



The genus *Gynochthodes* (*Rubiaceae*) in Sumatra

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Key words

Gynochthodes
Rubiaceae
Sumatra
taxonomy

Abstract A study of *Gynochthodes* from Sumatra is presented. Eight species can be recognized, i.e., *G. coriacea*, *G. jackiana*, *G. lanuginosa*, *G. leparensis*, *G. rigida*, *G. sublanceolata*, *G. suratmanii*, and *G. umbellata*. An identification key to the species is provided and detailed descriptions, synonymy, taxonomic notes, and an index to specimen collections of the taxa are given. Natural history notes, including distribution and ecology, vernacular names and uses are also included.

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INTRODUCTION

Gynochthodes Blume is one of the 611 genera belonging to the *Rubiaceae* Juss. (Govaerts et al. 2015). The genus was first described by Blume (1826) with one species, *Gynochthodes coriacea* Blume, from Java. The genus currently consists of at least 93 species, mostly lianas, distributed in tropical Asia, the Pacific, tropical Australia, and Madagascar (Razafimandimbison & Bremer 2011). The presence of raphide idioblasts, valvate corolla aestivation and often heterostylous flowers points to a position within subfamily *Rubioideae* (Razafimandimbison et al. 2008). It has been grouped in the tribe *Morindeae* together with *Appunia* Hook.f., *Coelospermum* Blume, *Morinda* L., *Pogonolobus* F.Muell., and *Siphonandrium* K.Schum. (Razafimandimbison et al. 2009). The members of tribe *Morindeae* are characterized by having massive T-shaped placentae inserted in the middle of the septum with two anatropous ovules per carpel and pyrenes with a single lateral germination slit (Igersheim & Robbrecht 1993). The tribe is additionally characterized by the frequent occurrence of head-like inflorescences and multiple fruits. The multiple fruits are composed of two to many fully to basally fused drupaceous (fleshy) fruits which are derived from ovaries of the adjacent flowers (Razafimandimbison et al. 2012). *Gynochthodes* can be recognized from other *Morindeae* genera by the following characters: inflorescences that are not paniculate bearing small flowers, corolla tubes that are 0.7–5.5 mm long, and corolla lobes that are 1.5–11.0 mm long (Razafimandimbison et al. 2009). Zollinger & Moritz (1845) separated *Guttenbergia* Zoll. & Moritz from *Morinda* based on its pyrene (in having 2 pyrenes, 2 locular in each pyrene), but Razafimandimbison & Bremer (2011) included *Guttenbergia* as new synonym for *Gynochthodes*, which is followed here.

Razafimandimbison et al. (2009) also discussed the circumscription of *Gynochthodes* in a wider sense to accommodate all lianescent species of *Morinda* with small flowers in order to make *Morinda* monophyletic based on molecular phylogenetic assessment. Recently, the vast majority of lianescent species of *Morinda* which have multiple fruits were formally transferred to *Gynochthodes*; the necessary, nomenclatural changes were made by Razafimandimbison & Bremer (2011).

Study of *Gynochthodes* in Sumatra was first done by Miquel (1860) who included one previously known species *G. coriacea* and proposed one new species, *G. sublanceolata* Miq. Since that time, there has been no comprehensive study of the genus for the whole region of Sumatra and therefore this study of the genus *Gynochthodes* for this island was undertaken. During the treatment of the genus *Morinda* in Sumatra, two new lianescent species were published (Suratman 2011), which later were transferred to *Gynochthodes* (Wong & Razafimandimbison 2015). Sumatran specimens annotated and identified as *Morinda* were found in various herbaria whose habit and reproductive structures showed that they are better placed in *Gynochthodes*. The Sumatran species of *Gynochthodes* are here described and some are illustrated. There are eight species of *Gynochthodes* in Sumatra, i.e., *G. coriacea*, *G. jackiana*, *G. lanuginosa*, *G. leparensis*, *G. rigida*, *G. sublanceolata*, *G. suratmanii*, and *G. umbellata*. *Gynochthodes coriacea* is the most widespread species whereas *G. leparensis* is possibly endemic.

The present work is based on the specimens kept in Herbarium Bogoriense (BO), Java, and Herbarium of Andalas University (ANDA), West Sumatra, Indonesia. Some specimens of *Gynochthodes* from surroundings areas such as Malay Peninsula, Java, and Borneo were also studied for comparison, especially for the widespread species. Specimens from other herbaria seen as photo images are indicated with *.

TAXONOMIC TREATMENT

Gynochthodes Blume

Gynochthodes Blume (1826) 993; DC. (1830) 467; Korth. (1851) 230; Miq. (1857) 313; (1869) 244; Hook.f. (1880) 160; Backer & Bakh.f. (1965) 349; Puff et al. (2005) 156; Razafim. & B.Bremer (2011) 286. — Type: *Gynochthodes coriacea* Blume.

Guttenbergia Zoll. & Moritz (1845) 2; Razafim. & B.Bremer (2011) 286. — Type: *Guttenbergia umbellata* (L.) Zoll. & Moritz.

Tetralopha Hook.f. (1870) 57, t. 1072; Razafim. & B.Bremer (2011) 286. — Type: *Tetralopha motleyi* Hook.f.

Imantina Hook.f. (1873) 120; Razafim. & B.Bremer (2011) 286. — Type: *Imantina deplanchei* Hook.f.

Slender lianas, rarely shrubs. *Branchlets* subterete to subquadrangular, glabrous or hirsute or pubescent, usually slightly sulcate. *Stipules* interpetiolar, glabrous or hirsute or pubescent. *Leaves* petiolate, decussate, penninerved, with or without

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domatia in axils of secondary veins on leaf abaxial surface, chartaceous to more or less coriaceous. *Inflorescences* mostly terminal or axillary or sometimes terminal on axillary (lateral) shoots, consisting of quite congested few- to many-flowered cymes (fascicles) or flowering heads arranged in pseudo-umbels (umbell-like), pseudo-umbels consisting of 2–11 flowering heads, each head with c. 2–40 flowers, peduncles thin subquadrangular, glabrous or occasionally puberulent, slightly sulcate to sulcate. *Flowers* polygamous (bisexual and functionally unisexual) or dioecious, 4- or 5-merous, mostly completely to basally fused when clustered in heads, sessile or pedicellate; calyx limb tubular, truncate, glabrous; calyx lobes none to distinct (4 or 5); corolla tube glabrous on both sides in mature open flowers but lanuginose inside in immature bud flowers, shorter than corolla lobes, rarely as long as or longer than corolla lobes; corolla throat lanuginose; corolla lobes 4 or 5, valvate in bud, reflexed in open flowers, with incurved top, glabrous on both sides; stamens 4 or 5, inserted in corolla throat, partly exserted; filaments thin, glabrous, subbasifixed or dorsifixed below the middle of the anther; anthers elliptic or lanceolate or linear-lanceolate or oblong to linear-lanceolate; style filiform, thin, subterete to terete; stigma bilobe, lobes oblong, exserted; ovary inferior, with longitudinal false dissepiment separating the ovules, ovaries of all flowers of a head basally to completely fused, 2–4-celled, ovules 1 in each cell. *Infructescences* in pseudo-umbels or fascicles, pseudo-umbels consisting of 2–11 fruiting heads, fruitlets of fruiting head fused a syncarp whereas fascicles consisting of simple drupes, mostly terminal or axillary or sometimes terminal on axillary (lateral) shoots; fruits subglobose to globose, glabrous, bright white to orange or orange-brown when ripe; stalks thin subquadrangular, glabrous or sparsely puberulent, slightly sulcate. *Seeds* globose to subglobose or obovate to obovate-oblong, triangular in across section, apically obtuse to rounded and basally acute to obtuse glabrous.

