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New Combinations, New Names and New Species of *Madhuca* (Sapotaceae) from Sabah and Sarawak, Borneo

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Abstract

Five new species of *Madhuca*, *M. engkikiana*, *M. markleeana*, *M. multinervia*, *M. ochracea*, and *M. silamensis*, are described and two new combinations, *M. daemonica* and *M. prolixa*, and two new names, *M. cheongiana* and *M. kuchingensis*, are proposed as a consequence of the reduction of *Ganua* to *Madhuca*.

Introduction

In revising the family Sapotaceae for the Tree Flora of Sabah and Sarawak, we accepted Pennington's reduction (1991) of *Ganua* Dubard (1908) to *Madhuca* Buch.–Ham. *ex* J.F. Gmelin (1791). The enlarged genus *Madhuca* comprises 47 species and one variety in Sabah and Sarawak out of a total of 50 species found in Borneo.

The Sabah and Sarawak account includes two new combinations (*M. daemonica* and *M. prolixa*), two new names (*M. cheongiana* and *M. kuchingensis*), and five new species (*M. engkikiana*, *M. markleeana*, *M. multinervia*, *M. ochracea*, and *M. silamensis*) here described.

New Combinations and New Names

1. ***Madhuca cheongiana*** Yii & P. Chai, **nom. nov.**

Synonyms: *Ganua sarawakensis* Pierre *ex* Dubard, Bull. Mus. Hist. Nat. Paris 14 (1908) 409. **Type:** *Beccari PB 3105*, Borneo, Sarawak, Kuching (holotype FI, *n.v.*); Van den Assem, Blumea 7 (1953) 375; *Ganua attenuata* Griffioen & H.J. Lam, *nom. ined.*, Anderson, A Checklist of the Trees of Sarawak (1980) 314, *nom. nud.*

Notes: In transferring *Ganua sarawakensis* to the genus *Madhuca*, the species name "*sarawakensis*" cannot be used because it is already preoccupied by *Madhuca sarawakensis* (Pierre *ex* Dubard) H.J. Lam, Bull. Jard. Bot. Buitenz., 3, 7 (1925) 180, based on *Kakosmanthus sarawakensis* Pierre *ex*

Dubard, Bull. Mus. Hist. Nat. Paris 14 (1908) 407, and typified by *Beccari PB 423*, Borneo, Sarawak, Kuching (holotype P, *n.v.*; isotypes FI, L, *n.v.*).

The species is endemic to Borneo (Brunei Darussalam, Kalimantan, Sabah, and Sarawak). In Sabah and Sarawak, it is uncommon and scattered in a few localities (*SAN 29561*, *SAN 33601*, *SAN 36601A*, *SAN 86191*, *SAN 126691*; *S 2162*, *S 2222*, *S 7559*, *S 15043*, *S 15437*, *S 29477*, and *S 32947*), and occurs mainly in lowland kerangas and mixed dipterocarp forests below 200 m altitude.

The species is named in honour of Mr. Cheong Ek Choon, the Director of the Sarawak Forestry Department, for his interest and continuous support in the study of the diversity, conservation and sustainable management of forest tree resources in Sarawak.

2. ***Madhuca daemonica*** (Van den Assem) Yii & P. Chai, **comb. nov.**

Basionym: *Ganua daemonica* Van den Assem, Blumea 7 (1953) 394. **Type:** *Egar A 0932*, Borneo, Sarawak, Setapok FR (holotype KEP!).

Notes: A species endemic to Borneo and found in a few localities in Sabah (*SAN 17437*, *SAN 17448*), and more commonly in Sarawak (*Egar A 0932*, *S 2618*, *S 2722*, *S 2768*, *S 4423*, *S 4666*, *S 5866*, *S 7088*, *S 12393*, *S 12965*, *S 14462*, *S 30039*, and *S 36452*). Its habitats include peatswamp, kerangas and mixed dipterocarp forests at altitudes up to 700 m.

3. ***Madhuca kuchingensis*** Yii & P. Chai, **nom. nov.**

Based on *Ganua beccarii* Pierre *ex* Dubard, Bull. Mus. Hist. Nat. Paris 14 (1908) 408. **Type:** *Beccari PB 2241*, Borneo, Sarawak (holotype FI, *n.v.*).

Notes: In the genus *Madhuca*, there exists *M. beccarii* (Engl.) H.J. Lam, Bull. Jard. Bot. Buitenz., 3, 7 (1925) 177, based on *Payena beccarii* Engl., Bot. Jahrb. 12 (1890) 508, and typified by *Beccari PB 1598*, Borneo, Sarawak, Kuching (holotype FI, *n.v.*; isotypes K, P, *n.v.*). The new name *Madhuca kuchingensis* Yii & P. Chai is, therefore, proposed.

The species is endemic to Borneo and confined to the central and western parts of Sarawak (*S 3356*, *S 4307*, *S 14846*, *S 24344*, *S 24514*, *S 24516*, *S 24545*, *S 24602*, *S 27064*, *S 32394*, *S 32472*, *S 37044*, and *S 37861*), and found mainly in lowland kerangas and mixed dipterocarp forests at altitudes up to 100 m.

