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RESEARCH ARTICLE

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A revision of *Garnotia* (*Gramineae*) in Malesia and Thailand

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Key words

history
Oman

Abstract The genus *Garnotia* (*Gramineae*) in Malesia and Thailand has eight taxa, one new, and with one new combination. *Garnotia tenella* also occurs in Oman. A nomenclatural history, key, descriptions, and notes are provided.

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INTRODUCTION

Garnotia Brongn. (*Gramineae*) has about 30 species ranging from the Seychelles and Oman through India to S China, Polynesia, and N Australia (Queensland). There are eight taxa in Malesia and Thailand.

It was first described and depicted by Brongniart (1832) based on *G. stricta* Brongn. from Tahiti. The genus was dedicated to Prosper Garnot (1794–1838), a medical officer of the French expedition of the *La Coquille* (1822–1825) who published on the zoological collections made (Levot 1856, in French; Backer 1936, in Dutch).

It was also described as *Miquelia* Arn. & Nees (1843 in Nees 1841), non Blume (June 1838, *Gesneriaceae*, nom. rej.), nec Meisn. (1838a, b, *Icacinaceae*, nom cons.), dedicated to Friedrich Anton Wilhelm Miquel (1811–1871, for a biography see Stafleu 1974) with 3 species from India: *M. barbulata*, *M. courtallensis*, and *M. emodii*. It was renamed therefore to *Berghausia* by Endlicher (1843) probably for Heinrich Karl Wilhelm Berghaus (1797–1884).

Its taxonomic position has much varied over the years with a tendency to panicoid affinities and especially with *Arundinella* Raddi.

1832 – Brongniart regarded it as similar to *Leptocoryphium* Nees and *Paspalum* L. (s.l.) of the *Paniceae* R.Br. Interestingly, he interpreted the spikelet as being biflorous where the lower glume was not developed and the lower floret reduced to the lemma and so resembling a glume, as is found in these panicoids.

1851 – Miquel described *Berghausia* in the very heterogeneous *Tristegineae* Nees. For a discussion on this tribe see Veldkamp (2014). The place of deposit of Miquel's material is not clear. It is not in U, could not be found in K from where he did loan specimens, and the specimens in E do not have his labels.

1854 – Steudel placed it above *Milium* L. which is now in the *Stipeae* Dumort.

1861, 1881 – Bentham placed it in the *Tristegineae* with *Arundinella*.

1883 – Bentham placed between *Limnas* Trin. (now in the *Aveneae* Dumort.) and *Arundinella* in the *Tristegineae*.

1887 – Hackel gave a better circumscription of the *Tristegineae*, but still included genera that are now considered to belong to several other (sub)tribes. He more or less followed Bentham (1883).

1896 – Hooker f. regarded the spikelet as uniflorous with two well-developed glumes, and so placed the genus, together with *Cyathopus* Stapf, in the *Agrostideae* Dumort. *Cyathopus* is now considered to be a member of the *Aveneae* (Clayton & Renvoize 1986: 140). It is a very obscure genus, known from a few collections, only (Bor 1960).

1913 – Ridley described *Muhlenbergia arundinella* ('*Muehlenbergia*') which turned out to be *Garnotia stricta* Brongn. var. *longiseta* Hack.

1936 – Hubbard revised the genera of the *Arundinelleae* without any mention of *Garnotia*.

1941 – Ohwi included it in the *Sporoboleae* Stapf, in his concept very heterogeneous, including also *Aristida* L, *Muhlenbergia* Schreb., and *Sphaerocaryum* Nees ex Steud. He regarded *G. acutigluma* (Steud.) Ohwi as a species distinct from *G. stricta*.

1943–1950 – Santos made a magnum opus in revising the genus. In 1950 he distinguished no less than 2 sections, 6 subsections, and 5 unranked groups with 73 species, 41 varieties and 23 formae. The infrageneric names are all invalidly published as they are only described in the English key and lack a Latin diagnosis or description, or have to be replaced by autonyms. They therefore have no types, hence the use of 'Type' here. He distinguished c. 40 taxa for Malesia.

His definitions for variety and form are in 1950: 138. Later authors, e.g. Gould (1972) have regarded this number as highly optimistic. Unfortunately, Santos could not study herbaria important to the flora of Malesia as BO, L, P, SING, and U.

He followed Hooker f. by placing the genus in the *Agrostideae*.

He pointed out epiphytism in e.g. *G. arborum* Stapf and *G. muricola* Santos, an occasional life form in some grasses; *G. arborum* var. *saxicola* Santos was found on rocks, a more usual habitat. Epiphytism was also noted for a collection from Oman. *Garnotia tenella* (Arn. ex Miq.) Janowski also may grow on trees.

Some species may be rheophytic, e.g. *G. stricta* var. *acutigluma* (Steud.) Veldk. (Van Steenis 1981, as *G. acutigluma*).

A copy of the 1950 publication with corrections by Santos himself is to be deposited in the main library of L.

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1953 – Jansen revised the Malesian species and distinguished 9 species, regarding *G. acutigluma* as distinct from *G. stricta*.
1954 – Pilger distinguished the *Garnotiinae* as a monotypic subtribe in the *Eragrosteae* Benth.
1957 – Conert made a study of the *Arundinelleae* and following Hubbard (1936) did not mention *Garnotia*.
1957 – Tateoka erected the monotypic *Garnotieae* next to the *Arundinelleae* Stapf in the *Arundoideae* Tateoka. The circumscription of the subfamily is very wide here and has later been much modified.
1958 – Tateoka reconsidered the taxonomic position and regarded both as panicoids, related by their leaf anatomy, but because of spikelet structure in two different subtribes.
1960 – Bor included it, together with *Cyathopus*, in the *Pooideae, Garnotieae*.
1972 – Gould published a revision of the genus reducing many of Santos's taxa. Like Santos he did not consult the important Malesian and Thai herbaria. Thus he missed the occurrence of the genus in Celebes, the Lesser Sunda Isles, and the Moluccas (1972: Map 1, 2) (Borneo mentioned on p. 543!) and reported only the new *G. thailandica* Gould for Thailand, thinking that *G. acutigluma* would be disjunct North and South of that country.
He concluded that it should be included in the *Panicoideae*. He divided the genus into two sections, *Garnotia* and *Scoparia*, the latter with 3 species in Sri Lanka and S India. Santos (1950) already had distinguished the latter as the subsect. *Scoparieae* Santos.
1979 – Prakash & Jain published a revision for India with 12 species.
1982 – Renvoize studied the leaf anatomy of *G. stricta* and pointed out similarities to the *Arundinelleae*. In fact he studied *Craven & Schodde 1336*, which is the var. *longiseta.*
1986 – Clayton & Renvoize placed it in the *Arundinelleae* as derived from *Arundinella* in the *Panicoideae* A.Br. They noted that "The tribe suffers from an overabundance of potentially significant generic characters which occur in a bewildering number of different combinations. Consequently there is considerable disagreement over generic limits, and a variety of alternative treatments may be found.".
1987 – Prendergast & Hattersley studied the leaf anatomy of Australian C_4 grasses and included *Garnotia* in the supertribe *Panicanae* L.Watson et al., but remarkably did not mention the C_4 type to which their only specimen (attributed to *G. stricta*) belonged.
1993 – Kellogg & Birchler and Kellogg & Watson found *Garnotia* nesting in the *Andropogoneae* Dumort. as sister to *Leptosaccharum* (Hack.) A.Camus and *Oxyrhachis* Pilg., members of what are generally regarded as different subtribes.
2001 – Nanakorn & Norsaengsri enumerated 5 species for Thailand, *G. patula* (Munro) Benth. being a new record.
2011 – Recent chemical / molecular research has been summarised by Teerawatananon et al. (2011). They concluded that *Arundinella* and *Garnotia* were best regarded as members of the monotypic subtribes *Arundinellinae* (Stapf) Honda and *Garnotiinae*, the first sister to and the second nested within the *Andropogoneae* Dumort. This position would support Brongniart's idea that the first glume was lost and that the apparently second glume is an empty lemma.

