
REVISION OF *GREWIA* (*MALVACEAE*–*GREWIOIDEAE*) IN PENINSULAR MALAYSIA AND BORNEO

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Two keys to distinguish the genera *Grewia* and *Microcos* are presented, one based on macromorphological characters and the other on micromorphological characters. *Grewia* is revised for Peninsular Malaysia and Borneo. Despite the 33 names published under *Grewia* for the region only four species are recognized here. *Grewia multiflora* is newly recorded from Borneo and attention is drawn to its curious distribution; *G. huluperakensis* is endemic to Peninsular Malaysia; *G. polygama* is found in limestone forest in northern Peninsular Malaysia, and *G. laevigata* is common in Peninsular Malaysia and Borneo. A key, descriptions and illustrations are provided for all four species. A list of excluded species names is included: all are referable to *Microcos*.

Keywords. *Grewia*, *Malvales*, *Microcos*, taxonomic revision, *Tiliaceae*.

INTRODUCTION

It has long been apparent to systematists that the delimitation of families within the core *Malvales* (i.e. *Tiliaceae*, *Sterculiaceae*, *Bombacaceae*, and *Malvaceae* s.s.) is problematic (Hutchinson, 1967; Cronquist, 1981). Certain genera have been transferred back and forth between these families. The distribution of distinctive characters derived from morphology and palynology is only partly consistent with traditional classifications (Edlin, 1935; Erdtman, 1952; Takhtajan, 1997; Bayer, 1999). Recently these closely related families have been merged into an expanded *Malvaceae* s.l. with nine subfamilies. The genera formerly included in *Tiliaceae* are now distributed in subfamilies *Brownlowioideae*, *Dombeyoideae*, *Grewioideae*, and *Tilioideae* of *Malvaceae* s.l. Morphological and molecular data show that *Brownlowioideae* and *Grewioideae* include the vast majority of ‘tiliaceous’ genera, the rest being in *Tilioideae* (*Tilia* L. and *Craigia* W.W.Sm. & W.E.Evans) and *Dombeyoideae* (*Schoutenia* Korth. and other tiliaceous genera outside the Malesian region) which are more closely related to traditional *Sterculiaceae* (Judd & Manchester, 1997; Bayer *et al.*, 1999; Bayer & Kubitzki, 2003).

The genus *Grewia* L., the type genus of subfamily *Grewioideae*, is grouped there with 24 other genera (including *Microcos* L.), the subfamily comprising about 700 species in the tropics (Bayer & Kubitzki, 2003). In the past few decades, the delimitation and taxonomic status of *Grewia* and *Microcos* have been the subject of controversy. The disagreement among botanists has arisen since the publication

of Burret's monograph of *Tiliaceae* (Burret, 1926). The confusion centred on whether the two genera should be united (e.g. Ridley, 1922; Kochummen, 1973; Ashton, 1988; Argent *et al.*, 1997), kept separate (e.g. Masamune, 1942; Backer & Bakhuizen, 1964; Phengklai, 1986, 1993; Turner, 1995) or divided into a number of subgenera or sections (e.g. King, 1891). Recently, Chung (2001, 2002, 2003) and Chung *et al.* (2003, 2005a,b) identified a total of 42 macromorphological and micro-morphological characters which, in combination, can be used to distinguish species of *Grewia* from those of *Microcos* in Peninsular Malaysia and Borneo, and concluded that the two genera are distinct. The findings support previous conclusions reached by several authors: Burret (1926) and Bayer & Kubitzki (2003) based on the morphology of inflorescences, flowers and fruits; Chattaway (1934) based on wood anatomy; Zhang & Chen (1984) based on pollen morphology, and Bayer *et al.* (1999) based on combined analyses of plastid *atpB* and *rbcL* DNA sequences.

Grewia was established by Linnaeus (1753) with two species: *G. occidentalis* L. from tropical Africa and *G. orientalis* L. from Sri Lanka. To date, a total of 690 binomials for *Grewia* have been published, representing taxa from tropical Africa, Madagascar, Arabia, the Himalaya, Pakistan, India, China, Myanmar, Thailand, Indo-China, Malesia, the Pacific Islands (Tonga and Samoa), and northern Australia (Bayer & Kubitzki, 2003; International Plant Names Index, 2005). About 80 binomials have been published for plants from Southeast Asia, of which 33 were attributed to Peninsular Malaysia and Borneo (Miquel, 1859, 1861; King, 1891; Merrill, 1921, 1923; Ridley, 1922, 1925; Craib, 1925; Burret, 1926, 1927, 1934; Masamune, 1942; Backer & Bakhuizen, 1964; Kochummen, 1973; Phengklai, 1986, 1993; Ashton, 1988; Whitmore *et al.*, 1990; Turner, 1995; Coode *et al.*, 1996; Argent *et al.*, 1997; Beaman & Anderson, 2004). Chung (2001, 2003) and Chung *et al.* (2005a), however, recognized only four species of *Grewia* (i.e. *G. huluperakensis* I.M.Turner, *G. laevigata* Vahl, *G. multiflora* Juss. and *G. polygama* Roxb.) in Peninsular Malaysia and Borneo and included the others in *Microcos* (see Table 1 and 'Species excluded from *Grewia*' on p. 22).

MATERIALS AND METHODS

This work was carried out without any attempt to revise or to monograph the genera *Grewia* and *Microcos* on a world scale. However, in order to establish the correct taxonomic status of the species recognized in Peninsular Malaysia and Borneo, other specimens including those of type species of the two genera were examined and compared. For this purpose herbarium specimens referable to the two genera were examined from several herbaria. All specimens cited have been seen by the author. The dimensions given in the descriptions are from dried material except for the gynoecium and androecium characters which are from rehydrated flowers or spirit collections.

For scanning electron microscopy (SEM), stigmas from mature flowers were directly mounted on stubs, coated with gold and observed under a JOEL JSM-6400 scanning electron microscope.

TABLE 1. Numbers of species recognized by various authors in *Grewia* and *Microcos* in Peninsular Malaysia and Borneo

Geographical coverage	Authors	Number of species		Current treatment (Chung, 2001, 2003; Chung <i>et al.</i> , 2005a)
		<i>Grewia</i>	<i>Microcos</i>	
Peninsular Malaysia	Burret (1926)	2	8	Unchanged
	King (1891)	9	0	<i>Grewia</i> = 1, <i>Microcos</i> = 8
	Ridley (1922, 1925)	13	0	<i>Grewia</i> = 3, <i>Microcos</i> = 10
	Kochummen (1973)	12	0	<i>Grewia</i> = 3, <i>Microcos</i> = 9
	Turner (1995)	3	10	Unchanged
Borneo	Merrill (1921)	6	0	<i>Grewia</i> = 1, <i>Microcos</i> = 5
	Burret (1926, 1927, 1934)	1	15	<i>Grewia</i> = 1, <i>Microcos</i> = 14
	Masamune (1942)	7	13	<i>Grewia</i> = 2, <i>Microcos</i> = 15
	Ashton (1988)	16	0	All in <i>Microcos</i>
	Whitmore <i>et al.</i> (1990)	8	15	<i>Grewia</i> = 1, <i>Microcos</i> = 20
	Coode <i>et al.</i> (1996)	1	13	Unchanged
	Argent <i>et al.</i> (1997)	1	2	All in <i>Microcos</i>
	Beaman & Anderson (2004)	1	3	Unchanged

The descriptions were made from herbarium specimens; thus all colours given are for dried material. Terminology and definitions mainly follow Lawrence (1951), Benson (1957) and Radford *et al.* (1974). Specimen citations and herbarium acronyms follow Holmgren *et al.* (1990).

DISTINGUISHING GREWIA FROM MICROCOS

The results of this revision show that *Grewia* and *Microcos* in Peninsular Malaysia and Borneo are well-defined but also closely related. The major macromorphological and micromorphological differences between the two genera are given in the following keys. For further distinguishing characters, see Chung (2001, 2002, 2003), Chung *et al.* (2003, 2005a,b) and Figs 1 and 2.

Key based on macromorphological characters

- a. *Leaf margins* usually serrate or double serrate. *Inflorescences* axillary, supra-axillary, leaf-opposed or sometimes (sub-)terminal umbels of 3–7(–13)-flowered cyme-like units. *Bracteoles* of cymes not involucrate. Upper part of *androgynophore* well-developed. *Stigma* usually lobulate, divided or laciniate. *Fruits* usually 2–4-lobed, depressed globose _____ **Grewia**
- b. *Leaf margins* usually entire, sometimes distally serrate to serrulate. *Inflorescences* terminal and/or axillary panicles of triflorous cyme-like units with first and second order branching. *Bracteoles* of cymes involucrate. Upper part of *androgynophore* absent. *Stigma* with 3 plano-convex stigmatic arms or inconspicuously lobulate. *Fruits* usually unlobed, sometimes slightly 3(4)-lobed near apex; globose, obovoid or pyriform _____ **Microcos**

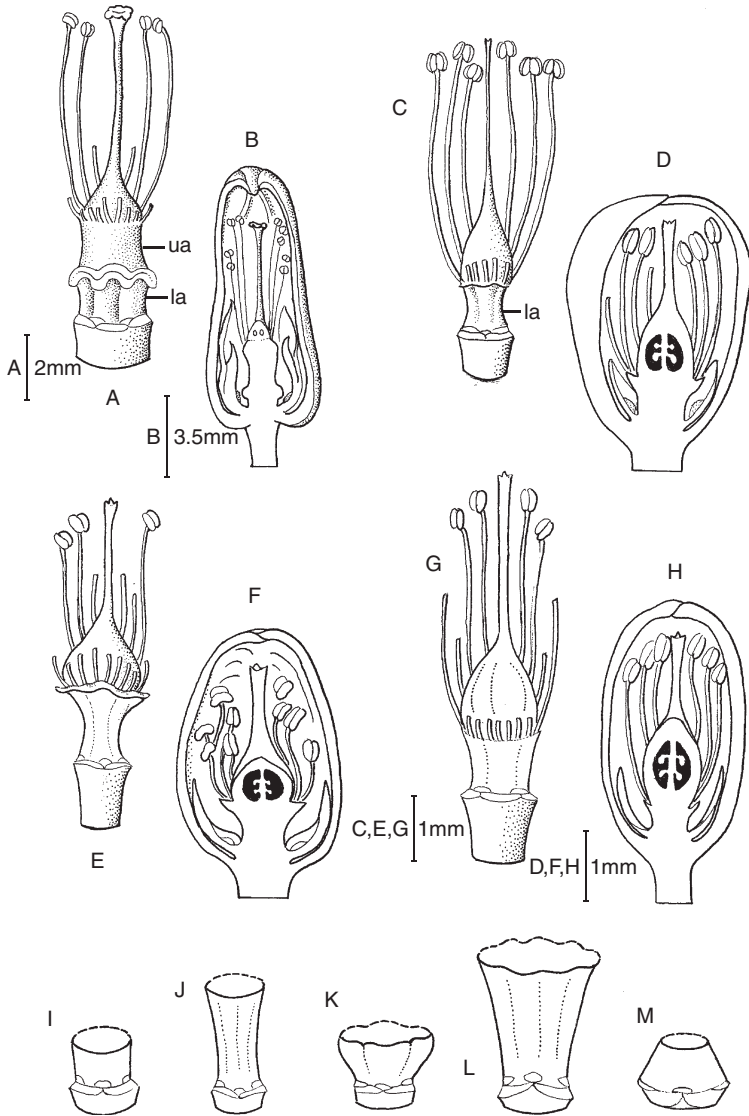


FIG. 1. Dissections of flower buds and flowers in *Grewia* (A & B, I-M) and *Microcos* (C-H). A, C, E & G: flowers with sepals, petals and some stamens removed; B, D, F & H: longitudinal sections of buds. A & B, androgynophore of two parts, upper and lower; C-H, androgynophore of lower part only; E & F, apex of lower androgynophore extended outwards; G & H, apex of lower androgynophore not extended outwards; I-M, lower androgynophore shapes in *Grewia* (not to scale): I, cylindrical; J, concave; K, cup-shaped; L, obovate; M, depressed ovoid. ua = upper androgynophore; la = lower androgynophore.

