

RUBIACEAE

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Juss., Gen. Pl. (1789) 196, nom. cons.; Hooker, Fl. Brit. India 3, fasc. 7 (1880) 17; Schumann in Engler & Prantl, Nat. Pflanzenfam. 4(4) (1891) 1; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 90; Ridley, J. Straits Branch Roy. Asiat. Soc. 35 (1901) 88; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’]) 115; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 47; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 74(1) (1906 [‘1905’]) 1; Ridley, Fl. Malay Penins. 2 (1923) 3; Wong, Arbor. Rubiac. Malaya (1988) 1; Wong, Tree Fl. Malaya 4 (1989) 324; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 151; Puff et al., Rubiac. Thailand (2005) 1. **Type:** *Rubia* L.

Trees, treelets, shrubs, herbs, creepers, or climbers; terrestrial or epiphytic, some with ant associations in tuberous stems or cartons along leaf veins. **Stems** typically orthotropic with decussate leaves in most woody taxa, plagiotropic with distichous leaves in creeping taxa; branches with either decussate or distichous leaves; axillary buds in some cases supernumerary, sometimes developing into characteristic thorns or brachyblasts (short-shoots with abbreviated internodes and usually bract-like (reduced) foliar structures). **Stipules** typically interpetiolar, rarely intrapetiolar, small and inconspicuous or leafy and conspicuous, entire or bifid or variously divided into segments. **Leaves** opposite or sometimes in whorls of 3–several, in some taxa one or both members of a pair characteristically reduced at the initial nodes of branches or alternate branch nodes, margin entire, petiolate. **Inflorescences** terminal and/or axillary, or terminal and displaced to one side by axillary shoot development to appear leaf-opposed, cymose, thyrsoid, or paniculate, less often sub-umbellate, sometimes reduced to 1–few flowers, or sometimes (if flowers of different sexual states occur) more branched and with more flowers in one of the sexes. **Flowers** small to large and conspicuous, actinomorphic, in some taxa with curved corolla tubes appearing slightly zygomorphic, hermaphrodite, sometimes unisexual, sometimes heterostylous; **calyx** crowning the ovary, with a conspicuous or insignificant basal tubular portion and with or without lobes of various shapes, of which 1–several are sometimes enlarged and petaloid; **corolla** sympetalous, rotate, urceolate, tubular, campanulate, hypocrateriform (salver-shaped) or infundibular, lobes (3–)5(–10),

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Author contributions: R. Harwood: *Dentella*, *Hexasepalum*, *Mitracarpus*, *Spermacoce*. R.C.J. Lim, I.M. Turner & K.M. Wong: *Geophila*. X.Y. Ng, I.M. Turner & K.M. Wong: *Tarenna*. W.W. Seah: *Coelospermum*, *Gardenia*, *Prismatomeris*. W.W. Seah & K.M. Wong: *Aidia*, *Gynochthodes*, *Morinda*, *Nauclea*, *Ochreinauclea*. I.M. Turner: *Chassalia*, *Discospermum*, *Eumachia*, *Lasianthus*, *Mussaenda*, *Psychotria*, *Uncaria*. R.J. Wang: *Hedyotis*. K.M. Wong: *Adina*, *Canthium*, *Coptosapelta*, *Dibridsonia*, *Gaertnera*, *Gardeniopsis*, *Guettarda*, *Hydnophytum*, *Hypobathrum*, *Ixora*, *Jackiopsis*, *Lecananthus*, *Mussaendopsis*, *Mycetia*, *Myrmecodia*, *Neolamarckia*, *Ophiorrhiza*, *Oxyceros*, *Paederia*, *Pavetta*, *Porterandia*, *Schradera*, *Scyphiphora*, *Singaporandia*, *Timonius*, *Urophyllum*. K.M. Wong & H.K. Lua: *Saprosma*. K.M. Wong & R. Mahyuni: *Psydrax*. K.M. Wong & X.Y. Ng: *Canthiumera*. K.M. Wong & W.W. Seah: *Neonauclea*.

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typically valvate or contorted, sometimes imbricate in bud; **stamens** usually as many as and alternating with corolla lobes, in heterostylous flowers typically occurring at different levels in the corolla throat of the different morphs; filaments inconspicuous or long; anthers dorsi- or basifixed, introrse, thecae 2, dehiscent lengthwise, rarely with apical pores; **ovary** basically inferior, rarely becoming (half-)superior during fruit development, syncarpous, locules (1–)2 or sometimes more, nectar-secreting disk often present at ovary apex; placentas axile, parietal, basal or apical; ovules 1–many in each locule, mostly anatropous; **style** mostly simple, rarely divided into branches; **stigmas** capitate, clavate or 2- to several-lobed. **Fruits** small or large, indehiscent and fleshy (drupes, berries or berry-like), or dehiscent and dry (capsules), or rarely indehiscent and dry or splitting into fruit portions (mericarps), or winged; in some taxa the (ovaries and) fruits of 2 or more individual flowers united to form typically ovoid to subglobular syncarps. **Seeds** discrete or in pyrenes (encased by its testa fused with an endocarp layer), sometimes variously winged, endosperm entire or ruminant, embryo straight or curved, often tiny.

Distribution. Widespread, present on all continents, but predominantly tropical, with 614 genera and 13,150 species counted (Davis et al., Ann. Missouri Bot. Gard. 96 (2009) 68–78), and so globally the fourth largest flowering-plant family after Orchidaceae, Asteraceae and Fabaceae (Robbrecht, Opera Bot. Belg. 1 (1988) 1–271). The family is particularly diverse in tropical and subtropical America, tropical Africa and Madagascar, Southeast Asia and the southwestern Pacific (Davis et al., Ann. Missouri Bot. Gard. 96 (2009) 68–78).

Although many (211) genera are monotypic and over 70% have fewer than 10 species, some are sizeable in terms of number of species, such as *Psychotria* L. (the largest genus with 1834 species; also the third largest angiosperm genus), *Ixora* L. (c. 530 species), *Pavetta* L. (c. 357 species), *Ophiorrhiza* L. (c. 317 species), *Timonius* DC. (c. 250 species, estimate here is based on recent confirmation of some 100 species present in Borneo alone), or *Lasianthus* Jack (c. 228 species). The majority of species have restricted distributions. Davis et al. (Ann. Missouri Bot. Gard. 96 (2009) 68–78) suggest that many Rubiaceae are consequently vulnerable to extinction. For Southeast Asia, they identify New Guinea (with large landmass, high topography and extreme physiographic differentiation), the Philippines (an archipelago of numerous islands with topographic and edaphic variation and relative isolation), and Borneo (also with large landmass and much edaphic and topographic variation) as among the world's top five areas with the highest number of endemic Rubiaceae species.

In Singapore 52 genera and 150 species are considered native and another 8 species are exotic but known to have naturalised. By our latest reckoning, 50 species (c. 33%) are presumed Nationally Extinct.

Ecology. The majority are lowland taxa, but a number of genera (such as *Argostemma* Wall., *Ophiorrhiza*) are richer at mid- to montane elevations. This, however, does not apply to Singapore; *Ophiorrhiza* has but a single species and *Argostemma* is absent. Ridley (J. Straits Branch Roy. Asiatic Soc. 33 (1900) 90) was sceptical that three *Argostemma* collections labelled Singapore by Lobb were correctly attributed. In this relatively small and topographically limited area, even predominantly forest understorey groups such as *Psychotria*, *Lasianthus* and *Urophyllum* Wall. are more species-rich than a number of big-tree genera, especially those dispersed by wind.

The Rubiaceae is Singapore's most important and diverse family of dicotyledonous plants. The fact that the Rubiaceae includes low ground herbs, shrubs, creepers, slender climbers, lianas, epiphytes, treelets and small trees, as well as canopy-sized trees, attests to its general ecological importance in the tropical rain forest. *Scyphiphora hydrophylacea* Gaertn.f. can be found in mangroves, *Guettarda speciosa* L., *Morinda citrifolia* L. and *Timonius finlaysonianus* (Wall. ex G.Don) Hook.f. in strand vegetation or back mangroves, and *Jackiopsis ornata* Wall. in swamp or riverine forest. *Morinda elliptica* (Hook.f.) Ridl. and *Neolamarckia cadamba* (Roxb.) Bosser are generally secondary forest or open-site trees but are now uncommon in Singapore, with urban and suburban redevelopment to the fore. Naturalised taxa such as the Neotropical *Mitracarpus hirtus* (L.) DC. and various *Spermacoce* L. species, or probably native taxa, such as *Dentella repens* (L.) J.R.Forst. & G.Forst. and several *Hedyotis* s.l. taxa, are important members of the urban and wasteland weed flora.

Although studies of floral biology and reproductive ecology are generally rare, several insights can be gleaned from our existing understanding. Momose et al. (Amer. J. Bot. 85 (1998) 1477–1501) found that for 13 species in 9 genera of Rubiaceae in a Bornean lowland rain forest, butterflies, social bees and other insects, as well as insectivorous birds, were the pollinators. Among these, bees, butterflies and moths seem to be most important. Corner (Gard. Bull. Straits Settle. 11(3) (1941) 177–235), in studying the ixoras, paid particular attention to whether the flowers were scented. Non-fragrant flowers with yellow or red corollas are likely visited by birds and butterflies, whereas nocturnally fragrant flowers with white or pale corollas are likely moth-pollinated. Secondary pollen presentation (SPP) is typical of *Ixora* flowers, and also widespread in the Gardenieae and Pavetteae. It was once called the 'ixoroid pollination mechanism' (Bremekamp, Bull. Jard. Bot. Buitenzorg, sér. 3, 14 (1937) 204) and even used to classify a whole subfamily (Bremekamp, Acta Bot. Neerl. 15 (1966) 1–33). SPP refers to the strongly protandrous flowers before floral opening, when anthers dehisce and deposit their pollen masses onto an as-yet unreceptive stylar head. The stylar head serves as a pollen presenter when the flowers open. When the stigmas become receptive to fresh pollen brought by flower visitors, the flowers enter the female stage (Robbrecht & Puff, Bot. Jahrb. Syst. 108 (1986) 63). SPP (with various other parts besides the stylar head as the pollen presenter) can be found among other eudicot and monocot families as well (Howell et al., Austral. J. Bot. 41 (1993) 417–438).

The survey by Snow (Biotropica 13 (1981) 1–14) has underscored the importance of the Rubiaceae as a food resource for smaller unspecialised avian frugivores. In the forest understorey, a good number of Rubiaceae species flower and fruit aseasonally, contributing to frugivore resources (Leighton & Leighton in Sutton et al. (ed.), Tropical Rain Forest: Ecology and Management (1983) 181–196). Nearer to home, Putz (Malayan Forester 42 (1979) 1–24) has documented macaques and gibbons dispersing berries of *Aidia densiflora* (Wall.) Masam., and birds also taking fruits of this as well as *Timonius wallichianus* Valetton in the Peninsular Malaysian forest. For Singapore, Wong et al. (Reinwardtia 17 (2018) 101–124) noted that *Canthiumera robusta* K.M.Wong & X.Y.Ng fruits are eaten by frugivorous birds with larger gape sizes, such as the red-crowned barbet, *Megalaima rafflesii* (Lesson, 1839), and common hill myna, *Gracula religiosa* (Linnaeus, 1758), which peck at ripening fruits and swallow and regurgitate the pyrenes, or swallow the fruits whole and later regurgitate the pyrenes (reported online by the Bird Ecology Study Group, 2016). In Sumatra the fruits of this species are known to be eaten by the Mentawai langur, *Presbytis potenziani* (Bonaparte, 1856) (Hadi et al., Int. J. Primatol. 33 (2012) 218–232, under *Canthium glabrum*). The common palm civet,

Paradoxurus hermaphroditus (Pallas, 1777), can travel hundreds of metres over the duration of its gut-passage time and then pass out intact seeds, often on bare or open sites such as forest gaps (Ridley, Dispersal Pl. Throughout World (1930) 352; Nakashima et al., Mammal Study 35 (2010) 209–215) and could potentially be an important longer-distance disperser of *Canthiumera robusta* seeds. *Dibridsonia conferta* (Korth.) K.M.Wong (under *Canthium confertum* Korth.) has been reported in the diet of the long-tailed macaque, *Macaca fascicularis* (Raffles, 1821), in Singapore (Lucas & Corlett, Folia Primatol. 57 (1991) 201–215).

Among Singapore Rubiaceae, an association with ants is strongly displayed by the epiphytic *Hydnophytum* Jack and *Myrmecodia* Jack, which develop tuberous stem bases riddled with interconnected channels that house ants. They are more common in exposed littoral or coastal habitats. Otherwise the association is loose and much less consistent for some species with larger leaves, along which midribs are sites for ant-cartons to be constructed, such as occasionally in *Porterandia anisophylla* (Jack ex Wall.) Ridl. A specialised myrmecophytic habit such as in *Hydnophytum* has only evolved comparatively recently, about 13 Ma or even less (Chomicki & Renner, Proc. R. Soc. B 284 (2017) 2017.0013). Razafimandimbison et al. (Molec. Phylogenet. Evol. 34 (2005) 334–354) demonstrated that specialised myrmecophytism has arisen several times in the Rubiaceae, including a number of Bornean *Neonauclea* species developing swollen branch internodes that house ants, which do not occur in Singapore.

Bacterial leaf nodules are characteristic of some African *Psychotria* species and several hundred *Pavetta* (including the species in Singapore and others in Southeast Asia), as well as the African *Sericanthe* Robbr.; this seems to involve a high specificity with the *Burkholderia* bacterial endophytes, the loss of which affects plant growth adversely (Lemaire et al., PLoS ONE 6(9) (2011) e24430).

Uses. Coffee (*Coffea* L.) is the world's most important commodity after oil (Vega et al., Nature 425 (2003) 343). In Singapore *Coffea canephora* Pierre ex A.Froehner and *C. liberica* W.Bull ex Hiern. have been cultivated. *Uncaria gambir* (W.Hunter) Roxb., a vestige of former cultivation, persists as a naturalised taxon. In times gone by, its leaf extracts have been added to betel-quid for chewing in Southeast Asia. Some species of the American *Cinchona* L., of which the bark yields quinine used in the treatment of malarial fever, are found planted or naturalised in some highland stations in Southeast Asia, but not in Singapore.

Morinda citrifolia enters into the health tonic commercially distributed as *noni*, essentially a fruit extract that some people take for arthritis, diabetes, high blood pressure, muscle aches and pains, and other conditions; we have seen no scientific verification of its efficacy, however. *Hedyotis diffusa* Willd. is a key ingredient of the Chinese *baihuasheshecao* (白花蛇舌草), a popular traditional medicine for its claimed anti-inflammatory, hepatoprotective, neuroprotective, antioxidant, antipyretic, diuretic, blood-stimulant, and anti-carcinogenic effects. In some Asian societies, it has also been regarded by some practitioners of traditional medicine as having potential use in the treatment of cancers and tumours. It is also an important ingredient of herbal tea for health maintenance in East and tropical Asia.

The Rubiaceae do not enter conspicuously into the timber trade, with the exception of *laran* (*Neolamarckia* Bosser, now grown in fast-growing timber plantations in parts of Southeast Asia). Several of the better-known Malaysian timbers include *bangkal* (*Nauclea* L., *Neonauclea* Merr., *Ochreinauclea* Ridsdale & Bakh.f.), *malabera bukit* (*Mussaendopsis* Baill.), *meraga* (*Adina* Salisb.) and *selumar* (*Jackiopsis* Ridsdale). But as these are all lowland forest species that were more common in the past, their timbers are now expectedly more difficult to encounter.

Notable exotic ornamentals in Singapore include *Arachnothryx leucophylla* Planch. (Central America), *Gardenia carinata* Wall. (Peninsular Malaysia), *G. jasminoides* J.Ellis (South China), *Ixora chinensis* Lam. (South China), *I. finlaysoniana* Wall. ex G.Don (Peninsular Malaysia, Thailand), *I. javanica* (Blume) DC. var. *javanica* (Peninsular Malaysia), *Mussaenda erythrophylla* Schumach. & Thonn. (West Africa), *M. philippica* A.Rich. (Philippines), *Paracarphalea kirondron* (Baill.) Razafim. et al. (Madagascar), *Pentas lanceolata* (Forssk.) Deflers (Africa), *Pseudomussaenda flava* Verdc. (East Africa), *Rondeletia odorata* Jacq. (Cuba, Panama), *R. strigosa* (Benth.) Hemsl. (Guatemala) and *Warszewiczia coccinea* (Vahl) Klotzsch (Central and South America).

The endangered trees *Jackiopsis ornata* (Wall.) Ridsdale, *Mussaendopsis beccariana* Baill. and *Tarenna fragrans* (Blume) Koord. & Valeton, all of which produce flamboyantly beautiful inflorescences, have their wild Singapore provenances augmented by plantings introduced from Peninsular Malaysia. Another tree, *Gardenia tubifera* Wall., presumed Nationally Extinct in Singapore, is also cultivated for its ornamental yellow blooms, including in parks and the streetscape.

Vernacular names. In English, commonly also referred to as the coffee or madder family.

Taxonomy. Bremer & Eriksson (Int. J. Pl. Sci. 170(6) (2009) 766–793) and Neupane et al. (Amer. J. Bot. 104(3) (2017) 419–438) have estimated that the Rubiaceae could have diverged 85–100 Ma.

Early classifications attempting division into series or subfamilies based solely on ovule number (De Candolle, Prodr. 4 (1830) 341–621; Bentham & Hooker, Gen. Pl. 2 (1873–1876) 7–151, 1227–1229; Schumann in Engler & Prantl, Nat. Pflanzenfam. 4(4) (1891) 1–156) were found difficult to use. Subsequently, several other characters were considered for grouping the tribes into larger affiliations, such as the presence of raphides (bundles of needle-like crystals) in the tissues (Bremekamp, Acta Bot. Neerl. 15 (1966) 1–33), fruit type, ovule placentation, pollen and seed coat morphology, and whether seeds are albuminous (Verdcourt, Bull. Jard. Bot. État Bruxelles 28 (1958) 209–281). Generally, the recognition of coherent tribes has been more realistic than understanding the relationships among them and larger affinities (or the family’s ‘deep divergences’), and it was the advent of molecular phylogenetic studies since the 1990s and well into the present that began to allow much clearer perspectives (Bremer, Ann. Missouri Bot. Gard. 96 (2009) 4–26). Therefore, the outline features that could help recognise the various tribes and genera presented in our first key in the present account should be understood as being often, but not always, (potentially) synapomorphic in the phylogenetic sense for a tribe or cluster of genera in the stated affiliation. Indeed, for such a large, diverse family, we can only expect a multi-dimensional evolution in time and space, and expecting to construct a linear key that expresses these relationships quite accurately and simply might be an exercise in futility. In contrast, our second key emphasises habit and vegetative (even ecological) characters, and it must be remembered that some statements expressly refer to the genus as represented in Singapore, not necessarily elsewhere.

Bremer & Eriksson (Int. J. Pl. Sci. 170(6) (2009) 766–793) recovered strong statistical support in their analyses for three subfamilies, Rubioideae, Ixoroideae and Cinchonoideae. The tribe Luculieae (Himalayas, northern Thailand to southwestern China) (Rydin et al., Pl. Syst. Evol. 278 (2009) 101–123) is essentially basal to these subfamilies and Coptosapelteae has been either found in an unsupported basal position outside of the three subfamilies

(using plastid data) or in a well-supported sister group to Cinchonoideae and Ixoroideae (using mitochondrial data) (Rydin et al., *Amer. J. Bot.* 104 (2017) 1522–1532). Also, while analyses based on plastid data have consistently recovered the Ixoroideae and Cinchonoideae as monophyletic sister-groups, results with mitochondrial data place the tribes Cinchoneae and Isertieae in the Ixoroideae instead of Cinchonoideae (as with plastid data) with strong statistical support. There were also other conflicts in tribal associations recovered between mitochondrial and plastid topologies within all three subfamilies as defined by plastid markers. The possibility of reticulate evolution based on different inheritance of plastids (mainly maternally) and mitochondria (maternal, paternal or biparental) and past introgression is not well investigated but cannot be underestimated. Such perspectives will probably lead to a re-examination of the evidence as to whether two subfamilies (Robbrecht & Manen, *Syst. Geogr. Pl.* 76 (2006) 85–146), or three, should be recognised.

The taxonomy of extremely large genera (see above) is a daunting prospect but as molecular studies are used to investigate generic limits, some justified splitting of larger paraphyletic or polyphyletic groups might result. Conservative definitions of plant genera may be die-hard (note the long and faithful retention of the ‘*Randia*’ concept in Asia), but it is hard not to appreciate the extent of biogeographical influences of isolation, or dispersal and vicariance, on taxonomic diversification within the extreme landscape heterogeneity of Southeast Asia, in terms of geology, soils, physiography, historical climate change and landmass fragmentation or continuity; there are also, of course, biological phenomena to consider, such as hybridisation leading to introgression and reticulate evolution. On the other hand, there are also recent notions that the splitting of some groups, such as in the Naucleaeae, are unnecessary even from a phylogenetic viewpoint (Löfstrand et al., *Syst. Bot.* 39 (2014) 304–315).

The revision of Rubiaceae for the *Flora of Singapore* has distilled a realisation that some names applied to Singapore or Malay Peninsula taxa in the past could be erroneous, and that, in fact, some taxa in our midst given names from adjacent areas could be new taxa. In this revision 5 new species have been described, 7 new name combinations have been proposed for taxa, and even three new genera (*Canthiumera* K.M.Wong & Mahyuni, *Dibridsonia* K.M.Wong and *Singaporandia* K.M.Wong) have only recently been recognised; another 6 have also been remodelled or recognised to include Singapore representatives (*Adina* Salisb., *Canthium* Lam., *Discospermum* Dalzell, *Eumachia* DC., *Gynochthodes* Blume, *Morinda* L.).

Key to genera

(following tribal affiliations)

1. Ovary locules 4–many; ovules solitary and pendulous from the locule apex. Inflorescences axillary and opposite. Seeds exalbuminous. [*GUETTARDEAE*] 2
- Ovary locules 2–several; ovules 2–many in each locule, or solitary and variously attached (but mostly in axile placentation). Inflorescences axillary or terminal, or terminal becoming pushed to one side by axillary branch development (‘pseudo-axillary’). Seeds albuminous 3

2. Flowers unisexual (plants dioecious). Corolla lobes 4, mostly valvate or very slightly overlapping at the base (in one species 5 in male flowers, 6–8 in females and conspicuously imbricate); stigma linear or cylindric, 4-lobed (6–8 in one species). Pyrene walls separate, sometimes immersed in a hard matrix **50. Timonius**
 Flowers hermaphrodite or polygamo-dioecious. Corolla lobes (4–)6–8(–9), imbricate; stigma knoblike, entire. Pyrene walls fused into a hard stone **16. Guettarda**
3. Flowers borne in a true head (with globose or ovoid-ellipsoid receptacle) and the fruits non-succulent (dehiscent or forming woody syncarps). [*NAUCLEAEAE*] 4
 Flowers in clusters or branched inflorescences, not borne in a head, or if in heads then fruits or syncarps fleshy 9
4. Fruits indehiscent; seeds not winged 5
 Fruits dehiscent; seeds winged, at least slightly at one end 6
5. Hypanthia fused, the infructescence a woody syncarp. Ovary distinctly 2-locular. Stipules appressed together forming a plane structure at shoot tips **32. Nauclea**
 Hypanthia free, the infructescence a head of loose fruits. Ovary 2-locular in lower part and apparently 4-locular in upper part due to development of a false septum. Stipules overlapping around the terminal bud at shoot tips **33. Neolamarckia**
6. Woody climbers developing paired axillary hooks. Corolla lobes valvate ... **51. Uncaria**
 Trees without hooks. Corolla lobes contorted in bud 7
7. Hypanthia fused at the apices, later breaking free. Stigma spindle-shaped **35. Ochreinauclea**
 Hypanthia completely free. Stigma globose or clavate 8
8. Stipules entire. Peduncle with a conspicuous distal swelling. Stigma globose **34. Neonauclea**
 Stipules bifid at the tips. Peduncle without any conspicuous swelling. Stigma clavate **1. Adina**
9. Corolla lobes valvate 10
 Corolla lobes contorted in bud 38
10. Fruits dry, indehiscent or capsular, with seeds not fused to fruit endocarp, and without foetid leaves when bruised. [*SPERMACOCEAE*] 11
 Fruits succulent, berry-like or if dry, then leaves foetid when bruised 14
11. Ovules several to many per locule 12
 Ovules one per locule 13

12. Flowers usually 4-merous. Fruits dehiscent or not. Stipules typically fimbriate or with marginal teeth, segments or bristles, or laciniate **18. Hedyotis** s.l.
 Flowers 5-merous. Fruits indehiscent. Stipules subentire, or slightly bifid at apex
 **8. Dentella**
13. Fruit a circumscissile capsule **26. Mitracarpus**
 Fruit generally a 2-valved capsule dehiscing septicidally into basally attached portions, or only one valve dehiscing from the base, or indehiscent
 **19. Hexasepalum** and **48. Spermacece**
 (see notes under these genera)
14. Ovules one per locule (or apparently solitary when biovulate locules are seemingly partitioned by an intruding placenta forming a false septum, as in *Gynochthodes*) 15
 Ovules several to numerous per locule. 32
15. Ovules pendulous, attached to ovary apex or upper part of septum. [*VANGUERIEAE*] ...
 16
 Ovules attached to ovary septum or base 19
16. Climbers, scramblers, shrubs or trees with scrambling branches. Axillary buds supernumerary, a distal axillary bud typically developing into a straight, slightly curved or recurved spine, and a proximal axillary bud (just below the spine) developing either into a normal shoot or a short-shoot ('brachyblast', with tightly condensed internodes). Inflorescences of solitary or fascicled flowers or 1–few-flowered pedunculate cymes from the axils of leaves along normal shoots as well as leaves and bracts on short-shoots **3. Canthium**
 Trees. Axillary buds solitary, not developing into spines. Inflorescences in axils of leaves along normal branches 17
17. Corolla throat with no or sparse short, smooth hairs. Pyrenes somewhat plano-convex without shoulders, surface verrucose **43. Psydrax**
 Corolla throat with dense long, moniliform hairs. Pyrenes with two lateral shoulder-like protrusions, surface smooth or verrucose 18
18. Flowers hermaphrodite. Corolla throat hairs in distinct tufts, longest at the base of corolla lobes. Pyrenes dorsally with a prominent keel-like crest reaching to the base, laterally with two sub-apical extensions ('shoulders') flattening out as keels and reaching to the base, smooth **4. Canthiumera**
 Flowers functionally unisexual. Corolla throat hairs in a continuous band. Pyrenes dorsally with a rounded ridge-like crest reaching to only halfway to the base, laterally with two rounded sub-apical extensions ('shoulders') sloping downwards, verrucose or minutely tuberculate **9. Dibridsonia**
19. Ovules attached to the ovary base, erect. 20
 Ovules attached to the ovary crosswall or near its base ('sub-basally') 29

20. Leaves foetid when bruised. [*PAEDERIEAE* and allies] 21
 Leaves not foetid when bruised 22
21. Climbers. Fruits dry, exocarp splitting into two valves. Pyrenes with a compressed subcircular wing derived from the fruit endocarp or hemispherical and not winged **38. Paederia**
 Shrubs or treelets. Fruits fleshy, drupe-like or berry-like, indehiscent. Pyrenes mostly plano-convex, never winged **44. Saprosmia**
22. Ovary half-inferior, developing to somewhat superior in fruit stage. Stipules fused into a cylindrical sheath with a 4-toothed margin. [*GAERTNEREEAE*] **12. Gaertnera**
 Ovary distinctly inferior. Stipules free or only partly fused at the edges, not forming a cylindrical sheath (except in some *Psychotria*, not in Singapore), the margins entire to lacinate 23
23. Treelets and trees. Branches solitary at stem nodes. Inflorescences axillary and opposite. Inside of corolla tube and inner surface of corolla lobes typically villous hairy. Ovary with 3–9 locules. [*LASIANTHEAE*] **24. Lasianthus**
 Treelets, trees, shrubs, ground creepers, climbers, or epiphytes. Branches typically paired at stem nodes (or mainly arising from near the apex of a tuberous stem base, and then epiphytic). Inflorescences axillary or terminal. Corolla tube glabrous to hairy at the throat, inner surface of corolla lobes typically glabrous. Ovary with 2 locules (except the epiphytic *Myrmecodia*, 2–10 locules) 24
24. Stipules persistent or fragmenting and typically leaving basal portions or shreds, leathery to somewhat corky. Inflorescences terminal. Pyrenes with marginal preformed germination slits. [*PALICOUREEAE*] 25
 Stipules persistent or caducous, thin or leathery but not becoming corky. Inflorescences axillary or terminal. Pyrenes without marginal preformed germination slits. [*PSYCHOTRIEAE*] 27
25. Ground creeper, rooting at stem nodes, with cordate-reniform leaves **15. Geophila**
 Shrubs to small trees or climbers, less commonly herb-like, not rooting at stem nodes, leaves not cordate 26
26. Inflorescences involucrate, or corolla tubes ostensibly curved, corolla throat not hairy. Infructescences with succulent, coloured distal branches. Leaves drying brown or olive brown **5. Chassalia**
 Inflorescences not involucrate and corolla tubes straight, not curved, corolla throat glabrous or with short hairs. Infructescences with green slender distal branches. Leaves typically drying yellowish green **11. Eumachia**
27. Trees, shrubs or climbers without ant-inhabited stems. Inflorescences terminal (mostly) or axillary **42. Psychotria**
 Epiphytes with swollen ant-inhabited stem base. Inflorescences axillary 28

28. Stipules interpetiolar; tubers without spines. Ovary with 2 locules **20. Hydnohytium**
 Stipules intrapetiolar; tubers bearing long straight spines. Ovary with 2–10 locules
 **31. Myrmecodia**
29. Stipules bifid. [*PRISMATOMERIDEAE*] **41. Prismaticomeris**
 Stipules entire. [*MORINDEAE*] 30
30. Flowers in umbels in panicles **6. Coelospermum**
 Flowers not in panicles 31
31. Lianas. Inflorescences axillary or terminal. Ovules 2 per locule but seemingly partitioned
 by an intruding placenta forming a false septum, and ovary apparently with 4 uniovulate
 locules **17. Gynochthodes**
 Trees. Inflorescences terminal, becoming leaf-opposed by displacement. Ovules 1 per
 locule, and ovary 2-loculate **27. Morinda**
32. Fruits several to many fused together as fleshy syncarps. Slender climbers or
 creepers ascending by adventitious rootlets on nodes and internodes, or epiphytes.
 [*SCHRADEREAE*] 33
 Fruits free, not fused into syncarps. Trees, shrubs, climbers or herbs 34
33. Flowering and fruiting heads ovoid-ellipsoid. Calyx tube lobed. Stems with longitudinal
 ridges or wings **25. Lecananthus**
 Flowering and fruiting heads globose. Calyx tube truncate. Stems quite smooth
 **45. Schradera**
34. Herbs. Fruits laterally compressed, obcordate. [*OPHIORRHIZEAE*] **36. Ophiorrhiza**
 Trees, shrubs, climbers or herbs. Fruits not compressed: obconical, globose to ellipsoid
 or slightly bilobed 35
35. Stipules united into a short cylinder with many linear marginal segments. Calyx 3-merous,
 the lobes subsequently enlarged into persistent fruit wings. [*JACKIEAE*]
 **23. Jackiopsis**
 Stipules not united into a cylinder, entire or variously cleft or with many linear marginal
 lobes. Calyx 4-8-merous, lobes deciduous or if persistent not enlarged as fruit wings ... 36
36. Climbers or shrubs. Young stems and branches conspicuously lenticellate. Stipules ovate,
 not or 1–several times cleft. Calyx often with 1 or more lobes expanded as petal-like
 structures (‘calycophylls’), early deciduous from fruit. Fruits ellipsoid, mostly 1–1.5 cm
 long. [*MUSSAENDEAE*] **28. Mussaenda**
 Treelets or trees. Young stems and branches not conspicuously lenticellate. Stipules
 triangular to ovate, entire or minutely toothed to bifid at apex. Calyx never with
 calycophylls, persistent or not in fruit. Fruits globose to obovoid, mostly not longer than
 0.5 cm 37

37. Axillary buds at stem nodes solitary. Inflorescences terminal to normal leafy shoots or axillary short-shoots (and then apparently axillary). Flowers hermaphrodite. Stigma bifid. [*ARGOSTEMMATEAE*] **30. Mycetia**
 Axillary buds at stem nodes supernumerary. Inflorescences axillary and opposite. Flowers unisexual. Stigma 3–8-lobed. [*UROPHYLLAE*] **52. Urophyllum**
38. Fruits dry 39
 Fruits baccate 40
39. Climbers. Stipules interpetiolar. Inflorescences terminal and axillary. Calyx lobes not specially enlarging. Fruits loculicidal. [*COPTOSAPELTEAE*] **7. Coptosapelta**
 Trees. Stipules intrapetiolar. Inflorescences axillary. Calyx of outer flowers of clusters on the panicle developing an enlarged petaloid lobe ('calycophyll'). Fruits septicidal. [*CONDAMINIEAE*] **29. Mussaendopsis**
40. Seeds pendulous from an apical placenta, imbricately arranged. Inflorescences axillary and opposite. [*OCTOTROPIDEAE*] **21. Hypobathrum**
 Seeds attached to fruit crosswall, or on axile placentas, not imbricately arranged. Inflorescences axillary or terminal 41
41. Corolla lobes contorted to the right. Anthers basifixed. [*TRIBE UNCERTAIN*]
 **14. Gardeniopsis**
 Corolla lobes contorted to the left. Anthers dorsifixed 42
42. Ovary 2-locular. Erect trees or shrubs with leaves well developed in pairs. Inflorescences terminal or terminal and axillary. Anthers conspicuously exerted from corolla tube. Corolla lobes 4–6 43
 Ovary 1-locular: otherwise plants climbing, or inflorescences axillary and in pairs at each node or apparently singly at nodes with one or both leaves reduced, or anthers included. Corolla lobes 5 or more 45
43. Exserted part of style not longer than corolla lobes. [*IXOREAE*] **22. Ixora**
 Exserted part of style as long as, or much longer than, corolla lobes. [*PAVETTEAE*] 44
44. Leaves developing dark bacterial nodules in the lamina. Corolla lobes 4 **39. Pavetta**
 Leaves without dark nodules. Corolla lobes 5–6 **49. Tarenna**
45. Inflorescences always axillary and in opposite pairs. Treelets and trees 46
 Inflorescences typically terminal to leafy shoots, sometimes pushed to apparently lateral positions by sympodial branch development, or borne singly along branches at alternate nodes with one or both leaves reduced. Trees or climbers. [*GARDENIEAE*] 47
46. Locule in fruit falsely divided by an intruding transverse placenta, the upper part with an erect seed and the lower with a pendulous seed. Stipules united to form a low truncate tube. [*SCYPHIPHOREAE*] **46. Scyphiphora**
 Locule in fruit not transversely divided, the seeds attached to axile placentas. Stipules only partly fused at the edges, with pointed apices. [*COFFEEAE*] **10. Discospermum**

47. Inflorescences borne singly along branches at alternate nodes with one or both leaves reduced **2. Aidia**
 Inflorescences or flowers ostensibly terminal to leafy shoots 48
48. Scramblers or climbers with hooks on the branches **37. Oxyceros**
 Shrubs, treelets or trees 49
49. Gynodioecious, rarely gynomonoeious, trees. Flowers small, less than 2 cm long.
 **40. Porterandia**
 Monoecious treelets, trees or shrub-like plants. Flowers conspicuous, at least 3.5 cm long, often much longer, to around 15 cm 50
50. Stipules triangular, free. Flowers 1–3 together in cymes terminating typically short branches each of which develops only 2 nodes, with only a pair of leaves at the proximal node, the distal one leafless. Corolla infundibular, with dark purplish streaks down the corolla tube **47. Singaporandia**
 Stipules fused into a cylindric, often subtruncate sheath. Flowers solitary and terminal to shoots with multiple leaf pairs. Corolla salverform, without purplish streaks down the corolla tube **13. Gardenia**

Key to genera

(with emphasis on habit and vegetative characters)

1. Epiphytic plants developing swollen, ant-inhabited tubers 2
 Terrestrial plants: creepers, herbs, shrubs, treelets, trees, scramblers, or climbers (or if epiphytic then without swollen tubers) 3
2. Tubers unarmed. Stipules interpetiolar **20. Hydnohytium**
 Tubers with spines. Stipules intrapetiolar **31. Myrmecodia**
3. Creeping plants over the ground with cordate-reniform leaves and inflorescences terminating creeping stems **15. Geophila**
 Other plants; if creeping (forming dense mats in open sites, or as juvenile stems before ascending other plants in the forest) then leaves not cordate-reniform and creeping stems with axillary flowers or never in flower 4
4. Slender climbers or creepers ascending by adventitious rootlets at stem nodes and along internodes, or epiphytes 5
 Plant habit various but stems without adventitious roots 8
5. Branches with both pairs of leaves reduced or bract-like at alternate nodes
 **2. Aidia** (in part)
 Branches without such leaf reduction 6

6. Climbers. Flowers and fruits free, in branched inflorescences (although some species have densely packed inflorescence branches and flowers that look superficially like heads of flowers) **42. Psychotria** (in part)
Climbers or epiphytes. Flowers and fruits in true heads, arising on a subglobular receptacle 7
7. Stems with longitudinal ridges or wings. Flowering and fruiting heads ovoid-ellipsoid. Calyx tube lobed **25. Lecananthus**
Stems quite smooth. Flowering and fruiting heads globose. Calyx tube truncate **45. Schradera**
8. Climbing or scrambling plants with axillary hooks or straight spines 9
Plants climbing or not, without axillary hooks or spines 11
9. Low scrambler. Leaf axils along branches typically with two axillary buds, a distal one developing into a straight, slightly curved or recurved spine, and a proximal axillary bud (just below the spine) becoming a normal shoot or a short-shoot ('brachyblast', with tightly condensed internodes). Flowers solitary or fascicled or on 1–few-flowered small cymes not or only slightly longer than the leaf petioles **3. Canthium**
Low scramblers or high climbers typically persisting on taller trees in the forest. Leaf axils along branches with solitary axillary buds. Flowers often many in conspicuous heads or cymes, mostly much longer than leaf petioles 10
10. Stems and branches often conspicuously 4-angled. Stipules apically cleft or entire. Axillary hooks in strongly recurved pairs, often more than semi-circular in curvature. Inflorescences globose heads, often borne on the axillary hooks. Fruits capsular, seeds minute, winged **51. Uncaria**
Stems and branches terete. Stipules never divided. Axillary spines either a pair of longer retrorse fang-like structures at the first node of deflexed branches, with a single shortly recurved spine at the next node, or all spines subequal and shortly recurved. Inflorescences branched cymes, terminal to leafy shoots. Fruits berry-like, indehiscent; seeds granular, not winged **37. Oxyceros**
11. Leaves foetid when bruised 12
Leaves not foetid when bruised 13
12. Climbers. Fruits dry, exocarp splitting into two valves **38. Paederia**
Shrubs or treelets. Fruits fleshy, drupe-like or berry-like, indehiscent **44. Saprosma**
13. Stipules fused into a cylindric sheathing tube, or fused along one side into a subtruncate sheath, above the leaf petioles 14
Stipules free or only slightly fused at the edges, or fused to the petioles, or above them, to form a shallow cupular sheath 19
14. Climbers 15
Trees, treelets or shrubs 16

15. Stipules fused to form a subtruncate sheath. Flowers in panicles **6. Coelospermum**
 Stipules forming a subtruncate sheath fused along one side. Flowers not in panicles
 **17. Gynochthodes** (in part)
16. Stipular sheath not toothed or lobed 17
 Stipular sheath provided with teeth or lobes 18
17. Shoot tips resinous. Monoecious trees. Flowers conspicuous, at least 3.5 cm long, often
 much longer, to around 15 cm **13. Gardenia**
 Shoot tips non-resinous. Gynodioecious, rarely gynomonocious, trees. Flowers small,
 less than 2 cm long **40. Porterandia**
18. Stipular sheath without any basal ridges encircling the leaf petiole bases, with many linear
 marginal segments. Calyx 3-merous, the lobes subsequently enlarged into persistent fruit
 wings **23. Jackiopsis**
 Stipular sheath with basal ridges encircling the leaf petiole bases, and a 4-toothed margin.
 Calyx 4- or 5(-6)-merous, the lobes not enlarging into fruit wings **12. Gaertnera**
19. Habitat mangroves or littoral sites 20
 Inland sites 22
20. Buds resinous. Stipules a short-cupular structure, to 2 mm high. Corolla 4(-5)-merous ...
 **46. Scyphiphora**
 Buds non-resinous. Stipules free. Corolla 5-8-merous 21
21. Leaf base rounded to cordate. Flowers hermaphrodite or polygamo-dioecious. Corolla
 lobes 6-8-merous. Fruits 1-1.7 cm long; pyrenes 4-6 **16. Guettarda**
 Leaf base cuneate. Flowers unisexual. Corolla lobes 5 in male flowers, 6-8 in females.
 Fruits up to 1 cm long; pyrenes many (20-60) **50. Timonius** (in part)
22. Stipules intra-petiolar when fully developed, the terminal pair pressed flat together over
 the terminal bud and initially mostly fused together, later separating. Leaves broadly
 elliptic to subrotund. Trees **29. Mussaendopsis**
 Stipules interpetiolar, free or fused at the edges, whether or not tightly appressed together.
 Leaves of various shapes. Trees or plants of other habit 23
23. Stipules fused to petiole bases 24
 Stipules not fused to petiole bases 26
24. Stipules with marginal teeth, segments or bristles, or laciniate
 **18. Hedyotis** s.l. (in part)
 Stipules fimbriate 25
25. Fruit a circumscissile capsule **26. Mitracarpus**
 Fruit generally a 2-valved capsule dehiscing septicidally into basally attached portions,
 or only one valve dehiscing from the base, or indehiscent
 **19. Hexasepalum** and **48. Spermacoe** (*see notes under these genera*)

26. Stipules setaceous and undivided, hairy (2.5–)4–5 mm long, or sometimes divided into 2–4 linear lobes. Fruits capsular and laterally compressed **36. Ophiorrhiza**
Stipules or their divisions not setaceous. Fruits not capsular and not laterally compressed 27
27. Stipules with marginal teeth, or lanceolate or linear divisions. Low herbs or slender climbers **18. Hedyotis** s.l. (in part)
Stipules entire, or only bifid at the apex, or margin irregular and sometimes minutely toothed to bifid at apex. Creepers, climbers, scramblers, treelets and trees 28
28. Climbers or scandent shrubs with conspicuously lenticellate stem and branch internodes ...
..... **28. Mussaenda**
Climbing or non-climbing plants, stems and branches not conspicuously lenticellate ... 29
29. Stipules bifid at the apex, or margin irregular and sometimes minutely toothed to bifid at apex 30
Stipules entire 32
30. Treelets. Stems just behind new growth developing smooth, corky or spongy, pale brown to whitish bark. Stipules ovate, with an irregular margin, sometimes minutely toothed to bifid at the apex. Fruit a berry **30. Mycetia**
Treelets or trees. Stem bark never corky or spongy, usually brownish. Stipules bifid. Fruit a berry or capsule 31
31. Medium to big trees, the trunk often fluted, becoming latticed (with conspicuous slits and holes) in older specimens. Stipules narrow-triangular, bifid with two very narrow apical divisions. Young branch internodes not regularly ridged. Flowers in subglobose heads. Fruits capsular **1. Adina** (*applicable to the Singapore taxon*)
Treelets or small trees, the stems or trunks never fluted or latticed. Stipules generally triangular in shape and usually cleft or divided into two smaller triangular lobes at the apex. Young branch internodes with two conspicuous longitudinal ridges along interpetiolar median. Flowers in subumbellate clusters. Fruits berry-like
..... **41. Pristomeris**
32. Leaves at the proximal node of each branch segment fully developed and in a pair, those at the distal node with one or both leaves reduced. Inflorescences terminating such 2-node branch segments pushed to the upper side of the branch by development of the next segment and therefore pseudo-lateral, generally cymose **2. Aidia** (in part)
Leaves consistently developing in pairs, the branches without such leaf reduction at its nodes. Inflorescences typically clearly terminal or axillary 33
33. Climbers 34
Non-climbing plants 35
34. Leaves typically hairy on lower surface; secondary veins 2–5 pairs. Fruit a capsule
..... **7. Coptosapelta**

- Leaves hairy or glabrous; secondary veins 4–9 pairs. Fruit fleshy, indehiscent
 **17. Gynochthodes** (in part)
35. Creeping plant, much branched and forming dense mats. Leaves small, up to 10 × 5 mm,
 often smaller **8. Dentella**
 Non-creeping plants. Leaves much larger 36
36. Treelet or shrub with branches typically short and developing only 2 nodes, with only a
 pair of leaves at the proximal node, the distal one leafless, later to be terminated by an
 inflorescence. Flowers conspicuous, to around 15 cm, with infundibular corolla with dark
 purplish streaks down the tube **47. Singaporandia**
 Treelets, shrubs or trees, the branches not so restricted. Flowers not as large, corollas
 various, without purplish streaks inside 37
37. Stipules pressed together to form a strongly flattened structure enclosing the vegetative
 terminal bud 38
 Stipules not so 39
38. Leaves often drying yellowish; midrib on upper surface slightly sunken. Fruits
 indehiscent; seeds not winged. Hypanthia fused, the infructescence a woody syncarp
 **32. Nauclea**
 Leaves typically drying brown; midrib on upper surface flat to slightly raised. Fruits
 dehiscent; seeds winged, at least slightly at one end. Hypanthia free, the infructescence a
 head of loose fruits **34. Neonauclea**
39. Leaves consistently developing dark bacterial nodules in the blade **39. Pavetta**
 Not so 40
40. Stipules with a sharp extended acicular cusp at the apex. Branches with leafless nodes
 occurring close together especially at proximal parts. Flowers 4-merous and in terminal
 inflorescences **22. Ixora**
 Stipules without such a cusp. Branches without such leafless nodes. Flowers if 4-merous,
 in axillary inflorescences 41
41. Treelets with solitary branches along the stem. Inside of corolla tube and inner surface of
 corolla lobes typically villous hairy **24. Lasianthus**
 Treelets, trees, or shrubs, branches typically paired along stem. Corolla tube glabrous to
 hairy at the throat, inner surface of corolla lobes typically glabrous 42
42. Twigs with 1–several leafless flowering nodes marked by persistent annular stipular scars
 immediately distal to every 1–2 leafy nodes **14. Gardeniopsis**
 Not so 43

43. Branches each consisting of a sympodial series of 2-node segments (modules), each segment with the apex flowering or not. Inflorescences stalked heads of flowers terminating the 2-node branch segments, pushed to the upper side of the branch by development of the next segment and therefore pseudo-lateral, appearing leaf-opposed owing to development of leaves on the lower side of the branch only **27. Morinda**
Branches and inflorescences not as above 44
44. Stems or trunks with opposite and decussate leaves (or leaf scars), branches with leaf pairs developing in a horizontal plane (i.e. distichously) 45
Stems and branches all with opposite and decussate leaves 52
45. Leaf margins consistently wavy 46
Leaf margins plane to very remotely undulate 47
46. Stipules without a median keel, often with an apical awn **10. Discospermum**
Stipules with a median keel prolonging into an apical cusp or lobe
..... **43. Psydrax** (in part)
47. Stipules with one or two prominent ridges or keels 48
Stipules without raised ridges or keels 51
48. Stipules with 2 short lateral keels joining to form a prominent median keel running to the apex **21. Hypobathrum**
Stipules with a slight to pronounced median keel prolonged into an apical cusp or lobe ...
..... 49
49. Leaf secondary veins (5–)6–8(–10) pairs, often with intermediate veins visible in between secondaries, tertiary veins distinct in dried leaves. Fruits ellipsoid, ripening dark bluish green to purplish black, more than 2 cm long **4. Canthiumera**
Leaf secondary veins 3–5(–6) pairs, without any distinct intermediate or tertiary veins in dried leaves. Fruits of other shapes, ripening other colours, up to 1 cm long 50
50. Leaves mostly with 3 pairs of secondary veins, rarely 4–5. Fruits obovoid, not bilobed, ripening orange **9. Dibridsonia**
Leaves mostly with 4–6 pairs of secondary veins, rarely 3. Fruits obovoid-obcordate, strongly bilobed, ripening black **43. Psydrax** (in part)
51. Stipules obvolutely clasping the terminal bud (i.e. each with one edge overlapping onto the other stipule). Inflorescences terminal, flowers in a globose head. Sizeable tree of gaps and forest edges. Axillary buds on the main stem one in each axil. Leaves with short-pointed apex **33. Neolamarckia**
Stipules appressed together, not obvolutely clasping. Inflorescences axillary, paired, flowers in a cluster or on branched cymes. Small trees or treelets in forest understorey. Axillary buds on the main stem more than one per axil. Leaves often with slender apical cauda **52. Urophyllum**

52. Stipules persistent or fragmenting and typically leaving basal portions or shreds, leathery to somewhat corky 53
 Stipules persistent or caducous, thin or leathery but not becoming corky 54
53. Leaves drying brown or olive brown. Inflorescences involucrate, or corolla tubes ostensibly curved. Infructescences with succulent, coloured distal branches **5. Chassalia**
 Leaves typically drying yellowish green. Inflorescences not involucrate and corolla tubes straight, not curved. Infructescences with green slender distal branches **11. Eumachia**
54. Leaves densely hairy all over the lamina and veins 55
 Leaves glabrous or sparsely hairy 57
55. Lower leaf surface completely covered by dense silvery appressed hairs **50. Timonius** (in part)
 Lower leaf surface with red to brown or rusty-brown hairs, appressed to suberect to erect 56
56. Treelet or shrub. Flowers tiny (corolla c. 1.5 mm long) in axillary inflorescences of dense heads **42. Psychotria** (in part)
 Small trees. Flowers conspicuous (corolla longer than 10 mm) in terminal, distinctly branched inflorescences **49. Tarenna** (in part)
57. Leaf tertiary veins mostly transversely parallel and running almost perpendicular to the midrib **50. Timonius** (in part)
 Leaf tertiary veins reticulate 58
58. Inflorescences axillary and opposite **50. Timonius** (in part)
 Inflorescences terminal 59
59. Inflorescences globular heads of flowers **35. Ochreinauclea**
 Inflorescences of distinctly branched cymes 60
60. Seeds encased by inner fruitwall to form pyrenes (stones) with dorsal ridges. Leaves drying lead-grey, reddish brown, dark brown to black **42. Psychotria** (in part)
 Seeds not in such ridged stones. Leaves drying brown to black **49. Tarenna** (in part)

1. ADINA Salisb.

(Greek, *adinos* = crowded; referring to the flowers densely gathered in heads)

Parad. Lond. 2(2) (1808) pl. 115 [‘116’]; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’]) 126; Ridley, Fl. Malay Penins. 2 (1923) 10; Corner, Wayside Trees Malaya, ed. 3, 2 (1988) 624; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 152; Puff et al., Rubiac. Thailand (2005) 50, pl. 3.1.3; Löfstrand et al., Syst. Bot. 39 (2014) 310. **Type:** *Adina globiflora* Salisb. (= *Adina pilulifera* Franch. ex Drake).

Metadina Bakh.f., Taxon 19 (1970) 472; Ridsdale, Blumea 24(2) (1979 [‘1978’]) 350; Wong, Arbor. Rubiac. Malaya (1988) 124; Wong, Tree Fl. Malaya 4 (1989) 374. **Type:** *Metadina trichotoma* (Zoll. & Moritzi) Bakh.f. (= *Adina trichotoma* (Zoll. & Moritzi) Benth. & Hook.f. ex B.D.Jacks.).

Adinauclea Ridsdale, Blumea 24(2) (1979 [‘1978’]) 349. **Type:** *Adinauclea fagifolia* (Teijsm. & Binn. ex Havil.) Ridsdale (= *Adina fagifolia* (Teijsm. & Binn. ex Havil.) Valetton ex Merr.).

Haldina Ridsdale, Blumea 24(2) (1979 [‘1978’]) 360; Wong, Arbor. Rubiac. Malaya (1988) 71; Wong, Tree Fl. Malaya 4 (1989) 353; Puff et al., Rubiac. Thailand (2005) 52, pl. 3.1.4. **Type:** *Haldina cordifolia* (Roxb.) Ridsdale (= *Adina cordifolia* (Roxb.) Hook.f. ex B.D.Jacks.).

Pertusadina Ridsdale, Blumea 24(2) (1979 [‘1978’]) 353; Wong, Arbor. Rubiac. Malaya (1988) 156; Wong, Tree Fl. Malaya 4 (1989) 391; Turner, Gard. Bull. Singapore 45 (1993) 202. **Type:** *Pertusadina eurhyncha* (Miq.) Ridsdale (= *Adina eurhyncha* (Miq.) Å.Krüger & Löfstrand).

Medium-sized to big trees. **Stipules** entire or bifid, obvolutely clasping over the terminal bud. **Inflorescences** subglobose heads either solitary or in simple or compound dichasial panicles, axillary or terminal, densely covered with flowers and interfloral bracteoles; peduncles slender, without any conspicuous swelling. **Flowers** bisexual, 4–5-merous; hypanthia completely free; corolla salver-shaped to infundibular, lobes valvate or apically contorted; anthers basifixed, exerted; style exerted, stigma globose or clavate; ovary 2-locular; ovules 4–10 per locule. **Fruitlets** obconical, dehiscent septically and loculicidally into 4 from the base upwards, the calyx remaining attached to the central axis formed from the ovary septum. **Seeds** ovoid to trigonal, slightly winged at one end.

Distribution. A genus of 4 species in the Malay Peninsula, Sumatra and Borneo. In Singapore 1 native species.

Taxonomy. In a molecular phylogenetic study employing both nuclear and chloroplast datasets by Löfstrand et al. (Syst. Bot. 39 (2014) 304–315), *Pertusadina* was recovered as paraphyletic with respect to *Metadina* and a species of *Adina*. As these genera were also segregated on the basis of very few morphological characters (Ridsdale, Blumea 24(2) (1979 [‘1978’]) 307–366), a broader circumscription of *Adina* was adopted, including *Adinauclea*, *Haldina*, *Metadina* and *Pertusadina*.

Adina eurhyncha (Miq.) Å.Krüger & Löfstrand

(Greek, *eu-* = truly, *-rhyncha* = beaked; referring to the abruptly narrowed leaf tips)

Meraga (Malay)

Syst. Bot. 39 (2014) 310. **Basionym:** *Uncaria eurhyncha* Miq., Fl. Ned. Ind., Eerste Bijv., fasc. 3 (1861) 539. **Synonym:** *Pertusadina eurhyncha* (Miq.) Ridsdale, Blumea 24(2) (1979 [‘1978’]) 354; Wong, Arbor. Rubiac. Malaya (1988) 156; Wong, Tree Fl. Malaya 4 (1989) 391; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 440; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 68, 176, 223. **Type:** *Teijsmann s.n.*, [Indonesia], Banka [Bangka Island], Djebus (lectotype K [K000729896], designated by Löfstrand et al., Syst. Bot. 39 (2014) 310). **Fig. 1, 2.**

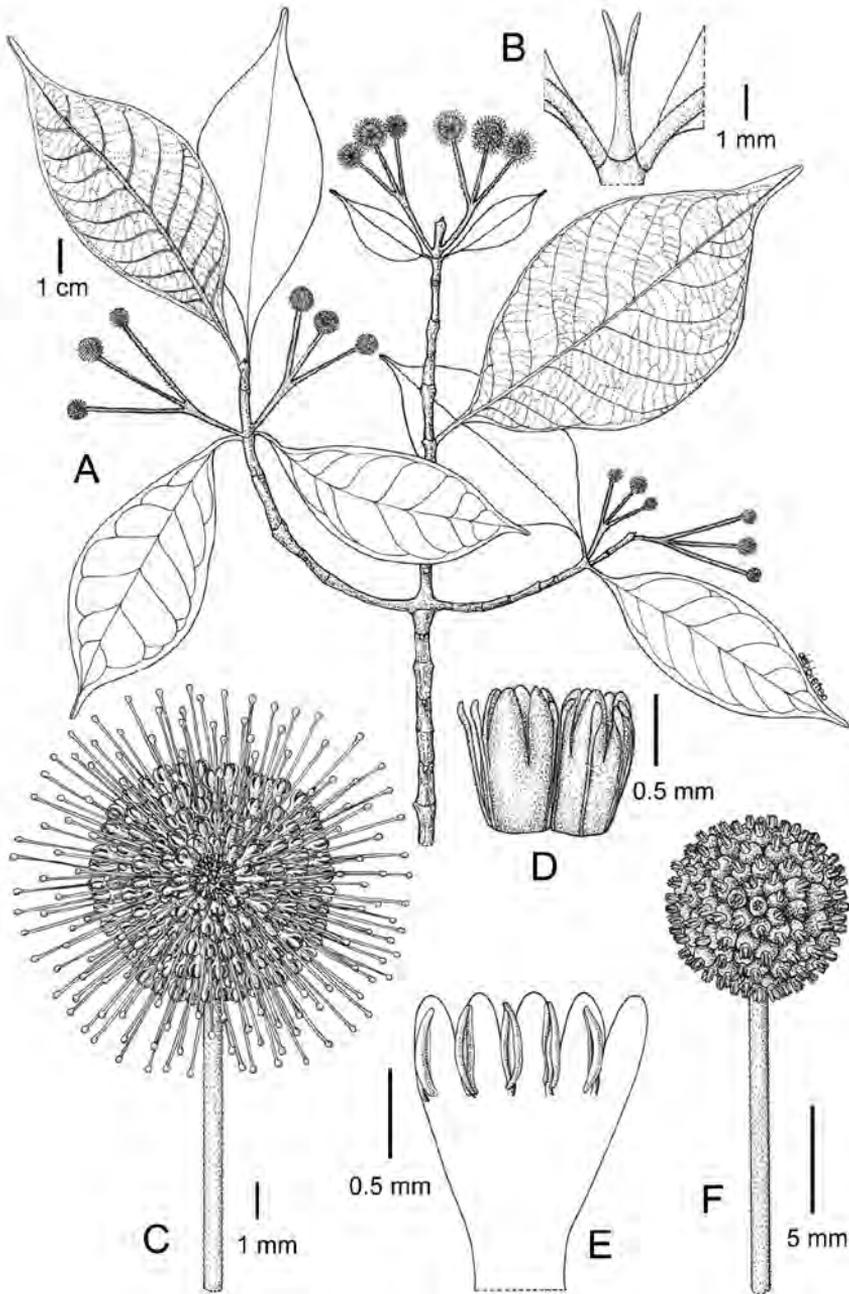


Figure 1. *Adina eurhyncha* (Miq.) Å.Krüger & Löfstrand. **A.** Flowering and fruiting branch. **B.** Stipule showing bifid apex. **C.** Head of flowers. **D.** Two hypanthia with adjacent interfloral bracteoles. **E.** Inner side of cut-open corolla showing stamens. **F.** Head of fruitlets. (From Singapore, A from MacRitchie, *Mhd Shah & Ali MS 3931*; B from MacRitchie, *Corner s.n.* [SING0207042]; C–E from Bukit Timah Nature Reserve, *Ngadiman SFN 35785*; F from Bukit Timah Nature Reserve, *Sinclair 20822*. Drawn by D. Teo).

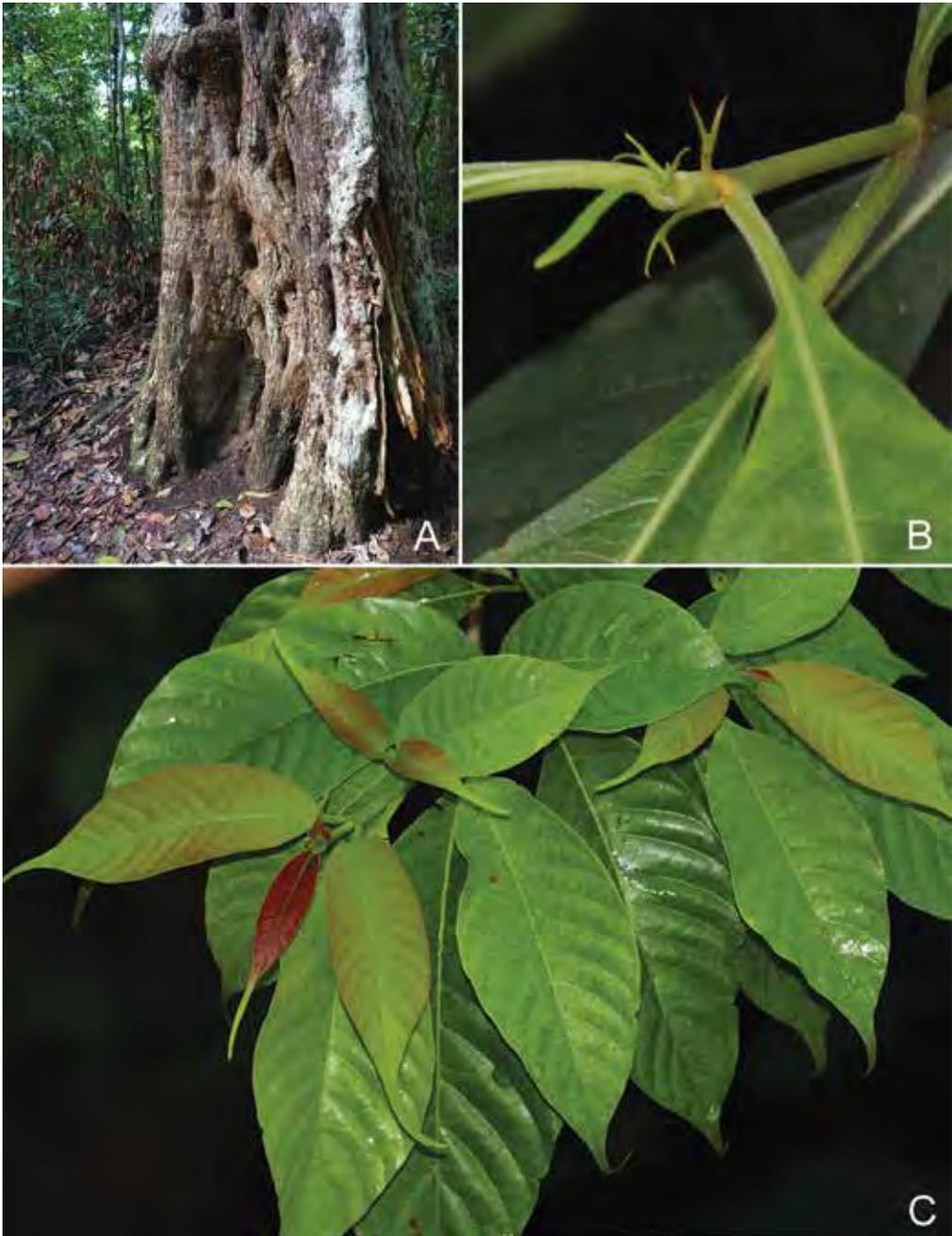


Figure 2. *Adina eurhyncha* (Miq.) Å.Krüger & Löfstrand. **A.** Latticed trunk. **B.** Detail of bifid stipules at shoot tips. **C.** Foliage with young leaves. (From Singapore, A from Bukit Timah Nature Reserve; B, C from MacRitchie. Photos: A, S.K. Ganesan; B, C, X.Y. Ng).

Nauclea oxyphylla Miq., Fl. Ned. Ind., Eerste Bijv., fasc. 3 (1861) 538. **Type:** *Teijsmann s.n.*, [Indonesia], Sumatra, Palembang (lectotype K [K000729897], designated here).

Adina rubescens Hemsl., J. Bot. 25 (1887) 204; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 90; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 ['1903']) 126; Ridley, Fl. Malay Penins. 2 (1923) 10; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 1 (1966) 52; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 152. **Type:** *Wray 539*, [Malaysia], Perak, January 1884 (holotype K [K000729902]).

Adina minutiflora Valetton, Icon. Bogor. 4 (1914) 273, t. 390. **Type:** *Van Rossum s.n.*, [Indonesia], Billiton [Belitung] (L n.v.).

Medium-sized to big tree to c. 30 m tall. Trunk often fluted, becoming latticed (with conspicuous slits and holes) in older specimens. Bark finely fissured to slightly scaly, grey-brown. **Stipules** narrow-triangular, 2–8 mm long, bifid at the apex. **Leaves:** lamina elliptic to obovate, (2.5–)3.5–12(–16) × 3–4(–6) cm, apex abruptly narrowed for 1–2 cm, base cuneate, chartaceous; upper surface glabrous, lower surface short-hairy on the veins; secondary veins (6–)8–12(–15) pairs, tertiary veins fine, subscalariform; petioles 4–12 mm long. **Inflorescences** of subglobose heads of flowers on a dichasially branched structure 1.5–3.5 cm long, the branches sometimes subtended by reduced leaves, heads 2.5–3 mm across calyces, 7–8 mm across corollas, interfloral bracteoles 1–1.5 mm long. **Flowers** with calyx tube c. 0.5 mm long, short-hairy, lobes 5, obovate, c. 0.5 mm long; corolla tube 1.5–2 mm long, scantily hairy, lobes 4–5, ovate, 0.5 mm long, scantily short-hairy on their outer surface; anthers c. 0.5 mm long, protruding from the corolla throat; style exerted from corolla tube for 2–3.5 mm; stigma globose. **Fruting heads** 3.5–6 mm diam. **Seeds** trigonal, c. 0.2 mm long, with a thin short apical wing.

