lower half, 3(–5)-nerved, awn subapical, 4.5–5 mm long. Callus apically ciliate, oblique, scar ± rounded, c. 0.25 mm diam. *First palea* linear-lanceolate, c. 6.5 by 1 mm, 0.67–0.82 times as long as the lemma, keels scaberulous in the upper half, apex retuse. Lower rachilla node ± terete, 2–2.5 mm long, abaxially hairy. Anthers 3, 1.5–2 mm long, orange-yellowish (i.s.). Caryopsis not seen.

D i s t r i b u t i o n. Taiwan, Malesia: Philippines (Luzon, Benguet Prov., Pauai). Malesian specimen seen: *Merrill 4714* p.p.

H a b i t a t. Wet, open grassland at 2075 m altitude in Luzon, subalpine pine forest in Taiwan.

N o t e s. This species was collected only once in Malesia (*Merrill 4714*, in 1905; W). This collection differs slightly from the descriptions and the two collections (one a topotype, *van Steenis 20982*, L) seen from Taiwan, e.g. a palea with shorter spicules on the keels and slightly shorter anthers, but this seems insufficient to distinguish the populations of the two islands.

The duplicate in W on which the above description is based, was identified by Hackel as “aff. *B. paucifloro* H.” This number is a mixture of the present species and *Brachypodium sylvaticum* (Huds.) Beauv. var. *pseudo-distachyon* Hook. f. (Veldkamp & Van Scheindelen, Blumea 34, 1989, 72). The duplicate in PNH is a mixture of a *Brachypodium* and a *Bromus* (J.V. Santos, in litt.).

At first sight the species is similar to *B. pauciflorus* (Thunb.) Hack., as suggested by Hackel. This differs, however, by having densely retrorsely puberulous culms, blades 4–5(–8) mm wide, sheaths pilose, ligules semi-rounded, 1–2.5 mm long, inflorescences 15–30 cm long, glumes scabrous on the keels, upper glume 8–10 (–12) mm long, lemma 10–15 mm long, 7-nerved, glabrous, awns 6–12 mm long, and growing at low altitudes.

The correct name at the specific level is *B. remotiflorus* (Steudel) Ohwi, as there is a *B. pauciflorus* Schumach. (1801).

From Taiwan a *B. remotiflorus* var. *piananensis* Ohwi [Acta Phytotax. Geobot. 10 (1941) 106] has been described, which we have not seen, but because of the glabrous culms, smaller spikelets, 3-nerved lemmas, and its occurrence in the mountains (viz. Hsu, 1975: 819, and Hsu, 1978, incl. Mt Morrison) we doubt it is part of *B. remotiflorus*; it would seem a form of *B. morrisonensis* with somewhat shorter leaves, more pubescent sheaths, and glabrous spikelets, with which taxon it should be compared again, as was already suggested by Ohwi (1941).

7. *Bromus scopulorum* Chase

Bromus scopulorum Chase, J. Arnold Arbor. 24 (1943) 78. — *Bromus insignis* Buse var. *scopulorum* Jansen, Reinwardtia 2 (1953) 246; Henty, Bot. Bull., Lae 1 (1969) 43; Veldk. & Royen in Royen, Alp. Fl. New Guinea 2 (1980) 1118, t. 363. — T y p e: Brass & Meijer Drees 9825 (A, holo, BO, L, US), Irian Jaya, 7 km NE of Mt Wilhelmina, 3560 m alt., Sept. 1938.