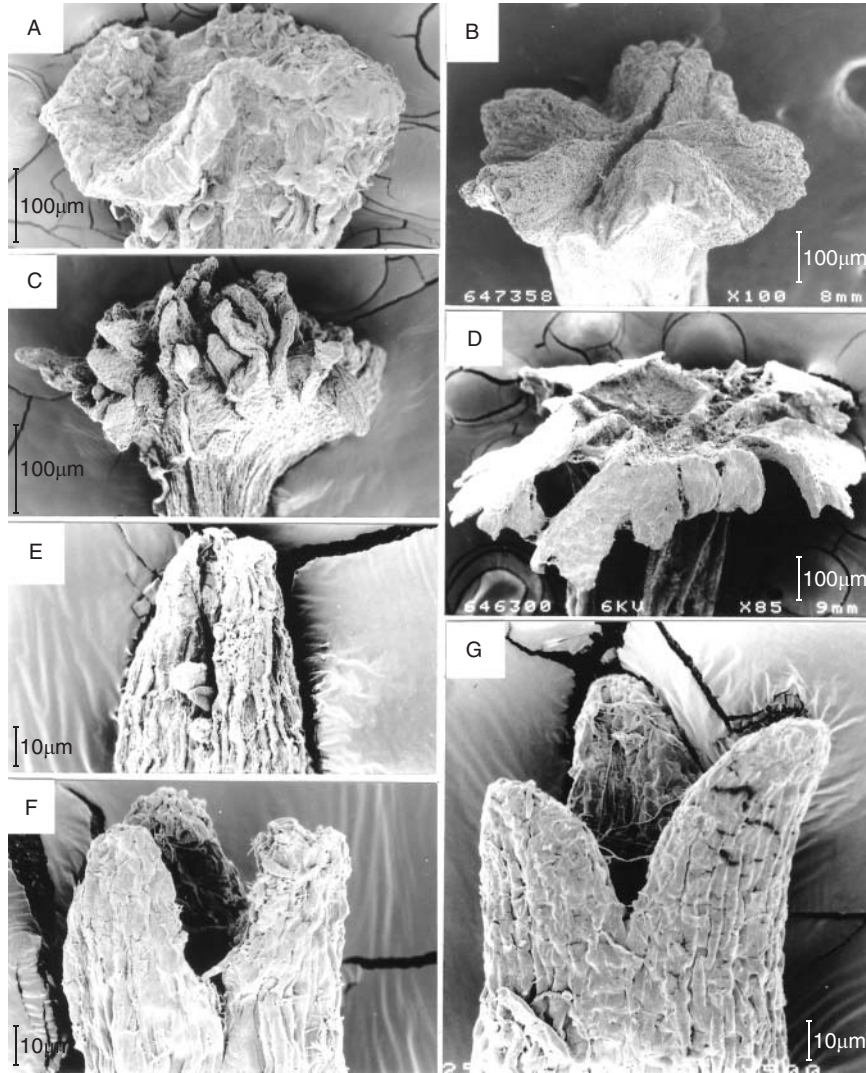


FIG. 2. Micrographs of stigma shapes in *Grewia* and *Microcos*. A & B, lobulate; C, lacinate; D, irregularly lobed/divided with spreading lobes; E–G, with 3 plano-convex stigmatic arms. A, *Grewia occidentalis* L. (type species from type locality, Moss 3959); B, *G. huluperakensis* I.M. Turner (Turner 94-94); C, *G. polygama* Roxb. (Kamarudin & Mustapa FRI42255); D, *G. multiflora* Juss. (Blume s.n. [=L sheet no. 908.253.1458]); E, *Microcos gracilis* Stapf ex Ridl. (Haviland 1683); F, *M. pearsonii* (Merr.) Burret (Agam & Aban SAN40876); G, *M. borneensis* Burret (Tinggi S3311).

Key based on micromorphological characters

- a. *Wood vessels* usually round, sometimes oval in cross section; intervessel pits sparse, round, rarely oval, aperture 1–2 μ m across; *axial parenchyma* predominantly scanty paratracheal to rarely vasicentric with narrow sheath around vessel; uniseriate rays rare; *tile cells* of *Pterospermum*-type (i.e. 2–4 times taller than procumbent cells and with 4–6 cells per procumbent cell). *Stomata* predominantly anomocytic, occasionally paracytic or anisocytic, elliptic to broadly elliptic in outline, average length:width 1.2–1.4. *Pollen grains* with average polar axis >52 μ m, average equatorial axis >38 μ m; average exine thickness 1.55–2.15 μ m, lumina >1.5 μ m across _____ **Grewia**
- b. *Wood vessels* usually oval, rarely round in cross section; intervessel pits dense, polygonal or rarely oval, aperture <1 μ m across; *axial parenchyma* predominantly apotracheal diffuse and diffuse-in-aggregates; uniseriate rays common; *tile cells* intermediate to *Durio*-type (i.e. slightly taller than procumbent cells and with 3–6 cells per procumbent cell). *Stomata* mainly paracytic or anisocytic, occasionally anomocytic, broadly elliptic, oblate to rounded, average length:width 0.9–1.1. *Pollen grains* with average polar axis <36 μ m, average equatorial axis <28 μ m; average exine thickness 0.84–0.90 μ m, lumina <1.5 μ m across _____ **Microcos**

THE GENUS *GREWIA* IN PENINSULAR MALAYSIA AND BORNEO

Grewia L., Sp. Pl.: 964 (1753); King, J. Roy. As. Soc. Beng. II, 60(1): 109 (1891), pro parte quoad sect. *Grewia*; Merrill, J. Str. Br. Roy. As. Soc., Spec. No.: 373 (1921); Ridley, Fl. Malay Penins. 1: 299 (1922); Burret, Notizbl. Bot. Gart. Berl.-Dahl. 9: 632 (1926); Masamune, En. Phan. Born.: 449 (1942); Kochummen in Whitmore, Tree Fl. Malaya 2: 396 (1973); Anderson, Checkl. Trees Sarawak: 337 (1980); Phengkklai, Thai For. Bull., Bot. 16: 15 (1986), Fl. Thailand 6(1): 14 (1993); Ashton, Man. Non-Dipt. Trees Sarawak 2: 439 (1988); Corner, Wayside Trees Malaya 3rd edition, 2: 732 (1988); Whitmore *et al.* (eds), Tree Fl. Indon., Checkl. Kalimantan 2(1): 355 (1990); Kessler *et al.*, Checkl. Tree Fl. Balikpapan-Samarinda Area: 66 (1992); Turner, Gard. Bull. Singapore 47(2): 487 (1995); Coode *et al.* (eds), Checkl. Flow. Pl. Gymno. Brunei: 323 (1996); Kochummen, Tree Fl. Pasoh: 427 (1997); Argent *et al.* (eds), Man. Non-Dipt. Trees Centr. Kalimantan 2: 640 (1997). Type species: *Grewia occidentalis* L., tropical Africa.

Small trees or scandent shrubs (climbers); bole usually crooked, to 35cm in diameter, without buttresses. *Twigs* terete, lenticellate. *Stipules* unlobed, persistent or caducous. *Leaves* alternate (distichous), simple; petioles usually not swollen at distal end; lamina usually serrulate or denticulate, 3-veined at base, often whitish beneath, indumentum of simple, tufted or stellate hairs. *Inflorescences* axillary, supra-axillary, leaf-opposed, or sometimes (sub-)terminal umbels of 3–7(–13)-flowered cyme-like units, solitary or fasciculate, rarely flowers solitary. *Flowers* bisexual or unisexual,

actinomorphic, pedicellate; bracteoles of cymes not involucrate. *Sepals* 5, free, valvate, margin flat, apex acute not cucullate, tufted- or stellate-hairy outside, glabrous inside. *Petals* 5, shorter than sepals, with or without gland at base inside; gland, if present, usually barbellate on margin. *Androgynophore* well-developed comprising glabrous lower part (torus) and densely tufted- or stellate-hairy upper part (sometimes very short). *Stamens* numerous, borne on upper part of androgynophore, filaments distinct, usually glabrous, anthers dorsifixed, reniform, 2-thecate, longitudinally dehiscent. *Ovary* superior, sessile, (1)2(5)-locular, each locule with 2–8 ovules; style slender; stigma usually lobulate, divided or lacinate. *Fruits* drupaceous, usually 2–4-lobed, depressed globose; mesocarp pulpy or fibrous; endocarp coriaceous or woody. *Pyrenes* (2)3 or 4 per fruit, free, each pyrene 1(2)-seeded. *Seeds* wingless, endosperm copious or scanty; cotyledons foliaceous.

Distribution. About 280–300 species, distributed from tropical Africa and Madagascar northwards to the Himalaya, China and Taiwan, southeast to India, Sri Lanka, Myanmar, Thailand, Indo-China, Malesia, western Pacific (Marianas, Fiji, Samoa, New Caledonia) and the northern parts of Australia. In the Malesian region about 30 species are known, of which four occur in Peninsular Malaysia and Borneo.

Habitat and ecology. Common constituents of the understorey of primary and secondary, deciduous or evergreen, lowland to lower montane (including limestone) forests, up to 1700m altitude, on a wide variety of soil types. Several are pioneers in open dry deciduous forest, scrub vegetation, forest edges and hedgerows.

In most *Grewia* species from Peninsular Malaysia and Borneo, the flowering season peaks from May to August, while the fruiting season peaks from August to November (Chung, 2001). Seed germination is epigeal, with emergent cotyledons leaf-like, hypocotyl elongated, first pair of leaves sometimes subopposite (Phengklai, 1998).

Vernacular names. Bungsi (Sarawak-Iban), chenderai and damak-damak (Peninsular Malaysia-Malay).