Distribution. Malay Peninsula, Sumatra and Borneo. In Singapore recorded from Bukit Timah (*Ngadiman SFN 35785*, 9 May 1938, SING [SING0015301]; *Sinclair 20822*, 23 Jun 1965, A, BM, E, FI, G, K, L, SING [SING0030434]; *Teo SING2010-745*, 19 Apr 2010, SING [SING0144875]) and MacRitchie (*Sinclair SFN 39479*, 6 Feb 1953, SING [SING0030433]; *Mhd Shah & Ali MS 3931*, 21 Jul 1976, SING [SING0207044]). Ridley (J. Straits Branch Roy. Asiat. Soc. 33 (1900) 90) mentioned that it was then common in Tanglin and at Bukit Timah.

Ecology. Lowland forest. Regeneration is reasonably common along the Lornie Trail at MacRitchie.

Provisional conservation assessment. Globally not assessed. Listed as Vulnerable (VU/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 68, 176, 223).

2. AIDIA Lour.

(Greek, *aidios* = long-lasting; referring to the wood)

Fl. Cochinch. 1 (1790) 143; Wong, Malayan Nat. J. 38 (1984) 9; Tirvengadam & Sastre, Bull. Mus. Natl. Hist. Nat., B, Adansonia 8 (1986) 257; Wong, Arbor. Rubiac. Malaya (1988) 30; Wong, Tree Fl. Malaya 4 (1989) 338; Ridsdale, Blumea 41 (1996) 135; Puff et al., Rubiac. Thailand (2005) 66, pl. 3.1.11. **Type:** *Aidia cochinchinensis* Lour.

Randia auct. non L.: Hooker, Fl. Brit. India 3, fasc. 7 (1880) 109, p.p.; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’]) 203, p.p.; Ridley, Fl. Malay Penins. 2 (1923) 70, p.p.; Corner, Wayside Trees Malaya, ed. 3, 2 (1988) 645, p.p.; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 160, p.p.

Treelets, small trees, climbers or (not in Singapore) hemi-epiphytes. Branches opposite on stems, each consisting of a sympodial series of 2-node segments (modules), each segment with the apex flowering or not. **Stipules** triangular to ovate. **Leaves** at the proximal node of each branch segment fully developed and in a pair, those at the distal node with both leaves reduced or only one leaf reduced. **Inflorescences** terminating the 2-node branch segments, pushed to the upper side of the branch by development of the next segment and therefore pseudo-lateral, generally cymose. **Flowers** bisexual, typically 5-merous, in some taxa 6–9-merous; corolla tube short, cylindric, white, hairy at the throat; corolla lobes 5 or 6–9, contorted in the bud, reflexed in the open flower; stamens inserted at the throat, filaments short, anthers dorsifixed, exserted; style slightly exserted; stigma as long as the style, 2-lobed, the lobes linear; ovary 2-locular; ovules many, placentation axile. **Fruits** berries, globose, smooth. **Seeds** variously shaped, angular.

Distribution. About 50 species, from East Africa, northeast India, through southeast China into Southeast Asia (including Malesia) to Australia and the Pacific islands. In Singapore 3 native species.

Ecology. Across its range, known from a variety of forest types and habitats including lowland mixed dipterocarp forest, *kerangas* and limestone vegetation, peat swamp and freshwater swamp forest, and mid-montane forest to 1700 m. In Singapore documented in lowland dipterocarp forest and swamp forest.

Uses. Not known to be used for timber owing to their small size but may have potential for ornamental plant use because of their fragrant and showy inflorescences.

Taxonomy. Once included in *Randia* L., which is now restricted to the New World, the genus *Aidia* was recognised as including arborescent and climbing forms by Wong (Malayan Nat. J. 38 (1984) 9). However, Tirvengadam & Sastre (Bull. Mus. Natl. Hist. Nat., B, Adansonia 8 (1986) 257–296) separated the taxa into *Aidia* s.s. and other genera including *Anomanthodia* Hook.f. for some of the climbing forms such as *Aidia auriculata* and *A. lancifolia* below. Here we follow the subsequent revision by Ridsdale (Blumea 41 (1996) 135–179), who accepts the broader circumscription of *Aidia*.

Notes. The branch architecture in the *Gardenia* tribe is often interesting and distinctive for particular genera, including *Aidia*. As described above, each branch is constructed of a jointed series of progressively higher-order segments (thus sympodial in construction), each new segment developing from the axil of the reduced or fully formed leaf at the distal node on the lower side of the previous segment (Fig. 3).

Key to *Aidia* species

1. Treelet or small tree; leaf pairs on stem decussate; distal nodes of each branch segment with one leaf reduced **2. A. densiflora**
Climber; leaf pairs along creeping juvenile stems distichous; distal nodes of each branch segment with both leaves reduced 2
2. Leaves broadly elliptic, with 7–9(–11) pairs of secondary veins, base (sub-)auriculate and more or less symmetric **1. A. auriculata**
Leaves lanceolate, with 10–14 pairs of secondary veins, base obtuse and usually asymmetric **3. A. lancifolia**

1. *Aidia auriculata* (Wall.) Ridsdale

(Latin, *auriculatus* = with ear-like lobes; referring to the leaf base)

Blumea 41 (1996) 163; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 416; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 239; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 11, 173, 200. **Basionym:** *Webera auriculata* Wall. in Roxburgh, Fl. Ind. 2 (1824) 537. **Synonyms:** *Randia auriculata* (Wall.) Steud., Nomencl. Bot., ed. 2, 2, fasc. 10 (1841) 430; Schumann in Engler & Prantl, Nat. Pflanzenfam. 4(4) (1891) 75; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’]) 207; Merrill, Philipp. J. Sci., C 2 (1907) 427; Merrill, Enum. Philipp. Fl. Pl. 3 (1923) 527; Ridley, Fl. Malay Penins. 2 (1923) 75; Craib, Fl. Siam. 2(1) (1932) 98; Backer & Bakhuizen van den Brink, Fl. Java (Spermatoph.) 2 (1965) 312, p.p.; Corner, Gard. Bull. Singapore, Suppl. 1 (1978) 81, 150; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 160. – *Pseudixora auriculata* (Wall.) Miq., Fl. Ned. Ind. 2, fasc. 2 (1857) 210. – *Anomanthodia auriculata* (Wall.) Hook.f. in Bentham & Hooker, Gen. Pl. 2(1) (1873) 87; Hooker, Fl. Brit. India 3, fasc. 7 (1880) 108; Boerlage, Handl. Fl. Ned. Ind. 2(1) (1891) 18, 68, 130; Tirvengadam & Sastre, Bull. Mus. Natl. Hist. Nat., B, Adansonia 8 (1986) 277. – *Genipa auriculata* (Wall.) Baill., Hist. Pl. 7 (1880) 309. **Type:** *Wallich s.n.* [EIC 8402], [Malaysia], Penang (lectotype K-W [K001125410]), first step designated by Tirvengadam & Sastre, Bull. Mus. Natl. Hist. Nat., B, Adansonia 8 (1986) 277, second step designated here; isolectotype K-W [K001125411]). **Fig. 3B.**

Randia corymbosa auct. non (Blume) Boerl.: Koorders & Valetton, Meded. Lands Plantentuin 59 (1902) 88 [Bijdr. Boomsort. Java 8 (1902) 88], p.p.

Aidia corymbosa auct. non (Blume) K.M. Wong: Wong, Malayan Nat. J. 38 (1984) 19, p.p.; Turner, Gard. Bull. Singapore 45 (1993) 195.

Distribution. Peninsular Thailand, Peninsular Malaysia, Sumatra, Bangka, Borneo (Brunei, Kalimantan, Sabah and Sarawak) and the Philippines (Mindanao).

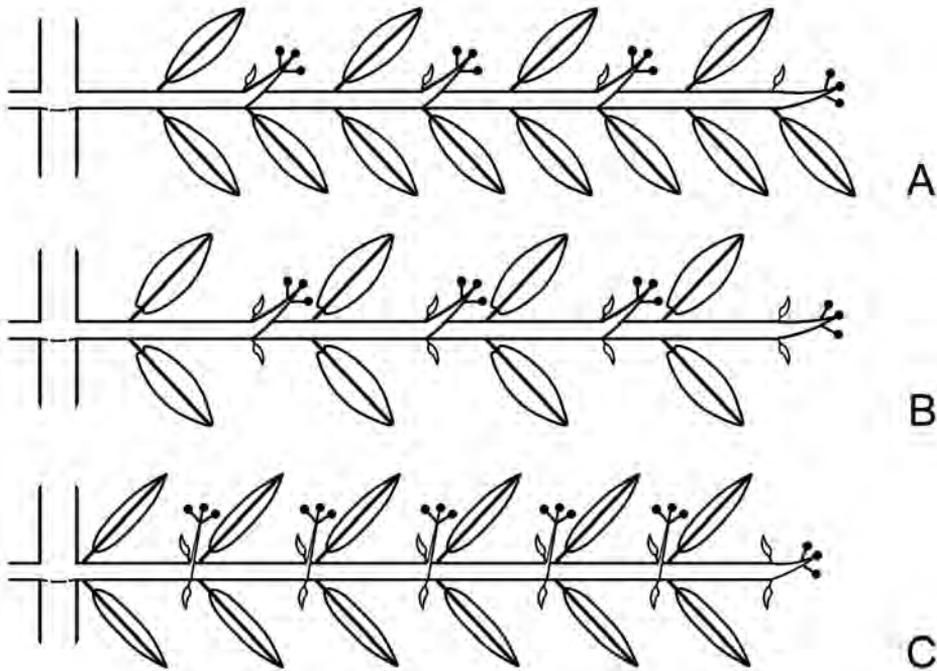


Figure 3. Schematic analysis of branch architecture in species of *Aidia* Lour. **A.** *Aidia densiflora* (Wall.) Masam. **B.** *Aidia auriculata* (Wall.) Ridsdale. **C.** *Aidia lancifolia* K.M. Wong. Each branch is a sympodial progression of repeating units or modules, each module consisting of a proximal node with a fully developed leaf pair and a distal node where one leaf (A) or both leaves (B, C) are reduced. Inflorescences are terminal but pushed to one side as the next module develops, so appearing lateral in position. (Drawn by W.W. Seah).

var. *auriculata*

Large root-climber, up to 30 m high. **Stipules** triangular, margins slightly ciliate, 4–5 mm long. **Leaves** in juvenile creeping stems in distichous pairs, those on aerial branches in fully developed pairs at alternate nodes and reduced into tiny bract-like structures or undeveloped at the other nodes; lamina broadly elliptic, (6.5–)11.5–17 × (3–)6.5–7(–9) cm, apex acute, base (sub-)auriculate, glabrous on both surfaces, midrib flat to slightly raised above, prominently raised below, secondary veins 7–9(–11) pairs, flat to slightly raised above, raised below, sometimes with domatia in their axils on the lower leaf surface, tertiary veins indistinct; petioles 0–2(–3) mm long. **Inflorescences** cymose, developing on the upper side of branches at alternate nodes with both leaves reduced, such nodes 0.7–2.5 cm from the 2-leaf node distal to it and 2.5–6.5 cm from the 2-leaf node preceding it; main axis glabrous to sparsely pubescent, lateral branches densely pubescent. **Flowers** 6–7-merous; calyx 2–3(–4) mm long including a limb 1(–2) mm long, margin slightly toothed, glabrous to sparsely pubescent; corolla tube (2–)3–4 mm, glabrous outside, densely hairy at the throat inside, the hairs protruding from the throat, corolla lobes (4–)5–7 mm long, occasionally with scattered hairs at the base outside;

anthers 3–4 mm long, recurved, transversely multilocellate; filaments short, 1–2 mm long; style (4–)5–6 mm long; stigma (1.5–)2–3 mm long, with two recurved lobes. **Fruits** subglobose, 5–6 mm diam., longitudinally ridged.

Distribution. As for the species. In Singapore historically recorded in Mandai (*Kiah SFN* 37750, 5 Sep 1940, SING [SING0056118], K [K001129466], KEP [KEP43684]) and Jurong (fide Corner, Gard. Bull. Singapore, Suppl. 1 (1978) 81). More recently recorded from Bukit Timah (*Ho & Lua BTMRP36-28C*, 25 Feb 2019, SING [SING0267382]) and observed at Springleaf. A Singapore specimen without further locality is also known (*Wallich s.n.* [EIC 8338], 1822, K [K001125272]).

Ecology. In Singapore known from swamp forest, lowland dipterocarp and secondary forest. Elsewhere, also found in peat swamp forest.

Provisional conservation assessment. Globally not assessed. Listed as Critically Endangered (CR/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 239) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 11, 173, 200).

Taxonomy. This is the only variety of the species found in Singapore; the other variety, var. *indigiriensis* Ridsdale, is only found in the Indigiri Highlands in Sumatra (Ridsdale, *Blumea* 41 (1996) 164).

Notes. The description above applies to the species as known for the Malay Peninsula in general, as there is but one fruiting collection for Singapore. The creeping juvenile stems display a leaf development that is different from the typical pattern found in aerial branches of mature shoots. Whereas creeping juvenile stems have fully developed leaf pairs at each node, the aerial branch system has a modular sympodial construction, with each 2-node branch module having reduced or undeveloped leaves at the distal node and fully developed leaves at the proximal node.

2. *Aidia densiflora* (Wall.) Masam.

(Latin, *densi*- = dense, *-flora* = flowers; referring to the many-flowered cymes)

Sci. Rep. Kanazawa Univ., Biol. 4 (1955) 85; Ridsdale, *Blumea* 41 (1996) 150; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 416; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 239; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 11, 173, 219. **Basionym:** *Webera densiflora* Wall. in Roxburgh, Fl. Ind. 2 (1824) 536. **Synonyms:** *Randia densiflora* (Wall.) Benth., Fl. Hongk. (1861) 155; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 94; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’]) 208; Ridley, Fl. Malay Penins. 2 (1923) 75; Corner, Wayside Trees Malaya, ed. 3, 2 (1988) 647. – *Aidia wallichiana* Tirveng., Bull. Mus. Natl. Hist. Nat., B, Adansonia 8 (1986) 263, nom. illeg. superfl.; Wong, Arbor. Rubiac. Malaya (1988) 31; Wong, Tree Fl. Malaya 4 (1989) 338; Turner, Gard. Bull. Singapore 45 (1993) 195. **Type:** *Wallich s.n.* [EIC 8404], [Malaysia], Penang (lectotype K-W [K001125415], first step designated by Tirvengadam & Sastre, Bull. Mus. Natl. Hist. Nat., B, Adansonia 8 (1986) 263, second step designated here; isolectotypes BM, CAL, G, K-W [K001125414], NY). **Fig. 3A, 4.**



Figure 4. *Aidia densiflora* (Wall.) Masam. **A.** Flowering leafy branches. **B.** Flowers with conspicuous exerted stigmas and reflexed stamens. **C.** Fruiting branch. (From Singapore, MacRitchie. Photos: X.Y. Ng).

Gynopachis attenuata Korth., Ned. Kruidk. Arch. 2(4) (1851) 182. **Type:** *Korthals s.n.*, [Indonesia], Sumatra (lectotype L [sheet no. 908.223.1066] n.v., designated by Ridsdale, Blumea 41 (1996) 150).

Gynopachis oblongata Miq., Fl. Ned. Ind. 2, fasc. 2 (1857) 221. **Synonym:** *Aidia oblongata* (Miq.) Tirveng., Bull. Mus. Natl. Hist. Nat., B, Adansonia 8 (1986) 271. **Type:** *Junghuhn s.n.*, [Indonesia], Sumatra, Opper-Angkola (lectotype L [sheet no. L 908.223-199] n.v., designated by Ridsdale, Blumea 41 (1996) 150; isolectotypes L [L0000039, L0000040]).

Urophyllum coriaceum Miq., Fl. Ned. Ind., Eerste Bijv., fasc. 3 (1861) 542. **Synonym:** *Aidia coriaceae* (Miq.) Tirveng., Bull. Mus. Natl. Hist. Nat., B, Adansonia 8 (1986) 268. **Type:** *Teijsmann s.n.*, [Indonesia], Sumatra, Palembang, Kebu-lahat (lectotype BO, designated by Tirvengadam & Sastre, Bull. Mus. Natl. Hist. Nat., B, Adansonia 8 (1986) 268; isolectotypes FI, L, P n.v.).

Stylocoryna dimorphophylla Teijsm. & Binn., Natuurk. Tijdschr. Ned.-Indië 25 (1863) 402. **Type:** *Teijsmann s.n.*, [Indonesia], Baleh-Balehang (lectotype BO, designated by Tirvengadam & Sastre, Bull. Mus. Natl. Hist. Nat., B, Adansonia 8 (1986) 268; isolectotypes FI, L, P [n.v.]).

Randia gardneri auct. non (Thwaites) Hook.f.: Gamble, Fl. Madras 2 (1921) 617, p.p.

Aidia cochinchinensis auct. non Lour.: Wong, Malayan Nat. J. 38 (1984) 10, p.p.

Randia cochinchinensis auct. non (Lour.) Merr.: Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 160.

Small to medium tree, 15–20 m tall, c. 10 cm diam. **Bark** smooth, lenticellate, or slightly cracking, greyish brown, inner bark pale brown, darkening on exposure, faintly laminate; sapwood pale yellow. **Stipules** triangular, sometimes with a narrowed sharp tip, 4–5–(6) mm long. **Leaves** at alternate nodes along branches in fully developed pairs, at the other nodes with only the leaf on the upper side reduced into a tiny bract-like structure or under-developed; lamina elliptic-ovate to elliptic-lanceolate, (7–)14.5–17.5(–20) × (3–)5–7.5(–8.5) cm, apex acute to acuminate, base cuneate to obtuse, chartaceous to subcoriaceous, glabrous on both surfaces, midrib flat to slightly sunken above, especially towards the base, raised below, secondary veins 7–11 pairs, slightly sunken above, raised below, arching and sometimes strongly looping towards the margin, tertiary nerves reticulate, sometimes indistinct; petioles 10–15 mm long. **Inflorescences** cymose, basically dichasial, developing along the upper side of branches at alternate nodes, subtended by a reduced leaf and opposed to the normal leaf on the lower side, such nodes clearly separated by a distinctly elongate internode from both 2-leaf nodes adjacent (i.e. proximal and distal) to it; main axis sparsely pubescent. **Flowers** 5-merous; calyx 3–4 mm long including limb 2–2.5 mm long, with 5 tiny deltoid teeth, glabrous; corolla tube 2–4 mm long, glabrous outside, hairy in the throat inside, corolla lobes 4–5(–6) mm long, glabrous outside except for a thin line of hairs in the middle; anthers 4–6 mm long, linear; filaments shorter; style 3–4 mm long; stigma 5–6 mm long, clavate. **Fruits** globose, 5(–8) mm diam., ripening yellow to red and then black.

Distribution. Myanmar, Thailand, Andaman Islands, Peninsular Malaysia, Sumatra, Riau Archipelago and Borneo (Kalimantan and Sarawak). In Singapore it has been recorded from Bukit Timah (*Lai LJ 24*, 27 Oct 1996, SING [SING0033709]), Changi (*Goodenough 143*, 11 Mar 1889, SING [SING0033713]), Lentor (*Lua SING2014-159*, 10 Apr 2004, SING

[SING0205580]), MacRitchie (*Samsuri SA 1458*, 10 Mar 1977, SING [SING0033715]) and Pulau Ubin (*Gwee et al. GAT 176*, 14 Jan 2003, SING [SING0042941]). It is also represented by leafy branch vouchers for other localities: Mandai and Upper Peirce.

Ecology. In Singapore, as elsewhere, mainly found in lowland forest and sometimes at the back of mangroves (Pulau Ubin, Chek Jawa); also in secondary forests.

Provisional conservation assessment. Globally not assessed. Listed as Vulnerable (VU/D) in Singapore by Tan et al. (in Davison et al. (ed.), *Singapore Red Data Book*, ed. 2 (2008) 239) and Chong et al. (*Checkl. Vasc. Pl. Fl. Singapore* (2009) 11, 173, 219).

Taxonomy. The type number of *Aidia densiflora* given as *Wallich 8408* by Ridsdale (Blumea 41 (1996) 150) is in error; it should be *Wallich s.n.* [EIC 8404]. *Randia oppositifolia* (Roxb.) Koord. (basonym *Webera oppositifolia* Roxb.) was often regarded as a synonym of *Aidia densiflora* (or *Randia densiflora*). Roxburgh states that his *Webera oppositifolia* was from Chittagong, although no original material has been located and there is no drawing of the species commissioned by him according to Sealy (Kew Bull. 11 (1956) 394). From the available specimen material examined, it seems that only one species of the alliance occurs in the Chittagong area, so this must have been the *Webera oppositifolia* of Roxburgh. It is in fact a different species from *Aidia densiflora*, as it has cincinnoid inflorescence branches and typical *A. densiflora* has inflorescences that are dichasially branched throughout. We therefore vary from earlier authors and do not list *Webera oppositifolia* as a synonym of *Aidia densiflora*.

3. *Aidia lancifolia* K.M. Wong

(Latin, *lanci-* = narrow, *-folia* = leaves; with narrow leaves)

Malayan Nat. J. 38 (1984) 20; Ridsdale, Blumea 41 (1996) 166; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 416. **Synonym:** *Anomanthodia lancifolia* (K.M. Wong) Tirveng., Bull. Mus. Natl. Hist. Nat., B, Adansonia 8 (1986) 279. **Type:** *Holtum SFN 9348*, [Malaysia], Malay Peninsula, Johore, Kluang, 2nd mile toward Mersing (holotype SING [SING0062108]; isotype A [A00092300]). **Fig. 3C.**

Slender climber, 25–30 m high. **Stipules** broadly triangular, edges joined, 5–6 mm long. **Leaves** at alternate nodes along branches in fully developed pairs, at the other nodes reduced into tiny bract-like structures or undeveloped; lamina lanceolate to narrowly elliptic, 10.5–13 × 3–4 cm, apex acuminate, base obtuse, usually asymmetrical; drying dark reddish brown, glabrous on both surfaces; midrib flat to slightly raised above, raised below, secondary veins 10–14 pairs, indistinct, with domatia in their axils on the lower leaf surface, tertiary veins indistinct; petioles 1–3 mm long. **Inflorescences** cymose, developing along the upper side of branches at alternate nodes with both leaves reduced, such nodes very close to the 2-leaf node distal to it but separated by a distinctly elongate internode from the 2-leaf node preceding it; main axis glabrous, lateral branches glabrous to slightly pubescent, especially towards the apex. **Flowers** 6–9-merous; calyx 4–5 mm long including limb 2–4.5 mm long, minutely toothed, glabrous; corolla tube 2.5–4 mm long, glabrous outside, with dense hairs at the upper third inside, the hairs not obviously sticking out from the throat, corolla lobes 7–8 mm long, reflexed; anthers

6–7 mm long, transversely multilocellate; filaments short; style 6 mm long; stigma 3(–4) mm long, clavate, grooved or notched at the apex. **Fruits** globose to ellipsoid, (4–)5–7 mm wide, with distinct longitudinal ridges.

Distribution. Malay Peninsula, Sumatra and Borneo (Brunei, Kalimantan, Sabah and Sarawak). In Singapore it is represented by two specimens collected from Jurong (*Corner s.n.*, 4 Dec 1932, K, SING [SING0267383]) and an unspecified locality (*Collector unknown. s.n.*, SING [SING0267384]).

Ecology. In Jurong it was found in swamp forest.

Provisional conservation assessment. Globally not assessed. In Singapore presumed Nationally Extinct.

Notes. This species was omitted by Keng (Concise Fl. Singapore, vol. 1, Gymn. Dicot., 1990) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore, 2009).

3. CANTHIUM Lam.

(from *kanti*, a vernacular name from India's Malabar coast)

Encycl. 1, fasc. 2 (1785) 602; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 57; Ridley, Fl. Malay Penins. 2 (1923) 122; Craib, Fl. Siam. 2(1) (1932) 135; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 1 (1966) 446, p.p.; Wong, Arbor. Rubiac. Malaya (1988) 36; Wong, Tree Fl. Malaya 4 (1989) 340; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 152; Puff et al., Rubiac. Thailand (2005) 196, pl. 3.1.39, p.p.; Wong & Lua, Gard. Bull. Singapore 70 (2018) 275. **Type:** *Canthium parviflorum* Lam. (= *Canthium coromandelicum* (Burm.f.) Alston).

Scrambling or climbing plants, or small trees with scrambling branches; normal shoots (developing elongate internodes) with each leaf axil with a distal axillary bud that typically develops into a straight, slightly curved or recurved spine, and a proximal axillary bud (just below the spine) which develops either into a normal shoot or a short-shoot ('brachyblast', with tightly condensed internodes), the latter sometimes reverting to develop as a normal shoot. **Stipules** typically broad-triangular, without keels, the apex prolonged or not. **Leaves** borne at nodes of normal shoots as well as together with other reduced bract-like leaves on developing brachyblasts. **Inflorescences** of solitary or fascicled flowers or 1–few-flowered pedunculate cymes from the axils of leaves along normal shoots as well as leaves and bracts on brachyblasts. **Flowers** hermaphrodite (rarely functionally dioecious), 4–5-merous; calyx short, lobes deltoid to dentate; corolla tube broad-cylindric, inside typically with a ring of deflexed hairs, lobes valvate, spreading; stamens inserted in the throat, erect or patent to reflexed, exserted; style and stigma exserted, stigma mitriform (with conspicuous basal recess around its insertion), ovary 2-locular, ovules 1 per locule, pendulous. **Fruits** drupaceous, subglobose, with 2 dorsiventrally flattened, rugulose pyrenes. **Seeds** 1 per pyrene.

Distribution. Tropical Africa, India, Sri Lanka, continental Southeast Asia and Malesia. In Singapore 2 native species.

Taxonomy. Following the restriction of *Canthium* to spiny trees or shrubs, scramblers and climbing taxa found in India and Sri Lanka (type provenances), as well as Africa, by Bridson (Kew Bull. 40 (1985) 687–725), other non-spiny, arborescent taxa previously identified with that genus have been allocated to various other genera (e.g. *Psyrax*, this volume). In the combined analysis using molecular (ITS and *trnT-F* sequences) and 30 morphological characters by Lantz & Bremer (Bot. J. Linn. Soc. 146 (2004) 257–283), a ‘spiny group’ including *Canthium* s.s. and a few other taxa was distinguished clearly from other genera such as *Psyrax* Gaertn., *Cyclophyllum* Hook.f. and other genera in the *Canthium* alliance. Wong (Arbor. Rubiac. Malaya (1988) 36–47; Tree Fl. Malaya 4 (1989) 340–343) has further shown that the spiny taxa of the Malay Peninsula present a diverse morphology, so that a firm identification of all spiny taxa with *Canthium* s.s. is yet to be obtained. In the present treatment, our two spiny taxa are retained in the genus because they share a number of key features with *Canthium coromandelicum*, the generic type, such as the scrambling or climbing habit, presence of spines and brachyblasts, the minute flowers with short corolla tubes slightly constricted just below the lobes and bearing a ring of reflexed hairs within, exserted anthers, and mitriform stigmas.

Key to *Canthium* species

1. Leaves ovate, with 3–4(–5) pairs of secondary veins; the midrib and veins on the upper surface (and sometimes also lower surface) with appressed to spreading short hairs less than 0.5 mm long, the lamina with sparse appressed hairs or glabrescent on both surfaces; corolla lobes with apiculate tips **1. *C. malayense***

Leaves elliptic to obovate or oblanceolate, with 5–7 pairs of secondary veins; the midrib and veins on both surfaces with spreading to suberect hairs 0.5–1 mm long, the lamina with dense (rarely sparse) spreading to suberect hairs on both surfaces; corolla lobes with acute tips **2. *C. molle***

1. *Canthium malayense* K.M.Wong

(of Malaya)

Gard. Bull. Singapore 70 (2018) 275. **Type:** *Lua SING2018-320*, Singapore, Nee Soon freshwater swamp forest, Mandai Track 7, 29 March 2018 (holotype SING [SING0238285]; isotypes A, K). **Fig. 5.**

Canthium horridum auct. non Blume: Hooker, Fl. Brit. India 3, fasc. 7 (1880) 135; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 96; Ridley, Fl. Malay Penins. 2 (1923) 123; Craib, Fl. Siam. 2(1) (1932) 140; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 1 (1966) 448, p.p.; Wong, Arbor. Rubiac. Malaya (1988) 45; Wong, Tree Fl. Malaya 4 (1989) 341 (in clavi); Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 152; Turner, Gard. Bull. Singapore 45 (1993) 195; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 420; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 239; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 23, 174, 214.

Canthium parvifolium auct. non Roxb.: King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 59.

Scrambling shrub, liana or small tree to 3 m tall, branches straggly and spiny; axillary spines paired, slightly to strongly recurved. **Stipules** broad-triangular, c. 1.5 mm long, acute, not keeled. **Leaves:** lamina ovate, 1.2–4.7 × 0.8–2.5 cm, apex acute to short-cuspidate, base cuneate to rounded, coriaceous; midrib impressed on upper surface, prominent on lower, secondary veins 3–4(–5) pairs, impressed on upper surface, prominent on lower, both midrib and veins with appressed to spreading short hairs less than 0.5 mm long on the upper (and sometimes also lower) surface, the lamina with sparse similar appressed hairs or glabrescent on both surfaces; petioles 2–3 mm long. **Inflorescences** 1-flowered, borne in the axils of leaves on normal shoots or both leaves and bracts on brachyblasts; peduncle c. 1.5 mm long. **Flower** pedicel 0.5–1 mm long, glabrous, subtended by two small bracts; calyx broadly obconical, 1.2–1.5 mm long, subglabrous, limb c. 0.5 mm long bearing 5 deltoid lobes c. 0.3 mm long with short spinulose hairs; corolla broad-cylindric, c. 2.2 mm long, 2 mm wide, slightly constricted just below the throat, glabrous outside, inside with a ring of deflexed hairs just below the throat, lobes lanceolate, 2–2.5 mm long, with apiculate tips especially conspicuous in bud stage, spreading in the open flower; anthers spreading, wholly exerted; style exerted for c. 2 mm from corolla throat, stigma cylindrical, c. 1 mm long, 0.5 mm wide, base mitriform. **Fruits** subglobose, to 1.6 cm diam.

Distribution. Peninsular Thailand, Peninsular Malaysia, northern Sumatra and Borneo (Sarawak). In Singapore recorded in Nee Soon (type), with older collections from Chan Chu Kang (*Ridley 3766*, 1892, SING [SING0190412]), secondary forest behind Tyersall Avenue (*Collector unknown s.n.*, 7 May 1893, SING [SING0019991]), Grange Road (*Ridley s.n.*, 1894, SING [SING0019994]) and Changi (*Ridley s.n.*, 1893, SING [SING0019995]).

Ecology. Secondary forest, freshwater swamp forest, and coastal areas.

Provisional conservation assessment. Globally not assessed. Listed (under *Canthium horridum*) as Endangered (EN/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 239) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 23, 173, 214).

Vernacular name. *Bulangan tikus* (Malay).

Taxonomy. Previously, this species was mistaken for the Javanese *Canthium horridum* Blume, which has consistently straight (not recurved) spines, chartaceous (not coriaceous) leaves with acuminate (not acute to cuspidate) apices, spreading hairs (not appressed hairs) on the midrib and veins, immersed and flat (not impressed) secondary veins on the upper surface, and 0.5–1 mm (not 0.3 mm) long calyx lobes. Backer & Bakhuizen van den Brink (Fl. Java (Spermatoph.) 2 (1965) 319) erroneously considered *Canthium scandens* Blume (with recurved spines, acute corolla lobe tips) as a synonym of *C. horridum* (straight spines, apiculate corolla lobe tips).

Notes. The sexuality of this and other species of *Canthium* has been difficult to determine with certainty because of lack of material. For this species, functionally female plants could be ascertained because their advanced flower buds had empty anthers and clearly bilobed stigmatic heads, and fruits were formed. Whether other individuals could be functionally male or fully hermaphrodite remains to be verified.



Figure 5. *Canthium malayense* K.M.Wong. Straggly habit and flowering branches. Inset: Condensed short-shoots and recurved spines along branch. (From Singapore, Nee Soon, *Lua SING2018-320*. Photos: main photo, P.K.F. Leong; inset, X.Y. Ng).

2. *Canthium molle* King & Gamble

(Latin, *mollis* = soft, pliant; referring to the hairs on the leaves)

J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 60; Ridley, Fl. Malay Penins. 2 (1923) 123; Wong, Arbor. Rubiac. Malaya (1988) 39 (in clavi); Wong, Tree Fl. Malaya 4 (1989) 341 (in clavi); Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 152; Turner, Gard. Bull. Singapore 45 (1993) 196; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 420; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 239; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 23, 174, 189. **Type:** *Ridley 2859*, Singapore, Gardens’ Jungle [Singapore Botanic Gardens’ Rain Forest], 1890 (holotype K [K000763656]). **Fig. 6.**

Canthium scandens auct. non Blume: Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 96.

Climber, branches straggly and spiny; axillary spines paired, slightly to strongly recurved. **Stipules** broad-triangular, c. 1.5 mm long, with a narrow pointed apical lobe to c. 1.5 mm long, not keeled. **Leaves:** lamina elliptic to obovate or oblanceolate, 3.1–11 × 1.2–3.5 cm, apex acute to acuminate, base cuneate to rounded, chartaceous; midrib flat to slightly impressed on upper surface, prominent on lower, secondary veins 5–7 pairs, flat on upper surface, prominent on lower, both midrib and veins with spreading to suberect hairs 0.5–1 mm long on both surfaces, the lamina with dense (rarely sparse) spreading to suberect hairs on both surfaces; petioles 2–5(–8) mm long. **Inflorescences** 1-flowered or small 2–3-flowered dichasial cymes, the branches subtended by small bracts, borne in the axils of leaves on normal shoots or both leaves and bracts on brachyblasts; peduncle c. 1 mm long. **Flower** pedicel 2–3 mm long, with spreading hairs; calyx broadly obconical, 1–1.2 mm long, with dense spreading hairs, rarely subglabrous, limb c. 0.5 mm long bearing 5 deltoid lobes c. 0.2 mm long with scanty short hairs; corolla broad-cylindric, c. 2 mm long, 1.8 mm wide, slightly constricted just below the throat, glabrous outside, inside with a ring of deflexed hairs just below the throat, lobes lanceolate, c. 1.5 mm long, with acute tips, spreading in the open flower; anthers spreading to reflexed, wholly exerted; style exerted for c. 1 mm from corolla throat, stigma cylindric, c. 0.8 mm long, 0.5 mm wide, base mitriform. **Fruits** subglobose, to c. 0.8 cm diam.

Distribution. Known only from Melaka in Peninsular Malaysia and from Singapore. In Singapore, besides the type collection from the Singapore Botanic Gardens’ Rain Forest (*Ridley 2859*, 1890, K [K000763656]), this species has been collected from MacRitchie (*Sinclair SFN 39147*, 23 Feb 1951, SING [SING0012038]; *Ng & Han SING2015-007*, 7 Jan 2015, SING [SING0212479]; *Ng & Han 2015-096*, 20 Mar 2015, SING [SING0232189]) and Chestnut (*Leong et al. SING2015-208*, 1 Jul 2015, SING [SING0214525]).

Ecology. Lowland forest including secondary forest.

Provisional conservation assessment. Globally not assessed. Listed as Nationally Extinct in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 239) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 23, 174, 189) but, with the more recent collections, it is assessed here as Vulnerable (VU/D).

Vernacular name. *Akar kuku baning* (Malay).

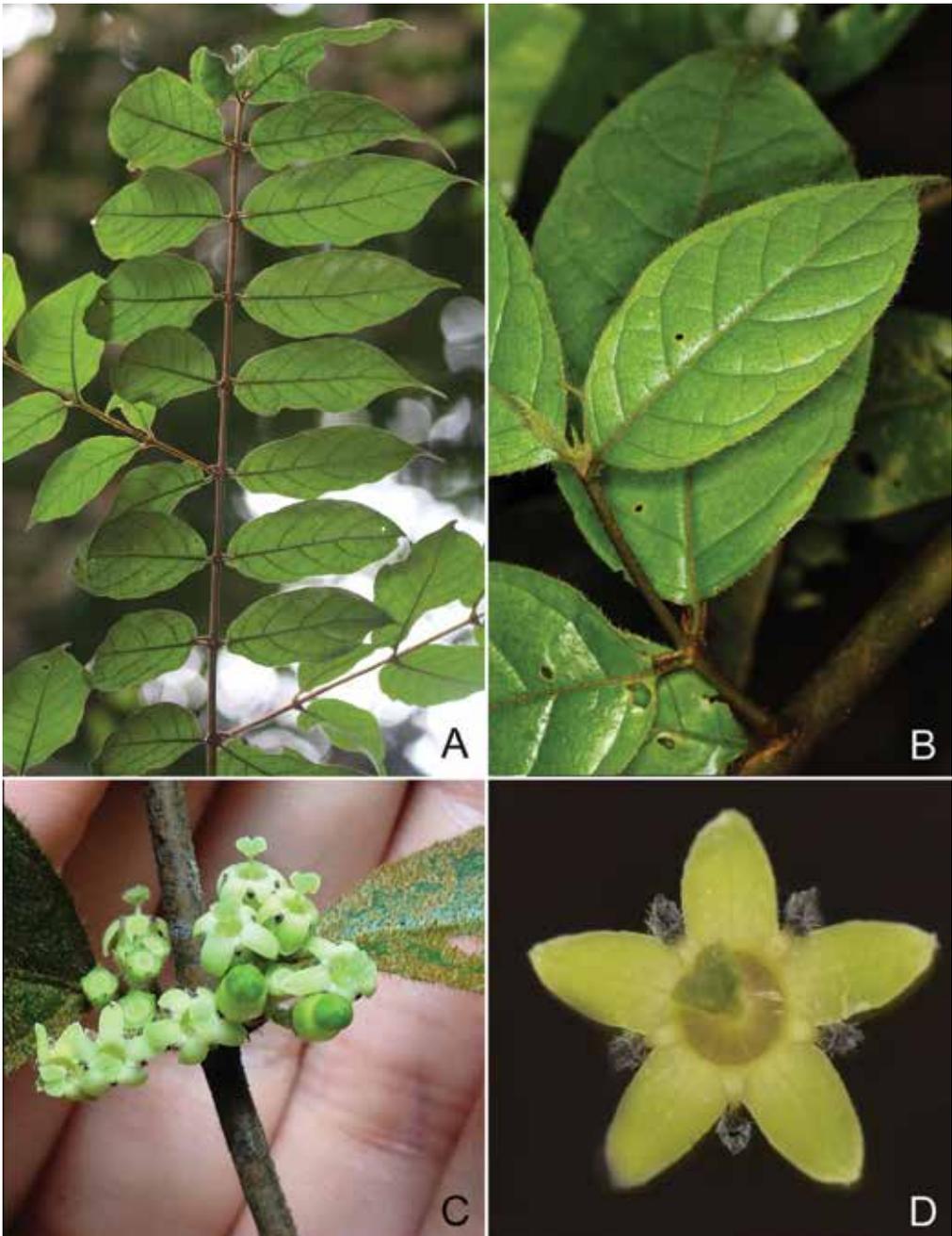


Figure 6. *Canthium molle* King & Gamble. **A.** Leafy branches. **B.** Venation on lower leaf surface. **C.** Axillary inflorescences. **D.** Open flower showing reflexed stamens and a ring of stiff deflexed hairs below the corolla throat. (From Singapore, MacRitchie, Ng & Han SING2015-007. Photos: X.Y. Ng).

4. CANTHIUMERA K.M.Wong & Mahyuni

(Latin, *canthi-* = pertaining to *Canthium* Lam., the genus with which it was confused, *-umerus* = shoulder; referring to the prominent lateral extensions in the pyrene)

Reinwardtia 17 (2018) 107. **Type:** *Canthiumera glabra* (Blume) K.M.Wong & Mahyuni.

Canthium auct. non Lam.: Korthals, Ned. Kruidk. Arch. 2(4) (1851) 231, p.p.; Miquel, Fl. Ned. Ind. 2, fasc. 2 (1857) 252, p.p.; Hooker, Fl. Brit. India 3, fasc. 7 (1880) 131, p.p.; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 57, p.p.; Ridley, Fl. Malay Penins. 2 (1923) 122, p.p.; Craib, Fl. Siam. 2(1) (1932) 135, p.p.; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 1 (1966) 446, p.p.; Corner, Wayside Trees Malaya, ed. 3, 2 (1988) 625, p.p.; Wong, Arbor. Rubiac. Malaya (1988) 36; Wong, Tree Fl. Malaya 4 (1989) 340, p.p.; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 152, p.p.; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 420, p.p.

Trees. **Stipules** triangular-ovate, with a slight to pronounced median keel prolonged into an apical cusp or lobe. **Leaves** opposite and decussate on vertical stem axes but distichous on lateral (horizontal) branches; frequently with pit-domatia in the axils of secondary or higher-order veins. **Inflorescences** axillary on lateral branches, pedunculate, cyme-like or sub-umbellate, bracts small and inconspicuous. **Flowers** bisexual; corolla subrotate-urceolate to broadly cylindric, constricted just below corolla lobes, glabrous or short-pubescent outside, throat with dense tufts of erect-spreading (becoming flexuous-crisped) moniliform hairs longest at the base of corolla lobes, the tube around the same length as the lobes or shorter, inside with a ring of stiff deflexed hairs just below the throat, corolla lobes spreading in the open flower; stamens alternate with the corolla lobes and not longer than the corolla throat hairs, anthers ovate with broad connective, suberect to spreading, inserted on short filaments at the throat; style glabrous or pubescent, stigma globose to club-shaped, with a slight basal recess; ovary with 2 locules, each locule with a solitary ovule inserted near the upper part. **Fruits** ellipsoid, obovoid or obcordate-compressed; pyrenes obovoid-compressed, ventrally plane, dorsally with a prominent keel-like crest reaching to the base, laterally with two sub-apical extensions (‘shoulders’) flattening out as keels and reaching to the base, smooth. **Seeds** one in each pyrene.

Distribution. A genus of 4 species in India, continental Southeast Asia and western Malesia. In Singapore 1 native species.

Taxonomy. The genus was, for the most part of its range, misidentified with the largely Javanese *Canthium glabrum* Blume. It does not belong to *Canthium* because in that genus, the flowers or inflorescences are characteristically also borne in both the axils of normal leaves and scale- or bract-like reduced leaves found on axillary short-shoots (‘brachyblasts’, with internodes condensed into a very short axis); *Canthiumera* does not have such short-shoots or spines. Additionally, in contrast to that found in other genera of the alliance, the apical-dorsal pyrene crest in *Canthiumera* continues as a prominent keel that reaches to the pyrene base; there is a broadening out of the upper lateral parts of the pyrene into ‘shoulders’ that are more level sideways and the pyrene surface is smooth rather than verrucose (Wong et al., Reinwardtia 17 (2018) 107).

Canthiumera robusta K.M.Wong & X.Y.Ng

(Latin, *robustus* = robust; referring to more robust fruit
and pyrene size, compared to its congeners)

Reinwardtia 17 (2018) 109. **Type:** *Ng et al. SING2018-409*, Singapore, Mandai Road Track 7, 11 June 2018 (holotype SING [SING0243434]; isotypes K, BO, A, KEP, L, BRUN, SGN, SAN, BKF). **Fig. 7, 8.**

Canthium glabrum auct. non Blume: Korthals, Ned. Kruidk. Arch. 2(4) (1851) 234, p.p.; Miquel, Fl. Ned. Ind. 2, fasc. 2 (1857) 254, p.p.; Hooker, Fl. Brit. India 3, fasc. 7 (1880) 133, p.p.; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 96; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 61, p.p.; Ridley, Fl. Malay Penins. 2 (1923) 124, p.p.; Craib, Fl. Siam. 2(1) (1932) 139, p.p.; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 1 (1966) 447; Corner, Wayside Trees Malaya, ed. 3, 2 (1988) 627; Wong, Arbor. Rubiac. Malaya (1988) 44; Wong, Tree Fl. Malaya 4 (1989) 343; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 152; Turner, Gard. Bull. Singapore 45 (1993) 195; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 420; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 239; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 23, 174, 214.

Tree to 25 m tall. **Stipules** with a basal triangular-ovate portion 2–3 mm long and a pronounced median keel prolonged into an apical cusp or lobe to 5 mm long. **Leaves:** lamina ovate to elliptic, 7–18 × 3–9 cm, apex acute to slightly cuspidate, base obtuse-rounded to cuneate, typically subcoriaceous when fresh but often drying with a chartaceous texture; secondary veins (5–)6–8(–10) pairs, frequently with pit-domatia in the axils of secondary or higher-order veins, often with intermediate veins in between secondaries; petioles 7–14 mm long. **Inflorescences** with short peduncles 1–3 mm long and branches 3–6 mm long, the axes mostly glabrescent, rarely scantily hispid. **Flowers** on short pedicels 2–3 mm long; calyx obconical, hypanthium 1.5–2 mm long, limb c. 1.5–2 mm long with 5 minute triangular teeth; corolla subrotate-urceolate, constricted just below corolla lobes, glabrous, tube c. 1.5–2 mm long and nearly to completely hidden by the calyx limb in the open flower, throat with dense tufts of pale erect-spreading (becoming flexuous-crisped) moniliform hairs longest at the base of corolla lobes, inside with a ring of stiff deflexed hairs just below the throat; corolla lobes around the same length as the tube or slightly longer, spreading to slightly recurved in the open flower; stamens with anthers 2–2.5 mm long on short filaments c. 0.5 mm long, suberect to spreading in the open flower; style 2.5–3 mm long, glabrous, stigma 1–1.5 mm long, globose to club-shaped, with a slight basal recess; ovary with 2 locules, each locule with a solitary ovule. **Fruits** ellipsoid to obovoid, 4-ridged when dry, to 46 × 35 mm when fresh, 40 × 28 mm when dried, ripening dark bluish green to purplish black, drying black; pyrenes to 40 × 24 mm, ventrally plane, the dorsal crest keel-like, to 5–7 mm wide, continuous and narrowing from apex to base, the shoulders sub-horizontal to slightly upcurved, extending as keels 2–4 mm wide down to the base, smooth. **Seeds** one in each pyrene.

Distribution. Peninsular Thailand, Peninsular Malaysia, Sumatra, Anambas Islands and Borneo. In Singapore recorded from Bukit Mandai (*Ridley 4434*, 9 Apr 1892, SING [SING0019983]), Bukit Timah (*Hill H.314*, 15 Apr 1970, SING [SING0189481]), MacRitchie (*Samsuri SA 1456*, 10 Mar 1977, SING [SING0019988]), Nee Soon (*Liew 2007-331*, 12 Jun 2007, SING [SING0093484]), Seletar (*Ridley 6718*, 1891, SING [SING0019989]), Sungei Hantu opposite Pulau Sarimbun (*Sinclair SFN 39530*, 28 Mar 1953, SING [SING0239956]) and the Singapore Botanic Gardens.



Figure 7. *Canthiumera robusta* K.M.Wong & X.Y.Ng. **A.** Leafy branch with inflorescences. **B.** Flower. **C.** Fruits. **D.** Pyrenes. (A cultivated in Singapore, Pasir Panjang Nursery; B, C from Singapore, Nee Soon, *Lim et al. SING2013-079*; D exact locality uncertain. Photos: A, W.F. Ang; B–D, X.Y. Ng).



Figure 8. *Canthiumera robusta* K.M.Wong & X.Y.Ng. Fruiting branch. (From Singapore, Nee Soon, Ng et al. SING2018-631. Photo: W.H. Lim).

Ecology. Lowland forest, freshwater swamp forest, and coastal areas.

Provisional conservation assessment. Globally not assessed. Listed (under *Canthium glabrum*) as Endangered (EN/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 239) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 23, 174, 214).

Taxonomy. The misidentification of this species as being the same as Blume's *Canthium glabrum* arose with botanists working in what is now Indonesia and was perpetuated in the absence of revisionary studies across the region by Hooker (Fl. Brit. India 3, fasc. 7 (1880) 133) and subsequent authors. In *Canthiumera glabra* (Blume) K.M.Wong & Mahyuni, the calyx limb is short and overlaps only with the basal portion of the corolla tube, whereas in *Canthiumera robusta*, the calyx limb almost entirely hides the corolla tube.

5. CHASSALIA Comm. ex Poir.

(probably commemorating a member of the de Chazal de Chamarel family,
famed Mauritian rum-distillers)

in Lamarck, Encycl., Suppl. 2, fasc. 2 (1812) 450; Ridley, Fl. Malay Penins. 2 (1923) 141; Wong, Tree Fl. Malaya 4 (1989) 344; Puff et al., Rubiac. Thailand (2005) 100. **Type:** *Chassalia capitata* DC., neotype designated by Bremekamp, Candollea 18 (1962) 202.

Procephaleium Korth., Ned. Kruidk. Arch. 2(4) (1851) 248; Backer & Bakhuizen van den Brink, Fl. Java (Spermatoph.) 2 (1965) 333. **Synonym:** *Uragoga* Baill. sect. *Procephaleium* (Korth.) Baill., Adansonia 12 (1879) 327. **Type:** *Procephaleium javanicum* (Blume) Korth. (= *Chassalia javanica* (Blume) I.M.Turner).

Zwaardekronia Korth., Ned. Kruidk. Arch. 2(4) (1851) 252. **Type:** *Zwaardekronia lurida* (Blume) Korth. (= *Chassalia curviflora* (Wall.) Thwaites).

Cephaelis auct. non Sw.: Ridley, Fl. Malay Penins. 2 (1923) 143; Backer & Bakhuizen van den Brink, Fl. Java (Spermatoph.) 2 (1965) 334, p.p.

Shrubs or subshrubs, more rarely epiphytes, unbranched treelets and perhaps small trees. **Stems** glabrous or pubescent. **Stipules** interpetiolar, ovate to triangular, variably connate, entire or bifid, generally persistent at least as corky remnants, often with colleters inside near base and raphides present. **Leaves** opposite, lamina mostly membranous to chartaceous, generally petiolate. **Inflorescences** terminal, involucrate or not, sessile or pedunculate, mostly branched panicles bearing groups of flowers, sometimes compressed into heads. **Flowers** sessile or pedicellate, 4–5-merous, hermaphrodite, generally heterostylous; calyx cupular to tubular, lobes triangular to linear, small; corolla tubular to infundibuliform, sometimes distinctly curved, in bud often with narrow longitudinal flanges or wings, pure white or tinged pink or purple, may be yellow within throat, lobes valvate in bud, triangular to linear, relatively short, often drying translucent with distinctive vascular bundles; stamens inserted in upper part of corolla tube, included or exerted, filaments short or absent; pollen colpate or porate with reticulate exine; ovary 2-locular, ovules solitary, attached basally; style included or exerted. **Infructescences** with distal axes red, purple or white and distinctly succulent. **Fruits** fleshy,

globose or ellipsoidal, ripening blue or purple to black; pyrenes 2, pale, flat to orbicular, often plano-convex with ventral surface flat to excavated, dorsal face with preformed germination slits often along a basal median ridge and sometimes also at the pyrene margins. **Seeds** 1 per pyrene, flat to concavo-convex, endosperm without rumination.

Distribution. About 120 species distributed throughout tropical Africa and Madagascar and in Asia from India to the Philippines. In Singapore 4 native species are recorded, only 1 of which is definitely extant.

Ecology. Generally found in the shaded understory of lowland to montane tropical forest.

Taxonomy. A group of species from western Malesia with involucrate inflorescences were formerly considered species of *Cephaelis* Sw. due to superficial similarities with New World species so named. However, critical examination shows the Malesian species to be aligned with *Chassalia* rather than *Psychotria* (whither most of the neotropical *Cephaelis* species have been moved). The huge and diverse genus *Psychotria* is morphologically variable but *Chassalia* can generally be distinguished by the chaffy stipules, narrowly winged flower buds, curved corolla tubes, succulent and non-green infructescence axes, pyrenes with preformed germination slits and seeds lacking alcohol-soluble pigments and endosperm ruminations.

Notes. Historically, the spelling of the generic name *Chassalia* has been inconsistent, with ‘*Chasalia*’ or ‘*Chasallia*’ often being used. The original spelling of *Chassalia* is now accepted as correct, though it is somewhat distant from the name of the person supposedly being honoured.

Key to *Chassalia* species

1. Inflorescences involucrate with large bracts surrounding flower buds 2
 Inflorescences not involucrate, bracts relatively small, not obscuring flowers 3
2. Petioles to 3 cm long; inflorescences pedunculate at anthesis, peduncle 2.5 cm long or more, bracts not developing brown spongy margins **4. C. singaporensis**
 Petioles generally more than 3 cm long; inflorescences sessile as anthesis, bracts rapidly developing brown spongy margin **2. C. griffithii**
3. Young twigs, petioles, leaf undersides with multicellular hairs **3. C. pubescens**
 Young twigs, petioles, leaf undersides glabrous or with simple hairs **1. C. curviflora**

1. *Chassalia curviflora* (Wall.) Thwaites

(Latin, *curvi-* = crooked, curved, bent, *-flora* = flowers; referring to the curved corolla tubes)

Enum. Pl. Zeyl., fasc. 2 (1859) 150; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 133; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 98; Ridley, Fl. Malay Penins. 2 (1923)

142; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 152, fig. 125.2; Wong, Tree Fl. Malaya 4 (1989) 344; Turner, Gard. Bull. Singapore 45 (1993) 196; Tan et al., Gard. Bull. Singapore, Suppl. 3 (1995) 44; Turner, Gard. Bull. Singapore 47 (1997 ['1995']) 421; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 239; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 25, 174, 215; Turner & Chua, Checkl. Vasc. Pl. Sp. Bukit Timah Nat. Res. (2011) 67. **Basionym:** *Psychotria curviflora* Wall. in Roxburgh, Fl. Ind. 2 (1824) 167. **Synonym:** *Uragoga curviflora* (Wall.) Kuntze, Revis. Gen. Pl. 1 (1891) 299. **Type:** *Jack s.n.* [EIC 8360A], [Malaysia], Penang, 1819 (lectotype K-W [K001125306], first step designated by Deb & Krishna, Bull. Bot. Surv. India 24 (1983 ['1982']) 221, second step designated by Turner, Feddes Repert. (2019) in press). **Fig. 9, 10A–C.**

Psychotria ophioxylodes Wall. in Roxburgh, Fl. Ind. 2 (1824) 168. **Synonyms:** *Chassalia ophioxylodes* (Wall.) Craib, Gard. Bull. Straits Settlements. 6(3) (1930) 474. – *Chassalia curviflora* (Wall.) Thwaites var. *ophioxylodes* (Wall.) Deb & B.Krishna, Bull. Bot. Surv. India 24 (1983 ['1982']) 222; Deb, Fl. Tripura State 2 (1983) 44. **Type:** *De Silva s.n.* [EIC 8364A], [Bangladesh], Sylhet, 1821 (lectotype K-W [K001125326], first step designated by Deb & Krishna, Bull. Bot. Surv. India 24 (1983 ['1982']) 222, second step designated by Turner, Feddes Repert. (2019) in press; isolectotype K-W [K001125327]).

Psychotria lurida Blume, Bijdr. Fl. Ned. Ind., pt 16 (1826–1827) 959. **Synonyms:** *Zwaardkronia lurida* (Blume) Korth., Ned. Kruidk. Arch. 2(4) (1851) 252. – *Chassalia lurida* (Blume) Miq., Fl. Ned. Ind. 2, fasc. 2 (1857) 282. – *Chassalia curviflora* (Wall.) Thwaites var. *lurida* (Blume) Hochr., Candollea 5 (1934) 270. **Type:** *Blume 2270*, [Indonesia], Java (lectotype L [L.2950785], designated by Turner, Feddes Repert. (2019) in press).

Psychotria gendarussifolia Blume, Bijdr. Fl. Ned. Ind., pt 16 (1826–1827) 960, as '*gendarussaefolia*'. **Synonym:** *Uragoga gendarussifolia* (Blume) Kuntze, Revis. Gen. Pl. 2 (1891) 960. **Type:** *Blume s.n.*, [Indonesia], Java, Bantam (lectotype L [L0001107], designated by Turner, Feddes Repert. (2019) in press).

Psychotria ambigua Wight & Arn., Prodr. Fl. Ind. Orient. (1834) 433. **Synonym:** *Chassalia ambigua* (Wight & Arn.) Alston in Trimen, Handb. Fl. Ceylon 6 (Suppl.) (1931) 152. **Type:** *Wight s.n.* [Herb. Wight propr. 1350], India, Cootalum [Courtallum] (lectotype E [E00174836], designated by Turner, Feddes Repert. (2019) in press).

Psychotria longifolia Dalzell, Hooker's J. Bot. Kew Gard. Misc. 2 (1850) 133, nom. illeg. non Hofmanns. ex Schult. (1819), nec (Kunth) Spreng. (1824). **Synonyms:** *Chassalia curviflora* (Wall.) Thwaites var. *longifolia* Hook.f., Fl. Brit. India 3, fasc. 7 (1880) 177; Ridley, Fl. Malay Penins. 2 (1923) 142. – *Chassalia longifolia* (Hook.f.) K.M.Wong, Tree Fl. Malaya 4 (1989) 344. **Type:** *Dalzell s.n.*, India, Bombay (lectotype K [K000031779], designated by Turner, Feddes Repert. (2019) in press).

Chassalia lurida (Blume) Miq. var. *angustifolia* Miq., Fl. Ned. Ind. 2, fasc. 2 (1857) 283. **Type:** *Horsfield Rub. 29*, [Indonesia], Java (holotype K [K001129562]).

Chassalia lurida (Blume) Miq. var. *megacoma* Miq., Fl. Ned. Ind. 2, fasc. 2 (1857) 283. **Synonym:** *Chassalia curviflora* (Wall.) Thwaites var. *megacoma* (Miq.) Hochr., Candollea 5 (1934) 270. **Type:** *Teijsmann HB923*, [Indonesia], Sumatra, Kotta [Kota] Nopan (lectotype U [U0041392], designated by Turner, Feddes Repert. (2019) in press).

Chassalia curviflora (Wall.) Thwaites var. *ellipsoidea* Hook.f., Fl. Brit. India 3, fasc. 7 (1880) 177. **Type:** *Clarke 17908*, India, [Meghalaya], Jarain in Jaintea, 3000 ft, 21 November 1872 (holotype K [K000031780]; isotype CAL).

Uragoga curviflora (Wall.) Kuntze var. *lanceolata* Kuntze, Revis. Gen. Pl. 1 (1891) 299. **Type:** *Kuntze 6100*, Singapore, October 1875 (lectotype NY [NY03468427], designated by Turner, Feddes Repert. (2019) in press).

Uragoga curviflora (Wall.) Kuntze var. *latifolia* Kuntze, Revis. Gen. Pl. 1 (1891) 299. **Type:** *Kuntze 5007*, [Indonesia], Java, Tjiemas, 13 June 1875 (lectotype NY [NY03468428], designated by Turner, Feddes Repert. (2019) in press).

Uragoga curviflora (Wall.) Kuntze var. *angustifolia* Kuntze, Revis. Gen. Pl. 1 (1891) 300. **Type:** *Kuntze*, [Indonesia], Java (not traced).

Chassalia virgata Talbot, Syst. List Trees Bombay (1894) 114. **Type:** *Talbot 337*, India, Karnataka, North Kanara [Uttara Kannada] District, Siddapore [Siddapur] (lectotype BSI [BSI0000001604], designated by Turner, Feddes Repert. (2019) in press).

Chassalia curviflora (Wall.) Thwaites var. *linearis* King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 133. **Type:** *Goodenough in Ridley 1606*, [Malaysia], Malacca, Ayer Panas, November 1893 (lectotype CAL [CAL0000024823], designated by Turner, Feddes Repert. (2019) in press).

Chassalia chartacea Craib, Bull. Misc. Inform. Kew 1931 (1931) 279; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 1 (1966) 527; Wong, Tree Fl. Malaya 4 (1989) 344; Turner, Gard. Bull. Singapore 45 (1993) 196; Tan et al., Gard. Bull. Singapore, Suppl. 3 (1995) 44; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 421; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 239; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 25, 174, 220; Turner & Chua, Checkl. Vasc. Pl. Sp. Bukit Timah Nat. Res. (2011) 67. **Type:** *Kerr 18175*, Siam [Thailand], Surat, Yanyao, 50 m, 21 February 1930 (holotype K [K000761880, K001129592 – 1 specimen over 2 sheets]; isotype BM [BM000945616]).

Ophiorrhiza staintonii H.Hara, J. Jap. Bot. 52 (1977) 358. **Synonym:** *Chassalia staintonii* (H.Hara) Deb & Mondal, J. Jap. Bot. 57 (1982) 160. **Type:** *Stainton 6875*, Nepal, East Nepal, Saktim T.E., 1500 ft, 21 May 1971 (holotype BM [BM000945617]; isotype TI).

Shrub to 2 m tall. **Twigs** glabrous, sometimes flushed purple when living, drying pale brown to dark grey, finely longitudinally striate, sometimes with a slight central ridge running lengthways between nodes on each side. **Stipules** bifid, very variable in shape, on older parts of the stem pale brown and chaffy. **Leaves:** lamina generally narrowly elliptic, sometimes obovate or rarely ovate, (4–)8–23 × (1.5–)2.5–7.5 cm, apex acuminate, base cuneate with lamina margin extending down petiole as very narrow ridge on each side; glabrous, membranous to chartaceous, drying various shades of brown, grey-brown or grey-green, old specimens generally a uniform dark brown above and lighter shade below; midrib generally raised on upper surface, prominent below, secondary veins (4–)6–9 pairs, arching forward and forming a series of loops within margin, often purplish below in life, flush to slightly raised on both sides; petiole 0.5–3 cm, c. 1–1.5 mm wide, often with three ridges adaxially formed by extensions of lamina margins and top of midrib. **Inflorescences** terminal, pedunculate, or more rarely not, peduncle 0.5–1.5(–3) cm long, inflorescence branching as a series of trichotomies but with each branch relatively short (rarely longer than 1 cm) giving a generally compact inflorescence, inflorescence axes drying laterally compressed, angular and longitudinally ridged, sometimes with very short pubescence. **Flowers** white tinged purple externally with purple calyx, corolla mouth without or with faint yellow ‘eye’; subsessile, pedicel plus hypanthium 0.5–1 mm long, drying dark brown, longitudinally ridged; calyx lobes broadly triangular, c. 0.3 × 0.6 mm,

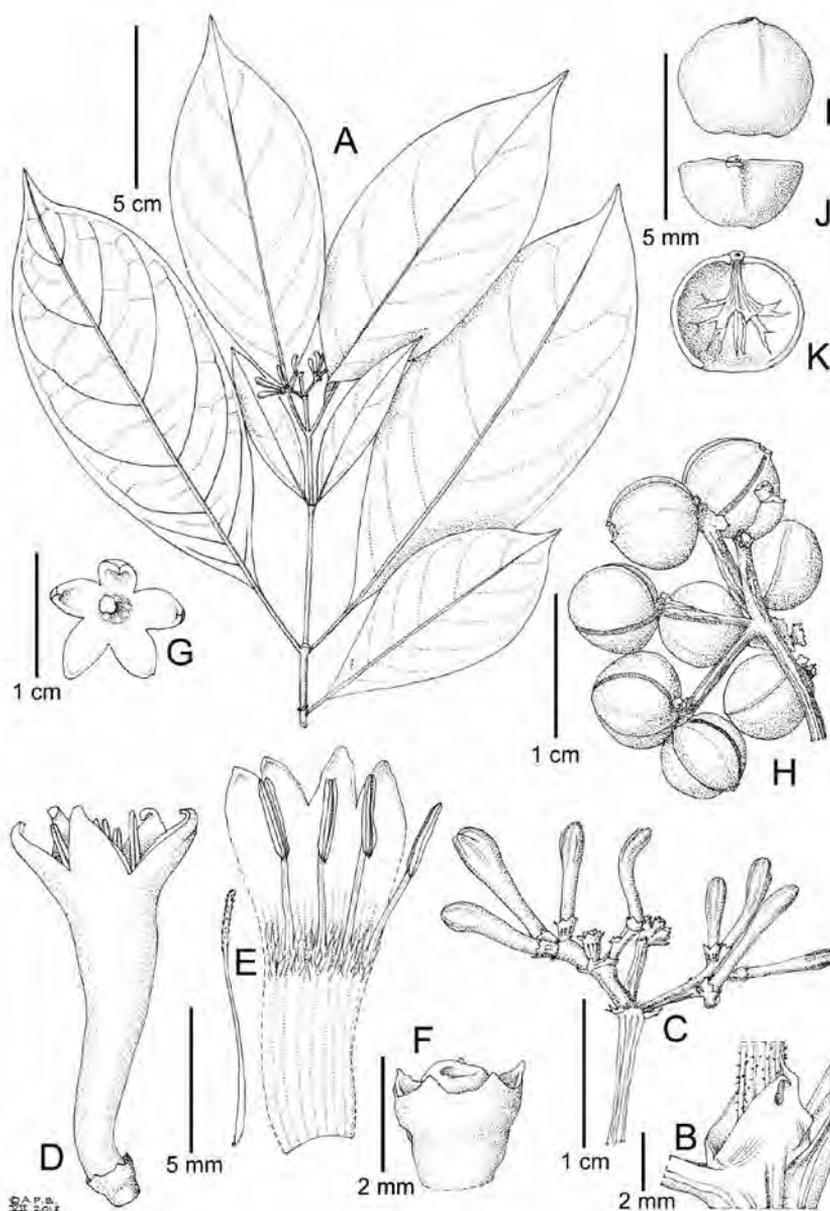


Figure 9. *Chassalia curviflora* (Wall.) Thwaites. **A.** Habit. **B.** Stipule at base of inflorescence. **C.** Inflorescence prior to anthesis. **D.** Open 5-merous flower. **E.** Corolla of 4-merous flower, adaxial view, opened out to show attached stamens and with the style and stigma removed to the side. **F.** Calyx and central disk. **G.** Front view of open 5-merous, long-styled flower (from photograph). **H.** Inflorescence with mature fruits. **I.** Pyrene, dorsal face. **J.** Pyrene, apical view. **K.** Pyrene, ventral face strongly concave. (From Singapore, A–C, F from MacRitchie, *Lua et al. SING2014-233*; D, E, I–K from Pulau Ubin, *Gwee et al. SING2005-297*; H from MacRitchie, *Lim HOB 012*. Drawn by A. Brown, reproduced with the kind permission of the Director and the Board of Trustees, Royal Botanic Gardens, Kew).