GARNOTIA

Garnotia Brongn. (1831) t. 21, (1832) 133; Santos (1944) 85; (1950) 3; Gould (1972) 515. — *Garnotia* Brongn. sect. *Erectae* Santos (1950) 25, nom. inval. — *Garnotia* Brongn. subsect. *Muticae* Santos (1950) 25, 27, nom. inval. — Type: *Garnotia stricta* Brongn.
Miquelia Arn. & Nees in Nees (1841) 45; (1843: 177), non Blume (June 1838, nom. rej.), nec Meisn. (Sept. 1838, nom. cons.). — *Berghausia* Endl. (1843) 57. — Lectotype: *Miquelia courtallensis* Arn. & Nees [= *Berghausia courtallensis* (Arn. & Nees) Endl. = *Garnotia courtallensis* (Arn. & Nees) Thwaites], designated by Santos (1950: 23).
Garnotia Brongn. subsect. *Longiaristatae* Santos (1950) 25, 27, nom. inval. — 'Type': *Garnotia longiaristata* Santos.
Garnotia Brongn. sect. *Deflexae* Santos (1950) 26, nom. inval. — Type: Not indicated.
Garnotia Brongn. subsect. *Asiaticae* Santos (1950) 26, 37, nom. inval. — *Garnotia* Brongn. rankless *Scabridae* Santos (1950) 26, 39, nom. inval. — 'Type': *Garnotia asiatica* Santos.
Garnotia Brongn. subsect. *Zelanicae* Santos (1950) 26, 37, nom. inval. — 'Type': *Garnotia zelanica* Santos.
Garnotia Brongn. subsect. *Geniculatae* Santos (1950) 27, 46, nom. inval. — 'Type': *Garnotia geniculata* Santos.
Garnotia Brongn. subsect. *Scopariae* Santos (1950) 27, 46, nom. inval. — *Garnotia* Brongn. sect. *Scoparia* Gould (1972) 555. — 'Type': *Garnotia scoparia* Thwaites.
Garnotia Brongn. rankless *Flexuosae* Santos (1950) 25, nom. inval. — 'Type': *Garnotia flexuosa* Santos.
Garnotia Brongn. rankless *Patulae* Santos (1950) 25, nom. inval. — 'Type': *Garnotia patula* (Munro) Benth.
Garnotia Brongn. rankless *Tortuosae* Santos (1950) 25, nom. inval. — 'Type': *Garnotia tortuosa* Santos.
Garnotia Brongn. rankless *Laeves* Santos (1950) 26, 44, nom. inval. — 'Type': *Garnotia laevis* Santos.

Ligule a membranous collar. Inflorescence paniculate, axes spicate, ending in spikelets, persistent. *Spikelets* pedicellate, paired (or ternate), falling with the glumes, 1-flowered, callus usually puberulous, rachilla process absent. At least one glume as long as the spikelet, 3-nerved. Lemmas not indurated, glabrous, 1–3-nerved, muticous or awned from the sometimes bilobed apex. Stamens 3. Styles free to base, exserted laterally. Hilum punctiform. x = 10, ? 16.

Distribution — Approximately 30 spp from Oman (see under *G. tenella*), the Seychelles, India to Hawaii, eight taxa in Malesia, six in Thailand.

Anatomy — Kranz MS.

Karyology — 2n = usually 20 (Gould 1972: 519; Rice et al. 2014), but for '*G. stricta*' from India there are reports of 20+0–2B, 30 (Rice et al. 2014), 38 (Muniyama & Narayan 1975), 40 (Sindhe & Narayan 1976), n = 20+1B (Mehra & Sood 1974), 30 (Mehra & Sharma 1975). 2n = 32 was counted for *G. tenella* (Arn. ex Miq.) Janowski by Gosavi & Yadav (2011).

Notes — For the species of sect. *Garnotia* to which the Thai and Malesian taxa belong it is stated by Bor (1960) followed by Prakash & Jain (1979) and Sunil et al. (2014) that the leaves would articulate between sheath and blade, but we have only seen this occasionally in *G. spadicea* Ohwi.

Muticous and awned lemmas may occur within the same species, e.g. *G. courtallensis* (Arn. & Nees) Thwaites and *G. micrantha* Thwaites (both awned, but sometimes with muticous lemmas in the same inflorescence) and var. *nana* Stapf (muticous), *G. patula* (Munro) Benth. var. *patula* and var. *mutica*, *G. stricta* Brongn. var. *stricta* (muticous) and the awned var. *acutigluma* (Steud.) Veldk. and var. *longiseta* Hack., etc. Hooker f. (1896) already had awned, with or without a tortuous column (!), and muticous specimens within his concept of *G. stricta* which is perhaps one reason for the misapplication of the specific combination to a diverse range of taxa in Asia.

KEY TO THE TAXA

1. Lemma awn present 2
1. Lemma awn absent. — Culms erect, 0.4–1 m long. Blades 8–30 cm long. Panicle 9–28 cm long. Spikelets 3.5–5 mm long. Celebes, New Guinea . . . . . 3a. *G. stricta* var. *stricta*
2. Lemma awn column present 3
2. Lemma awn column absent 4

3. Culms 0.15–0.9 m long. Blades (3–)5–18 cm long. Panicle 5–34 cm long. First glume subequal to the second glume. — Widespread in Thailand, W Malesia . . . . . 4. *G. tenella*
3. Culms 1–1.5 m long. Blades 20–40 cm long. Panicle 40–80 cm long. First glume shorter than the second glume. — Peninsular Thailand (Trang) . . . . . 5. *G. thailandica*
4. Lemma arista thread-like, wavy , crinkly, or even distally looped 5
4. Lemma arista more or less straight 6
5. Culms simple or branched at base. Ligules 0.2–0.5 mm long. Blades 6–40 cm long, base truncate to narrowly attenuate. Panicle 20–40 cm long, common axis longer than the lowest branches, branches at maturity appressed, erecto-patent, stiffly spreading, scaberulous. Callus hairs 0–0.5 mm long. Anthers 1–1.2 mm long. — Widespread in Malesia . . . . . 3c. *G. stricta* var. *longiseta*
5. Culms branched along the culm. Ligules 0.5–1 mm long. Blades 3–6 cm long, base abruptly narrowed. Panicle 8–10 cm long, common axis shorter than the lowest branches, branches at maturity patent, undulate, smooth. Callus hairs 0.5–0.9 mm long. Anthers c. 0.7 mm long. — N Sumatra (Samosir Isl.) . . . . . 6. *G. undulata*
6. Panicle branches at maturity appressed to erecto-patent 7
6. Panicle branches at maturity reflexed. — Culms erect, simple or branched at base. Blades 15–60 cm long. Panicle branches scaberulous. Spikelets 3–6.3 mm long. North-eastern Thailand (Loei), Malay Peninsula (Pahang) . . . . . 1. *G. patula*
7. Blades 4–9 mm wide. Spikelets 5–6 mm long (excl. awn). Lemma arista 2.5–8 mm long. — N Sumatra (Leuser Mts) . . . . . 2. *G. spadicea*
7. Blades 1.7–5.5 mm wide. Spikelets 3–4.25(–5.5) mm long (excl. awn). Lemma arista 8–15 mm long. — Widespread in Thailand, Malesia (not in New Guinea) . . . . . 3b. *G. stricta* var. *acutigluma*

1. *Garnotia patula* (Munro) Benth.