Tufted perennial branching extra-vaginally at base. Culms few, erect, often geniculate at base, simple, up to 50 cm tall, unbranched, 3-noded, glabrous. Nodes glabrous. *Sheaths* glabrous to sparsely, retrorsely puberulous. Ligules collar-shaped, \pm rounded to truncate, 0.5–1 mm long, usually glabrous. Blades flat, flaccid, 17–19 cm by 2.25–3.5 mm, smooth, subglabrous to sparsely pilose on both sides; auricles present. *Panicle* drooping, lax, (6–)8–9 by c. 2 cm diam.; axis smooth to scaberulous; lowermost branches 1 or 2 together, longest branch 0.7–3.5 cm long, with 1 spikelet. *Spikelets* c. 7-flowered, chasmogamous, 2.2–3 cm by 4–8 mm. *Glumes* keeled, keel smooth; lower glumes linear-lanceolate to linear, 6–8.5 by 0.5–1.5 mm, 0.52–0.68 times as long as the first lemma, apex mucronate, mucro 0.35–1.25 mm long, 1- or 3-nerved; upper glumes oblong to lanceolate, 8–10 by 2–3 mm, apex with a 0.5–2 mm long mucro, 5-nerved. *First lemma* lanceolate, (9–)11–13.5 by 2.5–4 mm, 4.7–6.25 times as long as the rachilla node, scaberulous on the nerves, marginal zone pilose, 5-nerved, awn subapical, 6–8 mm long. Callus apically ciliolate, oblique, scar \pm rounded, c. 0.25 mm diam. *First palea* linear-lanceolate, 9–10 by 1.5 mm, 0.67–0.82 times as long as the lemma, keels setulose, apex acutish. Lower rachilla node \pm terete, 2–2.25 mm long, abaxially densely ciliolate to \pm puberulous. Anthers 3, 2–2.8 mm long, citron (i.v.). Caryopsis not seen.

Distribution. New Guinea: Irian Jaya (Mt Carstensz, Mt Wilhelmina), Papua New Guinea (W Sepik Prov.: Star Mts). Specimens seen: Brass & Meijer Drees 9825; Hope 10954 p.p.; Mangan 1251; Veldkamp 6228.

Habitat. Shaded, moist, grassy gullies subjected to periodical flooding; *Cyathia* shrubland; dry ledges on limestone; 2960–3560 m altitude.

Collector's notes. Tufted. Leaves midgreen. Panicles drooping. Spikelets green with purple margins to reddish brown, purple. Stigmas white.

Note. Veldkamp 6228 is slightly different by having lemmas with 7, 9, or 11 nerves, and very shortly ciliolate rachilla joints.

8. *Bromus sundaicus* Ohwi

Bromus sundaicus Ohwi, Bull. Tokyo Sc. Mus. 18 (1947) 11. — T y p e: Van Steenis 10936 (BO, holo), Java, Besuki, Jang Plateau, Selonyeng, 15 July 1938.

Bromus insignis auct. non Buse: Monod de Froideville in Backer & Bakh. f., Fl. Java 3 (1969) 517, p. p.; Steen., Mt. Fl. Java (1972) t. 22, f. 8.

Tufted perennial branching extra-vaginally at base. Culms few, erect, often geniculate at base, simple, up to 70 cm tall, unbranched, 3-noded, puberulous at least under the panicle. Nodes glabrous to sparsely, rarely densely pubescent. *Sheaths* sparsely puberulous to densely soft hairy, hairs retrorse. Ligules triangular, \pm rounded, 2.25–3.5 mm long, glabrous. Blades flat, flaccid, 19–35.5 cm by 2–6 mm, scaberulous on both sides, rarely smooth, above sparsely to densely soft hairy, below glabrous to sparsely pubescent; auricles present. *Panicle* drooping, lax, 18–22 by 2.5–4 cm diam.; axis usually scaberulous; lowermost branches usually 2 together, sometimes 1 or 3, longest branch 7–14 cm long, with 1 or 2(–4) spikelets, naked for the larger part, scaberulous. *Spikelets* 6- or 7-flowered, chasmogamous, 1.7–3 cm by c. 4 mm. *Glumes* keeled, keel \pm scaberulous; lower glumes lanceolate, 7.5–9 by 1.5–2.3 mm, 0.55–0.62 times as long as the first lemma, apex acute, 3- or 5-nerved; upper glumes lanceolate, 10–11 by 2.5–3 mm, apex abruptly apiculate to mucronate, mucro up to 0.75 mm long, 5(–7)-nerved. *First lemma* lanceolate, 12.5–13 by 3.5–4 mm, 4–7.5 times as long as the rachilla node, scaberulous on the nerves, marginal zone short hairy, sometimes also on the nerves, (3- or) 7-nerved, awn subapical, (3–)5–6.5 mm long. Callus apically ciliolate, oblique, scar \pm rounded, c. 0.25 mm diam. *First palea* linear-lanceolate, 8–11 by 1–1.7 mm, 0.65–0.85 times as long as the lemma, keels scabrous, apex acutish. Lower rachilla node \pm terete, 1.7–3.3 mm long, abaxially densely ciliolate. Anthers 3, (2.3–)3–4 mm long, orange-yellowish (i. s.). Caryopsis 8.5–9 mm long.