Figure 10. *Chassalia curviflora* (Wall.) Thwaites. **A.** Open flowers. **B.** Ripe fruits showing succulent distal branches of the infructescence. **C.** Pink succulent distal branches of infructescence bearing young fruits. *Chassalia pubescens* Ridl. **D.** Curved corollas. (A–C from Singapore, MacRitchie; D from Peninsular Malaysia, cultivated at FRIM. Photos: X.Y. Ng).

apex sometimes apiculate, corolla tube cupular, 0.3–0.4 mm long, in bud clavate, at anthesis c. 11 mm long, 1 mm wide at base, 2 mm wide at mouth, sometimes curved at base and again near apex so that the corolla mouth is much closer to the horizontal than the ascending tube, drying light brown, glabrous, generally with visible parallel longitudinal veins, corolla lobes acute triangular, 2 mm long, 1 mm wide at base, relatively thick, tips often curved in; stamens inserted just below the mouth of the corolla tube with anthers protruding, c. 3 mm long; only short-styled morph observed among Singapore collections. **Infructescence** axes becoming swollen and fleshy, white or bright pink, as fruits ripen. **Fruits** globose, slightly longitudinally compressed, 5.5–6 mm × 6–7 mm, sessile, glabrous, ripening black, drying brown to black, sometimes pale spotted, more or less smooth but with one longitudinal furrow marking where the pyrenes meet and generally one prominent longitudinal ridge, calyx persistent; pyrenes 2, concavo-convex with incomplete flat plate internally, 4.5 × 5 × 2.5 mm, convex surface smooth often with one partial and irregular rib, endocarp thin and horny, drying pale brown. **Seed** bowl-shaped, drying brown.

Distribution. Widespread from India to the Philippines. In Singapore it still occurs at various sites, including Bukit Timah (*Lee et al. s.n.*, 2 Sep 2002, SING [SING0046168], SINU), the Central Catchment (*Lua & Hassan SING2011-035*, 17 Feb 2011, SING [SING0153729]; *Hassan Ibrahim et al. SING2013-003*, 3 Jan 2013, SING [SING0192218]; *Lua et al. SING2014-233*, 10 Jun 2014, SING [SING0212397]), Singapore Botanic Gardens' Rain Forest (*Koh & Lim SING2017-022*, 25 Jan 2017, SING [SING0230971]) and on Pulau Ubin (*Gwee et al. SING2005-297*, 19 Sep 2005, SING [SING0065657]).

Ecology. Shrub of the forest understorey.

Provisional conservation assessment. Globally Least Concern (LC). For Singapore, Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 239) and Chong et al. (Checkl. Vasc. Pl. Singapore (2009) 25, 174, 215) listed *Chassalia curviflora* as Endangered (EN/D) but they also listed *C. chartacea* as Vulnerable (VU/D). Treating these as synonyms, this taxon is assessed here as Vulnerable (VU/D) in Singapore.

Vernacular name. *Pechah piring puteh* (Malay; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 98).

Taxonomy. *Chassalia curviflora* is widespread and variable. The Singapore plant, with the yellow throat to the corolla absent or only faintly discernible, equates with *Chassalia lurida* (Blume) Miq. described from Java. However, it is difficult to distinguish *Chassalia lurida* from depauperate specimens of *C. curviflora* s.s. (described from Penang). The possibility of recognising *Chassalia lurida* as a variety of *C. curviflora* is made less appealing because Kuntze's varietal names, which never seem to have been used since their publication, have priority over *C. curviflora* var. *lurida* (Blume) Hochr.

Throughout its range, narrow-leaved plants of *Chassalia curviflora* are found. *Psychotria gendarussifolia* Blume and *Chassalia curviflora* var. *longifolia* Hook.f. are the oldest names available at the rank of species and variety respectively for the narrow-leaved group. However, specimens of intermediate leaf widths are found, even on the same plant, so this entity is not given formal taxonomic recognition here. The only specimen of the narrow-

leaved plant of possible relevance to the *Flora of Singapore* is *Cantley's Collector 2783* (SING [SING0030031]), but though labelled 'Singapore', the locality may not be correct.

2. *Chassalia griffithii* (Hook.f.) A.P.Davis

(William Griffith, 1810–1845, English botanist known for his work in India and Malaya)

Bot. J. Linn. Soc. 157 (2008) 118; Turner & Chua, Checkl. Vasc. Pl. Sp. Bukit Timah Nat. Res. (2011) 67. **Basionym:** *Cephaelis griffithii* Hook.f., Fl. Brit. India 3, fasc. 7 (1880) 178; Ridley, Fl. Malay Penins. 2 (1923) 144. **Synonyms:** *Uragoga griffithii* (Hook.f.) K.Schum. in Engler & Prantl, Nat. Pflanzenfam. 4(4) (1891) 120. – *Psychotria malaccensis* I.M.Turner, Asian J. Trop. Biol. 1(2) (1995) 27; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 441. **Type:** *Griffith s.n.* [Kew Distribution 3032], [Malaysia], Malacca (lectotype K [K000761844], designated by Turner, Feddes Repert. (2019) in press).

Twigs glabrous, drying black or brown and relatively smooth when young, pale brown or grey-brown when older and longitudinally wrinkled. **Stipules** entire, large, at least 5 mm long, soon becoming pale brown, spongy, soft and brittle. **Leaves:** lamina elliptic, elliptic-obovate to obovate, 16–34 × (4–)6.5–12 cm, apex shortly acuminate, base cuneate, membranous to thinly chartaceous, glabrous, drying dark brown or green-brown above, lighter brown below, midrib more or less flush above, generally with a sunken longitudinal groove centrally, secondary veins immersed above, midrib raised below but generally broad and low, often dashed longitudinally with pale idioblasts, secondary veins flush to slightly raised below, secondary veins (11–)13–16 pairs, arching forward and looping obscurely within the margin; petiole 2–9 cm long, 2–3 mm wide, glabrous, often drying dark brown, laterally compressed with several longitudinal ridges including one arising at the top of the petiole below the lamina margin, base of petiole generally with distinct rim and groove. **Inflorescences** generally terminal, though older ones sometimes appear axillary, perhaps through overtopping by the growing shoot apex, more or less sessile when flowering but apparently peduncle and inflorescence branches extending in later stage, surrounded by many broad chartaceous bracts that rapidly develop scarious pale brown margins. **Flowers** shortly pedicellate, pedicel plus hypanthium c. 1.5 mm long, glabrous, drying brown, longitudinally ridged, calyx truncate, c. 1 mm long, corolla tube linear expanding distally into a top-shaped end in bud, linear portion c. 6 mm long, 1 mm wide, glabrous outside, drying brown, sometimes with longitudinal nerves visible, distal expanding region 3–5 mm long [no open flowers available]. **Fruits** distinctly pedicellate, pedicel c. 1 mm long, 0.5 mm wide, elliptic in outline, laterally compressed but with two prominent flat-topped longitudinal ridges on each side centrally, 10–12 × 6.5–7 × 5.5–6 mm, drying light brown with many pale spots. **Pyrenes** 2, 9–10 × 6.5 × 3–4 mm, concavo-convex with a narrow longitudinal ridge running from the base to roughly the middle of the concave face and a prominent longitudinal ridge, with a shallow central groove, running the length of the convex face. **Seed** flat with a dorsal ridge.

Distribution. Peninsular Malaysia and Singapore. In Singapore it is known only from a few collections made by Ridley on Bukit Timah in the period 1897–1911 (*Ridley 9515*, SING [SING0064113]; *Ridley s.n.*, 1897, SING [SING0064119]; *Ridley s.n.*, 1908, BM; *Ridley s.n.*, Mar 1911, BM).

Ecology. Lowland rain forest.

Provisional conservation assessment. Globally not assessed. In Singapore presumed Nationally Extinct.

Vernacular name. Recorded as *Cempedak hutan* (Malay), although that name should imply *Artocarpus integer* (Thunb.) Merr. var. *silvestris* Corner (Moraceae).

3. *Chassalia pubescens* Ridl.

(Latin, *pubescens* = pubescent, downy with short soft hairs; referring to the generally hairy foliage)

J. Straits Branch Roy. Asiat. Soc. 54 (1910) 46; Ridley, Fl. Malay Penins. 2 (1923) 143; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 153; Turner, Gard. Bull. Singapore 45 (1993) 196; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 421; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 239; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 25, 174, 189; Turner & Chua, Checkl. Vasc. Pl. Sp. Bukit Timah Nat. Res. (2011) 67. **Type:** *Ridley 13531*, [Malaysia], Johore, Sedenah, August 1908 (lectotype SING [SING0209189], designated by Turner et al., Gard. Bull. Singapore 70 (2018) 340; isolectotypes BM [BM001190961], K [K000761828]). **Fig. 10D.**

Twigs drying dark red-brown or grey-brown, sometimes with pale patches, finely longitudinally striate, densely to sparsely pubescent with crisped multicellular hairs, often with a distinct narrow ridge running basally from the centre of the node on each side. **Stipules** bifid or entire, hairy externally, becoming pale and chaffy. **Leaves:** lamina elliptic to obovate, 5–24 × 2–9 cm, base cuneate, apex acuminate, membranous, drying dark brown to grey-brown or greenish, glabrous above, densely covered with multicellular hairs on nerves below with uniformly spread multicellular hairs, or hair bases, on lower lamina surface; midrib above raised to sunken, secondary veins flush to slightly raised, midrib below prominent, secondary veins raised, secondary veins 7–10 pairs, arching forward and looping within margin; petiole 2–25 mm long, c. 1 mm wide, generally densely covered in multicellular hairs, sometimes lamina margin extending to base of petiole. **Inflorescences** terminal, generally pedunculate, peduncle 2–5 mm long, axes branching closely to form compact structure, branches generally less than 1 cm long, axes drying dark brown, longitudinally ridged, generally covered with multicellular hairs. **Flowers** subsessile, pedicel plus hypanthium c. 1 mm long, drying dark brown, longitudinally ridged, with scattered or dense hairs, calyx cup-like, tube c. 0.3 mm long, glabrous or hairy outside, calyx lobes broadly triangular c. 0.4 × 0.5 mm, corolla narrowly clavate in bud, at anthesis tube 17–18 mm long, c. 1 mm wide at base, c. 1.5 mm wide at mouth, drying light brown with distinct longitudinal veins, corolla lobes triangular. c. 4 mm long, 1 mm wide at base, anthers c. 3 mm long. **Fruits** subsessile, globose, c. 5 mm long, 6 mm diam., drying dark red-brown with one longitudinal ridge, one groove and some longitudinal ribs. **Pyrenes** 2, concavo-convex, 5–6 × 5.5–6 × 3–3.5 mm, with flat wall to the interior missing a central vertical slot, convex wall either smooth or with a partial longitudinal ridge.

Distribution. Peninsular Malaysia and Singapore. Only recorded once from Singapore on Bukit Timah in 1894 (*Ridley s.n.*, 1894, SING [SING0172346]).

Ecology. Lowland forest.

Provisional conservation assessment. Globally not assessed. Listed as Nationally Extinct in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 239) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 25, 174, 189).

4. *Chassalia singaporensis* (Ridl.) A.P.Davis (of Singapore)

Bot. J. Linn. Soc. 157 (2008) 119; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 25, 174, 202. **Basionym:** *Cephaelis singaporensis* Ridl., J. Straits Branch Roy. Asiat. Soc. 79 (1918) 89; Ridley, Fl. Malay Penins. 2 (1923) 144; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 152; Turner, Gard. Bull. Singapore 45 (1993) 196, as '*singaporensis*'. **Synonym:** *Psychotria singaporensis* (Ridl.) I.M.Turner, Asian J. Trop. Biol. 1(2) (1995) 27; Turner, Gard. Bull. Singapore 47 (1997 ['1995']) 443; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241. **Type:** *Ridley 4966*, Singapore, Bajau, 1892 (lectotype K [K000761838], designated by Turner et al., Gard. Bull. Singapore 70 (2018) 339; isolectotypes BM [BM001118900], SING [SING0064264]).

Cephaelis griffithii auct. non Hook.f.: Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 99

Probably shrublet or shrub. **Twigs** glabrous, drying black in youngest parts, sometimes pale brown when older. **Stipules** entire become pale brown, spongy, soft and brittle with age. **Leaves:** lamina narrowly elliptic to more commonly oblanceolate, 14–25 × 3–6 cm, apex shortly acuminate, base long and acutely cuneate; membranous, glabrous, drying brown to dark brown, midrib above flush to slightly raised though often with a central longitudinal groove, secondary veins more or less immersed, midrib prominent below, secondary veins flush to slightly raised below; secondary veins 7–17 pairs, arching forward and looping obscurely; petiole glabrous, 1.5–3 cm long, 1–2 mm wide, drying dark brown, often laterally compressed with a distinct but slight rim around base. **Inflorescences** terminal, sometimes paired, pedunculate, peduncle 2.5–8 cm long, branching closely distally to produce a dense head of flowers subtended by large bracts to 1.5 cm wide. **Flowers** subsessile, pedicel plus hypanthium c. 1 mm long, calyx more or less truncate, tube c. 0.5 mm long, corolla in bud with tube linear, basally expanding distally into a top-shaped end with an apex of a short broad cone formed by the still connate corolla lobes, at anthesis tube 7–11 mm long to base of distal swelling with 3–4 mm further to mouth, drying brown, glabrous, with parallel longitudinal veins visible, corolla lobes ovate-triangular, 3–4 mm long, 2–3 mm wide, glabrous, drying brown with anastomosing veins visible, stigma bifid. **Fruits** not seen.

Distribution. Peninsular Malaysia and Sumatra (Riau). In Singapore only definitely known from one very old collection (the type) from Bajau (*Ridley 4966*, 1892, BM [BM001118900], K [K000761838], SING [SING0064264]). A Cantley collection simply labelled Singapore (SING [SING0064112]) may represent a second record.

Ecology. Lowland forest.

Provisional conservation assessment. Globally not assessed. Listed as Critically Endangered (CR/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241, under *Psychotria singaporensis*) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 25, 174, 202) but, with no definite records since 1892, it must be presumed Nationally Extinct.

6. COELOSPERMUM Blume

(Greek, *coelo-* = hollow, *-spermum* = seed; referring to the pyrene)

Bijdr. Fl. Ned. Ind., pt 16 (1826–1827) 994, as ‘*Caelospermum*’; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 50; Ridley, Fl. Malay Penins. 2 (1923) 120; Johansson, Blumea 33 (1988) 275; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 153; Razafimandimbison & Bremer, Adansonia, sér. 3, 33 (2011) 285. **Type:** *Coelospermum scandens* Blume (= *Coelospermum truncatum* (Wall.) Baill. ex K.Schum.).

Olostyla DC., Prodr. 4 (1830) 440. **Type:** *Olostyla corymbosa* (Labill.) DC. (= *Coelospermum balansanum* Baill.).

Pogonolobus F.Muell., Fragm. 1 (1858) 55. **Type:** *Pogonolobus reticulatus* F.Muell. (= *Coelospermum reticulatum* (F.Muell.) Benth.).

Trisciadia Hook.f., Fl. Brit. India 3, fasc. 7 (1880) 94. **Type:** *Trisciadia truncata* (Wall.) Hook.f. (= *Coelospermum truncatum* (Wall.) Baill. ex K.Schum.).

Merismostigma S.Moore, J. Linn. Soc., Bot. 45 (1921) 332. **Type:** *Merismostigma neocaledonicum* S.Moore (= *Coelospermum balansanum* Baill.).

Lianas or (not in Singapore) sometimes shrubs. **Stipules** fused and forming a subtruncate sheath, with numerous colleters near the base on the adaxial side. **Leaves** usually in a pair or sometimes 3 at each node, occasionally with domatia in the axils of the secondary veins on the lower leaf surface. **Inflorescences** terminal or axillary, paniculate or corymbose. **Flowers** hermaphrodite, 4–6-merous, arranged into an umbel-like structure at the tips of the inflorescence branches; calyx bell-shaped or cup-shaped; calyx tube truncate or denticulate with minute, triangular, acute or obtuse teeth, typically with colleters inside at base; corolla salver-shaped, fleshy, white to yellowish- or brownish-white; corolla lobes narrowly oblong or narrowly obovate, obtuse; stamens inserted in corolla throat; anthers exerted, slightly recurved, dorsifixed below its middle; stigma bilobed, exerted or not; ovary simple or fused, typically 2-locular, with 2 secondary (i.e. later developing) septa running lengthwise; ovules 2 per locule. **Fruits** drupes, globose or wedge-shaped, shiny, with 1–4 pyrenes, or sometimes a syncarp composed of many fused ovaries. **Seeds** flattened, ovate or elliptic, narrowly winged at the base and along the edges.

Distribution. Worldwide c. 11 species, from China through Southeast Asia (including the Malay Peninsula, Indonesia, Philippines and Papua New Guinea) to Australia and the Pacific islands (Solomon Islands and New Caledonia). In Singapore 1 native species.

Taxonomy. Here we adopt the spelling of *Coelospermum* for this genus although Blume (Bijdr. Fl. Ned. Ind., pt 16 (1826–1827) 994) first spelt the generic name as *Caelospermum*; he later corrected this in a footnote in Blume (Fl. Javae, fasc. 1–2 (1828) vi). Blume (Bijdr. Fl. Ned. Ind., pt 16 (1826–1827) 994) first considered this genus as closely related to *Morinda* L. and *Gynochthodes* Blume, a concept which was later accepted by various authors. However, the circumscription of the genus remained controversial as Bentham (Fl. Austral. 3 (1867) 425) and Baillon (Bull. Mens. Soc. Linn. Paris 1 (1879) 218) transferred two species, *Pogonolobus reticulatus* F.Muell. and *Morinda reticulata* Benth., to this genus but this was not followed by many specialists, including Johansson (Grana 26 (1987) 148). Most recently, several phylogenetic studies conducted by Razafimandimbison et al. (Molec. Phylogenet. Evol. 48 (2008) 207; Molec. Phylogenet. Evol. 52 (2009) 879) concluded that a broad circumscription of *Coelospermum*, including the two species mentioned above (now *Coelospermum reticulatum* (F.Muell.) Benth. and *Coelospermum decipiens* Baill., respectively), should be adopted. They have maintained the three genera as distinct and separate from each other in the tribe Morindeae.

***Coelospermum truncatum* (Wall.) Baill. ex K.Schum.**

(Latin, *truncatus* = truncate, cut off, ending abruptly; referring to the calyx)

in Engler & Prantl, Nat. Pflanzenfam. 4(4) (1891) 136; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 51; Ridley, Fl. Malay Penins. 2 (1923) 121; Johansson, Blumea 33 (1988) 277; Turner, Gard. Bull. Singapore 45 (1993) 195; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 421; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 239; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 21, 173, 202, as ‘*Caelospermum*’. **Basionym:** *Webera truncata* Wall. in Roxburgh, Fl. Ind. 2 (1824) 538. **Synonyms:** *Cupia truncata* (Wall.) DC., Prodr. 4 (1830) 394. – *Diplospora truncata* (Wall.) Steud., Nomencl. Bot., ed. 2, 1 (1840) 516. – *Pseudixora truncata* (Wall.) Miq., Fl. Ned. Ind. 2, fasc. 2 (1857) 210. – *Trisciadia truncata* (Wall.) Hook.f., Fl. Brit. India 3, fasc. 7 (1880) 94. **Type:** *Wallich s.n.* [EIC 8403], [Malaysia], Penang, August 1822 (lectotype K-W [K001125413], first step designated by Johansson, Blumea 33 (1988) 277, second step designated here; isolectotypes K-W [K001125412], K [K000763735 & K000763735]). **Fig. 11.**

Coelospermum scandens Blume, Bijdr. Fl. Ned. Ind., pt 16 (1826–1827) 994; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 51; Ridley, Fl. Malay Penins. 2 (1923) 121; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 153. **Type:** *Blume s.n.*, [Indonesia], Java, Nusa Kambangan (lectotype L [L0000247], designated by Johansson, Blumea 33 (1988) 277).

Coelospermum corymbosum Blume ex DC., Prodr. 4 (1830) 468. **Type:** *Blume s.n.*, [Indonesia], Java (lectotype G-DC n.v., designated by Johansson, Blumea 33 (1988) 277).

Coelospermum biovulatum C.B.Clarke ex Ridl., J. Straits Branch Roy. Asiat. Soc. 79 (1918) 87; Ridley, Fl. Malay Penins. 2 (1923) 121. **Type:** *Maingay 3053*, [Malaysia], Malacca, 31 October 1867 (lectotype K [K000763733], designated by Johansson, Blumea 33 (1988) 277).

Climber, up to 15 m high. **Stipules** fused and forming a subtruncate sheath, with numerous collectors near the base on the adaxial side. **Leaves:** lamina broadly elliptic to ovate, (2.2–)6.4–13 × (0.7–)2.7–7.3 cm, subcoriaceous, glabrous on both surfaces, drying dark brown, sometimes yellowish green, midrib sunken to flat above, raised below, secondary veins (3–)4–8

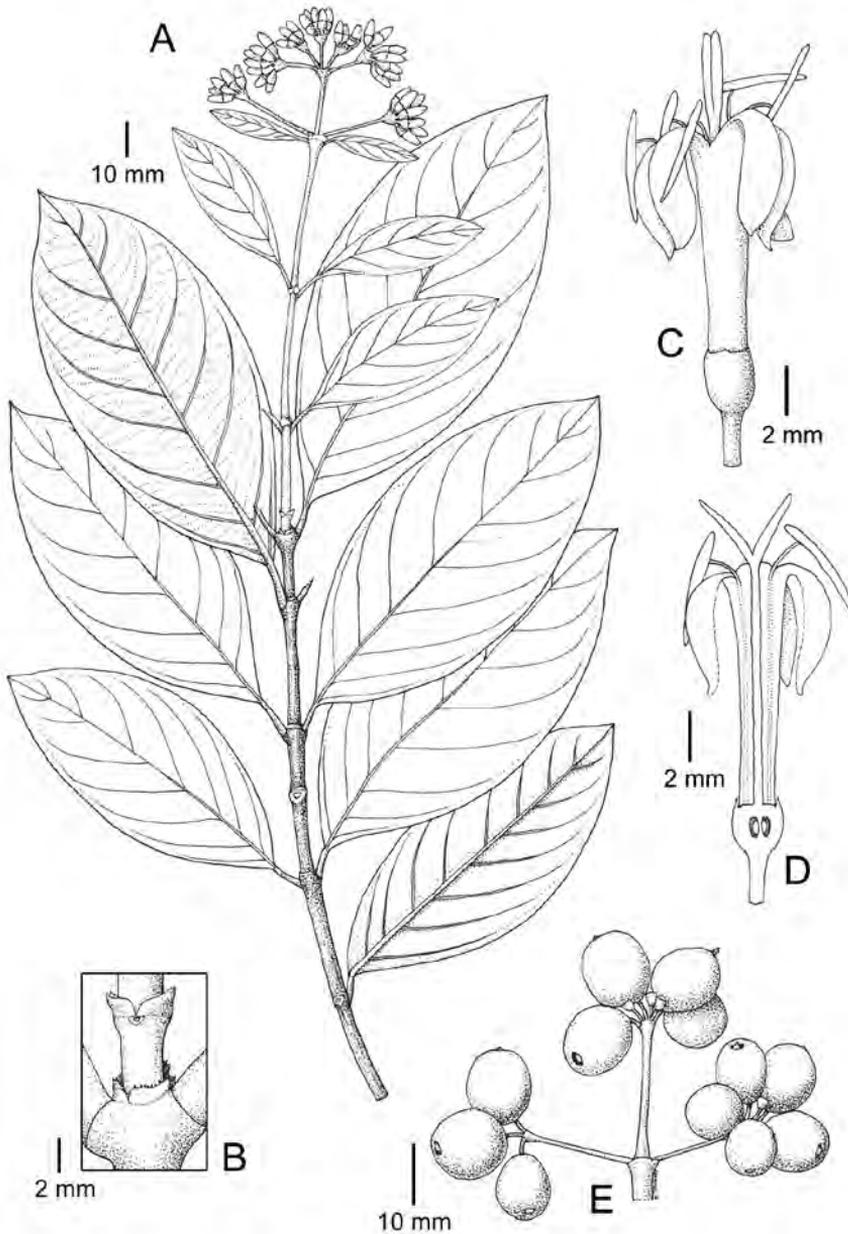


Figure 11. *Coelospermum truncatum* (Wall.) Baill. ex K.Schum. **A.** Leafy branch with flower buds. **B.** Stipules showing protruding apices of colleters from the adaxial side. **C.** Flower. **D.** Longitudinal section of flower showing bilobed stigma and biloculate ovary. **E.** Infructescence with umbel-like fruit clusters. (From Singapore, A, B exact locality uncertain, *Noor SRMN 4*; C, D from MacRitchie, *Lua SING2012-374*; E from Bukit Kallang, *Maxwell 82-87*. Drawn by E. Tay).

pairs, often with domatia in their axils on the lower leaf surface, tertiary veins faintly reticulate or inconspicuous, apex acute to acuminate, base cuneate to obtuse; petioles 7–20 mm long. **Inflorescences** terminal or axillary, typically paniculate or sometimes corymbose, branches usually opposite or alternate on the main axis, sometimes several together forming a whorl. **Flowers** many, arranged into an umbel-like structure at the tips of the inflorescence branches; calyx 2–2.5 mm long, cup-shaped, with inconspicuous teeth; corolla 13–14 mm long; corolla tube 8–9 mm long; corolla lobes 4–5 mm long. **Fruits** drupes, globose to subglobose, to 11.7 mm across.

Distribution. Southeast China, Thailand, Vietnam, Peninsular Malaysia, Indonesia (Sumatra and Java) and Borneo. In Singapore it is recorded from the Central Catchment (*Lua SING2012-374*, 30 Aug 2012, SING [SING0184340]), Bukit Timah (*Ridley s.n.*, 23 Feb 1890, SING [SING0242147]), Chan Chu Kang (*Hullett 623*, 9 Feb 1887, SING [SING0019998]), Changi-Pulau Ubin area (*Ridley 9563*, 1892, SING [SING0019999]) and Seletar (*Noor SRMN 4*, 10 Mar 1971, SING [SING0019997]).

Ecology. Across its range, found in a variety of different forest types and habitats, including primary to secondary lowland mixed dipterocarp forest or montane forest as well as shrubby areas, to 1900 m. In Singapore known from lowland mixed dipterocarp forest, swamp forest, and areas near the coast.

Provisional conservation assessment. Globally not assessed. Listed as Critically Endangered (CR/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 21, 173, 202).

Taxonomy. Here we list only some synonyms relevant to our region typified by material that matches the Singapore taxon well. For a full list of synonyms see Johansson (*Blumea* 33 (1988) 277).

Notes. The description above applies to the species as found in Singapore. There is considerable variation, especially in the size of the calyx, for the species as found elsewhere.

7. COPTOSAPELTA Korth.

(Greek, *koptein* = broken, *pelte* = shield; referring to the appearance of the peltate, circular fringed seed wing)

Ned. Kruidk. Arch. 2(3) (1850) 112; Kurz, Forest Fl. Burma 2 (1877) 37; Hooker, Fl. Brit. India 3, fasc. 7 (1880) 35; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’]) 137; Valetton, Recueil Trav. Bot. Néerl. 19 (1922) 281; Ridley, Fl. Malay Penins. 2 (1923) 17; Valetton, Proc. Sect. Sci. Kon. Akad. Wetensch. Amsterdam 26 (1923) 361; Craib, Fl. Siam. 2(1) (1932) 20; Backer & Bakhuizen van den Brink, Fl. Java (Spermatoph.) 2 (1965) 297; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 1 (1966) 663; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 153; Puff et al., Rubiac. Thailand (2005) 152, pl. 3.2.2. **Type:** *Coptosapelta flavescens* Korth.

Lianas, young stems twining. **Stipules** triangular. **Leaves:** lamina thin-coriaceous, often hairy on the lower surface, typically with few (not more than 5) pairs of secondary veins. **Inflorescences** many-flowered thyrsoid panicles, terminal and axillary to distal-most leaves on a shoot, such distal leaves sometimes much reduced in size. **Flowers** hermaphrodite, fragrant; hypanthium obconical; calyx limb with or without conspicuous tubular basal portion, lobes 5, rounded to ovate or sub-elliptic; corolla salverform, white becoming creamy white with age, tube narrow, lobes oblong, blunt, valvate, shorter than tube or as long or longer; stamens 5, typically strongly reflexed or spreading and wholly exerted in the open flower, filaments short, anthers very long (often almost as long as corolla lobes), linear, bifid at base, dorsally hairy; ovary 2-locular, style glabrous, stigma narrowly cylindrical and wholly exerted; ovules peltately attached to septum. **Fruits** capsules, subglobose to bilobed and slightly obcordate, loculicidally dehiscent into 2 or 4 valves. **Seeds** numerous, flattened, peltate, the wing circular and often lacinate to lobed along its margin.

Distribution. A genus of 15 species in Myanmar, Thailand, Cambodia, Vietnam, Laos, China, Japan and Malesia. In Singapore 2 native species.

Ecology. Lowland forest, some species extending to mid-montane forests. In Singapore documented in lowland dipterocarp forest. Secondary pollen presentation (SPP) is effected through the release of pollen just before floral opening so that the pollen masses are lodged on, and presented by, the narrowly cylindrical stigma in the open flower prior to stigmatic receptiveness (Puff et al., *Opera Bot. Belg.* 7 (1996) 369).

Uses. Despite a number of species having conspicuous, attractive and fragrant blooms, their potential for ornamental plant use does not appear to have been tried. Some folk medicinal use has been documented (see Burkill, *Dict. Econ. Prod. Malay Penins.*, ed. 2, 1 (1966) 663).

Taxonomy. Molecular and morphological studies indicate *Coptosapelta* is an isolated and basal lineage in the Rubiaceae (Bremer et al., *Syst. Biol.* 48 (1999) 413–435; Bremer & Manen, *Pl. Syst. Evol.* 225 (2000) 43–72). Its closest relatives include *Acranthera* Arn. ex Meisn. and *Luculia* Sweet (Rydin et al., *Pl. Syst. Evol.* 278 (2009) 101–123).

Key to *Coptosapelta* species

1. Leaves with 4–5 pairs of secondary veins; calyx limb without conspicuous basal tubular portion, the lobes broadly sub-elliptic and as long as the hypanthium; corolla throat glabrous, corolla lobes as long as or only slightly longer than tube **1. *C. flavescens***
Leaves with 2–3(–4) pairs of secondary veins; calyx limb with conspicuous basal tubular portion longer than the rounded to broad-triangular lobes; corolla throat villous, corolla lobes about twice as long as tube **2. *C. griffithii***

1. *Coptosapelta flavescens* Korth.

(Latin, *flavescens* = yellowish; referring to the flowers)

Ned. Kruidk. Arch. 2(3) (1850) 112; Kurz, Forest Fl. Burma 2 (1877) 37; Hooker, Fl. Brit. India 3, fasc. 7 (1880) 35; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 91; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’]) 138; Valetton, Recueil Trav. Bot. Néerl. 19 (1922) 281; Ridley, Fl. Malay Penins. 2 (1923) 17; Craib, Fl. Siam. 2(1) (1932) 20; Backer & Bakhuizen van den Brink, Fl. Java (Spermatoph.) 2 (1965) 297; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 153; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 28, 174, 190. **Type:** *Kostermans 21649*, [Indonesia], Indonesian East Borneo [Kalimantan], Berau, Tandjong Redeb, along Birang River, 7 November 1963 (neotype BO, designated here; isoneotypes A, G, K, L, P [P03984057], US).

Coptosapelta parviflora Ridl., J. Straits Branch Roy. Asiat. Soc. 79 (1918) 76; Ridley, Fl. Malay Penins. 2 (1923) 18; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 153; Turner, Gard. Bull. Singapore 45 (1993) 196; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 239; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 28, 174, 190. **Type:** *Ridley 14117*, Singapore, Bukit Timah, January 1909 (lectotype K [K000760081], designated by Turner et al., Gard. Bull. Singapore 70 (2018) 340; isolectotype SING [SING0058045]).

Coptosapelta beccarii Valetton, Recueil Trav. Bot. Néerl. 19 (1922) 289. **Type:** *Beccari 2271*, Borneo (holotype B n.v. (possibly destroyed); isotype P [P00228644]).

Coptosapelta flavescens Korth. var. *dongnaiensis* Pierre ex Pit., Fl. Indo-Chine 3, fasc. 1 (1922) 54. – *Coptosapelta tomentosa* (Blume) Valetton ex K. Heyne var. *dongnaiense* (Pierre ex Pit.) P.H.Hô, Ill. Fl. Vietnam [Cây cỏ Việt Nam] 3(1) (1993) 164, nom. inval. **Type:** *Poilane 1093*, [Vietnam], Annam, Ben Tram province, Quang Tri, 10 March 1920 (lectotype P [P03984083], designated here; isolectotype P [P03984084]).

Coptosapelta tomentosa auct. non (Blume) Valetton ex K. Heyne: Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 1 (1966) 664; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 153; Turner, Gard. Bull. Singapore 45 (1993) 196; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 421; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 239.

Lianas, stems terete, scantily to densely brown appressed-hairy. **Stipules** triangular, 2–3 mm long. **Leaves:** lamina elliptic-ovate, 3–11.5(–13) × 1.5–5.5(–6.2) cm, apex cuspidate, base cuneate, chartaceous to thin-coriaceous, upper surface scantily to densely appressed brown-hairy on lamina and veins, lower surface scantily to densely appressed brown-hairy becoming glabrescent, secondary veins 4–5 pairs and prominent on lower surface, tertiary veins reticulate and immersed to subprominent; petioles 4–13 mm long, 1–1.5 mm diam., scantily to densely appressed hairy. **Panicles** 4–6 cm long, axes all scantily to densely appressed hairy, peduncle 22 mm long, branches 2–3 mm long. **Flowers** with pedicels 1–2 mm long; hypanthium 1.5–2 mm long, 1.5 mm diam., sparsely to densely appressed to spreading-hairy; calyx limb without conspicuous tubular basal portion, lobes sub-elliptic, 1–1.5 mm long, c. 1 mm wide; corolla tube 6–9 mm long, c. 1 mm wide, sparsely to densely appressed pale-hairy outside, corolla throat glabrous, corolla lobes 7–9(–12) mm long, 1–1.5 mm wide, linear, sparsely hairy to glabrescent outside, glabrous inside; stamen filaments 1.5–2 mm long, slender, anthers 7–8(–10) mm long, appressed to spreading hairy on the back; style 6–9 mm long, stigma 7–9(–12) mm long, glabrous. **Fruits** on pedicels 4–5 mm long, obovoid, obcordate or subrotund, 6–12 × 4–10 mm. **Seeds** flattened, with a sub-circular wing, 1.5–2 mm diam. including a fringe of c. 0.5 mm long marginal segments.

Distribution. Cambodia, Peninsular Thailand, Peninsular Malaysia, Sumatra, Java and Borneo. In Singapore it has been documented with flowering and fruiting material from Bukit Timah, near Fern Valley (*Ridley 14117*, 1909, SING [SING0058045]) and from an unspecified locality (*Cantley s.n.*, SING [SING0030035]). More recently (2009–2010), vouchers with only leafy stems have been collected from Bukit Timah (*Gwee SING2009-504*, 24 Nov 2009, SING [SING0144232]), Chestnut, MacRitchie and Nee Soon (*Gwee SING2010-405*, 23 Feb 2010, SING [SING0145605]).

Ecology. Lowland, secondary and freshwater swamp forests.

Provisional conservation assessment. Globally not assessed. Listed as Nationally Extinct in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 239, under *Coptosapelta parviflora* and *C. tomentosa*) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 28, 174, 190, under *Coptosapelta flavescens* and *C. parviflora*). It has since been rediscovered but, as the numbers are still very low, it is assessed here as Endangered (EN/D).

Taxonomy. Although Valetton (Recueil Trav. Bot. Néerl. 19 (1922) 281) clearly stated in a footnote that he did not intend to make the name change to *Coptosapelta tomentosa*, Heyne's use of the name and attribution to Valetton can be taken as indirect citation of the basionym because this was done before 1953 (Article 41.3 of the ICN), making the combination legitimate. Blume's original material (locality 'in montanis Provinciae Bantam') could not be traced for verifying his name *Stylocoryna tomentosa* Blume. His cursory description in the protologue of this taxon as arborescent (rather than climbing) appears to be at variance with the habit of *Coptosapelta*. We are unwilling to assign a neotype under these circumstances and continue to use Korthal's name as above. Korthal's original material of *Coptosapelta flavescens* also could not be traced but his description is detailed enough to enable neotypification with a Kostermans collection from East Kalimantan (Borneo).

Keng (Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 153) cited *Ridley 14117*, the type of *Coptosapelta parviflora* Ridl., under his enumeration of *C. tomentosa* (Blume) Valetton ex K. Heyne but also noted the locality 'Bukit Timah (No specimen available)' under the former name.

2. *Coptosapelta griffithii* Hook.f.

(William Griffith, 1810–1845, English botanist known for his work in India and Malaya)

Hooker's Icon. Pl. 11 [ser. 3, 1], fasc. 4 (1871) pl. 1089; Hooker, Fl. Brit. India 3, fasc. 7 (1880) 35; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 ['1903']) 138; Ridley, Fl. Malay Penins. 2 (1923) 17; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 1 (1966) 663; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 153; Turner, Gard. Bull. Singapore 45 (1993) 196; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 239; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 28, 174, 190. **Type:** *Griffith s.n.*, [Malaysia], Malacca (lectotype K [K000760083], designated here).

Fig. 12.



Figure 12. *Coptosapelta griffithii* Hook.f. **A.** Leafy branch showing veins on upper leaf surface. **B.** Open flower; note villous corolla throat and hairy stigma. **C.** Dehiscent fruit capsules. **D.** Seeds with fringed circular wings. (From Singapore, MacRitchie, Yeoh SING2012-475. Photos: Y.S. Yeoh).

Lianas, stems terete, scantily to densely pale brown appressed-hairy. **Stipules** triangular, 2–3 mm long. **Leaves:** lamina suborbicular to elliptic-ovate, 1–8 × 1.4–4.5 cm, apex obtuse or short-pointed to cuspidate, base cuneate to rounded, subcoriaceous, upper surface scantily to densely appressed brown-hairy on lamina and veins, lower surface scantily to densely appressed brown-hairy becoming glabrescent, secondary veins 2–3(–4) pairs and prominent on lower surface, tertiary veins reticulate and immersed to subprominent; petioles 4–13 mm long, 1–1.5 mm diam., scantily to densely appressed hairy. **Panicles** 3–6 cm long, axes all scantily to densely appressed to spreading-hairy, peduncle 20–33 mm long, branches 6–15 mm long. **Flowers** with pedicels 2–6 mm long; hypanthium 2–2.5 mm long, 2.5–3 mm diam., densely pale brown appressed to spreading-hairy; calyx limb with conspicuous tubular basal portion 2–3 mm long, lobes short-triangular to rounded, 0.5–1 mm long, c. 0.5–1 mm wide; corolla tube 5–9 mm long, c. 1 mm wide, densely appressed pale-hairy outside, corolla throat densely pale villous, corolla lobes 10–11(–13) mm long, 1.5–2 mm wide, linear, densely appressed pale hairy outside, glabrous inside; stamen filaments 1.5–2 mm long, slender, anthers 10–11 mm long, appressed to spreading hairy on the back; style 5–9 mm long, stigma 10–11(–13) mm long, with multiple longitudinal rows of fine pale hairs interspersed with grooves (these stigmatic hairs often absent in dry material). **Fruits** on pedicels 7–10(–15) mm long, obovoid, obcordate or subrotund, 9–12 × 8–11 mm. **Seeds** flattened, with a sub-circular wing, 3–4 mm diam. including a fringe of c. 1 mm long marginal segments.

Distribution. Endemic to the southern half of the Malay Peninsula, including Singapore. In Singapore documented from Chan Chu Kang (*Mat 6824*, 1895, SING [SING0030036]; *Mat 6891*, 1895, SING [SING0030034]) and MacRitchie (*Lua SING2014-203*, Nature Trail, 9 Jun 2014, SING [SING0205596]; *Lua SING2014-259*, Nature Trail, 11 Jul 2014, SING [SING0179787]).

Ecology. Lowland forest.

Provisional conservation assessment. Globally not assessed. Listed as Nationally Extinct in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 239) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 28, 174, 190) but rediscovered in 2014 and assessed here as Endangered (EN/D).

8. DENTELLA J.R.Forst. & G.Forst.

(Latin *denti-* = a tooth, *-ella* = diminutive ending; possibly referring to small corolla lobes)

Char. Gen. Pl. (1775) 13; Pitard, Fl. Indo-Chine 3, fasc. 1 (1922) 75; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’]) 140; Ridley, Fl. Malay Penins. 2 (1923) 44; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 1 (1966) 794; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 153. **Type:** *Dentella repens* (L.) J.R.Forst. & G.Forst.

Herbs, annual or perennial, prostrate. **Stipules** persistent, interpetiolar and at least partly fused to petioles. **Leaves** opposite. **Inflorescences** pseudoaxillary and terminal, 1-flowered. **Flowers** 5-merous, bisexual; calyx usually deeply lobed, ovary portion sometimes with distinctive

flattened hairs; corolla white to pink, tube inside with hairs at least on upper part, corolla lobes much shorter than tube, valvate; stamens 5, inserted on lower half of tube, included; ovary 2-locular, ovules numerous on axile placenta, style included, stigma 2-lobed. **Fruit** indehiscent, calyx lobes persistent; seeds numerous, angular reticulate.

Distribution. About 10 species, one occurring from India and southern China through continental Southeast Asia and Malesia to Australia, the others restricted to Australia. In Singapore 1 native species.

Dentella repens (L.) J.R.Forst. & G.Forst.

(Latin *repens* = creeping, prostrate and rooting; referring to the habit)

Char. Gen. Pl. (1775) 13; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 92; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 ['1903']) 140; Pitard, Fl. Indo-Chine 3, fasc. 1 (1922) 76; Ridley, Fl. Malay Penins. 2 (1923) 44; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 1 (1966) 794; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 153; Turner, Gard. Bull. Singapore 45 (1993) 196; Turner, Gard. Bull. Singapore 47 (1997 ['1995']) 421; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 33, 174, 270. **Basionym:** *Oldenlandia repens* L., Mant. Pl. 1 (1767) 40. **Synonym:** *Hedyotis repens* (L.) Lam., Tabl. Encycl. 1, fasc. 2 (1792) 271. **Type:** *Collector unknown s.n.*, India? (lectotype LINN [Herb. Linn. no. 155.2], designated by Verdcourt, Kew Bull. 37 (1983) 545). **Fig. 13.**

Prostrate herb, short-lived or possibly perennial (see notes), often mat-forming; stems glabrous or with short hairs, often rooting at nodes. **Stipules** triangular or ovate, to 1 mm long. **Leaves:** lamina narrowly elliptic to obovate, to 10 × 5 mm, mostly a lot smaller, apex acute, base cuneate, glabrous or with a few hairs on margin and lower midrib; petioles short to subobsolete. **Flowers** in leaf axils of alternating nodes, pedicels to 2 mm; calyx with ovary portion subglobose, glabrous or with distinctive flattened hairs, lobes erect, narrowly triangular, to 1.5 mm long; corolla white, tube to 10 mm long, glabrous outside, inside with hairs, corolla lobes to 2 mm long. **Fruits** more or less globose, to 4 mm diam., if flattened hairs on calyx then these persisting on fruit, as do the calyx lobes.

Distribution. From India and southern China through continental Southeast Asia and Malesia to Oceania. Introduced in the Americas. In Singapore there are historical collections from Kallang (*Ridley s.n.*, Feb 1894, SING [SING0030038]) and Singapore Botanic Gardens (*Ridley 10132*, 1899, SING [SING0030041]), a collection from the 1930s (*Teruya 2472*, 20 May 1934, SING [SING0030037]) and more recent collections from Pepys Road (*Maxwell 83-301*, 30 Dec 1982, SING [SING0030039]) and Kampong Glam (*Lai et al. LJ259*, 6 Sep 1997, SING [SING0030102]).

Ecology. Likes floodplains and other open wet sites. In Singapore it has also been collected in urban areas, including in cracks in cement.

Provisional conservation assessment. Globally Least Concern (LC). In Singapore Least Concern (LC).

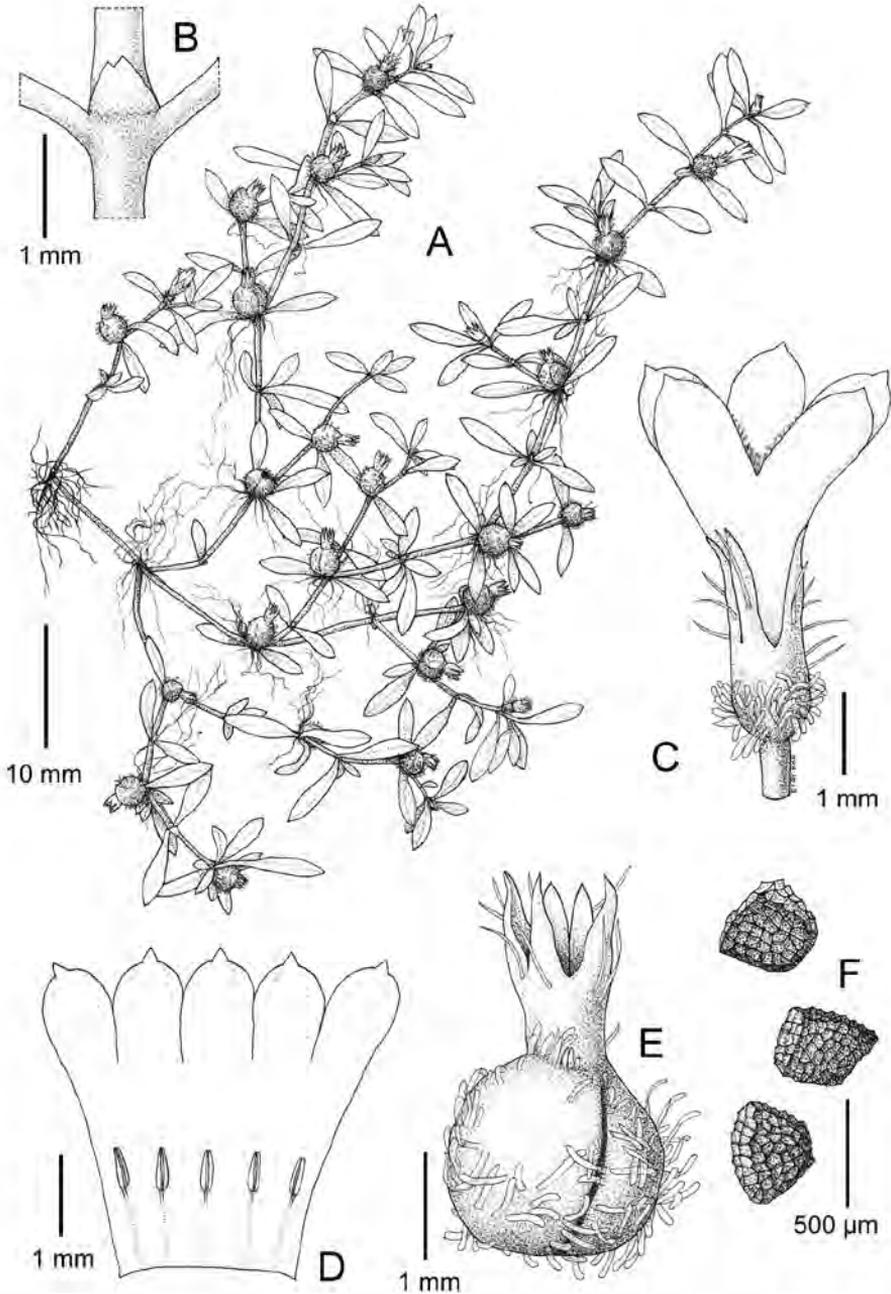


Figure 13. *Dentella repens* (L.) J.R.Forst. & G.Forst. **A.** Creeping stems and branches forming a weft-like tangle. **B.** Stipule. **C.** Flower bearing distinctive flattened hairs on calyx. **D.** Inside of cut-open corolla. **E.** Indehiscent fruit with persistent calyx lobes and flattened hairs. **F.** Seeds. (From Singapore, Bukit Batok, *Ho LCMJ* 2018-041. Drawn by E. Tay).

Notes. Whether there is only one species in Asia is debatable. Airy Shaw (Bull. Misc. Inform. Kew 1932 (1932) 289–292) recognised *Dentella serpyllifolia* Wall. ex Craib and *D. concinna* Airy Shaw as distinct from *D. repens*, but expressed doubts about both species. The glabrous fruits of *Dentella serpyllifolia* supposedly separate it from *D. repens*, but opinions vary on whether this is enough to justify a second species. At SING there are collections with hairy or glabrous fruits. When Verdcourt (Kew Bull. 37 (1983) 545) lectotypified *Dentella repens* he reduced *D. serpyllifolia* to a variety of *D. repens* stating that ‘I have compromised between Airy Shaw’s treatment and the idea of Backhuizen van den Brink, who does not recognise *serpyllifolia* at all’. *Dentella concinna* was described from a Myanmar specimen, and Airy Shaw noted the differences between it and *D. serpyllifolia* may only be due to the different habitat of the specimen. A more detailed revision of the materials than is possible here is needed, but, in the mean time, only a broad concept of *Dentella repens* is here recognised. Many additional synonyms are listed by various authors for this very widespread species.

An occasional taproot has been recorded in other parts of its range so this species may be perennial.

9. DIBRIDSONIA K.M. Wong

(Diane M. Bridson, b. 1942, botanist at Kew who provided valuable insight into the taxonomy of the *Canthium* alliance)

Reinwardtia 17 (2018) 115. **Type:** *Dibridsonia conferta* (Korth.) K.M.Wong.

Canthium auct. non Lam.: Korthals, Ned. Kruidk. Arch. 2(4) (1851) 231, p.p.; Hooker, Fl. Brit. India 3, fasc. 7 (1880) 131, p.p.; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 57, p.p.; Ridley, Fl. Malay Penins. 2 (1923) 122, p.p.; Craib, Fl. Siam. 2(1) (1932) 135, p.p.; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 1 (1966) 446, p.p.; Corner, Wayside Trees Malaya, ed. 3, 2 (1988) 625, p.p.; Wong, Arbor. Rubiac. Malaya (1988) 36; Wong, Tree Fl. Malaya 4 (1989) 340, p.p.; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 152, p.p.; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 420, p.p.

Trees. **Stipules** triangular-ovate, with a slight to pronounced median keel prolonged into an apical cusp or lobe. **Leaves** opposite and decussate on vertical stem axes but distichous on lateral (horizontal) branches; frequently with pit-domatia in the axils of secondary veins. **Inflorescences** axillary on lateral branches, pedunculate, sub-umbellate, bracts small and inconspicuous. **Flowers** functionally unisexual; corolla subrotate or broadly funnel-shaped, glabrous outside, throat with a continuous dense band of erect-spreading (becoming flexuous-crisped) moniliform hairs, the tube around the same length as the lobes, inside without a ring of stiff deflexed hairs just below the throat, corolla lobes spreading in the open flower; stamens alternate with the corolla lobes and not longer than the corolla throat hairs, anthers ovate with broad connective, suberect to spreading, inserted on short filaments at the throat; style glabrous or pubescent, stigma globose to club-shaped, with a slight basal recess; ovary with 2 (rarely 5) locules, each locule with a solitary ovule inserted near the upper part. **Fruits** obovate to obcordate-compressed (elsewhere from Singapore rarely subglobose and 5-lobed); pyrenes obovoid-compressed, ventrally plane, dorsally with a rounded ridge-like crest reaching to only halfway to the base, laterally with two rounded sub-apical extensions (‘shoulders’) sloping downwards, verrucose or minutely tuberculate. **Seeds** one in each pyrene.

Distribution. A genus of 3 species in western Malesia and the Philippines. In Singapore 1 native species.

Taxonomy. The genus was formerly misplaced in *Canthium* where the flowers or inflorescences are typically borne in the axils of normal leaves and scale- or bract-like reduced leaves are found on axillary short-shoots ('brachyblasts'; see both *Canthium* and *Canthiumera* in this account). *Dibridsonia* does not have such short-shoots or spines.

Razafimandimbison et al. (Ann. Missouri Bot. Gard. 96 (2009) 161–181) found *Dibridsonia conferta* (as *Canthium confertum* Korth.) to be sister to the *Cyclophyllum* Hook.f. clade, and that both were in turn well-distinguished from other taxa representing *Pyrostria* Comm. ex Juss. s.l. These three groups share the morphological similarity of the corolla throat being congested by moniliform hairs, and also lack a deflexed hair-ring inside the corolla tube. *Cyclophyllum* and *Pyrostria* are easily distinguished from *Dibridsonia* by their stigmatic form, which has been described as capitate with a convex base; that in *Dibridsonia* has a slight recess around the stigma base.

***Dibridsonia conferta* (Korth.) K.M. Wong**

(Latin *confertus* = crowded; referring to the fascicles of flowers in the leaf axils)

Reinwardtia 17 (2018) 116. **Basionym:** *Canthium confertum* Korth., Ned. Kruidk. Arch. 2(4) (1851) 235; Hooker, Fl. Brit. India 3, fasc. 7 (1880) 133; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 96; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 60; Ridley, Fl. Malay Penins. 2 (1923) 125; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 1 (1966) 447; Corner, Wayside Trees Malaya, ed. 3, 2 (1988) 626; Wong, Arbor. Rubiac. Malaya (1988) 42; Wong, Tree Fl. Malaya 4 (1989) 342; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 152; Turner, Gard. Bull. Singapore 45 (1993) 195; Turner, Gard. Bull. Singapore 47 (1997 ['1995']) 419; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 239; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 23, 173, 214. **Type:** *Korthals s.n.*, [Indonesia], Borneo, [Kalimantan], G. Pamatton (lectotype A [A00092452], designated by Wong et al., Reinwardtia 17 (2018) 116; possible isolectotypes K [K000763635, K000763636], L [L0000158, L0000159, L0000160, L0000161, L0000162, L0000163, L0000164]). **Fig. 14, 15.**

Plectronia viridis Merr., Philipp. J. Sci. 1, Suppl. 1 (1906) 131. **Type:** *Merrill 3945*, Philippines, Luzon, Bataan Province, Mt Mariveleo (holotype PNH, probably destroyed; lectotype US [US00138321], designated here, isolectotype K [K000763616]).

Plectronia leytensis Merr., Philipp. J. Sci., C 8 (1913) 49. **Synonym:** *Canthium leytense* (Merr.) Merr., Philipp. J. Sci. 35 (1928) 8. **Type:** *Ramos Bur. Sci. 15383*, Philippines, Leyte, Dagami, August 1912 (holotype PNH, probably destroyed; lectotype K [K 000763621], designated here, isolectotype P [P00836750]).

Tree to 18 m tall. **Stipules** triangular, 2–3 mm long. **Leaves:** lamina elliptic, 3.5–12 × 1.5–5.5 cm, apex acuminate, base cuneate, typically subcoriaceous, drying greenish, secondary veins 3–5 pairs, frequently with pit-domatia in the axils of secondary veins, tertiary veins inconspicuous; petioles 5–10 mm long. **Inflorescences** with short peduncles less than 1 mm long, subumbellate; bracts inconspicuous. **Flowers** functionally unisexual, on short pedicels 1–2.5 mm long; hypanthium c. 1–1.5 mm long in males, 2 mm long in females; calyx obconical, limb to c. 0.5 mm long with 5–6 minute triangular teeth, glabrous; corolla subrotate-cylindric,



Figure 14. *Dibrisonia conferta* (Korth.) K.M.Wong. **A.** Flowers. **B.** Pyrenes with characteristic verrucose surface. **C.** Fruiting branch. (From Singapore, MacRitchie. Photos: X.Y. Ng).

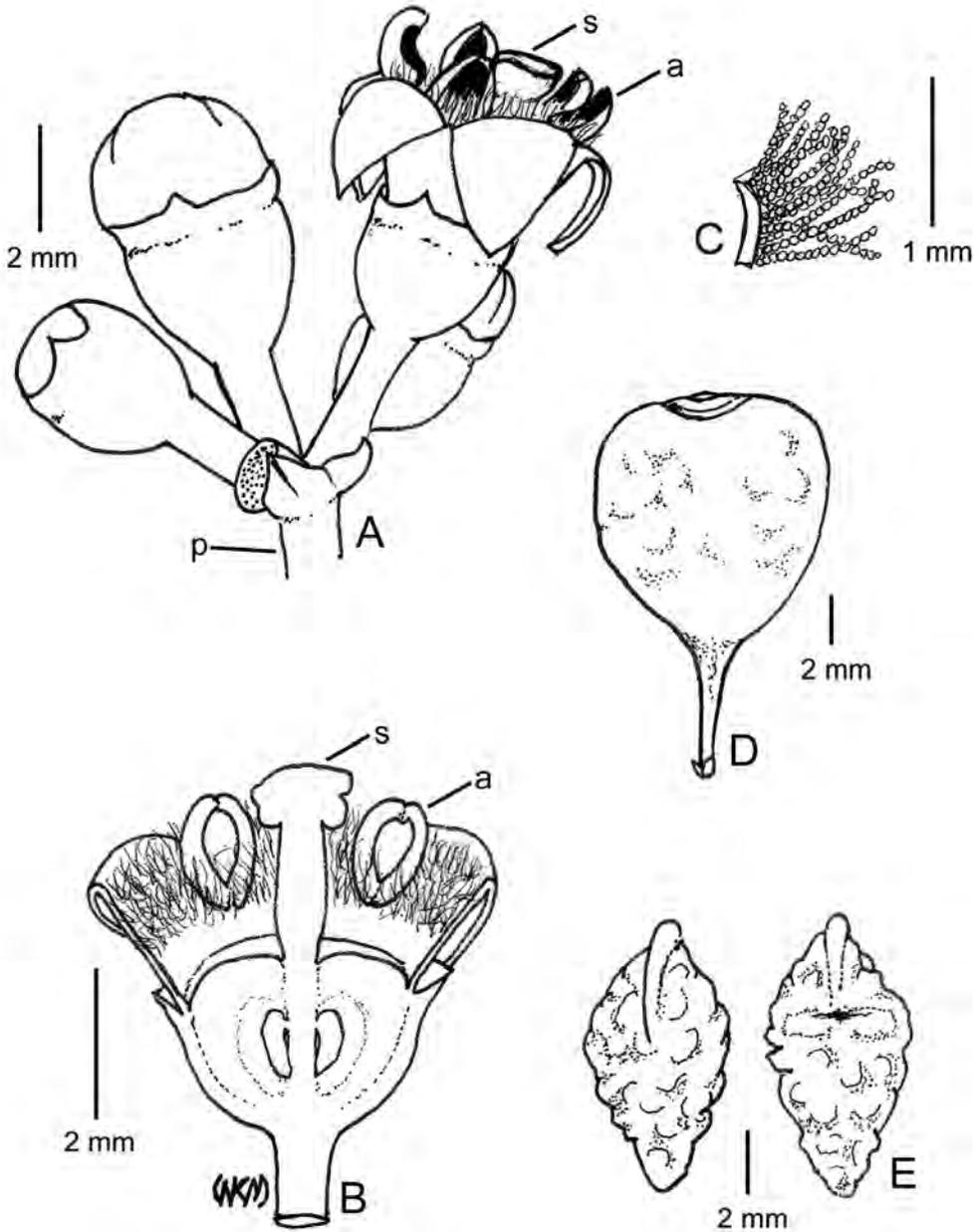


Figure 15. *Dibridsonia conferta* (Korth.) K.M. Wong. **A.** Inflorescence with one flower removed (stippled surface). **B.** Longitudinal section through female flower, showing band of moniliform hairs at the corolla throat. **C.** Corolla fragment bearing moniliform hairs. **D.** Fruit. **E.** Pyrene, dorsal (left) and ventral views. **a.** empty anther, **p.** peduncle, **s.** stigma. (From Singapore, A, B from MacRitchie; C–E from MacRitchie Samsuri SA 1363. Drawn by K.M. Wong).

glabrous outside, tube c. 1.5–2 mm long, throat with dense cover of pale erect-spreading (becoming flexuous-crisped) moniliform hairs; corolla lobes around the same length as the tube, spreading to recurved in the open flower; stamens with anthers 1–1.5 mm long (those in females empty or with scant pollen grains), filaments c. 0.5 mm long, suberect to spreading in the open flower; ovary with 2 locules (not developed in males), each locule with a solitary ovule, style 1.5–2 mm long, glabrous, stigma 0.5–1 mm long, globose to peltate, with a slight basal recess. **Fruits** obovoid, to 10 × 9 mm; pyrenes to 9.5 × 5.5 mm, obovoid, ventrally plane, the dorsal crest a low rounded ridge, from apex to halfway down the dorsal side, the shoulders sloping down, verrucose. **Seeds** one in each pyrene.

Distribution. Peninsular Thailand, Peninsular Malaysia, Sumatra, Borneo and the Philippines. In Singapore most commonly recorded from MacRitchie (*Mhd Shah & Maxwell 3962*, 9 Dec 1976, SING [SING0019968]; *Lee et al. MRR 9*, Lornie Trail, 9 Dec 2003, SING [SING0050008]) and Pulau Ubin (*Ali Ibrahim SING2008-370*, Sep 2008, SING [SING0146646]). There are also older collections from Changi (*Ridley 5910*, Feb 1894, SING [SING0019991]), Kranji, Labrador (*Maxwell 82-41*, open cliffs, 15 Feb 1982, SING [SING0019957]) and Pulau Tekong.

Ecology. Coastal areas and lowland forest.

Provisional conservation assessment. Globally not assessed. Listed (under *Canthium confertum*) as Endangered (EN/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 239) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 23, 173, 214).

10. DISCOSPERMUM Dalzell

(Greek, *disco-* = disc, *-spermum* = seed; referring to the round seeds)

Hooker's J. Bot. Kew Gard. Misc. 2 (1850) 257. **Synonym:** *Diplospora* DC. sect. *Discospermum* (Dalzell) Hook.f., Fl. Brit. India 3, fasc. 7 (1880) 123. **Type:** *Discospermum sphaerocarpum* Dalzell, lectotype designated by Ali & Robbrecht, Blumea 35(2) (1991) 296.

Xantonnea Pierre ex Pit., Fl. Indo-Chine 3, fasc. 2 (1923) 270. **Type:** Not designated.

Diplospora auct. non DC.: King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’]) 224; Ridley, Fl. Malay Penins. 2 (1923) 86, p.p.; Backer & Bakhuizen van den Brink, Fl. Java (Spermatoph.) 2 (1965) 316; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 1 (1966) 850; Corner, Wayside Trees Malaya, ed. 3, 2 (1988) 629; Wong, Tree Fl. Malaya 4 (1989) 345, p.p.