Garnotia patula (Munro) Benth. (1861) 416. — *Berghausia patula* Munro (1860) 362. — Type: *Wright s.n.* (holo A; K).
For more synonyms see Gould (1972: 545).

a. var. *patula*

Plants perennial. *Culms* erect, simple to branched at base, 0.6–1.65 m long. *Nodes* puberulous to pilose. *Sheath mouth* glabrous to densely hairy. *Ligule* 0.3–0.5 mm long. *Blades* linear, flat, 15–29(–60) cm by 4–15 mm, glabrous to pilose, sometimes with bulbous-based hairs, base narrowly attenuate. *Panicle* 20–45(–60) cm long, common axis longer than the lowest branches, branches solitary or fascicled, at maturity to stiffly reflexed, scaberulous. *Spikelets* 3–6.3 mm long (excl. awn), callus hairs 0.2–1.2 mm long. First glume 3–6.3 mm long, shorter than to subequal to the second glume, obtuse to mucronate. Second glume 3–6.3 mm long, apex acute to aristate, arista 0–8 mm long. Lemma awn apical, imperfect, column absent, arista straight, 6–12(–17) mm long. *Anthers* 1.2–2 mm long.

Distribution — Thailand (North-eastern: Loei), Malay Peninsula (Pahang); N Vietnam, S China (Fujian, Guangdong, Guangxi, Hainan).

Habitat — Along streams, rocky cliffs, sandy soil, borders of woods, oak forest, 0–1500 m altitude.

Notes — The occurrence in Thailand is an extension of the known range.

There is a muticous form, var. *mutica* (Munro) Rendle, that has been reported for Burma, N Vietnam and S China, but has not yet been seen in Thailand.

2. *Garnotia spadicea* Ohwi

Garnotia spadicea Ohwi (1947) 9. — Type: *Van Steenis 8479*, p.p. (holo BO, L, fragm.; K 000290153).

Plants perennial. *Culms* stiffly erect, branched at base and along the culm, 0.2–0.75 m long. *Nodes* glabrous to puberulous. *Sheath mouth* sparsely to densely hairy. *Ligule* 0.3–0.8 mm long. *Blades* linear, flat to folded, 9–17 cm by 4–9 mm, glabrous to pilose, base narrowly attenuate. *Panicle* 5–11.5 cm long, common axis longer than the lowest branches, branches fascicled, at maturity appressed, smooth. *Spikelets* 5–6 mm long (excl. awn), callus hairs 0.7–1 mm long. First glume 5–6 mm long, subequal to the second glume, acuminate to mucronate. Second glume 5–6 mm long, apex acuminate to mucronate, arista 0–2 mm long. Lemma awn apical, imperfect, column absent, arista straight, 2.5–8 mm long. *Anthers* 1.5–2 mm long.

Distribution — Sumatra, Aceh (Leuser).

Habitat — Locally not rare in open grasslands, heaths, edge of thicket, 2200–2800 m altitude.

Collector's notes — Small, dense to loose tussocks, stiff, brittle herb. Grey hairy. Inflorescence purplish greenish.

Note — The leaves in several collections are blackish suggestive of fire. The lemmas conspicuously castaneous, hence the epithet.

3. *Garnotia stricta* Brongn.

Garnotia stricta Brongn. (1831) t. 21; (1832) 133. — Type: *Dumont d'Urville s.n.* (holo P 00698468; iso P 000698400, 000698469, 000698470, ? P000698471), designated here.

a. var. *stricta*

Garnotia philippinensis Santos (1944) 94, t. 1. — Type: *BS 42963 (Ramos)* (holo US; K, PNH lost, UC).
Garnotia philippinensis Santos var. *celebica* Jansen, ined. — Voucher: *Kjellberg 3024* (BO).

Plants perennial. *Culms* erect to erect and geniculate at base, simple to branched at base, (0.1–)0.4–1 m long. *Nodes* glabrous to pilose. *Sheath mouth* glabrous to densely hairy. *Ligule* 0.2–0.5 mm long. *Blades* linear, flat to folded or involute, 8–30 cm by 3–16 mm, glabrous to pilose, base rounded to cuneate. *Panicle* 9–28 cm long, common axis longer than the lowest branches, branches fascicled, at maturity appressed, smooth to scaberulous. *Spikelets* 3.5–5.5 mm long, callus glabrous or puberulous, hairs 0–1.7 mm long. First glume 3.5–5.5 mm long, subequal to longer than the second glume, acute to aristate; second glume 3.5–5 mm long, apex acute to aristate, arista 0–3 mm long. Lemma awn absent. *Anthers* c. 1 mm long.

Distribution — Malesia: SW Celebes (Toraja), Kabaëna, New Guinea (Irian Jaya: Triton Bay; Papua New Guinea: Central Prov.), Pacific: Guam, Palau, Raiatea, Tahiti. Records for elsewhere in Asia are misidentifications.

Habitat — Grassy slopes, seepage area in savannah, 0–1600 m altitude.

Collector's notes — Perennial, culms geniculate, rooting. Leaves pale yellow. Panicle greenish yellow, often violet.

Uses — Attractive to horses.

Notes — A statistical analysis, except for the presence of a lemmatal awn and distribution, showed no significant differences between *G. stricta* var. *acutigluma* and *G. stricta* var. *stricta*.

Garnotia philippinensis was included in *G. stricta* var. *stricta* by Gould (1972: 551), who said "non *G. philippinensis* Stapf (1896)". Although clearly a *lapsus calami* for *Garnotiella philippinensis* Stapf = *Asthenochloa tenera* Buse, *Garnotia philippinensis* Stapf ex Gould (1972) 559 is a valid combination but a later homonym of Santos (1944).