KEY TO THE SPECIES OF GYNOCHTHODES IN SUMATRA

1. Flowers borne in heads that are arranged in pseudo-umbels, always terminal. Fruits fused into a syncarp 3
1. Flowers individual, arranged in fascicles and not borne in heads, mostly axillary. Fruits drupaceous 2
2. Secondary veins prominent, intramarginal nerves and domatia present 1. *G. coriacea*
2. Secondary veins indistinct to slightly prominent, intramarginal nerves and domatia absent 6. *G. sublanceolata*
3. Domatia in axils of secondary veins on leaf abaxial surface 4
3. Domatia absent 6
4. Leaves with 10–16 pairs of secondary veins, margin hairy. Calyx limb hirsute outside; calyx lobes 5 . . . 2. *G. jackiana*
4. Leaves with less than 10 pairs of secondary veins, margin glabrous. Calyx limb glabrous outside; calyx lobes not developed 5
5. Leaves 0.4–5.8 cm long, secondary veins 2–4 pairs, the midrib pubescent on the upper surface . . . 4. *G. leparensis*
5. Leaves 6.7–12.3 cm long, secondary veins 6–8 pairs, the midrib glabrous on the upper surface . . . 8. *G. umbellata*
6. Hairs present on young branchlets. Lower leaf surface hairy on the lamina and veins. Outer surface of calyx limb pubescent 5. *G. rigida*
6. Hairs not found on young branchlets. Lower leaf surface glabrous. Outer surface of calyx limb always glabrous . . 7
7. Calyx limb subcampanulate, 2–3.5 mm long 7. *G. suratmanii*
7. Calyx limb tubular, 1–1.5 mm long 3. *G. lanuginosa*

DESCRIPTIONS

1. *Gynochthodes coriacea* Blume

Gynochthodes coriacea Blume (1826) 993; DC. (1830) 467; Miq. (1857) 313; (1860) 548; (1869) 244; Backer & Bakh.f. (1965) 349. — Lectotype (designated here): *Blume s.n.* (L 0057744*), Indonesia, Java.

Slender lianas. *Branchlets* subquadrangular to quadrangular when young and becoming subterete to terete with age, bark glabrous, slightly sulcate, pale when dry. *Stipules* broadly triangular, connate along one or both edges, apex truncate or obtuse or acute, glabrous, membranous to subcoriaceous, veins slightly raised inside but distinct outside. *Leaves*: petiole subquadrangular or subterete, flattened on the upper side, glabrous, 10–20 by 2–5 mm; lamina ovate or obovate-elliptic to elliptic-lanceolate, 7–14 by 2.5–8 cm, apex shortly acuminate, margin entire and glabrous, base acute and narrowed into petiole, glabrous on both sides, coriaceous, drying dark brown to pale greyish brown below and dark or medium brown above; midrib prominent below and slightly grooved above; secondary veins 4–9 pairs, slender, flat to slightly raised both sides, glabrous, forming an intramarginal nerve, domatia present in the axils of secondary veins; tertiary veins indistinct below and prominent above, glabrous. *Inflorescences* fasciculate, mostly axillary or sometimes terminal on axillary (lateral) shoots, consisting of 2–5 flowers; peduncles subquadrangular or subterete, 5–10 by 0.5–1 mm, glabrous, smooth or slightly sulcate; pedicels about as long as calyx, strongly accrescent after anthesis, bracts broad, imbricate, concealing the peduncle and ultimately becoming corky; bracteoles fleshy-membranous, forming a small involucre. *Flowers* unisexual or bisexual, 4- or 5-merous; calyx limb tubular, 1.5 mm long, glabrous on both sides; calyx lobes 4 or 5, triangular or broadly triangular, apex acute or obtuse, margin entire and glabrous; corolla at most 5.5 mm long, glabrous outside; corolla tube glabrous on both sides, 0.5–1.5 mm long; corolla lobes 4 or 5, elliptic or oblong, (sub)obtuse, pilose inside at lower half, glabrous outside, c. 4 mm long; corolla throat pilose; stamens 4 or 5; filaments thin, 1.5 mm long; anthers linear or linear-lanceolate, 2 mm long, slightly exsert (in male flowers, but hidden among corolla throat hairs); ovary in male flowers rudimentary with reduced style and stigma, in females 4-celled; ovules 1 in each cell; stigma bilobate, linear-oblong, glabrous, usually hidden among corolla throat hairs; style subterete, 1 mm long. *Infructescences* fasciculate, consisting of 2–5 fruits. *Fruits* drupaceous, subglobose to globose, 0.5–1 by 0.5–1 cm, fleshy, glabrous, white when ripe; stalks subquadrangular, 5–15 by 0.5–1 mm, glabrous. *Seeds* obovate-oblong or subreniform, 1–3 by 0.5–2 mm, apically obtuse to rounded and basally acute to obtuse, smooth, glabrous.

Distribution & Ecology — Malesia (Sumatra, Java, Borneo, Malay Peninsula, Lesser Sunda Island) (Govaerts et al. 2015). *Gynochthodes coriacea* is the most widespread species in Sumatra. *Gynochthodes coriacea* is known from S Sumatra, N Sumatra, Jambi, Bangka Belitung, Riau Archipelago, Lampung, in peat swamp forest or slightly depleted primary forest, at elevation 2–1300 m asl.

Vernacular names — Sumatra: Akar itam, akar kancing baju (Malay); kayu galugur manuk (Asahan).

Uses — Unknown.

Note — Based on collector's notes, the unripe fruits are blue-green or dark green, with up to four young seeds. *Gynochthodes coriacea* is characterized by having fasciculate axillary inflorescences, drupaceous fruits (with 2–4 pyrenes), coriaceous and glabrous leaves, intramarginal nerves and domatia in the vein axils on the lower leaf surface. It contrasts with the majority of species in *Gynochthodes* as well as the *Morindeae*, which have

head-like inflorescences developing into syncarps, in having flowers not grouped into heads and drupaceous fruits.