Shrubs or small trees. **Stipules** interpetiolar, shortly sheathing, often with an apical awn. **Leaves** petiolate, opposite, decussate, sometimes with domatia. **Inflorescences** axillary, paired at each node, many-flowered, strongly congested. **Flowers** 4-merous, hermaphrodite or unisexual, generally small; calyx varying from a short rim to a tube with large lobes; corolla white, saucer-shaped, lobes contorted in bud, spreading at anthesis, throat hairy; stamens inserted at top of corolla tube, exserted, filaments short; ovary 2-locular, each locule containing 3–15 ovules with axile placentation; style generally shortly exserted with bilobed stigma. **Fruits**

relatively large, indehiscent, globose to ellipsoidal, mesocarp dry, leathery to sclerified, seeds embedded in placental outgrowth. **Seeds** few to many, lenticular or discoid, with linear hilum along edge of seed, exotestal cells elongate.

Distribution. Perhaps 20 species ranging from India to the Philippines. In Singapore 1 native species.

Ecology. In a range of forest types.

Taxonomy. Ali & Robbrecht (*Blumea* 35(2) (1991) 279–305) split the Asian genera *Diplospora* DC. and *Discospermum* more than a century since these two had first been combined by Hooker. The former has small, fleshy fruits with relatively few seeds, while the latter has large, leathery fruits with many seeds embedded in copious placental tissue. A recent molecular phylogeny confirmed this separation of *Diplospora* and *Discospermum* as strongly supported (Arriola et al., *Bot. J. Linn. Soc.* 188 (2018) 132–143). The poorly known genus *Xantonnea* from continental Southeast Asia was found to be nested within *Discospermum* and therefore reduced to synonymy.

***Discospermum malaccense* (Hook.f.) Kuntze**

(of Malacca, now Melaka)

Revis. Gen. Pl. 1 (1891) 281. **Basionym:** *Diplospora malaccensis* Hook.f., *Fl. Brit. India* 3, fasc. 7 (1880) 124; King & Gamble, *J. Asiat. Soc. Bengal*, Pt. 2, *Nat. Hist.* 72(4) (1904 [‘1903’]) 225; Ridley, *Fl. Malay Penins.* 2 (1923) 86; Burkill, *Dict. Econ. Prod. Malay Penins.*, ed. 2, 1 (1966) 850; Corner, *Wayside Trees Malaya*, ed. 3, 2 (1988) 629; Wong, *Tree Fl. Malaya* 4 (1989) 346; Keng, *Concise Fl. Singapore*, vol. 1, *Gymn. Dicot.* (1990) 153; Turner, *Gard. Bull. Singapore* 45 (1993) 196; Turner, *Gard. Bull. Singapore* 47 (1997 [‘1995’]) 422; Tan et al. in Davison et al. (ed.), *Singapore Red Data Book*, ed. 2 (2008) 239; Chong et al., *Checkl. Vasc. Pl. Fl. Singapore* (2009) 35, 174, 204; Turner & Chua, *Checkl. Vasc. Pl. Sp. Bukit Timah Nat. Res.* (2011) 67. **Synonym:** *Tricalysia malaccensis* (Hook.f.) Merr., *Univ. Calif. Publ. Bot.* 15 (1929) 285. **Type:** *Griffith s.n.*, [Malaysia], Malacca, 1845 (lectotype K [K000763121], designated by Turner, *Gard. Bull. Singapore* 71 (2019) 46). **Fig. 16, 17.**

Tree to 12 m tall or more. **Twigs** terete to faintly quadrangular or laterally compressed, often drying longitudinally channelled along wide faces, drying pale straw-coloured, grey-brown or red-brown, glabrous, older twigs with shallow longitudinal cracks and some flaking. **Stipules** broadly ovate with a centrally thickened sharp apical point to 3 mm long. **Leaves:** lamina oblong-ovate, elliptic or oblong-obovate, 7–19.5 × 2.5–7.5 cm, apex acuminate, base cuneate, chartaceous to subcoriaceous, drying dark brown, mottled grey-brown or dark olive above, pale matt grey-brown below with main veins straw-coloured, lower lamina surface not drying smooth, but with irregular shallow undulations, midrib and laterals more or less flush above, though sometimes drying with one or more slightly raised ridges, midrib prominent below, often drying with a few longitudinal wrinkles, secondary veins slightly raised, 2–8 pairs, ultimately slightly decurrent, no obvious domatia, tertiary venation obscure to undetectible; petiole 5–10 mm long, 1–2.5 mm wide, channelled above with lamina margin extending down petiole to form ridges (sometimes flat-topped) on each side of the adaxial groove, drying pale



Figure 16. *Discospermum malaccense* (Hook.f.) Kuntze. **A.** Trunks of multi-stemmed individual. **B.** Leafy branches; note characteristic wavy leaf margins. **C.** Stipule. **D.** Flower buds. (From Singapore, A, B, D from Bukit Timah Nature Reserve; C from MacRitchie. Photos: Y.S. Yeoh).

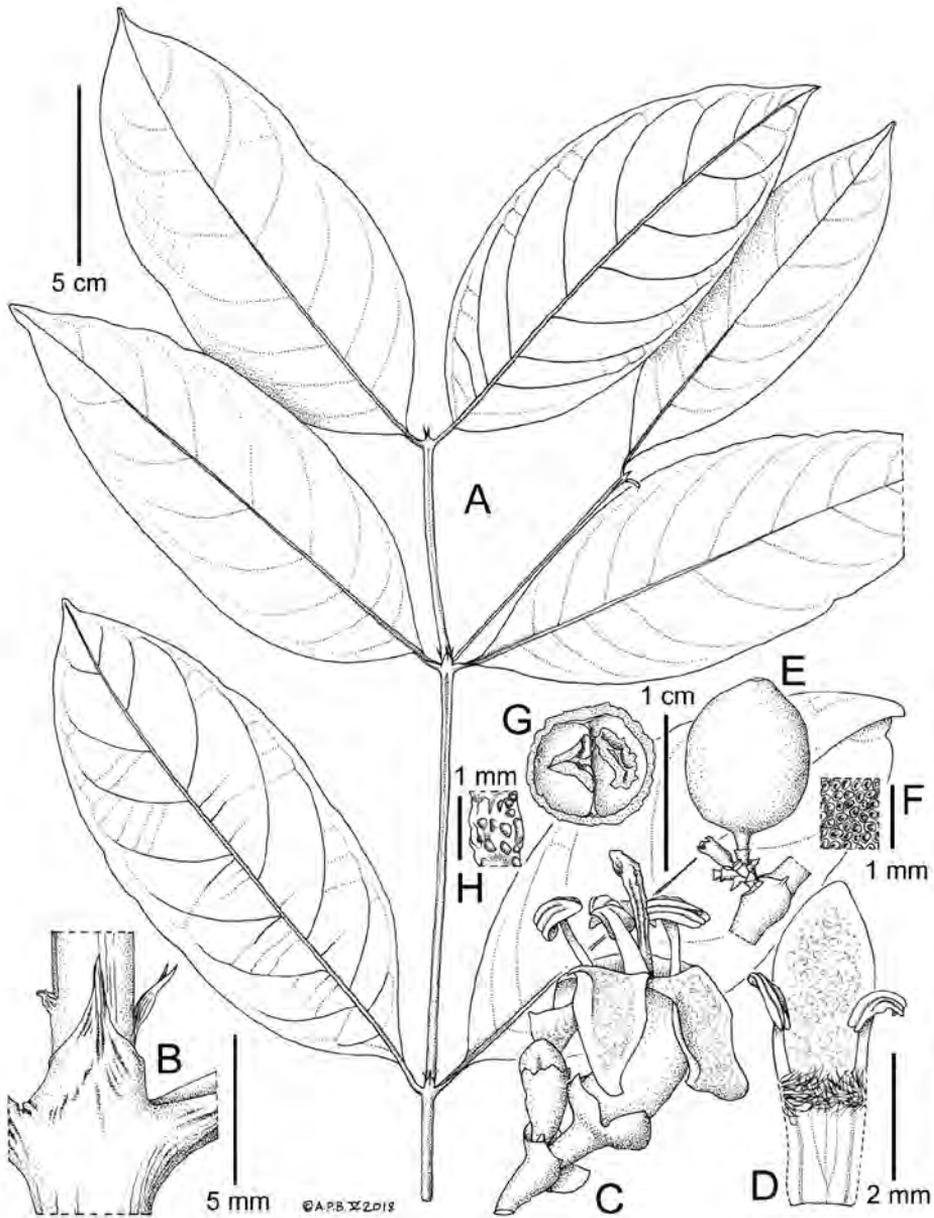


Figure 17. *Discospermum malaccense* (Hook.f.) Kuntze. **A.** Habit, sterile shoot. **B.** Stipule. **C.** Flower and young flower bud. **D.** Adaxial view of single corolla lobe and supporting section of corolla tube showing position of two stamens and indumentum in throat of corolla. **E.** Mature fruit. **F.** Magnified detail of exterior of pericarp. **G.** Transverse section of fruit. **H.** Magnified detail of transverse section of pericarp. (From Singapore, A, B from Pulau Ubin, *Gwee et al. GAT 80*; C, D without locality, *Noor I*; E, F without locality, *Liew SFN 36453*; G, H from Upper Peirce, *Maxwell 82-91*. Drawn by A. Brown, reproduced with the kind permission of the Director and the Board of Trustees, Royal Botanic Gardens, Kew).

yellow or brown with several irregular, sharp-edged longitudinal wrinkles. **Inflorescences** in leaf axils or axils of fallen leaves, solitary, short (to 3 mm long), branched axes congested with multiple flowers, apparently with connate bracts subtending groups of flowers. **Flowers** 4-merous, subsessile; pedicel c. 0.5 mm long; calyx lobes ovate, c. 1 mm long, 0.5 mm wide, slightly connate at base, apex rounded to acute, drying dark brown becoming hyaline towards margin, glabrous on both sides; corolla tube c. 2 mm long, 1 mm diam., glabrous outside, white hairs dense in mouth of corolla tube within, lobes imbricate in bud, oblong c. 2 mm long, 1 mm wide, apex rounded; stamens in mouth of corolla, filaments c. 1 mm long, anthers c. 1 mm long, white; style c. 2.5 mm long, bifid, stigmas clavate. **Fruits** yellow, ripening red, more or less sessile, globose to ovoid, 10–12 mm diam., calyx persistent, pericarp firm, with many minute globular structures, c. 1 mm thick, drying dark brown with a minutely dimpled surface, mesocarp thin, horny, drying straw-coloured, locules 2. **Seeds** several per locule, lenticular to convex, dark brown, shiny, surface minutely sculpted.

Distribution. Peninsular Malaysia, Sumatra and Borneo. In Singapore known from Bukit Timah (*Maxwell 81-46*, 26 Mar 1981, SING [SING0172348], SINU) and several places in the Central Catchment such as Pierce (*Ang & Lok s.n.*, 22 Mar 2011, SING [SING0158567], SINU), Upper Pierce (*Yeo & Ang SING2012-230*, 19 May 2012, SING [SING0176378]) and Nee Soon (*Yeo & Ang SING2012-222*, 19 May 2012, SING [SING0185301]). Sterile collections also indicate a presence on Pulau Ubin (*Ali Ibrahim & Lai SING2012-322*, 12 Jun 2012, SING [SING0179380]).

Ecology. Lowland forests including secondary forest.

Provisional conservation assessment. Globally not assessed. Listed (under *Diplospora malaccensis*) as Critically Endangered (CR/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 239) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 35, 174, 204).

Taxonomy. Ali & Robbrecht (*Blumea* 35(2) (1991) 298) excluded *Diplospora malaccensis* from *Diplospora* / *Discospermum* and indicated that it should be placed in the Hypobathreae (now Octotropideae) based on the orientation of the embryo radicle and details of the seed coat anatomy. However, in general form the species fits well within *Discospermum* and is notably similar to *Discospermum beccarianum* (King & Gamble) S.J.Ali & Robbr., which Ali & Robbrecht transferred to *Discospermum* and Arriola et al. (*Bot. J. Linn. Soc.* 188 (2018) 139) confirmed to be a close ally of the type species of *Discospermum*. *Discospermum malaccense* is here considered to be the correct name for the species.

11. EUMACHIA DC.

(Eumakhos of Kerkura, Ancient Greek who wrote a treatise on cutting roots)

Prodr. 4 (1830) 478; Taylor et al., *Candollea* 72 (2017) 289; Turner, *Edinburgh J. Bot.* 76 (2018) 23.

Synonym: *Psychotria* L. sect. *Eumachia* (DC.) A.C.Sm., Bernice P. Bishop Mus. Bull. 141 (1936) 151.

Type: *Eumachia carnea* (G.Forst) DC.

Margaris Griseb., Cat. Pl. Cub. (1866) 134, nom. illeg. non DC. (1830). **Synonyms:** *Margaritopsis* C.Wright, Anales Acad. Ci. Med. Habana 6 (1869) 146; Barrabé et al., Taxon 61 (2012) 1251. – *Uragoga* Baill. sect. *Margaritopsis* (C.Wright) Baill., Adansonia 12 (1879) 334. **Type:** *Margaritopsis acuífolia* C.Wright (= *Eumachia acuífolia* (C.Wright) Delprete & J.H.Kirkbr.).

Mapouria Aubl. ser. *Chaenotrichae* Müll.Arg., Flora 59 (1876) 496. **Type:** *Mapouria chaenotricha* (DC.) Müll.Arg., lectotype designated by Taylor et al., Candollea 72 (2017) 292 (= *Eumachia chaenotricha* (DC.) Razafim. & C.M.Taylor).

Readea Gillespie, Bernice P. Bishop Mus. Bull. 74 (1930) 35. **Type:** *Readea membranacea* Gillespie (= *Eumachia membranacea* (Gillespie) Delprete & J.H.Kirkbr.).

Chytropsia Bremek., Recueil Trav. Bot. Néerl. 31 (1934) 291. **Synonym:** *Psychotria* L. sect. *Chytropsia* (Bremek.) Steyerl., Mem. New York Bot. Gard. 23 (1972) 484. **Type:** *Chytropsia astrellantha* (Wernham) Bremek. (= *Eumachia astrellantha* (Wernham) Delprete & J.H.Kirkbr.).

Chazaliella E.M.A.Petit & Verdc., Kew Bull. 30 (1975) 268. **Type:** *Chazaliella abrupta* (Hiern) E.M.A.Petit & Verdc. (= *Eumachia abrupta* (Hiern) Delprete & J.H.Kirkbr.).

Psychotria auct. non L.: Ridley, Fl. Malay Penins. 2 (1923) 127, p.p.; Backer & Bakhuizen van den Brink, Fl. Java (Spermatoph.) 2 (1965) 328, p.p.; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1852, p.p.; Wong, Tree Fl. Malaya 4 (1989) 396, p.p.

Shrubs or small trees with raphides in tissues. **Stipules** interpetiolar, triangular to bilobed, sometimes basally fused, becoming hard and straw-coloured and generally fragmenting with age. **Leaves** opposite, often membranous to chartaceous, typically drying yellowish green; petiolate. **Inflorescences** terminal, lax to subcapitate, axes often drying yellowish green. **Flowers** 4–5-merous, often heterostylous; calyx truncate to lobate; corolla salverform to tubular, generally white or greenish, lobes valvate in bud, throat barbate; ovary bilocular with a solitary ovule basally attached in each locule. **Fruits** fleshy drupes ripening orange to red; pyrenes 2, plano- or concavo-convex, ribbed or not on dorsal wall, walls pale and horny with marginal preformed germination slits. **Seeds** 1 per pyrene, endosperm not ruminant, seed coats without alcohol-soluble pigments.

Distribution. About 90 species found throughout the tropics with the exception of Madagascar and Southern India. In Singapore 2 native species, although *Eumachia montana* is only known from one very early collection.

Ecology. Understorey of lowland and upland tropical forests.

Taxonomy. *Psychotria* L. is a very large pantropical Rubiaceae genus with probably more than 2000 species. Given its diversity, it is hardly surprising that taxa have been included in *Psychotria* that do not really belong. In revising African *Psychotria*, Petit (Bull. Jard. Bot. État Bruxelles 34 (1964) 23) provisionally excluded a group of species based largely on endocarp morphology under the provisional name *Chazaliella*. With the advent of modern molecular techniques, Andersson (Syst. Geogr. Pl. 71 (2001) 73–85) was able to demonstrate that this cryptic genus was distinct from *Psychotria* s.s. and that it was pantropical. Further research has

supported the separation of the genus, its placement in the tribe Palicoureeae rather than tribe Psychotrieae, and shown that the earliest name available for it is *Eumachia* DC. (Barrabé et al., *Taxon* 61 (2012) 1251–1268; Taylor et al., *Candollea* 72 (2017) 289–318).

Key to *Eumachia* species

1. Leafy twigs consistently with leafless nodes between those bearing leaves; leaves to 6 cm wide, secondary veins 7–9 pairs; flowers 4-merous **2. *E. rostrata***
 Leafy twigs occasionally with leafless nodes between those bearing leaves; leaves generally more than 6 cm wide, secondary veins 10–12 pairs; flowers 5-merous
 **1. *E. montana***

1. *Eumachia montana* (Blume) I.M. Turner

(Latin, *montanus* = montane, pertaining to mountains)

Edinburgh J. Bot. 76 (2018) 24. **Basionym:** *Psychotria montana* Blume, *Cat. Gew. Buitenzorg* (1823) 54; Ridley, *Fl. Malay Penins.* 2 (1923) 137; Burkill, *Dict. Econ. Prod. Malay Penins.*, ed. 2, 2 (1966) 1853; Wong, *Tree Fl. Malaya* 4 (1989) 397; Turner, *Gard. Bull. Singapore* 47 (1997 [‘1995’]) 442. **Synonyms:** *Chassalia montana* (Blume) Miq., *Fl. Ned. Ind.* 2, fasc. 2 (1857) 281. – *Uragoga montana* (Blume) Kuntze, *Revis. Gen. Pl.* 2 (1891) 961. **Type:** *Blume s.n.*, [Indonesia], Java, Megamendung? (lectotype L [L0001196], designated by Turner, *Edinburgh J. Bot.* 76 (2018) 25, specifically excluding the shoot mounted on the lower left of the sheet).

Psychotria expansa Blume, *Bijdr. Fl. Ned. Ind.*, pt 16 (1826–1827) 963. **Synonym:** *Chassalia expansa* (Blume) Miq., *Fl. Ned. Ind.* 2, fasc. 2 (1857) 280. **Type:** *Blume s.n.*, [Indonesia], Java (lectotype L [L0001195], designated by Sohmer, *Bishop Mus. Bull. Bot.* 1 (1988) 320).

Psychotria umbellata Korth., *Ned. Kruidk. Arch.* 2(4) (1851) 245, nom. illeg. non Thonning (1827), nec Vellozo (1829). **Synonym:** *Uragoga acutifolia* Kuntze, *Revis. Gen. Pl.* 2 (1891) 954. **Type:** *Korthals s.n.*, [Indonesia], Sumatra (lectotype L [L.2952601], designated by Turner, *Edinburgh J. Bot.* 76 (2018) 25).

Psychotria bantamensis Miq., *Fl. Ned. Ind.* 2, fasc. 2 (1857) 288. **Type:** *Junghuhn s.n.*, [Indonesia], Java, zuidkust van Bantam (lectotype L [L0281706], designated by Turner, *Edinburgh J. Bot.* 76 (2018) 25).

Psychotria viridissima Kurz, *J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist.* 41 (1872) 315. **Type:** *Kurz s.n.*, Burma [Myanmar], Pegu, Toukyeghat, Chymenah evergreen forest (lectotype K [K000031773], designated by Turner, *Edinburgh J. Bot.* 76 (2018) 25; isolectotype CAL).

Psychotria montana Blume var. *tabacifolia* Hook.f., *Fl. Brit. India* 3, fasc. 7 (1880) 174; Ridley, *J. Straits Branch Roy. Asiat. Soc.* 33 (1900) 98. **Type:** *Wallich s.n.* [EIC 8334], Singapore, 1822 (lectotype K-W [K001125265], designated by Turner, *Edinburgh J. Bot.* 76 (2018) 25).

Psychotria montana Blume var. *leiopyrena* Valetton, *Icon. Bogor.* 3 (1908) 191. **Type:** *Koorders 25966* (syntype n.v.), *Koorders 31650* (syntype n.v.), *Koorders 34822* (syntype n.v.), *Koorders 34823* (syntype n.v.), [Indonesia], Java, Mt Oenganran.

Shrub. **Twigs** frequently hollow, drying pale straw-coloured to light brown, finely longitudinally striate, youngest parts often darker and sometimes with scattered pale, erect, very short hairs. **Leaves:** lamina elliptic to obovate, 19–28 × 5–13 cm, apex shortly acuminate, base cuneate to obtuse, membranous to thinly chartaceous, drying green or grey-green, midrib flush to slightly raised above in dry leaves, secondary veins flush to very slightly raised, glabrous above; midrib prominent below with scattered short erect pale hairs, secondary veins raised; secondary veins 10–12 pairs, arching forward and looping within margin, reticulations generally distinct, particularly from below; petiole 1–3 cm long, c. 2 mm wide, with lamina margin decurrent forming a very narrow flange down each side almost to the base, sometimes with tiny erect pale hairs. **Inflorescences** terminal, pedunculate, peduncle, 1–2(–4) cm long, with generally 7–8 main branches decreasing in length distally giving a flat-topped structure to the inflorescences, each branch bearing head-like conglomerations of flowers arising from repeated close branching distally, inflorescence axes drying laterally compressed, angled, longitudinally striate, with tomentum of short, erect pale hairs. **Flowers** pedicellate; pedicel plus hypanthium c. 1 mm long, with erect pale hairs; calyx 5-merous, calyx tube c. 0.5 mm long, calyx lobes c. 0.4 × 0.8 mm, with scattered very short pale hairs outside; corolla tube c. 3 mm long, corolla lobes c. 2 mm long, 1–1.3 mm wide. **Fruits** drying brown, irregularly ovoid 8–9 mm long, 5–6 mm wide, drying ridged, stalk to 1 mm long; pyrenes 2, drying straw-coloured, c. 9 × 6 × 3 mm, inner face concave, readily detaching around edge from outer convex face with has two faint but sharp-edged ridges centrally.

Distribution. India to Malesia. The only record for Singapore comes from a Wallich collection that lacks more precise locality details (*Wallich s.n.* [EIC 8334], 1822, K-W [K001125265]).

Ecology. Lowland and montane forests.

Provisional conservation assessment. Globally not assessed. In Singapore presumed Nationally Extinct.

2. *Eumachia rostrata* (Blume) I.M.Turner

(Latin, *rostratus* = beaked, hooked, curved; unclear as to what this refers)

Edinburgh J. Bot. 76 (2018) 25. **Basionym:** *Psychotria rostrata* Blume, Bijdr. Fl. Ned. Ind., pt 16 (1826–1827) 961; Ridley, Fl. Malay Penins. 2 (1923) 134; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1853; Wong, Tree Fl. Malaya 4 (1989) 397; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 160; Turner, Gard. Bull. Singapore 45 (1993) 203; Tan et al., Gard. Bull. Singapore, Suppl. 3 (1995) 48; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 442; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 73, 176, 210; Turner & Chua, Checkl. Vasc. Pl. Sp. Bukit Timah Nat. Res. (2011) 71. **Synonyms:** *Chassalia rostrata* (Blume) Miq., Fl. Ned. Ind. 2, fasc. 2 (1857) 281; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 134; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 99. – *Uragoga rostrata* (Blume) Kuntze, Revis. Gen. Pl. 1 (1891) 300. **Type:** *Blume s.n.*, [Indonesia], Java (lectotype L [L.2944787]), designated by Turner, Edinburgh J. Bot. 76 (2018) 25). **Fig. 18.**

Polyozus acuminata Blume, Bijdr. Fl. Ned. Ind., pt 16 (1826–1827) 948. **Type:** *Blume s.n.*, [Indonesia], Java (lectotype L [L.2944703]), designated by Turner, Edinburgh J. Bot. 76 (2018) 25).

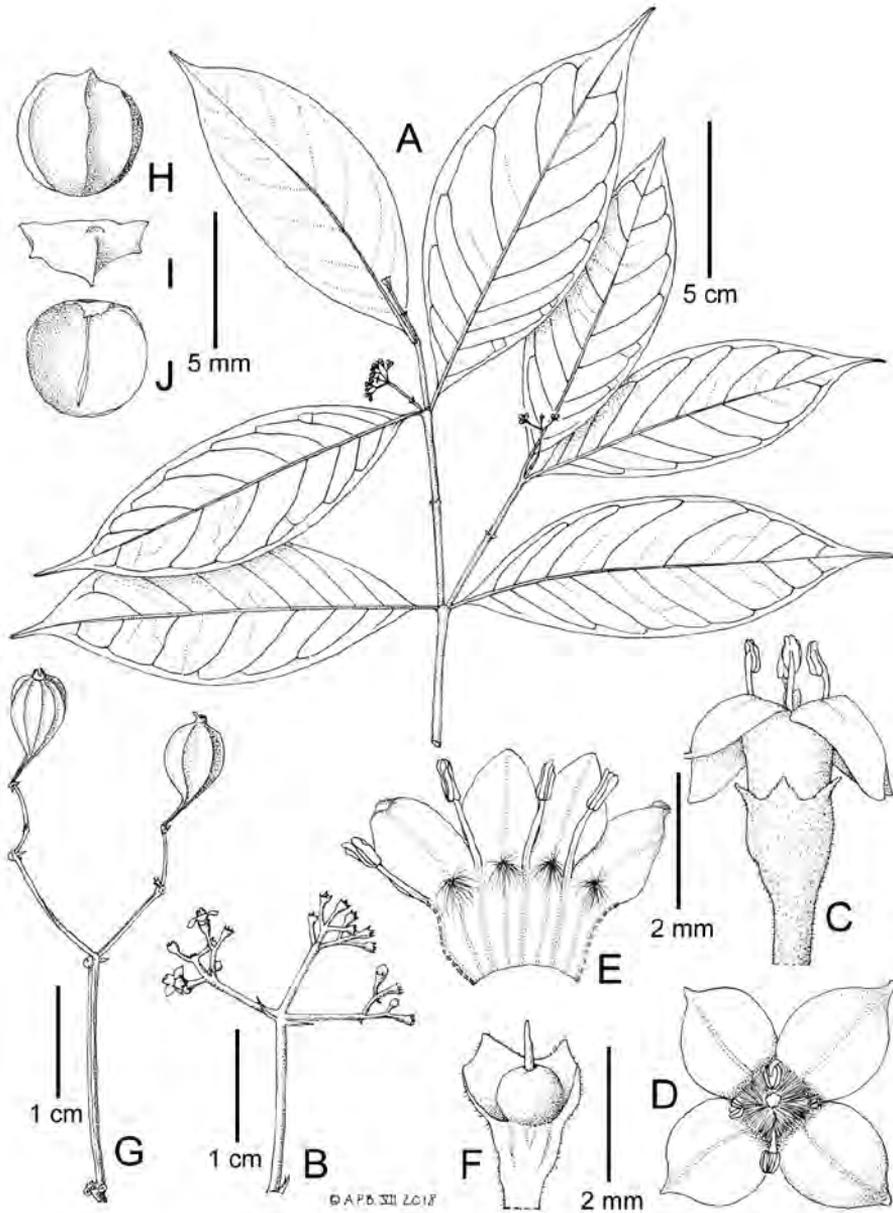


Figure 18. *Eumachia rostrata* (Blume) I.M.Turner. **A.** Habit. **B.** Inflorescence (from photograph). **C.** Flower, side view (from photograph). **D.** Flower, front view (from photograph). **E.** Corolla opened out with stamens attached. **F.** Longitudinal section of base of flower including calyx, disk and style. **G.** Two fruits on lax infructescence. **H.** Pyrene, dorsal face. **I.** Pyrene, apical view. **J.** Pyrene, ventral face, strongly concave. (From Singapore, A from Bukit Timah Nature Reserve, *Ridley s.n.* [SING0012160]; E, F from MacRitchie, *Yeoh SING2012-501*; G–J from Mandai, *Yee et al. SING2012-339*. Drawn by A. Brown, reproduced with the kind permission of the Director and the Board of Trustees, Royal Botanic Gardens, Kew).

Polyzus latifolia Blume, Bijdr. Fl. Ned. Ind., pt 16 (1826–1827) 948. **Synonym:** *Chassalia rostrata* (Blume) Miq. var. *latifolia* (Blume) Miq., Ann. Mus. Bot. Lugduno-Batavi 4, fasc. 7 (1869) 203. **Type:** *Blume 1646*, [Indonesia], Java (lectotype L [L.2944716], designated by Turner, Edinburgh J. Bot. 76 (2018) 26, restricted to the large-leaved shoot, the apex of which reaches highest on the sheet).

Psychotria tetrandra Blume, Bijdr. Fl. Ned. Ind., pt 16 (1826–1827) 961. **Type:** *Blume s.n.*, [Indonesia], Java, Gunong Seribu (lectotype L [L.2944702], designated by Turner, Edinburgh J. Bot. 76 (2018) 26).

Shrub to 1.5 m tall. **Twigs** apparently hollow, drying pale brown or yellow-brown, glabrous, finely longitudinally striate, with a leafless node between nodes bearing leaves. **Stipules** tiny, broadly triangular, 1–1.5 mm long, drying pale brown and chaffy. **Leaves:** lamina generally elliptic with variation to ovate-elliptic and obovate-elliptic, 7–17.5 × 2–6 cm, not infrequently asymmetric, base cuneate, apex acuminate, acumen slender, membranous to chartaceous, typically drying greenish with contrasting straw-coloured venation, glabrous (occasionally tiny erect hairs are found along the midrib below but they require high-power magnification to see), midrib slightly sunken above in dry leaves, secondary veins flush to slightly sunken above, midrib and secondary veins prominent below, secondary veins 7–9 pairs arching forward and looping distinctly within margin, reticulations distinct from below at least; petiole 7–17 mm long, 1 mm wide. **Inflorescences** terminal, pedunculate, peduncle 10–24 mm long at antheses, primary branches 3 or 4, to 12 mm long at anthesis, branching twice more fairly regularly giving an open arrangement of flowers, inflorescence axes slender, more or less glabrous, longitudinally striate. **Flowers** pedicellate, more or less glabrous externally; pedicel 1–2 mm long, 0.2–0.3 mm wide; calyx tube 0.5–0.7 mm long, c. 1 mm wide at mouth, calyx lobes 4, triangular, c. 0.6 × 0.6 mm, widely spaced; corolla tube c. 1 mm long, c. 0.8 mm wide, corolla lobes ovate, c. 1 mm long, 0.7 mm wide at base. **Fruits** obovoid, c. 6.5 mm long, 5–5.5 mm diam., drying longitudinally ridged but otherwise quite smooth, pale brown to dark brown, fruit stalk to 1–3 mm long, c. 0.3 mm wide; pyrenes 2, obovate in outline, c. 7 × 5 × 3 mm, with 3 ridges on convex face, otherwise surface smooth, pyrene wall thin and horny; flat (or slightly concave) and convex faces not attached.

Distribution. Thailand to Sumatra and Java. In Singapore it is still found in MacRitchie (*Yeoh SING2012-501*, 23 Nov 2012, SING [SING0192210]), Mandai (*Yee SING2012-339*, 29 Jul 2012, SING [SING0179382]) and Bukit Timah (*Samsuri SA 902*, 7 Feb 1974, SING [SING0064262]). Ridley collected it from many other locations in Singapore including Changi, Punggol, Kranji, Pulau Ubin and the Singapore Botanic Gardens' Rain Forest.

Ecology. Lowland forest.

Provisional conservation assessment. Globally not assessed. Listed (under *Psychotria rostrata*) as Critically Endangered (CR/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 73, 176, 210).

12. GAERTNERA Lam.

(Joseph Gaertner, 1732–1791, German professor of medical anatomy and botany)

Tabl. Encycl. 1, fasc. 2 & 3 (1792) 379, t. 167, nom. cons., non Schreb. (1789), nec Medik. (1789), nec Neck. (1790), nec Retz. (1791); Clarke in Hooker, Fl. Brit. India 4, fasc. 10 (1883) 91; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 74(2) (1908) 622 (sub Loganiaceae); Ridley, Fl. Malay Penins. 2 (1923) 426 (sub Loganiaceae); Van Beusekom, Blumea 15(2) (1968 [‘1967’]) 359; Wong, Arbor. Rubiac. Malaya (1988) 58; Wong, Tree Fl. Malaya 4 (1989) 347; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 153; Puff et al., Rubiac. Thailand (2005) 110, pl. 3.1.33; Malcomber & Taylor, Ann. Missouri Bot. Gard. 96(4) (2009) 575. **Type:** *Gaertnera vaginata* Lam.

Sykesia Arn., Nova Acta Phys.-Med. Acad. Caes. Leop.-Carol. Nat. Cur. 18(1) (1836) 351. **Synonym:** *Gaertnera* Lam. subg. *Sykesia* (Arn.) Benth., J. Proc. Linn. Soc., Bot. 1 (1857) 112. **Type:** *Sykesia koenigii* Arn., nom. illeg. superfl. (= *Gaertnera vaginans* (DC.) Merr.).

Treelets or shrubs. **Leaves** subsessile to petiolate, decussate. **Stipules** fused partly or wholly into a tubular structure, either cylindrical and closely clasping the twig or flared outwards at the apex and loosely clasping the twig, or somewhat deeply cleft along one or both interpetiolar medians, typically with 4 ribs or wings extending longitudinally from the 4 apical lobes (teeth) usually present at the apex down to and around the petiole bases, the apical lobes sometimes well separated as two opposite pairs in the axillary positions. **Inflorescences** terminal to normal leafy shoots or sometimes short axillary shoots, or less commonly axillary or supra-axillary, commonly cymose. **Flowers** 4- or 5(–6)-merous, unisexual or bisexual and heterodistylous; calyx limb cup-shaped, subtruncate to distinctly lobed; corolla commonly white or sometimes pink, commonly salverform to infundibular, outside glabrous or hairy, the tube inside glabrous or hairy, lobes narrowly triangular-ovate; stamens inserted in corolla tube, anthers narrowly oblong, dithecal, longitudinally dehiscent, sessile or on conspicuous filaments, below the stigma and included to only partially exerted in long-styled flowers, above the stigma and included to exerted in short-styled flowers, at the middle of the corolla tube or exerted in staminate flowers; ovary basically inferior at inception, later secondarily superior, 2-locular, with 1 erect basal ovule in each locule; style filiform, stigma 2-lobed, in males rudimentary; disk absent. **Fruits** drupes, globose to ellipsoid or obovoid; pyrenes (1–)2 per drupe, hemispherical to wedge-shaped, endosperm sometimes ruminated.

Distribution. A genus of 69 species and one presumed hybrid following the most recent revision by Malcomber & Taylor (Ann. Missouri Bot. Gard. 96(4) (2009) 575–671). Northwestern to central southeastern Africa (Senegal to Zambia), Madagascar, Mascarenes (Mauritius, Réunion), Sri Lanka and Southeast Asia (Thailand, Cambodia, Vietnam, Peninsular Malaysia, Sumatra, Borneo and Sulawesi). In Singapore 4 native species.

Taxonomy. *Gaertnera* has sometimes been placed in the Loganiaceae on account of its apparently superior ovaries and fruits. Igersheim et al. (Bot. Jahrb. Syst. 116(3) (1994) 401–414) have demonstrated that ovarial development is basically inferior and only secondarily superior with ensuing histological development over a shallow concave receptacle.

Key to *Gaertnera* species

1. Young stem internodes and lower leaf surface slightly to densely pale grey-brown hairy (appearing silvery green in fresh material) **1. *G. grisea***
 Young stem internodes and lower leaf surface glabrous to puberulent (appearing plain green in fresh material) 2
2. Stipules widening outwards towards their apex, the apex deeply cleft in the interpetiolar position, loosely clasping the twig **3. *G. obesa***
 Stipules cylindric-tubular, the apex subtruncate with the exception of tiny lobes (teeth), closely clasping the twig 3
3. Flowers 4-merous **4. *G. viminea***
 Flowers 5-merous **2. *G. junghuhniana***

1. *Gaertnera grisea* Hook.f. ex C.B. Clarke

(Latin, *griseus* = greyish; referring to the lower leaf surface)

in Hooker, Fl. Brit. India 4, fasc. 10 (1883) 92; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 115; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 74(2) (1908) 625; Ridley, Fl. Malay Penins. 2 (1923) 431; Van Beusekom, Blumea 15(2) (1968 ['1967']) 373; Wong, Arbor. Rubiac. Malaya (1988) 59; Wong, Tree Fl. Malaya 4 (1989) 347; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 153; Turner, Gard. Bull. Singapore 45 (1993) 197; Turner, Gard. Bull. Singapore 47 (1997 ['1995']) 422; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 239; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 43, 174, 221; Malcomber & Taylor, Ann. Missouri Bot. Gard. 96(4) (2009) 620. **Synonym:** *Sykesia grisea* (C.B. Clarke) Kuntze, Revis. Gen. Pl. 2 (1891) 425. **Type:** *Wallich s.n.* [EIC 8389], Singapore (lectotype K [K000173239], designated by Van Beusekom, Blumea 15(2) (1968 ['1967']) 373; isolecotypes BM [BM000055215], K-W [K000173238]).

Small tree or treelet, to c. 7 m tall; branches moderately to densely pale grey hairy when young. **Stipules** tubular, densely hairy, persistent on younger shoots, tube 9–20 mm, with 4 ribs extending down as narrow wings below and around the petioles, apex subtruncate with 4 triangular to linear teeth 2–4 mm long. **Leaves:** lamina elliptic, obovate or oblanceolate, 8–9 × 3–11 cm, apex acuminate or cuspidate, base cuneate to obtuse, coriaceous, upper surface glabrous, lower surface moderately to densely pale grey-brown hairy, secondary veins 7–11 pairs, prominent on lower side, domatia sometimes present; petioles 5–18 mm. **Inflorescences** terminal to axillary branches, many-flowered; peduncle 2.2–6.5 cm, branched portion 4–11.5 cm long, branched to 3–4 orders. **Flowers** 5-merous, unisexual; calyx cup-shaped, 3–4 mm wide, outside densely hairy, inside with a ring of hairs, truncate or with triangular lobes to 1 mm long; corolla salverform, white, outside densely puberulent, corolla tube 3–4.5 mm long, 1–2 mm diam., inside long-hairy at the upper part, lobes 2–3 mm long, ovate-elliptic; pistillate flowers: staminodes slightly exserted, style c. 5 mm long, stigma c. 2 mm long; staminate flowers: anthers shortly exserted, style rudimentary. **Fruits** ripening purple-black, subglobose to slightly 2-lobed, 5–7 × 5–8 mm; pyrenes hemispherical, endosperm entire.

Distribution. Peninsular Malaysia and the Riau Archipelago (Indonesia). In Singapore common in MacRitchie and Bukit Timah (*Maxwell 81-159*, 3 Jul 1981, SING [SING0030130]). Documented also in other localities such as Bukit Panjang (*Ridley 12528*, 1906, SING [SING0030052]), Sungei Murai (*Ridley 2679*, 1890, SING [SING0030065]), Choa Chu Kang (*Ridley 2674*, 1891, SING [SING0030054]), Seletar (*Gwee et al. SING2008-528*, 16 Dec 2008, SING [SING0116884]), Punggol and Changi.

Ecology. Understorey in lowland forest.

Provisional conservation assessment. Globally not assessed. Listed as Vulnerable (VU/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 239) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 43, 174, 221) but assessed here as Least Concern (LC).

Notes. Flowering in most months. The pale pubescence on the lower leaf surface and young twigs is distinctive. *Lee et al. MRR 30* (Singapore, MacRitchie, SING [SING0055842]) has ant-cartons along the midrib of some lower leaf surfaces.

2. *Gaertnera junghuhniana* Miq.

(Franz Wilhelm Junghuhn, 1809–1864, German-Dutch botanist, who served in the Dutch East Indies based in Java and Sumatra)

Fl. Ned. Ind. 2, fasc. 3 (1857) 383; Malcomber & Taylor, Ann. Missouri Bot. Gard. 96(4) (2009) 626. **Synonyms:** *Sykesia junghuhniana* (Miq.) Kuntze, Revis. Gen. Pl. 2 (1891) 425. – *Gaertnera vaginans* (DC.) Merr. subsp. *junghuhniana* (Miq.) Beusekom, Blumea 15(2) (1968 [‘1967’]) 388; Wong, Arbor. Rubiac. Malaya (1988) 61; Wong, Tree Fl. Malaya 4 (1989) 348; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 153; Turner, Gard. Bull. Singapore 45 (1993) 197, as ‘*junghuhnii*’; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 423; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 239, as ‘*junghuhnii*’; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 44, 174, 192, as ‘*junghuhnii*’. **Type:** *Junghuhn s.n.*, [Indonesia], Sumatra (lectotype L [L0537708], designated by Van Beusekom, Blumea 15(2) (1968 [‘1967’]) 385; isolectotype U [U0006010]).

Gaertnera oxyphylla Benth., J. Proc. Linn. Soc., Bot. 1 (1857) 112. **Synonyms:** *Psychotria oxyphylla* Wall., Numer. List (1847) no. 8374, nom. nud. – *Gaertnera koenigii* Wight var. *oxyphylla* (Benth.) C.B. Clarke in Hooker, Fl. Brit. India 4, fasc. 10 (1883) 91; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 115. – *Sykesia oxyphylla* (Benth.) Kuntze, Revis. Gen. Pl. 2 (1891) 425. – *Gaertnera acuminata* Benth. var. *oxyphylla* (Benth.) Ridl., Fl. Malay Penins. 2 (1923) 428. **Type:** *Wallich s.n.* [EIC 8374], Singapore, 1822 (lectotype K [K000772017], designated here; isolectotypes BM [BM000055219], K [K000772015, K000772016]).

Gaertnera acuminata Benth., J. Proc. Linn. Soc., Bot. 1 (1857) 112. **Synonym:** *Sykesia acuminata* (Benth.) Kuntze, Revis. Gen. Pl. 2 (1891) 425. **Type:** *Wallich s.n.* [EIC 8342], Singapore (lectotype K [K000772019], designated here; isolectotypes BM [BM000055205], K [K000772018]).

Small tree or treelet, to 15 m tall; branches glabrous to very sparsely hairy when young. **Stipules** tubular, glabrous or slightly hairy, sometimes persistent on younger shoots, tube 3–23 mm,

with 4 ribs extending down as narrow wings below and around the petioles, apex subtruncate with 4 triangular to linear lobes 1.5–7 mm long. **Leaves:** lamina elliptic, lanceolate, obovate or oblanceolate, 3–24 × 1–9 cm, apex acuminate or cuspidate, base cuneate to obtuse, chartaceous, upper surface glabrous, lower surface glabrous to short-hairy on the veins, densely minutely papillate and dark-spotted, secondary veins 3–11 pairs, prominent on lower side, domatia sometimes present; petioles 2–25 mm. **Inflorescences** terminal to axillary branches, few- to many-flowered; peduncle to 6.5 cm, branched portion 1.5–18 cm long, branched to 2–6 orders. **Flowers** 5-merous, unisexual; calyx cup-shaped, 2–3 mm wide, outside glabrous to sparsely short-hairy, inside with a ring of hairs, truncate or with triangular lobes to 0.7 mm long; corolla salverform, pale green to white, glabrous to sparsely short-hairy, corolla tube 2.5–5 mm long, 1.5–2.2 mm diam., inside long-hairy at the upper part, lobes 1.5–3 mm long, ovate-lanceolate; pistillate flowers: staminodes included, style 3–6 mm long, stigma 2–2.5 mm long; staminate flowers: anthers shortly exerted, style rudimentary. **Fruits** ripening purple-black, subglobose to slightly 2-lobed, 5–7 × 5–8 mm; pyrenes hemispherical, endosperm entire.

Distribution. Thailand, Peninsular Malaysia, Sumatra, Borneo (Brunei, Kalimantan and Sarawak) and Sulawesi. In Singapore only known from the otherwise unlocalised type collection of *Gaertnera oxyphylla* (Wallich s.n. [EIC 8374], 1822, BM [BM000055219], K [K000772015, K000772016, K000772017]).

Ecology. Lowland to lower montane forest up to 1500 m in the rest of its range.

Provisional conservation assessment. Globally not assessed. In Singapore presumed Nationally Extinct.

Notes. The measurements above reflect those documented for its range by Malcomber & Taylor (Ann. Missouri Bot. Gard. 96(4) (2009) 575). Apparently flowering and fruiting all year round.

3. *Gaertnera obesa* Hook.f. ex C.B. Clarke

(Latin, *obesus* = stout; referring to the branches)

in Hooker, Fl. Brit. India 4, fasc. 10 (1883) 92; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 115; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 74(2) (1908) 624; Ridley, Fl. Malay Penins. 2 (1923) 431; Van Beusekom, Blumea 15(2) (1968 [‘1967’]) 381; Wong, Arbor. Rubiac. Malaya (1988) 59; Wong, Tree Fl. Malaya 4 (1989) 347; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 154; Turner, Gard. Bull. Singapore 45 (1993) 197; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 422; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 239; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 44, 174, 215; Malcomber & Taylor, Ann. Missouri Bot. Gard. 96(4) (2009) 637. **Synonyms:** *Psychotria obesa* Wall., Numer. List (1847) no. 8328, nom. nud. **Type:** Wallich s.n. [EIC 8328], Singapore (lectotype K [K000173249], designated by Van Beusekom, Blumea 15(2) (1968 [‘1967’]) 381; isolectotype K-W [K000173251]). **Fig. 19.**



Figure 19. *Gaertnera obesa* Hook.f. ex C.B.Clarke. **A.** Habit. **B.** Stipules. **C.** Young infructescence. Inset: Flower. (From Singapore, A, B, from Nee Soon, *Leong-Škorničková et al. SING2011-140*; C (inset) from Nee Soon. *Ho et al. SING2017-673*; C (main photo) from Chestnut Nature Park. Photos: A, B, J. Leong-Škorničková; C (inset), L.M.J Chen; C (main photo), X.Y. Ng).

Small tree or treelet, to c. 2 m tall; branches glabrous when young. **Stipules** tubular, glabrous to sparsely short-hairy, persistent on some younger shoots, tube 15–50 mm, with 4 ribs extending down as conspicuous wings below and around the petioles, apex deeply incised along the interpetiolar median, each segment topped by 2 triangular lobes 2–3 mm long. **Leaves:** lamina elliptic to obovate, 20–42 × 7–16 cm, apex acute to acuminate, base cuneate to (mostly) gradually narrowed down the petiole, subcoriaceous, upper surface glabrous, lower surface glabrous and densely minutely papillate, secondary veins 9–13 pairs, prominent on lower side, domatia absent; petioles 1–25 mm. **Inflorescences** terminal to axillary branches or axillary, many-flowered; peduncle 1.5–6 cm, branched portion 1.5–4 cm long, branched to 3–5 orders. **Flowers** 5-merous, unisexual; calyx cup-shaped, 2–3 mm wide, outside glabrous to sparsely short-hairy, inside with a ring of hairs, subtruncate; corolla salverform, white, outside glabrous, corolla tube 2–3.5 mm long, 1.5–2 mm diam., inside long-hairy at the upper part, lobes 2–3.5 mm long, elliptic-lanceolate; pistillate flowers: staminodes included, style 3–3.5 mm long, stigma 1–1.5 mm long; staminate flowers: anthers included, style rudimentary. **Fruits** ripening purple-black, subglobose to slightly 2-lobed, 6–8 mm diam.; pyrenes hemispherical, endosperm entire.

Distribution. Peninsular Malaysia and Borneo (Sarawak). In Singapore documented in Nee Soon (*Samsuri et al. NES 293*, 2 Sep 2003, SING [SING0046516]), Mandai (*Yee et al. SING2012-250*, 28 May 2012, SING [SING0174854]), Upper Peirce (*Malcomber et al. 3007*, 14 May 1998, MO [MO2049724]), Chestnut (*Leong et al. SING2008-92*, 14 Apr 2008, SING [SING0106410]) and MacRitchie (*Mhd Shah & Ali MS 4177*, Thomson Ridge, 4 Feb 1982, SING [SING0046184]). Older collection localities include Jurong, Chan Chu Kang, Sungai Buloh, Ang Mo Kio and Dalvey Road.

Ecology. Understorey of lowland forest.

Provisional conservation assessment. Globally not assessed. Listed as Endangered (EN/D) in Singapore by Tan et al. (in Davison et al. (ed.), *Singapore Red Data Book*, ed. 2 (2008) 239) and Chong et al. (*Checkl. Vasc. Pl. Fl. Singapore* (2009) 44, 174, 215) but assessed here as least Concern (LC).

Notes. A Singapore collection, *Cantley's Collector 3008* (SING [SING0046183]) has intermediate characteristics between *Gaertnera obesa* and *G. grisea* and was annotated by Van Beusekom as a possible hybrid of the two (with the hairiness of *G. grisea* and leaf shape and venation of *G. obesa*). There is a well-known problem of the correct locality of Cantley collections so it is not guaranteed that this collection is from Singapore.

4. *Gaertnera viminea* Hook.f. ex C.B.Clarke

(Latin, *vimineus* = with long flexible shoots)

in Hooker, *Fl. Brit. India* 4, fasc. 10 (1883) 91; Ridley, *J. Straits Branch Roy. Asiat. Soc.* 33 (1900) 115; King & Gamble, *J. Asiat. Soc. Bengal*, Pt. 2, *Nat. Hist.* 74(2) (1908) 623; Ridley, *Fl. Malay Penins.* 2 (1923) 427; Van Beusekom, *Blumea* 15(2) (1968 [‘1967’]) 377; Wong, *Arbor. Rubiac. Malaya* (1988)

62; Wong, *Tree Fl. Malaya* 4 (1989) 348; Keng, *Concise Fl. Singapore*, vol. 1, *Gymn. Dicot.* (1990) 154; Turner, *Gard. Bull. Singapore* 45 (1993) 197; Turner, *Gard. Bull. Singapore* 47 (1997 [‘1995’]) 423; Tan et al. in Davison et al. (ed.), *Singapore Red Data Book*, ed. 2 (2008) 239; Chong et al., *Checkl. Vasc. Pl. Fl. Singapore* (2009) 44, 174, 205; Malcomber & Taylor, *Ann. Missouri Bot. Gard.* 96(4) (2009) 658. **Synonyms:** *Psychotria viminea* Wall., *Numer. List* (1847) no. 8354, nom. nud. – *Sykesia viminea* (Hook.f. ex C.B. Clarke) Kuntze, *Revis. Gen. Pl.* 2 (1891) 425. **Type:** Wallich *s.n.* [EIC 8354], Singapore (lectotype K [K000173240], designated by Van Beusekom, *Blumea* 15(2) (1968 [‘1967’]) 377; isolectotypes BM [BM000055242], CGE, G [G00369246], K-W [K000173241]).

Small tree or treelet, to c. 6 m tall (documented as flowering at c. 0.5 m height); branches glabrous or sparsely short-hairy when young. **Stipules** tubular, glabrous, persistent on some younger shoots, tube 4–5 mm long, with 4 ribs extending down as ribs or narrow wings below and around the petioles, apex subtruncate with 2–4 triangular to filiform lobes to 0.5 mm long. **Leaves:** lamina elliptic to lanceolate, 3–11 × 1–3 cm, apex caudate, base cuneate, chartaceous, upper surface glabrous, lower surface glabrous to slightly pubescent, densely minutely papillate and dark-spotted, secondary veins 5–6 pairs, prominent on lower side, domatia absent; petioles 2–11 mm. **Inflorescences** terminal to shoots, many-flowered; peduncle 1–5 cm, branched portion 1–1.5 cm long, branched to 2–4 orders. **Flowers** 4-merous, unisexual; calyx cup-shaped, 1–1.5 mm wide, outside glabrous to sparsely short-hairy, inside with a ring of hairs, teeth c. 0.5 mm long; corolla salverform, white, outside glabrous, corolla tube 2.5–3.5 mm long, 0.7–1 mm diam., inside long-hairy at the upper part, lobes 1.5–2 mm long, elliptic-lanceolate; pistillate flowers: staminodes included, style 3–4 mm long, stigma c. 1 mm long; staminate flowers: anthers shortly exerted, style rudimentary. **Fruits** ripening purple-black, subglobose to 2-lobed, 4–5 × 4–7 mm diam.; pyrenes hemispherical, endosperm entire.

Distribution. Only known from Peninsular Malaysia and Singapore. In Singapore collected from Bukit Timah (*Ridley 4828b*, 1890, BM, K, SING [SING0030155]), Bukit Mandai (*Ridley 179*, 30 Mar 1889, SING [SING0030157]), Seletar (*Goodenough 4827a*, 3 Nov 1899, SING [SING0046189]) and Pulau Ubin (*Ridley 9500*, Aug 1890, SING [SING0046192]). Other historical collections include those from Sungei Jurong, Dalvey Road, Holland Road and Changi.

Ecology. Across its range in lowland forest up to 1300 m.

Provisional conservation assessment. Globally not assessed. Listed as Critically Endangered (CR/D) in Singapore by Tan et al. (in Davison et al. (ed.), *Singapore Red Data Book*, ed. 2 (2008) 239) and Chong et al. (*Checkl. Vasc. Pl. Fl. Singapore* (2009) 44, 174, 205) but, given the lack of recent collections, it must be presumed Nationally Extinct.

13. GARDENIA J.Ellis

(Alexander Garden, 1730–1791, a Scottish naturalist)

Mentiong (Malay)

Philos. Trans. 51(2) (1761) 935, t. 23, nom. cons.; King & Gamble, *J. Asiat. Soc. Bengal*, Pt. 2, *Nat. Hist.* 72(4) (1904 [‘1903’]) 216; Ridley, *Fl. Malay Penins.* 2 (1923) 79; Sprague, *Nom. Prop. Brit. Bot.* (1929)

59, 92; Corner, Gard. Bull. Straits Settlem. 10 (1939) 46; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 1 (1966) 1074, p.p.; Wong, Gard. Bull. Singapore 35(1) (1982) 21; Corner, Wayside Trees Malaya, ed. 3, 2 (1988) 629; Wong, Arbor. Rubiac. Malaya (1988) 63; Wong, Tree Fl. Malaya 4 (1989) 348; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 154; Puff et al., Rubiac. Thailand (2005) 56, pl. 3.1.6, p.p. **Type:** *Gardenia jasminoides* J.Ellis.

Shrubs, small to medium trees. Branch tips, twigs and other parts of the plant often covered in resinous exudates. **Stipules** often fused and forming a tubular structure, generally subtruncate, semi-persistent. **Leaves** opposite; lamina usually obovate. **Flowers** bisexual, solitary, terminal; calyx smooth to often ribbed or keeled, apex truncate, toothed or lobed; corolla hypocrateriform, the tube especially conspicuous, corolla lobes typically 5–10, usually white or creamish to yellowish, often turning orange; anthers usually as many as lobes, dorsifixed and slightly exserted; ovary 1-locular, stigma club-shaped, often slightly exserted. **Fruits** thick-walled berries, subglobose, ellipsoid to obovoid, usually ridged or smooth, rarely winged, often crowned with persistent calyx remnants, often irregularly dehiscent. **Seeds** many.

Distribution. About 140 species, from Africa through East and Southeast Asia to Australia and the Pacific including Fiji and the Hawaiian islands. In Singapore 4 native species.

Uses. Several species, most notably *Gardenia jasminoides*, represented by several varieties, are cultivated for their fragrant, attractive and large flowers. Some parts of the plant, especially dried fruits, have also been traded and used in traditional medicine.

Taxonomy. *Gardenia tubifera* Wall. sensu Corner (Gard. Bull. Straits Settlem. 10 (1939) 46) is a heterogeneous complex now revised and considered to be three distinct species: *Gardenia elata* Ridl., *Gardenia subcarinata* (Corner) Y.W.Low, and *Gardenia tubifera* Wall., all also recorded for Singapore.

Notes. Owing to their size, *Gardenia* flowers are ideal for observing secondary pollen presentation (SPP). The anthers dehisce and deposit their pollen onto grooves in the terminal part of the style-stigma complex (often just considered a stigmatic head but referred to by some with a more exclusive term, the pollen presenter) even before the flower opens. Upon floral opening, the pollen is presented in an initially male phase when the actual stigma is not yet receptive (the lobes still cohering). Only later does the flower enter a female phase, with the stigma by then receptive and the pollen (mostly) no more viable or dispersed.

Key to *Gardenia* species

1. Leaves sparsely to densely pubescent below including over the lamina; calyx sheathing and covering about half to two-thirds or more of the corolla tube **2. *G. griffithii***
 Leaves glabrous below except for occasionally sparsely to densely puberulent secondary veins and midrib; calyx not distinctly sheathing and covering only the very base of the corolla tube 2
2. Calyx surface distinctly keeled **3. *G. subcarinata***
 Calyx surface smooth, not keeled or ridged 3

3. Calyx 20–33 mm long, 8–11 mm wide at the apex **1. *G. elata***
 Calyx 9–18 mm long, 5–8 mm wide at the apex **4. *G. tubifera***

1. *Gardenia elata* Ridl.

(Latin, *elatus* = tall or high; most likely referring to the height that the species reaches)

J. Straits Branch Roy. Asiat. Soc. 79 (1918) 81; Merrill, J. Straits Branch Roy. Asiat. Soc., Special No. (1921) 564; Ridley, Fl. Malay Penins. 2 (1923) 83; Low & Wong, Gard. Bull. Singapore 61 (2009) 107; Wong & Low, Edinburgh J. Bot. 68 (2011) 18. **Synonym:** *Gardenia tubifera* Wall. var. *tubifera* f. *elata* (Ridl.) K.M.Wong, Gard. Bull. Singapore 35(1) (1982) 22; Wong, Arbor. Rubiac. Malaya (1988) 67; Wong, Tree Fl. Malaya 4 (1989) 350; Turner, Gard. Bull. Singapore 45 (1993) 197. **Type:** *Ridley 11332*, Singapore, Bukit Timah, 1898 (lectotype K [K000173283], designated by Low & Wong, Gard. Bull. Singapore 61 (2009) 107; isolectotypes BM [BM001124571], SING [SING0058423]).

Randia speciosa Hook., Icon. Pl. 9 [ser. 2, 5], fasc. 1 (1851) t. 824, nom. illeg. non DC. (1830). **Synonyms:** *Gardenia speciosa* Hook.f., Fl. Brit. India 3, fasc. 7 (1880) 117, nom. illeg. non Salisb. (1796), nec Roxb. ex Wight & Arn. (1834); Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 95; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’]) 220; Ridley, Fl. Malay Penins. 2 (1923) 83. – *Gardenia lobbii* Craib, Fl. Siam. 2(1) (1932) 120. **Type:** [Published illustration] Hooker, Icon. Pl. 9 [ser. 2, 5], fasc. 1 (1851) t. 824, lectotype designated here.

Gardenia longituba Ridl., J. Bot. 72 (1934) 274. **Type:** *Fraser 164*, [Malaysia], British North Borneo [Sabah], Kudat, July 1885 (lectotype K [K000173261], designated by Turner et al., Gard. Bull. Singapore 70 (2018) 345, or possibly holotype).

Gardenia tubifera auct. non Wall.: Corner, Gard. Bull. Straits Settlement. 10 (1939) 46, p.p.

Distribution. India (Nicobar Islands), Indonesia (Sumatra, Java and Sumbawa), Peninsular Thailand, Peninsular Malaysia, Borneo (Brunei, Kalimantan and Sabah) and the Philippines.

var. *elata*

Small-sized to medium tree, to approximately 24 m tall. Branches and other parts of the plant often covered in resinous exudates; twig sparsely puberulent to glabrous. **Stipules** fused and forming a tubular structure, often subtruncate. **Leaves:** lamina oblong to obovate, 4.4–22.4 × 2.2–8.8 cm, apex acute to shortly acuminate, base cuneate to sometimes asymmetrical, chartaceous to subcoriaceous, glabrous except for sparsely puberulent midrib above as well as secondary veins and midrib below, midrib flat to ridged above, raised below, secondary veins (9–)12–19 pairs, with pubescent domatia in their axils on the lower leaf surface, tertiary veins scalariform-reticulate; petioles (5–)11–41 mm long, sparsely to densely puberulent. **Flowers** solitary; calyx 20–33 mm long, 8–11 mm wide at the apex, subtruncate to sometimes cleft or torn on one side at the apex, surface smooth, more or less glabrous at the upper half and sparsely puberulent at the lower half, sometimes with flat longitudinal markings (never raised as ribs or keels); corolla salver-shaped, corolla tube 77–138 mm long, hairy at the throat,

corolla lobes 8–10, 23–35 mm long, obovate; anthers as many as and alternating with corolla lobes, inserted at the corolla throat, dorsifixed on short or inconspicuous filaments; style glabrous, stigma club-shaped, exserted; pedicels to 4 mm long. **Fruits** globose to subglobose, 34.1–48.3 × 36.4–45.1 mm, capped with persistent calyx remains to 26 mm long.

Distribution. As for the species. In Singapore it has been collected from Bukit Timah (*Hullett 445*, Apr 1885, SING [SING0164567]; *Ridley s.n.*, 1907, SING [SING0048521]; *Ngadiman SFN 35595*, 21 Jul 1938, SING [SING0172354]) and Sungei Buloh (*Ridley s.n.*, 1891, SING [SING0030154]).

Ecology. In Singapore, as elsewhere, commonly found in lowland forests and only occasionally found in wetter sites such as mangroves (Sungei Buloh) and swampy forests.

Provisional conservation assessment. Low & Wong (Gard. Bull. Singapore 61 (2009) 110) proposed a global conservation assessment of Least Concern (LC) due to its widespread distribution. In Singapore presumed Nationally Extinct.

Taxonomy. This is the only variety of the species found in the Malay Peninsula, the other variety, *Gardenia elata* var. *longipedicellata* K.M.Wong is endemic to the island of Luzon in the Philippines.

Notes. The description above largely applies to the taxon as known for the Malay Peninsula in general, as there are only a few flowering and fruiting collections for Singapore.

2. *Gardenia griffithii* Hook.f.

(William Griffith, 1810–1845, English botanist known for his work in India and Malaya)

Fl. Brit. India 3, fasc. 7 (1880) 118; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 95; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’]) 221; Ridley, Fl. Malay Penins. 2 (1923) 83; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 1 (1966) 1076; Wong, Gard. Bull. Singapore 35(1) (1982) 25; Corner, Wayside Trees Malaya, ed. 3, 2 (1988) 631; Wong, Arbor. Rubiac. Malaya (1988) 65; Wong, Tree Fl. Malaya 4 (1989) 349; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 154; Turner, Gard. Bull. Singapore 45 (1993) 197; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 423; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 239; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 44, 174, 192. **Type:** *Griffith s.n.* [Kew Distribution 2821], [Malaysia], Malacca (lectotype K [K000173266], designated here; isolectotype K [K000173265]). **Fig. 20.**

Gardenia griffithii Hook.f. var. *maingayi* Hook.f., Fl. Brit. India 3, fasc. 7 (1880) 118; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’]) 221; Ridley, Fl. Malay Penins. 2 (1923) 84. **Type:** *Maingay 2645* [Kew Distribution 841], [Malaysia], Malacca, 24 July 1867 (lectotype K [K000173264], designated here; isolectotype K [K000173263]).

Gardenia dolichantha Merr., Pap. Michigan Acad. Sci. 23 (1938 [‘1937’]) 196. **Type:** *Rahmat 3925*, [Indonesia], Sumatra, Laboehan Batoe, Kota Pinang, Goenoeng Si Papan (lectotype NY [NY00131574],



Figure 20. *Gardenia griffithii* Hook.f. **A.** Flower with the calyx completely enveloping the corolla tube. **B.** Flower with calyx tube cut open, showing colleters at the base. (From Peninsular Malaysia. Photos: K.M. Wong).

designated here; isoelectotypes A [A00092884, A00092885], F [catalogue number V0069267F], K [K000173276], L [L0000361], MICH [MICH1000034A], S [Herb no. S-G-2783], US [US00169800]).

Shrub or small tree, to 8 m tall. Branches and other parts of the plant often covered in resinous exudates. **Stipules** fused and forming a tubular structure, often subtruncate. **Leaves:** lamina obovate, 10.3–20.4 × 4.7–8.7 cm, apex shortly acute, base obtuse, subcoriaceous to coriaceous, glabrous above except for sparsely pubescent midrib, sparsely to densely pubescent below, especially on veins and midrib, midrib flat to raised above, raised below, secondary veins 11–15 pairs, with densely pubescent domatia in their axils on the lower leaf surface, tertiary veins scalariform-reticulate; petioles 6–15 mm long, sparsely pubescent. **Flowers** solitary; calyx 84–95 mm long, 23–31 mm wide at the apex, trumpet-shaped, sheathing and slightly flaring at the top, covering about half to two-thirds or more of the corolla tube, surface smooth, mostly glabrous, margins more or less lobed; corolla salver-shaped, corolla tube 115–125 mm long, hairy at the throat, corolla lobes c. 10, 35–50 mm long, spatulate; anthers as many as and alternating with corolla lobes, inserted at the corolla throat, dorsifixed on short or inconspicuous filaments; style glabrous, stigma club-shaped, exserted; pedicels subsessile. **Fruits** 48.6–52.6 × 44.6–47.1 mm, subglobose, capped with large persistent calyx remains to 75 mm long.