4. ***Madhuca prolixa*** (Pierre *ex* Dubard) Yii & P. Chai, **comb. nov.**

Basionym: *Ganua prolixa* Pierre *ex* Dubard, Bull. Mus. Hist. Nat. Paris 14 (1908) 409. **Type:** *Beccari PB 2446*, Borneo, Sarawak, Kuching (holotype FI, *n.v.*; isotype L, *n.v.*).

Notes: A species occurring in Peninsular Malaysia and Borneo. Scattered throughout Sarawak in lowland mixed dipterocarp forest at altitudes up to 200 m (*S 4099*, *S 18771*, *S 25258*, and *S 29249*). It also occurs in Brunei (*BRUN 2476* and *BRUN 3317*).

New Species

1. ***Madhuca engkikiana*** Yii & P. Chai, **sp. nov.**
(Engkik Soepadmo, Coordinator and Chief Editor of the Tree Flora of Sabah & Sarawak project)

Madhucae kuchingensi arcte similis, sed in ramulis glabris foliis bene dispositis, venatione intercostali reticulata supra non impressa, venis paucis e costa enascentibus venis lateralibus parallelis differt. **Typus:** *Kodoh Tarodop SAN 83612*, Borneo, Sabah, Sandakan, Telupid (holotypus SAR!; isotypi AA, K, KEP!, L, SAN!, SING!).

Figure 1

Tree up to 25 m tall, 42 cm diameter. *Bark* reddish grey; inner bark yellowish red. Sapwood yellow. *Twigs* slender, terete, glabrous. *Terminal buds* c. 3 mm long, puberulous. *Stipules* triangular, c. 1 x 0.4 mm. *Leaves* spirally arranged, scattered and well-spaced along the twigs, coriaceous, glabrous on both surfaces; blade elliptic to elliptic-obovate, 9–13 x 3.5–4.8 cm, base cuneate, slightly decurrent and oblique, margin entire and plane, apex short-acuminate; midrib raised on both surfaces; lateral veins 11–15 pairs, ascending at an angle of c. 80° from the midrib, distinctly connected by the thickened intercostal veins to form intramarginal vein-loops, prominent on both surfaces; intercostal venation reticulate, with a few veins arising from the midrib and parallel to the lateral veins; petioles 2–3.5 cm long, flat to slightly raised on the adaxial side, thickened, black and puberulous at the base. *Inflorescences* axillary, 6–8-flowered; pedicels up to 0.3 cm long, yellowish appressed hairy. *Flowers:* calyx biseriate, consisting of two whorls of two sepals; sepals suborbicular, c. 3 x 2.5 mm, tufted hairy at the apex; corolla c. 2 mm long, tube c. 0.75 mm long, lobes 7, oblanceolate, densely pubescent with tufted yellowish hairs at the apex; stamens 16, in two whorls,