Distribution. Java (G. Argopuro). Specimens seen: *Backer* 9709, 13277, 13318; *Koorders* 43457, 43519, 43568.

Habitat. Grassy slopes, *Casuarina* forest; 2000–2300 m.

Pests. *Koorders* 43568 (L) is infected by an ergot.

Vernacular name. Röbbö (Jav.).

Notes. The *Bromus* mentioned for G. Widodaren by *Koorders* [Natuurk. Tijdschr. Ned. Ind. 62 (1903) 239; *Koorders* 37596] is *Helictotrichon virescens* (Nees ex Steudel) Henr. [see Sevenster & Veldkamp, *Blumea* 28 (1983) 338, 342].

Koorders 43519 differs from the other specimens seen by having the lower glumes 5-nerved, the upper ones 7-nerved, in both the outer nerves are inconspicuous, and some lemmas have 3 nerves only.

9. *Bromus timorensis* Veldk., *spec. nov.*

Bromus insignis auct. non Buse: De Castro, *Garcia de Orta* 12 (1964) 61.

Bromo sundaico similior, principue in ligulis brevioribus, glumis inferioribus 1-nervatis, lemmate 0,6–0,7-plo longioribus, glumis superioribus 3-nervatis, lemmatibus longioribus angustioribusque aristas longioribus differt. — **Type:** *Van Steenis* 18467 (L, holo, BO, LISC), Indonesia, Timor, Mt. Tatamailau, 2800 m alt., 5 Jan. 1954.

Tufted perennial branching extra-vaginally at base. Culms few, erect, often geniculate at base, simple, up to 90 cm tall, unbranched, 3-noded, puberulous at least under the panicle. Nodes retrorsely pubescent. *Sheaths* retrorsely puberulous to

pilose. Ligules collar-shaped to triangular, truncate to acutish, 0.9–2 mm long, glabrous. Blades flat, flaccid, 20–27 cm by 4–7 mm, scaberulous on both sides, above subglabrous to densely pilose, below glabrous to sparsely pilose; auricles absent. *Panicle* drooping, lax, 16–17 by 3–3.5 cm diam.; axis smooth to scaberulous; lowermost branches 2 together, longest branch 4–8.5 cm long, with 2–4 spikelets, naked for the lower half, scaberulous. No entire spikelets seen, chasmogamous. *Glumes* keeled, keel ± scaberulous, glabrous; lower glumes linear-lanceolate, 7.5–9 by 1.2–1.5 mm, 0.6–0.7 times as long as the first lemma, apex acute to mucronate, mucro up to 1.3 mm long, 1-nerved; upper glumes lanceolate, 9.5–11.5 by 2–2.6 mm, apex acute to mucronate, mucro up to 1.5 mm long, 3-nerved. *First lemma* linear-lanceolate, 13–14.5 by 2–2.5 mm, 4.6–6.4 times as long as the rachilla node, puberulous, especially at base, marginal zone short hairy, 3–7-nerved, 3 distinct, the others faint, awn subapical, 6.5–8.5 mm long. Callus apically ciliolate, oblique, scar ± rounded, c. 0.25 mm diam. *First palea* linear-lanceolate, 9.5–10.5 by c. 1.5 mm, 0.7–0.77 times as long as the lemma, keels setulose, apex acutish. Lower rachilla node ± terete, 2.25–2.85 mm long, abaxially densely ciliolate. Anthers 3, c. 3.75 mm long, brown (i.s.). No ripe caryopsis seen.