Distribution. Thailand, Peninsular Malaysia, Sumatra and Borneo (Kalimantan and Sarawak). In Singapore it has been recorded from Bukit Mandai (*Ridley s.n.*, 22 May 1889, SING [SING0030144]; *Ridley* 2857, 1891, SING [SING0030145]; *Ridley* 6673, 1894, SING [SING0030142]) and Chan Chu Kang (*Hullett* 611, 21 Apr 1888, SING [SING0030143]).

Ecology. In Singapore, as elsewhere, it was recorded in swamp forests and sometimes in lowland and secondary forests.

Provisional conservation assessment. Globally not assessed. In Singapore presumed Nationally Extinct.

Notes. The description above largely applies to the species as known for the Malay Peninsula in general, as there are only a few flowering and fruiting collections for Singapore.

3. *Gardenia subcarinata* (Corner) Y.W.Low

(Latin, *sub-* = somewhat, not completely, a little, *-carinata* = keeled; referring to the calyx tube)

Gard. Bull. Singapore 61 (2009) 116. **Basionym:** *Gardenia tubifera* Wall. var. *subcarinata* Corner, Gard. Bull. Straits Settlements 10 (1939) 48; Wong, Gard. Bull. Singapore 35(1) (1982) 22; Wong, Arbor. Rubiac. Malaya (1988) 67; Wong, Tree Fl. Malaya 4 (1989) 350; Turner, Gard. Bull. Singapore 45 (1993) 197; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 44, 174, 206. **Type:** *Curtis* 686, [Malaysia], Penang, Government Hill, February 1889 (lectotype SING [SING0048397], designated here; isolectotype SING [SING0048383]). **Fig. 21.**

Gardenia resinifera auct. non Roth: *Ridley*, Fl. Malay Penins. 2 (1923) 83.

Gardenia tubifera auct. non Wall.: *Ridley*, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 95, p.p.; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’]) 219 (‘Form 2’).

Distribution. Peninsular Malaysia, Singapore and Sumatra.

var. *subcarinata*

Shrub to small tree, to 12–15 m tall. Branches and other parts of the plant often covered in resinous exudates. **Stipules** fused and forming a tubular structure, often subtruncate. **Leaves:** lamina obovate, (2.8–)8.3–14.8(–21.8) × (1.2)–2.8–4.6(–6.2) cm, apex acute to acuminate, base narrowly cuneate, subcoriaceous, glabrous on both surfaces except for densely puberulent midrib above and secondary veins and midrib below, midrib flat to slightly raised above, raised below, secondary veins 8–15(–21) pairs, with densely pubescent domatia in their axils on the lower leaf surface, tertiary veins scalariform-reticulate; petioles (3–)5–21 mm long, densely puberulent. **Flowers** solitary; calyx 6.5–10 mm long, 6–7 mm wide at the apex, surface distinctly keeled, densely puberulent, margins sometimes inconspicuously lobed; corolla salver-shaped, corolla tube 42–70 mm long, corolla lobes 6–8, 12–22 mm long, spatulate;

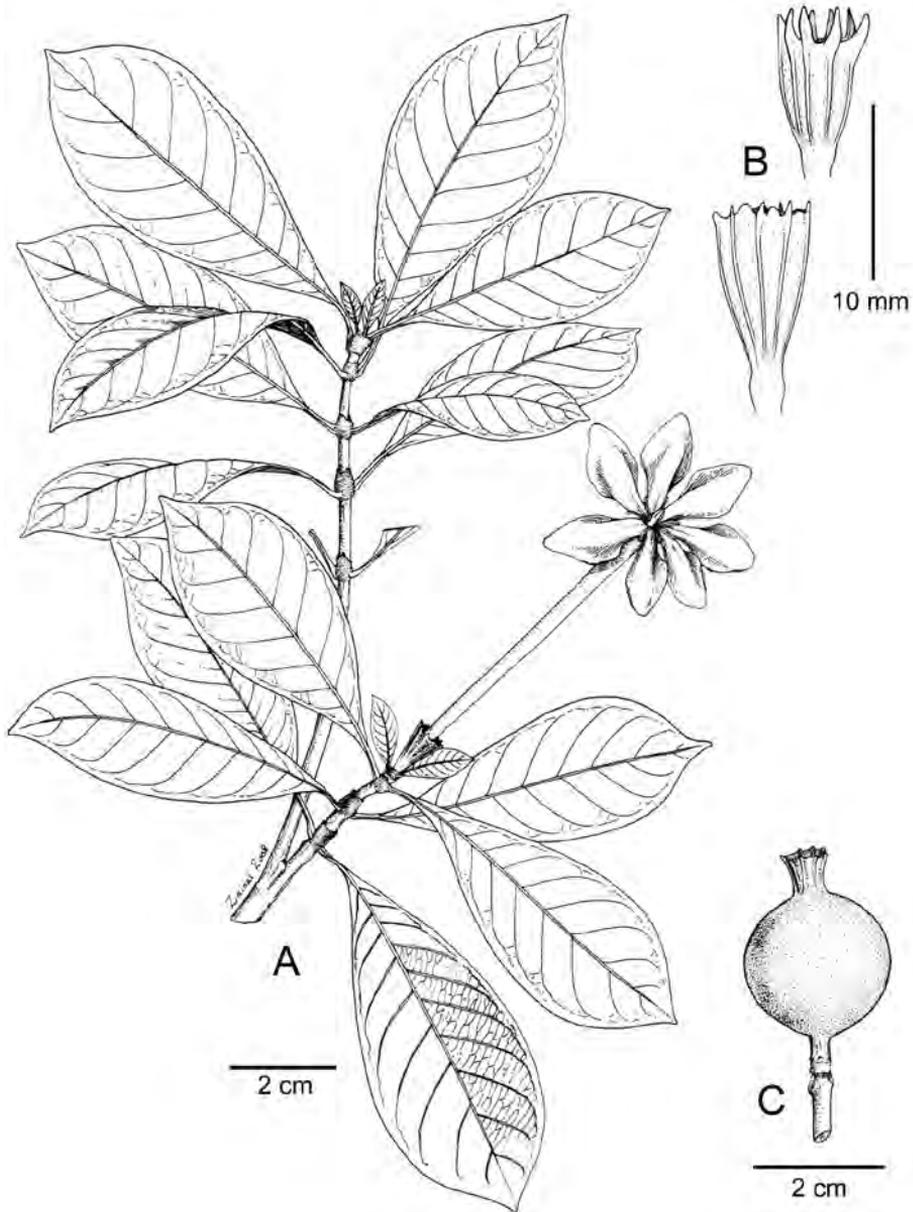


Figure 21. *Gardenia subcarinata* (Corner) Y.W.Low var. *subcarinata*. **A.** Flowering leafy branch. **B.** Calyx with pronounced (upper, less common condition) or inconspicuous (bottom, more common) lobes. **C.** Fruit with persistent calyx. (A from Peninsular Malaysia, *T. & P.* 389; B (upper) from Singapore, Bukit Timah Nature Reserve, *Ngadiman SFN 34926*; B (lower) from Peninsular Malaysia, *Zahir KEP 99132*; C from Peninsular Malaysia, *Curtis 686*. Drawn by Zainal Mustafa, reproduced with permission of Gardens' Bulletin Singapore).

anthers as many as and alternating with corolla lobes, inserted at the corolla throat, dorsifixed on short or inconspicuous filaments; style glabrous, stigma club-shaped, exerted; pedicels to 3 mm long. **Fruits** 24.3–30.2 × 26.4–29.5 mm, subglobose, capped with short persistent keeled calyx remains to 6 mm long.

Distribution. Peninsular Malaysia. In Singapore it has been collected from Bukit Timah (*Khoo KMS 91*, 27 May 2009, SING [SING0137299]; *Ngadiman SFN 34926*, 4 Apr 1938, SING [SING0172349]), Changi (*Goodenough s.n.*, 25 Jan 1890, SING [SING0030153]) and the Singapore Botanic Gardens' Rain Forest (*Ridley 2588*, 9 Dec 1889, SING [SING0030152]).

Ecology. In Singapore, as elsewhere, found in lowland and secondary forests.

Provisional conservation assessment. Low & Wong (Gard. Bull. Singapore 61 (2009) 119) proposed a global conservation assessment of Vulnerable (VU/D) due to the decline and fragmentation of its habitat. Listed (under *Gardenia tubifera* var. *subcarinata*) as Critically Endangered (CR/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 44, 174, 206).

Taxonomy. This variety of the species is endemic to the Malay Peninsula; the other variety, *Gardenia subcarinata* (Corner) Y.W.Low var. *sumatrana* Y.W.Low is endemic to Sumatra.

Notes. The description above largely applies to the taxon as known for the Malay Peninsula in general, as there are only a few flowering and fruiting collections for Singapore.

4. *Gardenia tubifera* Wall.

(Latin, *tubi-* = tube, *-fera* = bearing; referring to the long corolla tubes)

in Roxburgh, Fl. Ind. 2 (1824) 562; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 95, p.p.; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 ['1903']) 219, p.p. ('Form 1' and 'Form 3', non 'Form 2'); Ridley, Fl. Malay Penins. 2 (1923) 82; Corner, Gard. Bull. Straits Settlement. 10 (1939) 46, p.p.; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 1 (1966) 1077; Wong, Gard. Bull. Singapore 35(1) (1982) 21; Corner, Wayside Trees Malaya, ed. 3, 2 (1988) 631; Wong, Arbor. Rubiac. Malaya (1988) 66; Wong, Tree Fl. Malaya 4 (1989) 349; Turner, Gard. Bull. Singapore 45 (1993) 197; Turner, Gard. Bull. Singapore 47 (1997 ['1995']) 423. **Type:** *Wallich s.n.* [EIC 8266], Singapore, October 1822 (lectotype K-W [K001125081], designated here; isolectotypes K [K000173277, K000173278]).

Gardenia resinifera Korth., Ned. Kruidk. Arch. 2(4) (1851) 191, nom. illeg. non Roth (1821). **Type:** *Korthals s.n.*, [Indonesia], Borneo, [Kalimantan], G. Pamatton (lectotype L [L0063028], designated here; isolectotypes K [K000173271], L [L0063025, L0063026, L 0063027], LE [LE00017344]).

Shrub to small tree, to 12 m tall. Branches and other parts of the plant often covered in resinous exudates. **Stipules** fused and forming a tubular structure, often subtruncate. **Leaves:** lamina obovate, (3.1–)6.8–20.4 × (1.4–)2.9–7.7 cm, apex acute to acuminate, base cuneate, subcoriaceous to coriaceous, usually glabrous on both surfaces, rarely sparsely puberulent on the secondary veins and midrib below, midrib flat to sunken above, raised below, secondary

veins 9–16 pairs, with pubescent domatia in their axils on the lower leaf surface, tertiary veins scalariform-reticulate; petioles (2–)9–21 mm long, puberulent. **Flowers** solitary; calyx 9–18 mm long, 5–8 mm wide at the apex, subtruncate to sometimes cleft or torn on one side at the apex, surface smooth, sparsely pubescent especially at the lower half, sometimes with longitudinal markings (never ribbed or keeled); corolla salver-shaped, corolla tube 35–71 mm long, hairy at the throat, corolla lobes 6–8, 13–31 mm long, obovate to spatulate; anthers as many as and alternating with corolla lobes, inserted at the corolla throat, dorsifixed on short or inconspicuous filaments; style glabrous, stigma club-shaped, exserted; pedicels to 5 mm long. **Fruits** (20–)25–30 mm around, globose, capped with persistent calyx remains up to 13 mm long.

Distribution. Thailand, Peninsular Malaysia, Sumatra and Borneo (Kalimantan). In Singapore previously documented only in Chan Chu Kang (*Ridley s.n.*, 1895, SING [SING0030146]). It was also possibly cultivated in the ‘Zoo Nursery’ at Mandai (*Tay s.n.*, 18 Sep 1993, SING [SING0015537]).

Ecology. Elsewhere, commonly found in swampy forests (such as in Chan Chu Kang) and rarely found in drier sites such as lowland forests.

Provisional conservation assessment. Low & Wong (Gard. Bull. Singapore 61 (2009) 124) proposed a global conservation assessment of Vulnerable (VU/D) due the widespread decline and fragmentation of its habitat. In Singapore presumed Nationally Extinct.

14. GARDENIOPSIS Miq.

(Greek, *gardenio-* = pertaining to *Gardenia* J.Ellis, *-opsis* = sight, indicates resemblance; similar to *Gardenia*)

Ann. Mus. Bot. Lugduno-Batavi 4, fasc. 8 (1869) 250; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 63; Ridley, Fl. Malay Penins. 2 (1923) 111; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 1 (1966) 1077; Wong, Arbor. Rubiac. Malaya (1988) 68; Wong, Tree Fl. Malaya 4 (1989) 350; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 154. **Type:** *Gardeniopsis longifolia* Miq.

Shrub or treelet. **Stipules** ovate to lanceolate, conspicuous. **Leaves** in (sub-)decussate pairs alternating with leafless nodes. **Flowers** axillary, sessile in leaf axils or at leafless nodes, bisexual; calyx 5-lobed; corolla salver-shaped, with 5 lobes contorted to the right in the bud; stamens 5, inserted at the base of the corolla tube and included within, anthers basifixed; style stout-cylindric; stigma fusiform, 2-lobed, included within the corolla tube; ovary 2-locular; ovules 1 in each ovary locule, attached to the septum. **Fruits** sessile. **Seeds** usually 2, shaped like longitudinal halves of an ellipsoid.

Distribution. A genus of 1 species in Peninsular Thailand, Peninsular Malaysia, Singapore, Sumatra and Borneo (Sarawak).

Ecology. Lowlands to montane forest.

Gardeniopsis longifolia Miq.

(Latin, *longi*- = long, *-folia* = leaves; with long leaves)

Ann. Mus. Bot. Lugduno-Batavi 4, fasc. 8 (1869) 250; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 94; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 63; Ridley, Fl. Malay Penins. 2 (1923) 112; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 1 (1966) 1077; Wong, Arbor. Rubiac. Malaya (1988) 68; Wong, Tree Fl. Malaya 4 (1989) 350; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 154; Turner, Gard. Bull. Singapore 45 (1993) 197; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 423; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 44, 174, 192. **Type:** *Korthals s.n.*, [Indonesia], Sumatra (lectotype L [L0057910], designated here; isolectotypes L [L0057908, L0057909, L0057911, L0057912, L0057913, L0057914, L0057915, L0057916, L0057917], LE [LE00017509], U [U0044342, U0044343, U0044344, U0044345]). **Fig. 22.**

Shrub or treelet to about 8 m tall. Twigs with 1–several leafless flowering nodes marked by persistent annular stipular scars immediately distal to every 1–2 leafy nodes. **Stipules** ovate to lanceolate, 5–50 mm long, conspicuously overlapping at the tips of young shoots but later caducous. **Leaves:** lamina obovate to oblanceolate, 15–40 × 3–9 cm, apex caudate, base narrowly tapering, coriaceous, glabrous, secondary veins 12–22 pairs, impressed on the upper leaf surface, prominent on the lower, tertiary veins reticulate-tessellate (patterned like a random mosaic arrangement of angular tiles), distinct, often impressed on the upper leaf surface, slightly prominent; petioles 5–20 mm long. **Flowers** 1–2 developing in leaf axils or at 1–several leafless nodes immediately distal to leafy nodes, sessile; calyx 1–2 mm long, glabrous, with 5 ovate to triangular lobes, each 1–3 mm long; corolla salver-shaped, pink turning white, corolla tube 5–10 mm long, 2–3 mm wide, glabrous outside, minutely pale hairy within, corolla lobes 5, ovate to rounded, 10–20 mm long, 8–20 mm wide, glabrous; anthers 5, 2–3.5 mm long, attached on filaments 0.5–1 mm long; style 1–1.5 mm long; stigma fusiform, 2-lobed, 2.5–4 mm long. **Fruits** obconical to ellipsoid, 10–17 × 5–10 mm when mature, smooth to strongly ribbed longitudinally, with 5 persistent enlarged calyx lobes each 3–6 mm long and 2–3 mm wide, green ripening brown. **Seeds** to 10 × 4 mm.

Distribution. As for the genus. In Singapore only recorded from Bukit Timah (Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 94; Ridley, Fl. Malay Penins. 2 (1923) 112), however, no specimens have been traced.

Ecology. Lowland forest.

Provisional conservation assessment. Globally not assessed. In Singapore presumed Nationally Extinct.

Notes. The description above includes measurements of the species throughout its range, as it had been collected but once in Singapore.



Figure 22. *Gardeniopsis longifolia* Miq. Fruits at shoot tip. (From Peninsular Malaysia. Photo: Zaharil Dzulkafly).

15. GEOPHILA D. Don

(Greek, *geo-* = earth, *-phila* = fondness for; referring to the creeping habit)

Prodr. Fl. Nepal. (1825) 136, nom. cons.; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 102; Ridley, Fl. Malay Penins. 2 (1923) 146; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 1 (1966) 1085; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 154; Puff et al., Rubiac. Thailand (2005) 176, pl. 3.4.1. **Type:** *Geophila reniformis* D. Don. (= *Geophila herbacea* (Jacq.) K. Schum.).

Small, slender, creeping herbs, glabrous or pubescent, with stems rooting, forming colonies. **Stipules** triangular. **Leaves** orbicular, reniform or ovate, base typically cordate, on long petioles. **Inflorescences** a terminal clusters of 1–4 flowers. **Flowers** bisexual, small and sessile; calyx tube obovoid, lobes 4–6, glabrous to pubescent; corolla hypocrateriform, lobes 4–6, valvate in bud, hairy; stamens equal in number to the lobes; anthers linear; filaments thin; style slender, with 2 branches; ovary 2-locular; ovules one in each locule, erect. **Fruits** fleshy, crowned by persistent calyx. **Pyrenes** 2, plano-convex.

Distribution. Pantropical, about 28 species. In Singapore 2 native species.

Ecology. Shaded, damp places in the understorey of forests, including secondary growth and vegetation near the sea.

Uses. Some species have potential use as a ground cover plant in shady places.

Key to *Geophila* species

1. Stems, leaves and petioles glabrous (petioles sometimes covered in very short hairs); lamina rotund-reniform with rounded apex, primary venation palmate with several main veins radiating from the leaf base, the central one often with distinct secondary veins; peduncles, calyces and fruits glabrous **1. G. herbacea**
Stems, leaves and petioles covered in dense, pilose hairs; lamina ovate-lanceolate with acute apex, primary venation a single midrib with secondary veins; peduncles, calyces and fruits hairy **2. G. pilosa**

1. *Geophila herbacea* (Jacq.) K. Schum.

(Latin, *herbaceus* = herbaceous; referring to the habit of the plant)

in Engler & Prantl, Nat. Pflanzenfam. 4(4) (1891) 119; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 1 (1966) 1085. **Basionym:** *Psychotria herbacea* Jacq., Enum. Syst. Pl. (1760) 16. **Synonyms:** *Geophila reniformis* D. Don, Prodr. Fl. Nepal. (1825) 136, nom. illeg. superfl. – *Geophila repens* (L.) I.M. Johnst. subsp. *reniformis* M.R. Almeida, Fl. Maharashtra 3A (2001) 16. **Type:** [Published illustration] Rheede, Hort. Malab. 10 (1690) t. 21, lectotype designated by Howard, Fl. Lesser Antilles 6(3) (1989) 416. **Fig. 23.**

Geophila reniformis D. Don var. *asiatica* Cham. & Schltldl., Linnaea 4 (1829) 137. **Synonym:** *Geophila repens* (L.) I.M. Johnst. var. *asiatica* (Cham. & Schltldl.) Fosberg, Smithsonian Contr. Bot. 45 (1980) 27;

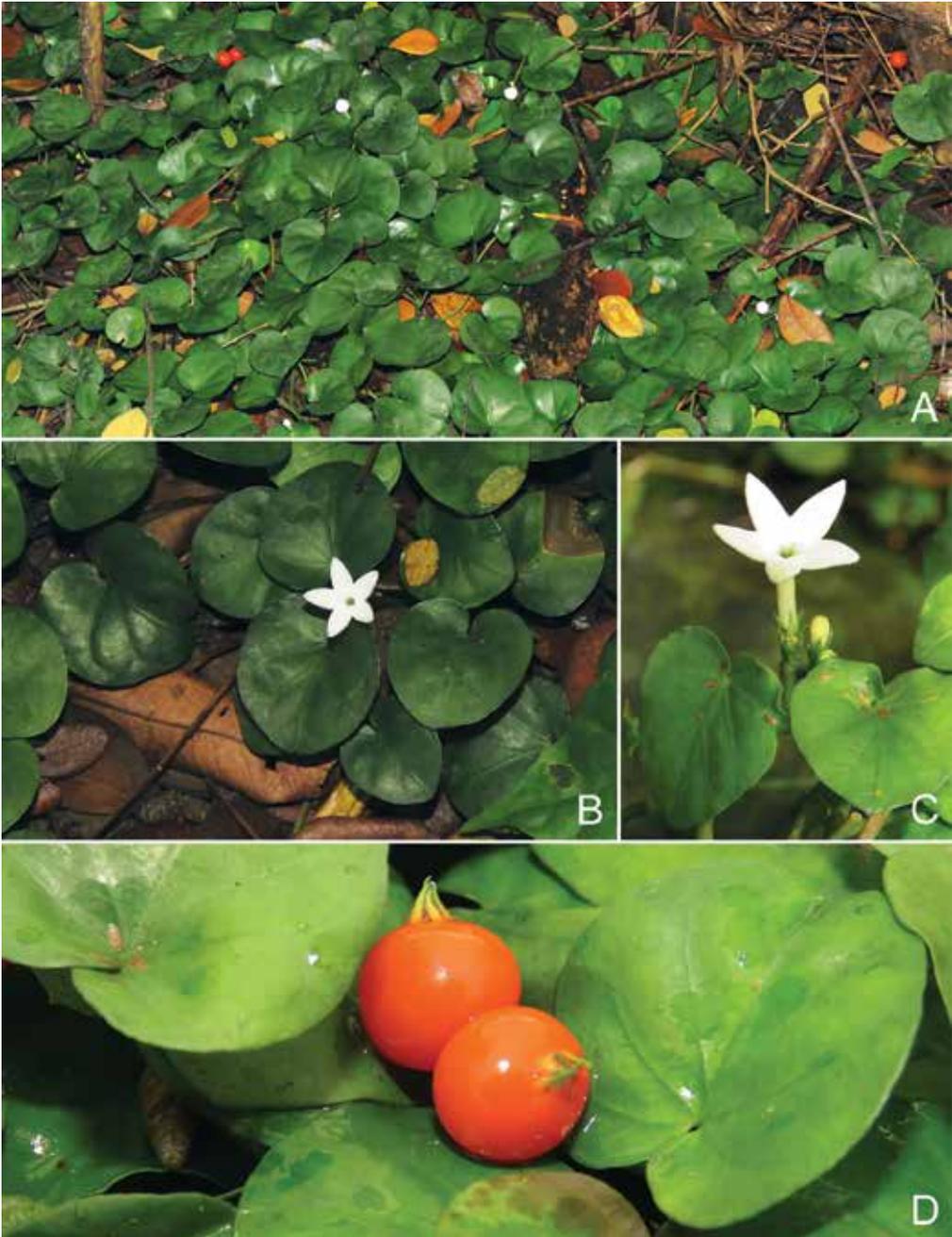


Figure 23. *Geophila herbacea* (Jacq.) K.Schum. **A.** Habit. **B.** Flowering leafy stem. **C.** Flower. **D.** Fruits. (From Singapore, Eng Neo Avenue. Photos: R.C.J Lim).

Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 424; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 44, 174, 215; Teo et al., Nat. Singapore 3 (2010) 183. **Type:** [Published illustration] Rheede, Hort. Malab. 10 (1690) t. 21, lectotype designated by Heuchert et al., Schlechtendalia 31 (2017) 68.

Geophila uniflora Hiern, Fl. Trop. Afr. 3 (1877) 221; Razafimandimbison et al., Amer. J. Bot. 101 (2014) 1102. **Type:** Schweinfurth 3856, Sudan, Niamniam-land, Nabambiso, 2 June 1870 (lectotype K [K000412333], designated here; isolectotypes BM [BM000903687], P [P00099924]).

Creepers with erect leafy branches to 52 cm long bearing the inflorescences and infructescences. **Stipules** triangular, 3 mm long. **Leaves:** lamina rotund-reniform, 1.2–3.6 × 1.1–3 cm, apex rounded, base cordate, glabrous, with 5–9 main veins radiating from the leaf base, raised on both surfaces, the central vein with 1–3 secondary veins; petioles 0.7–2 cm long, hairs short, appressed. **Inflorescences** with peduncles 2.1–4 cm long, glabrous to sometimes pubescent, bearing apical clusters of 1–3 flowers. **Flowers** with calyx campanulate, glabrous to sometimes pubescent, 5 mm long, lobes 5–6; corolla hypocrateriform, pubescent, white, tube 8 mm long, 1 mm wide, lobes 5–6, ovate with acute tips, 3 mm long, 1 mm wide at base; stamens 5, inserted in the corolla tube, included within; style 2–3 mm long, exserted from corolla tube; stigma 2-lobed. **Fruits** ovoid, 5–6 × 2–3 mm, glabrescent. **Pyrenes** plano-convex.

Distribution. Africa and Asia to Micronesia. In Singapore recorded from many urban areas such as Bukit Merah Central (*Chong s.n.*, 25 Sep 2011, SING [SING0166332]), Fort Canning Park (*Ali Ibrahim et al. AI-279*, 17 Mar 1998, SING [SING0030094]), Kampong Glam (*Chen LCMJ-159*, 20 Aug 1997, SING [SING0042206]), Makeway Avenue (*Ali Ibrahim et al. AI-287*, 19 Apr 1998, SING [SING0030093]) and Pierce Road Depot (*Hassan et al. SING2005-329*, 30 Sep 2005, SING [SING0075764]).

Ecology. Creeping herb in shaded sites in forests, forest margins and under planted trees.

Provisional conservation assessment. Globally Least Concern (LC). Listed (under *Geophila repens* var. *asiatica*) as Endangered (EN/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 44, 174, 215) but assessed here as Least Concern (LC).

Uses. Lemmens (PROSEA 12(3) (2003) 209) notes that the plant is used for medicinal purposes in Southeast Asia and is eaten as a vegetable in some parts of Africa.

Taxonomy. For a long time, Old World and New World material has all been included under *Geophila repens* (L.) I.M.Johnst., at times as different varieties of the same species. Neither Johnston (Sargentia 8 (1949) 281) nor anyone else before him designated a lectotype although the basionym, *Rondeletia repens* L., when published included two elements, represented by *Karinta Kali* in Rheede (Hort. Malab. 10 (1690) t. 21) (Indian) as well as Sloane’s Jamaican material. Howard (Fl. Lesser Antilles 6(3) (1989) 416) chose the Jamaican material as lectotype, thereby fixing the name *Geophila repens* to American material. Razafimandimbison et al. (Amer. J. Bot. 101 (2014) 1102–1126) demonstrated that the American and Asia-Pacific material were clearly resolved into different molecular clades, and that the African material identified as *Geophila uniflora* was associated with the Asia-Pacific taxon. Howard (Fl. Lesser

Antilles 6(3) (1989) 416) designated the Rheede illustration as lectotype of *Psychotria herbacea* Jacq., thus providing the oldest name at species rank for the Asia-Pacific plants. Schumann, when making the combination *Geophila herbacea*, cited *Psychotria herbacea* L. rather than the Jacquin name which was published earlier. However, while Linnaeus did not cite Jacquin directly when he published his *Psychotria herbacea* (though Jacquin is cited repeatedly in the volume), he did cite the same Rheede element and was certainly describing the same plant. It is therefore assumed that *Psychotria herbacea* L. represents an isonym of *P. herbacea* Jacq. (making *Geophila reniformis* D. Don a superfluous renaming of *Psychotria herbacea* Jacq.). Therefore, Schumann's combination in *Geophila* is effectively based on *Psychotria herbacea* Jacq. and provides the correct name at species rank for the Old World taxon. Chamisso and Schlechtendal clearly referred to Rheede (Hort. Malab. 10 (1690) t. 21) when they described their variety.

2. *Geophila pilosa* H. Pearson

(Latin, *pilosus* = pilose; referring to the indumentum of the leaves)

Hooker's Icon. Pl. 27 [ser. 4, 7], fasc. 4 (1901) pl. 2691; Ridley, J. Straits Branch Roy. Asiat. Soc. 35 (1901) 88; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 103; Ridley, Fl. Malay Penins. 2 (1923) 146; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 154, fig. 125.3; Turner, Gard. Bull. Singapore 45 (1993) 197; Turner, Gard. Bull. Singapore 47 (1997 ['1995']) 424; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 44, 174, 192. **Type:** *Ridley 9516*, Singapore, Bukit Timah, 1890 (lectotype SING [SING0030171], designated here).

Geophila hirta auct. non Korth.: Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 98.

Creepers with erect leafy branches to 40 cm long bearing the inflorescences and infructescences. **Stipules** triangular, 2 mm long. **Leaves:** lamina ovate-lanceolate, 1.8–3 × 1–2 cm, apex acute, base cordate, midrib raised on both surfaces, secondary veins 3–5 on each side, both surfaces densely pilose; petioles 1–4 cm long, densely pilose. **Inflorescences** with peduncles 2–4 cm long, densely pilose, bearing apical clusters of 1–4 flowers. **Flowers** with calyx campanulate, densely pilose, 3 mm long, lobes 5; corolla hypocrateriform, white, tube 5 mm long, 2 mm wide, lobes 5, ovate with acute tips, c. 2 mm long, c. 1 mm wide at base, densely pilose on upper surface; stamens 5, inserted in the corolla tube, included within; style 2–3 mm long, exerted from corolla tube; stigma 2-lobed. **Fruits** globose, 4–6 mm, glabrous. **Pyrenes** plano-convex.

Distribution. Malay Peninsula and Borneo. In Singapore it has been recorded from Bukit Timah (*Baker s.n.*, 8 Oct 1917, SING [SING0030170]) and MacRitchie (*Goodenough 1803*, Jan 1890, SING [SING0030169]).

Ecology. Herb creeping on forest floor.

Provisional conservation assessment. Globally not assessed. In Singapore presumed Nationally Extinct.

16. GUETTARDA L.

(Jean-Étienne Guettard, 1715–1786, French medical doctor, botanist and mineralogist)

Sp. Pl. 2 (1753) 991; Roxburgh, Fl. Ind., ed. 2, 1 (1832) 686; Hooker, Fl. Brit. India 3, fasc. 7 (1880) 126; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 52; Ridley, Fl. Malay Penins. 2 (1923) 112; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 1 (1966) 1133; Corner, Wayside Trees Malaya, ed. 3, 2 (1988) 633; Wong, Kew Bull. 43 (1988) 495; Wong, Arbor. Rubiac. Malaya (1988) 70; Wong, Tree Fl. Malaya 4 (1989) 351; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 154; Puff et al., Rubiac. Thailand (2005) 130, pl. 3.1.43. **Type:** *Guettarda speciosa* L.

Trees. **Stipules** triangular, entire. **Inflorescences** axillary, cymose, branches subtended by conspicuous linear-lanceolate bracts. **Flowers** hermaphrodite or polygamodioecious; calyx limb subtruncate; corolla infundibular, hairy outside and at the throat; corolla lobes 6–8, imbricate; stamens as many as corolla lobes, inserted at the upper part of the corolla tube; stigma knob-like, slightly exserted; ovary 4–9-locular; ovules solitary in each locule, pendulous. **Fruits** globose to depressed globose to obovoid; pyrenes 4–9, the walls fused into a hard stone.

Distribution. A genus of about 80 species, predominantly New World; 1 species from E Africa to Malesia (including Peninsular Malaysia and Singapore) and Micronesia.

Guettarda speciosa L.

(Latin, *speciosus* = showy, splendid, handsome;
referring to the overall appearance of the plant)

Sp. Pl. 2 (1753) 991; Roxburgh, Fl. Ind., ed. 2, 1 (1832) 686; Hooker, Fl. Brit. India 3, fasc. 7 (1880) 126; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 95; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 52; Ridley, Fl. Malay Penins. 2 (1923) 112; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 1 (1966) 1133; Corner, Wayside Trees Malaya, ed. 3, 2 (1988) 633; Wong, Kew Bull. 43 (1988) 496; Wong, Arbor. Rubiac. Malaya (1988) 70; Wong, Tree Fl. Malaya 4 (1989) 351; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 154, fig. 125.4; Turner, Gard. Bull. Singapore 45 (1993) 197; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 424; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 46, 174, 215. **Type:** *Collector unknown s.n.*, Java or India (lectotype LINN [Herb. Linn. no. 1121.1], designated by Wong & Verdcourt, Kew Bull. 43 (1988) 496). **Fig. 24.**

Shrub or tree to 6 m tall, frequently many-stemmed, crooked; bark smooth, grey-brown; twigs with scattered small pale lenticels. **Stipules** triangular, entire, caducous. **Leaves:** lamina broadly obovate, 9–25 × 6–20 cm, apex blunt to short-cuspidate, base rounded to cordate, slightly coriaceous, minutely appressed hairy on midrib and veins on both sides when young, becoming glabrescent, the lower leaf lamina sometimes persistently short-hairy, secondary veins 8–9 pairs, tertiary veins prominent and subscalariform between the secondaries; petiole 25–90 mm long. **Inflorescences** axillary, cymose; peduncle (2.5–)3–7.8 cm long, the branches short, to 5 mm long, subtended by pronounced linear-lanceolate bracts, crowded together with flowers at the apex. **Flowers** bisexual (Peninsular Malaysian and Singapore specimens; variably polygamodioecious in material from elsewhere), sessile; calyx cup 3–4 mm long, 3–4

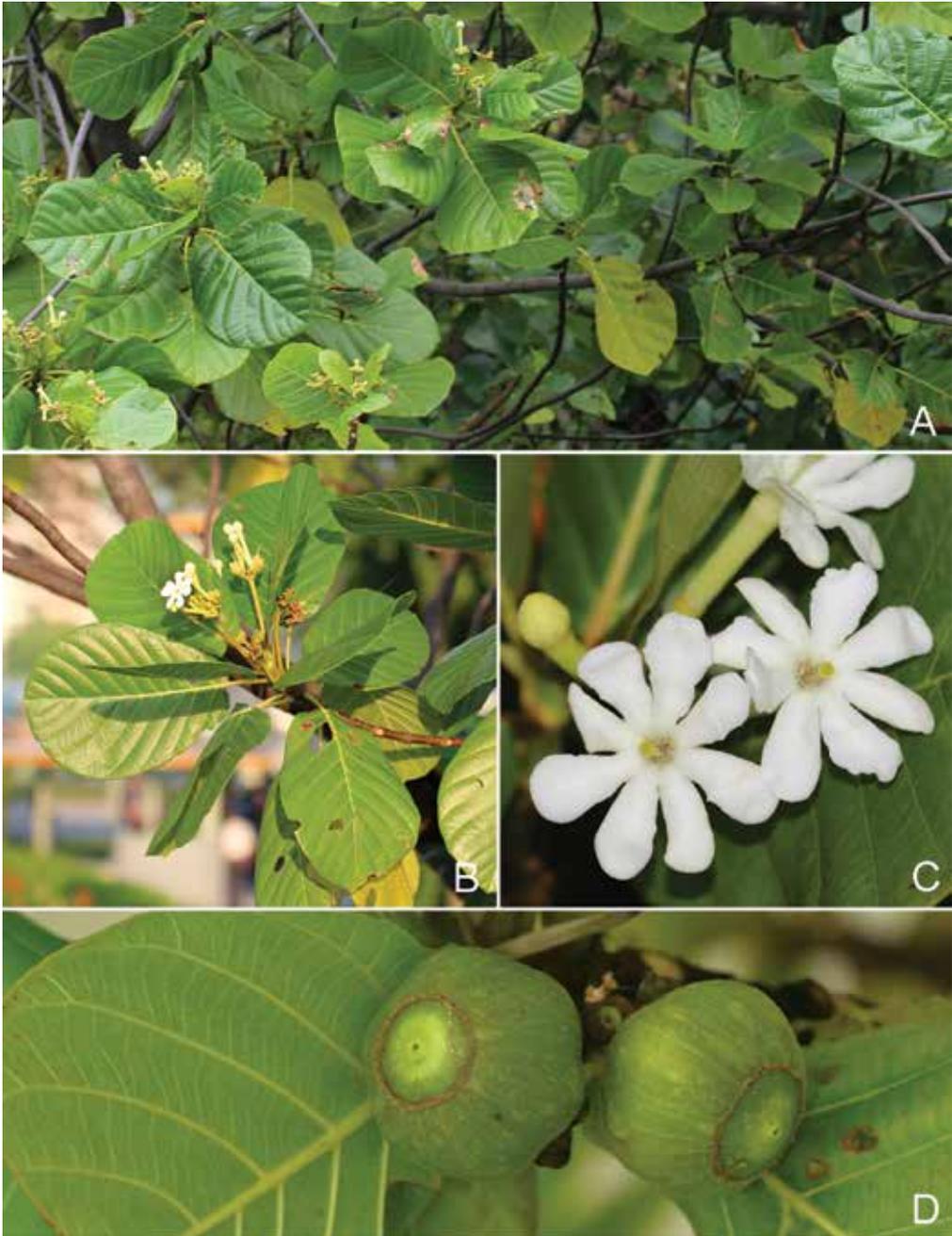


Figure 24. *Guettarda speciosa* L. **A.** Flowering branches. **B.** Close-up of flowering branch showing inflorescences. **C.** Open flowers. **D.** Fruits. (Cultivated in Singapore, Gardens by the Bay. Photos: X.Y. Ng).

mm diam., pale velvety hairy, subtruncate; corolla infundibular, outside pale velvety short-hairy, inside hairy at the throat, corolla tube 17–35 mm long, 2–3 mm wide in mature open flowers, corolla lobes (4–)6–8(–9), c. 4.5 mm long, 4–4.5 mm wide; anthers sessile, inserted at the upper part of and included within the corolla tube; style as long as the corolla tube; stigma knoblike, entire, slightly exerted; ovary 4–9-celled; ovules solitary in each cell, pendulous. **Infructescence** peduncles 3.5–7 cm long. **Fruits** depressed globose, 1–1.7 cm long, 1.5–2.5 cm wide, minutely pale hairy to glabrescent, sessile; pyrenes 4–6, fused into a hard stone, each with a single seed; pericarp fibrous; without a persistent calyx.

Distribution. East Africa to Malesia and Micronesia. In Singapore it has been documented by older collections from Choa Chu Kang, River Valley Road and Changi. More recent collections are from the offshore islands, including Pulau Ubin (*Gwee et al.* 163, 14 Jan 2003, SING [SING0042927, SING0042928]), Pulau Seletar (*Samsuri* 1214, 10 Jan 1976, SING [SING0030166]), Pulau Semakau (*Lai* 52, 1996, SING [SING0008215]), Pulau Pawai (*Koh et al.* SING2012-103, 10 Apr 2012, SING [SING0173578]) and Pulau Unum (*Lua* SING2010-790, 8 Jul 2010, SING [SING0146698]).

Ecology. Coastal, chiefly in exposed sites on beaches and back mangrove areas.

Provisional conservation assessment. Globally not assessed. Listed as Endangered (EN/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 239) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 46, 174, 215).

Notes. The above measurements are from the Singapore material and may be slightly wider for the species across its range.

17. GYNOCHTHODES Blume

(Greek, *gyn-* = female, pertaining to female organs, *-ochthodes* = mound-like, hilly; referring to the conspicuous disk)

Bijdr. Fl. Ned. Ind., pt 16 (1826–1827) 993, as ‘*Gynochtododes*’, nom. cons.; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 91; Ridley, Fl. Malay Penins. 2 (1923) 121; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 154; Puff et al., Rubiac. Thailand (2005) 156, pl. 3.2.4; Razafimandimbison & Bremer, *Adansonia*, sér. 3, 33 (2011) 286; Razafimandimbison et al., *Taxon* 63 (2014) 1381; Suratman, *Blumea* 62(3) (2018) 230; Seah & Wong, *Gard. Bull. Singapore* 70 (2018) 267. **Type:** *Gynochthodes coriacea* Blume.

Guttenbergia Zoll. & Moritzi, *Natuur-Geneesk. Arch. Ned.-Indië* 2 (1845) 2. **Type:** *Guttenbergia umbellata* (L.) Zoll. & Moritzi. (= *Gynochthodes umbellata* (L.) Razafim. & B.Bremer).

Sphaerophora Blume, *Mus. Bot.* 1, fasc. 12 (1850) 179, nom. illeg. non (Hassall) Lindl. (1846). **Type:** *Sphaerophora glomerata* Blume, lectotype designated by Johansson, *Opera Bot.* 122 (1994) 15 (= *Gynochthodes glomerata* (Blume) Razafim. & B.Bremer).

Pogonanthus Montrouz., *Mém. Acad. Imp. Sci. Lyon, Sect. Sci.*, sér. 2, 10 (1860) 225. **Type:** *Pogonanthus candollei* Montrouz. (= *Gynochthodes candollei* (Montrouz.) Razafim. & B.Bremer).

Tetralopha Hook.f., Icon. Pl. 11 [ser. 3, 1], fasc. 3 (1870) pl. 1072. **Type:** *Tetralopha motleyi* Hook.f. (= *Gynochthodes motleyi* (Hook.f.) Ruhsam).

Imantina Hook.f. in Bentham & Hooker, Gen. Pl. 2(1) (1873) 120. **Type:** *Imantina deplanchei* Hook.f. (= *Gynochthodes deplanchei* (Hook.f.) Razafim. & B.Bremer).

Lianas. **Stipules** broadly triangular and joined at the edges or a subtruncate sheath fused along one side. **Leaves** decussate, chartaceous to more or less coriaceous, petiolate. **Inflorescences** stalked heads of flowers with fused calyx tubes at the tips of shoots, many, arranged into an umbel-like structure, or individual pedicellate flowers in the axils of leaves, fasciculate. **Flowers** polygamous (hermaphrodite and functionally unisexual) or unisexual, 4- or 5-merous; hypanthia fused basally or completely when arranged into a head; corolla tube short; stamens inserted in corolla throat; anthers partly exerted; stigma bilobed, exerted or inserted at the centre of the disk without an obvious style; ovary 2-locular, with false septum running lengthwise and separating the ovules; ovules 2 per locule. **Infructescences** heads of fused fruits (syncarps) or drupes. **Seeds** globose or semi-globose.

Distribution. Worldwide c. 93 species, found in Madagascar, tropical Asia to tropical Australia and the Pacific islands. In Singapore 5 native species.

Taxonomy. Here we adopt the spelling of *Gynochthodes* for this genus although Blume (Bijdr. Fl. Ned. Ind., pt 16 (1826–1827) 993) first spelt the generic name as *Gynochtodes*; he later corrected this in a footnote in Blume (Fl. Javae, fasc. 1–2 (1828) vii). See Ford & Halford (Austrobaileya 7 (2006) 357–364) for a summary. More recently, after molecular phylogenetic studies conducted by Razafimandimbison et al. (Molec. Phylogenet. Evol. 52 (2009) 879–886), several taxa with lianescent or climbing habit formerly placed in *Morinda* L. (including *Morinda ridleyi* (King & Gamble) Ridl. (= *Gynochthodes ridleyi* (King & Gamble) Razafim. & B.Bremer), *Morinda rigida* Miq. (= *Gynochthodes rigida* (Miq.) Razafim. & B.Bremer), and *Morinda umbellata* L. (= *Gynochthodes umbellata* (L.) Razafim. & B.Bremer) below) have been transferred into *Gynochthodes* by Razafimandimbison & Bremer (Adansonia, sér. 3, 33 (2011) 283–309). Although we follow the molecular evidence supporting the new circumscription, we note that some morphological differences still exist, as many taxa originally included in *Gynochthodes* have axillary inflorescences and flowers borne on solitary pedicels while many taxa transferred from *Morinda* have terminal umbel-like inflorescences and flowers borne on a stalked head.

Notes. The description above applies to the genus as found in Singapore. There are differences, especially in inflorescence form, for the genus as found elsewhere.

Key to *Gynochthodes* species

1. Inflorescences consisting of many stalked heads of flowers with fused calyx tubes at the tips of shoots, arranged into an umbel-like structure 2
- Inflorescences consisting of individual pedicellate flowers in the axils of leaves, fasciculate 4

2. Leaves glabrous on both surfaces **5. G. umbellata**
 Leaves usually at least sparsely pubescent on the upper surface, always sparsely to densely pubescent on the lower surface 3
3. Leaves densely pubescent with shiny golden-brown appressed hairs on lower surface; flowering heads numerous, 8–14 **3. G. ridleyi**
 Leaves densely to sparsely pubescent with dark brown loosely appressed to erect hairs on lower surface; flowering heads few, 4–5 **4. G. rigida**
4. Leaves chartaceous to subcoriaceous, narrowly elliptic to broadly elliptic or lanceolate, margin plane to slightly recurved; flowers with corolla lobes distinctly longer than corolla tube **1. G. coriacea**
 Leaves coriaceous, ovate to obovate, margin consistently recurved; flowers with corolla lobes more or less equal in length to the corolla tube **2. G. praetermissa**

1. *Gynochthodes coriacea* Blume

(Latin, *coriaceus* = coriaceous, leathery; referring to the leaf texture)

Bijdr. Fl. Ned. Ind., pt 16 (1826–1827) 993; Backer & Bakhuizen van den Brink, Fl. Java (Spermatoph.) 2 (1965) 349; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 46, 174, 221; Razafimandimbison & Bremer, Adansonia, sér. 3, 33 (2011) 305; Suratman, Blumea 62(3) (2018) 231; Seah & Wong, Gard. Bull. Singapore 70 (2018) 267. **Type:** *Blume s.n.*, [Indonesia], Java, Kuripan (lectotype L [L0057744], designated by Suratman, Blumea 62(3) (2018) 231).

Gynochthodes sublanceolata Miq., Fl. Ned. Ind., Eerste Bijv., fasc. 3 (1861) 542; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 97; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 92; Ridley, Fl. Malay Penins. 2 (1923) 122; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 155, fig. 125.5; Turner, Gard. Bull. Singapore 45 (1993) 197; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 424; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 46, 174, 228. **Type:** *Amann/Kurz s.n.*, [Indonesia], Sumatra, Bangka, near Muntok, September 1858 (lectotype U [U0006036], designated by Suratman, Blumea 62(3) (2018) 236).

Liana. **Stipules** broadly triangular. **Leaves:** lamina broadly elliptic or lanceolate, (4.0–)5.3–9.2(–12.7) × (1.0–)1.5–4.7 cm, apex acute to acuminate, base cuneate, margin planar to very slightly recurved, chartaceous to subcoriaceous, rarely very coriaceous, usually drying dark brown or sometimes drying black, glabrous on both surfaces, midrib sunken above, raised below, secondary veins 5–7 pairs, flat to slightly raised or sometimes inconspicuous above, raised below, faintly to noticeably looping and joining some distance away from the margin, typically with hairy domatia in their axils on the lower leaf surface, tertiary veins reticulate, sometimes inconspicuous; petioles 4–7 mm long. **Inflorescences** of individually pedicellate flowers in the axils of leaves, fasciculate. **Flowers** 4-merous; pedicels 0.7–1.8 mm long; calyx cup-shaped, 1–1.5 × 0.8–1.2 mm including a limb 0.2–0.3 mm long; corolla 3.1–5 mm long, glabrous outside, densely hairy at the throat inside, corolla tube 0.5–1 mm long, corolla lobes 2.6–4 mm long; anthers 1.5 mm long, dorsifixed on very short filaments inserted in the throat,

partly exerted; stigma bilobed, arising from the centre of the disk without an obvious style. **Fruits** drupaceous, subglobose, 7.3–9.6 mm across, pale to dark greenish, sometimes with some remnants of pericarp vasculature remaining as fibrous strands on pedicels.

Distribution. Thailand, Peninsular Malaysia, Sumatra, Java and Borneo. In Singapore the species is widespread. Recent collections include the Western Catchment (*Samsuri et al. WC 12*, 30 Mar 2004, SING [SING0053914]) and the Sisters' Islands (*Maxwell 81-155*, 24 Jun 1981, SING [SING0051236]). Historical collections include Changi (*Teruya 2201*, 19 Jan 1933, SING [SING0051243]; *Ridley 2*, 1891, SING [SING0051241]) and Sarimbun (*Ridley s.n.*, 1894, SING [SING0073242]).

Ecology. In Singapore, as elsewhere, frequently found in or near coastal areas (including offshore islands) and less commonly found inland.

Provisional conservation assessment. Globally Least Concern (LC). Listed as Vulnerable (VU/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 46, 174, 22) although the synonym, *Gynochthodes sublanceolata*, was listed as common in Singapore by Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 46, 174, 228). Considering the widespread distribution and regular collections of the species, it is assessed here as Least Concern (LC) in Singapore.

Notes. The description above applies to the species as found in Singapore; there is considerable variation in the length of the petioles for the species as found elsewhere. Furthermore, we observed leaves with slightly more pairs of secondary veins (8–9) on the type specimen.

2. *Gynochthodes praetermissa* W.W.Seah & K.M.Wong

(Latin, *praetermissus* = neglected, omitted; the species had been overlooked by many authors)

Gard. Bull. Singapore 70 (2018) 267. **Type:** *Ridley 10393*, 1899, Singapore, Gardens' Jungle [Singapore Botanic Gardens' Rain Forest] (holotype SING [SING01993141]). **Fig. 25, 26.**

Gynochthodes coriacea auct. non Blume: *Ridley*, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 98; *King & Gamble*, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 92; *Ridley*, Fl. Malay Penins. 2 (1923) 122; *Keng*, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 154; *Turner*, Gard. Bull. Singapore 45 (1993) 197; *Turner*, Gard. Bull. Singapore 47 (1997 [‘1995’]) 424; *Chong et al.*, Checkl. Vasc. Pl. Fl. Singapore (2009) 46, 174, 221.

Slender liana. **Stipules** triangular, inconspicuous, not persistent. **Leaves:** lamina ovate to obovate, (3.8–)5–9.1(–12.9) × 1.5–4.9(–5.8) cm, apex rounded to acute, base cuneate to obtuse, margin consistently recurved, typically coriaceous, usually drying dark brown or sometimes black, glabrous on both surfaces, midrib sunken above, raised below, secondary veins 4–8 pairs, slightly to prominently raised or slightly sunken above, prominently raised below, looping and joining some distance away from the margin, typically with densely to sparsely hairy domatia in their axils on the lower leaf surface, tertiary veins reticulate; petioles

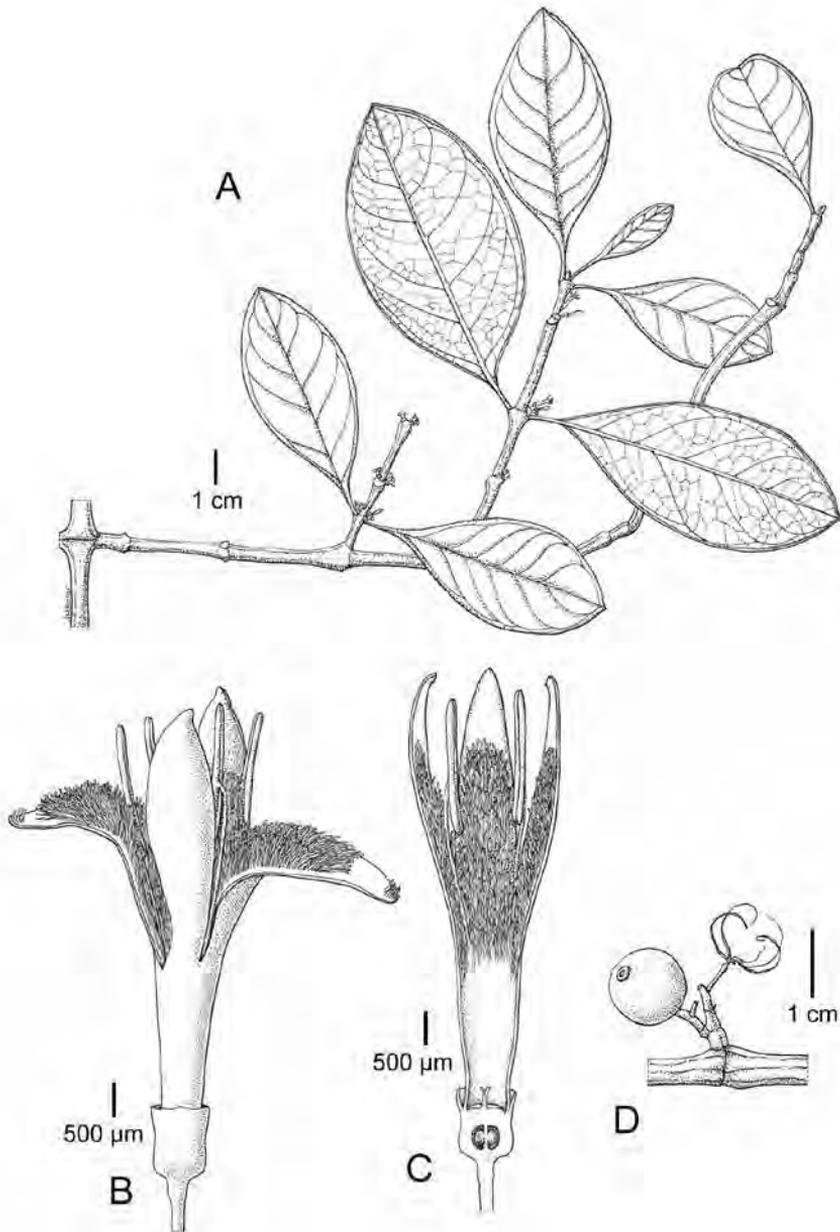


Figure 25. *Gynochthodes praetermissa* W.W.Seah & K.M.Wong. **A.** Flowering leafy branches. **B.** Flower showing indumentum on inner surface of corolla lobes (the hairs become sub-erect and straggly when dried). **C.** Longitudinal section of flower showing indumentum on inner surface and a probably reduced style and stigma. **D.** Intact fruit and persistent remnant strands of pericarp vasculature from a separate disintegrated fruit. (From Singapore, A from Singapore Botanic Gardens' Rain Forest, *Ridley 6410*; B, C from Singapore Botanic Gardens' Rain Forest, *Ridley 10393*; D from MacRitchie, *Lai LJ 83*. Drawn by D. Teo).



Figure 26. *Gynochthodes praetermissa* W.W.Seah & K.M.Wong. **A.** Inflorescences. **B.** Fruiting leafy branches. (From Singapore, A from Singapore Botanic Gardens; B from the Western Catchment, *Lua LHK 11-49*. Photos: A, P.K.F. Leong; B, H.K. Lua).

10–17 mm long. **Inflorescences** fascicles of individual flowers in leaf axils. **Flowers** 4- or 5-merous; pedicels 0.7–2.2 mm long, sparsely hairy; calyx cup-shaped, 0.8–1 × 0.5–0.8 mm, including a limb 0.2–0.3 mm long; corolla (5.5–)6–7 mm long, white, corolla tube (2.0–)2.5–3 mm long, corolla lobes 3.5–4 mm long, glabrous outside, densely hairy inside; anthers 2 mm long, dorsifixed on very short glabrous filaments inserted in the corolla throat, partly exerted; stigma bilobed, arising from the centre of the disk without an obvious style. **Fruits** drupaceous, subglobose, 11.9–13.2 mm diam., pale to dark greenish, often with persistent remnants of pericarp vasculature remaining as fibrous strands on pedicels.

Distribution. Peninsular Malaysia, Indonesia and Borneo. In Singapore it is recorded from Changi (*Ridley 2871*, 1891, SING [SING0030176]), Singapore Botanic Gardens' Rain Forest (*Ridley 10393*, 1899, SING [SING0199314]), MacRitchie (*Lai LJ 83*, 1996, SING [SING0008208]), Mandai (*Samsuri SA 1388*, 27 Jan 1977, SING [SING0030173]) and the Western Catchment (*Lua LHK 11-49*, 31 Aug 2011, SING [SING0166661]).

Ecology. In Singapore, as elsewhere, found in lowland dipterocarp and secondary forest as well as coastal areas.

Provisional conservation assessment. Seah & Wong (Gard. Bull. Singapore 70 (2018) 267) proposed a global conservation assessment of Least Concern (LC). In Singapore, owing to much modifications of the forest and coastal habitats, it is assessed here as Vulnerable (VU/D).

Taxonomy. This species most resembles and has been confused with *Gynochthodes coriacea*, from which it differs in having ovate to obovate leaves that are coriaceous and with consistently recurved margins as well as flowers with corolla lobes only slightly to at most twice as long as the corolla tube. *Gynochthodes coriacea* has broadly elliptic or lanceolate leaves, which are chartaceous to subcoriaceous and with planar to slightly recurved margins, and flowers with corolla lobes that are at least three times as long as the corolla tube.

3. *Gynochthodes ridleyi* (King & Gamble) Razafim. & B. Bremer

(Henry Nicholas Ridley, 1855–1956, prolific botanist
and first Director of Singapore Botanic Gardens)

Adansonia, sér. 3, 33 (2011) 294. **Basionym:** *Morinda umbellata* L. var. *ridleyi* King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 88. **Synonym:** *Morinda ridleyi* (King & Gamble) Ridl., Fl. Malay Penins. 2 (1923) 118; Wong, Malayan Nat. J. 38 (1984) 96; Wong, Arbor. Rubiac. Malaya (1988) 131 (in clavi); Wong, Tree Fl. Malaya 4 (1989) 377 (in clavi); Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 158; Turner, Gard. Bull. Singapore 45 (1993) 200; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 435; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 62, 175, 209. **Type:** *Ridley 6470*, Singapore, Gardens’ Jungle [Singapore Botanic Gardens’ Rain Forest] (lectotype SING [SING0058323], designated by Wong, Malayan Nat. J. 38 (1984) 96; isolectotype K [K000763800]).

Climber. **Stipules** lanceolate, chartaceous, fused along one side and forming a subtruncate sheath, sparsely hairy on the outside. **Leaves:** lamina elliptic to narrowly oblanceolate, (3.5–)4.9–8.9(–10.5) × (1–)1.9–3.0 cm, apex long acuminate, base cuneate to obtuse, chartaceous to subcoriaceous, sometimes drying darker brown above than below, glabrous to sparsely pubescent on upper surface, densely pubescent with shiny golden-brown appressed hairs on lower surface especially on the secondary veins and midrib, midrib flat to slightly sunken above, raised below, secondary veins 5–7 pairs, tertiary veins minutely reticulate; petioles 5–10 mm long, densely to sparsely pubescent. **Inflorescences** comprising 8–14 flowering heads, terminal, arranged into an umbel-like structure, peduncles 10–13 mm long, each flowering head to 3 mm across, of several flowers with fused calyx tubes. **Flowers** 4-merous; hermaphroditic flowers with corolla 3–4 mm long, corolla tube indistinct, corolla lobes sparsely hairy outside, densely hairy at the throat inside; anthers 1 mm long, dorsifixed on short filaments, partly exerted; stigma bilobed, exerted; unisexual flowers not seen. **Fruiting heads** subglobose, each to 9 mm across.

Distribution. Southern Malay Peninsula. In Singapore it is known from Bukit Timah (*Ridley 6471*, 1894, SING [SING0172365]), Jurong (*Corner s.n.*, 11 Dec 1932, SING [SING0012115]), Kranji (*Ridley 61170a*, SING [SING0251444]), Namazie Estate (*Sinclair SFN39596*, 25 Apr 1953, K, SING [SING0012117]) and Nee Soon (*Maxwell 81-235*, 3 Dec 1981, SING [SING0012116]). It is also represented by leafy branch vouchers for other localities: Chestnut Avenue and Mandai.

Ecology. In Singapore, as elsewhere, known from lowland forest and swamp forest.

Provisional conservation assessment. Globally not assessed. In Singapore no fertile material has been collected in recent years although it is known from some sterile vouchers as noted above. It was listed (under *Morinda ridleyi*) as Critically Endangered (CR/D) by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 62, 175, 209).

4. *Gynochthodes rigida* (Miq.) Razafim. & B. Bremer

(Latin, *rigidus* = stiff; likely referring to the hairs on the leaf lower surface)

Adansonia, sér. 3, 33 (2011) 295. **Basionym:** *Morinda rigida* Miq., Fl. Ned. Ind. 2, fasc. 2 (1857) 246; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 87; Ridley, Fl. Malay Penins. 2 (1923) 118; Wong, Malayan Nat. J. 38 (1984) 95; Wong, Arbor. Rubiac. Malaya (1988) 130 (in clavi); Wong, Tree Fl. Malaya 4 (1989) 376 (in clavi); Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 158; Turner, Gard. Bull. Singapore 45 (1993) 200; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 435; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 62, 175, 195; Razafimandimbison & Bremer, Adansonia, sér. 3, 33 (2011) 295. **Type:** *Teijsmann s.n.*, [Indonesia], Sumatra, near Sibogo (lectotype U [U0006084] in L, designated by Johansson, Opera Bot. 122 (1994) 15). **Fig. 27.**

Climber. **Stipules** broadly triangular, chartaceous, shortly jointed at the edges. **Leaves:** lamina broadly to narrowly elliptic, (3.8–)6.5–12.8 × (1.2–)3.2–5.5 cm, apex acute to abruptly shortly acuminate, sometimes rounded, base cuneate, subcoriaceous, often drying dark brown above, lighter brown below, glabrous on upper surface, densely to sparsely pubescent with dark brown loosely appressed to erect hairs on lower surface especially on the secondary veins and midrib; midrib raised above and below, secondary veins 6–9, inconspicuous, tertiary veins faintly reticulate, inconspicuous; petioles 11–23 mm long, typically glabrous. **Inflorescences** comprising 4–5 flowering heads, terminal, arranged into an umbel-like structure, peduncles 10–15 mm long, each flowering head 4–6 mm across, of several flowers with fused calyx tubes. **Flowers** 4-merous; male flowers with corolla 8–12 mm long, corolla tube 5–8 mm long, corolla lobes 3–4 mm long, densely short-hairy outside, densely hairy at the throat inside; anthers 2 mm long, dorsifixed below its middle, on short filaments; hermaphrodite flowers not seen. **Fruiting heads** subglobose, each to 28 mm across.

Distribution. Peninsular Malaysia, Sumatra and Borneo. In Singapore it has been recorded from various localities, most notably Kranji (*Ridley 4126*, Nov 1892, SING [SING0030358]), Pulau Ubin (*Ridley 3818*, 1892, SING [SING0030357]); *Ali Ibrahim AI04-06*, 4 May 2004, SING [SING0090231]), Mandai (*Ridley s.n.*, 1917, SING [SING0030356]) and Pulau Tekong (*Ridley s.n.*, 1892, SING [SING0030359]); *Gwee et al. SING2008-227*, 17 Jun 2008, SING [SING0109168]). It is also represented by leafy branch vouchers for other localities: Admiralty Park, Chestnut Avenue and Upper Seletar.

Ecology. In Singapore it is found in lowland forest, swamp forest, and areas near the coast.