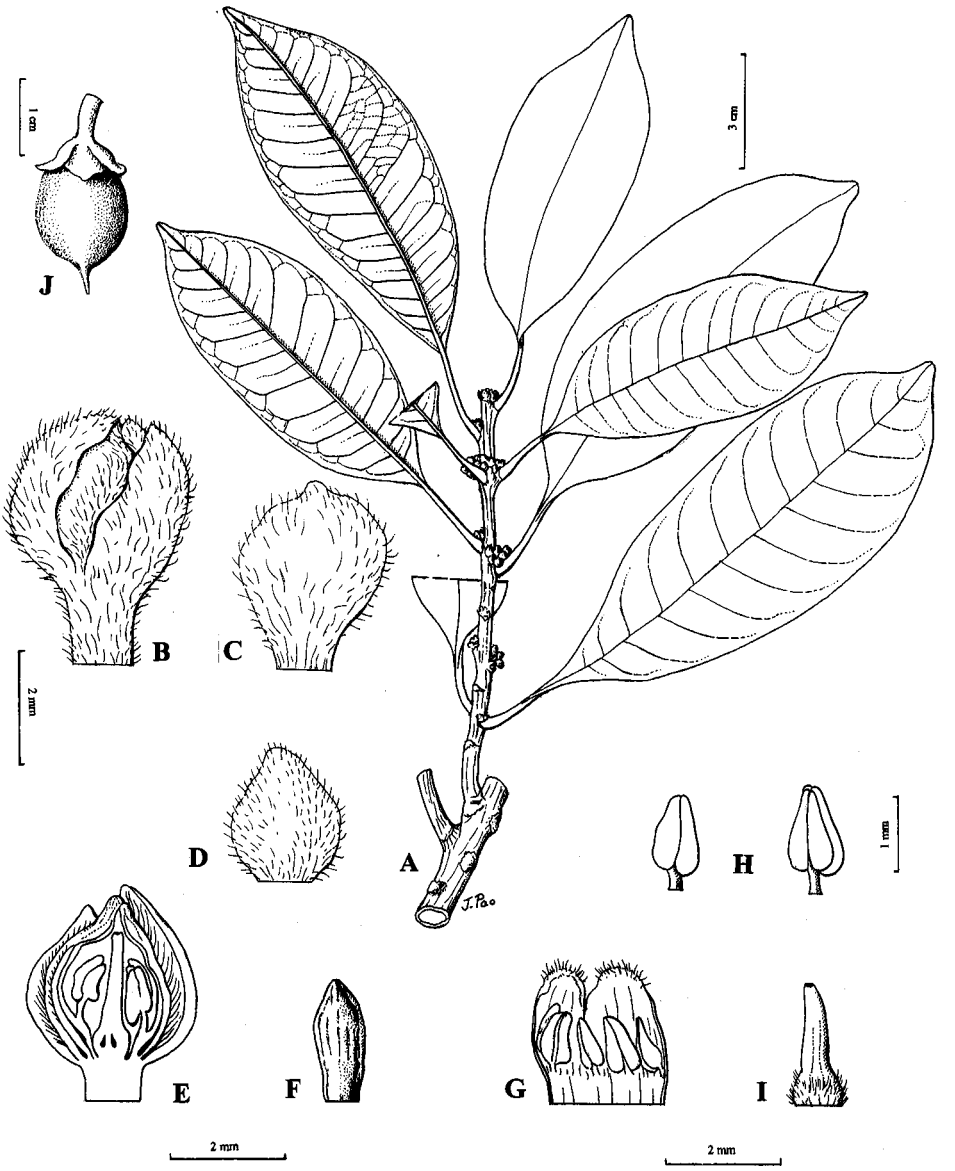

Figure 1. *Madhuca engkikiana*. A, leafy flowering twig; B, flower bud; C, outer sepal; D, inner sepal; E, longitudinal section of flower bud; F, petal; G, petals and stamens; H, stamens in different views; I, gynoecium; J, fruit. (A–I from *SAN 83612*, J from *SAN 131963*.)

filaments very short, anthers lanceolate, c. 1 x 0.5 mm, slightly hairy; ovary subconical, c. 2 mm long, hairy, 6–7-loculed, style stout, c. 1.5 mm long. *Fruits* (young) ellipsoid, laterally compressed, 1.5 x 0.6–1.2 cm, densely brownish tomentose. *Seeds* laterally compressed, pointed at both ends; testa thin, smooth; scar linear.

Distribution: Endemic to Borneo. Known only from four collections from Sabah (*SAN 53982*, *SAN 54205*, *SAN 131963*, and the type).

Ecology: In lowland mixed dipterocarp forest, up to 250 m altitude.

Notes: Similar to *Madhuca kuchingensis* but differs by its glabrous twigs, leaves well-spaced along the twigs, and reticulate intercostal venation that is not impressed above and with a few shorter veins arising from midrib and parallel to lateral veins.

2. ***Madhuca markleeana*** Yii & P. Chai, **sp. nov.**
(Mark Lee Hua Seng, Deputy Director, Forestry Department, Sarawak)

Madhucae borneensi et M. sarawakensi in characteribus vegetativis similis, sed in ramulis laminisque foliorum glabris, stipulis orbicularibus, sepalis exterioribus magnis suborbicularibus et recurvatis, pedicello fructifero longiore (7–8 cm longo) differt. **Typus:** *Yii S 72728*, Borneo, Sarawak, Bukit Meluku (holotypus SAR!; isotypi K, KEP!, L, SAN!).

Figure 2

Tree up to 15 m tall, 25 cm diameter, with very low buttresses. *Bark* chocolate brown with greyish green mottles, smooth to finely fissured; inner bark c. 4 mm thick, dull orange, granular. *Twigs* terete, rusty-brown velvety hairy at the tips, glabrescent. *Terminal buds* up to 8 mm long; bud-scales elliptic, 10–14 x 9–11 mm. *Stipules* lanceolate, c. 10 x 3 mm, velvety hairy, caducous. *Leaves* spirally arranged, scattered and well-spaced along the twigs, coriaceous, glabrous on both surfaces; blade lanceolate or oblong, 25–35 x 7–8 cm, base broadly cuneate and slightly oblique, margin entire and plane, apex obtuse or acuminate with a sharp tip; midrib broadly crested above, prominent below; lateral veins 28–35 pairs, ascending at an angle of 75–85° from the midrib, straight at first and then curving and joining at their tips to form vein-loops rather far from the leaf margin, impressed above, prominent below; intercostal venation slender, scalariform, with at least one vein descending from the margin and parallel to the lateral veins, faint above, distinct below; petioles 1.5–2.5 cm long, flat on