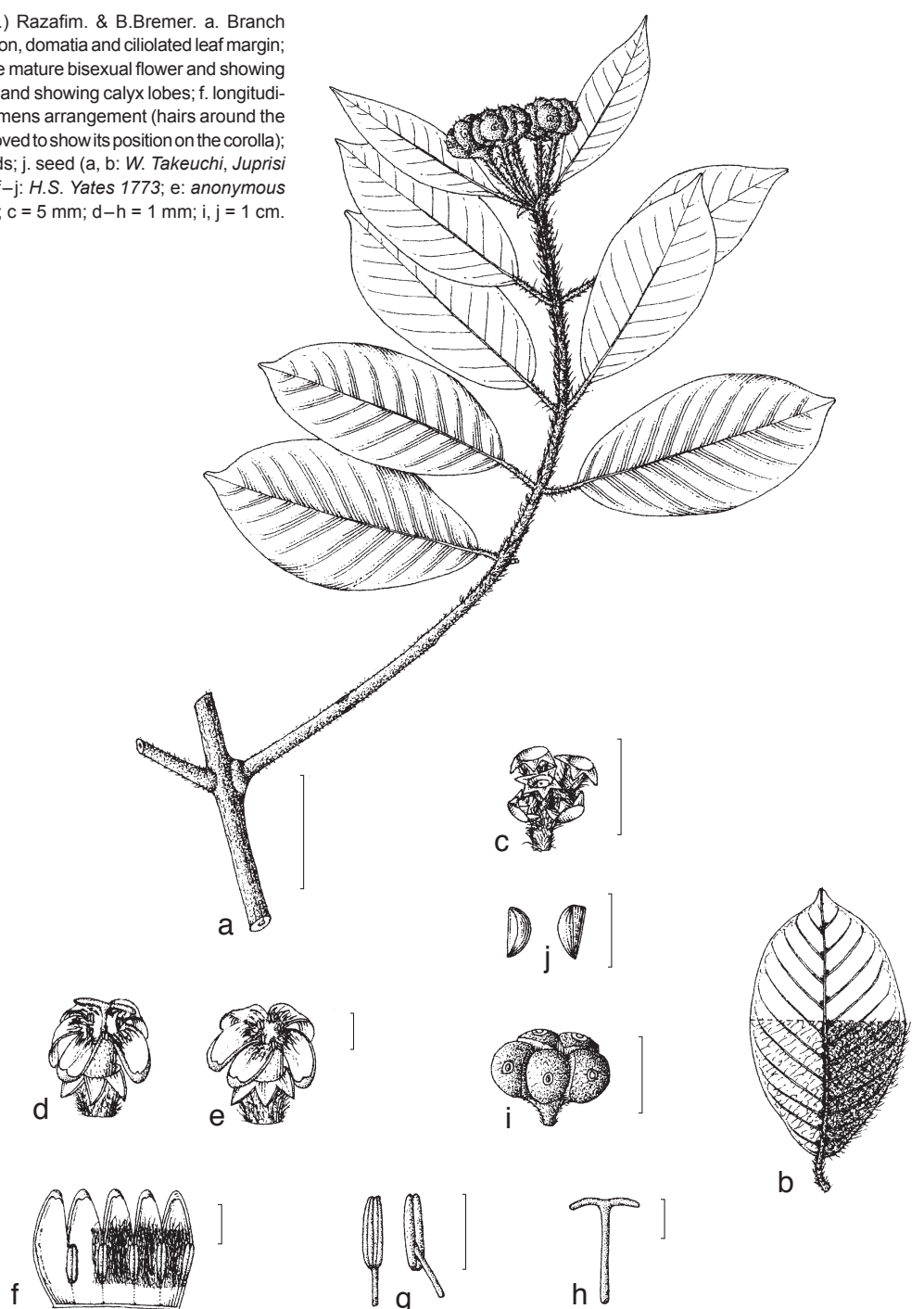
2. *Gynochthodes jackiana* (Korth.) Razafim. & B.Bremer — Fig. 1

Gynochthodes jackiana (Korth.) Razafim. & B.Bremer (2011) 291. — *Morinda jackiana* Korth. (1851) 227; Miq. (1857) 245; (1869) 212; Koord. (1912) 280; Backer & Bakh.f. (1965) 350. — Lectotype (designated here): *Korthals s.n.* (holo L L0057508*; iso L L0057509*, L0057510*, AA00096323*), Indonesia, Borneo. Other syntypes: *Korthals s.n.* (L L0057750*), Indonesia, Sumatra; *Korthals s.n.* (L L0057751*, L0057752*), Indonesia, Java.

Slender lianas. *Branchlets* subquadrangular to quadrangular when young and becoming subterete or subquadrangular with age, bark hirsute and more densely so on young growth, not or slightly sulcate, not glossy, light yellow to brown when dry; internodes 7–63 by 1.5–5 mm. *Stipules* sheathing, 3–11 by

2–6 mm, connate along one or both edges, apex truncate or obtuse or acute, densely hirsute outside but sparsely so or almost glabrous inside, membranous, veins slightly raised inside but distinct outside. *Leaves*: petioles subquadrangular or subterete, 5–11 by 0.5–1 mm, flattened on the upper side, densely hirsute; lamina elliptic to oblong, 2.1–9.3 by (0.7–)1.3–5.1 cm, base obtuse or nearly rounded but rarely acute, margin entire and ciliolate, apex cuspidate or shortly acuminate or acuminate but rarely acute, hirsute on both sides, subcoriaceous to chartaceous when dry, drying brown or light greyish brown below and greyish or dark brown above; midrib prominent below and flat to slightly raised above, densely hirsute below but sparsely hairy above, not or usually slightly sulcate; secondary veins 10–16 pairs, prominent below and flat to slightly prominent above, densely hirsute below and almost glabrous above; domatia present; tertiary veins prominent below and indistinct above, densely hirsute below and almost glabrous

Fig. 1 *Gynochthodes jackiana* (Korth.) Razafim. & B.Bremer. a. Branch habit; b. lower leaf surface showing venation, domatia and ciliolated leaf margin; c. flowering head without flowers; d. single mature bisexual flower and showing calyx lobes; e. single mature male flower and showing calyx lobes; f. longitudinal section of flower showing corolla-stamens arrangement (hairs around the anther at the left side of the corolla are removed to show its position on the corolla); g. stamen; h. pistil; i. young fruiting heads; j. seed (a, b: *W. Takeuchi, Juprisi Zegar & Kolang Sinotang 18573*; c–d, f–j: *H.S. Yates 1773*; e: *anonymous s.n.*; all BO). — Scale bars: a, b = 3 cm; c = 5 mm; d–h = 1 mm; i, j = 1 cm. — Drawn by Mr Subari (BO).



above. *Flowering heads* arranged in terminal, pseudo-umbels of 2–9 heads; each head with 5–8 flowers, 3.5–7 by 5–7 mm (across hypanthia); peduncles subquadrangular or subterete, 5–40 by 0.5–1 mm, sparsely to densely hirsute, not or slightly sulcate; bracts lacking; bracteoles none. *Flowers* unisexual or bisexual, 4- or 5-merous; calyx limb subcampanulate, sparsely to densely hirsute outside; calyx lobes 5, triangular or broadly triangular, apex acute or obtuse, margin entire and glabrous, hirsute to glabrous outside but glabrous inside; corolla tube 0.5–1.5 by 0.75–1 mm, glabrous on both sides in mature open flowers but lanuginose inside in immature bud flowers; corolla throat lanuginose inside but glabrous or sparsely hirsute outside; corolla lobes 4 or 5, elliptic or oblong; 1.5–2.25 by 0.5–1 mm, apex obtuse or acute, pubescent or almost glabrous outside but glabrous inside; stamens 4 or 5; anthers lanceolate or linear-lanceolate; filaments thin, c. 0.1–0.2 mm wide, dorsifixed below the middle of the anther or subbasifixed. *Male flowers* 2–4 by 1–2 mm; calyx limb 0.75–1.75 by 1–2 mm; calyx lobes 0.5–0.75(–1) by 0.5 mm; anthers 1.25–1.5 by c. 0.2–0.25 mm; filaments c. 0.2–0.75 mm long. *Bisexual flowers* 2–4 by 1–2 mm; calyx limb 0.75–1.75 by 1–2 mm; calyx lobes 0.5–0.75(–1) by 0.5–1 mm; anthers 0.75–1 by c. 0.2 mm; filaments c. 0.5–1.5 mm long; style thin, subterete, 1.5–2.5 by 0.1–0.2 mm; stigma lobes oblong, 0.5–2 by c. (0.1–)0.2–0.3 mm. *Infructescences* pseudo-umbellate, terminal, consisting of 2–6(–9) heads. *Syncarps* subglobose, 6–13(–19) by 5–16.5 mm, composed of 5–9 fused fruitlets; sparsely hirsute; stalks subquadrangular, 7–22 by 0.5–1 mm, densely hirsute, not or usually slightly sulcate. *Seeds* obovate to oblong or reniform, 3.5–7.8 by 1.5–4.5 mm, triangular or elliptic-oblong or lanceolate in outline, apically obtuse to rounded and basally acute to obtuse, glabrous.

Distribution & Ecology — Malesia (Sumatra, Borneo, Java) (Govaerts et al. 2015). In Sumatra, this species is recorded from N Sumatra, at logging concessional area and elevation up to 910 m asl.