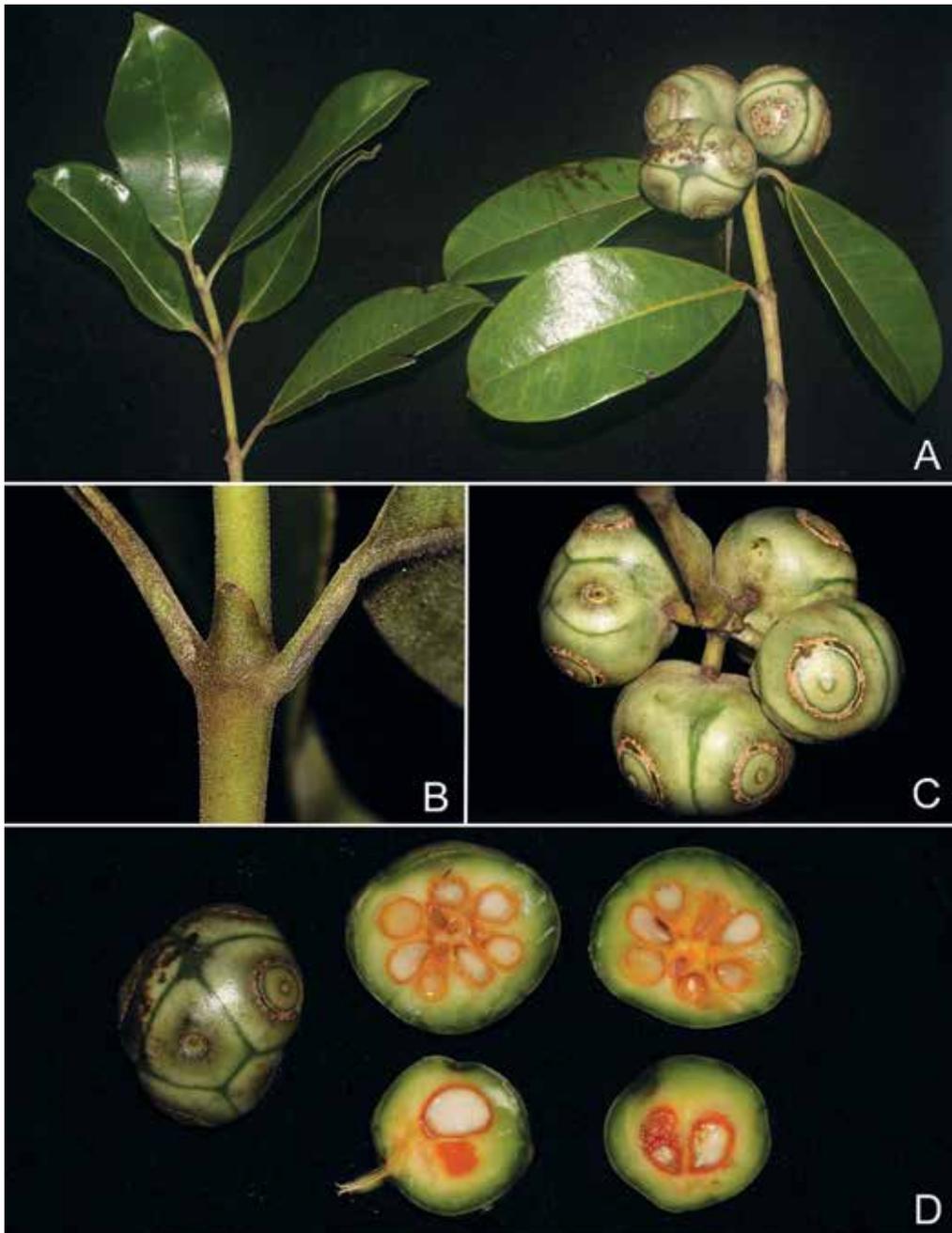


Figure 27. *Gynochthodes rigida* (Miq.) Razafim. & B. Bremer. **A.** Leafy branches with a cluster of fruiting heads. **B.** Detail of stipule. **C.** Umbellate arrangement of fruiting heads at shoot tip. **D.** Detail of fruiting heads, sections showing individual seeds. (From Singapore, Bukit Timah Nature Reserve, *Lua SING2018-562*. Photos: X.Y. Ng).

Provisional conservation assessment. Globally Least Concern (LC). The listing of this species as Nationally Extinct in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 62, 175, 195) was an error (see Chong et al., Biodivers. Conserv. 21 (2012) Suppl. Mat.). Considering the frequent collections of this species from a number of locations and habitats but given the ever-changing natural landscape, it is assessed here as Vulnerable (VU/D).

5. *Gynochthodes umbellata* (L.) Razafim. & B.Bremer

(Latin, *umbellatus* = umbellate; referring to the arrangement of the flowering heads)

Adansonia, sér. 3, 33 (2011) 296. **Basionym:** *Morinda umbellata* L., Sp. Pl. 1 (1753) 176; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 97; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 88; Ridley, Fl. Malay Penins. 2 (1923) 119; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1520; Wong, Malayan Nat. J. 38 (1984) 95; Wong, Arbor. Rubiac. Malaya (1988) 131 (in clavi); Wong, Tree Fl. Malaya 4 (1989) 377 (in clavi); Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 158; Turner, Gard. Bull. Singapore 45 (1993) 201; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 435; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 62, 175, 229; Razafimandimbison & Bremer, Adansonia, sér. 3, 33 (2011) 296. **Type:** Herb. Hermann 3: 11, no. 81, [Sri Lanka] (lectotype BM [BM000621833], designated by Smith & Darwin, Fl. Vit. Nova 4 (1988) 333). **Fig. 28.**

Climber. **Stipules** chartaceous, fused along one side and forming a subtruncate sheath, with shiny adpressed hairs sparsely to evenly scattered on the outside. **Leaves:** lamina elliptic, (3.7–)4.9–12.5 × (1.0–)1.5–3.8 cm, apex acute, base cuneate, coriaceous, glabrous on both surfaces, midrib raised above and below, often bright pink or red in colour when fresh, secondary veins 5–7 pairs, with hairy domatia in their axils on the lower leaf surface, tertiary veins minutely reticulate, prominent on both surfaces; petioles 5–12 mm long. **Inflorescences** of 8–12 flowering heads, terminal, arranged into an umbel-like structure, peduncles 12–49 mm long, each flowering head to 39 mm across, of several flowers with fused calyx tubes. **Flowers** 4–5-merous; male flowers with corolla 3–5 mm long, corolla tube indistinct, corolla lobes more or less glabrous outside, densely hairy at the throat inside; anthers 1.5 mm long, dorsifixed on short filaments; hermaphrodite flowers not seen. **Fruiting heads** subglobose, each to 12.3 mm across, orange when ripe.

Distribution. Broadly distributed from South Asia (India and Sri Lanka) through East Asia (China and Japan) into Southeast Asia (including Vietnam and the Malay Peninsula) and the Pacific islands (New Guinea, Fiji and the Society Islands). In Singapore it has been recorded from various localities including Changi (*Goodenough* 3821, 25 Jan 1890, SING [SING0255815]), Kranji (*Ridley s.n.*, 1890, SING [SING0255824]), Labrador (*Samsuri SA1068*, 8 Aug 1975, SING [SING0255825]), Upper Peirce (*Maxwell* 82-92, 31 Mar 1982, SING [SING0255820]), and some offshore islands such as Pulau Tekong (*Koh* SING2012-042, 21 Feb 2012, SING [SING0173349]).

Ecology. In Singapore, as elsewhere, particularly common in areas near seashores and less common in lowland forest.

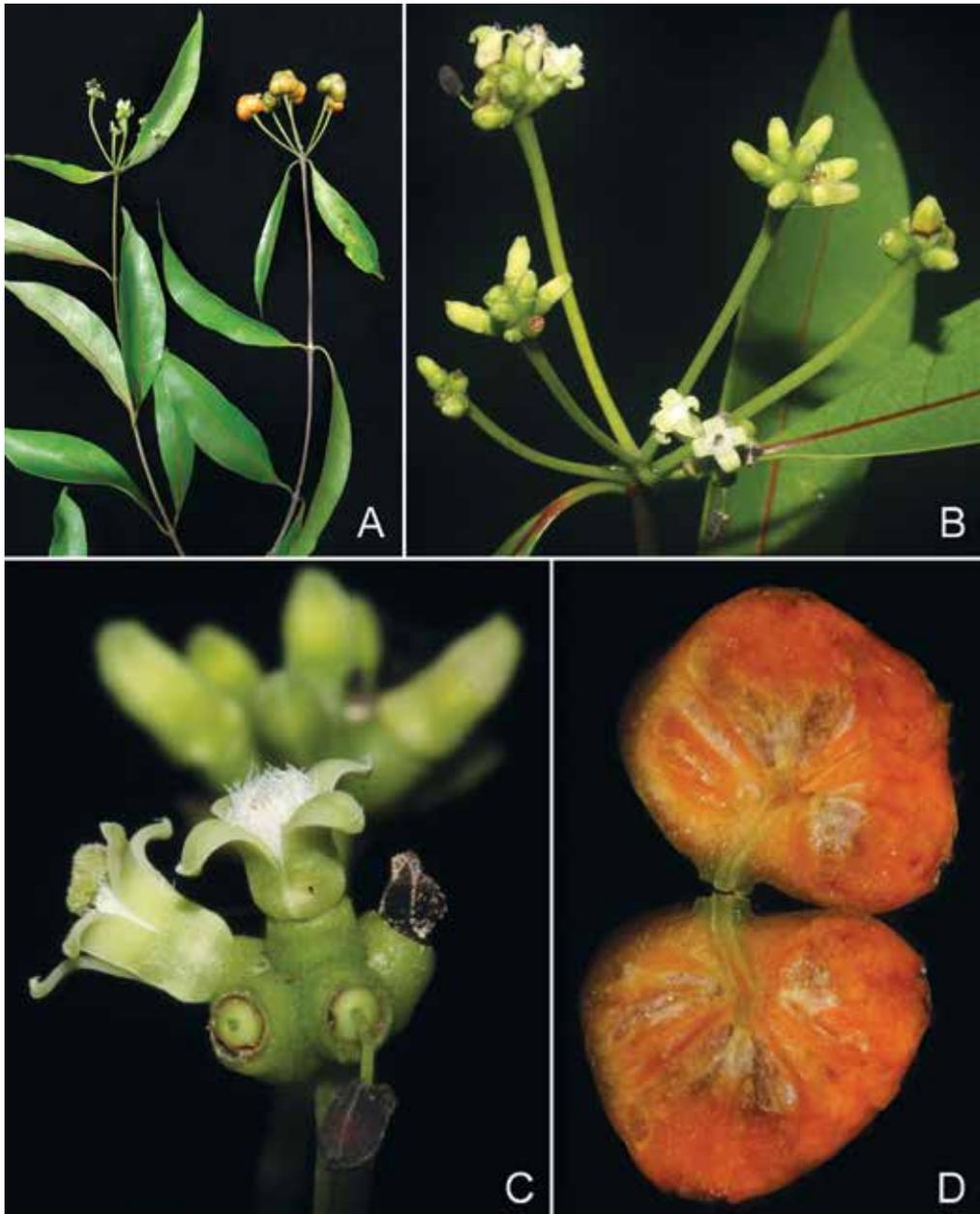


Figure 28. *Gynochthodes umbellata* (L.) Razafim. & B. Bremer. **A.** Flowering and fruiting branches. **B.** Close-up of inflorescence. **C.** Two open flowers in a cluster with fused calyx tubes. **D.** Fruiting head, sectioned. (From Singapore, Upper Peirce, *Ng et al. SING2017-836*. Photos: A, K.M. Wong, B–D, X.Y. Ng).

Provisional conservation assessment. Globally Least Concern (LC). Not listed by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2, 2008) but listed as common in Singapore by Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 62, 175, 229). Given the wide distribution and frequent collections of this species in Singapore, it is assessed here as Least Concern (LC).

Taxonomy. For a full list of synonyms applicable outside the Malay Peninsula, see Razafimandimbison & Bremer (*Adansonia*, sér. 3, 33 (2011) 296).

18. HEDYOTIS L.

(Greek, *hedy-* = sweet, *-otis* = ear; alluding to the sweet-scented, ear-shaped leaves of some species)

Starviolets (English)

Sp. Pl. 1 (1753) 101, nom. cons.; Linnaeus, Gen. Pl., ed. 5 (1754) 44; Jussieu, Gen. Pl. (1789) 198; Willdenow, Sp. Pl., ed. 4, 1(2) (1798) 564; Roxburgh, Fl. Ind. 1 (1820) 368; Roxburgh, Fl. Ind., ed. 2, 1 (1832) 363; De Candolle, Prodr. 4 (1830) 419; Don, Gen. Hist. 3 (1834) 524; Miquel, Fl. Ned. Ind. 2, fasc. 2 (1857) 177; Bentham & Hooker, Gen. Pl. 2(1) (1873) 56; Hooker, Fl. Brit. India 3, fasc. 7 (1880) 49; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’]) 156; Ridley, Fl. Malay Penins. 2 (1923) 44; Craib, Fl. Siam. 2(1) (1932) 50; Backer & Bakhuizen van den Brink, Fl. Java (Spermatoph.) 2 (1965) 284; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 1 (1966) 1148; Puff et al., Rubiac. Thailand (2005) 202, pl. 3.4.14; Chen & Taylor, Fl. China 19 (2011) 147. **Type:** *Hedyotis fruticosa* L. (typ. cons.)

Oldenlandia L., Sp. Pl. 1 (1753) 119; Linnaeus, Gen. Pl., ed. 5 (1754) 55; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’]) 166; Ridley, Fl. Malay Penins. 2 (1923) 52; Puff et al., Rubiac. Thailand (2005) 204, pl. 3.4.15. **Type:** *Oldenlandia corymbosa* L., lectotype designated by Hitchcock, Nom. Prop. Brit. Bot. (1929) 125 (= *Hedyotis corymbosa* (L.) Lam.).

Edrastima Raf., Actes Soc. Linn. Bordeaux 6 (1834) 269. **Type:** *Edrastima uniflora* (L.) Raf. (= *Hedyotis uniflora* (L.) Lam.).

Leptopetalum Hook. & Arn., Bot. Beechey Voy., fasc. 7 (1838) 295. **Type:** *Leptopetalum mexicanum* Hook. & Arn. (name in *Hedyotis* to be determined).

Dimetia (Wight & Arn.) Meisn., Pl. Vasc. Gen. 1 (Tab. Diagn.), fasc. 5 (1838) 160. **Type:** *Dimetia scandens* (Roxb.) R.J.Wang, lectotype designated here (= *Hedyotis scandens* Roxb.).

Scleromitron (Wight & Arn.) Meisn., Pl. Vasc. Gen. 1 (Tab. Diagn.), fasc. 5 (1838) 160. **Type:** *Scleromitron angustifolium* (Cham. & Schltdl.) Benth., lectotype designated here (= *Hedyotis angustifolia* Cham. & Schltdl.).

Exallage Bremek., Verh. Kon. Ned. Akad. Wetensch., Afd. Natuurk., Sect. 2, 48(2) (1952) 140. **Type:** *Exallage auricularia* (L.) Bremek. (= *Hedyotis auricularia* L.).

Thecagonum Babu, Bull. Bot. Surv. India 11 (1969) 214. **Type:** *Thecagonum pteritum* (Blume) Babu (= *Hedyotis biflora* (L.) Lam.).

Herbs, annual or perennial. **Stems** erect, procumbent or climbing, usually branching dichotomously, terete or angular, glabrous to hairy. **Stipules** usually persistent, interpetiolar, free or fused to petiole bases, triangular to truncate, entire or with glandular margin or pectinately elongating or truncated with marginal bristles. **Leaves:** lamina opposite, decussate or not, sometimes clustered at top of stems; lamina linear, linear-lanceolate, lanceolate, elliptic or orbicular; apex acute, acuminate or obtuse, base attenuate, cuneate or rarely obtuse, margin entire but revolute or ciliate, coriaceous to membranous, glabrous, puberulous or pubescent, secondary venation distinct or obscure; petioles obsolete or distinct. **Inflorescences** terminal or axillary, simple to many-flowered or fasciculate, cymose, paniculate, capitate, or glomerulate, sessile or pedunculate, bracteate, bracteolate or not. **Flowers** pedicellate or sessile, bisexual, isostylous or heterostylous; hypanthium globose, ovoid ellipsoid, terete to angular, compressed or not; calyx limb shallowly to deeply 4-lobed, lobes triangular, lanceolate or linear, often teeth-like; corolla white, pink, purple or blue, tubular, funnelform, salverform, or urceolate, glabrous or pubescent adaxially, tube obviously swollen above or not, throat glabrous, densely pubescent or woolly adaxially, lobes usually 4, rarely 5, valvate in bud, straight or reflexed, often setulose abaxially, glabrous, minutely pubescent or puberulous adaxially; stamens usually 4, rarely 5, included or exerted, filaments adnate below the throat or at the sinus of the corolla lobes, anthers oblong, linear-oblong, 2-thecate, dorsifixed; ovary inferior or half-inferior, 2-locular, ovules usually numerous, placentas axile, median globose or ellipsoid, peltate; styles included or exerted; stigma bilobed, lobes linear to clavate, included or exerted. **Capsules** sessile or shortly stalked, crowned with persistent calyx lobes, generally subglobose to ovoid, crustaceous to membranous, indehiscent or dehiscent septically along the beak or loculicidally; pericarp thin, cartilaginous or fleshy. **Seeds** several to numerous, small, angular, plano-convex; testa thin, composed of pentagonal, hexagonal or globose cells with smooth, reticulate, granulate, perforated, punctate, striate or verrucose walls.

Distribution. More than 500 species in warmer parts of the world, mainly in Africa, East and Southeast Asia, Australia and America. In Singapore 14 native species, one of which is very rare.

Ecology. Sparse and secondary mountain forests, roadsides, lawns, waste places, from sea level to mountains; many are invasive and establish readily in disturbed sites.

Taxonomy. *Hedyotis* L. and *Oldenlandia* L., occurring throughout tropical and subtropical regions worldwide, were proposed by Linnaeus simultaneously in 1753 and were two of the largest genera, comprising together more than 500 species. They are very similar and share a herbaceous or shrubby habit, relatively small flowers generally with four petals, 2-locular ovaries and dehiscent or indehiscent capsules with many seeds. The subsequent taxonomic circumscriptions and classifications are controversial and have been disputed for centuries. ‘Lumpers’ merged most species of the *Hedyotis*-*Oldenlandia* complex into *Hedyotis*, while ‘splitters’ favoured recognising many small genera besides the more narrowly circumscribed *Hedyotis* and *Oldenlandia*. Therefore, in taxonomic nomenclature many species have a scientific name in *Hedyotis*, and also a synonym in *Oldenlandia*, and vice versa. In addition, many homonymous, combined, illegitimate and invalid names with confused types are also very common for many species. Recent molecular phylogenetic analyses (Guo et al., Molec.

Phylogenet. Evol. 67 (2013) 110–122; Wikström et al., Taxon 62 (2013) 357–374) has proved that the *Hedyotis-Oldenlandia* complex is a polyphyletic group. According to the suggested taxonomic treatments, the species in Singapore may be divided into seven genera, which are not obviously distinguished because of few reliable morphological characters. In order to avoid a complicated classification and allow easier recognition of the species, a broad concept of *Hedyotis* is adopted in this revision, not implying it is scientifically preferred, but at least affording a reasonably convenient account for general use.

Key to *Hedyotis* species

1. Inflorescences axillary 2
 Inflorescences terminal or restricted to upper leaf axils 11
2. Flowers sessile or pedicels short and not conspicuous 3
 Flower pedicels short or long, conspicuous 7
3. Leaves linear, linear-lanceolate, narrowly elliptic-oblong, or narrowly spatulate, 0.2–0.4 cm wide **2. *H. angustifolia***
 Leaves lanceolate, lanceolate-oblong or elliptic-lanceolate, 0.3–6 cm wide 4
4. Stem stout, tetragonal, glabrous; stipules pinnately lacerate **10. *H. prostrata***
 Stem weak, terete, sparsely to densely pubescent; stipules connate, with bristles 5
5. Stems sparse to densely patent-villous with yellowish-green or yellowish-white hairs throughout **14. *H. vestita***
 Stems glabrous, sparse to densely pubescent but not with yellowish hairs throughout ... 6
6. Secondary veins impressed adaxially, conspicuous **3. *H. auricularia***
 Secondary veins obscure adaxially **13. *H. verticillata***
7. Leaves orbicular, broadly ovate or elliptic **12. *H. trinervia***
 Leaves linear, narrowly elliptic or spatulate, linear-lanceolate 8
8. Flowers (2–)3–5 per inflorescence **6. *H. corymbosa***
 Flowers 1–2 per inflorescence 9
9. Stems terete to slightly flattened **7. *H. diffusa***
 Stems acutely angular 10
10. Leaves linear or linear-lanceolate; flowers solitary **8. *H. herbacea***
 Leaves elliptic or elliptic-lanceolate; inflorescence 1–2 flowered **11. *H. pumila***
11. Scandent, climbing, prostrate or creeping herbs 12
 Erect herbs 13

12. Inflorescences comprising capitate cymes **5. *H. capitellata***
 Inflorescences comprising lax panicles **1. *H. affinis***
13. Leaves sessile or subsessile, linear; flowers (sub-)sessile **9. *H. pinifolia***
 Leaves petiolate, linear to narrowly elliptic or oblong; flowers sessile or pedicels to 1 cm long **4. *H. biflora***

1. *Hedyotis affinis* Roem. & Schult.

(Latin, *affinis* = related, allied to; it is not clear to what this refers)

Syst. Veg., ed. 15 bis, 3 (1818) 194. **Synonyms:** *Oldenlandia affinis* (Roem. & Schult.) DC., Prodr. 4 (1830) 428; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 64, 175, 222. – *Hedyotis dichotoma* J.Koenig ex Roth, Nov. Pl. Sp. (1821) 93, nom. illeg. non Cav. (1801); King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’]) 168; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 155, fig. 125.6; Turner, Gard. Bull. Singapore 45 (1993) 198; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 425; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240. – *Oldenlandia dichotoma* Hook.f., Fl. Brit. India 3, fasc. 7 (1880) 67, nom. illeg. non Spreng. (1815), nec Roxb. ex Wight & Arn. (1834); Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 92; Ridley, Fl. Malay Penins. 2 (1923) 53. **Type:** Requires clarification.

Oldenlandia viarum Craib, Bull. Misc. Inform. Kew 1931 (1931) 443; Craib, Fl. Siam. 2(1) (1932) 58. **Synonym:** *Hedyotis viarum* (Craib) Fukuoka, S. E. Asian Stud. 8 (1970) 331. **Type:** *Kerr 13669*, Thailand, Puket, Satul (lectotype K [K000760515], designated here; isolectotypes ABD, BK [BK257366], BM [BM000945127]).

Herbs, annual or perennial. **Stems** prostrate or creeping; old stems terete, young branches slender, 4-angled and ribbed, glabrous or sparsely pubescent. **Stipules** connate, truncate, 2–3 mm long, sometimes with 2–3 bristles. **Leaves:** lamina linear-lanceolate, ovate-lanceolate or elliptic-oblong to elliptic, 2–4.5 × 0.3–0.7 cm, apex acute or acuminate, base cuneate or rounded, margin revolute when dry, glabrous or scabrid above and along the margin and midrib beneath, secondary veins 4–5 each side; subsessile. **Inflorescences** terminal or in axillary, slender, lax panicles. **Flowers** heterostylous, 4–7 mm long; pedicel 1–2 mm long, glabrous; corolla funnel shaped, dark blue, blue-purple or deep violet, 4.5–5.5 mm long, tube 2–2.5 mm long, lobes 2–3 mm long, elliptic oblong, hairy below the sinus; stamens 4, anthers 0.3–1 mm long, oblong, in long-styled flowers with very short (c. 0.3 mm) filaments and inserted at basal part of corolla tube, included, in short-styled flowers with filaments c. 1.5 mm long and adnate near corolla throat, exerted; style 3–4 mm long, exerted in long-styled flowers, or c. 1.5 mm long, extending only to the corolla throat in short-styled flowers; ovary globose or subglobose, 0.2–0.5 mm long, ovules many, stigma bifid, linear, 0.8–1.2 mm long. **Capsules** globose, 1.5–1.8 × 1.2–1.5 mm, narrowed above, crown raised slightly, glabrous, usually thin-walled. **Seeds** many, triangular, 0.18–0.25 × 0.18–0.2 mm, exotesta purple-red, reticulate.

Distribution. Africa, India, Myanmar, China and Malaysia. In Singapore known from Changi (*Burkill s.n.*, 14 Feb 1913, SING [SING0030212]), Pulau Tekong (*Samsuri PT326*, 31 Jan 2002, SING [SING0040010]), Coney Island (*Samsuri SING2004-26*, 15 Jul 2004, SING

[SING0055717]), Geylang (*Teruya* 2220, 22 May 1930, SING [SING0030210]) and some other places.

Ecology. Grows on soil with moist humus, either in shade or open.

Provisional conservation assessment. Globally Least Concern (LC). This species is widespread in Africa and Asia. Listed as Vulnerable (VU/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240, under *Hedyotis dichotoma*) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 64, 175, 222, under *Oldenlandia affinis*) but assessed here as Least Concern (LC).

Uses. This species has been used quite extensively in African traditional medicine for the facilitation of childbirth.

Notes. Roemer & Schultes obtained a manuscript copy of Roth's *Novae Plantarum Species praesertim Indiae Orientalis* and published many of the names before Roth's book was published in 1821. In some cases they changed the name. In this case Roth's *Hedyotis dichotoma* was changed to *H. affinis* and even though many later authors revived Roth's name, *H. affinis* has priority.

2. *Hedyotis angustifolia* Cham. & Schldl.

(Latin, *angusti-* = narrow, *-folia* = leaves; with narrow leaves)

Linnaea 4 (1829) 153; De Candolle, Prodr. 4 (1830) 419. **Synonyms:** *Scleromitron angustifolium* (Cham. & Schldl.) Benth., Hooker's J. Bot. Kew Gard. Misc. 4 (1852) 172. – *Oldenlandia angustifolia* (Cham. & Schldl.) Benth., Fl. Hongk. (1861) 151. **Type:** *Chamisso s.n.*, Philippines, Luzon (holotype LE).

Scleromitron tetraquetrum Miq., Fl. Ned. Ind. 2, fasc. 2 (1857) 186. **Type:** *Junghuhn s.n.*, Indonesia, Java (lectotype L [L0000457], designated here).

Hedyotis tenelliflora auct. non Blume: King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’]) 164; Ridley, Fl. Malay Penins. 2 (1923) 51; Chen & Taylor, Fl. China 19 (2011) 170.

Herbs, annual or perennial. **Stems** diffusely branched at base and then erect to decumbent, smooth or weakly to sharply 4-angled or grooved above, subterete or terete below, glabrous or often scaberulous along grooves or near nodes. **Stipules** triangular, 2–3 mm broad, fused to petiole bases, with 2–5 linear or setiform bristles, 3–4 mm long. **Leaves:** lamina linear or linear-lanceolate, 1.2–5 × 0.2–0.4 cm, apex acute or acuminate, base cuneate, acute or decurrent, margin revolute, thinly leathery, adaxially glabrous or scaberulous near margins, abaxially glabrous, secondary veins not visible; sessile or subsessile with petiole to 1 mm long, glabrescent. **Inflorescences** axillary, usually 2–3-flowered, sometimes solitary or 4-flowered, congested-cymose, glomerulate, or fasciculate, 4–8 mm diam., sessile to subsessile; bracts acicular to lanceolate, 1–2.5 mm, entire or marginally scaberulous. **Flowers** sessile to subsessile with pedicels to 1 mm long, homostylous; hypanthium subglobose to obovoid, c. 1 mm long, calyx limb lobed nearly to base, lobes linear-lanceolate, triangular or spatulate,

1.5–2 mm, ciliolate; corolla white or yellowish white, funnellform, outside glabrous, tube 1–2 mm long, pubescent in throat, lobes narrowly spatulate-oblong to lanceolate, 1–1.5 mm long, incurved at apex; stamens 4, exserted, filament c. 1 mm long, attached below sinus of corolla lobes, anthers oblong, c. 0.5 mm long; style as long as corolla, stigma bifid, 0.2–0.3 mm long, subglobose, papillose; ovary 0.5–1 mm long, ovules many. **Capsules** ovoid, 2–3 × 1.5–2 mm, cartilaginous to stiff, loculicidal across top. **Seeds** numerous, angular, 0.5 × 0.3 mm, exotesta finely reticulate.

Distribution. India, China, Japan, Myanmar, Thailand, Vietnam, Malaysia, Indonesia, Philippines, Australia. In Singapore known from Pierce (*Maxwell 82-90*, 31 Mar 1982, SING [SING0030221]) and Chan Chu Kang (*Ridley s.n.*, 1892, SING [SING0030224]).

Ecology. Partially exposed conditions.

Provisional conservation assessment. Globally Least Concern (LC). It has a wide distribution in the tropical and subtropical areas of the Old World but, in Singapore, it is presumed Nationally Extinct.

3. *Hedyotis auricularia* L.

(Latin, *auricularius* = shaped like an ear, eared;
probably referring to paired leaves resembling ears)

Sp. Pl. 1 (1753) 101; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 92; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’]) 163; Ridley, Fl. Malay Penins. 2 (1923) 49; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 1 (1966) 1148; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 155; Turner, Gard. Bull. Singapore 45 (1993) 197; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 424; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 47, 174, 228; Chen & Taylor, Fl. China 19 (2011) 153. **Synonyms:** *Oldenlandia auricularia* (L.) K.Schum. in Engler & Prantl, Nat. Pflanzenfam. 4(4) (1891) 25. – *Metabolos auricularius* (L.) Blume ex Bremek., Meded. Bot. Mus. Herb. Rijks Univ. Utrecht 56 (1939) 439. – *Exallage auricularia* (L.) Bremek., Verh. Kon. Ned. Akad. Wetensch., Afd. Natuurk., Sect. 2, 48(2) (1952) 142. **Type:** Herb. Hermann 1: 27; 3: 35; 4: 36, no. 64, Ceylon [Sri Lanka] (lectotype BM, designated by Fosberg & Sachet, Allertonia 6(3) (1991) 215).

Herbs, perennial. **Stems** tufted or procumbent, terete or slightly angular, erect or loosely spreading, sparse to densely hirtellous, hispidulous, pilosulous or puberulent, sometimes glabrescent. **Stipules** connate, 2–3 mm broad, densely puberulent, lobes 3–9, linear or setiform, 2–8 mm long, often glandular at apex. **Leaves:** lamina ovate-lanceolate, elliptic-lanceolate or lanceolate, 1–10 × 1–3.5 cm, apex acute, base cuneate or rounded, adaxially glabrous or puberulent along midrib or scabrous, abaxially glabrous on lamina and densely puberulent to hispidulous along midrib and margins, secondary veins 3–7 pairs, conspicuously impressed adaxially; sessile to petiolate. **Inflorescences** axillary, glomerulate to congested-cymose, subsessile or short-pedunculate. **Flowers** distylous; pedicels 0.5–1 mm long, bracts minutely pectinate, 0.7–1 mm long; hypanthium obconic or ovoid, c. 1 mm long, sparsely pubescent; calyx lobes 4 or 5, triangular to lanceolate, 0.8–1.2 mm long, usually ciliolate along the margin; corolla white, tubular or tubular-funnelform, tube 1–1.5 mm long, inside

densely pubescent around the style, lobes ovate-oblong, 0.8–1.5 mm long, incurved at apex, minutely pubescent inside; stamens 4, anthers 0.5–1 mm long, oblong, in long-styled flowers included and with filaments 0.3–0.5 mm long, adnate to the corolla tube, in short-styled flowers exserted and with filaments 1–1.5 mm long, adnate to sinus between corolla lobes; styles pubescent, 2–3 mm long and exserted in long-styled flowers, 0.3–0.5 mm long and included in short-styled flowers; stigmas 0.3–0.5 mm long, bilobed, fleshy, pubescent; ovary 0.5–0.8 mm long, ovules many. **Capsules** indehiscent, 2–2.5 × 1–2 mm, globose to ovoid, crustaceous, muricate, minute or densely pubescent. **Seeds** many, angular, 0.3–0.5 mm long, exotesta black, reticulate.

Distribution. India, Sri Lanka, Nepal, Myanmar, Thailand, Vietnam, China, Japan (Ryukyu Islands), Malaysia, Philippines and Australia. In Singapore known from an unspecified locality (*Hamilton s.n.*, 12 Sep 1926, SING [SING0030181]), Rogu (*Daud s.n.*, Mar 1894, SING [SING0030178]), Bukit Panjang (*Ridley s.n.*, 1892, SING [SING0030179]), Bukit Timah (*Collector unknown s.n.*, SING [SING0030177]), Tuas (*Ridley 2863*, 1 Jan 1890, SING [SING0030180]), Singapore Botanic Gardens and Chan Chu Kang.

Ecology. Common in open places and roadsides.

Provisional conservation assessment. Globally Least Concern (LC). Listed as common in Singapore by Chong et al. (Checkl. Vasc. Pl. Singapore (2009) 47, 174, 228) presumably because it is distributed very widely in the region. However, with no collections since 1955, it must be presumed Nationally Extinct.

4. *Hedyotis biflora* (L.) Lam.

(Latin, *bi-* = two, *-flora* = flowers; with two flowers)

Tabl. Encycl. 1, fasc. 2 (1792) 272; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 155; Turner, Gard. Bull. Singapore 45 (1993) 198; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 424. **Basionym:** *Oldenlandia biflora* L., Sp. Pl. 1 (1753) 119; Chong et al., Checkl. Vasc. Pl. Singapore (2009) 64, 175, 272; Chen & Taylor, Fl. China 19 (2011) 154. **Synonyms:** *Thecagonum biflorum* (L.) Babu, Bull. Bot. Surv. India 11 (1969) 214. – *Leptopetalum biflorum* (L.) Neupane & N.Wikstr., Taxon 64 (2015) 317. **Type:** Herb. Hermann 3: 19, no. 68, ‘Habitat in India’ (lectotype BM [BM000594661], designated by Biju et al., Rheede 2(1) (1992) 11, fig. 1A).

Herbs, annual or perennial. **Stems** erect, angled to subterete, glabrous. **Stipules** triangular, connate at base, 1–2 mm in width, glabrous. **Leaves:** lamina elliptic-oblong, elliptic-ovate, obovate or elliptic, 1–4 × 0.3 cm, apex obtuse or acute, base attenuate to obtuse, papery, glabrous, secondary veins obscure; subsessile or with petioles 2–10 mm long. **Inflorescences** terminal or in axils of uppermost leaves, cymose to compound-cymose, 2–many flowered, glabrous, pedunculate; bracts triangular to lanceolate, 0.5–3 mm. **Flowers** homostylous, subsessile or pedicels 0.5–1 mm long and slender; hypanthium ovoid or turbinate, 0.5–1 mm long, calyx lobes ovate-lanceolate or triangular, 0.5–1 mm long; corolla white, tubular to somewhat urceolate, outside glabrous or puberulent, inside with a pubescent ring at throat; tube swollen, 1.2–2 mm long; lobes 1–1.5 mm long, spatulate-oblong; stamens 4, included,

filaments c. 0.5 mm long, adnate to corolla tube, anther 0.3–0.5 mm long; ovary c. 0.8 mm long, ovules many, style c. 1.0 mm long, stigma bilobed, linear, c. 0.5 mm long. **Capsules** subglobose, oblate or hemispherical, 2–3 mm diam., loculicidally dehiscent across top. **Seeds** many, globose or subglobose, 0.3–0.5 mm, exotesta foveolate.

Distribution. India, Nepal, China, Thailand, Vietnam, Malaysia, Indonesia and the Pacific islands. In Singapore it has been collected in Singapore Botanic Gardens (*Ridley s.n.*, 1898, SING [SING0033723]; *Purseglove P4009*, 26 Sep 1954, SING [SING0033718]; *Purseglove P4058*, 13 Feb 1955, SING [SING0033719]; *Ridley s.n.*, Nov 1892, SING [SING0033724]), Bukit Batok (*Ho SING2018-381*, 10 Apr 2018, SING), Tanglin Barracks and Anson Road.

Ecology. A common weed of coastal areas, fields, wastelands, roadsides and gardens.

Provisional conservation assessment. Globally Least Concern (LC). Despite being infrequently collected, this species is widespread in Singapore and is assessed here as Least Concern (LC).

5. *Hedyotis capitellata* Wall. ex G. Don

(Latin, *capitellatus* = in very small heads; referring to the flowers)

Gen. Hist. 3 (1834) 527; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 92; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’]) 159; Ridley, Fl. Malay Penins. 2 (1923) 46; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 1 (1966) 1148; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 155; Turner, Gard. Bull. Singapore 45 (1993) 198; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 424; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 47, 174, 228; Chen & Taylor, Fl. China 19 (2011) 156. **Synonyms:** *Dimetia capitellata* (Wall. ex G. Don) Neupane & N. Wikstr., Taxon 64 (2015) 315. – *Oldenlandia capitellata* (Wall. ex G. Don) Kuntze, Revis. Gen. Pl. 1 (1891) 292. **Type:** *Gomez s.n.* [EIC 837.1], [Myanmar], Tavoy, 22 September 1827 (lectotype K-W [K001110027], designated by Dutta & Deb, Taxon. Rev. Hedyotis Ind. (2004) 48; isolectotypes CAL, G [G00436290]). **Fig. 29.**

Herbs or subshrubs, perennial. **Stems** climbing, clambering or scandent, obtusely angular and grooved above, terete below, swollen at nodes, glabrous. **Stipules** connate, 2–4 mm broad, with 3–10 glabrous coarse teeth. **Leaves:** lamina lanceolate or elliptic-oblong, 2–12 × 1–4 cm, apex acuminate, base cuneate, margin sometimes revolute, membranous or submembranous, glabrous on both sides, secondary veins 3–5 pairs, prominent below; sessile or petiole 1–4 mm long, glabrous. **Inflorescences** terminal and often also in axils of uppermost leaves, trichotomously branched, with paniculate groups of capitate to subcapitate heads, glabrous or hirtellous, peduncles 1–5 cm long. **Flowers** sessile or short-pedicellate, distylous, bracteate; hypanthium ovoid to obconic, 0.7–1 mm long, glabrous or minutely pubescent, calyx lobes 4, triangular, ovate to ovate-lanceolate, 1–2 mm long, acute, ciliate at margin; corolla white or pale blue, funnellform, outside glabrous, inside densely pubescent in throat and on lobes, tube 1–2 mm long; lobes 3–4 mm long, oblong, recurved; stamens 4, anthers oblong, 1–2 mm long, in long-styled flowers included and with filaments c. 2 mm long, adnate at corolla tube, in short-styled flowers exerted and with filaments c. 4 mm long, adnate at the sinus



Figure 29. *Hedyotis capitellata* Wall. ex G.Don. **A.** Flowering shoots. **B.** Long-styled flowers with included stamens and conspicuously exerted styles. **C.** Short-styled flower with exerted stamens. (From Singapore, A, C from Nee Soon, *Ng SING2018-267*; B from Bukit Timah Nature Reserve, *Yee et al. RR 11021*. Photos: X.Y. Ng).

between corolla lobes; styles linear, 6–7 mm long and exerted in long-styled flowers, 2–3 mm long and included in short-styled flowers; stigma linear, 1–1.5 mm long, bilobed, papillose; ovary 0.7–1 mm long, ovules many. **Capsules** globose or ellipsoid, hemispherical or obscurely 2-lobed, 2–3 × 1.5–2 mm, protruding at the top, glabrous, opening septicidally at apex initially, then loculicidally. **Seeds** many, angular, 0.2–0.5 × 0.2–0.3 mm, narrowly winged, exotesta reticulate, brownish.

Distribution. India, China, Myanmar, Thailand, Vietnam, Malaysia and Indonesia. In Singapore it has been collected in Bukit Timah (*Yee et al. RR 11021*, 27 Jan 2018, SING [SING0243436]), Nee Soon (*Mhd Shah & Ali MS 4154*, 3 Dec 1981, SING [SING0030186]; *Gwee SING2010-503*, 3 Mar 2010, SING [SING0138155]), Akon Tanjong Piah (*Cantley 2136*, SING [SING0030185]), Bukit Mandai (*Goodenough 2862a*, 14 Apr 1890, SING [SING0030188]) and Chan Chu Kang (*Ridley s.n.*, 1891, SING [SING0030187]).

Ecology. Lowlands to mountain slopes, in sunny sites.

Provisional conservation assessment. Globally Least Concern (LC). Listed as Critically Endangered (CR/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 47, 174, 228) but assessed here as Least Concern (LC).

6. *Hedyotis corymbosa* (L.) Lam.

(Latin, *corymbosus* = with flowers arranged in corymbs;
referring to the broad or flat-topped flower cluster)

Tabl. Encycl. 1, fasc. 2 (1792) 272; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 155; Turner, Gard. Bull. Singapore 45 (1993) 198; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 424.

Basionym: *Oldenlandia corymbosa* L., Sp. Pl. 1 (1753) 119; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 92; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’]) 169; Ridley, Fl. Malay Penins. 2 (1923) 54; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 64, 175, 267; Chen & Taylor, Fl. China 19 (2011) 160. **Type:** [Published illustration] Plumier, Nov. Pl. Amer. (1703) 42, t. 36, lectotype designated by Verdcourt, Fl. Trop. E. Africa, Rubiaceae (Pt 1) (1976) 308.

Herbs, annual or perennial. **Stems** prostrate or erect, branching near the base, acutely angular, ridges prominent, glabrous or scabridulous. **Stipules** rounded to triangular, fused to petiole bases, with 2–5(–7) linear lobes or bristles, puberulent to glabrous. **Leaves:** lamina linear, narrowly lanceolate or elliptic, 1–3.5 × 0.1–0.7 cm, apex acute or apiculate, base cuneate, margin flat or revolute, membranous, glabrous or sparsely to densely scabridulous, particularly on the midrib, secondary veins indistinct; subsessile. **Inflorescences** axillary, (2–)3–5-flowered corymbs, umbels or racemose cymes, peduncles 0.5–2 cm long, filiform, glabrous. **Flowers** homostylous, pedicels slender, 0.1–1.2 cm long; hypanthium subglobose, ovoid or ellipsoid, 0.5–1 mm long, calyx lobes 4, narrowly triangular or triangular-lanceolate, 0.5–1.2 mm long, entire to ciliate; corolla white, tubular, often gibbous at base, tube 0.8–1.5 mm long, glabrous or with a ring of pubescent hairs inside below lobe sinuses or throat, lobes ovate or oblong, 0.7–1.5 mm long, incurved at apex, minutely pubescent inside; stamens 4, included, filaments

0.2–0.8 mm long, adnate to lobe sinuses or throat of corolla tube; anthers subglobose, 0.3–0.5 mm long; style 0.5–2.5 mm long, often sparsely hirtellous, stigma subglobose, 0.3–0.5 mm long, bilobed, fleshy, papillose; ovary 0.5–1 mm long, ovules many. **Capsules** globose or ellipsoid, 1.2–2.5 × 1.8–2.8 mm, loculicidally dehiscent through the flat to broadly rounded apex. **Seeds** many, triangular, c. 0.2 × 0.2 mm, exotesta reticulate, pale brown.

Distribution. Africa and tropical Asia; widely naturalised in the Americas and the Pacific region. In Singapore known from Pulau Tekong (*Samsuri PT193*, 6 Dec 2001, SING [SING0039869]), Singapore Botanic Gardens (*Purseglove P4031*, 7 Feb 1955, SING [SING0033725]), Serangoon Road (*Teruya 580*, 21 Apr 1929, SING [SING0156964]) and Changi (*Goodenough s.n.*, 11 Mar 1889, SING [SING0033728]; *Shimizu S14304*, 5 Nov 1967, SING [SING0033727]).

Ecology. Moist sandy sites. Common in lawns and on roadsides.

Provisional conservation assessment. Globally Least Concern (LC). Listed (under *Oldenlandia corymbosa*) as naturalised in Singapore by Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 64, 175, 267) but we consider it native and give it a conservation assessment of Least Concern (LC).

Uses. In India, the root is used to produce a red dye. In Thailand, a decoction of whole plants is traditionally used for antipyretic purposes to decrease body temperature. Pharmacologically, anti-inflammatory, antioxidant, and hepatoprotective properties of plant extracts have also been reported. In traditional Chinese medicine, this species is usually added as an adulteration to *Hedyotis diffusa* in commercial and folk herbal medicine, although their chemical compounds are different (Noiarsa et al., J. Nat. Med. 62 (2008) 249–250; Wang et al., J. Trop. Subtrop. Bot. 22 (2014) 431–442).

7. *Hedyotis diffusa* Willd.

(Latin, *diffusus* = diffuse, loosely spreading; referring to the loose branching)

Sp. Pl., ed. 4, 1(2) (1798) 566; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 155; Turner, Gard. Bull. Singapore 45 (1993) 198; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 425; Chen & Taylor, Fl. China 19 (2011) 161. **Synonyms:** *Oldenlandia diffusa* (Willd.) Roxb., Hort. Bengal. (1814) 11; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 92; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’]) 170; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 64, 176, 272. – *Scleromitron diffusum* (Willd.) R.J.Wang, J. Trop. Subtrop. Bot. 22 (2014) 440. **Type:** *Klein 60* [Herb. Willdenow 2588] (element on the right, annotated B), India, Travancore (lectotype B [B-W 02588-010], designated by Sivarajan & Biju, Taxon 39 (1990) 671, 672). **Fig. 30.**

Oldenlandia brachypoda DC., Prodr. 4 (1830) 424. **Synonym:** *Hedyotis brachypoda* (DC.) Sivar. & Biju, Taxon 39 (1990) 672. **Type:** *Wallich s.n.*, Nepal, 1821 (lectotype G-DC [G00208558]), designated by Sivarajan & Biju, Taxon 39 (1990) 671, 672).

Herbs, annual, slender. **Stems** erect or diffusely branched, terete to slightly flattened, compressed, glabrous. **Stipules** connate, 2–3 mm broad, with 2–3 bristles. **Leaves:** lamina



Figure 30. *Hedyotis diffusa* Willd. Straggly leafy stems with flower and fruits. Inset: Open flowers. (From China. Photo: R.J. Wang).

linear, narrowly elliptic or narrowly oblanceolate, $4\text{--}5 \times 0.2\text{--}0.5$ cm, apex acute, base acute, margins usually revolute when dry, membranous, adaxially glabrous to scaberulous, abaxially glabrous, secondary veins not visible; sessile or subsessile. **Inflorescences** axillary, solitary-flowered, rarely 2–3-flowered, glabrous, sessile or slender-pedunculate. **Flowers** homostylous, subsessile to short-pedicellate or pedunculate; hypanthium globose, $0.8\text{--}1.3 \times 1\text{--}1.5$ mm, calyx lobes 4, triangular, 1–1.5 mm long, ciliate along the margin or serrated; corolla white, abaxially glabrous, tube 1–1.7 mm long, glabrous at throat, lobes triangular to ovate, 1–1.5 mm, incurved at apex; stamens 4, exserted, filaments 0.5–1.5 mm long, adnate to sinus of corolla lobes, anthers ovoid, c. 0.6 mm long; style stout, 2–2.5 mm long, stigma bilobed, c. 0.8 mm, exserted; ovary subglobose, c. 1 mm long, ovules many, placenta axile. **Capsules** depressed globose to subglobose, $2\text{--}3 \times 2\text{--}4$ mm, membranous to papery, loculicidally dehiscent through the flattened apex. **Seeds** c. 20, angled, c. 0.2 mm diam., exotesta deeply and thickly foveolate, brown.

Distribution. India, Nepal, Bhutan, Sri Lanka, Bangladesh, China, Japan, Thailand, Vietnam, Malaysia, Indonesia and the Philippines. In Singapore documented from Singapore Botanic Gardens (*Ridley 10641*, 1899, SING [SING0033732]; *Purse-glove P4054*, 8 Feb 1955, SING [SING0033737]), Geylang (*Teruya 2334*, Apr 1933, SING [SING0164746]), Sungei Sinpang (*Lua SING2018-392*, 12 Apr 2018, SING [SING0267370]) and Pasir Panjang (*Chen SING2017-728*, 6 Dec 2017, SING [SING0267372]).

Ecology. In moist humus-covered clayey or sandy alluvial soils, or on lawns.

Provisional conservation assessment. Globally Least Concern (LC). In Singapore Least Concern (LC).

Uses. It was traditionally used in folk medicine for anti-inflammatory, hepatoprotective, neuroprotective, antioxidant, antipyretic, diuretic, blood-stimulant, and anticarcinogenic effects, and is thought to have enormous potential in therapy for cancer and tumours in many Asian countries. It is also an important ingredient of herbal teas for health maintenance in Eastern and tropical Asia (Wang et al., *J. Trop. Subtrop. Bot.* 22 (2014) 431–442).

8. *Hedyotis herbacea* L.

(Latin, *herbaceus* = herbaceous; referring to the habit of the plant)

Sp. Pl. 1 (1753) 102; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 155; Turner, Gard. Bull. Singapore 45 (1993) 198; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 425; Chen & Taylor, Fl. China 19 (2011) 163. **Synonyms:** *Oldenlandia herbacea* (L.) Roxb., Hort. Bengal. (1814) 11; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 64, 176, 272. – *Gerontogea herbacea* (L.) Cham. & Schldl., Linnaea 4 (1829) 154. **Type:** Herb. Hermann 4: 19, no. 65, Ceylon [Sri Lanka] (lectotype BM [BM000628086], designated by Trimen, Handb. Fl. Ceylon 2 (1894) 315). **Fig. 31.**

Oldenlandia heynei auct. non (R.Br. ex Wight & Arn.) G.Don: Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 92; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’]) 169.

Herbs, annual or perennial. **Stems** erect or suberect, weakly to sharply 4-ribbed, often narrowly winged at nodes, glabrous. **Stipules** reduced or truncate, fused to petiole bases, 2–4 × 0.2–0.3 mm, with few setae or bristles on the margin. **Leaves:** lamina linear or linear-lanceolate, 1–5.5 × 0.1–0.3 cm, apex acute, base acute to obtuse, margins weakly to strongly revolute, membranous to papery, glabrous to scaberulous on both sides, secondary veins not distinct; sessile or subsessile. **Inflorescences** axillary, solitary, rarely several-flowered and fasciculate to cymose, glabrous. **Flowers** 3–4 mm long, homostylous, rarely heterostylous, pedicels 6–22 mm long, as long as or longer than the leaves; hypanthium subglobose to ovoid, 0.8–1 mm long, usually glabrous, calyx lobes 4, narrowly triangular to linear, 0.5–1.5 mm long, scabridulous at the margin; corolla white to reddish or pale purple, infundibuliform, outside glabrous, tube 2–3 mm long, glabrous at throat, lobes ovate to oblong, 0.5–1 × 0.2–1 mm, acute; stamens 4, inserted within tube or on throat, often visible, filaments very short in isostylous flowers, anthers c. 0.2 mm long, linear; ovary 0.5–1 mm long, ovules many; style slender, 3–3.5 mm long, stigma bilobed, lobes filiform, c. 0.8 mm long. **Capsules** globose or ovoid, 2–2.5 mm long, top protruding beyond the erect calyx segments, glabrous, loculicidally dehiscent through the beaked apex. **Seeds** many, angular, c. 0.2 mm diam., exotesta strongly reticulate, brownish, mucilaginous.

Distribution. Widespread in tropical Africa and Asia. In Singapore only known from the Singapore Botanic Gardens (*Ridley s.n.*, Jun 1892, SING [SING0033738]).

Ecology. Generally in rocky crevices, near edges of ponds, roadsides, and elsewhere in harvested rice fields among grasses or sand dunes.

Provisional conservation assessment. Globally Least Concern (LC). In Singapore presumed Nationally Extinct.

9. *Hedyotis pinifolia* Wall. ex G. Don

(Latin, *pini-* = pertaining to *Pinus* L., *-folia* = leaves; referring to the narrow pine-like leaves)

Gen. Hist. 3 (1834) 526; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 92; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’]) 166; Ridley, Fl. Malay Penins. 2 (1923) 52; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 1 (1966) 1149; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 155; Turner, Gard. Bull. Singapore 45 (1993) 198; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 426; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 47, 174, 228; Chen & Taylor, Fl. China 19 (2011) 167. **Synonyms:** *Oldenlandia pinifolia* (Wall. ex G. Don) K. Schum. in Engler & Prantl, Nat. Pflanzenfam. 4(4) (1891) 25. – *Scleromitrium pinifolium* (Wall. ex G. Don) R. J. Wang, J. Trop. Subtrop. Bot. 22 (2014) 440. **Type:** *Wallich s.n.* [EIC 850.3], [Myanmar], Prome, 1824 (lectotype K-W [K001110065], designated here).

Hedyotis caerulea auct. non (L.) Hook.: Ridley, Fl. Malay Penins. 2 (1923) 52; Sinclair, Gard. Bull. Singapore 14(1) (1953) 33; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 424.

Herbs, annual or perennial. **Stems** erect or diffusely branched, slender, subterete to 4-angled or winged, grooved. **Stipules** truncate, slightly fused to petiole bases, 1–3 mm long, puberulent to

glabrous, with 1–5 bristles. **Leaves:** lamina on very short axillary stems appearing verticillate or clustered, linear, $2\text{--}4 \times 0.1\text{--}0.3$ cm, apex and base acute, margin revolute, subcoriaceous, upper surface hispid, lower surface glabrous, secondary veins not distinct; sessile to subsessile, **Inflorescences** terminal and pseudo-axillary on short axillary shoots, capitate to short-fasciculate, congested or lax, 3–10-flowered, subtended by 1 or 2 pairs of somewhat reduced leaves; bracts lanceolate to setose, entire to ciliate. **Flowers** apparently homostylous, sessile to subsessile or pedicellate, hispid; hypanthium obconical or globose, 0.8–1.2 mm long, glabrous to densely hispidulous, calyx lobes 4, subulate to narrowly triangular, 1–2 mm long, glabrescent, entire to densely ciliate; corolla tubular to funnelliform, white, sometimes flushed with pink, c. 4 mm long, outside glabrous, tube 1.5–2 mm long, pubescent in throat, lobes 4, spatulate-oblong to elliptic, 1–2 mm long, acute and incurved at apex, glabrous; stamens 4, filaments 1.5–2 mm long, stout, attached at sinus of corolla lobes, anthers c. 1 mm long, oblong, exerted; ovary ovoid, 0.8–1 mm, ovules many, style 4–6 mm long, stigma 0.5–1 mm long, bifid, the lobes linear, feathery, exerted above anthers. **Capsules** ovoid to lanceoloid, $2.5\text{--}3 \times 1\text{--}2$ mm, ridged, cartilaginous to stiff, hispid, dehiscing loculicidally at apex. **Seeds** many, polyhedral or irregular in outline, c. 0.2 mm, exotesta reticulate, brownish or rusty red.

Distribution. India, Nepal, China, Myanmar, Thailand, Vietnam and Malaysia. In Singapore known from St Michael's Road (*Sinclair s.n.*, 27 Jan 1950, SING [SING0030190]), Lim Chu Kang Road (*Sinclair s.n.*, 23 Jan 1951, SING [SING0030189]) and Singapore Botanic Gardens (*Purseglove P4080*, 27 Feb 1955, SING [SING0030191]).

Ecology. Common in moist, sandy sites throughout its range, especially near seashores and riversides but also in wastelands and on open hillsides.

Provisional conservation assessment. Globally Least Concern (LC). Listed as Vulnerable (VU/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 47, 174, 228) but assessed here as Data Deficient (DD). While it is common elsewhere, it is unclear whether it has been overlooked for collection in Singapore or whether it is truly threatened. A concerted search is necessary.

10. *Hedyotis prostrata* Blume

(Latin, *prostratus* = prostrate, lying flat against a surface; presumably referring inaccurately to the habit)

Cat. Gew. Buitenzorg (1823) 40; Chen & Taylor, Fl. China 19 (2011) 168. **Type:** *Collector unknown s.n.*, Indonesia, Java, Katumpun tanna (lectotype L [L2916647], designated here).

Hedyotis congesta R.Br. ex G.Don, Gen. Hist. 3 (1834) 526; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 92; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 ['1903']) 161; Ridley, Fl. Malay Penins. 2 (1923) 51; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 155; Turner, Gard. Bull. Singapore 45 (1993) 198; Turner, Gard. Bull. Singapore 47 (1997 ['1995']) 426; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240. **Synonym:** *Oldenlandia congesta* (R.Br.

ex G.Don) Kuntze, Revis. Gen. Pl. 1 (1891) 292. **Type:** *Wallich s.n.* [EIC 844], [Malaysia], Pulo-Penang (lectotype K-W [K001110042], designated here; isolectotypes CAL, E [E00326842]). **Fig. 31.**

Oldenlandia cristata ined.: Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 64, 176, 222.

Shrubby herb, perennial. **Stems** stout, robust, 4-angled, acute or obtuse, glabrous. **Stipules** triangular, 2–4 × 4–10 mm, pinnately lacerate, coriaceous, puberulous. **Leaves:** lamina oblong, elliptic or linear-lanceolate, 6–16 × 1.5–6 cm, apex acute or acuminate, base cuneate, coriaceous, upper surface pubescent towards base and along midrib, lower surface glabrous, secondary veins 5–6 pairs, minutely pubescent or glabrescent; petioles 3–7(–10) mm long. **Inflorescences** in axillary, sub-pedunculate cymes of 8–15(–20) flowers. **Flowers** homostylous, 4–5 mm long, subsessile or with pedicels 1–2 mm long, glabrous; bracts 1–1.5 mm long, ciliate; hypanthium ovoid or obconic, 0.6–1 mm long, calyx lobes 4, ovate or lanceolate, 1–1.2 × 0.8–1 mm, obtuse, ciliate at margin; corolla white to violet, campanulate to funnelform, tube 2–3 mm long, glabrous, lobes oblong or linear-lanceolate, 1–1.2 mm long, glabrous; stamens 4, included, filaments 0.2–0.3 mm long, attached below the sinus between corolla lobes, anthers 0.4–0.6 mm long, oblong; ovary 0.6–1 mm long, ovules 16–20, style c. 3 mm long, slender, stigma 0.5 mm long, slightly swollen, 2-lobed, pubescent, exerted at corolla mouth. **Capsules** white when young and then green, ellipsoid to ovoid, 3–3.5 × 2–3 mm, apparently indehiscent or tardily septically dehiscent, glabrous, crown included within calyx lobes, sub-drupaceous. **Seeds** 16–20, triangular, 0.5–0.6 × 0.3–0.5 mm, narrowly winged, exotesta reticulate, black.

Distribution. India, China, Vietnam, Indonesia and the Philippines. In Singapore known from Nee Soon (*Wang SING2008-04*, 15 Jan 2008, SING [SING0114792]; *Leong-Škorničková SING2015-041*, 10 Feb 2015, SING [SING0213854]), Chestnut Avenue (*Gwee SING2010-723*, 31 Mar 2010, SING [SING0145728]), MacRitchie (*Lim HOB008*, 5 Jul 2010, SING [SING0153641]) and Bukit Timah (*Chen LCMJ202*, 2 May 1998, SING [SING0042720]).

Ecology. Across its range, generally growing in dense bamboo forest, mostly in hilly areas on sandy loamy soil. Also found in sparsely forested areas, along streams and seasonally boggy localities, usually on sandy soils, at low to medium elevations.

Provisional conservation assessment. Globally Least Concern (LC). Listed as Vulnerable (VU/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240, under *Hedyotis congesta*) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 64, 176, 222, under *Oldenlandia cristata*) but assessed here as Least Concern (LC).

Uses. In the Philippines, a decoction is made from its roots to treat dysentery, colic and stomach aches. A decoction of the root is also used externally as a wash for listless children. The root is used as a poultice, specifically on scalds, and generally on any painful part of the body. The aerial parts of the plant are eaten with a bitter gourd (*Momordica* sp.) after childbirth.



Figure 31. *Hedyotis prostrata* Blume. **A.** Habit. **B.** Stem with axillary inflorescences. **C.** Flower. **D.** Pinnately lacerate stipules. **E.** Lower leaf surface. (From Singapore, A, from MacRitchie; B–D from Nee Soon, J. Leong-Škorničková SING2015-041. Photos: J. Leong-Škorničková).

11. *Hedyotis pumila* L.f.

(Latin, *pumilus* = dwarf, close-growing, short; referring to the small size of the plant)

Suppl. Pl. (1782 [‘1781’]) 119; Turner, Gard. Bull. Singapore 45 (1993) 198; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 426. **Synonym:** *Oldenlandia pumila* (L.f.) DC., Prodr. 4 (1830) 425; Tan et al., Gard. Bull. Singapore 44(2) (1993 [‘1992’]) 131; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 64, 176, 272. **Type:** *Koenig s.n.*, India, Tranquebaria (lectotype LINN [Herb. Linn. no. 123.7], designated by Fosberg & Satchet, Allertonia 6(3) (1991) 235).

Herbs, annual or perennial. **Stems** diffusely branched, procumbent to prostrate, sharply angular or sulcate, subglabrous to sparsely hirtellous. **Stipules** truncate or triangular, 2–3 × 0.5–2 mm, with 2–5 bristles, hirtellous. **Leaves:** lamina elliptic or elliptic-lanceolate, 0.7–1.8 × 0.1–0.6 cm, apex acute, base cuneate, margins ciliate, membranous to papery, sparsely hirtellous on both sides, secondary veins not distinct; subsessile. **Inflorescences** axillary, 1(–2)-flowered; peduncle 0.7–1 cm long. **Flowers** homostylous, 2.5–3 mm long, pedicels 1–1.5 cm long, distinctly ribbed, denticulate along ribs; hypanthium ovoid, 0.3–1 mm long, calyx lobes 4, rarely 5, ovate-lanceolate or triangular, c. 0.5 mm long, acute and dentate at margin; corolla white, c. 2 mm long, tube c. 1.2 mm long, pubescent at throat, lobes 4, ovate, 0.5–0.8 × c. 0.5 mm, acute and incurved at apex; stamens 4, filaments inconspicuous, 0.2–0.3 mm long, adnate to sinus between corolla lobes, anthers c. 0.2 cm long, ovoid, exerted at corolla throat; ovary c. 0.3 mm long, ovules many on a submedian oblong placenta, style 0.5–0.7 mm long, stigma clavate, 0.3–0.5 mm long, bilobed, fleshy, tufted-hairy, exerted above the anthers. **Capsules** ellipsoid or oblong-ovoid, 2–3 × 2.5–3 mm, distinctly ribbed, glabrous, dehiscent septicidally along the top. **Seeds** many, angular, c. 0.5 × 0.3 mm, exotesta strongly reticulate, brownish.

Distribution. India, Bangladesh, Myanmar, Vietnam, Malaysia and Indonesia. Introduced in Africa and Jamaica. In Singapore it grows on wastelands and roadsides, such as Bukit Batok West Avenue (*Ho SING2018-382*, 10 Apr 2018, SING [SING2018-382]) and Steven Drive (*Wang 5351*, 16 Jul 2018, IBSC).

Ecology. A small and inconspicuous plant that, nevertheless, is common on urban roadsides and in lawns, mixed with *Hedyotis corymbosa* and other herbaceous weeds.

Provisional conservation assessment. Globally Least Concern (LC). In Singapore Least Concern (LC).

12. *Hedyotis trinervia* (Retz.) Forsyth f.

(Latin, *tri-* = three, *-nervia* = nerves or veins; referring to the leaf veins)

Bot. Nomencl. (1794) col. 86; Maxwell, Gard. Bull. Singapore 35(2) (1983 [‘1982’]) 198; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 155; Turner, Gard. Bull. Singapore 45 (1993) 198; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 426; Chen & Taylor, Fl. China 19 (2011) 171. **Basionym:** *Oldenlandia trinervia* Retz., Observ. Bot. 4 (1786) 23; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 92; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’]) 170; Ridley, Fl. Malay Penins. 2 (1923) 55; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 64, 176, 272. **Synonym:**

Edrastima trinervia (Retz.) Neupane & N.Wikstr., Taxon 64 (2015) 316. **Type:** *Koenig s.n.*, India (lectotype LD [LD1613930], designated by Neupane et al., Taxon 64 (2015) 336; possible isolectotypes BM [BM000945131], K).

Herbs, annual or perennial. **Stems** prostrate or creeping to weakly erect, branches diffuse, slender, acutely 4-angled to winged, pilose. **Stipules** connate, 1.5–2 mm broad, with 2–3 bristles c. 1 mm long, hispidulous to villosulous. **Leaves:** lamina suborbicular, broadly ovate or elliptic, 3–12 × 6–10 mm, apex acute and often mucronate, base obtuse and short-decurrent, margin setulose, membranous, upper surface glabrous, lower surface glabrous or sparsely strigillose to hispid, secondary veins usually 3 pairs; petioles 0.5–2 mm long. **Inflorescences** axillary, solitary or with 2–6 flowers. **Flowers** apparently homostylous, 2–3 mm long, subsessile or with pedicels 1–1.5 mm long, pilose; hypanthium subglobose, 1–1.2 mm long, calyx lobes 4, triangular to ovate-lanceolate, 1–1.2 × 0.3–0.4 mm, outer surface pilose; corolla white, apparently glabrous, tube c. 0.5 mm long, lobes 1–2 × 0.6–1 mm; stamens 4, 0.5–1 mm long, anthers small, globose, attached around the level of the stigma; ovary 0.8–1 mm long, ovules several on globose placenta, styles c. 0.5 mm long, stigma capitate, bilobed. **Capsules** subglobose, laterally compressed, 1.5–1.8 × 1.5–1.8 mm, top truncate or shortly protruding, densely hispid, loculicidally dehiscent across apex. **Seeds** several, triangular, 0.1–0.2 mm long, exotesta reticulate, purple.

Distribution. India, Sri Lanka, Bangladesh, China, Myanmar, Vietnam and Malaysia. In Singapore it has been collected in Geylang (*Ridley 8047*, 1896, SING [SING0030228]) and Pulau Sudong (*Maxwell 82-295*, Nov 28 1982, SING [SING0030226, SING0030227]).

Ecology. In Singapore presumed to have been in sandy sites next to mangrove vegetation.

Provisional conservation assessment. Globally Least Concern (LC). In Singapore it is presumed Nationally Extinct as the last collection was made in 1982 and the known collecting sites have been transformed by construction work.