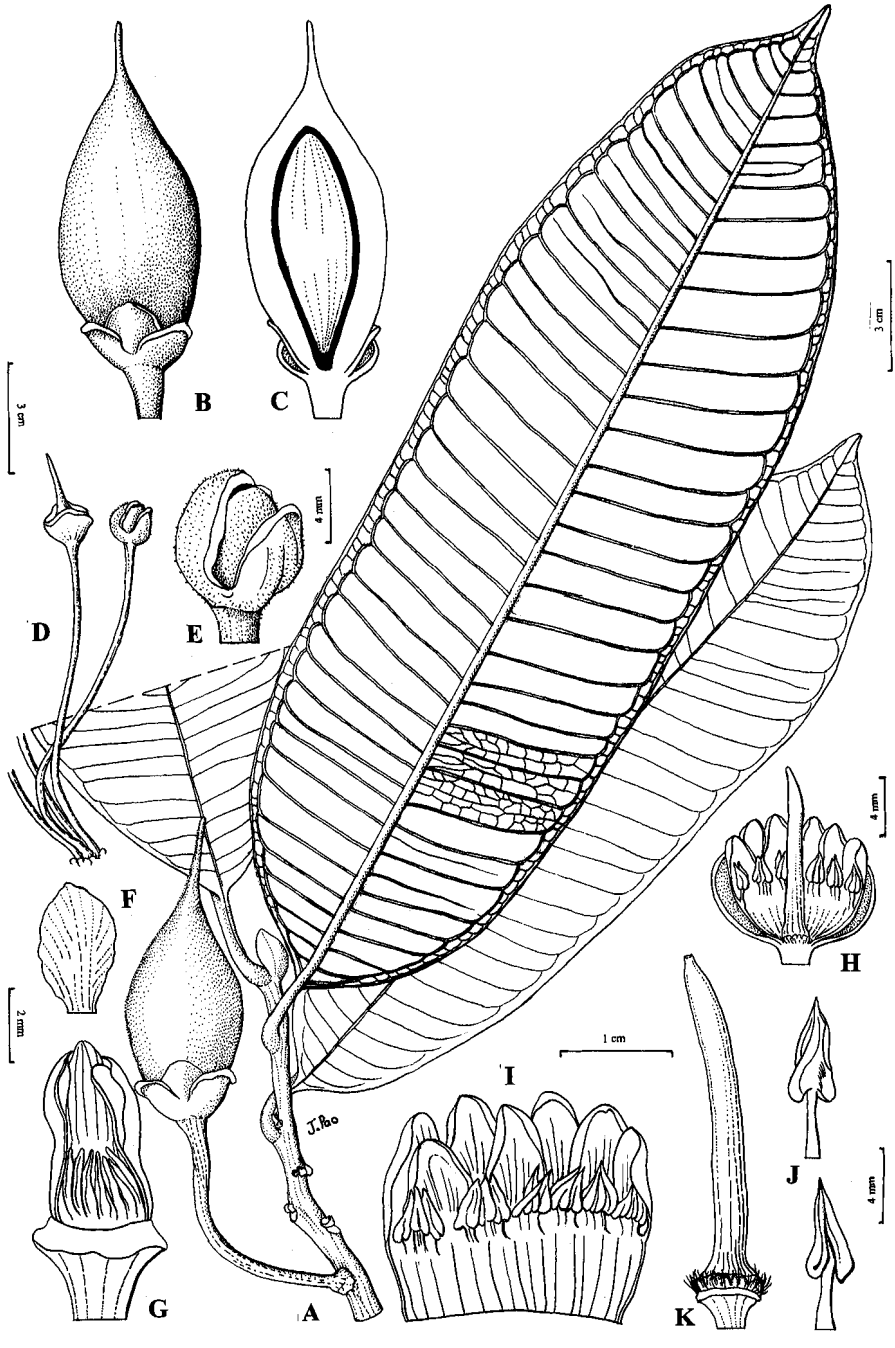

Figure 2. *Madhuca markleeana.* A, fruiting leafy twig; B, fruit; C, longitudinal section of fruit; D, part of inflorescence; E, flower bud; F, petal; G, flower bud with sepals and a few petals removed; H, longitudinal section of flower bud; I, petals and stamens; J, stamens in different views; K, gynoecium. (A–C from *S 72729*, D–K from *S 72728.*)

the adaxial side, round on the abaxial side, velvety hairy, glabrescent. *Inflorescences* axillary, 3–5-flowered; pedicels subangular, 5–6 cm long, pale green, sparsely pubescent. *Flowers:* calyx biseriate, consisting of two whorls of two sepals; sepals suborbicular, c. 10 x 14 mm, outer pair with recurved margin, inner pair smaller, margin not recurved, pubescent; corolla white, c. 12 mm long, lobes 8, lanceolate, 7–8 mm long, apex acute, tube c. 4 mm long, slightly pubescent at the throat; stamens 19, in two whorls, filaments subulate, c. 5 mm long, anthers sagittate, yellowish, c. 5 mm long; ovary disciform, c. 3 x 5 mm, 8-loculed, pilose, style filiform, pale green, tapering towards stigma. *Fruits* ellipsoid, c. 7 x 4 cm, 1-seeded, tapering at both ends; pericarp thick and fleshy, green, densely brown tomentose; stalk 7–8 cm long. *Seeds* ellipsoid, 4.5 x 1.2–2 cm, pointed at both ends; testa thin; scar narrowly linear, c. 43 x 3 mm.

Vernacular name: Sarawak—*nyatoh gasing* (Malay).

Distribution: Endemic to Sarawak; known only from two collections, the type and *Yii S 72729*, Borneo, Sarawak, Bukit Meluku (K, KEP!, L, MO, SAN!, SAR!, SING!).

Ecology: Understorey tree on steep slopes of lowland mixed dipterocarp forest, up to 400 m altitude.

Notes: Resembles *Madhuca borneensis* and *M. sarawakensis* in vegetative characters but differs in having glabrous twigs and leaves, orbicular stipules, large suborbicular and recurved outer sepals, and longer fruit stalk (7–8 cm long).