Vernacular names — Unknown.

Uses — Unknown.

Note — *Gynochthodes jackiana* is easily recognized by its thin tough leaves, light green on both sides and the syncarps are said to be orange upon ripening. *Gynochthodes jackiana* can be distinguished from the other Sumatran species of *Gynochthodes* in having 5 conspicuous calyx lobes, 10–16 pairs of secondary veins, and a ciliolate leaf margin.

3. *Gynochthodes lanuginosa* (Suratman) K.M.Wong & Razafim.

Gynochthodes lanuginosa (Suratman) K.M.Wong & Razafim. (2015) 297. — *Morinda lanuginosa* Suratman (2011) 24. — Type: *P. Buwalda* 6744 (holo BO; iso L L2927815*; also in A, K, PNH, SING, all not seen), Indonesia, Sumatra, Indragiri uplands, Kuala Belilas, 28 Apr. 1939.

Slender lianas. *Branchlets* subquadrangular when young and becoming terete or subterete with age, bark glabrous, not or slightly sulcate, not glossy, grey or dark brown or dark brown to black brownish when dry; internodes (5–)9–59 by 0.5–4 mm. *Stipules* triangular, 0.5–6 by 2–5 mm, shortly connate to connate, glabrous, apex obtuse or subacute or truncate, subchartaceous to membranous, vein indistinct to slightly raised on both sides. *Leaves*: petioles subquadrangular or subterete or subtriangular, 6–25 by 0.5–1.5 mm, grooved or flattened on the upper side, not or slightly sulcate, glabrous; lamina elliptic or oblong or elliptic to oblong or rarely lanceolate, (0.9–)4–11.1 by (0.45–)1.2–4.1 cm, base cuneate or obtuse, margin entire and glabrous, apex cuspidate or acuminate or acute or obtuse or nearly rounded, glabrous on both sides, coriaceous when dry, drying light to medium brown below and dark greyish brown

to light grey above; midrib prominent below and flat to slightly prominent above, glabrous, not or usually slightly sulcate; secondary veins (5–)6–8 pairs, indistinct to prominent below and flat to moderately raised above, glabrous, domatia absent; tertiary veins indistinct to slightly prominent on both sides, glabrous. *Male flowering heads* arranged in terminal, pseudo-umbels of 2–6 heads, each head with 8–18 flowers, 3–5.5 by 2–5.5 mm (across hypanthia); peduncles subquadrangular or subterete, 3–18 by 0.5–1 mm, glabrous, not or usually slightly sulcate; bracts and bracteoles none. *Male flowers* 4- or 5-merous, 2–10.5 by (0.5–)0.75–2 mm, green when still in bud; calyx limb tubular, 1–1.5 by 1–2 mm, subundulate to truncate, glabrous; calyx lobe none; adjacent calyx limbs fused with each other; corolla tube 2–7 by 0.5–1.5 mm, lanuginose inside but glabrous outside; corolla throat lanuginose; corolla lobes 4 or 5, oblong or elliptic to oblong, 2–4 by 0.75–2 mm, apex acute or obtuse, valvate in bud and thickened at margins, glabrous on both sides; stamens 4 or 5; anthers linear or linear-lanceolate, 1.75–2.75 by c. 0.1–0.3 mm, dorsifixed around the middle or below the middle of the filaments, only the tips exerted from the corolla throat; filaments thin, 0.25–1 by c. 0.1–0.25 mm; gynoecium completely undeveloped; stigma and rudimentary style none; disk present, located on the roof of the rudimentary ovary; rudimentary ovaries of adjacent flowers fused with each other, reduced and empty. *Bisexual flowers* unknown. *Fruits* and *seeds* unknown.

Distribution & Ecology — Restricted to Sumatra, where found in Bangka Island (Bangka Belitung) and Kuala Belilas (Riau). It can be found in primary forest, somewhat swampy.

Vernacular names — Sumatra: Akar padang (Bangka), akar seminyak (Kuala Belilas).

Uses — Unknown.

Note — *Gynochthodes lanuginosa* is similar to *G. umbellata* in habit and inflorescence shape but can be distinguished by the absence of domatia and the corolla tube considerably longer (2–7 mm long) in mature open male flower than in *G. umbellata* (0.25–1.5 mm long). *Gynochthodes lanuginosa* also somewhat resembles *G. suratmanii* in habit, inflorescence shape and leaf texture but can be distinguished by its shorter and tubular calyx limb in male flowers (Suratman 2011).

4. *Gynochthodes leparensis* (Valeton) Razafim. & B.Bremer — Fig. 2

Gynochthodes leparensis (Valeton) Razafim. & B.Bremer (2011) 291. — *Morinda leparensis* Valeton (1913) 197, t. 362; Backer & Bakf.f. (1965) 350. — Lectotype (designated here, see note): *Teysmann s.n.*, *Hortus Bogor, cult.* XVII C 102 (holo L L0700304*; iso P P03913275*), Indonesia, Lepar Island.

Slender lianas. *Branchlets* subquadrangular to quadrangular when young and becoming subquadrangular or subterete with age, bark pubescent and more densely on young branchlets, slightly sulcate, not glossy, drying grey or light yellow to dark brown; internodes 2–124 by 0.25–4 mm. *Stipules* sheathing or triangular or oblong, 0.75–4(–5) by 1–2.5 mm, connate along one edge or shortly connate at the base of both edges, glabrous on both sides, apex acute or truncate or nearly truncate or nearly obtuse or rounded, membranous, veins indistinct on both sides. *Leaves*: petioles semiterete, 1–6 by 0.25–1 mm, flattened to slightly grooved on the upper side, slightly sulcate, sparsely to densely pubescent; lamina ovate or elliptic or oblong or lanceolate, 0.4–5.8 by 0.25–3.45 cm, base rounded or obtuse, margin entire and glabrous, apex acute or acuminate or obtuse or mucronate or rounded, glabrous on both sides, chartaceous when dry, drying pale yellow to brown below and light brown to dark brown above; midribs prominently below and sunken to flat above, glabrous below but sparsely

to densely pubescent above, slightly sulcate; secondary veins 2–4 pairs, flat to prominent below and sunken to flat above, glabrous on both sides, domatia present in the axils of secondary veins; tertiary veins flat to prominent below and indistinct to sunken above, glabrous. *Flowering heads* arranged in terminal, pseudo-umbels of 2–8 heads; each head with 3–40 flowers, 1–7 by 1–5.5 mm (across hypanthia); peduncles subterete or subquadrangular, 0.5–38 by c. 0.2–1 mm, sparsely to densely pubescent, slightly sulcate; bracts persistent or caducous, triangular or narrowly triangular, 1–3.75 by 0.25–1.5 mm, apex acute or acuminate, sparsely pubescent; bracteoles caducous, triangular or narrowly triangular or lanceolate or rarely linear-lanceolate, 0.25–1(–1.2) by 0.1–0.3 mm, apex acute

or acuminate, glabrous. *Flowers* unisexual or bisexual; calyx limb tubular, subundulate to truncate above, glabrous on both sides; calyx lobes indistinct; corolla tube glabrous on both sides in mature open flowers but lanuginose inside in immature bud flowers; corolla throat lanuginose; corolla lobes apex obtuse or rarely acute, glabrous on both sides; filaments thin, dorsifixed below the middle of the anther. *Male flowers* 3–5-merous, 1–4 by 0.5–1.5(–3) mm; calyx limb 0.5–2(–3) by 0.5–1.5(–3) mm; corolla tube 0.25–1 by 0.25–1(–1.5) mm; corolla lobes (3 or) 4 (or 5), elliptic to oblong, (0.5–)1–2(–2.5) by (0.25–)0.5–1.25 mm; stamens (3 or) 4 (or 5); anthers oblong to linear-lanceolate, 0.5–2 by c. (0.1–)0.2–0.3(–0.5) mm; filaments c. (0.1–)0.2–1.5 by c. 0.1–0.2 mm. *Bisexual flowers*

Fig. 2 *Gynochthodes leporensis* (Valeton) Razafim. & B. Bremer. a. Branch habit; b. lower leaf surface showing venation and domatia; c. flowering head with bud flowers; d. single mature bisexual flower; e. single mature male flower; f. longitudinal section of flower showing corolla-stamens arrangement (hairs around the anther at the left side of the corolla are removed to show its position on the corolla); g. stamen; h. pistil (all: *Teysmann s.n., Hortus Bogor, cult. X.G.52, BO*). — Scale bars: a, b = 2 cm; c = 4 mm; d–h = 1 mm. — Drawn by Mr Subari (BO).