Uses. Due to their small size, the wood of *Grewia* species is used on a local scale only. It is generally used for making small articles where toughness is required, like tool handles, spades, shafts of golf clubs, shoulder poles for carrying small loads, pestles, bows, billiard cues and shingles (Phengklai, 1998).

The fibrous bark is used for making ropes. The fruits of most species are edible. The leaves of several species are used medicinally, chiefly for external applications (Phengklai, 1998).

Infrageneric classification. Burret (1926), using combinations of somewhat overlapping morphological characters of the inflorescences, flowers (petals, androgynophore and insertion of stamens), and fruits, recognized four sections within the genus. These were sect. *Axillares* Burret (none in Peninsular Malaysia or Borneo), sect. *Didymae* Burret (represented by *G. multiflora* Juss.), sect. *Glomeratae* Burret

(represented by *G. polygama* Roxb.) and sect. *Oppositiflorae* Burret (represented by *G. huluperakensis* I.M.Turner and *G. laevigata* Vahl).

More recently, Capuron (1963), Capuron & Mabberley (1999) and Mabberley & Capuron (1999) divided *Grewia* into three subgenera: *Burretia* (Hochr.) Capuron, *Grewia* (L.) Capuron and *Vincentia* (Benth.) Capuron. They based their classification on the characters of ovaries, styles and fruits. I agree with their treatment as it provides a better classification than that of Burret (1926). Based on these characters, all four species of *Grewia* known from Peninsular Malaysia and Borneo belong to subgen. *Grewia*.

Key to species

- 1a. Scandent shrub. Tertiary leaf-veins scalariform. Petals oblong _____ 2
 1b. Tree. Tertiary leaf-veins reticulate. Petals elliptic to broadly elliptic or obovate _____ 3
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- 2a. Twigs densely tufted-hairy. Stipules ovate, persistent. Leaves broadly ovate or occasionally broadly oblong, often with a pair of minute hairy auricles near petiole. Flower buds ovoid to broadly ovoid, 5–7mm in diameter _____
 _____ **1. *G. huluperakensis***
- 2b. Twigs glabrous or sparsely stellate-hairy. Stipules narrowly lanceolate, caducous. Leaves elliptic, oblong, lanceolate or ovate, without auricles. Flower buds oblong, narrowly ellipsoid or narrowly ovoid, 2–3.5(–4)mm in diameter _____
 _____ **2. *G. laevigata***
- 3a. Leaves symmetric, 3–5.5cm wide, glandular at lowest serration; midrib and secondary veins raised above; secondary veins 6–7 pairs, with hairy domatia. Flowers bisexual. Fruits deeply 2-partite, each part 1- or 2-lobed, drying black, not shiny _____ **3. *G. multiflora***
- 3b. Leaves weakly asymmetric, (1.5–)1.8–3(–3.5)cm wide, non-glandular at lowest serration; midrib and secondary veins impressed above; secondary veins 3 or 4(5) pairs, without hairy domatia. Flowers unisexual. Fruits shallowly 3- or 4-lobed, drying brown to dark brown, shiny _____ **4. *G. polygama***

1. *Grewia huluperakensis* I.M.Turner, Malay. Nat. J. 50: 281 (1997). Type: Peninsular Malaysia, Perak, Gerik, 17 vi 1924, *Burkill & Haniff* SFN12410 (holo. SING!, iso. K!). **Fig. 3.**

Syn.: *Grewia sclerophylla* auct. non Roxb. ex G.Don (1831); Ridley, Fl. Malay Penins. 5: 293 (1925), p.p. (excl. *Burkill & Haniff* SFN12410); Kochummen in Whitmore, Tree Fl. Malaya 2: 397 (1973), p.p. (excl. *Burkill & Haniff* SFN12410).

Scandent shrub. *Twigs* densely tufted-hairy. *Stipules* ovate, to 3 × 2mm, glabrous above, densely tufted-hairy beneath, persistent. *Leaves* dark brown above, light brown beneath, chartaceous, sparsely simple- and tufted-hairy on both sides, denser on midrib

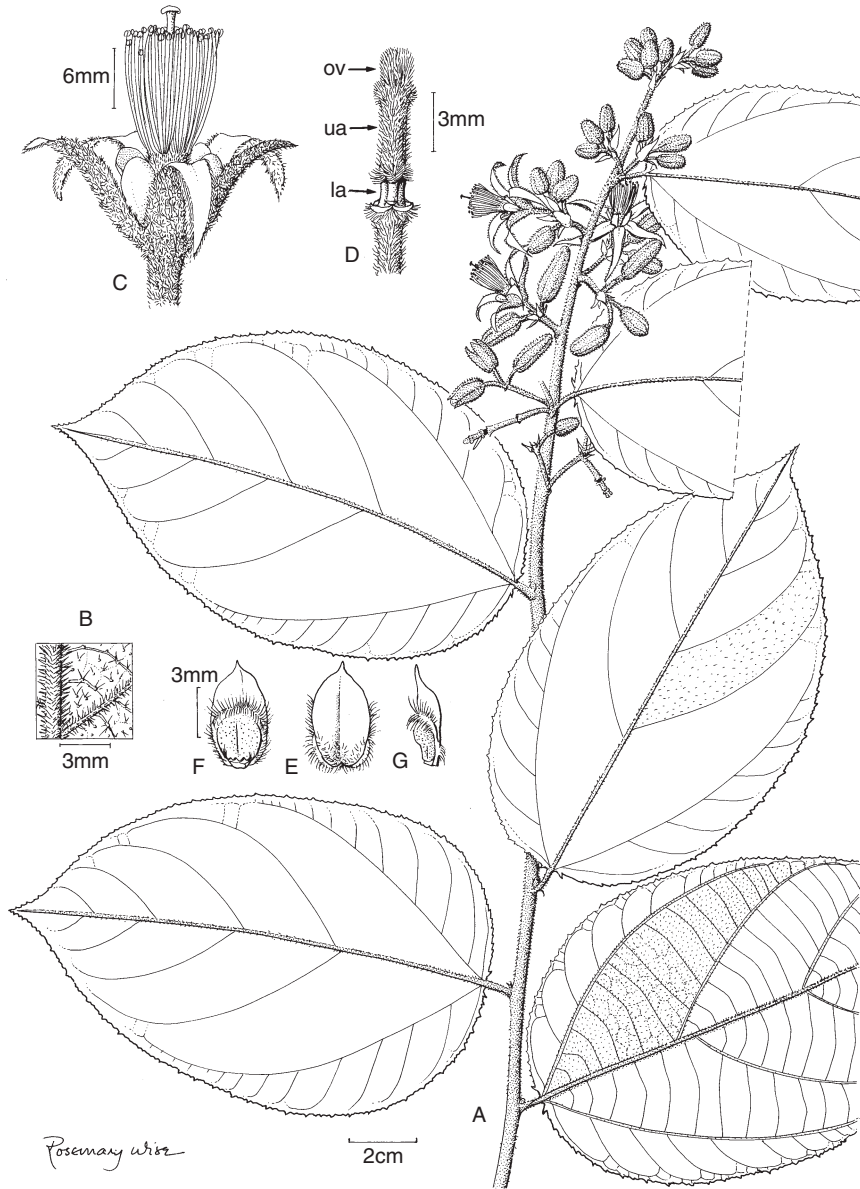


FIG. 3. *Grewia huluperakensis* I.M. Turner. A, flowering leafy twig; B, detail of abaxial leaf surface near midrib; C, flower; D, flower with sepals, petals, stamens and style removed; E, abaxial surface of petal; F, adaxial surface of petal with clawed appendage and gland at the base; G, lateral view of petal (A–D: *Burkill & Haniff* SFN12410; E–G: *Turner* 94-94). ov = ovary, la = lower androgynophore, ua = upper androgynophore. Drawn by Rosemary Wise.

and secondary veins; lamina broadly ovate or occasionally broadly oblong, symmetric, 9–15 × 5.5–9cm; base subcordate or rarely truncate, often with a pair of minute hairy auricles near petiole; margin serrulate, non-glandular at lower notches; apex acute or shortly acuminate, acumen to 0.6cm; midrib and secondary veins raised on both sides; secondary veins 6 or 7(8) pairs, basal pair more than ½ lamina length, without hairy domatia; tertiary veins scalariform, oblique, inconspicuous above, prominent beneath; petioles 4–6(–10) × 1.5(–2)mm, densely tufted-hairy. *Inflorescences* axillary or (sub-) terminal, triflorous, solitary or in clusters of 2 or 3, to 15(–20)mm long; peduncles to 6mm, densely tufted-hairy; bracts unlobed, oblong or broadly ovate, 2–3 × 1.5mm, densely tufted-hairy outside, glabrous inside; bracteoles 6, unlobed, linear-lanceolate, to 7(–9) × 1.5–2(–3)mm, apex acute, bifid, sometimes truncate, densely tufted-hairy outside, glabrous inside. *Flowers* bisexual; buds ovoid to broadly ovoid, 5–12(–17) × 5–7mm, densely tufted-hairy; pedicels 3–5 × 1.5–2mm, densely tufted-hairy. *Sepals* lanceolate, to 18 × 2.5mm, densely tufted-hairy outside. *Petals* oblong, 4.5–7 × 2–3.5mm, apex acute or rounded, not ciliate, lower portion borne on back of large, orbicular, clawed appendage, outside glabrous except sparsely tufted-hairy at base, inside glabrous except the densely tufted-hairy margin of appendage, glands globose or depressed ovoid. *Androgynophore*: lower part cylindrical, (1–)1.5–2 × (1–)1.5–2mm, grooved, angular, glabrous; upper part cylindrical, 4.5–5 × 1.5–2mm, densely tufted-hairy including the 5-angled plate (Figs 1I, 3D). *Stamens*: filaments 5.5–12mm, glabrous, anthers c.0.5mm in diameter. *Ovary* 4-locular, subglobose, 1.5–2mm in diameter, densely tufted-hairy; style 10–15mm long, sparsely tufted-hairy at base; stigma 4-lobed, discoid, centrally depressed at top (Fig. 2B). *Fruits* unknown.

Distribution. Endemic to Peninsular Malaysia. Very rare, known from only two collections from Gerik, Hulu Perak, Perak (Map: Fig. 4).

Habitat and ecology. Apparently confined to limestone hills. Flowering in April and June.

Ridley (1925) erroneously identified *Burkill & Haniff* SFN12410 as *G. sclerophylla*, and described the fruit as follows: ‘Drupe the size of a large cherry, stellate-hairy; pyrenes 4, 1-seeded’. I have not seen any specimens from Peninsular Malaysia with this kind of fruit, and therefore doubt the accuracy of Ridley’s description. In his recent revision and monograph of the *Tiliaceae* of Thailand, Phengklai (1986, 1993) reduced *G. sclerophylla* to synonymy under *G. abutilifolia* Vent. ex Juss. from India, China, Myanmar, Thailand and Indo-China. However, Turner (1997) found that collections of *G. abutilifolia* from Thailand differed significantly from those collected in Peninsular Malaysia. He discovered further that the specimens from Peninsular Malaysia were vegetatively similar to the type of *Grewia atrobrunnea* Burret from Sumatra (*H.O. Forbes* 1397; holo B†, iso. CAL) but significantly different in inflorescence and flower characters. The present study confirms Turner’s proposal to recognize the Peninsular Malaysian plants as a distinct species.