3. ***Madhuca multinervia*** Yii & P. Chai, **sp. nov.**
(Latin, *multi* = many, *nervis* = nerves; alluding to the many, closely parallel lateral veins of the leaves)

Madhucae elmeri arcte similis in characteribus vegetativis, sed in ramulis novellis foliis petiolisque glabris, venis lateralibus 28–45 paribus arcte approximatis ascendentibus distinguenda. **Typus:** *Dewol SAN 97008*, Borneo, Sabah, Tongod district, Bt. Pantagaluang (holotypus SAR!; isotypi AA, BO!, K, KEP!, L, OX, SAN!, SING!).

Figure 3

Tree up to 20 m tall, 40 cm diameter. *Bark* pale brown with greyish mottles, smooth; inner bark pale reddish, with sticky white latex. Sapwood whitish.

Twigs slender, solid, 2–4 mm diameter, subangular with distinct stipular scars, rusty-brown velvety hairy at the tips, quickly glabrescent and becoming blackish. *Terminal buds* c. 5 mm long. *Stipules* broadly ovate, c. 6 x 4 mm, truncate, rusty-brown velvety. *Leaves* spirally arranged and scattered along ends of twigs, papyraceous to subcoriaceous, glabrous or with appressed silvery hairs on the midrib above, glabrous or with remnants of appressed silvery hairs and subappressed ferrugineus hairs on the midrib below; blade oblong-elliptic, 16.5–19 x 5–12 cm, base obliquely cuneate to rounded, margin entire and plane, apex obtuse; midrib impressed and slightly crested above, strongly prominent and rounded below; lateral veins 28–45 pairs, ascending at an angle of 65–85° from the midrib, straight or slightly curved, arching and joining into vein-loops at 1–2 mm from the leaf margin, impressed above, prominent below; intercostal venation scalariform, faint; petioles 2–4 cm long, thickened, narrowly grooved on the adaxial side, rounded on the abaxial side, rugose and black at the base, glabrous. *Inflorescences* axillary, 3–10-flowered; pedicels 1–2 cm long, slender, velvety hairy. *Flowers:* calyx biseriate, consisting of two whorls of two sepals; sepals free, imbricate, orbicular, c. 6 mm across, velvety hairy, inner pair thinner, crested and hairy; corolla 7–10 mm long, 8-lobed, lobes elliptic or ovate, c. 3.5 x 1.5 mm, apex acute, densely hairy at the throat; stamens 16–24, in two or three whorls, filaments very short, anthers sagittate, c. 3.5 mm long; ovary subconical, c. 1 mm across, 8-loculed, glabrous, style c. 8 mm long, glabrous. *Fruits* ellipsoid, up to 2.1 x 1.2 cm, 1-seeded; pericarp thin, glabrous; stalk up to 2 cm long. *Seeds* laterally compressed, ellipsoid to obovoid, 1.7 x 1.1 x 0.8 cm, obtuse at both ends; scar as long as seed, c. 5 mm wide.

Distribution: Endemic to Borneo. Scattered throughout the eastern parts of Sabah (*SAN 88312*, *SAN 93874*, *SAN 96918*, *SAN 97008*, *SAN 99692*, *SAN 99726*, *SAN 111764*, *SAN 124566*, and *SAN 133478*).

Ecology: Usually on hillsides and ridges in primary lowland mixed dipterocarp forest.

Notes: Closely allied to *Madhuca elmeri* in vegetative characters but can be distinguished by its glabrous young twigs, leaves and petioles, and 28–45 pairs of closely set ascending lateral veins.

4. ***Madhuca ochracea*** Yii & P. Chai, **sp. nov.**
(Latin, *ochraceus* = pale yellowish brown; referring to the indumentum)