4-merous, heterostylus, (1–)1.5–4 by 0.75–2(–3) mm; calyx limb 0.5–2(–3) by (0.75–)1–1.5 mm; corolla tube 0.25–1 by 0.5–1 mm; corolla lobes 4, elliptic or broadly elliptic, 0.75–2.25 by 0.5–1 mm; stamens 4; anthers oblong or lanceolate, 0.5–1.5 by c. 0.2–0.3 mm; filaments c. 0.2–1.5 by c. 0.1–0.2 mm; style thin, subterete, 1–3 by c. 0.1–0.25 mm; stigma lobes elliptic or oblong, 0.5–0.75 by c. 0.1–0.25 mm. *Fruiting heads and seeds not seen.*

Distribution & Ecology — This species is recorded from Lepar Island (south of Bangka) and then cultivated in Hortus Botanicus Bogor (Bogor Botanic Garden) (Valeton 1913).

Vernacular names — Unknown.

Uses — Unknown.

Note — Based on field notes, this species can be found in coastal forest, the flowers are white whereas the ripening fruits are orange and fruiting in November. This species somewhat

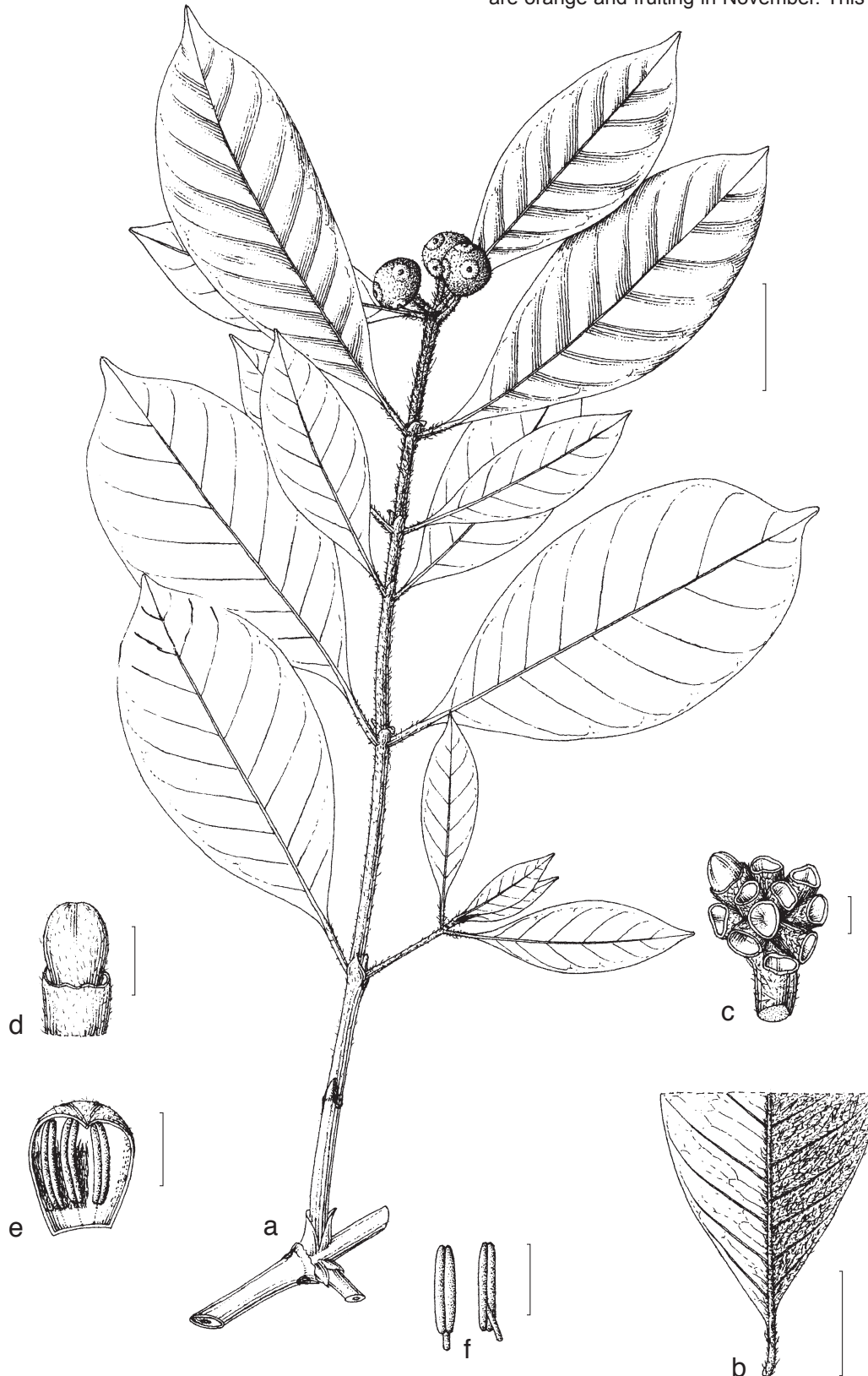


Fig. 3 *Gynochthodes rigida* (Miq.) Razafim. & B. Bremer. a. Branch habit; b. lower leaf surface showing venation (note that domatia is absent in axil of secondary veins); c. flowering head with bud flower; d. single bud male flower; e. longitudinal section of male flower showing corolla-stamens arrangement (with 1 corolla lobe and 1 stamen removed, hairs around the anther at the right side of the corolla are removed to show its position on the corolla); f. stamen (a, b: Dayar Arbain & Rusjdi Tamin 108 AS, ANDA; c–f: Teysmann 900 HB, BO). — Scale bars: a, b = 3 cm; c–f = 1 mm. — Drawn by Mr Subari (BO).

resembles with *G. umbellata* in habit, inflorescence shape, and presence of domatia in the axils of secondary veins, but differs by the smaller leaves, the fewer number of secondary veins and presence indumentum on upper surface midribs. It is presumably an endemic species to Lepar Island because I can not find this species in other Sumatran regions. Some specimens have been cultivated in Hortus Botanicus Bogor as it is represented by several sheets in BO and L. Several specimens of *G. leparensis* in L (L2927187*, L2927188*, L2927189*, L2927190*) are derived from a different plant than the specimen cited by Valetton (1913). A specimen in L (L0700304) cited by Valetton (1913) is in this study selected as lectotype.

5. *Gynochthodes rigida* (Miq.) Razafim. & B. Bremer — Fig. 3

Gynochthodes rigida (Miq.) Razafim. & B. Bremer (2011) 295. — *Morinda rigida* Miq. (1857) 246; Hook.f. (1880) 157; Ridl. (1923) 118; K.M.Wong (1984) 95; (1989) 376. — Lectotype (designated by Johansson (1994) 15): *Teysmann s.n.* (= *Teysmann 900 HB*) (U U0006084*; iso BO), Indonesia, Sumatra, near Sibogo.