b. var. ***acutigluma*** (Steud.) Veldk., *comb. nov.*

Garnotia acutigluma (Steud.) Ohwi var. *acutigluma*, automatically generated by Santos (1950: 84–85; the typical form not mentioned by name). See note. — *Urachne acutigluma* Steud. (1854) 121. — *Garnotia acutigluma* (Steud.) Ohwi (1941) 393. — Type: *Goering II, 141* (holo P; US fragm.) (from Java, not Japan).
Streptachne indica Buse (1856) 99. — Type: *Reinwardt Aº. 1818* (holo L, no. 908.97-1375), designated here.
Garnotia adscendens Munro ex Ridl. & H.J.P. Winkl. (1910) 522 ('*ascendens*'), nom. nud. — Voucher: *Winkler 3036* (W lost?; BM, BO, L, WRSL).
Garnotia caespitosa Santos (1944) 92. — Type: *BS 6237 (Gates)* (holo US; BM, K 000290161, NY, PNH lost).
Garnotia caespitosa Santos var. *longiuscula* Santos (1950) 67. — Type: *BS 34069 (Ramos & Edaño)* (holo UC; A, PNH lost).
Garnotia caespitosa Santos forma *permucronata* Santos (1950) 67. — Type: *BS 36776 (Ramos & Edaño)* (holo US; K 000943326, PNH lost).
Garnotia caespitosa Santos var. *emarginata* Santos (1950) 68. — Type: *BS 47127 (Ramos & Edaño)* (holo US; BM, NY, PNH lost, UC).
Garnotia caespitosa Santos forma *amboinensis* Santos (1950) 68. — Type: *BS 1649 (Robinson)* (holo US; PNH lost).
Garnotia longiaristata Santos (1950) 70. — *Garnotia acutigluma* (Steud.) Ohwi var. *longiaristata* Jansen (1953) 382. — Type: *Endert 2645* (holo US; BO, K, L).
Garnotia longiaristata Santos var. *basilanensis* Santos (1950) 71. — Type: *Ebalo 907* (holo MICH).
Garnotia erecta Santos (1950) 73. — Type: *SF 13854 (Robinson)* (holo K 000290154; BM, PNH lost, SING).
Garnotia erecta Santos forma *malayana* Santos (1950) 74. — Type: *SF 23465 (Henderson)* (holo US; SING).
Garnotia acutigluma (Steud.) Ohwi var. *aberrans* Santos (1950) 84. — Type: *Backer 22768* (holo US; BO, L, SING, U).
Garnotia acutigluma (Steud.) Ohwi var. *subvestita* Santos (1950) 84. — Type: *Bakhuizen v.d. Brink 3683* (holo US; BO, K, L, U).
Garnotia acutigluma (Steud.) Ohwi var. *ambigua* Santos (1950) 85. — Type: *Backer 22401* (holo US; BO, K 000943327, L, U, US).
Garnotia acutigluma (Steud.) Ohwi forma *abbreviata* Santos (1950) 85. — Type: *Backer 25632* (holo US; BO, K, L, U).
Garnotia acutigluma (Steud.) Ohwi forma *partiens* Santos (1950) 85. — Type: *Winckel 1404* ('*14043*') (holo US; BO, L, U).
Garnotia griffithii Munro (1865) 58, nomen; Hook.f. (1896) 243, in syn. — Voucher: *Griffith KD 6780* (K, L).
Garnotia stricta auct. non Brongn.

Plants perennial. *Culms* erect to decumbent, branched at base to branched along the culm, 0.2–0.85 m long. *Nodes* glabrous to pilose. *Sheath mouth* glabrous to sparsely hairy. *Ligule* 0.1–0.5(–1.75) mm long. *Blades* linear, flat to folded, 3.5–29(–40) cm by 1.7–6(–12) mm, glabrous to pilose (sparsely), base narrowly attenuate. *Panicle* 5–20(–35) cm long, common axis longer than the lowest branches, branches solitary to fascicled, at maturity appressed to erecto-patent, smooth to scaberulous. *Spikelets* 3–4.5(–5.5) mm long (excl. awn), callus hairs 0.2–0.7(–1) mm long. First glume 2.5–4.5(–5.5) mm long, shorter than to longer than the second glume, acute to mucronate. Second glume 2.5–4.25(–5) mm long, apex acute to mucronate, arista 0–1(–4) mm long. Lemma awn apical, imperfect, column absent, arista straight, 8–15 mm long. *Anthers* 1–1.8 mm long.

Distribution — Nepal, Sikkim, Bhutan, NE India (Assam) to S China (Guangdong, Guangxi, Guizhou, Yunnan), Taiwan; Thailand: Northern: Chiang Mai; North-eastern: Loei, Nakhon Phanom; South-eastern: Prachinburi; Penins.: Nakhon Sritamarat, Trang; Malesia: Malay Peninsula (Kedah, Pahang, Perak), Sumatra (Padang), W Java (Bantam, Bogor, Jakarta, Preanger), Central (Banyumas), Lesser Sunda Isl.: ? Bali, Flores, Sumbawa, Borneo (Brunei, SE Kalimantan, Sabah, Sarawak), Celebes (SW; Talaud Isl.), Philippines (Basilan, Luzon, Mindanao), Moluccas (Ceram, Ternate). Probably introduced and naturalised in Hawai'i.

Habitat — Local, but then sometimes vegetation forming. A facultative rheophyte on boulders, sandstone rocks, also in marshy places, open grassland, evergreen forest, bamboo forest, 15–1300 m altitude.

Collector's notes — Inflorescences pale green to green.

Notes — An autonym is generated by the description of a taxon not including the type of the specific name, even when it is not mentioned in the original text. When they are united, as here, the non-published autonym has priority (Art. 6.8, 7.6, 26.1; McNeill et al. 2012). Santos under the description of presumably the typical form, diagnosed the 5 varieties and formae as "similis formae typicae a qua differt…".

The only collection seen from Sumatra (*Meijer 6038*, L) is exceptional for being taller than the others, with longer leaves and spikelets.

c. var. ***longiseta*** Hack.

Garnotia stricta Brongn. var. *longiseta* Hack. (1909a) 141; (1909b) no. 744. — *Garnotia mindanaensis* Santos var. *longiseta* Santos (1950) 98. — *Garnotia acutigluma* (Steud.) Ohwi var. *longiseta* (Hack.) V.Prakash & S.K.Jain (1979) 6. — Type: *Merrill in Kneucker Gram. Exsicc. 744* (holo W; B, BM, E, G, K, L, UC, US, WAG).
Garnotia stricta Brongn. var. *adscendens* Hack. (1909a) 141; (1909b) no. 744. — Lectotype: *Hook. f. & Thomson s.n.* (holo K; GOET, U), designated here (see note).
Muhlenbergia arundinella Ridl. (1913) 267 ('*Muehlenbergia*'). — Lectotype: *Boden Kloss s.n., Camp 6a* (holo BM; K), designated here.
Garnotia ledermannii Pilg. (1914) 171. — Type: *Ledermann 12521* (holo B lost).
Garnotia mezii Janowski (1921) 86. — Lectotype: *Schlechter 19542* (B lost, US fragm.; A, K, UC), designated by Gould (1972: 552).
Garnotia papuana Ohwi (1942) 1. — *Garnotia mezii* Janowski var. *papuana* (Ohwi) Santos (1950) 92. — Type: *Kanehira & Hatusima 13092* (holo FU; A, BO, US fragm. in K).
Garnotia mindanaensis Santos (1943) 135, t. 1. — Type: *Bartlett 17235* (holo MICH; US).
Garnotia mezii Janowski var. *maculata* Santos (1950) 92. — Type: *Carr 12395* (holo NY; BM, K 000943324, KEP, L, US).
Garnotia mezii Janowski var. *clemensiana* Santos (1950) 93. — Type: *Clemens 4878* (holo US; A, K).
Garnotia mezii Janowski var. *longiramosa* Santos (1950) 93. — Type: *McGregor 74* (holo US).
Garnotia mindanaensis Santos forma *volcanicola* Santos (1950) 98. — Type: *BS 75748 (Ramos & Edaño)* (holo NY; K, PNH lost).
Garnotia mindanaensis Santos var. *ramosii* Santos (1950) 99. — Type: *BS 13983 (Ramos)* (holo US; BM, K 0009433325, PNH lost).
Garnotia stricta auct. non Brongn.