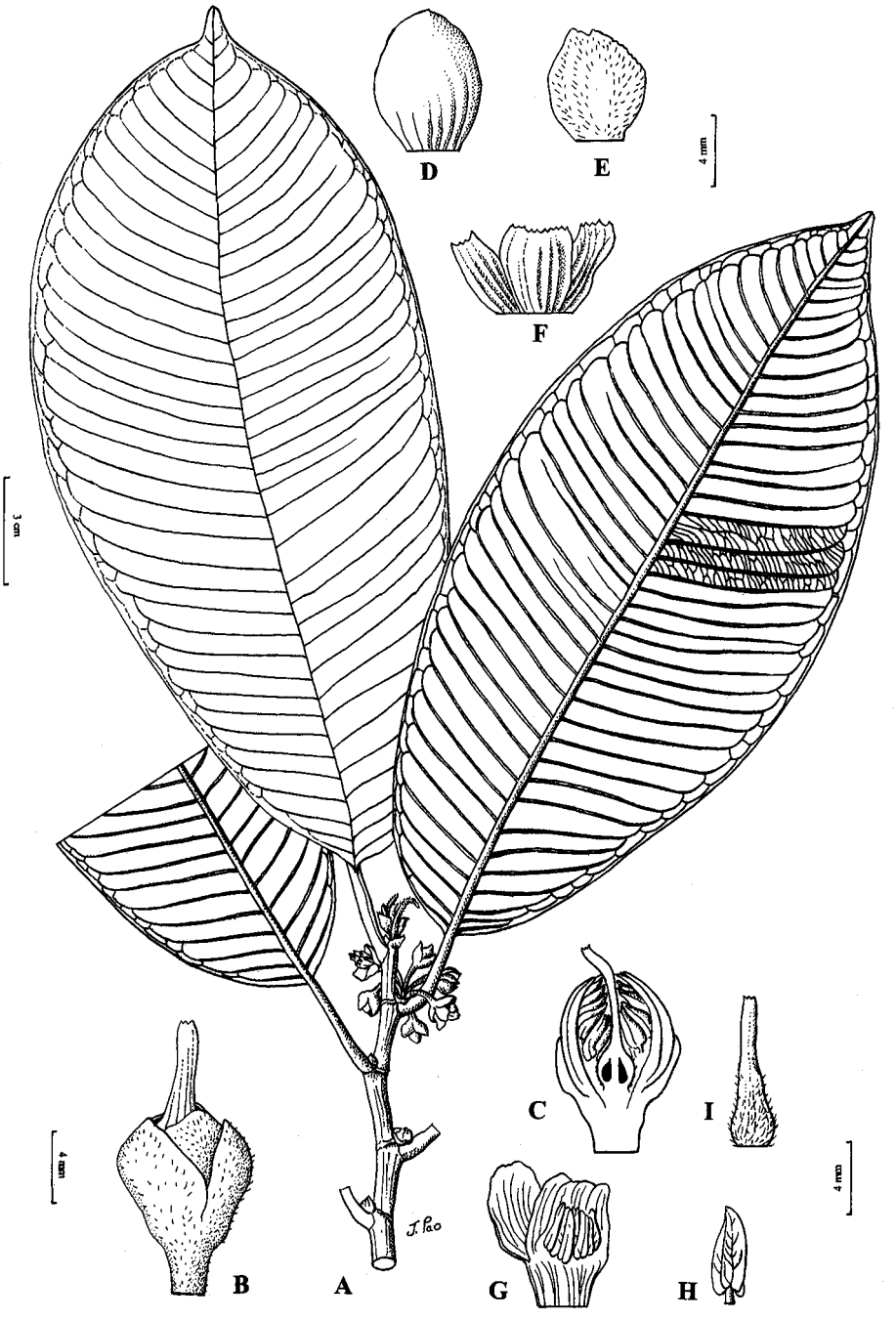

Figure 3. *Madhuca multinervia.* A, flowering leafy twig; B, flower bud; C, longitudinal section of flower bud; D, outer sepal; E, inner sepal; F, petals; G, part of flower with petals and stamens; H, stamen; I, gynoecium. (All from *SAN 97008.*)

Madhucae dubardii similis in foliis infra persistentiter pallide flavido-brunneo tomentosis, sed in folii margine recurvata, apice caudato, nervis intercostalibus a margine descendentibus venis lateralibus parallellis differt. **Typus:** *Wright S 29130*, Borneo, Sarawak, Niah National Park (holotypus SAR!; isotypi K, L, SAN!, SING!).

Figure 4

Tree up to 25 m tall, 70 cm diameter. *Bark* greyish brown, scaly; inner bark dull orange. *Twigs* angular, glabrous. *Terminal buds* c. 5 mm long. *Stipules* broadly ovate, c. 5 x 4 mm, glabrous, persistent. *Leaves* spirally arranged and crowded at the ends of twigs, coriaceous, glabrous above, covered with persistent pale yellowish brown tomentum below; blade elliptic or elliptic-obovate, 8.5–19 x 3.5–8.2 cm, base cuneate, margin recurved, apex caudate or acuminate, acumen c. 1 cm long; midrib shallowly grooved and crested above, rounded and prominent below; lateral veins slender, 26–34 pairs, ascending at an angle of 80–85° from the midrib, curved, diminishing and becoming inconspicuous toward the leaf margin, faint and impressed above, distinct below; intercostal venation slender, descending from the margin and parallel to the lateral veins, laxly reticulate towards the leaf margin, indistinct above, faint below; petioles 2–4.8 cm long, narrowly grooved on the adaxial side, thickened and rugose at the base. *Inflorescences* axillary, 2–7-flowered; pedicels c. 1.2 cm long, glabrous, angular and enlarged at the apex. *Flowers:* calyx biseriate, consisting of two whorls of two sepals; sepals orbicular, c. 6 mm across, apex rounded, velvety hairy; corolla c. 8 mm long, 10-lobed, lobes obovate, c. 4 x 3 mm, apex rounded and ciliate; stamens 16, in two whorls, filaments c. 2.5 mm long, anthers sagittate, c. 2.5 mm long; ovary subconical, c. 2 mm across, 6–8-loculed, velvety hairy, style c. 7 mm long, subangular, glabrous. *Fruits* (immature) ovoid, c. 1 cm across, base rounded, apex flattened and topped by stout remnant of style, pale yellowish brown hairy. *Seeds* unknown.

Vernacular name: Sarawak—*nyatoh kelabu* (Iban).

Distribution: Endemic to Borneo. Known from only two collections from Sarawak, the type and *S 23100* from the Mentagai Hills, Marudi, Miri Division.

Ecology: In primary lowland mixed dipterocarp forest on clay loam soils, up to 100 m altitude.