Slender lianas. *Branchlets* subquadrangular or quadrangular when young and becoming subterete with age, bark pubescent and more densely hirsute on young branchlets, slightly sulcate, not glossy, drying black brownish or brown greyish; internodes 9–68 by 1.25–5 mm. *Stipules* triangular or ovate, 5–8(–12) by (4–)5–7 mm, apex obtuse or acute, shortly connate at the base of both edges, sparsely pubescent, subchartaceous, veins indistinct on both sides. *Leaves*: petioles semi-terete or subtriangular or subquadrangular, (4–)10–15 by (0.5–)1–1.5(–2) mm, flattened on the upper side, sparsely pubescent, slightly sulcate; lamina elliptic to oblong, 3–14.6 by (0.7–)1–6.9 cm, base cuneate or acute, margin entire and glabrous, apex shortly acuminate or cuspidate or mucronulate, sparsely hirsute above and more densely hirsute below, coriaceous when dry, drying brown to light black greyish below and light brown to light black greyish above; midribs prominent below and flat to slightly prominent above, sparsely hirsute above but densely hirsute below, not or usually slightly sulcate; secondary veins 6–9 pairs, slightly prominent on both sides, glabrous, domatia absent; tertiary veins indistinct to slightly prominent on both sides, glabrous. *Flowering heads* arranged in terminal, pseudo-umbels of 2–4 heads; each head with 3–16 flowers, 2.75–5 by 3–5.5 mm (across hypanthia); peduncles subterete or subquadrangular, (1.5–)3–6 by 1–2.5 mm, sparsely pubescent, slightly sulcate; bracts and bracteoles none. *Male flowers* 4-merous, 0.75–2 by 0.75–2 mm, still in bud; calyx limb tubular, 0.75–1.5 by 1–2 mm, truncate or subundulate, sparsely pubescent outside; calyx lobes indistinct; corolla tube 0.25 by 0.5–0.75 mm, glabrous on both sides in immature bud flower; corolla throat lanuginose; corolla lobes 4, elliptic or oblong, 0.75–1 by 0.5–0.75 mm, apex obtuse, sparsely pubescent outside; stamens 4; anthers lanceolate or linear-lanceolate, 1.25–1.50 by c. (0.2–)0.25–0.3 mm; filaments thin, c. 0.2–0.3(–0.5) by c. 0.1–0.2 mm, dorsifixed below the middle of the anther. *Bisexual flowers* not seen. *Infructescences* pseudo-umbellate, terminal, consisting of 2–4 heads. *Syncarps* globose or subglobose, 4–15 by 4–23 mm, composed of 3–6 fused fruitlets, sparsely pubescent; stalks subterete, 3–6 by 1–1.5 mm, pubescent, not or usually slightly sulcate. *Seeds* not seen.

Distribution & Ecology — Thailand to W Malesia (Malay Peninsula, Sumatra, Borneo) (Govaerts et al. 2015). In Sumatra, this species is found in N Sumatra, W Sumatra, Riau, and S Sumatra, at elevation 400–580 m asl.

Vernacular names — Sumatra: akar sari (Palembang), pandancari (Malay), mengkudu akar (Minangkabau).

Uses — Unknown.

Note — Based on field notes, the fruits are orange, 8–11 mm wide. *Gynochthodes rigida* can be distinguished from *G. surat-*

manii and *G. lanuginosa* in having coriaceous and sparsely pubescent leaves, shortly stalked flowering heads, pubescence in young branchlets, lower surface of leaves, petioles, peduncles, outer surface of calyx limb and stalks.

6. *Gynochthodes sublancoolata* Miq.

Gynochthodes sublancoolata Miq. (1860) 548; (1869) 244; Hook.f. (1880) 160; Puff et al. (2005) 156, pl. 3.2.4. — Lectotype (designated here): *Junghuhn FW & Amand J. s.n.* (holo U U.0006036*), Indonesia, Sumatra, Sumatra Selatan, Bangka pr. Mintok, Sept. 1858.

Slender lianas. *Branchlets* subquadrangular to quadrangular when young and becoming subterete to terete with age, bark glabrous, slightly sulcate, drying shiny dark blackish brown. *Stipules* ovate, connate at base edges, apex acute to acuminate, glabrous, membranous to subcoriaceous, veins slightly raised inside but distinct outside. *Leaves*: petiole subquadrangular or subterete, flattened on the upper side, glabrous, 5–13 by 1–3 mm; lamina elliptic-lanceolate or sublancoolate, 3–12 by 1.5–5 cm, apex acute to shortly acuminate, margin entire and glabrous, base acute and narrowed into the petiole, glabrous on both sides, not shining, chartaceous to subcoriaceous, drying light brown to dark brown below and brown to dark brown above; midribs prominent below and slightly grooved above, glabrous; secondary veins 5–7 pairs, flat to indistinct below, flat to slightly prominent above, glabrous, domatia absent; tertiary veins indistinct below and flat to indistinct above, glabrous. *Inflorescences* fasciculate, axillary, consisting of 2–5(–7) flowers; peduncles subquadrangular or subterete, glabrous; pedicels short, c. 1 mm long; bracts deciduous. *Flowers* unisexual or bisexual, 4- or 5-merous; calyx limb turbinate, glabrous; calyx lobes 4 or 5, apex truncate, margin entire, persistent, glabrous; corolla tube 0.5–1.5 by 0.5–1 mm, glabrous, white to greenish white; corolla throat lanuginose; corolla lobes 4 or 5, oblong-lanceolate, valvate in bud with inflexed tips, 1–3 by 0.2–0.5 mm, apex obtuse or acute, glabrous; stamens 4 or 5; anthers lanceolate or linear-lanceolate or linear-oblong, slightly exsert (in male flowers, but hidden among corolla throat hairs); filaments linear, thin, c. 0.1–0.2 mm wide; in male flowers ovary rudimentary but style and stigma reduced, in females 4-celled; ovules 1 in each cell; stigma bilobate, oblong, glabrous, usually hidden among corolla throat hairs; style terete, style of male flowers entire, style of bisexual flowers stout, glabrous. *Infructescences* fasciculate, axillary, consisting of 2–5(–7) fruits. *Fruits* drupaceous, with 3 or 4 pyrenes, ellipsoid-globose or subglobose to globose, 0.4–1 by 0.4–1 cm, shiny, fleshy, dark green to whitish green, ripening black, glabrous; stalks subquadrangular, 5–8 by 0.5–1.5 mm, glabrous. *Seeds* compressed, obovate-oblong or subreniform, 1–3 by 0.5–1.5 mm, apically obtuse to rounded and basally acute to obtuse, glabrous.

Distribution & Ecology — Thailand to W Malesia (Malay Peninsula, Sumatra, Borneo) (Govaerts et al. 2015). In Sumatra, *G. sublancoolata* is known from Bangka Belitung, at elevation 2–201 m asl.

Vernacular names — Unknown.

Uses — Unknown.

Note — Based on field notes, the fruits are dark green. *Gynochthodes sublancoolata* somewhat resembles *G. coriacea* in habit, inflorescence shape, infructescence shape, and simple drupaceous fruits (with 3 or 4 pyrenes). However, *G. sublancoolata* is distinguished from *G. coriacea* by the absence of domatia and intramarginal nerves, secondary veins flat to indistinct below, and leaf texture considerably chartaceous to subcoriaceous. *Gynochthodes sublancoolata* and *G. coriacea* can easily be distinguished from the majority of Sumatran species of *Gynochthodes* in having flowers not grouped into heads and drupaceous fruits.

7. *Gynochthodes suratmanii* K.M.Wong & Razafim.