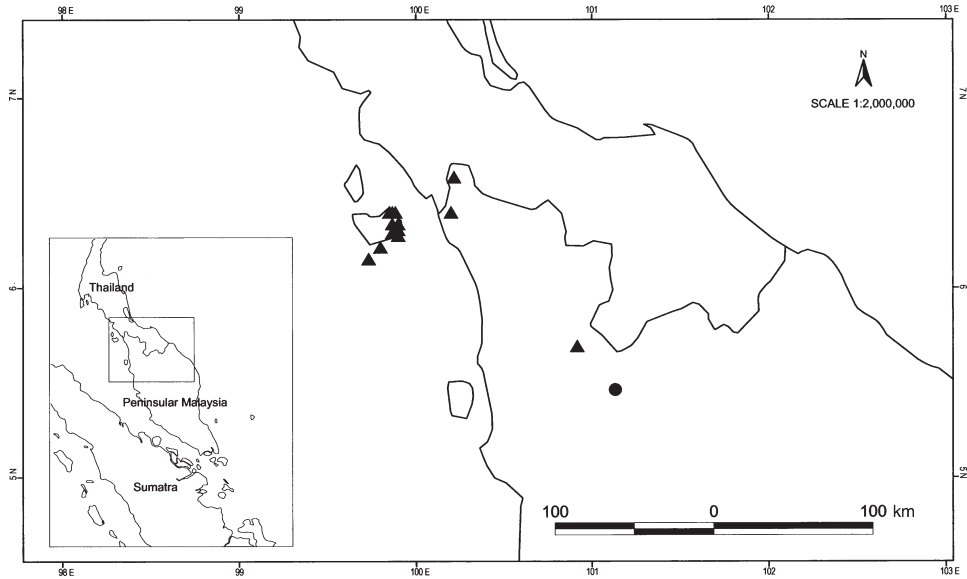


FIG. 4. Distribution of *Grewia huperakensis* I.M.Turner (●) and *G. polygama* Roxb. (▲) in Peninsular Malaysia.

Additional specimen examined. PENINSULAR MALAYSIA. **Perak:** Gerik, limestone island near the Temengor Dam, 21 iv 1994, Turner 94-94 (SING).

2. *Grewia laevigata* Vahl, Symb. Bot. 1: 34 (1790); Burret, Notizbl. Bot. Gart. Berl.-Dahl. 9: 700 (1926); Turner, Gard. Bull. Singapore 47(2): 487 (1995). Type: India, *Koenig* s.n. (holo. C [=IDC microfiche: Vahl no. 35 II, 2-3!]). **Fig. 5.**

Syn.: *Grewia acuminata* Juss., Ann. Mus. Hist. Nat. Paris 4: 91, t.48, f.2 (1804); Merrill, J. Str. Br. Roy. As. Soc., Spec. No.: 373 (1921); Burret, Notizbl. Bot. Gart. Berl.-Dahl. 9: 699 (1926); Masamune, En. Phan. Born.: 449 (1942); Kochummen in Whitmore, Tree Fl. Malaya 2: 397 (1973); Anderson, Checkl. Trees Sarawak: 338 (1980); Phengklai, Thai For. Bull., Bot. 16: 34, f.14 (1986), Fl. Thailand 6(1): 26 (1993), p.p.; Whitmore & Tantra, Tree Fl. Indon., Checkl. Sumatra: 240 (1986); Whitmore et al. (eds), Tree Fl. Indon., Checkl. Kalimantan 2(1): 355 (1990); Kessler et al., Checkl. Tree Fl. Balikpapan-Samarinda Area: 66 (1992); Coode et al. (eds), Checkl. Flow. Pl. Gymno. Brunei: 323 (1996); Beaman & Anderson, Pl. Mt. Kinabalu 5: 431 (2004). Type: 'Inde' [Java], 1799, *Lahaie* s.n. in *Herb. A. de Jussieu* 12569 (holo. P-JU [photocopy!]).

Grewia umbellata [Roxb., Hort. Beng.: 42 (1814) nom. nud., ex] DC., Prodr. 1: 509 (1824); Roxburgh, Fl. Ind. ed. 1832, 2: 591 (1832); King, J. Roy. As. Soc. Beng. II, 60(1): 109 (1891); Ridley, Fl. Malay Penins. 1: 300 (1922), Bull. Misc. Inform., Kew 1938: 229 (1938); Burret, Notizbl. Bot. Gart. Berl.-Dahl. 9: 700 (1926); Masamune, En. Phan. Born.: 449 (1942). Type: India, *Anon.* s.n. in *Herb. DC* 509/10 (holo. G-DC [fiche!]).

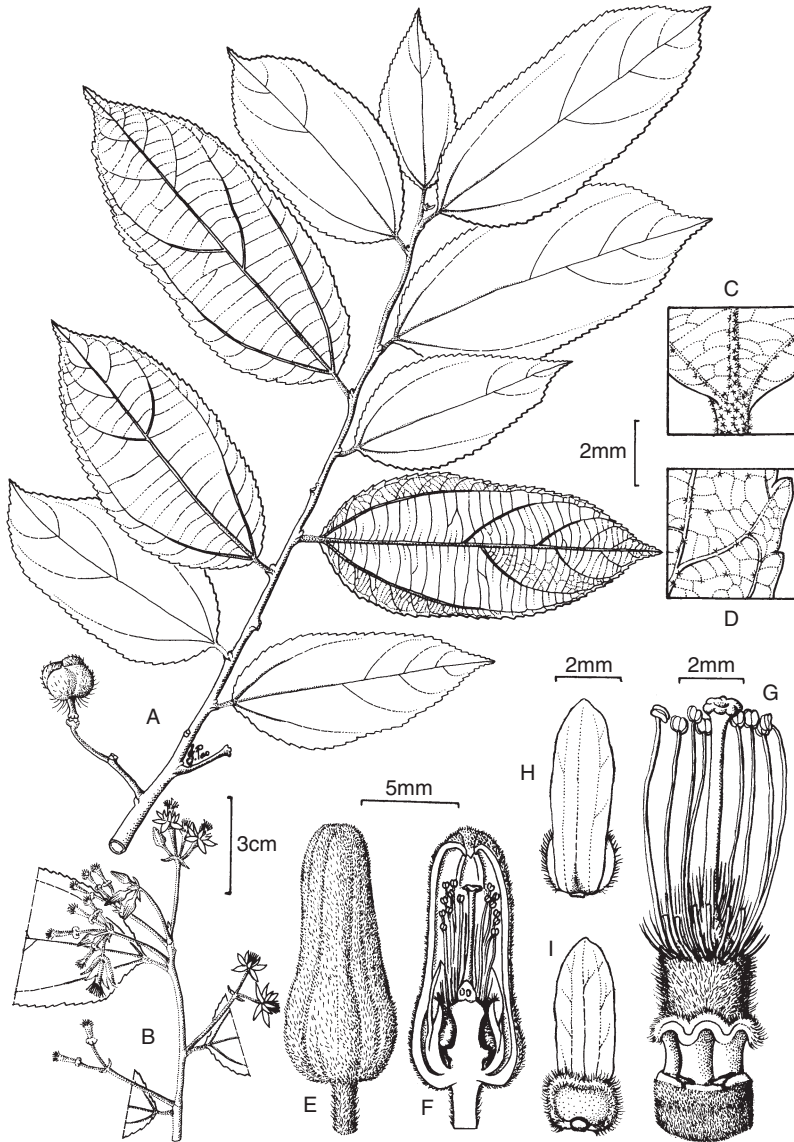


FIG. 5. *Grewia laevigata* Vahl. A, fruiting leafy twig; B, flowering leafy twig; C, detail of abaxial leaf surface near leaf base; D, detail of abaxial leaf surface near leaf margin; E, flower bud; F, longitudinal section of flower bud; G, flower with sepals and petals removed; H, abaxial surface of petal; I, adaxial surface of petal with clawed appendage and gland at base (Haviland 511). Drawn by Joseph Pao.

Grewia pedicellata Roxb., Fl. Ind. ed. 1832, 2: 585 (1832), **syn. nov.**; Burret, Notizbl. Bot. Gart. Berl.-Dahl. 9: 702 (1926). Type: Ambon, *Roxburgh Jr.* s.n. in *Herb. EIC* 1084B (lecto. K-W [photo!] designated here; isolecto. BR [=BR-S.P. 817075, photocopy!]).

Scandent shrub to 6m. *Twigs* dark when young, glabrous or sparsely stellate-hairy. *Stipules* narrowly lanceolate, to 6×1.5 mm, glabrous above, sparsely stellate-hairy beneath, caducous. *Leaves* olive-green to yellowish brown above, pale green to dark brown beneath, chartaceous, glabrous or sparsely stellate-hairy on both sides; lamina elliptic, oblong, lanceolate or ovate, symmetric, $(5-7-13(-15)) \times (3-4-6(-7))$ cm; base obtuse or truncate, without auricles, margin serrulate or denticulate, sometimes with two pairs of glands at lower notches, apex abruptly acuminate, acumen $0.5-1(-1.5)$ cm; midrib and secondary veins raised on both sides; secondary veins 4-6 pairs, basal pair more than $\frac{1}{2}$ lamina length, without hairy domatia; tertiary veins scalariform, (sub-)horizontal, inconspicuous above, conspicuous beneath; petioles $(3-4-8(-9)) \times (0.5-1-1.5)$ mm, densely stellate-hairy or glabrescent. *Inflorescences* axillary, supra-axillary, leaf-opposed, or sometimes (sub-)terminal, $(3-5-7(-13))$ -flowered, solitary or in clusters of 2(3), $(10-20-45(-50))$ mm long; peduncles $(7-12-25(-27))$ mm, sparsely stellate-hairy; bracts unlobed, oblong or lanceolate, $2-6 \times 0.8-1.2$ mm, densely stellate-hairy outside, glabrous inside; bracteoles $(6-10-14(-26))$, unlobed, narrowly elliptic, linear or lanceolate, $(1-4-6) \times (0.5-1-1.5(-2.5))$ mm, apex acute, glabrescent outside, glabrous inside. *Flowers* bisexual; buds oblong, narrowly ellipsoid or narrowly ovoid, $(3.5-5-15(-16)) \times 2-3.5(-4)$ mm, densely stellate-hairy; pedicels $(3-7-15(-17.5)) \times 0.5-1$ mm, densely stellate-hairy. *Sepals* linear or narrowly lanceolate, $10-15 \times 1.5(-2)$ mm, densely stellate-hairy outside. *Petals* oblong, $5-6 \times 1-1.5$ mm, apex acute, not ciliate, lower portion borne on back of large, orbicular, clawed appendage, outside glabrous except sparsely stellate-hairy at base, inside glabrous except for densely stellate-hairy margin of appendage, glands depressed ovoid. *Androgynophore*: lower part concave, $1-1.5 \times 1-2(-2.5)$ mm, slightly grooved, angular, glabrous; upper part cylindrical, $(2.5-3-4(-5)) \times (0.5-1-1.5)$ mm, densely stellate-hairy including the 5-angled plate (Figs II-J, 5F-G). *Stamens*: filaments $5-9(-12)$ mm long, glabrous, anthers c.0.5mm in diameter. *Ovary* 4-locular, subglobose, $1-1.5(-2)$ mm in diameter, densely stellate-hairy; style $5-7(-10)$ mm long, glabrous; stigma 4-lobed, with shallow central depression. *Infructescences* sparsely stellate-hairy or glabrescent, sometimes lenticellate. *Fruits* depressed-globose, $(6-10-15(-17)) \times (7-11-16(-18))$ mm, shallowly 2-4-lobed, each lobe with a pyrene, drying olive-green to yellowish brown, not shiny, sparsely stellate-hairy or glabrescent when mature; exocarp very thin; mesocarp c.0.5mm thick, fibrous, compact, hard when dried; endocarp c.1mm thick, woody; pedicel $12-25 \times 0.7-1.5$ mm. *Pyrenes* (2)3 or 4, free, 1(2)-seeded, 5-10mm long.