13. *Hedyotis verticillata* (L.) Lam.

(Latin, *verticillatus* = arranged in a whorl; referring to the arrangement of the flowers)

Tabl. Encycl. 1, fasc. 2 (1792) 271; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 1 (1966) 1149; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 426; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 47, 174, 271; Chen & Taylor, Fl. China 19 (2011) 172. **Basionym:** *Oldenlandia verticillata* L., Mant. Pl. 1 (1767) 40. **Synonym:** *Scleromitron verticillatum* (L.) R.J.Wang, J. Trop. Subtrop. Bot. 22 (2014) 440. **Type:** *Collector unknown s.n.*, [Indonesia] Amboinae [Ambon] (lectotype LINN [Herb. Linn. no. 155.1], designated by Fosberg & Sacht, Allertonia 6(3) (1991) 210, 242).

Hedyotis hispida Retz., Observ. Bot. 4 (1786) 23; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’]) 166; Ridley, Fl. Malay Penins. 2 (1923) 52. **Synonyms:** *Oldenlandia hispida* (Retz.) Lam., Encycl. 4, fasc. 2 (1798) 536. – *Scleromitron hispidum* (Retz.) Korth., Ned. Kruidk. Arch. 2(4) (1851) 155. **Type:** *Wennerberg s.n.*, China, Guangdong (holotype LD [LD1752513]).

Herbs, annual or perennial. **Stems** flattened, subterete, or 4-angled, diffusely branched, prostrate or procumbent, or weakly erect, sparse to densely pubescent along the grooves or puberulous throughout. **Stipules** triangular to subtruncate, fused to petiole bases, 1–4 mm broad, with 4–9 linear lobes or bristles 1–10 mm long. **Leaves:** lamina linear-lanceolate or elliptic-lanceolate, 2.5–7 × 0.3–2 cm, apex acute or acuminate, base acute to obtuse, margin revolute, thin-coriaceous, scaberulous or hispidulous to glabrescent on both sides, secondary veins obscure; sessile or petioles 0.5–1 mm long. **Inflorescences** axillary, flowers clustered, glomerulate to congested-cymose, hispidulous. **Flowers** homostylous, 8–10 mm long, pedicels 0.7–1 mm long, bracts 1–2 mm long; hypanthium ovoid to subglobose, 1–1.5 mm long, calyx lobes 4, ovate-lanceolate to triangular, 1–2.5 × 0.8–1 mm, ciliolate; corolla white, funnellform, 6–8 mm long, outside glabrous generally, tube 2–4 mm long, inside glabrous, lobes 4, linear-lanceolate, 2–4 × 1 mm, apex incurved with spinous appendages abaxially; stamens 4, slightly longer than corolla lobes, filaments 4–5 mm long, attached to sinus between corolla lobes, anthers oblong, 1–1.5 mm long, exserted; ovary 0.8–1.2 mm long, ovules many on a submedian placenta, style c. 9 mm long, stigma subglobose, bilobed, lobes 0.3–0.7 mm long. **Capsules** globose to ovoid, 2.5–3 × 1.5–3 mm, subcoriaceous, ribbed, loculicidal across apex. **Seeds** numerous, triangular, c. 0.3 mm diam., exotesta finely reticulate, purple.

Distribution. India, Bhutan, Nepal, Bangladesh, China, Japan (Ryukyu Islands), Myanmar, Thailand, Vietnam, Malaysia, Indonesia and the Philippines. In Singapore known from a site adjacent to Singapore Botanic Gardens (*Lai LJ144*, 12 Dec 1996, SING [SING0008217]), MacRitchie (*Lim HOB011*, 5 Jul 2010, SING [SING0153642]) and Chua Chu Kang (*Ridley s.n.*, Feb 1894, SING [SING0033739]).

Ecology. On roadsides and in open forest stands.

Provisional conservation assessment. Globally Least Concern (LC). The species is very common throughout its range hence also Least Concern (LC) in Singapore.

14. *Hedyotis vestita* R.Br. ex G.Don

(Latin, *vestitus* = clothed; alluding to the plant indumentum)

Gen. Hist. 3 (1834) 526; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 92; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’]) 159; Ridley, Fl. Malay Penins. 2 (1923) 49; Turner, Gard. Bull. Singapore 45 (1993) 198; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 426; Chen & Taylor, Fl. China 19 (2011) 173. **Synonym:** *Oldenlandia vestita* (R.Br. ex G.Don) Drake, J. Bot. (Morot) 9 (1895) 211. **Type:** *Wallich s.n.* [EIC 847], [Malaysia], Penang, 1822 (lectotype BM [BM000833378], designated here; isolectotypes CAL, K [K000770014], K-W [K001110053, K001110055]).

Hedyotis capituliflora Miq., Fl. Ned. Ind. 2, fasc. 2 (1857) 183. **Syntypes:** *Blume s.n.*, [Indonesia], Java (L [L0000473]); *Korthals s.n.*, [Indonesia], Java (L [L0000469, L0000471]); *Korthals s.n.*, [Indonesia], Sumatra (L [L0000464, L0000465, L0000466]); *Junghuhn s.n.*, [Indonesia], Sumatra, Padang (L [L0000467]).

Metabolos caeruleus Blume, Bijdr. Fl. Ned. Ind., pt. 16 (1826–1827) 992. **Type:** *Blume s.n.*, [Indonesia], Java, Buitenzorg (lectotype L [L0000468], designated here).

Herbs, annual or perennial. **Stems** stout, procumbent, clambering or prostrate, obtusely 4-angled or subterete, sometimes sulcate, densely villous or hirsute with trichomes drying golden yellow throughout. **Stipules** truncate to triangular, connate, 2–3 mm broad, membranous, moderately to densely hirtellous or villous, with 1–5 linear or setose lobes 2–8 mm long. **Leaves:** lamina lanceolate, elliptic-lanceolate, or ovate-lanceolate, 2–9.5 × 0.5–3 cm, apex acuminate, base cuneate to obtuse and frequently decurrent, membranous to papery, upper surface sparsely to densely strigose or strigillose to hirsute, lower surface sparsely strigillose to glabrescent, secondary veins 3–6 pairs, oblique; subsessile or with petioles 1–10 mm long. **Inflorescences** axillary, congested-cymose, capitate or fasciculate, 5–20 mm long, densely hirtellous to hirsute, peduncles 1–3 per leaf axil, 2–12 mm long, bracts subulate. **Flowers** heterostylous, sessile or subsessile, pedicels to 2.5–3 mm long; hypanthium turbinate to ovoid, c. 0.5 mm long, calyx lobes 4, lanceolate to triangular, 0.3–1 mm long, hispid along the margin; corolla white or purple, tubular to funnelform, tube 0.8–1.5 mm long, dense white-pubescent in throat, lobes lanceolate or narrowly elliptic, 0.8–1.2 mm long, incurved at apex, with spinous appendages on outer surface; stamens 4, long-styled flowers with filaments 0.3–0.5 mm long attached to sinuses between corolla lobes, anthers included, short-styled flowers with filaments attached at the base of corolla tube, anthers exserted, the anthers globose, 0.5–1 mm long; ovary 0.3–0.5 mm long, ovules many, style pubescent, usually swollen above, 1.5–2 mm long in long-styled flowers, 0.8–1 mm long in short-styled flowers, stigma subglobose or oblong, 0.3–0.6 mm long, bilobed, lobes fleshy, papillose. **Capsules** subglobose, c. 0.5–1 mm diam., indehiscent, flat at the apex, crustaceous, hard, pilosulous. **Seeds** 6–8, c. 0.5 mm long, angular, exotesta reticulate, black.

Distribution. India, Bangladesh, China, Myanmar, Thailand, Vietnam, Malaysia, Indonesia and the Philippines. In Singapore the species was only known from Changi (*Ridley s.n.*, Jan 1894, SING [SING0012040]).

Ecology. Weedy in open secondary forest growth, forest margins, and (elsewhere) in exposed montane sites.

Provisional conservation assessment. Globally Least Concern (LC). In Singapore presumed Nationally Extinct.

19. HEXASEPALUM Bartl. ex DC.

(Greek *hexa-* = six, *-sepalum* = sepals; the type species often has six sepals)

Prodr. 4 (1830) 561. **Type:** *Hexasepalum angustifolium* Bartl. ex DC.

Herbs or sometimes small shrubs, annual or perennial, unarmed. **Stipules** persistent, interpetiolar and fused to petioles, fimbriate. **Leaves** opposite or sometimes apparently verticillate, subsessile. **Inflorescences** axillary and terminal, few- to several-flowered, sessile. **Flowers** 4-merous, sessile, bisexual; calyx 2- or 4- (or 6-) lobed; lobes sometimes unequal in pairs; corolla white or mauve, lobes valvate in bud; stamens 4, inserted in corolla throat, exserted; ovary 2-locular, ovules 1 in each cell, placenta axile; style exserted, stigmas 2,

capitate to linear. **Fruits** schizocarpous or indehiscent capsules; mericarps 2, indehiscent, each with 1 seed.

Distribution. In the strict delimitation of the genus there are 6 species, all tropical, with five in the Americas and one in Africa, but at least two naturalised in parts of tropical Asia. In Singapore 1 naturalised species.

Hexasepalum sarmentosum (Sw.) Delprete & J.H.Kirkbr.

(Latin, *sarmentosus* = producing long runners; referring to the often vine-like habit)

J. Bot. Res. Inst. Texas 9(1) (2015) 105. **Basionym:** *Diodia sarmentosa* Sw., Prodr. Veg. Ind. Occ. (1788) 30; Ridley, Fl. Malay Penins. 2 (1923) 174; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 153; Turner, Gard. Bull. Singapore 45 (1993) 196; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 421; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 34, 174, 266. **Synonym:** *Diodella sarmentosa* (Sw.) Bacigalupo & Cabral ex Borhidi, Rubiác. México (2006) 186. **Type:** Swartz, *s.n.*, Jamaica (S [status not determined]).

Annual or perennial herb, robust and often vine-like; stems up to 4 m long, stems usually distinctly winged, wings ciliate. **Leaves:** lamina elliptic, to 40 × 14 mm, hispid above, surface below with scattered hairs, lateral veins prominently raised and more hairy. **Inflorescences** axillary, few to several-flowered. **Flowers:** calyx glabrous except for ciliate lobe margins, lobes narrowly triangular, to 2 mm long; corolla mauve or white, c. 2 mm long, tube 1 mm with hairs inside near throat, lobes 1 mm, with some hairs outside near apex; stamens and style exerted, not exceeding corolla lobes, stigma obscurely 2-lobed. **Capsules** glabrous, very tardily dehiscent, splitting into two closed valves. **Seeds** oblong or elliptic, to 3 × 1.5 mm, ventral groove broad and relatively deep, dark (almost black); testa surface finely reticulate.

Distribution. Native to the Neotropics, naturalised in tropical Asia. In Singapore it is only known from a single very old collection from the Central Catchment (*Ridley 5897*, 1894, SING [SING0072756]). It is unknown if this species is still present in Singapore but this weedy species is nevertheless known from surrounding countries and is likely to occur in Singapore.

Ecology. Unknown in Singapore.

Provisional conservation assessment. Globally Least Concern (LC). Not native in Singapore.

Notes. Current research shows that this taxon does not belong in *Hexasepalum* but it is currently the only valid name for it.

20. HYDNOPHYTUM Jack

(Greek, *hydno-* = tuber, *-phytum* = plant; referring to the tuberous form)

Trans. Linn. Soc. London 14(1) (1823) 124; Blume, Bijdr. Fl. Ned. Ind., pt 16 (1826–1827) 955; De Candolle, Prodr. 4 (1830) 450; Bentham & Hooker, Gen. Pl. 2(1) (1873) 132; Beccari, Malesia 2 (1884) 120; Schumann in Engler & Prantl, Nat. Pflanzenfam. 4(4) (1891) 123; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 101; Ridley, Fl. Malay Penins. 2 (1923) 172; Valetton, Bot. Jahrb. Syst. 61 (1927) 127; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 1 (1966) 1229; Wong, Arbor. Rubiac. Malaya (1988) 8 (in clavi); Wong, Tree Fl. Malaya 4 (1989) 327 (in clavi); Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 426; Puff et al., Rubiac. Thailand (2005) 166, pl. 3.3.1; Jebb & Huxley, Blumea 64 (2019) 23. **Type:** *Hydnophytum formicarum* Jack.

Epiphytic tuber-forming shrubs. **Tuber** derived from hypocotyl, fibrous or fleshy, forming between roots and leafy stems, typically solitary, subglobose to variously shaped, mostly without spines but in some taxa with stiff root-like or tubercle-like structures, with holes scattered over the surface or sometimes forming patterns, more numerous on the side of the tuber appressed to the substrate, variously forming interconnected cavities that have either smooth or warty internal surfaces. **Stems** at first single, later multiple, their common base often forming a woody boss on the tuber, rarely spaced out, suberect to spreading or pendant, branched. **Stipules** interpetiolar, small or conspicuous, keeled. **Leaves:** lamina linear, lanceolate, elliptic or sub-rotund, often thick-coriaceous to fleshy; petioles subobsolete to distinct. **Inflorescences** axillary, paired or solitary at nodes, rarely terminal, sessile or pedunculate; bracts nil to several and conspicuous. **Flowers** hermaphrodite, calyx cupular; corolla hypocrateriform or infundibular, tube glabrous inside or with a ring of hairs near the corolla throat, lobes 4, valvate, mostly white; anthers exerted (in short-styled flowers of heterostylous taxa) or not; stigma exerted (in long-styled flowers of heterostylous taxa) or not; ovary 2-locular, each locule with an erect ovule. **Fruits** drupaceous, ovoid to globose, typically with persistent calyx remains, yellow, pink or red when mature; pyrenes 2(–3–4), plano-obovoid to ovoid.

Distribution. A genus of 55 species (of which 44 are in New Guinea) in the Andaman Islands, continental Southeast Asia, Malesia, Australia, Solomon Islands, Vanuatu and Fiji. In Singapore 1 native species.

Ecology. Epiphytes in seasonally dry forests and savannah to equatorial rain forests, from sea level (including beach and mangrove vegetation) to montane forests over 3000 m; rarely lithophytes. Tubers and cavities develop regardless of the presence of ants. Ant-tenants mostly bring up their brood in tuber cavities with smooth walls, their discards are left in the chambers with warty walls through which organic matter derivatives can be absorbed, although there are intermediate cavities (Huxley, New Phytol. 80 (1978) 231–268).

Hydnophytum formicarum Jack

(Latin, *formicarum* = associated with ants; referring to the swollen tuber inhabited by ants)

Trans. Linn. Soc. London 14(1) (1823) 124; De Candolle, Prodr. 4 (1830) 451; Bentham & Hooker, Gen. Pl. 2(1) (1873) 132; Hooker, Fl. Brit. India 3, fasc. 8 (1881) 194; Beccari, Malesia 2 (1884) 159; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 99; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 101, as '*formicarum*'; Ridley, Fl. Malay Penins. 2 (1923) 172, as '*formicarum*'; Craib, Fl. Siam. 2(2) (1934) 223; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 1 (1966) 1229, as '*formicarum*'; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 155, fig. 125.7, as '*formicarum*'; Turner, Gard. Bull. Singapore 45 (1993) 198; Turner, Gard. Bull. Singapore 47 (1997 ['1995']) 426; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 49, 174, 207; Lok & Tan, Nat. Singapore 2 (2009) 231; Jebb & Huxley, Blumea 64 (2019) 23. **Type:** [Published illustration] Rumphius, Herb. Amboin. 6 (1750) t. 55: fig. 1, lectotype designated by Jebb & Huxley, Blumea 64 (2019) 23. **Epitype:** *Meijer 4602*, Sumatra, Mt Sago, 8 December 1955 (epitype L [L.2913758], designated by Jebb & Huxley, Blumea 64 (2019) 23). **Fig. 32.**

Tuber subglobose to variously shaped, to over 50 cm across in the largest specimens, smooth to rugose, grey-brown, remnants of roots on the tuber surface sometimes persisting as subspinose protuberances. **Stems** few to many, branches several or many, internodes smooth. **Stipules** broad-triangular, 1–3 mm long. **Leaves:** lamina usually elliptic to obovate, sometimes lanceolate or rarely subrotund, (2.3–)5.3–14 × (1.8–)2–6 cm, apex rounded to acute with blunt tip, base cuneate, chartaceous to coriaceous, glabrous, midrib flat to slightly raised on both leaf surfaces, secondary veins 3–6(–8) pairs; petioles subobsolete to 2–7 mm long. **Inflorescences** axillary, single or paired at nodes, sessile to slightly recessed. **Flowers** 1–several in a fascicle, white; calyx cupular, to c. 1–1.5 mm long; corolla tube 2–3 mm long, with a ring of hairs just below the throat, lobes triangular, 1.5–2 mm long, spreading and slightly recurved in the open flower; anthers 1 mm long, inserted at the corolla throat, exserted; apparently homostylous, stigma bilobed, exserted from corolla throat. **Fruits** ovoid, 4–7 × 3–5 mm, glabrous to slightly pubescent, green ripening red, crowned by the persistent calyx; pyrenes 1–3, ellipsoid or ovoid, apex acute, base rounded.

Distribution. Andaman Islands, continental Southeast Asia and Malesia to Waigeo Island (apparently absent from New Guinea proper). In Singapore older collecting localities have included Jurong (*Corner SFN 26154*, 18 Dec 1932, SING [SING0030237]), Sungei Murai, Sungei Tempeh, Bukit Timah (*Ridley s.n.*, 1891, SING [SING0030232]), Pasir Panjang (*Anderson 186*, 9 Sep 1911, SING [SING0030236]), Changi and Pulau Seletar. More recent collections have been made from Seletar Track (*Gwee et al. SING2008-513*, 16 Dec 2008, SING [SING0120389]) and Pulau Piawai (*Yang et al. SING2006-62*, 5 Dec 2006, SING [SING0090261]). Lok & Tan (Nat. Singapore 2 (2009) 231–236) have recorded populations at Rifle Range Road, Sime Road, and Nee Soon on the main island, as well as mangrove forests along the northern shoreline of Pulau Tekong.

Ecology. Across its range epiphytic in mangroves, savannah and tropical heath vegetation on nutrient-poor soils near sea level to sub-montane forest at c. 1500 m; rare in many places. Very frequently inhabited by ants from the genus *Philidris* Shattuck (of the *Iridomyrmex* complex). Other epiphytic plants may have roots invading and exploiting nutrients in the tuber cavities (Janzen, Biotropica 6 (1974) 237–259).

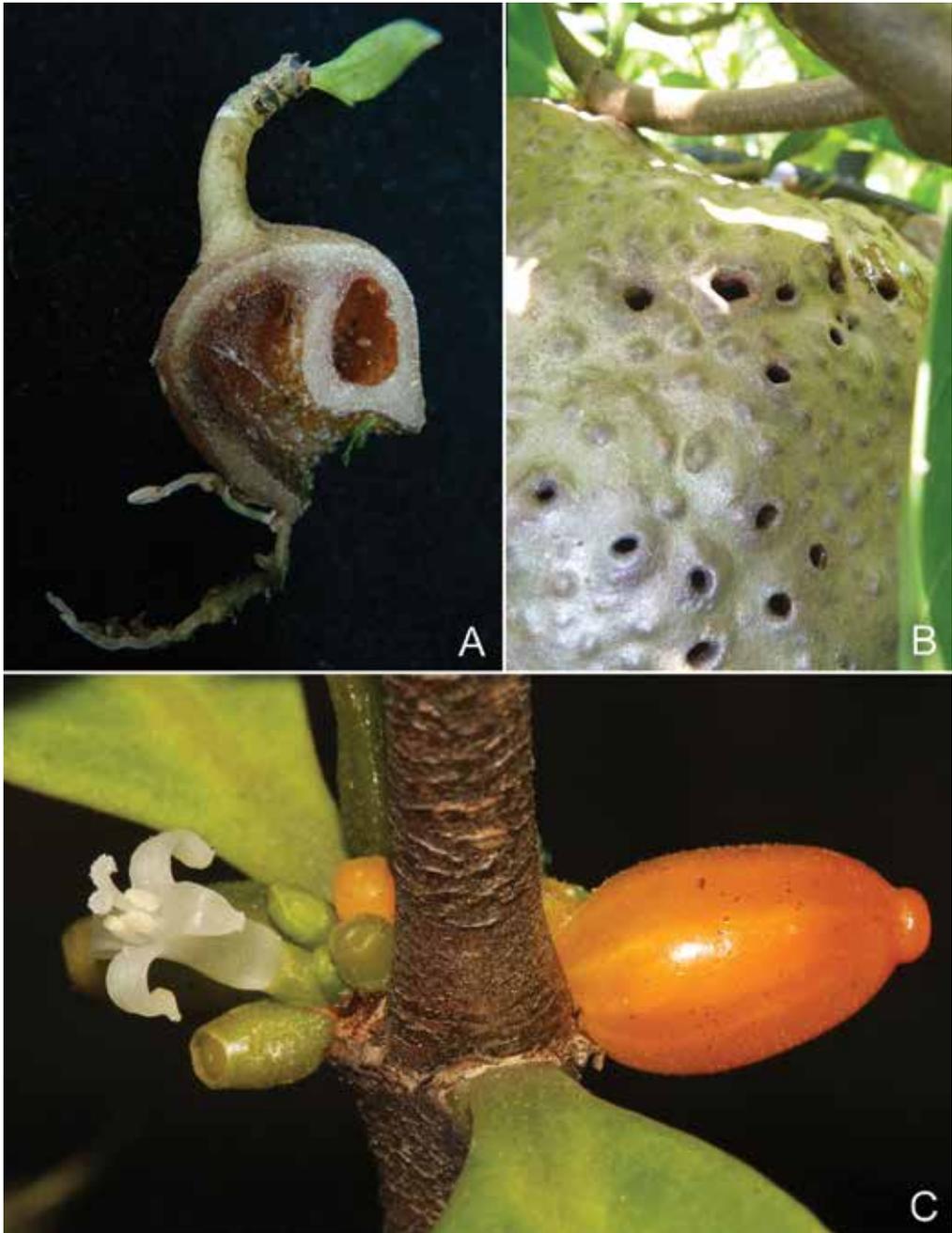


Figure 32. *Hydnophytum formicarum* Jack. **A.** Young plant with cavities already forming in the tuberous stem base. **B.** Older tuber surface showing ant holes. **C.** Detail of an open flower and fruits from a leaf axil. (A from Sabah; B from Singapore, Pulau Pawai; C from Singapore, Upper Seletar. Photos: A, K.M. Wong; B, W.F. Ang; C, X.Y. Ng).

Provisional conservation assessment. Jebb & Huxley (Blumea 64 (2019) 23–91) proposed a global conservation assessment of Least Concern (LC), while also noting that *Hydnophytum formicarum* is likely Vulnerable in parts of its range. They also reported that *Hydnophytum* on felled trees are soon deserted by their ant tenants, then dry up and decay, usually within a few weeks; the detrimental effects of logging and vegetation conversion are therefore tremendous. *Hydnophytum formicarum* is listed as Critically Endangered (EN/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 49, 174, 207).

Uses. Dried slices of tubers are sold in some Southeast Asian markets for their putative anti-tumour effects.

Taxonomy. As currently delimited, a very variable taxon, usually distinctive by its blunt leaf apex. For a very long list of synonyms from across the taxon’s range, see Jebb & Huxley (Blumea 64 (2019) 23).

Notes. The measurements given are those of material from Singapore; elsewhere the attributes are more variable.

21. HYPOBATHRUM Blume

(Greek, *hypo-* = under, *-bathrum* = chair;

with ovules in a hypanthium below the other flower parts)

Bijdr. Fl. Ned. Ind., pt 16 (1826–1827) 1007; Hooker, Fl. Brit. India 3, fasc. 7 (1880) 120; Wong, Arbor. Rubiac. Malaya (1988) 74; Wong, Tree Fl. Malaya 4 (1989) 354; Mulyaningsih & Ridsdale, Reinwardtia 12(1) (2002) 95; Puff et al., Rubiac. Thailand (2005) 86, pl. 3.1.21. **Type:** *Hypobathrum frutescens* Blume.

Petunga DC., Prodr. 4 (1830) 398; Korthals, Ned. Kruidk. Arch. 2(4) (1851) 169; Hooker, Fl. Brit. India 3, fasc. 7 (1880) 120; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’]) 221; Ridley, Fl. Malay Penins. 2 (1923) 84; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1729. **Type:** *Petunga roxburghii* DC. (= *Hypobathrum racemosum* (Roxb.) Kurz).

Shrub-sized treelets or small trees, often with straight stems or trunks and pairs of horizontal branches. **Stipules** variously shaped, free or basally connate, each with 2 short lateral keels joining to form a prominent median keel running to the apex. **Leaves** opposite and decussate on stems, distichous on branches. **Inflorescences** axillary or extra-axillary and opposite, a simple or compound dichasium or panicle, often with reduced branches and raceme-like. **Flowers** bisexual, 4–5-merous; calyx cup-shaped or campanulate, with 4–5 tiny triangular lobes; corolla tube short, cup-shaped to infundibular, the throat glabrous or hairy, corolla lobes 4–5, contorted in the bud, margins ciliate; stamens inserted in the corolla throat, anthers dorsifixed or sub-basifixed, erect, slightly protruding in the open flower; stigma linear, 2-lobed, exserted in the open flower; ovary 2-locular; ovules 1–many in each locule, attached to an apical placenta. **Fruits** baccate, 2-celled, globose to ellipsoid or obovoid and club-shaped. **Seeds** 1–many, concave to compressed, testa with linear thick-walled cells.

Distribution. A genus of 26 species in tropical Africa, Madagascar and Comoro Islands, India, continental Southeast Asia and Malesia (Malay Peninsula, Sumatra, Java, Lesser Sunda Islands, Borneo, Sulawesi and the Philippines). In Singapore 1 native species.

***Hypobathrum coniferum* (Ridl.) Kiew**

(Latin, *conifer* = cone bearing; referring to the cone-like inflorescence)

Gard. Bull. Singapore 55 (2003) 182. [Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 156; Turner, Gard. Bull. Singapore 45 (1993) 198; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 50, 174, 193, all as '*Hypobathrum coniferum* (Ridl.) Bakh.f.', nom. inval.]. **Basionym:** *Petunga conifera* Ridl., J. Straits Branch Roy. Asiat. Soc. 79 (1918) 81; Ridley, Fl. Malay Penins. 2 (1923) 85. **Type:** *Ridley 10722*, Singapore, Gardens' Jungle [Singapore Botanic Gardens' Rain Forest], 1899 (lectotype K [K001067665], designated by Turner et al., Gard. Bull. Singapore 70 (2018) 366; isolectotype SING [SING0045448]).

Hypobathrum sp. 11, Wong, Arbor. Rubiac. Malaya (1988) 82; Wong, Tree Fl. Malaya 4 (1989) 355.

Petunga venulosa auct. non Hook.f.: Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 95; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1729.

Treelet to small tree of c. 9 m tall. **Stipules** triangular, slightly fused at the base, caducous. **Leaves:** lamina elliptic, 6–10 × 4–6 cm, apex acute, base cuneate, chartaceous to slightly coriaceous, glabrous, drying blackish above and brown below, secondary veins 7–9 pairs, tertiary veins distinct and trending perpendicular to the midrib; petiole 4–6 mm long. **Inflorescences** axillary, raceme-like, 1–1.5 cm long; bracts to 1.5–2 mm long. **Flowers** with 5 short triangular calyx lobes, densely woolly hairy at tips; corolla tube c. 4 mm long, glabrous outside, pubescent inside, lobes blunt, as long as the tube, hairy at the tips; style and 2 stigma lobes pubescent. **Fruits** not seen.

Distribution. Apparently restricted to Singapore (the type collection and *Ridley 8427*, Singapore Botanic Gardens' Rain Forest, Apr 1897, SING [SING0045674]) and Johor, Malaysia (*Kiah SFN 32366*, Sungai Kayu, 10 Mar 1937, SING).

Ecology. Lowland rain forest.

Provisional conservation assessment. Globally not assessed. Presumed Nationally Extinct in Singapore.

Taxonomy. The combination attributed by Keng to Bakhuizen van den Brink was not published and so is invalid. Kiew (Gard. Bull. Singapore 55 (2003) 182) states that *Hypobathrum coniferum* differs from *H. venulosum* (Hook.f.) K.M.Wong in its very short inflorescences and larger, broader leaves with more veins. In fact, Hooker (Fl. Brit. India 3, fasc. 7 (1880) 121) seems to include more than one taxon under the name *Petunga venulosa*, although the type specimen, *Wallich s.n.* [EIC 8301], is clearly stated and has leaves and short inflorescences (only up to 1.5 cm long) just like that of *Hypobathrum coniferum*. However, *Hypobathrum coniferum* has significantly shorter inflorescence bracts than the type of *H. venulosum*.

Notes. No flowers have been seen and so the description of the flowers above comes from Ridley (J. Straits Branch Roy. Asiat. Soc. 79 (1918) 81).

22. IXORA L.

(from *ishvara*, a deity in Sanskrit, the classical language of the Brahmans in India)
Pecah periok (Malay)

Sp. Pl. 1 (1753) 110; Hooker, Fl. Brit. India 3, fasc. 7 (1880) 137; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 70; Ridley, Fl. Malay Penins. 2 (1923) 89; Craib, Fl. Siam. 2(2) (1934) 147; Bremekamp, Bull. Jard. Bot. Buitenzorg, sér. 3, 14 (1937) 197; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1280; Corner, Wayside Trees Malaya, ed. 3, 2 (1988) 634; Wong, Arbor. Rubiac. Malaya (1988) 83; Wong, Tree Fl. Malaya 4 (1989) 356; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 156; Puff et al., Rubiac. Thailand (2005) 92, 220, pl. 3.1.24, 4.1.4. **Type:** *Ixora coccinea* L.

Shrubs or trees. **Twigs** terete, often with leafless nodes occurring close together especially at proximal parts of branches. **Stipules** broad-triangular, apex with a pointed cusp or long stiff needle-like extension, slightly fused at their edges. **Leaves** opposite; lamina ovate, elliptic, obovate or lanceolate, very rarely hairy. **Inflorescences** terminal, a corymb or corymbose panicle. **Flowers** bisexual, 4-merous, fragrant or not; corolla white, pink, yellow or red, the colour darkening or not, salverform, tube cylindrical and always longer than the lobes, corolla lobes contorted in the bud; anthers dorsifixed on short filaments at the corolla throat, reflexed out of the open flower; style slightly exserted, the exserted portion generally not longer than the corolla lobes; stigma 2-lobed, the lobes linear and recurved; ovary 2-locular; ovules one per cell; disc annular. **Fruits** drupes, globose to 2-lobed, ripening red to black; pyrenes 1–2 per fruit, plano-convex, each with one seed.

Distribution. About 560 species, pan-tropical, mostly Indo-Malayan; 7 taxa native to Singapore. One of these, *Ixora javanica* (Blume) DC. var. *retinervia* Corner, was not accounted for by Keng (Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 156) nor Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 51, 175, 247).

Uses. *Ixora* is a well-known genus of popular cultivated ornamental species but there are interesting indigenous rain forest species across Southeast Asia (ranging from shrubs and treelets to trees c. 20 m high) with highly enchanting blooms that await introduction or horticultural use in breeding. In Singapore the popular garden species include the exotic *Ixora chinensis* Lam., *I. coccinea* L. and *I. finlaysonianana* Wall. ex D. Don, as well as the indigenous *I. congesta* Roxb. and *I. javanica* (Blume) DC. The many flower-colour forms (red, pink, yellow and white) of *Ixora coccinea*, especially the cultivars with much smaller leaves known as ‘dwarf coccineas’, are especially popular for pot culture, hedges and bedding.

Taxonomy. Corner (Gard. Bull. Straits Settlm. 11(3) (1941) 177–235) detailed numerous forms of several Malay Peninsula species, especially for *Ixora javanica* and *I. lobbii* Loudon ex King & Gamble, and Wong (Arbor. Rubiac. Malaya (1988) 83–100; Tree Fl. Malaya 4 (1989) 356–364) recognised intermediate forms between these species as well as with *I. congesta*. The complex variation suggests introgression among localised populations of these

understorey forest plants, mediated by birds and butterflies (likely in the case of taxa with yellow or red, non-fragrant flowers) or moths (mostly those with white or pale corollas and nocturnally fragrant). Certainly, this biological spectrum would repay further study.

Notes. Once known as the ‘ixoroid pollination mechanism’, secondary pollen presentation (SPP) is manifest in *Ixora* flowers, which are strongly protandrous, with the anthers depositing pollen on the outside of the as-yet unreceptive styler head that functions as a pollen presenter when the flowers open. This is followed by the female stage when the stigmas become receptive, when fresh pollen brought by flower visitors becomes available (Robbrecht & Puff, Bot. Jahrb. Syst. 108 (1986) 63–137). SPP (with not only the styler head as pollen presenter, but variously other parts of the flower as well) occurs across a range of distantly related eudicot and monocot families (Howell et al., Austral. J. Bot. 41 (1993) 417–438).

Key to *Ixora* species

1. Inflorescence branches not jointed; bracts absent at the junctions of inflorescence axes and their branches **3. *I. grandifolia***
 Inflorescence branches jointed to the axes bearing them, with clear lines marking such joints at their base; bracts often persistent at junctions of inflorescence axes and their branches 2
2. Inflorescence bracts and calyx lobes ovate to narrowly elliptic to lanceolate, 3–6 mm long, at least twice as long as hypanthium proper; flowers fragrant; corollas completely white **7. *I. umbellata***
 Inflorescence branches and calyx lobes not as conspicuous, not longer than hypanthium proper; flowers fragrant or not; corollas yellow, orange or pinkish yellow turning red, or white suffused pink at the base of the corolla tube 3
3. Flowers fragrant or not; corolla lobes narrowly elliptic to lanceolate or linear, not wider than 2 mm in dried specimens 4
 Flowers not fragrant; corolla lobes narrow- to broad-elliptic to obovate or rounded, wider than 2 mm in dried specimens 5
4. Lower leaf surface with tertiary venation slightly prominent to prominent; inflorescence with clear peduncle usually 5 cm long or longer, the whole deflexed or bent downwards; ultimate inflorescence branches with spiky erect short pale hairs; flowers not fragrant; corolla with pink-suffused white tube and white lobes **6. *I. pendula***
 Lower leaf surface with tertiary venation very fine and not prominent; inflorescence branched from the base or with a clear peduncle less than 5 cm long, the whole erect; ultimate inflorescence branches glabrescent; flowers fragrant; corolla yellowish or pinkish turning red **1. *I. concinna***
5. Leaves with prominent intermediate and tertiary veins between secondary veins on the lower leaf surface; corolla lobes typically blunt or obtuse **2. *I. congesta***

- Leaves with the intermediate and tertiary veins rather obscure or very fine and not prominent on the lower leaf surface; corolla lobes typically acute 6
6. Leaves broad-elliptic, with 6–12 pairs of secondary veins; hypanthia glabrescent
 **4. I. javanica**
 Leaves generally lanceolate to narrowly elliptic, with 12–26 pairs of secondary veins;
 hypanthia with rust-brown fine pubescence **5. I. lobbii**

1. *Ixora concinna* R.Br. ex Hook.f.

(Latin, *concinus* = elegant; referring to the inflorescences and slender corollas)

Fl. Brit. India 3, fasc. 7 (1880) 147; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 97; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 81; Ridley, Fl. Malay Penins. 2 (1923) 95; Bremekamp, Bull. Jard. Bot. Buitenzorg, sér. 3, 14 (1937) 280; Corner, Gard. Bull. Straits Settlements 11(3) (1941) 188; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1282; Corner, Wayside Trees Malaya, ed. 3, 2 (1988) 637; Wong, Arbor. Rubiac. Malaya (1988) 92 (in clavi); Wong, Tree Fl. Malaya 4 (1989) 360 (in clavi); Turner, Gard. Bull. Singapore 45 (1993) 198; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 428; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 51, 174, 193. **Type:** *Wallich s.n.* [EIC 6149], Singapore, 1822 (lectotype K-W [K001123173], designated here; isolectotype E [E00327899]).

Ixora parviflora auct. non Vahl: Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 97.

Shrub or treelet to 8 m high. **Leaves:** lamina elliptic to obovate, (3.5–)6–13 cm × (1.4–)2–5 cm, apex acute to slightly cuspidate, base cuneate, drying thin-coriaceous, secondary veins 7–9 pairs, weakly looping near the margin, tertiary veins obscure or only slightly prominent on the lower surface; petioles 0.4–1 cm long. **Inflorescences** erect, branched from the base, or with a clear peduncle 0.4–1 cm long, rachis (central axis) to c. 1.5 cm long, main lateral branches 1–1.5 cm long, branches jointed and subtended by usually persistent bracts, glabrescent. **Flowers** fragrant; hypanthium obconical, 1–1.5 mm long, glabrescent; calyx lobes broadly triangular to ovate, 0.5–1 mm long; corolla yellowish or pinkish turning red, tube 6–7 mm long, c. 1 mm wide at the middle, lobes narrowly elliptic to lanceolate or linear, c. 1.5–2 mm wide, apex acute. **Fruits** subglobose or slightly bilobed, c. 6 × 6 mm.

Distribution. Malay Peninsula, Sumatra and Borneo. In Singapore documented for Chan Chu Kang (*Mat in Ridley 6714*, 1894, SING [SING0012059]), Bukit Timah (*Ridley 8451*, Apr 1897, SING [SING0172356]), North Seletar (*Ridley s.n.*, 9 Dec 1890, SING [SING0012056]), Serangoon Road (*Ridley s.n.*, 1905, SING [SING0012055]) and Punggol (*Ridley s.n.*, Jan 1904, SING [SING0012058]).

Ecology. Understorey of lowland forest.

Provisional conservation assessment. Globally not assessed. Presumed Nationally Extinct in Singapore.

2. *Ixora congesta* Roxb.

(Latin, *congestus* = crowded; referring to flowers in the inflorescence)

Fl. Ind. 1 (1820) 397; Roxburgh, Fl. Ind., ed. 2, 1 (1832) 387; Hooker, Fl. Brit. India 3, fasc. 7 (1880) 146; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 96; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 76; Ridley, Fl. Malay Penins. 2 (1923) 93; Craib, Fl. Siam. 2(2) (1934) 154; Corner, Gard. Bull. Straits Settlements 11(3) (1941) 189; Corner, Wayside Trees Malaya, ed. 3, 2 (1988) 637; Wong, Arbor. Rubiac. Malaya (1988) 94 (in clavi); Wong, Tree Fl. Malaya 4 (1989) 361 (in clavi); Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 156; Turner, Gard. Bull. Singapore 45 (1993) 199; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 428; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 51, 174, 228. **Type:** *Wallich s.n.* [EIC 6138A], [Malaysia], Penang, 1822 (neotype K-W [K001123146], designated here; isoneotypes BR [BR0000005587193, BR0000005587520], P [P00836697, P00836698, P00836699, P00836700], PH [PH00016194]). **Fig. 33.**

Shrub or treelet to 4 m high. **Leaves:** lamina generally broadly elliptic, (10–)18–25.5 × (3–)5–9(–15) cm, apex acute to acuminate, base cuneate, drying thin-coriaceous, secondary veins (9–)11–23 pairs, not looping near the leaf margin, with prominent tertiary and intermediate veins in between on the lower surface; petioles (0.5–)0.8–1 cm long. **Inflorescences** erect; peduncle 0.6–2 cm long, rachis (central axis) to 2.5–5 cm long, main lateral branches 2–5.5 cm long, branches jointed and subtended by usually persistent bracts, glabrescent. **Flowers** not fragrant; hypanthium obconical, 1–1.5 mm long, glabrescent; calyx lobes broadly triangular to ovate, less than 0.5 mm long; corolla yellowish, orange or pinkish turning red, tube (28–)30–42 mm long, c. 1.5 mm wide at the middle, lobes rounded, oblong or obovate, (2.5–)3.5–6 mm wide, apex blunt. **Fruits** strongly bilobed to subglobose, 4–6 × 4–8.5 mm.

Distribution. Western Malesia to the Moluccas. Reasonably common in Singapore, with many collections including Seletar, Mandai Road (*Khaleque MAK 29*, 10 Mar 1971, SING [SING0030255]), Nee Soon (*Leong & Pannell SING2012-368*, 24 Aug 2012, SING [SING0185164]), MacRitchie (*Leong et al. MR 2014-012*, 3 Jun 2014, SING [SING0205864]), Bukit Timah (*Faizu NF 7*, 31 Oct 2008, SING [SING0137300]) and Pulau Tekong (*Samsuri 108*, 15 Nov 2001, SING [SING0039784]).

Ecology. Across its range in lowland to lower montane forest to 1000 m, also on limestone.

Provisional conservation assessment. Globally not assessed. In Singapore Least Concern (LC).

Taxonomy. Roxburgh did not explicitly cite a collection in the protologue, stating only that he intended a plant he thought was from the Moluccas. Bremekamp (Bull. Jard. Bot. Buitenzorg, sér. 3, 14 (1937) 351) considered Roxburgh’s description unsatisfactory and suggested that the interpretation in Hooker (Fl. Brit. India 3, fasc. 7 (1880) 146), which includes material from the Malay Peninsula, was better referred to *Ixora griffithii* Hook. (Bot. Mag. 73 (1847) t. 4325), which he accepted was widespread from Tenasserim, the Malay Peninsula, Sumatra and Borneo; he did not mention the Moluccas. Corner (Gard. Bull. Straits Settlements 11(3) (1941) 189) reiterated that this is a widespread taxon, from western Malesia to the Moluccas. The problem of interpretation largely stems from a lack of type material. Here, as also argued by Corner, we interpret the species concept as that which must have passed from Roxburgh



Figure 33. *Ixora congesta* Roxb. (From Singapore, Lower Peirce. Photo: S.K. Ganesan).

to Wallich and Hooker, and onward to King & Gamble, and Ridley, as all except Roxburgh have specimen material that attest to the identity. Accordingly, we designate a neotype to fix the identity of the species as that commensurate with our taxon found in the Malay Peninsula.

3. *Ixora grandifolia* Zoll. & Moritzi

(Latin, *grandi-* = large, *-folia* = leaves; with large leaves)

in Moritzi, Syst. Verz. (1846) 65; Hooker, Fl. Brit. India 3, fasc. 7 (1880) 143; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 81; Ridley, Fl. Malay Penins. 2 (1923) 97; Bremekamp, Bull. Jard. Bot. Buitenzorg, sér. 3, 14 (1937) 320; Corner, Gard. Bull. Straits Settlements 11(3) (1941) 197; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1283; Corner, Wayside Trees Malaya, ed. 3, 2 (1988) 637; Wong, Arbor. Rubiac. Malaya (1988) 99; Wong, Tree Fl. Malaya 4 (1989) 364; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 156; Turner, Gard. Bull. Singapore 45 (1993) 199; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 428; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 51, 175, 193. **Replaced synonym:** *Pavetta macrophylla* Blume, Bijdr. Fl. Ned. Ind., pt 16 (1826–1827) 953. **Type:** Blume 890, [Indonesia], Java, Gunong Salak (holotype L [L0000575]).

Distribution. Thailand and throughout Malesia.

Taxonomy. Numerous synonyms representing material throughout its wide range are given by Bremekamp (Bull. Jard. Bot. Buitenzorg, sér. 3, 14 (1937) 320) and Corner (Gard. Bull. Straits Settlements 11(3) (1941) 197). Two varieties are recognised for the Malay Peninsula of which *Ixora grandifolia* var. *lancifolia* Corner does not occur in Singapore.

Notes. This is the tallest *Ixora* we know of, and one of the most wide-ranging. The unjointed inflorescence branches are unique among Southeast Asian species (the others having jointed inflorescence branches).

var. *grandifolia*

Shrub or tree, height not recorded (but elsewhere to 18 m high). **Leaves:** lamina elliptic or ovate, 14–15.5 × 7–9.5 cm, apex blunt, base rounded or cordate, drying coriaceous, secondary veins 9–10 pairs, not conspicuously looping near the leaf margin, tertiary veins faint to immersed in the lamina on the lower surface; petioles 1.2–1.5 cm long. **Inflorescences** erect; peduncle subobsolete, rachis (central axis) to 13 cm long, main lateral branches c. 10 cm long, branches not jointed and without subtending bracts, glabrescent. **Flowers** weakly to conspicuously fragrant; hypanthium obconical, 0.5–1 mm long, glabrescent; calyx lobes broadly triangular to ovate, less than 0.5 mm long; corolla white and sometimes pink-tipped, tube to c. 30 mm long, 1–1.5 mm wide at the middle, lobes narrowly elliptic to ovate, 1.5–2 mm wide, apex blunt or subacute. **Fruits** strongly bilobed to subglobose, to 10 × 12 mm.

Distribution. Thailand and throughout Malesia. Known in Singapore from only a single collection from Sungei Pandan (*Sinclair SFN 39234*, 13 Apr 1951, SING [SING0012061]).

Ecology. Across its range in lowland forest, also on swampy ground.

Provisional conservation assessment. Globally Least Concern (LC). In Singapore presumed Nationally Extinct.

4. *Ixora javanica* (Blume) DC. (of Java)

Prodr. 4 (1830) 487; Bremekamp, Bull. Jard. Bot. Buitenzorg, sér. 3, 14 (1937) 253; Corner, Gard. Bull. Straits Settle. 11(3) (1941) 206; Corner, Wayside Trees Malaya, ed. 3, 2 (1988) 637; Wong, Arbor. Rubiac. Malaya (1988) 93 (in clavi); Wong, Tree Fl. Malaya 4 (1989) 360 (in clavi); Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 156; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 428; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 51, 175, 247. **Basionym:** *Pavetta javanica* Blume, Bijdr. Fl. Ned. Ind., pt 16 (1826–1827) 949. **Type:** *Blume s.n.*, [Indonesia], Java, Salak (lectotype L [L0000585]), designated here; isolectotype LE [LE00017433]).

Ixora javanica (Blume) DC. var. *multinervia* Corner, Gard. Bull. Straits Settle. 11(3) (1941) 206. **Type:** *Corner SFN 33438*, [Malaysia], Kelantan, Kota Bahru, 22 April 1937 (lectotype SING [SING0058802], here designated; isolectotype K [K000763279]).

Ixora javanica (Blume) DC. var. *paucinervia* Corner, Gard. Bull. Straits Settle. 11(3) (1941) 206. **Type:** *Burkill & Haniff SFN 17342*, [Malaysia], Pahang, Telok Sesik, 4 December 1924 (holotype SING [SING0059161]).

Ixora stricta auct. non Roxb.: King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 80; Ridley, Fl. Malay Penins. 2 (1923) 94, p.p.

Taxonomy. Two varieties are recognised for the Malay Peninsula but *Ixora javanica* var. *javanica* does not extend to Singapore.

var. *retinervia* Corner (Latin, *reti-* = network, *-nervia* = veins; referring to veins forming a network)

Gard. Bull. Straits Settle. 11(3) (1941) 206; Wong, Arbor. Rubiac. Malaya (1988) 93 (in clavi); Wong, Tree Fl. Malaya 4 (1989) 360 (in clavi); Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 428. **Type:** *Corner SFN 29020*, [Malaysia], Johore, 14th mile Mawai-Jemaluang Road, 9 February 1935 (holotype SING [SING0058801]; isotype KEP [KEP181749]).

Ixora amoena auct. non G.Don: Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 97.

Shrub or treelet, 3–5 m (elsewhere documented to 9 m) high. **Leaves:** lamina elliptic, (5–)6.5–13 × (2.5–)3–4.8 cm, apex acuminate to cuspidate, base broad-cuneate to cordate, drying chartaceous, secondary veins 6–9(–12) pairs, strongly and regularly looping just behind the leaf margin, tertiary veins only slightly to not prominent on the lower surface; petioles 0.5–0.7(–1.2) cm long. **Inflorescences** erect; peduncle subobsolete, 0.2–0.4 cm long only, rachis (central axis) 0.3–0.5(–0.7) cm long, main lateral branches 0.3–0.5 cm long, branches jointed and subtended by bracts, glabrescent. **Flowers** not fragrant; hypanthium obconical, c. 1 mm long, glabrescent; calyx lobes broadly triangular to ovate, less than 0.5 mm long; corolla yellow or orange turning dark red, tube 27–30 mm long, 1 mm wide at the middle, lobes narrowly elliptic to ovate, c. 2 mm wide, apex acute. **Fruits** strongly bilobed to subglobose, to 6–7 × 6–10 mm.

Distribution. Endemic to the Malay Peninsula. In Singapore known by old collections from Sarimbun (*Goodenough 5004*, 1893, SING [SING0270377]), Choa Chu Kang (*Ridley s.n.*, Feb 1894, SING [SING0270379]) and Serangoon Road (*Ridley s.n.*, 1904, SING [SING0270378]), and recent collections from Mandai (*Gwee SING2008-415*, 7 Oct 2008, SING [SING0113872]) and Chestnut (*Gwee SING2010-536*, Mar 2010, SING [SING0146557]).

Ecology. Across its range in understorey of lowland forest to c. 1000 m.

Provisional conservation assessment. The species is globally Least Concern (LC) but the variety has not been assessed. Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 51, 175, 247), under the species name alone, listed this as cultivated only but it is native in Singapore. It is assessed here as Critically Endangered (CR/D).

Taxonomy. Corner (Gard. Bull. Straits Settle. 11(3) (1941) 206) was hesitant in distinguishing this taxon as a separate species from *Ixora javanica* because he considered there to be overlaps in character variation with his *Ixora javanica* var. *multinervia* and var. *paucinervia*. Wong (Arbor. Rubiac. Malaya (1988) 93; Tree Fl. Malaya 4 (1989) 360) considered that these two latter varieties were not distinct from *Ixora javanica* var. *javanica*. The inflorescences of *Ixora javanica* var. *retinervia* tend to be smaller, and its looping secondary venation is indeed quite distinctive, but whether or not this taxon should continue to be treated as a variety of *I. javanica* is best left to more detailed studies that include a molecular characterisation. The Singapore material so far documented all belongs to *Ixora javanica* var. *retinervia*.

5. *Ixora lobbii* Loudon ex King & Gamble

(Thomas Lobb, 1817–1894, British plant hunter in Southeast Asia)

J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 78; Ridley, Fl. Malay Penins. 2 (1923) 93; Bremekamp, Bull. Jard. Bot. Buitenzorg, sér. 3, 14 (1937) 271; Corner, Gard. Bull. Straits Settle. 11(3) (1941) 216; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1283; Corner, Wayside Trees Malaya, ed. 3, 2 (1988) 637; Wong, Arbor. Rubiac. Malaya (1988) 95 (in clavi); Wong, Tree Fl. Malaya 4 (1989) 361 (in clavi); Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 156; Turner, Gard. Bull. Singapore

45 (1993) 199; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 428; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 51, 175, 216. **Type:** *Lobb 464*, Singapore (lectotype K [K000763211], designated here; isolectotype K [K000763212]). **Fig. 34.**

Ixora fulgens auct. non Roxb.: Hooker, Fl. Brit. India 3, fasc. 7 (1880) 146, p.p.; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 96; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 79.

Taxonomy. The species name has been attributed to Loudon (Encycl. Pl. (new ed.) 1855) 1543), who based his name on *Pavetta lobbii* Teijsm. & Binn. (Cat. Hort. Bot. Bogor. (1866) 112), but both these names are without description and invalidly published (see Corner, Gard. Bull. Straits Settlement. 11(3) (1941) 216). Two varieties are recognised for the Malay Peninsula of which *Ixora lobbii* Loudon ex King & Gamble var. *stenophylla* Corner does not occur in Singapore.

var. *lobbii*

Shrub or treelet, to 6 m high. **Leaves:** lamina narrowly elliptic to lanceolate, (8–)13–20(–32) × (2–)3–4.5(–7) cm, apex acuminate to caudate, base cordate, drying chartaceous, with the lamina bullate between secondary veins, secondary veins (9–)15–20(–26) pairs, strongly and regularly looping just behind the leaf margin, tertiary veins only slightly to not prominent on the lower surface; petioles 0.3–0.8 cm long. **Inflorescences** erect, peduncle subobsolete to 1.5 cm long only, rachis (central axis) (2–)3.5–4 cm long, main lateral branches (2–)3.3–4 cm long, branches jointed and subtended by bracts, glabrescent. **Flowers** not fragrant; hypanthium obconical, 1–1.5 mm long, with short rusty brown flexuous hairs; calyx lobes broadly triangular to ovate, c. 0.5 mm long; corolla yellow or pinkish-yellow turning red, tube 26–32 mm long, 1 mm wide at the middle, lobes narrowly elliptic to ovate, 2.5–3.5(–4) mm wide, apex acute. **Fruits** strongly bilobed to subglobose, 4–6 × 4–6 mm.

Distribution. Southern Thailand, Peninsular Malaysia, Sumatra, Anambas Islands, Natuta Islands and Borneo. In Singapore known from Mandai Road (*Leong SING2008-22*, Mandai Road, 20 Feb 2008, SING [SING0105488]), Mandai (*Gwee et al. SING2009-284*, 10 Mar 2009, SING [SING0120521]), Nee Soon (*Ang SING2014-330*, 2 Mar 2014, SING [SING0216261]), MacRitchie (*Corner s.n.*, 1 Apr 1937, SING [SING0270380]), Pulau Ubin (*Corner s.n.*, 9 Nov 1950, SING) and Pulau Tekong. Also collected from Changi Road in the past.

Ecology. Across its range in lowland to montane forest to 1200 m.

Provisional conservation assessment. Globally not assessed. Listed as Endangered (EN/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 51, 175, 216).



Figure 34. *Ixora lobbii* Loudon ex King & Gamble var. *lobbii*. Inflorescence. (From Singapore, MacRitchie. Photo: X.Y. Ng).

6. *Ixora pendula* Jack

(Latin, *pendulus* = pendulous; referring to the downturned or pendulous inflorescence)

Malayan Misc. 1(1) (1820) 11; Hooker, Fl. Brit. India 3, fasc. 7 (1880) 141; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 96; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 77; Ridley, Fl. Malay Penins. 2 (1923) 95; Bremekamp, Bull. Jard. Bot. Buitenzorg, sér. 3, 14 (1937) 292; Craib, Fl. Siam. 2(2) (1934) 164; Corner, Gard. Bull. Straits Settle. 11(3) (1941) 226; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1283; Corner, Wayside Trees Malaya, ed. 3, 2 (1988) 637; Wong, Arbor. Rubiac. Malaya (1988) 90 (in clavi); Wong, Tree Fl. Malaya 4 (1989) 359 (in clavi); Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 156; Turner, Gard. Bull. Singapore 45 (1993) 199; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 429; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 51, 175, 216. **Type:** *Wallich s.n.* [EIC 6127], [Malaysia], Penang, 1822 (neotype K-W [K001123127], designated by Chamchumroon, Thai Forest Bull., Bot. 34 (2006) 21; isoneotype BR [BR0000005740932]). **Fig. 35.**

Ixora opaca R.Br. ex G.Don, Gen. Hist. 3 (1834) 573; Hooker, Fl. Brit. India 3, fasc. 7 (1880) 147; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 96; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 77; Craib, Fl. Siam. 2(2) (1934) 162. **Synonym:** *Ixora pendula* Jack var. *opaca* (G.Don) Ridl., Fl. Malay Penins. 2 (1923) 96. **Type:** *Wallich s.n.* [EIC 6141A], [Malaysia], Penang, August 1822 (lectotype K-W [K001123155], designated here; possible isolectotypes K [K000763265], LE [LE00017488]).



Figure 35. *Ixora pendula* Jack var. *pendula*. **A.** Habit. **B.** Inflorescence. **C.** Infructescence. Inset: stipules. **D.** Close-up of inflorescence. (From Singapore, A, C (inset), D from Bukit Timah Nature Reserve, *Leong-Škorničková et al. SING2015-108*; B exact locality uncertain; C (main photo) from MacRitchie, *Leong-Škorničková et al. SING2011-267*. Photos: A, C, D, J. Leong-Škorničková; B, K.M. Wong).

Taxonomy. Two varieties are recognised for the Malay Peninsula but *Ixora pendula* var. *montana* (Ridl.) K.M.Wong does not extend to Singapore. The year ‘1826’ on the label of the isoneotype at BR is erroneous.

var. *pendula*

Shrub or treelet, 2–3 m (elsewhere to 10 m) high. **Leaves:** lamina ovate, elliptic or obovate, (7–)13–20(–23) × (2.5–)4–5.5(–7) cm, the ultimate leaf pair usually much reduced at the flowering shoot tip, apex acute to acuminate, base cuneate, drying chartaceous to subcoriaceous, secondary veins (9–)12–14(–18) pairs, regularly looping just behind the leaf margin, intermediate and tertiary veins only slightly to not prominent on the lower surface; petioles (0.8–)1–1.5 cm long. **Inflorescences** pendulous or deflexed, peduncle (2–)4–11(–15) cm long, rachis (central axis) 1–4 cm long, main lateral branches 1–3.5 cm long; branches jointed and subtended by bracts, the ultimate branches with stiff, erect pale hairs. **Flowers** not fragrant; hypanthium obconical, c. 1 mm long, glabrescent, calyx lobes broadly triangular to ovate, 0.5–1 mm long; corolla with proximally pink tube grading to white, tube (16–)18–24(–30) mm long, not more than 0.5 mm wide at the middle, lobes narrowly elliptic to lanceolate or linear, up to 1 mm wide, apex acute. **Fruits** strongly bilobed to subglobose, 7–9 × 6–10 mm.

Distribution. Southern Thailand, Peninsular Malaysia, Sumatra and Borneo. In Singapore known from Chan Chu Kang (*Ridley 5676*, SING [SING0030275]), Mandai (*Ng SING2012-335*, 30 Jul 2012, SING [SING0179453]), MacRitchie (*Tang & Sidek 638*, 29 May 1995, SING [SING0229601]), Bukit Timah (*Leong-Škorničková et al. SING2015-108*, Rock Path, 14 Apr 2015, SING [SING0213876]), Seletar, Peirce and Changi.

Ecology. Across its range in lowland forests to 600 m, rarely on limestone.

Provisional conservation assessment. Globally not assessed. Listed as Endangered (EN/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 51, 175, 216).

7. *Ixora umbellata* Valetton

(Latin, *umbellatus* = umbellate; referring to the flowers in tight clusters, as in umbels)

in Koorders & Valetton, Meded. Lands Plantentuin 59 (1902) 162 [Bijdr. Boomsort. Java 8 (1902) 162]; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 77; Ridley, Fl. Malay Penins. 2 (1923) 92; Bremekamp, Bull. Jard. Bot. Buitenzorg, sér. 3, 14 (1937) 287; Craib, Fl. Siam. 2(2) (1934) 162; Corner, Gard. Bull. Straits Settle. 11(3) (1941) 232; Corner, Wayside Trees Malaya, ed. 3, 2 (1988) 637; Wong, Arbor. Rubiac. Malaya (1988) 90 (in clavi); Wong, Tree Fl. Malaya 4 (1989) 358 (in clavi); Turner, Gard. Bull. Singapore 45 (1993) 199; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 429; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 51, 175, 193. **Type:** *Hallier s.n.*, [Indonesia], Java, Depok, 11 July 1896 (lectotype BO, designated here).

Becheria parviflora Ridl., J. Straits Branch Roy. Asiat. Soc. 61 (1912) 20. **Type:** *Mat s.n.*, [Malaysia], Pahang, Taka, Tahan, 1893 (lectotype SING [SING0059286], designated by Turner et al., Gard. Bull. Singapore 70 (2018) 336).

Taxonomy. Two varieties are known for this species. The other, *Ixora umbellata* var. *multibracteata* (H. Pearson ex King & Gamble) Corner, is not found in Singapore.

var. **umbellata**

Shrub or treelet, to 4 m high. **Leaves:** lamina elliptic to obovate, 13.5–25.5 × 5–6(–9.5) cm, apex acute to acuminate, base cuneate, drying chartaceous to thin-coriaceous, secondary veins 12–18 pairs, regularly looping just behind the leaf margin, intermediate and tertiary veins slightly prominent on the lower surface; petioles 0.8–1.2 cm long. **Inflorescences** erect; peduncle 1.2–2.2 cm long, rachis (central axis) 2.5–3 cm long, main lateral branches 2.5–2.8 cm long, branches jointed and subtended by bracts, ultimate branches with sparse erect minute pale hairs. **Flowers** fragrant; hypanthium obconical, c. 1.5 mm long, glabrescent; calyx lobes ovate to narrowly elliptic or lanceolate, 4–5 mm long and very conspicuous; corolla white, tube 27–32(–40) mm long, 0.5–1 mm wide at the middle, lobes narrowly elliptic to lanceolate, 1–1.5(–2.5) mm wide, apex acute. **Fruits** strongly bilobed to subglobose, 5–7 × 5–12 mm.

Distribution. Malay Peninsula, Sumatra, Java and Borneo. In Singapore known only from Bukit Timah (*Ridley 15463*, 1909, SING [SING0012063]; *Sinclair SFN 38910*, 2 Apr 1950, SING [SING0172359]; *Gwee SING2010-076*, 5 Jan 2010, SING [SING0144069]).

Ecology. Across its range in lowland forests, also on limestone.

Provisional conservation assessment. Globally Data Deficient (DD). Listed as Nationally Extinct in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 51, 175, 193) but rediscovered in 2010 and assessed here as Critically Endangered (CR/D).

Notes. The dimensions for flower characters in the description are for Peninsular Malaysian material.

23. JACKIOPSIS Ridsdale

(pertaining to *Jackia* Wall., Greek, *-opsis* = sight, indicates resemblance; similar to *Jackia*)
Selumar (Malay)

Blumea 25 (1979) 295; Wong, Arbor. Rubiac. Malaya (1988) 101; Wong, Tree Fl. Malaya 4 (1989) 364; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 156. **Type:** *Jackiopsis ornata* (Wall.) Ridsdale.

Jackia Wall. in Roxburgh, Fl. Ind. 2 (1824) 321, nom. illeg. non *Jakkia* Blume (1823); Hooker, Fl. Brit. India 3, fasc. 7 (1880) 126; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’])

229; Ridley, Fl. Malay Penins. 2 (1923) 89; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1284; Corner, Wayside Trees Malaya, ed. 3, 2 (1988) 638. **Type:** *Jackia ornata* Wall. (= *Jackiopsis ornata* (Wall.) Ridsdale).

Trees. **Stipules** fused into a sheath, the margin with long linear lobes. **Inflorescences** mostly axillary, rarely also terminal, a conspicuous panicle. **Flowers** hermaphrodite; calyx lobes typically 3; corolla hypocrateriform, densely pale-hairy outside, inside glabrescent; corolla lobes 5, valvate; stamens as many as corolla lobes, inserted at the upper part of the corolla tube, anthers dorsifixed, sessile; stigma clavate; ovary 2-locular; ovules several in each locule, placenta basally attached and ascending. **Fruits** dry 3-winged nutlets. **Seeds** usually 1 per fruit.

Distribution. A monotypic genus in the Malay Peninsula, Sumatra and Borneo.

Taxonomy. *Jackiopsis* was a new name to replace the later homonym *Jackia* Wall. Puff & Igersheim (Bot. J. Linn. Soc. 115 (1994) 29) reported the only known occurrence in the Rubiaceae of intra-ovarian trichomes (internal, unbranched, septate hairs over the entire interior surface of the locules in both ovaries and young fruit).

Jackiopsis ornata (Wall.) Ridsdale

(Latin, *ornatus* = decorative; referring to both stipules and inflorescences)

Blumea 25 (1979) 296; Wong, Arbor. Rubiac. Malaya (1988) 101; Wong, Tree Fl. Malaya 4 (1989) 364; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 156; Turner, Gard. Bull. Singapore 45 (1993) 199; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 429; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 51, 175, 207. **Basionym:** *Jackia ornata* Wall. in Roxburgh, Fl. Ind. 2 (1824) 321; Hooker, Fl. Brit. India 3, fasc. 7 (1880) 126; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 95; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’]) 229; Ridley, Fl. Malay Penins. 2 (1923) 89; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1284; Corner, Wayside Trees Malaya, ed. 3, 2 (1988) 639. – *Zuccarinia ornata* (Wall.) Spreng., Syst. Veg. (ed. 16) 4(2) (1827) 81. **Type:** *Wallich s.n.* [EIC 6284], Singapore, 1822 (lectotype K-W [K001123515], designated here; isolectotypes K-W [K001123513, K001123514, K001123516, K001123517]). **Fig. 36.**

Tree to over 20 m tall, flowering at about 5–6 m tall; bole cylindrical, straight, with steep buttresses to 1 m high; bark brown, narrowly fissured to flaky, inner bark and sapwood pale brown. **Stipules** connate into a shallow cup 5–15 mm long, glabrescent to short hairy; lobes many, linear, 5–30 mm long. **Leaves:** lamina obovate, 9–40 × 5–16 cm, apex short-cuspidate to rounded, base gradually narrowed, subcoriaceous, short-hairy below and sometimes on the midrib above, secondary veins 11–16 pairs, tertiary veins fine, reticulate; petioles 15–30 mm long. **Inflorescences** typically axillary, rarely terminal also, paniculate, 10–50 cm long, pendulous; peduncle 5–20 cm long, main branches 3, sometimes subtended by reduced leaves. **Flowers** bisexual, fragrant, subsessile, arranged alternately in 2 rows along the upper side of the ultimate branches of the inflorescence, each subtended by a papery, ovate bract 2–3 mm long and 2–3 mm wide; calyx cup obconical, 1–2 mm long, short-hairy, calyx lobes 3, ovate, each 3–4 mm long and 1–1.5 mm wide, soft pale hairy, dull pink; corolla infundibular, tube 8–10 mm long, outside pale villous hairy, inside glabrous to scantily short-hairy, corolla



Figure 36. *Jackiopsis ornata* (Wall.) Ridsdale. Showy young inflorescences. (From Brunei. Photo: K.M. Wong).

lobes 5, valvate, ovate, each 2–2.5 mm long, outside villous hairy, inside scantily short-hairy, cream-coloured to pink; anthers 5, alternate with corolla lobes, c. 2.5 mm long, the tips slightly protruding from the corolla tube; style hairy, exerted 4–6 mm from the corolla tube; stigma club-shaped, bilobed, c. 0.5 mm long; ovary 2-loculate; ovules 2–5 in each locule. **Fruits** a dry winged nutlet, obconical, 3–4 mm long, c. 1 mm wide, pale short-hairy; persistent calyx lobes 3, spreading, elliptic, 10–12 mm long, 2–5 mm wide, soft pale hairy, pink. **Seeds** usually only 1 formed per fruit, ovoid, 2–3 mm long.