Gynochthodes suratmanii K.M.Wong & Razafim. (2015) 297. — *Morinda wongiana* Suratman (2011) 27. — Type: *H.F. Sun* 9937 (holo BO), Indonesia, S Sumatra, Baturadja, June to July 1963.

Slender lianas. *Branchlets* subquadrangular when young and becoming terete with age, bark glabrous, slightly sulcate, not glossy, drying light brown to dark brown blackish; internodes 17–40(–78) by 1.25–4 mm. *Stipules* triangular or broadly triangular, (4–)5–7 by 3–7 mm, shortly connate above axils, glabrous, apex acute or subacute to obtuse, membranous or subchartaceous, veins indistinct to slightly prominent. *Leaves*: petioles subterete or subquadrangular, (5–)7–12(–16) by 0.5–1(–1.5) mm, grooved or flattened on the upper side, slightly sulcate, glabrous; lamina obovate-oblong or elliptic or oblong, (3.5–)3.7–9.5(–10) by 1.6–4.1 cm, base cuneate, margin entire and glabrous, apex shortly acuminate or shortly cuspidate, glabrous on both sides, coriaceous when dry, drying dark brown below and dark brown to light greyish brown above; midrib prominent below and flat to slightly prominent above, glabrous, not or usually slightly sulcate; secondary veins 6–8 pairs, prominent below and flat to prominent above, glabrous, domatia absent; tertiary veins slightly prominent to almost indistinct on both sides, glabrous. *Male flowering heads* arranged in terminal, pseudo-umbels of (2–)3–6(–7) heads, each head with (4–)5–10 flowers, (3–)4–7.7 by (5–)5.1–8.2 mm (across hypanthia); peduncles terete or subterete, 6–7.25 by 0.75–1(–1.5) mm, glabrous, not or slightly sulcate; bracts lacking; bracteoles none. *Male flowers* calyx limb subcampanulate, (1.75–)2–3.5 by (1.5–)2–3 mm, truncate, glabrous, red; calyx lobes indistinct, adjacent calyx limbs fused with each other; corollas not seen; stamens not seen; gynoecium completely undeveloped; stigma and rudimentary style none; disk present, located on the roof of the rudimentary ovary; rudimentary ovaries of adjacent flowers fused with each other, reduced and empty. *Bisexual flowers* unknown. *Syncarps* globose or subglobose, 5–17(–20) by 5–17(–20) mm, glabrous, composed of 4–7 fused fruitlets; stalks subterete, (6–)7.25–24 by 1–2 mm, glabrous, sulcate. *Seeds* not seen.

Distribution & Ecology — Malesia (Sumatra and Borneo). In Sumatra, this species only was recorded from S Sumatra. *Gynochthodes suratmanii* can be found in rainforest and secondary vegetation, at elevation of a few metres asl.

Vernacular names — Unknown.

Uses — Unknown.

Note — This species is similar to *G. rigida* in leaf texture and inflorescence shape but can be distinguished from the latter because the surface of young branchlets, leaves, midribs, petioles, peduncle, outer calyx limb of male flowers and fruiting head stalks are always glabrous. The calyx limb and fruiting head stalks are also considerably longer ((1.75–)2–3.5 by (6–)7.25–24 mm) than in *G. rigida* (0.75–1.5 by 3–6 mm) (Suratman 2011).

8. *Gynochthodes umbellata* (L.) Razafim. & B.Bremer — Fig. 4

Gynochthodes umbellata (L.) Razafim. & B.Bremer (2011) 296. — *Morinda umbellata* L. (1753) 176, non Blanco (1845) 106; Miq. (1857) 244; Koord. (1912) 280; Ridl. (1923) 119; Backer & Bakh.f. (1965) 350; K.M.Wong (1984) 95; (1989) 377. — *Guttenbergia umbellata* (L.) Zoll. & Moritz (1845) 2; Razafim. & B.Bremer (2011) 296. — Lectotype (designated by Smith (1988) 333): *Herb. Hermann* 3: 11, no. 81 (holo BM BM000621833*), habitat in India.

Slender lianas. *Branchlets* subquadrangular to quadrangular when young and becoming terete or subterete with age; bark slightly puberulent to glabrous when young and usually gla-

brous with age, slightly sulcate, not glossy, drying light brown to brown greyish; internodes 2.5–78 by 0.75–4 mm. *Stipules* sheathing or triangular, 3–7 by 1.75–3.5 mm, connate along one edge or shortly connate at the base of both edges, glabrous, apex obtuse to truncate, membranous, veins indistinct to prominent on both sides. *Leaves*: petioles subterete or subquadrangular, 3–10 by 0.5–1 mm, grooved to flattened on the upper side, sulcate to slightly sulcate, glabrous to sparsely puberulent; lamina oblong to lanceolate, 6.7–12.3 by 1.7–4.5 cm, base acute or cuneate, margin entire and glabrous, apex long cuspidate or acuminate, glabrous on both sides, subcoriaceous to chartaceous when dry, drying light brown below and brown to dark brown above; midribs prominent below and sunken to slightly prominent above, glabrous; secondary veins 6–8 pairs, prominent below and sunken to moderate above, glabrous, domatia present in the axils of secondary veins; tertiary veins prominent below and sunken to slightly prominent above, glabrous. *Flowering heads* arranged in terminal, pseudo-umbels of 5–11 heads; each head with 6–20 flowers, 1.5–4 by 2–4 mm (across hypanthia); peduncles thin subquadrangular, (5–)6–14 by 0.5–1 mm, glabrous to slightly puberulent, slightly sulcate to sulcate; bracts and bracteoles lacking. *Flowers* unisexual or bisexual, 4- or 5-merous; calyx limb tubular, truncate, glabrous; calyx lobes indistinct; corolla tube glabrous on both sides in mature open flowers but lanuginose inside in immature bud flowers; corolla throat lanuginose; corolla lobes 4 or 5, glabrous on both sides; stamens 4 or 5; filaments thin, dorsifixed below the middle of the anther. *Male flowers* 1–4 by 0.5–2 mm; calyx limb 0.5–1.5 by 0.5–2 mm; corolla tube 0.25–1 by 0.75–1.5 mm; corolla lobes elliptic or oblong, 1–2.25 by c. (0.25–)0.5–1 mm, apex obtuse or acute; anthers elliptic or lanceolate or linear-lanceolate, 0.3–1.5 by c. 0.2–0.5 mm; filaments c. 0.1–0.75(–1.5) by c. 0.1–0.2 mm. *Bisexual flowers* 1–4 by 0.5–1.75 mm; calyx limb 0.5–1.5 by 1–1.75 mm; corolla tube 0.5–1 by 0.75–1.5 mm; corolla lobes elliptic-oblong or oblong, 1–2 by c. 0.3–0.75 mm, apex obtuse or nearly acute; anthers oblong to linear-lanceolate, 0.5–1.5 by c. 0.2–0.25 mm; filaments 0.5–0.75 by c. 0.1–0.2 mm; style thin, subterete, 1.5–2 by c. 0.1–0.25 mm; stigma lobes oblong, 0.25–1 by c. 0.1–0.3 mm. *Infructescences* pseudo-umbellate, terminal, consisting of 5–11 heads. *Syncarps* subglobose, 4–12 by 4–12(–15) mm, glabrous, composed of 3–12 fused fruitlets, orange to orange-brown when ripening; stalks thin subquadrangular, 6–25 by 0.5–1 mm, glabrous, slightly sulcate. *Seeds* obovate to obovate-oblong, triangular in across section, 3.2–5.6 by 2–3.2 mm, apically obtuse to rounded and basally acute to obtuse, glabrous.