Distribution. Thailand, Indo-China (Vietnam), Sumatra, Peninsular Malaysia, Singapore, Java, Borneo, the Philippines, Sulawesi, Maluku, and Lesser Sunda Islands (Sumba). In Peninsular Malaysia, the species is recorded from Kedah (including Pulau Langkawi), Perak, Kelantan, Terengganu, Selangor, Negeri Sembilan and Johore. In Borneo, it is known from Sabah, Sarawak, Brunei and Kalimantan (Map: Fig. 6).

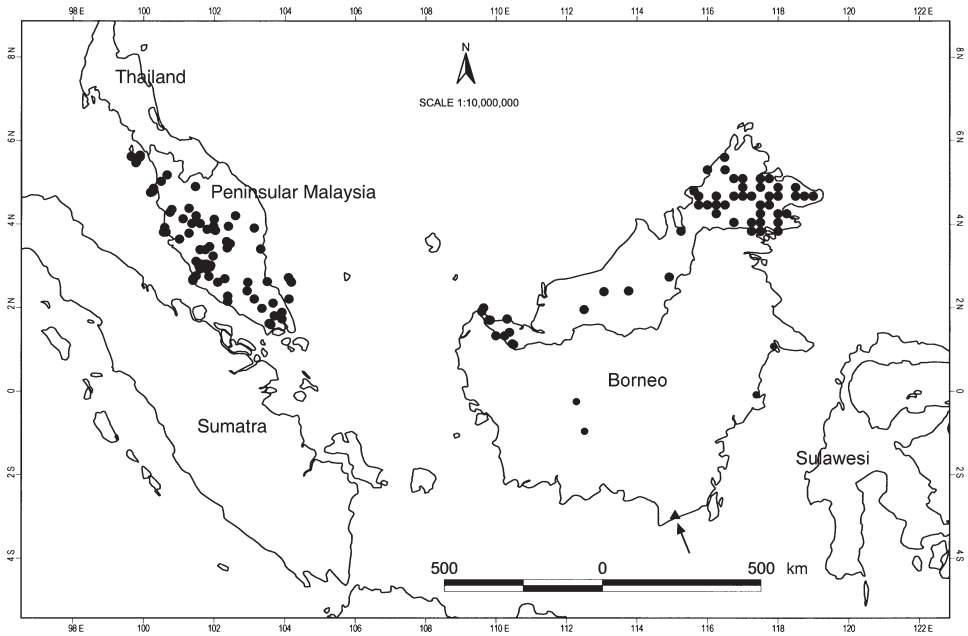


FIG. 6. Distribution of *Grewia laevigata* Vahl (●) and *G. multiflora* Juss. (▲), arrowed, in Peninsular Malaysia and Borneo.

Habitat and ecology. Common in secondary and limestone forests. Flowering and fruiting observed throughout the year.

Vernacular names. Akar chenderai, akar sempelas lida kuching, chenderai merah, chenderai rimba (Peninsular Malaysia-Malay), lapion (Sabah-Dusun, Kinabatangan), akar gerigu, tanchot (Sarawak-Iban), sumpit babi (Kalimantan-Malay).

Use. The leaves are used medicinally (*Kadir* A2813 and *Keith* A1529).

In the past, many authors [e.g. Persoon (1807), Don (1831), Miquel (1859, 1861), Masters (1874), Kurz (1877), Pierre (1888), Gagnepain (1909, 1911), Koorders (1912) and Phengklai (1986, 1993, 1998)] confused *Grewia laevigata* from India with *Grewia glabra* Blume (now a synonym of *Grewia multiflora* Juss.) from Java. Careful examination of the types of *G. laevigata* and *G. glabra* reveals that the two taxa are completely different (see 'Key to species').

Roxburgh's (1832) description of *G. pedicellata* and the type specimen (*Roxburgh Jr.* s.n. in *Herb. EIC* 1084B) matched very well the type specimens of *G. umbellata* (*Anon.* s.n. in *Herb. DC* 509/10) from Peninsular Malaysia and *G. acuminata* (*Lahaie* s.n. in *Herb. A. de Jussieu* 12569) from Java. All these specimens matched the type specimen of *G. laevigata*. Therefore, I reduce *G. pedicellata*, *G. umbellata* and *G. acuminata* to synonymy in *G. laevigata*.

Some of the specimens from Java (*Karta* 251), Sabah (*Aban* SAN49197, *Apostol* A6240, *Awang Amin & Haya* SAN86549, *Boden-Kloss* 19222, *Carr* 26730, *Clemens* 28549, 28849, *Hashim* SAN33470, *Keith* A1529, *Leopold* SAN90767), Palawan (*Ridsdale* SMHI1618, *Sulit* PNH12313), Sulawesi (*Vogel & Vermeulen* 6464) and E Sumba (*McDonald & Sunaryo* 4328) have ovate or lanceolate leaves which are different from the typical leaf shape of *G. laevigata*. However, the other vegetative and reproductive characters are similar to those of *G. laevigata*, and therefore no infraspecific taxa are recognized in the present study.

Selected additional specimens examined (Full list given in Chung, 2001). PENINSULAR MALAYSIA. **Kedah:** Sik, Bt. Enggang FR, 3 xii 1969, *Chan* FRI13196 (K, KEP, L, SING). **Penang:** Bt. Peninjau, 14 vii 1963, *Poore* 1207 (K, KLU). **Perak:** Larut & Matang, Bt. Larut, Maxwell Hill, 1 iii 1924, *Burkill & Haniff* SFN12936 (KEP, SING). **Kelantan:** Gua Musang, near Brooke Camp, 2 vi 1994, *Husmady et al.* FRI41842 (KEP, SING). **Pahang:** Rompin, Lesong FR, Sg. Jekatih, 27 iv 1971, *Whitmore* FRI15996 (K, KEP, SING). **Selangor:** Kuala Langat, Bt. Jugra VJR, 11 i 1972, *Kochummen* FRI16483 (K, KEP, SING). **Negeri Sembilan:** Jelebu, Serting FR, 4 x 1996, *Gardette* EC2300 (KEP). **Malacca:** Maingay 1146 [= Kew Dist. 247] (K). **Johore:** Lenggong FR, 17 vii 1975, *Teo* TP574 [= KL3174] (K, SING).

BORNEO. SARAWAK: **Kuching Div.:** Lundu, G. Gading, 25 ix 1974, *Mamit* S35157 (K, KEP, SAR). **Samarahan Div.:** Serian, Bt. Rawan, 4 iv 1983, *Dayang Awa & Ilias* S45297 (SAR). **Kapit Div.:** Belaga, Ulu Batang Balui, Ulu Sg. Kebhor, 27 iii 1989, *Yii* S62311 (SAN). **Miri Div.:** Baram, Sg. Ikan & Sg. Silat, 20 vi 1977, *Chin* CSC2747 (KLU). **Limbang Div.:** Limbang, G. Pagon Periuk, 8 viii 1984, *Dayang Awa & Lee* S47711 (KEP, SAR). **SABAH: Kudat Distr.:** Banguay Is., 2 ix 1927, *Boden-Kloss* SFN19222 (SING). **Kota Marudu Distr.:** Ulu Sg. Kapuakan, 9 viii 1985, *Sigin et al.* SAN110601 (SAN). **Kota Belud Distr.:** Mt. Kinabalu, Dallas, 17 viii 1931, *Clemens* 26099 (L, SING). **Kota Kinabalu Distr.:** Sapangar Is., 27 ix 1966, *Aban* SAN49197 (L, SAN). **Ranau Distr.:** Lohan, 10 viii 1987, *Amin et al.* SAN119828 (K, KEP, SAN). **Kuala Penyu Distr.:** Pulau Tiga Park, 13 viii 1985, *Awang Amin & Haya* SAN86549 (K, SAN). **Beaufort Distr.:** Lumat, 11 ix 1973, *Dewol & Karim* SAN77932 (KEP, SING). **Tenom Distr.:** Tenom, 15 v 1939, *Angian* SH10309 (=FMS49083) (KEP). **Tambunan Distr.:** Tambunan, 21 vii 1984, *Amin et al.* SAN60827 (K, KEP, SAN). **Keningau Distr.:** Nabawan, Wittit Range, 28 iii 1985, *Fedilis & Asik* SAN110182 (SAN). **Labuk Sugut Distr.:** Bidu-Bidu FR, Bidu-Bidu Hill, 31 vii 1990, *Maikin et al.* SAN130681 (KEP, SAN). **Kinabatangan Distr.:** Kinabatangan, Kertam Besar, 25 vi 1951, *Kadir* A3580 (KEP, L, SING). **Sandakan Distr.:** Sepilok Kabilu FR, Jalan Badak, 18 iii 1997, *Chung & Dewol* FRI40334 (KEP). **Tawau Distr.:** Tawau Hill Park, 19 x 1985, *Leopold & Sigin* SAN111186 (SAN). **Semporna Distr.:** Kunak, Kalumpang FR, 19 vii 1974, *Aban* SAN79786 (SAN). BRUNEI: **Belait Distr.:** Labi, Jalan Bt. Melayan, 29 v 1995, *Hussain et al.* BRUN16486 (KEP). **Temburong Distr.:** Sg. Temburong at Kuala Belalong, 22 vi 1989, *Boyce et al.* PB383 (BRUN, K, SAN, SAR, SING). **KALIMANTAN:** Berau, Tanjung Redeb, 7 xi 1974, *Kostermans* 21656 (SING). **E Kalimantan:** Kab. Kotawaringin Timur, Sangai, S Mentaya, 21 iv 1995, *Wilkie* 9529 (KEP). **W Kalimantan:** Sintang, Bt. Baka NP, 4 xi 1993, *Church et al.* 533 (KEP, SING).