Distribution. Indonesia, Timor (G. Tatamailau).

Habitat. In Eucalypt forest, 2800 m altitude.

Collector's notes. Large grass, but very soft. Perennial. Dense tufts. Leaves soft.

Note. This is very much like *B. sundaicus* and differs mainly by: shorter ligules, 1-nerved lower glumes, 0.6–0.7 times as long as the lemma, 3-nerved upper glumes, longer and narrower lemmas with longer awns.

SPECIES EXCLUDENDAE

1. *Bromus commutatus* auct. non Schrad.: Merr., Enum. Philipp. Fl. Pl. 1 (1923) 93.

= *Brachypodium sylvaticum* (Huds.) Beauv.

See note by Veldkamp & Scheindelen, Blumea 34 (1989) 72.

2. *Bromus erectus* Huds., Fl. Anglia (1762) 39; Buysman, Teysmannia 23 (1912) 768. — *Type*: Extant? Great Britain, Kent.

This species was introduced by Buysman in Java, but does not seem to have persisted.

3. *Bromus luzonensis* Presl, Rel. Haenk. 1 (1830) 262; Steudel, Syn. 1 (1854) 319; Merr., Philipp. J. Sc. 1, Suppl. (1906) 387; Philipp. J. Sc. 35 (1928) 3. — *Triticum luzonense* Kunth, Enum. 1 (1833) 446; Miq., Fl. Ind. Bat. 3 (1857) 402; F.-Vill., Nov. App. (1883) 323. — *Type*: *Haenke s.n.* (PR, holo), "Philippines, Luzon".

This is a mislabeled collection and an older combination for the North American *B. breviaristatus* Buckl. which species must therefore be renamed.

4. *Bromus pallens* Cav., Icon. 6 (1801) 66, t. 591, f. 1; Kunth, Enum. 1 (1833) 418; Miq., Fl. Ind. Bat. 3 (1857) 398; F.-Vill., Nov. App. (1883) 322.; Merr., Philipp. J. Sc. 1, Suppl. (1906) 386. — Type: *Née s.n.* (MA, holo, n.v.), Philippines, Manila.

A photocopy of the holotype was seen, showing that the panicle is much more contracted than figured, with probably much narrower lemmas. An identification with *B. sterilis* L. cannot be ruled out.

5. *Bromus sterilis* L., Sp. Pl. 1 (1753) 77; Buysman, Teysmannia 23 (1912) 768. — Lectotype: *Loefling 82* in Hb. Linn. 93-19 (LINN, holo), Spain. [appointed by P.M. Smith, Notes Roy. Bot. Gard. Edinburgh 42 (1985) 500, which is a mistake, as this is *B. diandrus* Roth! Dr. Jarvis, BM, in litt.].

This species was introduced in Java by Buysman, but does not seem to have persisted.

INDEX TO COLLECTORS

Numbered and dated collections have been included. Specimens not seen, but of which the identity seemed certain, have been included with the identity number between brackets.

- Afriastini 1486: 1 — ANU 10954 (Hope): 7.
 Backer 9709, 13277, 13318: 8; 21589: 4; 36690: 1 — Brass & Meijer Drees 9825: 7 — van Breemen 59: 1 — Buwalda 7394: 1.
 Cinatti II-57: 3 — Clemens 29174, 30134, 30134-bis: 5.
 Docters van Leeuwen 11963: 1 — Docters van Leeuwen-Reijnvaan 13347: 4 — Dorgelo 452: 1.
 Eyma 2246: (2).
 Hochreutiner 355, 2607: (1) — Hope, see ANU-series.
 Klay 8/1919: 1 — Koorders 43457, 43519, 43568: 8.
 Mangen 1251: 7 — Merrill 4714 p.p.: 6.
 Smith, P.M. 554: 5 — van Steenis 4927, 6790: 4; 10936: (8); 11628: 4; 18380: 3; 18467: 9.
 Veldkamp 6228: 7.
 Wiriosapoetro 52: 4.