Distribution & Ecology — *Gynochthodes umbellata* is a widespread species and distributed from the Indian Subcontinent to Japan, W Pacific (Samoa) and Australia (Queensland) (Govaerts et al. 2015). In Sumatra, this species is known from N Sumatra, Jambi and Bangka Belitung, at 120–1050 m asl.

Vernacular names — Sumatra: mengkudu akar, mengkudu hutan, mengkudu kecil, akar China (Malay).

Uses — Unknown.

Note — In field notes, the ripening fruits have been recorded as orange-brown. It is very variable in the surface of young branchlets, petioles, and peduncles. Many specimens of *Gynochthodes* from Sumatra which have a terminal umbellate-flowering head are usually identified as *G. umbellata* (but are possibly not always identical to that species, Ridsdale 1998). In this study, *G. umbellata* is distinguished from the other species of *Gynochthodes* with an umbellate-flowering head by its calyx lobes not developed and also in having calyx limb tubular, truncate, glabrous on both sides.

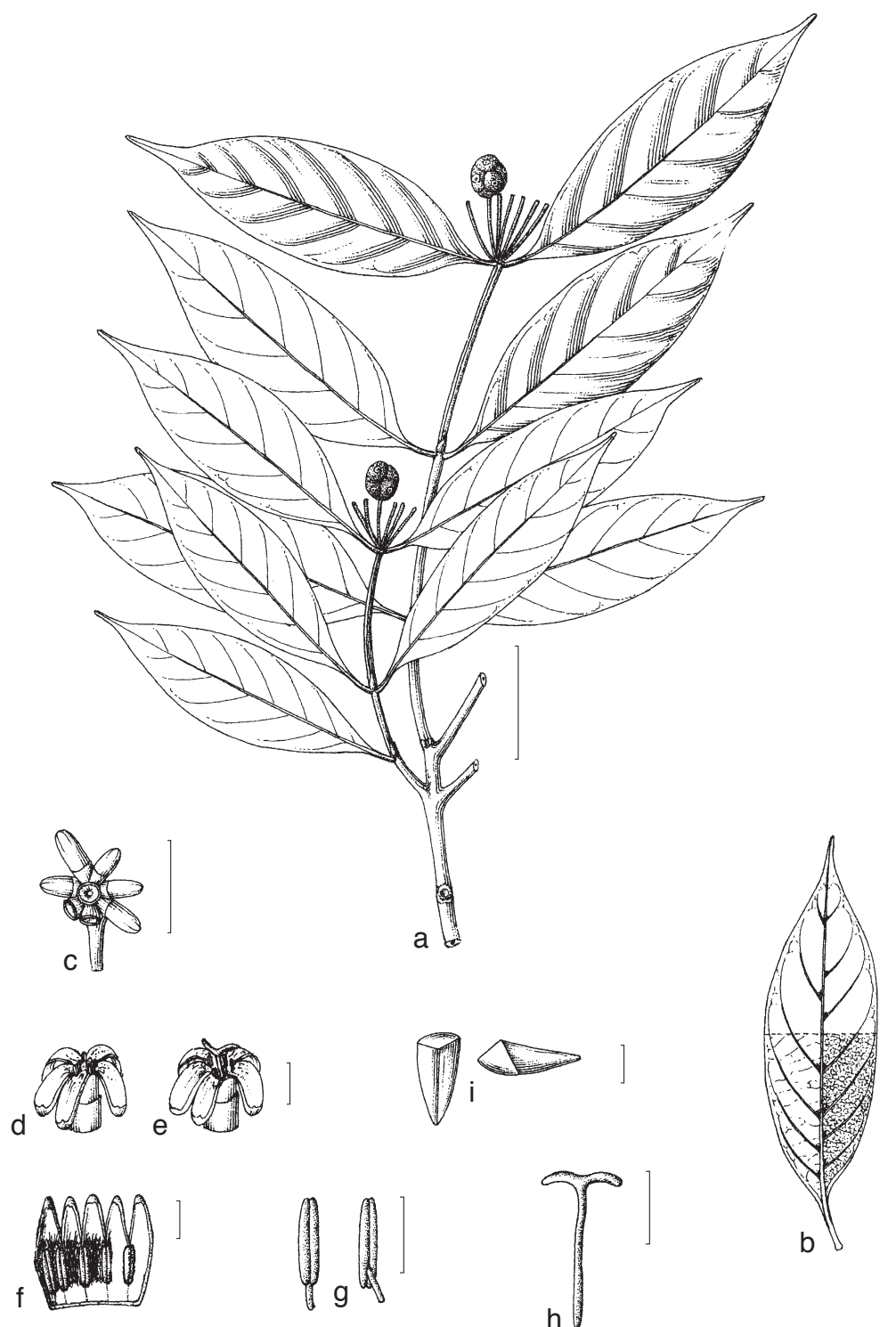


Fig. 4 *Gynochthodes umbellata* (L.) Razafim. & B. Bremer. a. Branch habit; b. lower leaf surface showing venation and domatia; c. flowering head with bud flowers; d. single mature male flower; e. single mature bisexual flower; f. longitudinal section of flower showing corolla-stamens arrangement (hairs around the anther at the right side of the corolla are removed to show its position on the corolla); g. stamen; h. pistil; i. seed (a–c, e–i: *Teysmann 19324*; d: *Teysmann 19327*; all BO). — Scale bars: a, b = 3 cm; c = 5 mm; d–i = 1 mm. — Drawn by Mr Subari (BO).

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INDEX TO SPECIMENS SEEN

Anonymous collections have not been included.

<i>Gynochthodes</i>	lan = <i>G. lanuginosa</i>	sub = <i>G. sub lanceolata</i>
cor = <i>G. coriacea</i>	lep = <i>G. leparensis</i>	sur = <i>G. suratmanii</i>
jac = <i>G. jackiana</i>	rig = <i>G. rigida</i>	umb = <i>G. umbellata</i>

Arbain & Tamin 108 AS: rig.
 Berkhout 1507: lan – Bünnemeijer 6387: cor – Buwalda 6744: lan.
 De Leeuw 13: sub.
 Hen, Eti, Yessy 93: rig – Henderson 20352: sub; 20410: umb; 20422: umb – Hidayat & Widjaja 1024: cor.
 Jacob 8118: cor.
 Korthals 1012: cor – Kostermans & Anta 477: cor.
 Lörzing 9947: umb.
 Meijer 7419: cor.
 Peles, Betty, Mira, Lyeli, Dewi 26: rig – Polak 145: cor.
 Ruttner 240: cor.
 Seren 81: rig – Si Boea 10037: cor – Sun 9937: sur.
 Takeuchi, Zegar & Sinotang 18573: jac – Tamin & Arbain 7091: umb – Teysmann 900 HB: rig; 1001: cor; 4017: rig; 18351: lan; 18671: lep; 19324: umb; 19327: umb.
 Yates 1773: jac – Y2DA 77: rig

Additional specimens from outside Sumatra

Borneo

Amin SAN 132148: rig.
 Dransfield & Hambali 4326: cor.
 Endert 3692: jac.
 Hallier 1048: sur – Haviland 2983: rig.
 Jaheri 1893: sur.
 Kostermans 13074: cor.
 Rahman, Ahmat & Jembu IS 416: umb.
 Teysmann 7908: sub; 11282: umb.

Java

Koorders 22507: cor; 26324: jac; 26474: cor.
 Smith 542: jac.
 Teysmann s.n., Hortus Bogor, cult. X.G.52: lep – Teysmann s.n., Hortus Bogor, cult. XV.K.A.XLII.1: lep – Teysmann 18328: umb.
 Van Steenis 12356: jac

Malay Peninsula

Aidil FRI 43930: umb.
 Corner 29830: umb.
 Henderson 18210: umb; 36782: sub.
 Ridley 6823: rig.
 Shah & Noor MS 650: cor.