Plants perennial. *Culms* erect to erect and geniculate at base, simple to branched along the culm, 0.4–1 m long. *Nodes* glabrous, puberulous, or pilose. *Sheath mouth* glabrous to densely hairy. *Ligule* 0.2–0.5 mm long. *Blades* linear, flat to folded, 4–40 cm by 2–18 mm, glabrous to pilose with bulbous-based hairs, base truncate to narrowly attenuate. *Panicle* (10–)20–40 cm long, common axis longer than the lowest branches, solitary to in whorls, at maturity appressed to spreading, scaberulous. *Spikelets* 2.5–5 mm long (excl. awn), callus hairs 0–0.5 mm long. First glume 2.5–5 mm long, shorter than to longer than the second glume, emarginate to mucronate. Second glume 2.5–5 mm long, apex acute to mucronate, arista 0–0.8 mm long. Lemma awn imperfect, column absent, arista thread-like, wavy, crinkly, or even looped, 6–15 mm long. *Anthers* 1–1.5 mm long.

Distribution — Malesia: N Sumatra (Aceh, see note), Celebes (Minahassa, Makassar), Moluccas (Ambon, Ceram, Halmahera), Philippines (Bohol, Leyte, Luzon, Mindanao, Visayan Isl.),

New Guinea (Aru Isl.; widespread on the mainland; Bismarck Arch.), Australia (N Queensland).

Habitat — Primary forest, on rocks, abandoned fields, grasslands, road sides, shaded forest, etc. 0–3200 m altitude. It would seem to be a facultative rheophyte.

Collector's notes — Growing in tussocks, culms leaning. Panicles narrow, more or less pendant, green, purplish green, purple. Anthers purple.

Notes — *Garnotia ledermanii* is only known from the type collection, apparently lost in Berlin, for no material has been seen by later authors. Santos (1950: 37) included it in his unranked *Patulae* Santos together with *C. patula* (Munro) Benth. We agree from the description with Gould (1972: 554) that it probably is a depauperate *G. stricta* var. *longiseta*.

On the same Kneucker sheet (and in the publication) the combination *Garnotia stricta* var. *adscendens* [Griseb.] Hack. was made based on *G. adscendens* [Munro] Griseb. (1868) 80, nom. nud. (based on *Berghausia adscendens* Munro (1865) 58 and *G. stricta* sensu Hook.f. (1896) 243: "quae differt arista inferne geniculata sub geniculo torta, foliis lateriobus". Both names were not mentioned by Santos (1950), Bor (1960), or Chase & Niles (1962). Vouchers for *Garnotia stricta* var. *breviaristata* Stapf ex Hook.f. (incl. *B. adscendens* Munro var. *breviaristata* Munro and *G. adscendens* Munro var. *breviaristata: Griffith 6783, Helfer s.n.*, Tenasserim, resp.) are in K and belong to *G. tenella*.

Setulose glumes occur occasionally, e.g. in *Wisse 69* from the Minahassa (BO, WAG).

4. *Garnotia tenella* (Arn. ex Miq.) Janowski

Garnotia tenella (Arn. ex Miq.) Janowski (1921) 86. — *Berghausia tenella* Arn. ex Miq. (1851) 34. — Type: *Wight Cat. 2599 = Wight Penins. Ind. Or. 3244a* (holo E).
Garnotia adscendens Munro var. *breviaristata* Munro (1865) 58, nomen. — *Garnotia stricta* Brongn. var. *breviaristata* Stapf ex Hook.f. (1896) 243. — Lectotype: *Griffith 6783* (K), designated here.
Garnotia ciliata Merr. (1918) 130. — Type: *Merrill 10701* (PNH lost; iso CAS, G, NY, UC, US).
Garnotia ciliata Merr. var. *conduplicata* Santos (1944) 89. — *Garnotia conduplicata* (Santos) Santos (1950) 134. — Type: *Hitchcock 19009½* (holo US 1106724; F).
Garnotia fragilis Santos (1944) 89. — Type: *Pételot 4745* (holo US 16100035, K 000943330, fragm.; NY, P).
Garnotia brevifolia Ohwi (1947) 9. — *Garnotia fragilis* Santos var. *brevifolia* Santos (1950) 132. — Type: *Bakhuizen v.d. Brink 4687* (holo BO; K 000290157, 000290169, L, US fragm.; B, PNH lost).
Garnotia nitens Santos (1950) 127. — Type: *Kerr 9956* (holo US; BM, K 000943328, 000943329, SING, UC).
Garnotia fragilis Santos var. *parcitorta* Santos (1950) 132. — Type: *SF 628* ('*638*') *(Haniff)* (holo K 000290156, '*paucitorta*'; SING).
Garnotia pahangensis Santos (1950) 133. — Type: *Seimund 435* (holo K 000290155; SING).
Garnotia ciliata Merr. forma *latifolia* Santos (1950) 134. — Type: *Hitchcock 19009-A* (holo US 1106725, fragm. in K).
Garnotia ciliata Merr. forma *paupercula* Santos (1950) 134. — Type: *CCC 2968 (Levine & McClure)* (holo US 1625596).
Garnotia ciliata Merr. forma *glabriuscula* Santos (1950) 135. — Type: *Hitchcock 19009-B* (holo UC 279296).
Berghausia adscendens Munro, ined.
Garnotia patula auct. non (Munro) Benth.
Garnotia stricta auct. non Brongn.
For a more extensive synonymy see Gould (1972: 528–529).

Plants perennial, sometimes annual. *Culms* erect to decumbent and rooting in the nodes, branched at base and along the culm, 0.15–0.75(–0.9) m long. *Nodes* glabrous to pilose. *Sheath mouth* glabrous to sparsely hairy. *Ligule* 0.3–0.5(–1.5) mm long. *Blades* linear, flat, (3–)5–18 cm by 3–17 mm, glabrous to pilose, sometimes with bulbous-based hairs, base rounded to narrowly attenuate. *Panicle* (5–)8–34 cm long, common axis longer than the lowest branches, branches fascicled, sometimes solitary, at maturity appressed to erecto-patent, smooth or scaberulous. *Spikelets* (2–)3–4.3(–6.5) mm long (excl. awn), callus puberulous, sometimes glabrous, callus hairs 0–0.7 mm long. *Glumes* subequal, (2–)3–4.3(–6.5) mm long, acute to aristate, arista 0–5 mm long. Lemma awn apical, perfect, geniculate well above the base, column twisted, 0.5–3 mm long. Lemma arista 4–12 mm long. *Anthers* 0.4–1.2 mm long.

Distribution — Oman (see note), Nepal, Bhutan, Sikkim, India (widespread), Burma, to S China (Guangdong, Yunnan). Thailand: Northern: Chiang Mai, Chiang Rai, Lampang, Phitsanulok, Tak; North-eastern: Loei; Eastern: Nakhon Ratchasima (Korat); South-western: Kanchanaburi, Ratchaburi; Central: Bangkok, Nakhon Nayok; Eastern: Trat; Peninsular: Nakhon Si Thammarat, Phangnga, Phattalung, Trang; South-eastern: Trat; Malesia: Malay Peninsula (Kedah, Pahang, fide Turner 1997), Sumatra, Java, Lesser Sunda Isl. (Sumbawa).

Habitat — Along path in humid deciduous forest, mixed evergreen / pine forest, forest with much bamboo, fire prone areas, along streams, ditches, waterfalls, on tree trunks, rocks, 400–2300 m altitude.

Collector's notes — Annual. Rhizomes present. Culms tufted, glossy pale green, often with brownish or reddish hue. Leaves dull, pale to dark green above, paler green underneath. Inflorescence axes green. Glumes pale green, straw coloured, with green nerves. Lemmas, paleas white. Awns brownish in lower 1/3–1/2, upper part white. Filaments white. Anthers dark violet. Ovary white. Styles, stigmas dark violet.