3. *Grewia multiflora* Juss., Ann. Mus. Hist. Nat. Paris 4: 89, t.47, f.1 (1804); Perkins, Fragm. Fl. Philipp.: 103 (1904); Merrill, Philipp. J. Sci. 1, Suppl.: 90 (1906), Fl. Manila: 313 (1912), Sp. Blancoan.: 250 (1918), Enum. Philipp. Fl. Pl. 3(1): 26 (1923). Type: The Philippines, *Anon.* s.n. in *Herb. A. de Jussieu* 12554 ('12555' teste G. Aymonin in litt. 20 iii 2003) (holo. P-JU [photocopy!]). **Fig. 7.**

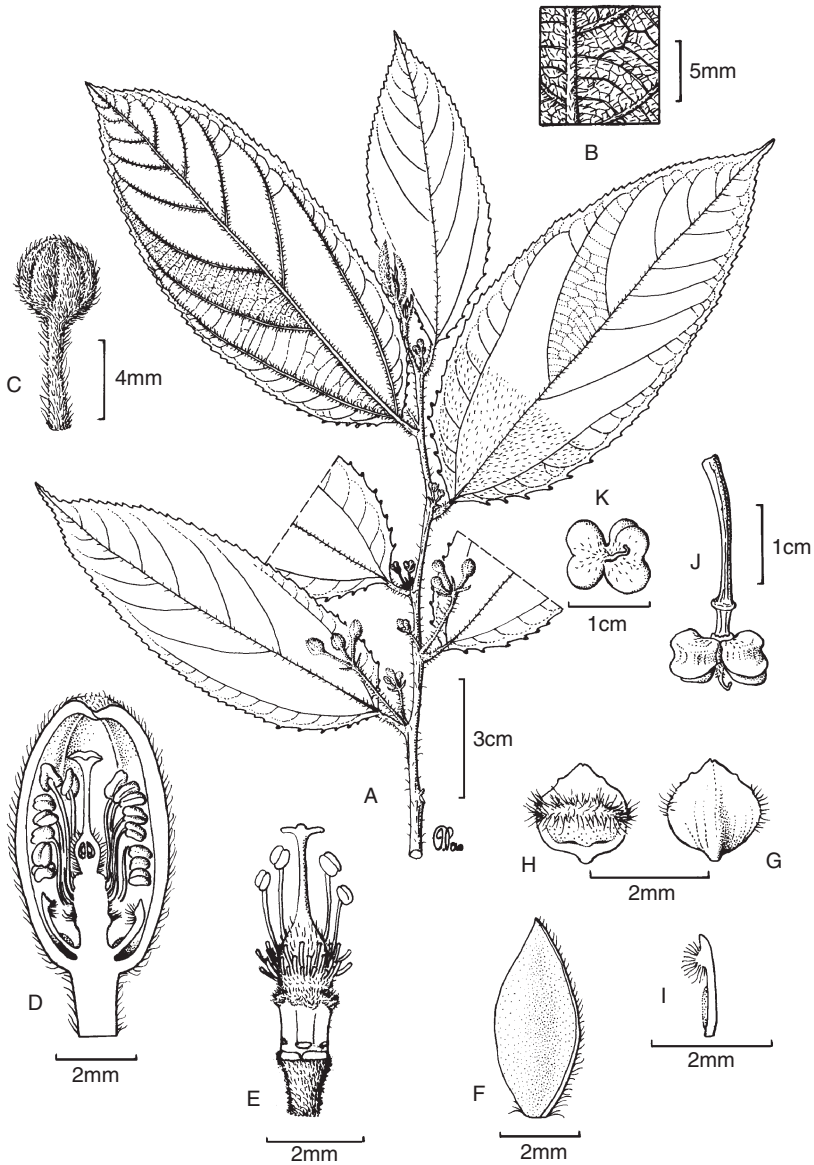


FIG. 7. *Grewia multiflora* Juss. A, flowering leafy twig; B, detail of abaxial leaf surface near midrib; C, flower bud; D, longitudinal section of flower bud; E, flower with sepals, petals and some stamens removed; F, adaxial surface of sepal; G, abaxial surface of petal; H, adaxial surface of petal with gland at the base; I, lateral view of petal; J, fruit; K, top view of fruit (A-C, E: *Motley* 240; D, F-I: *Blume* s.n. [=L sheet no. 908.258.187]; J-K: *Forbes* 1833). Drawn by Joseph Pao.

Syn.: *Grewia guazumifolia* Juss., Ann. Mus. Hist. Nat. Paris 4: 89, t.48, f.3 (1804) [as 'guazumaefolia'], **syn. nov.**; Miquel, Fl. Ind. Bat. 1(2, 2): 200 (1859); Koorders, Exkurs.-Fl. Java 2: 576 (1912); Burret, Notizbl. Bot. Gart. Berl.-Dahl. 9: 675 (1926). Type: 'Inde' [Java], 1799, *Lahaie* s.n. in *Herb. A. de Jussieu* 12555 (holo. P-JU [photocopy!]).

Grewia glabra Blume, Bijdr. Fl. Ned. Ind. 3: 115 (1825), **syn. nov.**; Burret, Notizbl. Bot. Gart. Berl.-Dahl. 9: 676 (1926); Ridley, Bull. Misc. Inform., Kew: 229 (1938); Masamune, En. Phan. Born.: 449 (1942). Type: Java, *Blume* 68 (lecto. L [=L sheet no. 908.253.1458]! designated here).

Grewia oblongifolia Blume, Bijdr. Fl. Ned. Ind. 3: 114 (1825), **syn. nov.**; Miquel, Fl. Ind. Bat. 1(2, 2): 199 (1859). Type: Java, *Blume* s.n. (lecto. L [=L sheet no. 951.341.895]! designated here; isolecto. L [=L sheet no. 951.341.896]!).

Grewia didyma Roxb. ex G. Don, Gen. Hist. 1: 549 (1831), **syn. nov.**; Roxburgh, Fl. Ind. ed. 1832, 2: 591 (1832). Type: India, *Roxburgh* s.n. (lecto. BR [=BR-S.P. 817083, photocopy!] designated here).

Grewia laevigata auct. non Vahl (1790): Phengklai, Thai For. Bull., Bot. 16: 38, f.16 (1986), Fl. Thailand 6(1): 26, f.16 (1993), p.p. (excl. syn. *G. glabra* Blume and *G. multiflora* Juss.).

Small tree. *Twigs* glabrous or sparsely tufted-hairy. *Stipules* lanceolate or ovate, to 6 × 1 mm, brown and glabrous above, sparsely tufted-hairy beneath, caducous. *Leaves* greenish brown above, green to yellowish brown beneath, chartaceous, glabrous or sparsely tufted-hairy above, densely simple-hairy or glabrescent beneath; lamina elliptic or oblong, symmetric, 9–16 × 3–5.5 cm; base attenuate, obtuse, without auricles, margin serrulate, with 3–6 pairs of glands at lowest serration, apex acuminate, acumen 0.5–1(–1.5) cm; midrib and secondary veins raised on both sides; secondary veins 6 or 7 pairs, basal pair to or slightly more than ½ lamina length, with hairy domatia in axil of basal pair of secondary veins; tertiary veins reticulate, oblique, inconspicuous above, conspicuous beneath; petioles (4.5–)5–7(–8.5) × 0.5–1(–1.5) mm, sparsely tufted-hairy or glabrescent. *Inflorescences* axillary or rarely supra-axillary, triflorous, solitary or in clusters of 2, (10–)15–30(–35) mm long; peduncles (10–)15–20 mm, sparsely tufted-hairy or glabrous; bracts unlobed, narrowly lanceolate, 1–2 × 0.5 mm, sparsely tufted-hairy or glabrous outside, glabrous inside; bracteoles 6, unlobed, narrowly lanceolate, 3–4 × 1 mm, apex acuminate, sparsely tufted-hairy outside, glabrous inside. *Flowers* bisexual; buds ellipsoid or broadly ovoid, (3.5–)4–6(–8.5) × 3.5–4.5(–5) mm, densely tufted-hairy; pedicels 4–8(–10) × 0.5–1 mm, densely tufted-hairy or glabrescent. *Sepals* linear or lanceolate, 8–13 × 2–2.5 mm, densely tufted-hairy outside. *Petals* broadly elliptic or obovate, 2–3 × 1.5–1.8 mm, apex acute or rounded, not ciliate, without clawed basal appendage, outside glabrous, inside glabrous except densely tufted-hairy around glands, glands depressed obovoid. *Androgynophore*: lower part cylindrical, 0.5–0.8 × 1–1.6 mm, smooth, glabrous; upper part cylindrical, c.0.5 × 1.5 mm, densely tufted-hairy, without 5-angled plate at base (see Figs 1I, 7D–E). *Stamens*: filaments 2–4.5 mm long, glabrous, anthers c.0.5 mm in diameter. *Ovary* 4-locular, globose,

c.1.5mm in diameter, densely tufted-hairy; style 2.5–3mm long, glabrous or sparsely tufted-hairy for $\frac{1}{2}$ – $\frac{3}{4}$ of its length; stigma irregularly 4-lobed, lobes spreading, c.0.4mm long (Fig. 2D). *Infructescences* glabrous, lenticellate. *Fruits* depressed-globose, deeply 2-partite, each part 1- or 2-lobed, 4–4.5 × 10.5–13mm, drying black, not shiny, sparsely tufted-hairy or glabrous when mature; exocarp very thin; mesocarp c.3mm thick, fibrous, compact, hard when dried; endocarp c.0.5mm thick, woody; pedicel 20–25 × 0.9–1.2mm. *Pyrenes* 3 or 4, free, 1(2)-seeded, 3–4mm long.

Distribution. India, Myanmar, Indo-China (Laos), Thailand, Sumatra, Java and Borneo (confined to Bandjarmasin, Kalimantan, single collection) (Map: Fig. 6).

Habitat and ecology. In secondary forest. Flowering and fruiting in August.

Use. Fruits edible (Phengkklai, 1986).

Previous authors [e.g. Persoon (1807), Don (1831), Miquel (1859, 1861), Masters (1874), Kurz (1877), Pierre (1888), Gagnepain (1909, 1911), Koorders (1912) and Phengkklai (1986, 1993, 1998)] reduced *G. acuminata* Juss., *G. guazumifolia* Juss., *G. multiflora* Juss., *G. umbellata* Roxb. ex DC., *G. glabra*, *G. oblongifolia* Blume and *G. pedicellata* Roxb. to synonymy under *G. laevigata* Vahl. This study reveals, however, that *G. acuminata*, *G. umbellata* and *G. pedicellata* belong to *G. laevigata*, while *G. glabra*, *G. guazumifolia* and *G. oblongifolia* are referable to *G. multiflora*.