Notes: Similar to *Madhuca dubardii* in the persistently pale yellowish brown tomentose leaf undersurface but differs by its recurved leaf margin, caudate

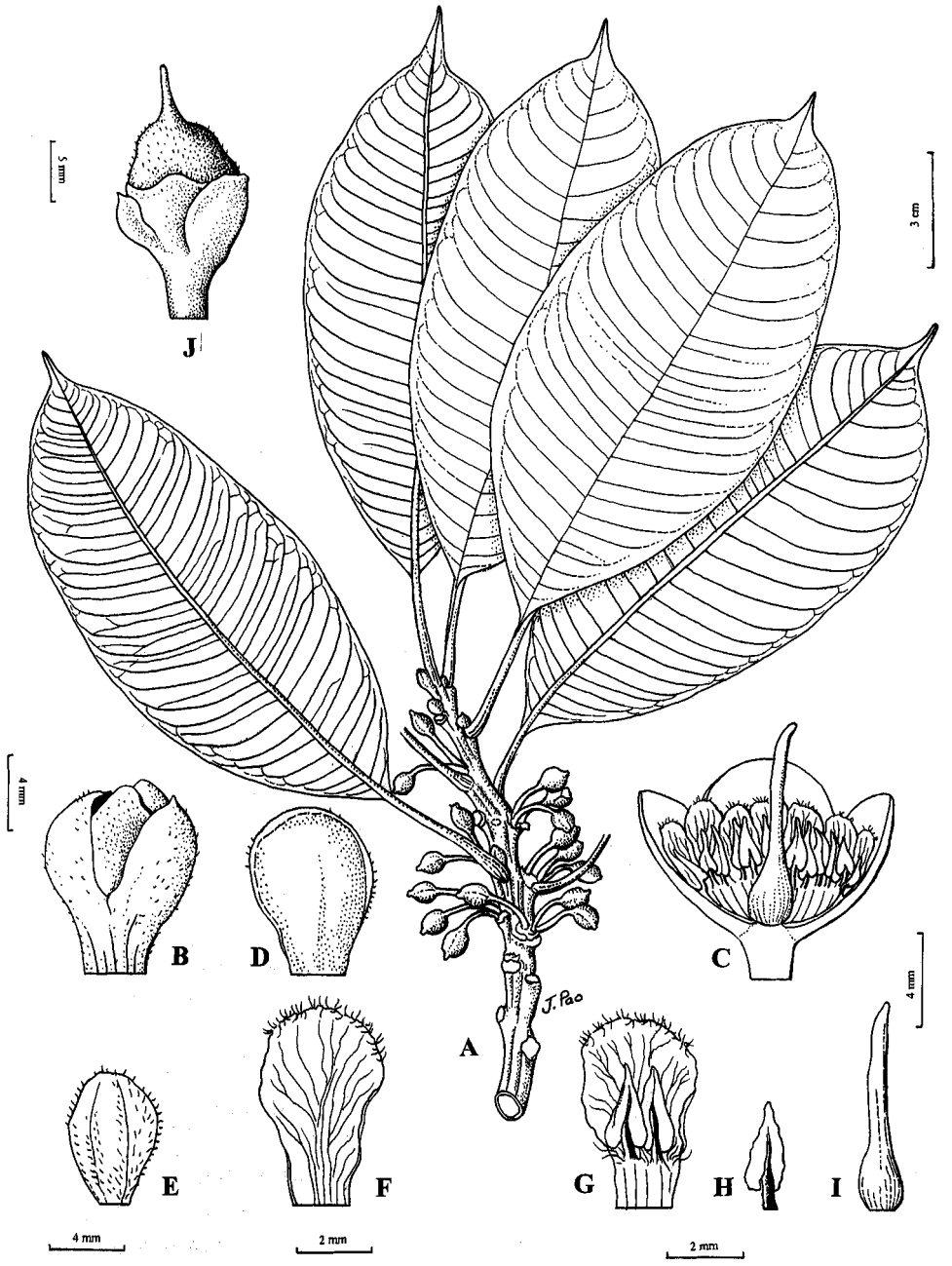

Figure 4. *Madhuca ochracea.* A, flowering leafy twig; B, flower bud; C, longitudinal section of flower bud; D, outer sepal; E, inner sepal; F, petal; G, petal and stamens; H, stamen; I, gynoecium; J, young fruit. (A–I from *S 29130*, J from *S 23100.*)

leaf apex and intercostal veins descending from the margin and parallel to the lateral veins.

5. ***Madhuca silamensis*** Yii & P. Chai, **sp. nov.**
(of Mt. Silam, Sabah)

Ab ullis speciebus borneensibus cognitis in foliis crasse coriaceis argenteo-brunneo tomentosis secus ramos crassos subangulares dispersis distincta. **Typus:** *Mujin SAN 37849*, Borneo, Sabah, Mt. Silam (holotypus SAR!; isotypus SAN!).