Notes — It might be argued that Miquel did not really accept *B. tenella* as a distinct species, and so the combination is invalid: "vix tamen sufficienti characterum valore genuina species consenda". Yet, he gave a fairly extensive description and we accept it here as validly described.

We have the impression that this is a facultative rheophyte forming more or less well-developed tufts, which may give the impression of the plants being annual.

Apparently very rare in Malesia and known from single collections, only: Sumatra (West Sumatra, Payakumbu, *Meijer 7428*, L) with glumes and lemmas with exceptionally long aristas, Java from the Preanger, Wanayasa, on the slopes of Gn. Burangrang (*Bakhuizen v.d. Brink 4687*, BO, K, L, US), and Sumbawa (N.W. slope of the G. Batulanteh, *Kostermans 18528*, A, BO, K, L).

Much overlooked is the occurrence on the Jebel Qamar, Dhafur Prov., Oman (Cope 2007, as *G. stricta*). We have seen specimens or photographs of *Cope 694* (K), *McLeish 2860* (K), *Miller & Nyberg 9241* (E, K)*, 9264-B* (E, K)*, 9309-A* (E, K). The plants are quite young and smaller than seen elsewhere, suggesting annuals that started flowering early. They have a perfect awn, although often with an inconspicuous and barely notably tortuous column, while in *9264-B* the arista is hair-like and wavy to curled as in *G. stricta* var. *longiseta*.

The vegetation in which they were found is the *Hybantho durae-Anogeissetum dhofaricae* association, a deciduous monsoon forest community found only in the Dhofar region of Southwestern Oman and the Al-Mahra region of Southeast Yemen. Because the plants were found in five different places in September 1989 and October 1993 at altitudes between 700 and 1000 m, it seems to us that they represent a native, not introduced taxon and that this is a Western, very disjunct outlier of the genus.

Garnotia ciliata was previously only known from Loh Fau Mountain, Guangdong, S China, but mentioned by Teerawatananon (2009) for Chiang Mai. Analyses with DELTA (Dallwitz et al. 1993) found no differences with the widespread *G. tenella*, which solves the 'disjunction'.

Fig. 1 *Garnotia undulata* Veldk. a. Habit; b. partial panicle branch; c. spikelet; d. lower glume; e. upper glume; f. caryopsis; g. lemma (*Veldkamp 7175*, L). — Drawn by A. Walsmit Sachs.

The types of *G. ciliata* Merr., G. *conduplicata* (Santos) Santos, var. *glabriuscula* Santos, forma *latifolia* Santos, and forma *paupercula* Santos were all collected on the same mountain, sometimes even on the same date. Glabrous and setulose glumes also occur in *G. stricta* var. *longiseta*. It is remarkable that Santos for these sole four collections distinguished five different taxa!

5. *Garnotia thailandica* Gould

Garnotia thailandica Gould (1972) 533, t. 2. — Type: *Kerr 19197* (holo K 000290151; iso BK, BM, K 000290150, 000290152), designated here following Gould's notes.

Plants base and thus lifeform unknown. *Culms* stiffly erect, branched, 1–1.5 m long (or more). *Nodes* puberulous. *Sheath mouth* sparsely hairy. *Ligule* 0.3–1 mm long. *Blades* linear, flat, 20–40 cm by 10–20 mm, pilose and with bulbous-based hairs, base narrowly attenuate. *Panicle* 40–80 cm long, common axis longer than the lowest branches, branches fascicled, at maturity erecto-patent, smooth to scaberulous. *Spikelets* 4.6–6 mm long (excl. awn), callus hairs 0.2–0.6 mm long. First glume 4.6–6 mm long, shorter than the second glume, aristate. Second glume 4.6–6 mm long, apex aristate, arista 1–7 mm long. Lemma awn perfect, geniculate well above the base, column twisted, 2–3 mm long, arista 10–15 mm long. *Anthers* 1.2–1.5 mm long.

Distribution — Thailand, Pen.: Trang, Kao Soi Dao, only known from the type.

Habitat — Open patch in evergreen forest, c. 800 m altitude (Gould misread the 'c. 800 m' as '1,800 m').

Note — Gould suggested that this might be a giant *G. tenella*, but overall it is more similar to *G. patula* (Munro) Benth.

6. *Garnotia undulata* Veldk., *sp. nov*. — Fig. 1

Plants perennial. *Culms* erect, geniculate at base and rooting in the decumbent nodes, branched along the culm, c. 0.5 m long. *Nodes* puberulous. *Sheath mouth* densely hairy. *Ligule* 0.5–1 mm long. *Blades* linear, flat, 3–6 cm by 4.5–6.5 mm, glabrous, base abruptly narrowed. *Panicle* 8–10 cm long, common axis shorter than the lowest branches, branches solitary, at maturity patent, smooth. *Spikelets* 4–4.5 mm long (excl. awn), callus hairs 0.5–0.9 mm long. First glume 4–4.5 mm long, subequal to longer than the second glume, acuminate. Second glume 3.75–4 mm long, apex acuminate to mucronate, arista 0–0.5 mm long. Lemma awn apical, imperfect, column absent, arista thread-like, wavy to crinkly, 11–15 mm long. *Anthers* c. 0.7 mm long. — Type: *Veldkamp 7175* (holo L; BO).

Distribution — Only known from the type from Sumatra, East Coast, Samosir Isl.

Habitat — Secondary forest along trail near rivulet, c. 950 m altitude.

Notes — Gould (1972: 427) accounted for only 4 taxa with curly, fine awns which range from Celebes to N Australia and into the Pacific. The collection West of the Wallace Line (*Veldkamp 7175*, BO, L) from Samosir Isl. in N Sumatra is highly aberrant for its fairly weak habit, basally geniculate culms, rooting at the decumbent nodes, short leaves, and inflorescences with a short common axis and wavy, more or less patent branches that gives a first impression of an *Arthraxon* P.Beauv.

In some specimens of *G. tenella* from Oman the arista is wavy to curled and even looped as well.

EXCLUDED NAMES (NOT MALESIAN OR THAI)

Garnotia africana Janowski (1921) 86. — Type: *Chevalier s.n.* (holo in Königsberg, now Kaliningrad, KLGU, destroyed), B (destroyed, Dr. H. Scholz, in litt.), holo, lost; iso probably in P, not found).
= *Panicum anabaptistum* Steud.

Garnotia barbulata (Nees) Merr. (1918) 130; Janowski (1921) 86, isonym. — *Miquelia barbulata* Nees (1843 in Nees 1841) 177–178. — *Berghausia barbulata* (Nees) Endl. ex Miq. (1851) 32. — Type: *Meyen s.n.* (holo B lost; iso perhaps in BM, BR, CAS, CGE, K, KIEL, LE; Gould for some reason suggested BONN, 'probably destroyed').
= *Arundinella setosa* Trin.

Garnotia japonica Hack. (1902) 55. — Type: *Faurie 4483* (holo W, US fragm.; P).
= *Phaenosperma globosum* Munro.

Garnotia philippinensis Stapf ex Gould (1972: 551, 559) is a *lapsus calami* for *Garnotiella philippinensis* Stapf (1896) t. 2494, yet it is valid, but a later homonym of Santos (1944). — Type: *Vidal 3994* (holo K), Philippines, Panay, Niagas.
= *Asthenochloa tenera* Buse.