Grewia multiflora can be easily distinguished from *G. laevigata* by the following characters:

	<i>G. multiflora</i>	<i>G. laevigata</i>
Habit	Small tree	Scandent shrub
Intercostal venation	Reticulate, oblique	Scalariform, sub-horizontal
Flowers per inflorescence	3	(3–)5–7(–13)
Petal appendage	Absent	Present
Lower androgynophore	Cylindrical, smooth	Concave, slightly grooved, angular
Fruit	Deeply 2-partite, each part 1- or 2-lobed	Shallowly 2- or 4-lobed

It may be significant that this plant has not been collected again in Borneo, considering that Motley's collections of *Mnesithea geminata* (Hack.) Ridl., *Perotis indica* (L.) Kuntze, and *Setaria clivalis* (Ridl.) Veldk. are also the only records for Borneo (J.F. Veldkamp, pers. comm.). This raises the suspicion that they may have been collected elsewhere in Malesia. However, Bandjarmasin is the only locality in Borneo for another grass, *Apocopis collina* Balansa. This matter needs further investigation.

The Roxburgh specimen on which Don (1831) based his description of *Grewia didyma* may well have been that at the Linnean Society of London which is now (Forman, 1997) deposited at the Brussels Herbarium (BR-S.P. 817083). Roxburgh also had this species drawn (Icon. Roxb. 229 [K, n.v.]).

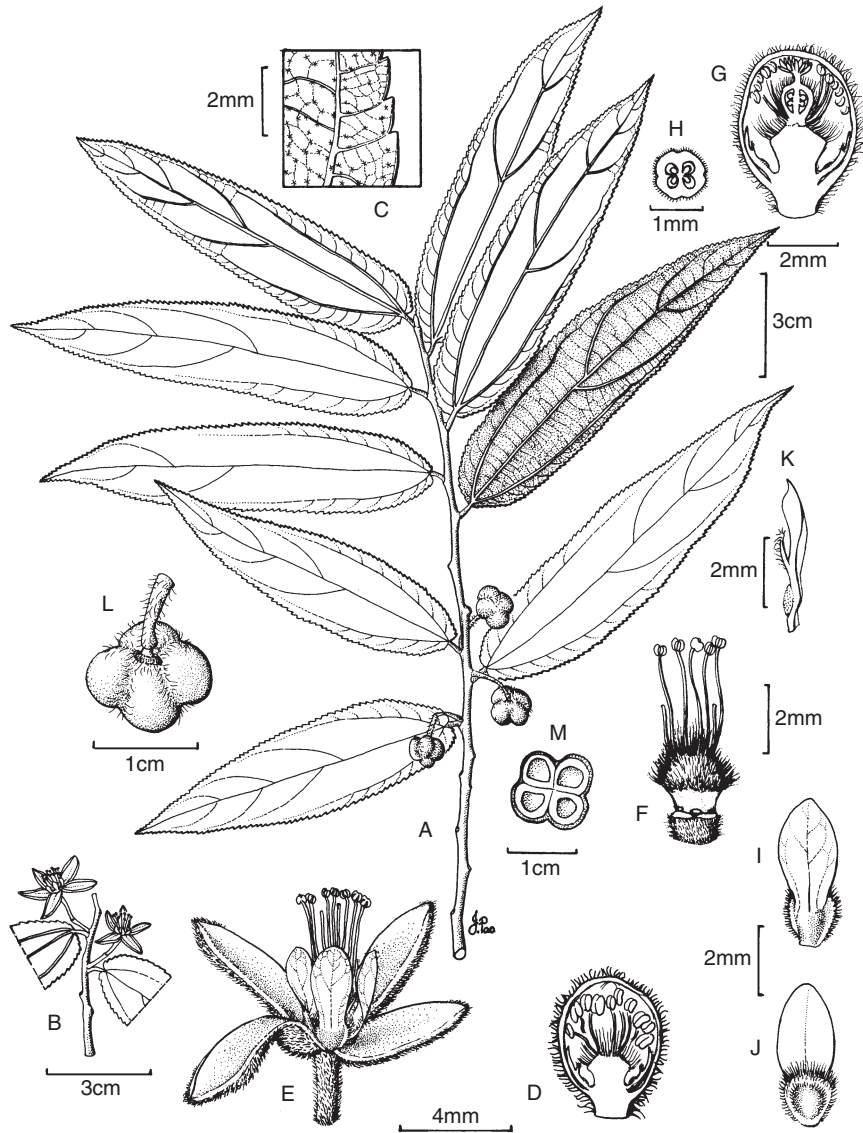


FIG. 8. *Grewia polygama* Roxb. A, fruiting leafy twig; B, flowering leafy twig; C, detail of abaxial leaf surface near margin; D, longitudinal section of male flower bud; E, male flower with one sepal (and two far-side petals) removed; F, male flower with sepals, petals and some stamens removed; G, longitudinal section of female flower bud; H, cross section of ovary; I, abaxial surface of petal; J, adaxial surface of petal with clawed appendage and gland at the base; K, lateral view of petal; L, fruit; M, cross section of fruit (A, C, L–M: Curtis 2518; B, E–F, I–K: Kiah SFN35286; D: Wyatt-Smith KEP72560; G–H: Kamarudin & Mustapa FRI42255). Drawn by Joseph Pao.

Additional specimen examined. BORNEO. KALIMANTAN: S Kalimantan: Bandjarmasin, 1857–1858, Motley 240 (K).

4. *Grewia polygama* Roxb., Fl. Ind. ed. 1832, 2: 588 (1832); Burret, Notizbl. Bot. Gart. Berl.-Dahl. 9: 715 (1926); Phengklai, Thai For. Bull., Bot. 16: 26, f.10 (1986). Type: India, Bengal, *Roxburgh* s.n. in *Herb. EIC* 1090B (lecto. K-W [photo!] designated here; isolecto. BR [=BR-S.P. 817086, photocopy!]). **Fig. 8.**

Syn: *Grewia polygama* Roxb. var. *curtisii* Ridl., Fl. Malay Penins. 5: 294 (1925), **syn. nov.** Type: Peninsular Malaysia, Kedah, Langkawi, ix 1890, *Curtis* 2518 (holo. K!, iso. SING!).

Grewia viminea Wall. ex Burret, Notizbl. Bot. Gart. Berl.-Dahl. 9: 711 (1926), **syn. nov.**; Kochummen in Whitmore, Tree Fl. Malaya 2: 397 (1973); Turner, Gard. Bull. Singapore 47(2): 487 (1995). Type: Myanmar, 'Prome Hills', 16 ix 1826, *Wallich* '309' in *Herb. EIC* 1111.1 (holo. B†, iso. K-W [photo!]).

Grewia hirsuta auct. non Vahl (1790): Phengklai, Fl. Thailand 6(1): 24, f.15, t.5:12 (1993), p.p. (excl. syn. *G. polygama* Roxb. and specim. Peninsular Malaysia).

Small tree to 5m tall, trunk c.10cm in diameter. *Twigs* black, densely stellate-hairy when young, glabrescent when older. *Stipules* subulate, to 6(–9) × 0.5(–1)mm, densely stellate-hairy on both sides, caducous. *Leaves* yellowish brown to light brown on both sides, chartaceous, glabrous or sparsely simple- and stellate-hairy above, densely simple- and stellate-hairy or glabrescent beneath; lamina lanceolate or narrowly oblong, weakly asymmetric, (3–)4.5–12(–14.5) × (1.5–)1.8–3(–3.5)cm; base obtuse, without auricles, margin serrulate, non-glandular at lower serration, apex acuminate, acumen to 0.5cm; midrib and secondary veins impressed above, raised beneath; secondary veins 3–4(–5) pairs, basal pair almost $\frac{3}{4}$ lamina length, without hairy domatia; tertiary veins reticulate, horizontal, inconspicuous above, conspicuous beneath; petiole (2–)3–5 × 0.5–1mm, sparsely stellate-hairy. *Inflorescences* axillary, sometimes supra-axillary or leaf-opposed, triflorous, solitary or in cluster of 2, (5–)7–13(–15)mm long; peduncles 3–6mm, densely stellate-hairy; bracts unlobed, linear, (2–)3–3.5(–4) × (0.2–)0.5–0.6mm, densely stellate-hairy outside, glabrous inside; bracteoles 6, unlobed, linear, 2.5–3.5(–6) × c.0.5mm, apex acuminate, densely stellate-hairy outside, glabrous inside. *Flowers* unisexual; buds ovoid or ellipsoid, 2.5–3.5(–4.5) × 2–2.5(–3.5)mm, densely stellate-hairy; pedicels 2–4 × c.0.5mm, densely stellate-hairy. *Sepals* ovate, 2.5–4.5 × 1–1.5mm, densely stellate-hairy outside. *Petals* elliptic, 1–2 × c.1mm, apex rounded, not ciliate, lower portion borne on back of large, orbicular, clawed appendage, outside glabrous, inside glabrous except for densely stellate-hairy margin of appendage, glands globose or obovoid. *Androgynophore*: lower part cup-shaped, 0.5–0.6 × 0.7–1.4mm, smooth, glabrous; upper part depressed ovoid, c.0.5 × 1mm, densely stellate-hairy, without 5-angled plate at base (Figs 1K,M, 8F–G). *Male flowers*: filaments 1.5–2mm long, glabrous, anthers c.0.5mm in diameter; pistillode rudimentary or absent. *Female flowers*: staminodes 1–1.7 × c.0.3mm, glabrous; ovary 4-locular, globose, c.1.5mm

in diameter, densely stellate-hairy; style 2.5–3mm long, glabrous; stigma lacinate, with broad, spreading, and fringed stigmatic lobes c.0.6mm long (see Fig. 2C). *Infructescences* glabrescent or glabrous, not lenticellate. *Fruits* depressed-globose, shallowly 3- or 4-lobed, each lobe with a pyrene, (3–)4–5(–6) × (7–)8–10(–12)mm, drying brown to dark brown, shiny, sparsely stellate-hairy when young, glabrescent or glabrous when mature; exocarp very thin; mesocarp c.0.2mm thick, not fibrous, not compact, coriaceous when dried; endocarp 0.7–1mm thick, woody; pedicel 5–10 × 0.5–1mm. *Pyrenes* 3 or 4, free, 1(2)-seeded, 2–3mm long.

Distribution. India, Sri Lanka, Myanmar, Indo-China (Laos), Thailand and Peninsular Malaysia. In Peninsular Malaysia, this species is found in Perlis and Kedah (Langkawi Island and Baling) (Map: Fig. 4).

Habitat and ecology. In Peninsular Malaysia found only in limestone forest. Flowering in April–May, July–August and November; fruiting in July–September and November–December.

Use. Bark produces good fibre for making ropes (Phengklai, 1986).

Ridley (1925) described two specimens from Peninsular Malaysia (*Curtis* 2518 and *Haniff* 7487) as *Grewia polygama* var. *curtisii* differing from the typical *G. polygama* from India by their less hairy leaves. Kochummen (1973) did not agree with Ridley's opinion and considered the two specimens as belonging to *Grewia viminea* from Myanmar. The present study shows that *G. polygama* var. *curtisii* and *G. viminea* are conspecific with *G. polygama*.