Figure 5

Tree up to 9 m tall, 15 cm diameter. *Bark* shallowly fissured or scaly, greyish brown; inner bark brittle, with white latex. *Twigs* stout, subangular, glabrous. *Terminal buds* up to 8 mm long. *Stipules* triangular, c. 4 x 4 mm, crested, glabrous. *Leaves* spirally arranged, scattered and well-spaced along the twigs, thickly coriaceous, silvery brown tomentose on both sides; blade elliptic to oblong-elliptic, 16–25 x 6–8 cm, base narrowly cuneate, margin entire and plane, apex blunt or rounded; midrib raised on both sides, stronger below; lateralveins 15–19 pairs, ascending at an angle of 70–80° from the midrib, curved, diminishing and becoming inconspicuous near the leaf margin, distinctly raised on both surfaces; intercostal venation laxly reticulate; petioles 3–4 cm long, grooved on the adaxial side, thickened at the base, glabrous. *Inflorescence* axillary, 2–3-flowered; pedicels 1–1.5 cm long, angular and slightly enlarged at both ends. *Flowers:* calyx biseriate, consisting of two whorls of two sepals; sepals broadly ovate, 6 x 4 mm, rusty-brown tomentose (mature flowers not seen). *Fruits* unknown.

Distribution: Endemic to Sabah; known only from the type collection from Mt. Silam, Lahad Datu district and *SAN 51742* from Bt. Tawai, Kinabatangan district.

Ecology: In forest on ultrabasic soils, up to 850 m altitude.

Notes: The spirally arranged leaves and the calyx comprising two whorls of two sepals confirm that the specimens belong to *Madhuca*. The species is distinct from any known species of *Madhuca* from Borneo in having thickly coriaceous, silvery-brown tomentose leaves that are scattered along the subangular and stout glabrous twigs.

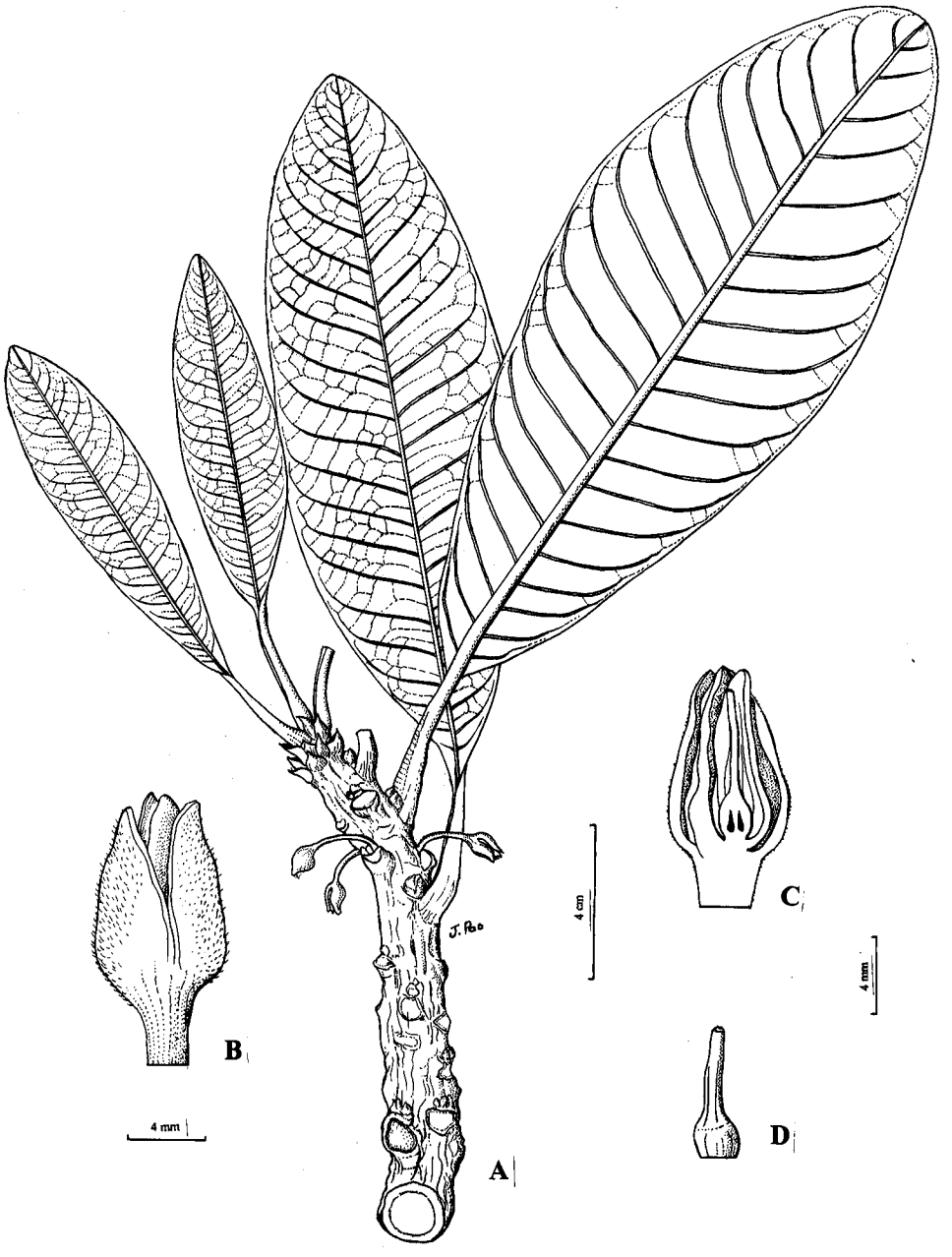

Figure 5. *Madhuca silamensis.* A, flowering leafy twig; B, flower bud; C, longitudinal section of flower bud; D, gynoecium. (All from *SAN 37849.*)

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