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INDEX TO MALESIAN AND THAI SPECIMENS

acu = *Garnotia stricta* var. *acutigluma*
ere = *Garnotia erecta*
lon = *Garnotia stricta* var. *longiseta*
pat = *Garnotia patula*
spa = *Garnotia spadicea*
str = *Garnotia stricta* var. *stricta*
ten = *Garnotia tenella*
tha = *Garnotia thailandica*
und = *Garnotia undulata*

Aet & Idjan 893: lon (BO, K, L) – Argent et al. 9148: acu (K).
Backer 20985: acu (BO, L); 22401 (T): acu (BO, K, L, U, US); 22768 (T): acu (BO, K, L, US); 25563: acu (BO); 25632 (T): acu (BO, K, L, U, US); 25718: acu (BO); 26429: acu (BO) – Bakhuizen v.d. Brink 492: acu (BO); 696 (sterile = cult. sub 492): acu (BO); 860: acu (BO, U); 1665: acu (BO); 2081: acu (BO); 3683 (T): acu (BO, K, L, U, US; PNH lost); 4193: acu (BO); 4687 (T): ten (BO, K, L, US; B, PNH lost); 5188: acu (BO, K, L, U) – Bartlett 17235 (T): lon (K, MICH, US) – Bauma ANG 2: lon (L) – Beguin 713: acu (BO) – Bergman 718: lon (L) – Boden Kloss s.n., Camp 3 (T): lon (K); Camp 6a (T): acu (K); Camp 6a (T): lon (K); Camp 8–9 (T): lon (K) – Brass 3818: lon (A, NY, US); 13216: lon (A, BISH, BRI, L, US); 23406: lon (A, K, L); 27095: lon (K, L) – BS 1649 (Robinson) (T): acu (K; PNH lost); 4716 (Merrill): lon (K; PNH lost); 5319 (Ramos): lon (BO, L; PNH lost); 6237 (Gates) (T): lon (K, NY, US; PNH lost); 8277 (Merrill): lon (L; PNH lost); 8563 (Sulit): lon (A; PNH lost); 9763 (Robinson): acu (BO, L, NY; PNH lost); 12606 (Fénix): lon (BO, K, L; PNH lost); 13983 (Ramos) (T): lon (BM, K, US; PNH lost); 14209 (McGregor): acu (BO, K, L; PNH lost); 15517 (Merrill & Darling): lon (US; PNH lost); 16842 (Curran): lon (L, US; PNH lost); 20403 (Ramos): acu (BO, K; PNH lost); 20904 (Escritor): lon (BM, L, NY, US); 24081 (Ramos): lon (A, BISH, BM, K, L, NY, UC, US; PNH lost); 30264 (Ramos): lon (US; PNH lost); 33021 (Ramos): lon (BM; PNH lost); 36776 (Ramos & Edaño) (T): acu (K; PNH lost); 42880 (Ramos): lon (UC, US; PNH lost); 42963 (Ramos) (T):

str (K, UC, US; PNH lost); 44721 (Ramos & Edaño): lon (BM, BO, NY, UC, US; PNH lost); 47127 (Ramos & Edaño) (T): acu (K, UC, US; PNH lost); 48501 (Ramos & Edaño): lon (BO, NY, UC, US; PNH lost); 48733 (Edaño): lon (NY, TAI, UC; PNH lost); 75257 (Ramos & Edaño): lon (NY; PNH lost); 75748 (Ramos & Edaño) (T): lon (K, NY; PNH lost) – Burcham 127: lon (US) – Buwalda 2874: acu (BO, K, L, US); 5147: lon (BO, L, US); 5267: lon (BO, K, L, US) – BW 3080 (Versteegh): lon (BO, L); 5273 (Iwanggin): lon (A, BO, L); 7389 (Versteegh): lon (L).

Carr 12395 (T): lon (BM, K, KEP, L, NY, US) – Charoenphol et al. 4347: ten (AAU, BKF, E, K, L); 4732: tem (AAU, BKF, C, K, P) – Cheesman 245: str (K) – Chermsirivathana 1095: pat (BK) – Chin 3398: lon (KLU, L); 3635: str (BO, KLU, L) – Clemens 4878 (T): lon (A, K, US); 6001-B: lon (B, L); 6101-a: lon (A); 7159: lon (UC); 16211: lon (NY, TAI, UC); 40875: lon (UC, US) – Craven & Schodde 1336: lon (BO, CANB, K, L).

Darbyshire 469: lon (CANB, L, LAE) – De Wilde & De Wilde-Duyfjes 15230: spa (BO, L); 15451: spa (BO, L); 16018: spa (BO, K, KEP, L); 16150: spa (BO, L) – Dissing et al. 2361: lon (K) – Dransfield S et al. 1000: acu (BRUN, K, KEP, L); 1151: acu (BRUN, K, KEP, L, SAN).

Ebalo 907 (T): acu (K) – Edwards 2129: acu (K, KEP) – Elmer 6210: lon (K); 6989: lon (K, NY); 8898: acu (BO, K, L, MICH, U); 11298: lon (BISH, BM, BO, K, L, NY, US); 11773: lon (BISH, BM, BO, K, L, NY, US); 16633: lon (BISH, BM, BO, K, L, MICH, NY, U, UC, US) – Endert 2645 (T): acu (BO, K, L, US).

Forster 10886: lon (BRI, L, LAE) – FRI 55752 (Yao et al.): acu (KEP, SAN); 55884 (Yao et al.): acu (KEP).

Garrett 597: ten (BKF, K, US) – Geesink et al. 7712: ten (AAU, BKF, C, K, L, P) – Giulianetti & English A° 1897 (ST): lon (K) – Goering II, 141 (T): acu (K, P).

Hiepko & Schulze-Motel 1043a: lon (B, L) – Hoogland 8843: lon (A, BO, BRI, CANB, G, K, L, LAE, US); 8871: lon (A, BO, BRI, CANB, K, L, LAE, US) – Hoogland & Pullen 5276: lon (BO, CANB, K, L, US).

Idjan & Mochtar 167: lon (BO, L); 319: lon (BO, L).

Jacobs 5585: acu (B, BH, BRUN, CANB, G, K, L, S, US) – Jeswiet 31 July 1929: lon (WAG).

Kalkman 4069: lon (BISH, L) – Kanehira & Hatusima 13092 (T): lon (A, BO, FU, K, US) – Kato et al. C-5564: lon (BO, L, TI); C-17644: lon (BO, L, TI) – Kerr 2770: ten (BM, K); 3417: ten (BM, K, UC); 6693: ten (BM, K, UC); 9956 (T): ten (holo US; BM, K, SING, UC); 17719: ten (BK, BM, K); 19197 (T): tha (BK, BM, K); 19874: ten (BK, BM, K) – Kjellberg 3024: acu (BO, S) – Kneucker 744 (Merrill) (T): lon (B, BM, E, G, K, L, UC, US, W, WAG) – KNP 1331 (Carr & Handry): acu (SNP) – Kostermans 18198: acu (A, BO, BRI, C, CANB, G, K, L, P, SING, US); 18528: ten (A, BO, K, L) – Kostermans & Soegeng 8: lon (BO, L) – Kostermans & Wirawan 533: acu (BO, K, L) – Koyama et al. T-15571: ten (AAU, BKF, KYO, L, NY); T-39967: ten (BKF, KYO, L); T-48646: ten (BKF, KYO) – Koyama & Phangklai T-40050: ten (A, AAU, KYO) – Kurz 507: acu (L).