Phengklai (1993) put *G. polygama* into synonymy under *Grewia hirsuta* Vahl. After examining the holotypes of *G. hirsuta* (IDC microfiche: Vahl no. 35 I; 3 & 4 with fruits, 5 & 6 with flowers) and of *G. polygama* (Roxburgh s.n. in *Herb. EIC* 1090B and BR-S.P. 817086), I disagree and conclude that *G. polygama* and *G. hirsuta* should be treated as two distinct species. These can be distinguished by the following characters:

	<i>G. polygama</i>	<i>G. hirsuta</i>
Leaf length (cm)	(3–)4.5–12(–14.5)	3–7.5
Leaf margin	Finely serrulate	Coarsely serrate
Inflorescence type	Long and branching	Short and compact
Leaf and flower indumentum	Sparse	Dense
Sex distribution	Flowers unisexual	Flowers bisexual
Petal indumentum outside	Glabrous	Hairy at base

Roxburgh (1832) mentioned that *G. polygama* produced polygamous flowers with male and bisexual flowers on the same plant. However, I have been unable to find any bisexual flowers in the Peninsular Malaysian specimens.

Roxburgh also had a drawing of *G. polygama* made (Icon. Roxb. 1448 [K-W, n.v.]).

Additional specimens examined. PENINSULAR MALAYSIA. **Perlis:** Bt. Lagi., 16 xi 1929, Henderson SFN22814 (K, KEP, SING); Titi Tinggi, Kaki Bukit., 14 iv 1938, *Kiah* SFN35286 (K, KEP, SING). **Kedah:** Baling, 19 vii 1956, *Wyatt-Smith* KEP72560 (K, KEP); Langkawi, ix 1890, *Curtis* 2518 (K, SING), Gua Cherita, 18 xi 1921, *Haniff* SFN7487 (K, SING), Kuah, 8 v 1996, *Kamarudin & Mustapa* FRI42255 (KEP), 8 xii 1998, *Chung* RC5 (KEP), Langkawi Country Club, 8 iv 1984, *Zainuddin* AZ1313 (KEP, UKMB), Pulau Chupa, 19 xi 1941, *Corner* s.n. (SING), Pulau Dayang Bunting, 3 v 1938, *Symington* FMS46716 (KEP), 17 viii 1972, *Soepadmo & Mahmud* ES1219 (KEP, KLU, SING), Pulau Langgun, 4 xi 1971, *Chin* 1765 (KLU), Pulau Timun, 19 viii 1972, *Stone* 11009 (KLU), Selat Panchor, 19 viii 1972, *Chin* 1832 (KEP, KLU), 21 xi 1934, *Henderson* SFN21377 (K, KEP, SING), Tg. Rhu, 17 xi 1992, *Zainuddin* AZ4351 (KEP, UKMB), 9 v 1967, *Stone* 6914 (KLU), 9 v 1967, *Students* 43 (KLU), 8 xii 1998, *Chung* RC10 (KEP).

SPECIES EXCLUDED FROM *GREWIA* IN PENINSULAR MALAYSIA
AND BORNEO

[See Chung (2001, 2003) and Chung *et al.* (2005a) for further details]

- Grewia antidesmifolia* King, J. Roy. As. Soc. Beng. II, 60(1): 113 (1891) [*antidesmaefolia*] = *Microcos antidesmifolia* (King) Burret, Notizbl. Bot. Gart. Berl.-Dahl. 9: 780 (1926).
- Grewia antidesmifolia* King var. *hirsuta* King, J. Roy. As. Soc. Beng. II, 60(1): 113 (1891) = *Microcos antidesmifolia* (King) Burret var. *hirsuta* (King) Burret, Notizbl. Bot. Gart. Berl.-Dahl. 9: 780 (1926).
- Grewia blattaefolia* Corner, Gard. Bull. S.S. 10: 262 (1939) = *Microcos latifolia* Burret, Notizbl. Bot. Gart. Berl.-Dahl. 9: 781 (1926). Notes: The epithet should be '*blattaefolia*' not '*blattifolia*', as it makes an etymological distinction (Rec.60G.b). Corner said it was like the wings of cockroach (*Blatta*), so they were not like the leaves of *Blatti* Adans. (= *Sonneratia* L.f.).
- Grewia borneensis* (Burret) P.S.Ashton, Man. Non-Dipt. Trees Sarawak 2: 442 (1988) = *Microcos borneensis* Burret, Notizbl. Bot. Gart. Berl.-Dahl. 9: 772 (1926).
- Grewia cinnamomifolia* (Burret) P.S.Ashton, Man. Non-Dipt. Trees Sarawak 2: 443 (1988) = *Microcos cinnamomifolia* Burret, Notizbl. Bot. Gart. Berl.-Dahl. 9: 770 (1926).
- Grewia dulitensis* (Airy Shaw) P.S.Ashton, Man. Non-Dipt. Trees Sarawak 2: 443 (1988) = *Microcos dulitensis* Airy Shaw, Kew Bull.: 159 (1949).
- Grewia elmeri* (Merr.) P.S.Ashton, Man. Non-Dipt. Trees Sarawak 2: 443 (1988) = *Microcos antidesmifolia* (King) Burret var. *hirsuta* (King) Burret.
- Grewia erythrocarpa* Ridl., J. Str. Br. Roy. As. Soc. 82: 174 (1920) = *Microcos erythrocarpa* (Ridl.) Airy Shaw, Kew Bull.: 160 (1949).
- Grewia fibrocarpa* Mast. in Hook.f., Fl. Brit. India 1, 2: 391 (1874) = *Microcos fibrocarpa* (Mast.) Burret, Notizbl. Bot. Gart. Berl.-Dahl. 9: 782 (1926).
- Grewia florida* Miq., Fl. Ind. Bat., Suppl. 3: 405 (1861) = *Microcos florida* (Miq.) Burret, Notizbl. Bot. Gart. Berl.-Dahl. 9: 772 (1926).

- Grewia globulifera* Mast. in Hook.f., Fl. Brit. India 1, 2: 391 (1874)=***Microcos globulifera*** (Mast.) Burret, Notizbl. Bot. Gart. Berl.-Dahl. 9: 779 (1926).
- Grewia gracilis* (Stapf ex Ridl.) P.S.Ashton, Man. Non-Dipt. Trees Sarawak 2: 444 (1988)=***Microcos gracilis*** Stapf ex Ridl., Bull. Misc. Inform., Kew 1938: 229 (1938).
- Grewia henrici* Baker f., J. Bot. 62: 13 (1924)=***Microcos henrici*** (Baker f.) Burret, Notizbl. Bot. Gart. Berl.-Dahl. 9: 781 (1926).
- Grewia hirsuta* (Korth.) Kochummen in Whitmore, Tree Fl. Malaya 2: 39 (1973), nom. illegit. et nom. superfl., non *G. hirsuta* Vahl, Symb. Bot. 1: 34 (1790)=***Microcos hirsuta*** (Korth.) Burret, Notizbl. Bot. Gart. Berl.-Dahl. 9: 782 (1926).
- Grewia latifolia* Mast. in Hook.f., Fl. Brit. India 1, 2: 392 (1874), non *G. latifolia* F.Muell. ex Benth., Fl. Austral. 1: 271 (1863)=***Microcos latifolia*** Burret, Notizbl. Bot. Gart. Berl.-Dahl. 9: 781 (1926).
- Grewia latistipulata* Ridl., Bull. Misc. Inform., Kew 1924: 262 (1924)=***Microcos latistipulata*** (Ridl.) Burret, Notizbl. Bot. Gart. Berl.-Dahl. 9: 795 (1926).
- Grewia laurifolia* Hook.f. ex Mast. in Hook.f., Fl. Brit. India 1, 2: 392 (1874)=***Microcos laurifolia*** (Hook.f. ex Mast.) Burret, Notizbl. Bot. Gart. Berl.-Dahl. 9: 771 (1926).
- Grewia miqueliana* Kurz, Flora 55: 398 (1872)=***Microcos lanceolata*** (Miq.) Burret, Notizbl. Bot. Gart. Berl.-Dahl. 9: 778 (1926).
- Grewia omphacarpa* Miq., Fl. Ind. Bat. 1(2, 2): 204 (1859)=***Microcos hirsuta*** (Korth.) Burret, Notizbl. Bot. Gart. Berl.-Dahl. 9: 782 (1926).
- Grewia opaca* (Korth.) Miq., Fl. Ind. Bat. 1(2, 2): 204 (1859)=***Microcos opaca*** (Korth.) Burret, Notizbl. Bot. Gart. Berl.-Dahl. 9: 781 (1926).
- Grewia ossea* (Burret) P.S.Ashton, Man. Non-Dipt. Trees Sarawak 2: 446 (1988)=***Microcos ossea*** Burret, Notizbl. Bot. Gart. Berl.-Dahl. 9: 779 (1926).
- Grewia paniculata* Roxb. ex DC., Prodr. 1: 510 (1824)=***Microcos tomentosa*** Sm. in Rees, Cycl. 23, 2, 46: 2 (1813).
- Grewia pearsonii* Merr., Philipp. J. Sci., Bot. 30: 83 (1926)=***Microcos pearsonii*** (Merr.) Burret, Notizbl. Bot. Gart. Berl.-Dahl. 9: 1171 (1927).
- Grewia pyriformis* Merr., J. Str. Br. Roy. As. Soc. 86: 327 (1922)=***Microcos crassifolia*** Burret, Notizbl. Bot. Gart. Berl.-Dahl. 9: 780 (1926).
- Grewia riparia* Boerl. & Koord. in Koorders-Schumacher, Syst. Verz. 2: 35 (1911)=***Microcos riparia*** (Boerl. & Koord.) Burret, Notizbl. Bot. Gart. Berl.-Dahl. 9: 795 (1926).
- Grewia stylocarpa* Warb. in Perkins, Fragm. Fl. Philipp. 1: 104 (1904)=***Microcos triflora*** (Blanco) R.C.K.Chung, Kew Bull. 58: 347 (2003).
- Grewia stylocarpa* Warb. var. *longipetiolata* Merr., J. Str. Br. Roy. As. Soc. 76: 97 (1917)=***Microcos triflora*** (Blanco) R.C.K.Chung var. *longipetiolata* (Merr.) R.C.K.Chung, Kew Bull. 58: 347 (2003).
- Grewia sumatrana* Baker f., J. Bot. 62: 13 (1924)=***Microcos sumatrana*** (Baker f.) Burret, Notizbl. Bot. Gart. Berl.-Dahl. 9: 783 (1926).

CONCLUSION

Four species of *Grewia* are recognized from Peninsular Malaysia and Borneo. Of these, *Grewia multiflora* is a new record for Borneo (with some reservations); *G. huluperakensis* is a very restricted endemic to Peninsular Malaysia; *G. polygama* is found in limestone forest in northern Peninsular Malaysia, and *G. laevigata* is common in Peninsular Malaysia and Borneo. Excluded species are all referable to *Microcos*.

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