LAE 58042 (Stevens): lon (A, BRI, CANB, E, K, L, LAE) – Laegaard & Norsangsri 21672: ten (AAU, BKF, K, QBG, US); 21729: ten (AAU); 21736: ten (AAU) – Lam 2971: acu (BO, L) – Larsen 593: acu (C); 2098: acu (C); 5587: acu (C); 6169: acu (C) – Ledermann 12521 (T): lon (B lost) – Loher 1790: lon (K); 1876: lon (K); 7185: lon (K); 7219: lon (K); 7232: acu (K).

Maxwell 72-517: ten (AAU); 87-433: ten (BKF, L, PSU); 87-1361: ten (BKF, CMU, L); 88-1213: ten (BKF, CMU, L); 89-1340: ten (A, C, CMU, E, L); 97-1421: ten (A, BKF, CMU, L) – McDonald & Ismail 4106: str (A, BO, L); 4107: str (A, BO) – McGregor 74 (T): lon (K, US) – Meijer 6038: acu (L); 7428: ten (K, L) – Merrill 3903: lon (K, L, NY, US) – Mitsuta et al. T-42259: acu (BKF, KYO, L) – Murata et al. J-615: acu (L); T-1450: (lon) (BO); T-40371: ten (AAU, BKF, KYO, L); T-42493: acu (BKF, KYO, L); T-42504: ten (BKF, KYO, L); T-52640: ten (BKF, KYO).

NGF 7658 (Native collector in Womersley & Millar): lon (BO, K, L); 9374: lon (K, LAE); 20804 (Henty): lon (BRI, L, LAE); 27300 (Henty & Frodin): lon (L, LAE, NY); 27347 (Henty & Frodin): lon (BRI, CANB, L, LAE, NY); 38760 (Henty & Katik): lon (BRI, CANB, K, L, LAE); 41973 (Henty & Katik): lon (A, BISH, BO, BRI, CANB, K, L, LAE, NSW, SING) – Nielsen 55: acu (AAU, SAR); 247: acu (AAU, SAR) – Nielsen & Balslev 1035: acu (AAU, BRUN, K, L) – Noona Dan Exp. (Køie) 2361: lon (K).

Ohwi 893: lon (US).

Pételot 4745 (T): ten (K) – Petrmitr 367: ten (BKF, CMU, L) – PNH 4136 (Edaño): lon (A, L, PNH, US); 20348 (Mendoza): acu (L, PNH) – PPI 15258 (Garcia et al.): lon (K, L) – Pullen 1198: lon (CANB, BO, K); 2637: lon (CANB, L); 2785: lon (CANB, L); 2801: lon (CANB, L); 6175: lon (BM, CANB, L, LAE) – Put 3343: ten (BM, K, NY).

Ramos Philip. Pl. 596: lon (U, US); 1933: lon (A, BM, BO, L, NY) – Rappard 160: acu (BO); 170: acu (BO) – Raynal 16711: lon (BR, L, P); 17176: lon (BR, L, P) – Richards 2014: acu (K, L, WAG) – Ridley 13054 (T): acu (BM, K) – Robinson Reliq. Herb. Amboin. 1649: lon (A, B, BM, BO, CAL, F, K, L, MO, NSW, NY, P, U, UC, US, W) – Römer 362: (min) (BO).

SAN 108381 (Argent et al.): acu (SAN); 151254 (Laegaard et al.): acu (BORH, KEP); 151285 (Laegaard et al.): acu (AAU, L, SAN) – Santos 5882: lon (US); 6661: ten (L); 6663: ten (L) – Schiefenhövel 338: lon (L) – Schlechter 19542 (T): lon (A, K, UC, US) – Schmutz 5650: acu (L); 5651: acu (L); 5830: acu (L) – Schodde 1386: lon (A, K, L, US) – Schodde & Craven 5090: lon (A, BO, BRI, CANB, K, L, LAE, US) – Seimund 380: acu (K); 435 (T): ten (K) – SF 628 ('638') (Haniff) (T): ten (K, SING); 6043 (Robinson & Kloss): ten (K, SING); 13854 (Robinson) (T): acu (K, SING); 23465 (Henderson) (T): acu (K, SING); 31322 (Holttum): acu (A, BO, SING); 31792 (Kiah): pat (K, SING); 31972 (Kiah): pat (K, SING) – Shimizu et al. T-23116: acu (BKF, KYO, L) – Sillitoe 9: lon (K) – Sirimongkol 46: ten (BKF, L) – Smitinand 2041: ten (BKF, K); 2079: ten (BKF, K); 2079-A: ten (BKF, K); 2225: ten (BKF, K); 2275: ten (BKF, K); 3097: ten (BKF, K); 4088: ten (BKF, K); 6994: ten (A, BKF, K); 9543: ten (BKF, K) – Sørensen et al. 593: ten (C, SING); 2098 (BKF, C, E, K); 5587: ten (A, C); 6169: ten (C) – Stevens et al. 492: acu (A, BO, L, SAN, SAR) – Sumadijaya 304: acu (BO) – Synge 501: acu (K).

Tagawa et al. 522: acu (BKF); 582: acu (BKF); 1575: pat (A, BKF, E) – Takeuchi et al. 23001: lon (L, LAE) – Teerawatananon 16100-16: ten (TCD, THNHM*) – Teerawatananon & Sungkaew 317: ten (TCD, THNHM); 663: ten (E, SING, TCD, THNHM); 669: ten (AAU, SING, TCD, THNHM); 703: ten (TCD, US); 741: ten (BKF, E, TCD); 742: ten (TCD); 746: ten (A, L, TCD); 772: ten (TCD); 802: ten (BM, TCD, THNHM); 805: ten (K, TCD, THNHM); 807: ten (TCD, THNHM); 812: pat (A, AAU, BKF, K, NY, TCD); 813: pat (THNHM, US); 815: pat (TCD, THNHM); 825: ten (BKF, TCD, THNHM); 826: ten (TCD); 869: ten (BKF, E, K, TCD); 870: ten (TCD, THNHM); 871: ten (TCD); 872: ten (TCD, THNHM); 873: ten (BKF, E, K, NY, TCD); 874: ten (TCD, THNHM); 875: ten (TCD, THNHM); 876: ten (A, BKF, K, NY, TCD, US); 877: ten (BM, TCD, THNHM); 894: acu (TCD, THNHM); 895: acu (TCD, THNHM).

Ueda et al. C-2894: acu (BO, KYO, L) – UPNG 293 (Gebo): str (L, UPNG).

Van Balgooy 6514: lon (BO, K, L) – Van Beusekom & Charoenpol 1840: ten (AAU, BKF, C, E, K, L, P) – Van Beusekom & Geesink 4581: str (BKF, C, K, L) – Van Slooten 1928: acu (US) – Van Steenis 8424a: spa (BO); 8479, p.p. (T): spa (BO, K, L); 8539: spa (BO, L); 10426: acu (BO, L); 11631 (T): acu (K) – Veldkamp 6656: lon (BISH, K, L); 7175 (T): und (BO, K, L) – Verheijen 2868: acu (L).

Watthana & Suksathan 1573: ten (SING) – Wenzel 1519: lon (A, BM, NY) – Widjaja & Hamzah 3026: lon (BO, L) – Wight Cat. 2599 (T): ten (K); KD 3244a (T): ten (K) – Williams 236: lon (NY, US) – Winckel 1404 (T): acu (K, U) – Winkler, Hub. 3036: acu (BM, BO, L, WRSL; W lost?) – Wisse 69: lon (BO, WAG) – Wong K.M. 246: acu (BRUN, K, L, SAN).

Yapp 537: acu (K) – Yen 25: (lon) (BISH).

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