Distribution. As for the genus. In Singapore it has been documented in Jurong (*Corner SFN 26183*, 26 Feb 1933, SING [SING0030421]), Choa Chu Kang, Kranji, Mandai (*Lai 183*, 11 Feb 1997, SING [SING0030428]), Nee Soon (*Ragupathy et al. SING2005-93*, 13 Apr 2005, SING [SING0061069]), Seletar (*Hullett 599*, 30 Dec 1886, SING [SING0030425, SING0030430]), Bukit Timah (*Ridley 3813*, 1890, SING [SING0172361]), Dalvey Road and Changi.

Ecology. Lowlands, frequent in swamp forest and riverine sites.

Provisional conservation assessment. Globally not assessed. Listed as Critically Endangered (CR/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 51, 175, 207).

Notes. The rose-pink inflorescences fully spread over the crown are a sight to behold; the species will certainly be a tree worthy of cultivation on account of the good form, large leaves, ornate stipules and spectacular flowering.

24. LASIANTHUS Jack

(Greek, *lasi-* = shaggy, velvety, hairy, *-anthus* = flower; referring to the villose flowers)

Trans. Linn. Soc. London 14(1) (1823) 125, nom. cons.; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 106; Ridley, Fl. Malay Penins. 2 (1923) 149; Backer & Bakhuizen van den Brink, Fl. Java (Spermatoph.) 2 (1965) 335; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1341; Wong, Tree Fl. Malaya 4 (1989) 367; Zhu, Acta Phytotax. Sin. 39 (2001) 116; Zhu, Syst. Geogr. Pl. 72 (2002) 63; Puff et al., Rubiac. Thailand (2005) 102; Zhu et al., Blumea 57(1) (2012) 1. **Type:** *Lasianthus cyanocarpus* Jack, typ. cons.

Dasus Lour., Fl. Cochinch. 1 (1790) 141, nom. rej. **Type:** *Dasus verticillata* Lour. (= *Lasianthus verticillatus* (Lour.) Merr.).

Litosanthes Blume, Cat. Gew. Buitenzorg (1823) 22. **Synonyms:** *Uragoga* Baill. sect. *Litosanthes* (Blume) Baill., Adansonia 12 (1879) 334. – *Lasianthus* Jack sect. *Litosanthes* (Blume) Ridl., Fl. Malay Penins. 2 (1923) 151. **Type:** *Litosanthes biflora* Blume (= *Lasianthus biflorus* (Blume) M.Gangop. & Chakrab.).

Mephitidia Reinw. ex Blume, Cat. Gew. Buitenzorg (1823) 51. **Type:** *Mephitidia hexandra* Blume (= *Lasianthus hexandrus* (Blume) Blume).

Santia Wight & Arn., Prodr. Fl. Ind. Orient. (1834) 422, nom. illeg. non Savi (1799). **Type:** *Santia venulosa* Wight & Arn. (= *Lasianthus venulosus* (Wight & Arn.) Wight).

Dressleriopsis Dwyer, Ann. Missouri Bot. Gard. 67 (1980) 153. **Type:** *Dressleriopsis panamensis* Dwyer (= *Lasianthus panamensis* (Dwyer) Robbr.).

Treelets and shrubs or subshrubs, more rarely small trees. **Twigs** terete. **Stipules** interpetiolar, often persisting. **Leaves** opposite, distichous, usually relatively thin in texture, apex acute to acuminate. **Inflorescences** axillary, paired at each node, sessile to pedunculate, several- to many-flowered, bracts conspicuous, obscure or absent. **Flowers** small, sessile or pedicellate, generally clustered; calyx campanulate, truncate to lobed with 3–6 teeth, persisting on fruit; corolla salveriform to infundibuliform, white, hairy in the throat, lobes 4–6; stamens 4–6, included or exerted, inserted in the throat of the corolla, filaments short; style linear with 3–9 lobes; ovary with 3–9 locules with 1 basal, erect ovule in each. **Fruits** drupes, more or less globose, pulpy, ripening blue or more rarely white, red or black; pyrenes 2–10, lunar, thick-walled.

Distribution. About 180 species across the tropics, though predominantly Asian (160 species) with few, patchily distributed, species in the Americas. In Singapore 11 species, of which four are presumed to be Nationally Extinct.

Ecology. Shrubs of the forest understorey.

Taxonomy. The revision of *Lasianthus* in Malesia by Zhu et al. (*Blumea* 57(1) (2012) 1–102) has largely been followed in preparing the account of the genus.

Notes. The identity of ‘*Lasianthus* sp. 8’ (Wong, *Arbor. Rubiaceae. Malaya* (1988) 122; Wong, *Tree Fl. Malaya* 4 (1989) 373; Turner, *Gard. Bull. Singapore* 45 (1993) 200; Tan et al. in Davison et al. (ed.), *Singapore Red Data Book*, ed. 2 (2008) 240) remains uncertain. ‘*Lasianthus* sp. 8’ was assigned by Wong (*Arbor. Rubiaceae. Malaya* (1988) 122) to several specimens from Peninsular Malaysia and Singapore, although the only Singapore specimen that he cited (*Ridley 14123*, Bukit Timah, Jan 1909, SING [SING0012079]) is actually annotated ‘*Lasianthus* sp. 9, K.M.Wong, 3 Aug 1987’.

Key to *Lasianthus* species

1. Stipules conspicuous, distinctly broader than twig and covering the inflorescence to a considerable degree 2
 Stipules inconspicuous and relatively narrow, not broader than twig and not covering inflorescence to a considerable degree 4
2. Leaves typically obovate, glabrous except for a fringe of hairs on margin of leaf apex (lens may be needed to see); flowers 4-merous; pyrenes 4 per fruit **10. L. stipularis**
 Leaves typically oblong-elliptic, hirsute to glabrous but hairs not confined to a fringe of hairs on margin of leaf apex; flowers 5-merous; pyrenes 7–10 per fruit 3

3. Leaves scabrid above, secondary veins to 12 pairs, petiole generally extending beyond inflorescence with scattered long hairs visible to the naked eye **9. L. scabridus**
 Leaves smooth above, secondary veins 14 or more pairs, petiole largely hidden by inflorescence, without long hairs visible to the naked eye **5. L. griffithii**
4. Inflorescences with conspicuous bracts 5
 Inflorescences with bracts inconspicuous or absent 8
5. Leaves typically less than 3 cm wide, petiole to 4 mm long **1. L. attenuatus**
 Leaves typically 3 cm or more wide, petiole 5 mm or more long 6
6. Inflorescence bracts linear **8. L. ridleyi**
 Inflorescence bracts not linear 7
7. Outer inflorescence bracts leaf-like and considerably larger than stipules with long spreading hairs **6. L. hirsutus**
 Outer inflorescence bracts ovate-elliptic not much bigger than stipules with adpressed hairs **4. L. ellipticus**
8. Twigs densely hairy; leaf undersides distinctly hairy **2. L. chryseus**
 Twigs glabrous to sparsely hairy; leaf undersides glabrous to sparsely hairy 9
9. Midrib above in dry leaves a raised narrow pale ridge or flange; mature fruits without distinct longitudinal ridges when dry 10
 Midrib above in dry leaves not a raised narrow pale ridge or flange; mature fruits with 10 distinct longitudinal ridges when dry **11. L. venosus**
10. Secondary veins to 5 pairs; pyrenes 2–4 per fruit **3. L. constrictus**
 Secondary veins generally more than 5 pairs; pyrenes 5 per fruit **7. L. reticulatus**

1. *Lasianthus attenuatus* Jack

(Latin, *attenuatus* = impaired, weak, meagre, reduced in thickness or become slender; presumably referring to the overall appearance of the plant)

Trans. Linn. Soc. London 14(1) (1823) 126; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 121; Ridley, Fl. Malay Penins. 2 (1923) 156; Wong, Tree Fl. Malaya 4 (1989) 367; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 156; Turner, Gard. Bull. Singapore 45 (1993) 199; Tan et al., Gard. Bull. Singapore, Suppl. 3 (1995) 45, 46; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 430; Zhu, Syst. Geogr. Pl. 72 (2002) 72; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 53, 175, 222; Turner & Chua, Checkl. Vasc. Pl. Sp. Bukit Timah Nat. Res. (2011) 68; Zhu et al., Blumea 57(1) (2012) 13. **Synonyms:** *Mephitidia attenuata* (Jack) DC., Prodr. 4 (1830) 452. – *Nonatelia attenuata* (Jack) Kuntze, Revis. Gen. Pl. 1 (1891) 291. **Type:** *Jack s.n.*, [Indonesia], Sumatra, Tappanooly [Tapanuli], 1819 (lectotype L [L0000674], designated by Merrill, J. Arnold Arbor. 33 (1952) 229). **Fig. 37.**

Nonatelia hispida Wall. in Roxburgh, Fl. Ind. 2 (1824) 187. **Synonyms:** *Mephitidia wallichii* Wight & Arn., Prodr. Fl. Ind. Orient. (1834) 390, nom. illeg. superfl. – *Lasianthus wallichii* Wight, Calcutta J. Nat. Hist. 6 (1846) 503, nom. illeg. superfl. **Type:** *Collector unknown s.n.* [EIC 8442], [Bangladesh], Silhet (lectotype K [K000031602], designated by Zhu, Acta Phytotax. Sin. 32 (1994) 57; isolectotypes K-W [K001125525, K001125526, K001125527]).

Mephitidia attenuata (Jack) DC. var. *glabra* Korth., Ned. Kruidk. Arch. 2(4) (1851) 220. **Type:** *Korthals*, [Indonesia], Sumatra, Singalang (not traced).

Lasianthus densifolius Miq., Fl. Ned. Ind. 2, fasc. 2 (1857) 321. **Synonym:** *Nonatelia densifolia* (Miq.) Kuntze, Revis. Gen. Pl. 1 (1891) 291. **Type:** *Junghuhn s.n.*, [Indonesia], Java, Ungaran (lectotype L [L0000679], designated by Zhu, Syst. Geogr. Pl. 72 (2002) 73).

Lasianthus plagiophyllus Hance, J. Bot. 13 (1875) 196. **Synonyms:** *Mephitidia plagiophylla* (Hance) Nakai, Trees Shrubs Japan (1922) 395. – *Lasianthus wallichii* Wight subsp. *plagiophyllus* (Hance) C.Y.Wu & H.Zhu, Acta Phytotax. Sin. 32 (1994) 57. **Type:** *Hance 18438*, China, Hong Kong Island, ‘in devexis collium vallem Wongneichung [Wong Nai Chung] curcumventium, juxta coemeteria, horto publico praepositus’, 21 April 1874 (lectotype K [K000763833], designated by Zhu, Acta Phytotax. Sin. 32 (1994) 57; isolectotypes BM [BM000945610], K [K000763831, K000763834]).

Lasianthus densifolius Miq. var. *calycinus* King, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 122, as ‘*calycina*’; Ridley, Fl. Malay Penins. 2 (1923) 156. **Type:** *Ridley 5679*, Singapore, Chan Chu Kang, 1892 (lectotype SING [SING0030305], designated by Turner, Gard. Bull. Singapore 71 (2019) 47; isolectotype CAL [CAL0000031880]).

Lasianthus densifolius Miq. var. *latifolius* King, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 122, as ‘*latifolia*’; Ridley, Fl. Malay Penins. 2 (1923) 156. **Type:** *Ridley 10948*, [Malaysia], Johore, Panchur, Johore River, 14 October 1900 (lectotype SING [SING0059263], designated by Turner, Gard. Bull. Singapore 71 (2019) 47; isolectotype K [K001129550]).

Mephitidia tonkinensis Drake, J. Bot. (Morot) 9 (1895) 240. **Synonym:** *Lasianthus tonkinensis* (Drake) Pit., Fl. Indo-Chine 3, fasc. 3 (1924) 376. **Type:** *Balansa 2656*, [Vietnam], Tonkin forêts du mont Bavi, 24 November 1887 (holotype P [P02285231]; isotype K [K000777039]).

Lasianthus brachyphyllus K.Schum., Nachtr. Fl. Schutzgeb. Südsee (1905) 399. **Type:** *Nyman 678*, [Papua New Guinea], Kaiser-Wilhelmsland, Sattelberg, July 1899 (lectotype UPS [V-102855], designated Turner, Gard. Bull. Singapore 71 (2019) 47).

Lasianthus bordenii Elmer, Leaf. Philipp. Bot. 1 (1906) 11, as ‘*bordeni*’. **Type:** *Elmer 6977*, Philippines, Luzon, Bataan, Mt Mariveles, November 1904 (lectotype K [K000777107], designated Turner, Gard. Bull. Singapore 71 (2019) 47; isolectotypes E [E00504401], NY [NY00132080]).

Lasianthus copelandii Elmer, Leaf. Philipp. Bot. 1 (1906) 10, as ‘*copelandi*’. **Type:** *Copeland s.n.*, Philippines, Negros, Gimogon River, January 1905 (not traced).

Lasianthus thorelii Pit., Fl. Indo-Chine 3, fasc. 3 (1924) 389. **Type:** *Thorel 2161*, Laos, Penongs, 1866–1868 (lectotype P [P02285232], first step designated by Zhu, Acta Bot. Yunnan. 20 (1998) 158, second step designated by Turner, Gard. Bull. Singapore 71 (2019) 47; isolectotype P [P02285233]).

Lasianthus attenuatus Jack var. *subsessilis* Valetton, Bot. Jahrb. Syst. 61 (1927) 108. **Type:** *Schlechter 17334*, [Papua New Guinea], New Guinea, Jaduna, 3 April 1907 (holotype B, destroyed).



Figure 37. *Lasianthus attenuatus* Jack var. *attenuatus*. **A.** Habit. **B.** Detail of stipule and young inflorescences. **C.** Nearly mature fruit. (From Singapore, A, C, from MacRitchie; B from Nee Soon, Chen *et al.* SING2017-662. Photos: A, C, J. Leong-Škorničková; B, L.M.J. Chen).

Lasianthus setosus Craib, Bull. Misc. Inform. Kew 1933 (1933) 26. **Synonym:** *Lasianthus wallichii* Wight var. *setosus* (Craib) C.Y.Wu & H.Zhu, Acta Phytotax. Sin. 32 (1994) 57. **Type:** *Kerr 11827*, Siam [Thailand], Ranawng [Ranong], Kao Talu, 4 February 1927 (lectotype K [K000777040], designated by Zhu, Acta Phytotax. Sin. 32 (1994) 57; islectotypes BK [BK257397], BM [BM000945596]).

Lasianthus wallichii Wight var. *glabriusculus* Deb & M.G.Gangop., J. Bombay Nat. Hist. Soc. 84 (1988 [‘1987’]) 462, fig. 3. **Type:** *Falconer 885*, Burma, [Myanmar], 1 March 1849 (holotype CAL; isotype CAL).

Lasianthus wallichii Wight var. *hispidocostatus* H.Zhu, Acta Bot. Yunnan. 20 (1998) 158. **Type:** *Henry 12789*, China, Yunnan, Szemao (holotype K [K000763835]; isotype MO [MO-716813]).

Lasianthus appressus auct. non Hook.f.: Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 99; Ridley, Fl. Malay Penins. 2 (1923) 156, p.p.; Wong, Tree Fl. Malaya 4 (1989) 371, p.p.; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 156; Turner, Gard. Bull. Singapore 45 (1993) 199; Tan et al., Gard. Bull. Singapore, Suppl. 3 (1995) 36; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240.; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 53, 175, 222; Turner & Chua, Checkl. Vasc. Pl. Sp. Bukit Timah Nat. Res. (2011) 68.

Key to *Lasianthus attenuatus* varieties

1. Leaves often more than 2 cm wide, petiole generally more than 2 mm long; calyx lobes more than 2 mm long **a. var. attenuatus**
- Leaves rarely more than 2 cm wide, petiole to 2 mm long; calyx lobes to 2 mm long
..... **b. var. minor**

a. var. attenuatus

Shrub to 1.5 m tall. **Twigs** generally very straight, densely and persistently covered with more or less straight decumbent, to more rarely adpressed, golden brown to pale brown multicellular (evident under high magnification) hairs to 1 mm long or more. **Stipules** long acute triangular, densely golden-brown hairy outside. **Leaves:** lamina typically oblong-lanceolate to oblong-obovate, more rarely ovate, (3–)8–12 × (1.5–)1.7–3.5 cm, base rounded to subcordate, often slightly unequal and asymmetric with lobe proximal on shoot better developed than its distal partner, apex acute extending to a very fine and sharp point, membranous to chartaceous, drying grey to grey-brown above, more rarely dark brown, grey below with pale brown main nerves, midrib slightly raised above in dry leaves, secondary veins immersed, midrib prominent below, secondary veins raised, decumbent hairs generally dense on midrib above and scattered at lamina margin, particularly near apex, upper lamina glabrous or with widely scattered, more or less adpressed hairs, below with hairs on all nerves and scattered on lower lamina surface, secondary veins (7–)9–11 pairs, arching forward and looping obscurely within margin, reticulations scalariform; petiole 2–4 mm long, c. 1 mm wide, densely golden-brown hairy. **Inflorescences** axillary, bracts few in number, linear acute to narrowly elliptic and leaf-like, to 8 mm long, 1 mm wide, with spreading multicellular hairs. **Flowers** calyx lobes 4–5,

acute triangular, 3 mm long, 1 mm wide at base, with spreading multicellular hairs outside, glabrous within; corolla tube 10–12 mm long, sparsely hirsute outside, villous inside. **Fruits** more or less sessile, pyriform to globose, roughly quadrangular distally, c. 5 mm diam., hairy, ripening dark blue; pyrenes 4–5, lunar, truncate apically and pointed basally with a small void adaxially, c. 4 mm long, c. 2 mm wide, convex face slightly bumpy basally.

Distribution. From Nepal to Japan and across Malasia to New Guinea. In Singapore it persists on Bukit Timah (*Chua & Tan 199*, 1990, SINU) and in places in the Central Catchment, including MacRitchie (*Gwee et al. SING2005-258*, 5 Jul 2005, SING [SING0063890]; *Liaw et al. NRS 1291*, 10 Jun 1992, SING [SING0037490], SINU) and Nee Soon (*Gan et al. NRS 1178*, 1 Jun 1992, SINU). Older collections are from Bukit Timah, Bukit Panjang, Chan Chu Kang (*Ridley 4122*, 1892, SING [SING0030288]), Nee Soon and Serangoon Road.

Ecology. Forest understorey.

Provisional conservation assessment. Globally not assessed. Listed (under the species name *Lasianthus attenuatus*) as Vulnerable (VU/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 53, 175, 222) but assessed here as Endangered (EN/D).

b. var. *minor* H.Zhu

(Latin, *minor* = smaller)

Blumea 57(1) (2012) 16. **Type:** *Maxwell 82–72*, Singapore, Nee Soon, 18 March 1982 (holotype L [L0310278]). **Fig. 38.**

Lasianthus densifolius auct. non Miq.: King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 122; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 99; Ridley, Fl. Malay Penins. 2 (1923) 156; Wong, Tree Fl. Malaya 4 (1989) 368; Turner, Gard. Bull. Singapore 45 (1993) 199; Tan et al., Gard. Bull. Singapore, Suppl. 3 (1995) 46, fig. 4; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 430; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240; Turner & Chua, Checkl. Vasc. Pl. Sp. Bukit Timah Nat. Res. (2011) 68.

Shrub to 1 m tall. **Twigs** with more or less erect, pale brown or yellowish, multicellular hairs to 1.5 mm long or more, generally not fully obscuring twig surface which dries pale brown or green-grey with irregular fine longitudinal wrinkles. **Stipules** long acute triangular with broad-based spreading multicellular hairs. **Leaves:** lamina oblong-lanceolate to oblong-ovate, (2–)4–9 × (1–)1.2–2.5(–3.2) cm, base rounded or truncate to subcordate, often slightly unequal and asymmetric with lobe proximal on shoot better developed than its distal partner, apex acute, often (not always) densely packed on twigs, membranous to chartaceous, drying grey to brown above, generally grey below with pale brown to almost white main nerves, midrib slightly raised above in dry leaves, secondary veins flush to very slightly raised, midrib prominent below, secondary veins raised, midrib above with more or less erect multicellular hairs, upper lamina surface with uniform covering of decumbent hairs generally giving a slightly rough feel, nerves below and lower lamina surface with generally spreading curved hairs giving a soft hairy feel, secondary veins 7–10 pairs, arching forward and looping obscurely within

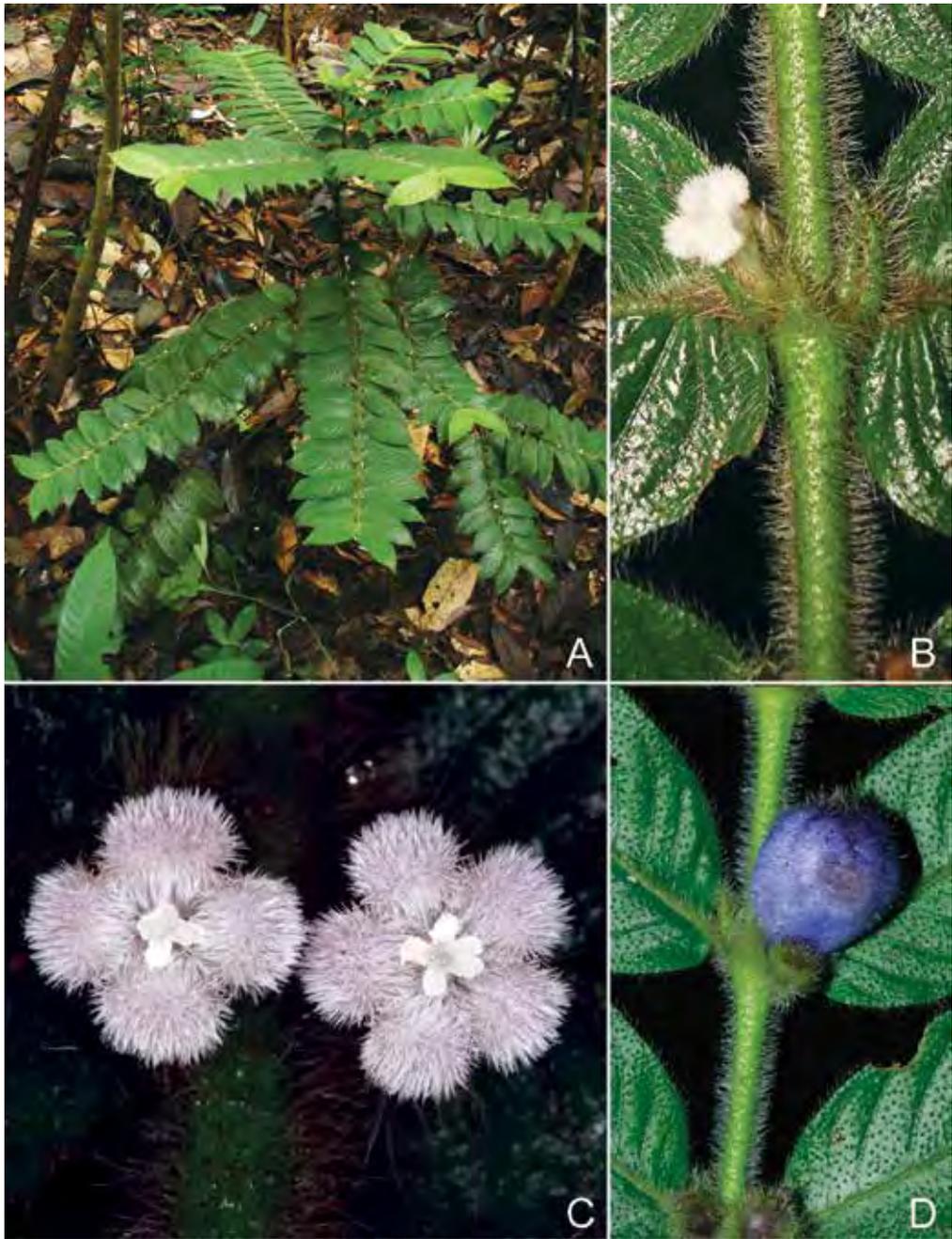


Figure 38. *Lasianthus attenuatus* Jack var. *minor* H.Zhu. **A.** Habit. **B.** Flower in side view and stipules. **C.** Flowers with both 4-merous and 5-merous forms and with dense hairs on the inner surface of the corolla lobes. **D.** Nearly mature fruit at a node; note hispid internodes and upper leaf surfaces. (From Singapore, A, B, from Nee Soon; C from Bukit Timah Nature Reserve; D from Nee Soon, *Chen et al. SING2017-664*. Photos: A, B, J. Leong-Škorničková; C, W.F. Ang; D, L.M.J. Chen).

margin, reticulations scalariform though sometimes obscure; petiole 1–2 mm long, c. 1 mm wide, with long spreading brownish hairs. **Inflorescences** axillary with narrow, long acute triangular bracts to 6 mm long with many spreading multicellular hairs particularly from margins. **Flowers** subsessile; calyx tube c. 1 mm long, with many multicellular hairs outside, calyx lobes 4, acute triangular, c. 2 mm long, 0.5 mm wide at base, with scattered multicellular hairs outside, more or less glabrous within; corolla tube 8 mm long. **Fruits** globose with scattered hairs, drying top-shaped when young, with 4 rounded lobes in outline seen from top; pyrenes 4 or more rarely 5, lunar, rounded apically and pointed basally, 3.5–5 mm long, 1.5–2 mm wide, convex face relatively smooth.

Distribution. Peninsular Malaysia, Sumatra and Java. In Singapore still present on Bukit Timah (*Chua & Tan 224*, 1990, SINGU) and in Nee Soon (*Samsuri et al. NES 50*, 15 Jul 2003, SING [SING0045759]; *Gwee et al. SING2009-226*, 24 Feb 2009, SING [SING0120506]), Seletar (*Gwee et al. SING2009-79*, 3 Feb 2009, SING [SING0120421]) and Mandai (*Gwee et al. SING2008-478*, 2 Dec 2008, SING [SING0116920]). Ridley collected it from other sites including Bajau, Changi and Bukit Panjang.

Ecology. Forest understorey.

Provisional conservation assessment. Globally not assessed. Listed as Vulnerable (VU/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240, under *Lasianthus densifolius*) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 53, 175, 222, under *Lasianthus attenuatus*) but assessed here as Endangered (EN/D).

Taxonomy. The two varieties of *Lasianthus attenuatus* can generally be distinguished fairly easily. The plants with slender, but densely packed, very hairy leaves, and short calyx lobes represent *Lasianthus attenuatus* var. *minor* while the plants with wider leaves, more widely spaced on the twigs, less hairy, particularly above and long pointed calyx lobes, particularly evident on the fruits, are the type variety. However, some collections, possibly related to growing in deep shade, are relatively sparsely hairy and in the absence of fruits can be difficult to assign to variety. Therefore, while it may be tempting to recognise these entities at species rank, Zhu et al. (*Blumea* 57(1) (2012) 16) is followed here and the varieties maintained.

2. *Lasianthus chryseus* Ridl.

(Greek, *chryseus* = gold-coloured, golden; referring to the golden hairs on the twigs and leaves)

J. Fed. Malay States Mus. 10 (1920) 143; Ridley, Fl. Malay Penins. 2 (1923) 158; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 156; Zhu et al., *Blumea* 57(1) (2012) 28. **Type:** *Ridley 140*, Singapore, Gardens' Jungle [Singapore Botanic Gardens' Rain Forest], February 1889 (lectotype K [K000763913], designated by Zhu et al., *Blumea* 57(1) (2012) 28). **Fig.** 39, 40.

Mephitidia capitata (Blume) DC. var. *ferruginea* Korth., Ned. Kruidk. Arch. 2(4) (1851) 221. **Type:** *Korthals s.n.*, [Indonesia], Borneo, [Kalimantan], Prarawin (lectotype L [L0057527], designated by Turner, Gard. Bull. Singapore 71 (2019) 48).

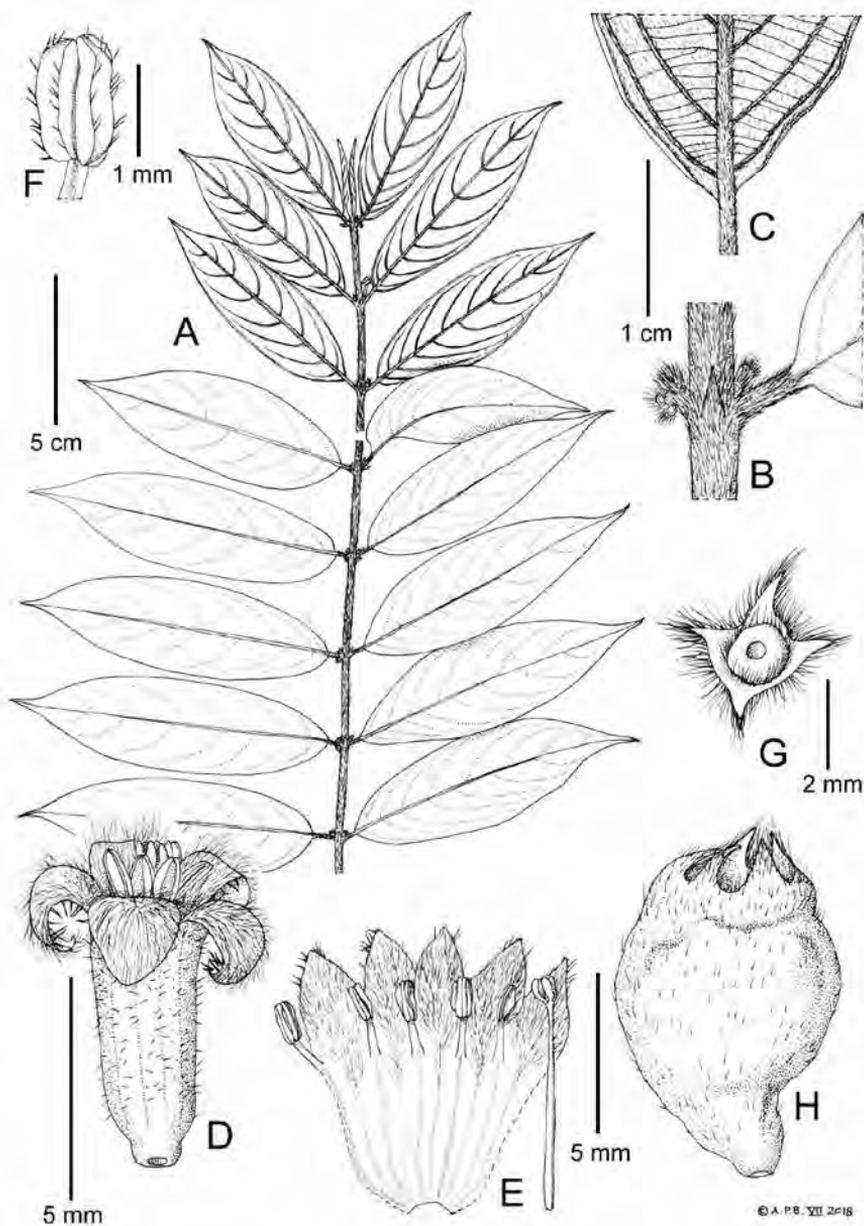


Figure 39. *Lasianthus chryseus* Ridl. **A.** Habit with top three nodes showing the abaxial surface of the leaves and those below showing the adaxial surface. **B.** Section of stem including node with stipule, base of one attached leaf (adaxial surface) and inflorescence remnants including persistent calyces. **C.** Base of leaf, abaxial surface, showing details of venation and indumentum. **D.** Corolla. **E.** Corolla opened out to show attached stamens and with the style and stigma removed to the side. **F.** Adaxial view of anther. **G.** Calyx with central disk. **H.** Immature fruit. (From Singapore, Nee Soon, A–G from Ng *et al.* SING2013-314; H from Gwee *et al.* SING2009-216A. Drawn by A. Brown, reproduced with the kind permission of the Director and the Board of Trustees, Royal Botanic Gardens, Kew).

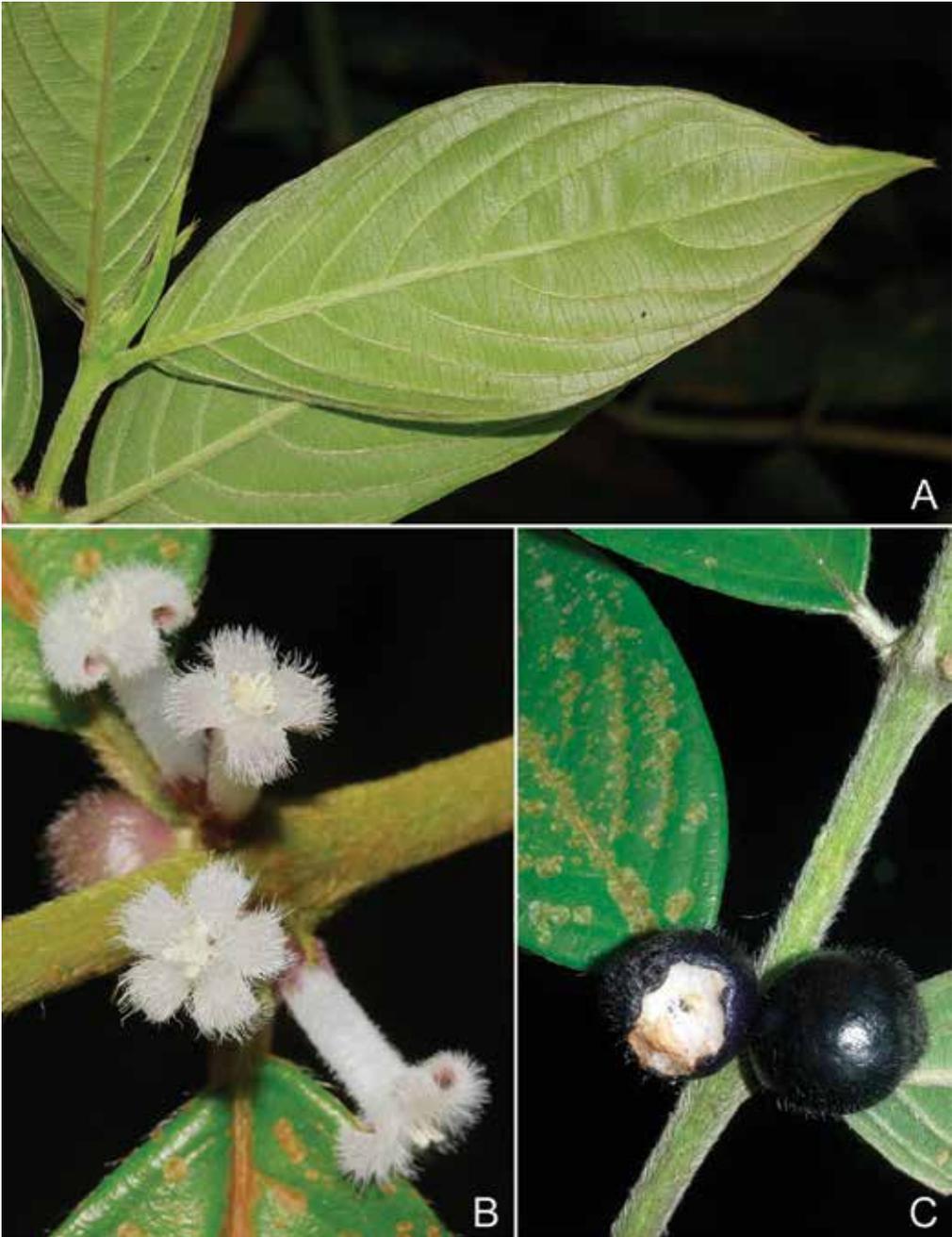


Figure 40. *Lasianthus chryseus* Ridl. **A.** Leaves with hairy lower surfaces. **B.** Open flowers exhibiting both 4-merous and 5-merous forms. **C.** Mature fruits. (From Singapore, Nee Soon, *Chen et al. SING2017-668*. Photos: L.M.J. Chen).

Lasianthus tomentosus auct. non Blume: King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 130; Ridley, Fl. Malay Penins. 2 (1923) 161, p.p.; Wong, Tree Fl. Malaya 4 (1989) 371; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 157; Turner, Gard. Bull. Singapore 45 (1993) 200; Tan et al., Gard. Bull. Singapore, Suppl. 3 (1995) 46; Turner, Gard. Bull. Singapore 47 (1997 ['1995']) 433; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 54, 175, 207; Turner & Chua, Checkl. Vasc. Pl. Sp. Bukit Timah Nat. Res. (2011) 60.

Lasianthus perakensis auct. non King & Gamble: Turner, Gard. Bull. Singapore 45 (1993) 200; Ng & Wee (ed.), Singapore Red Data Book (1994) 306; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240.

Treelet or shrub to 1.5 m tall. **Twigs** densely covered with decumbent multicellular hairs. **Stipules** acute triangular, densely hairy. **Leaves:** lamina ovate, elliptic or obovate, often narrowly oblong, 8.5–18.5 × 2.5–5 cm, base acutely acuminate, ultimately sometimes slightly unequal and asymmetric, apex acute to acuminate, often finely and sharply pointed, chartaceous, drying grey to brown above, often shiny, grey-green in new specimens, brown or grey-brown below with paler venation, midrib flush to very slightly sunken above in dry leaves, secondary veins immersed, midrib prominent below, secondary veins raised, glabrous above except for a few hairs extending up midrib from base, densely hairy on nerves and lamina surface below, usually sufficiently so to feel softly hairy, secondary veins 6–8 pairs, arching forward with the last few distally curving in and looping, reticulations markedly scalariform and orthogonal to midrib; petiole 5–13 mm long, 1–1.5 mm wide, densely hairy. **Inflorescences** axillary, bracts insignificant. **Flowers** subsessile; pedicel plus hypanthium c. 1 mm long; calyx tube c. 0.2 mm long, dark brown hairy outside, calyx lobes 4 or more rarely 5, acute triangular, c. 1 mm long, 0.5 mm wide at base, densely long dark brown hairy outside, glabrous within; corolla tube c. 5 mm long, 1 mm wide, with scattered short pale hairs becoming denser distally, corolla lobes 5 (or more rarely 4), linear lanceolate, c. 2.5 mm long, 1 mm wide, densely pale hairy outside. **Fruits** subsessile, ripening dark blue-black, drying shortly pyriform with a flattish top, 5–8 mm long, 4–8 mm diam. drying dark brown with pale hairs densest apically, drying with four distinct longitudinal grooves when immature; pyrenes 4, lunar, c. 5 mm long, 3 mm wide, rounded apically and pointed basally, convex face smooth and relatively thick forming a double outer wall to the pyrene due to a deep groove running around the outer edge of the two flat faces.

Distribution. Peninsular Malaysia and Borneo. In Singapore it has been collected recently from Bukit Timah (*Leong SING2010-595*, 2 Mar 2010, SING [SING0138159]), Seletar (*Lim et al. NRS 1155*, 28 May 1992, SINU), Nee Soon (*Gwee et al. SING2005-111*, 19 Apr 2005, SING [SING0063912]), Mandai (*Lua SING2014-308*, 9 Sep 2014, SING [SING0212422]) and the Singapore Botanic Gardens' Rain Forest (*Ali Ibrahim et al. 2017-030*, 7 Feb 2017, SING [SING0230972]). Ridley also made collections from the Singapore Botanic Gardens' Rain Forest, as well as from Pasir Panjang and Kranji.

Ecology. Understorey of mature forest.

Provisional conservation assessment. Globally not assessed. Listed (under *Lasianthus tomentosus*) as Critically Endangered (CR/D) in Singapore by Tan et al. (in Davison et al.

(ed.), Singapore Red Data Book, ed. 2 (2008) 240) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 54, 175, 207). Given that it still seems to be present at various different sites in Singapore and there are likely to be more than 50 plants, it is assessed here as Endangered (EN/D).

3. *Lasianthus constrictus* Wight

(Latin, *constrictus* = constricted, compressed, compact;
referring to the calyx cup being constricted at its mouth)

Calcutta J. Nat. Hist. 6 (1846) 515; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 117; Ridley, Fl. Malay Penins. 2 (1923) 163; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1341; Wong, Tree Fl. Malaya 4 (1989) 369; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 157; Turner, Gard. Bull. Singapore 45 (1993) 199; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 430; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 53, 175, 216; Zhu et al., Blumea 57(1) (2012) 30. **Synonyms:** *Mephitidia constricta* (Wight) Walp., Ann. Bot. Syst. 2 (1852) 762. – *Nonatelia constricta* (Wight) Kuntze, Revis. Gen. Pl. 1 (1891) 291. **Type:** *Griffith s.n.*, Burma [Myanmar], Mergui (holotype K [K000031672] fide Noltie, Bot. Robert Wight (2005) 414).

Lasianthus constrictus Wight var. *latifolius* Craib, Fl. Siam. 2(2) (1934) 209. **Type:** *Kerr 14940*, Siam, [Thailand], Pattani, Kao Kala Kiri, 1 April 1928 (lectotype K [K000777034], designated by Turner, Gard. Bull. Singapore 71 (2019) 49; isolecotypes BK [BK257385], BM [BM000945603], E [E00327855], K [K000777033]).

Treelet or shrub to 2 m tall. **Twigs** light brown to straw-coloured, drying finely longitudinally wrinkled with scattered decumbent to adpressed hairs to c. 0.5 mm long. **Stipules** inconspicuous, acute triangular with adpressed pale brown hairs outside, base aligned to upper side of petiole bases. **Leaves:** lamina typically elliptic or oblong-elliptic with some leaves slightly more ovate or obovate, 5.5–17 × 2–5 cm, apex acuminate, base broadly cuneate to obtuse, chartaceous drying brown, grey-brown or grey above, grey-brown or grey beneath with straw-coloured venation, midrib above in dry leaves raised as a pale narrow ridge or flange, secondary veins immersed to slightly raised, midrib below raised and round-topped, secondary veins slightly raised, glabrous above except perhaps for a few hairs along margin of midrib at base, below with scattered decumbent hairs on main nerves, secondary veins 4–5 pairs, curving forward, widely spaced, higher-order venation scalariform; petiole 5–8 mm long, 1 mm wide, drying brown, minutely bumpy with decumbent hairs. **Inflorescences** axillary, bracts inconspicuous. **Flowers** with pedicel plus hypanthium c. 1.5 mm long, drying brown with some longitudinal wrinkles and scattered decumbent hairs, calyx cupuliform; calyx tube c. 0.5 mm long, calyx lobes triangular, 0.5–1 mm long, 0.5 mm wide at base with hairs densest near apex; corolla in bud spindle-shaped with tube constricted near base and tips of lobes reflexing, at anthesis corolla tube c. 4 mm long, 1 mm wide, lobes c. 2 mm long, 1 mm wide, densely pale hairy inside. **Fruits** sessile, drying roughly ellipsoidal, 11–12 mm long, 8–9 mm diam., black and verrucose, glabrous except for scattered hairs near apex; pyrenes 2–4, lunar, 8 mm long, 3 mm wide, convex face with distinct protrusions.

Distribution. Myanmar, Thailand, Peninsular Malaysia, Sumatra, Java and Borneo. In Singapore it is known from Nee Soon (*Gan et al. NRS 1008*, 16 May 1992, SING [SING0037486]; *Yeo & Ang SING2012-224*, 19 May 2012, SING [SING0176375]), Upper Peirce (*Turner et al. NRS 34*, 1 Apr 1992, SINU) and MacRitchie (*Lua SING2014-251*, 11 Jul 2014, SING [SING0212468]). Ridley collected it from Kranji, Changi and North Seletar.

Ecology. Forest understorey.

Provisional conservation assessment. Globally not assessed. Listed as Endangered (EN/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 53, 175, 216).

4. *Lasianthus ellipticus* Wight

(Latin, *ellipticus* = elliptic; referring to the leaf shape)

Calcutta J. Nat. Hist. 6 (1846) 507; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 118; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 99; Ridley, Fl. Malay Penins. 2 (1923) 159; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 157; Turner, Gard. Bull. Singapore 45 (1993) 199; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 430; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 54, 175, 207; Zhu et al., Blumea 57(1) (2012) 35. **Synonyms:** *Mephitidia elliptica* (Wight) Walp., Ann. Bot. Syst. 2 (1852) 761. – *Nonatelia elliptica* (Wight) Kuntze, Revis. Gen. Pl. 1 (1891) 291. **Type:** *Griffith s.n.*, [Malaysia], Malacca (holotype K [K000763923], fide Noltie, Bot. Robert Wight (2005) 415).

Lasianthus sordidus Ridl., J. Straits Branch Roy. Asiat. Soc. 57 (1911) 60. **Type:** *Ridley 14488*, [Malaysia], Perak, Temango, July 1909 (lectotype BM [BM001190973], designated by Turner et al., Gard. Bull. Singapore 70 (2018) 356; isolectotype K [K000763925]).

Lasianthus venulosus Ridl., J. Straits Branch Roy. Asiat. Soc. 61 (1912) 23, nom. illeg. non (Wight & Arn.) Wight (1846). **Type:** *Ridley 12542*, Singapore, Bukit Panjang, 1906 (lectotype K [K000763924], designated by Turner et al., Gard. Bull. Singapore 70 (2018) 357; isolectotype SING [SING0012080]).

Lasianthus velutinus Ridl., J. Fed. Malay States Mus. 10 (1920) 144. **Type:** *Ridley s.n.*, [Malaysia], Kelantan, Chaning Woods, 4 February 1917 (lectotype SING [SING0059265], designated by Turner et al., Gard. Bull. Singapore 70 (2018) 357; isolectotype K [K000763926]).

Lasianthus scalaris Craib, Bull. Misc. Inform. Kew 1933 (1933) 26. **Type:** *Kerr 18809*, Siam [Thailand], Krabi, Tambon, Kao Panom [Khao Phanom], 1 April 1930 (lectotype K [K00777030, K000777029 – single specimen over two sheets], designated by Turner, Gard. Bull. Singapore 71 (2019) 50; isolectotypes BK [BK257396], BM [BM001191350]).

Lasianthus glaber auct. non Ridl.: Wong, Tree Fl. Malaya 4 (1989) 373, p.p.; Turner, Gard. Bull. Singapore 45 (1993) 199; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 54, 175, 194.

Shrub. **Twigs** with appressed to decumbent pale hairs, not fully obscuring twig surface. **Stipules** acute triangular, relatively small, brown hairy outside, glabrous within. **Leaves:**

lamina ovate-elliptic to elliptic, 13–14 × 4–6 cm, base broadly cuneate, apex acuminate with a short sharp acumen, chartaceous, drying grey-brown and rather shiny above, grey-brown below with brownish main nerves, midrib above flush to slightly sunken in dry leaves, secondary veins more or less flush, midrib below raised, with a rounded top, secondary veins slightly raised, glabrous above except for a few hairs near base of midrib, below with short adpressed hairs on nerves, secondary veins 7–8 pairs, arching forward and looping obscurely within margin, reticulations markedly scalariform, fine and close, more or less orthogonal to midrib; petiole 7–8 mm long, 1 mm wide, densely covered with pale or brownish hairs. **Inflorescences** axillary, relatively few-flowered, bracts ovate-elliptic with an acute apex, to c. 7 mm long, brown hairy outside, glabrous within. **Flowers** with calyx lobes 5, c. 1 mm long, acute triangular with adpressed hairs outside; corolla tube c. 6 mm long. **Fruits** globose, drying with faint longitudinal grooves, at least when immature; pyrenes 5, lunar with basal end more pointed, c. 5.5 mm long, 2.5 mm wide.

Distribution. Thailand, Peninsular Malaysia, Sumatra, Java and Borneo. In Singapore only known by one collection from Bukit Panjang (*Ridley 12542*, 1906, K [K000763924], SING [SING0012080]) and one collection from Chan Chu Kang (*Ridley 6146*, 1911, SING [SING0012081]).

Ecology. Lowland forest.

Provisional conservation assessment. Globally not assessed. Listed as Critically Endangered (CR/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 54, 175, 207) but, with no collections since 1911, it must be presumed Nationally Extinct.

5. *Lasianthus griffithii* Wight

(William Griffith, 1810–1845, English botanist known for his work in India and Malaya)

Calcutta J. Nat. Hist. 6 (1846) 505; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 111; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 99; Ridley, Fl. Malay Penins. 2 (1923) 152; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1341; Wong, Tree Fl. Malaya 4 (1989) 371; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 157; Turner, Gard. Bull. Singapore 45 (1993) 200; Tan et al., Gard. Bull. Singapore, Suppl. 3 (1995) 46; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 431; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 54, 175, 207; Zhu et al., Blumea 57(1) (2012) 45. **Synonyms:** *Mephitidia griffithii* (Wight) Walp., Ann. Bot. Syst. 2 (1852) 760. – *Nonatelia griffithii* (Wight) Kuntze, Revis. Gen. Pl. 1 (1891) 291. **Type:** *Griffith s.n.*, [Malaysia], Malacca (lectotype K [K000763947], designated by Turner, Gard. Bull. Singapore 71 (2019) 50).

Lasianthus spathulatus Miq., Ann. Mus. Bot. Lugduno-Batavi 4, fasc. 8 (1869) 246. **Type:** *De Vriese & Teijsmann s.n.*, [Indonesia], Borneo, [Kalimantan], 1859–1860 (lectotype L [L0057497], designated by Turner, Gard. Bull. Singapore 71 (2019) 50).

Lasianthus polycarpus Miq., Ann. Mus. Bot. Lugduno-Batavi 4, fasc. 8 (1869) 247. **Type:** *De Vriese s.n.*, [Indonesia], Borneo, 1857–1861 (lectotype L [L0057500], designated by Turner, Gard. Bull. Singapore 71 (2019) 50).

Lasianthus griffithii Wight var. *latibracteatus* King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 112, as '*latibracteata*'. **Type:** Ridley 10196, [Malaysia], Selangor, Petaling, 1899 (lectotype CAL [CAL0000031878], designated by Turner, Gard. Bull. Singapore 71 (2019) 50; isolectotype SING [SING0261046]).

Treelet. **Twigs** drying dark brown to blackish, becoming paler brown with age, rarely shiny, faintly longitudinally striate, glabrous to shaggily hairy with long (to 3 mm or more), tapered brown multicellular hairs. **Stipules** broadly ovate, drying blackish, glabrous or with scattered hairs particularly on the margin. **Leaves:** lamina lanceolate, oblong-elliptic or oblanceolate, 19–39 × 5–12 cm, apex shortly acuminate, base cuneate, sometimes slightly unequal, chartaceous to subcoriaceous, drying brown, grey-brown or grey above, brown or grey-brown below, midrib above in dry leaves generally raised, at least as a central ridge, prominent below, secondary veins more or less immersed above, raised below with even fine nerves appearing to run over lower lamina surface, glabrous above, hairy on nerves and lamina below, generally sufficiently dense for leaf underside to feel hairy and sometimes rough to the touch, hairs variable in size, but mostly small and hooked at the tip, secondary veins 14–22 pairs, arching forward and looping obscurely close to margin, higher-order nervation visible, particularly from below, subscalariform to more clearly scalariform distally; petiole 10–23 mm long, 2 mm wide, drying dark brown, sparsely hairy, generally with a distinct ridge or rim around base connecting to the base of the stipule on each side. **Inflorescences** axillary, subsessile, largely hidden by the stipules, containing numerous linear-lanceolate bracts, 5–7 × 1 mm, densely covered with brown, ribbon-like multicellular hairs to 2 mm long, on margins and adaxial face. **Flowers** subsessile; pedicel plus hypanthium c. 1 mm long, widening distally, drying dark brown, glabrous; calyx campanulate, tube c. 2 mm long, glabrous outside, calyx lobes 5, ovate-triangular, 1.5–2 × 1.5–2 mm, densely hairy or with a marginal fringe of hairs and scattered ones near apex; corolla long clavate in bud, tube c. 8 mm long at anthesis, drying blackish, glabrous outside, corolla lobes 5, acutely triangular, 3–5 mm long, c. 1 mm wide at base, tip incurved and minutely papillate, throat of corolla filled with long pale, ribbon-like, apically pointed hairs. **Fruits** shortly pedicellate, stalk to c. 1 mm long, 0.5 mm wide, drupe top-shaped, to almost obconical, c. 5 mm long, 6 mm diam., ripening dark purple-blue, drying dark brown, with 7–10 ribs, mounted by persistent calyx with brown hairs on edges; pyrenes, 7–10, lunar, c. 3 mm long, 2 mm wide, c. 1 mm thick on convex margin, flat-topped, drying pale brown.

Distribution. Peninsular Malaysia, Sumatra and Borneo. In Singapore only known from Nee Soon (*Ang et al. s.n.*, 25 Mar 2011, SINU; *Chen et al. SING2017-671*, 28 Nov 2017, SING [SING0267385]).

Ecology. Forest understorey.

Provisional conservation assessment. Globally not assessed. Listed as Critically Endangered (CR/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 54, 175, 207).

Taxonomy. The Singapore specimens of *Lasianthus griffithii* are notable for being almost entirely glabrous. A collection made by Ridley at Mt Austin in Johor is similar. Otherwise the

specimens conform to *Lasianthus griffithii*, and I therefore see no reason to make any formal taxonomic distinction for the glabrous plants.

6. *Lasianthus hirsutus* (Roxb.) Merr.

(Latin, *hirsutus* = hirsute, with coarse stiff hairs; referring to general hairiness of the plant)

J. Arnold Arbor. 33 (1952) 229; Zhu, Syst. Geogr. Pl. 72 (2002) 76; Zhu et al., Blumea 57(1) (2012) 47. **Basionym:** *Triosteum hirsutum* Roxb., Fl. Ind. 2 (1824) 180. **Synonym:** *Lasianthus roxburghii* Wight, Calcutta J. Nat. Hist. 6 (1846) 502, nom. illeg. superfl. **Type:** *Collector unknown 139*, [Bangladesh], Chittagong (lectotype BM [BM000848507], designated at the first step by Merrill, J. Arnold Arbor. 33 (1952) 230, and at the second step designated by Turner, Gard. Bull. Singapore 71 (2019) 50).

Lasianthus bracteatus Wight, Calcutta J. Nat. Hist. 6 (1846) 501, as ‘*bractiatus*’. **Synonym:** *Mephitidia bracteata* (Wight) Walp., Ann. Bot. Syst. 2 (1852) 759. **Type:** *Griffith s.n.*, [Malaysia], Malacca (not traced).

Lasianthus oculus-cati Miq., Fl. Ned. Ind. 2, fasc. 2 (1857) 315, as ‘*oculus cati*’. **Type:** *Zollinger 593*, [Indonesia], Java, Tjidoek Tjigalin, 4 September 1842 (lectotype P [P04005337], designated by Turner, Gard. Bull. Singapore 71 (2019) 52; isoelectotypes BM, P [P04005347]).

Lasianthus laevicaulis Kurz, J. Bot. 13 (1875) 327. **Type:** *Kurz s.n.*, Nicobar Islands, Kamorta, February 1875 (lectotype K [K000031667], first step designated by Deb & Gangopadhyay, J. Econ. Taxon. Bot. 15 (1991) 282, second step designated by Turner, Gard. Bull. Singapore 71 (2019) 52; possible isoelectotypes CAL, K).

Lasianthus everettii Merr., Philipp. J. Sci., C 3 (1908) 265. **Type:** *Everett Forest Bur. 5591*, Philippines, Negros Occidental (not traced).

Lasianthus cyanocarpus Jack var. *novaguineensis* Valetton, Nova Guinea 8 (1911) 498. **Type:** *Versteeg 1406*, [Indonesia], SW New Guinea, Noord-Fluss, umgegend des Geluks-Hügels (lectotype L [L0310256], designated by Turner, Gard. Bull. Singapore 71 (2019) 52; isoelectotype U [U0227184]).

Lasianthus cyanocarpus Jack var. *asperatus* Pierre ex Pit., Fl. Indo-Chine 3, fasc. 3 (1924) 381. **Type:** *Pierre 3256a*, Vietnam, Cochinchine, prov. Bienhoa, ad Gia Lau Mé, September 1869 (lectotype P [P03980331], designated by Turner, Gard. Bull. Singapore 71 (2019) 52, isoelectotypes P [×2] [P03980332, P03980336]).

Lasianthus cyanocarpus Jack var. *lucidulus* Pierre ex Pit., Fl. Indo-Chine 3, fasc. 3 (1924) 382. **Type:** *Pierre 3256b*, Vietnam, Cochinchine, pref. Bioen Hoa, ad Gia Lau Mé, September 1865 (lectotype P [P03980334], designated by Turner, Gard. Bull. Singapore 71 (2019) 52; isoelectotype L).

Lasianthus cyanocarpus Jack var. *bracteatus* Pit., Fl. Indo-Chine 3, fasc. 3 (1924) 382. **Type:** *Thorel 1464*, Vietnam, Cochinchine, Gi Tinh, 1862–1866 (lectotype P [P03980340], designated by Turner, Gard. Bull. Singapore 71 (2019) 52; isoelectotype P [P03980342]).

Lasianthus cyanocarpus auct. non Jack: King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 113; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 99; Ridley, Fl. Malay Penins. 2 (1923) 153, p.p.; Wong, Tree Fl. Malaya 4 (1989) 370, p.p.; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot.

(1990) 157; Turner, Gard. Bull. Singapore 45 (1993) 199; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 430; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 54, 175, 207.

Shrub to 1 m tall. **Twigs** drying brown to blackish with sparse to dense, more or less erect, though rarely straight, multicellular hairs reaching 1–3 mm long, twig surface finely longitudinally striate sometimes drying with more pronounced longitudinal wrinkles. **Stipules** acute triangular, distinctly shorter than inflorescence bracts, densely to sparsely covered in long spreading multicellular hairs. **Leaves:** lamina elliptic to obovate, generally narrowly so, 11–24 × 3–6(–8) cm, apex long-pointed acute to acuminate, base obtuse to rounded, sometimes slightly asymmetric and unequal, membranous to chartaceous, drying brown to dark brown above, paler brown or grey-brown below, midrib slightly raised above in dry leaves, secondary veins flush, midrib prominent below with secondary veins also distinctly raised with subsequent vein orders raised to a lesser degree, midrib above with hairs, rarely glabrous, upper lamina surface with more or less uniform covering of broad-based multicellular hairs giving a distinctly rough feel, or upper lamina surface glabrous, smooth and shiny with hairs restricted to a distinct fringe on and close to lamina margin, nerves below with many spreading multicellular hairs and lamina surface densely covered with multicellular hairs making the lower lamina soft to the touch, secondary veins 9–10 pairs, arching forward, reticulations scalariform; petiole 9–17 mm long, 1–2 mm wide, densely covered in long multicellular hairs. **Inflorescences** axillary, with at least outer bracts leaf-like, sessile, ovate, 5–14 mm wide, with prolonged acute apex, densely covered in long, spreading multicellular hairs 1–2 mm long. **Flowers** with calyx lobes 5, densely long multicellular hairy outside; corolla tube c. 7 mm long, widening distally, drying black with scattered pale, pointed hairs, corolla lobes 5, c. 2 mm long, 1 mm wide, outside with pale pointed hairs, inside with dense short fine, kinked hairs. **Fruits** globose, with scattered long hairs; pyrenes 5, lunar, apex slightly flattened, base pointed, 5 mm long, 2 mm wide, fairly smooth.

Distribution. India to New Guinea. In Singapore known from Pulau Ubin (*Gwee et al. SING2005-301*, 19 Sep 2005, SING [SING0065740]; *Ali Ibrahim SING2009-792*, 14 Aug 2009, SING [SING0145351]) and Pulau Tekong (*Gwee et al. SING2007-226*, 2 Mar 2007, SING [SING0093627]). Historical localities include Changi (*Ridley 4899*, 14 Feb 1889, SING [SING0012071]) and Tanjong Gul (*Sinclair s.n.*, 21 May 1953, K).

Ecology. Lowland forest including secondary growth.

Provisional conservation assessment. Globally not assessed. Listed (under *Lasianthus cyanocarpus*) as Critically Endangered (CR/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 54, 175, 207). Its persistence (or recolonisation) on Pulau Ubin and Pulau Tekong would seem to merit a more optimistic assessment and it is, therefore, assessed here as Endangered (EN/D).

Taxonomy. Amongst the Singapore material, there are two forms – one with leaves that dry greyer with uniform tomentum of broad-based hairs on the upper lamina surface giving a rough feel, the other with leaves that dry dark brown with hairs confined to a distinct fringe

near to and on the margin. The leaves of the more glabrous form also tend to be narrower with a long pointed apex, while those of the hairy form are broader with a more distinctly acuminate apex. The two forms have been collected from the same places, so presumably they represent ecological or ontogenetic variants or simply variability on a plant.

7. *Lasianthus reticulatus* Blume

(Latin, *reticulatus* = reticulate, net-like; referring to the leaf venation)

Bijdr. Fl. Ned. Ind., pt 16 (1826–1827) 1000; Zhu et al., *Blumea* 57(1) (2012) 77. **Synonyms:** *Mephitidia reticulata* (Blume) DC., Prodr. 4 (1830) 454. – *Nonatelia reticulata* (Blume) Kuntze, Revis. Gen. Pl. 1 (1891) 291. **Type:** *Blume* 862, [Indonesia], Java, Gunong Seribú (lectotype L [L0000700], designated by Turner, Gard. Bull. Singapore 71 (2019) 53). **Fig. 41.**

Lasianthus cinnamomoides Miq., Fl. Ned. Ind. 2, fasc. 2 (1857) 325. **Synonym:** *Nonatelia cinnamomoides* (Miq.) Kuntze, Revis. Gen. Pl. 1 (1891) 291. **Type:** *Zollinger 1478*, [Indonesia], Java, Passir Madang, 12 August 1843 (lectotype P [P04008190], designated by Turner, Gard. Bull. Singapore 71 (2019) 53; isolectotypes P [P04008191, P04008194, P04008192]).

Lasianthus maingayi Hook.f., Fl. Brit. India 3, fasc. 7 (1880) 188; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 132; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 99; Ridley, Fl. Malay Penins. 2 (1923) 160; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1342; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 157; Wong, Tree Fl. Malaya 4 (1989) 369; Turner, Gard. Bull. Singapore 45 (1993) 200; Tan et al., Gard. Bull. Singapore, Suppl. 3 (1995) 46; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 431; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 54, 175, 194; Turner & Chua, Checkl. Vasc. Pl. Sp. Bukit Timah Nat. Res. (2011) 69. **Synonym:** *Nonatelia maingayi* (Hook.f.) Kuntze, Revis. Gen. Pl. 1 (1891) 291. **Type:** *Maingay 1699* [Kew Distribution 871], [Malaysia], Malacca, 13 April 1867 (lectotype K [K000763918, K000763917 – a single specimen over two sheets], designated by Turner, Gard. Bull. Singapore 71 (2019) 53).

Lasianthus caloneurus K.Schum., Bot. Tidsskr. 24 (1902) 339. **Type:** *Schmidt 683*, Thailand, Koh Chang, Klong Son, 2 March 1900 (holotype C [C10018243]).

Lasianthus flavicans King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 116. **Type:** *King’s Collector 10974*, [Malaysia], Perak, September 1886 (lectotype CAL [CAL0000031871], designated by Turner, Gard. Bull. Singapore 71 (2019) 53).

Lasianthus flavicans King & Gamble var. *subglaber* King, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 116. **Synonym:** *Lasianthus maingayi* Hook.f. var. *subglaber* (King) Ridl., Fl. Malay Penins. 2 (1923) 160, as ‘*subglabra*’. **Type:** *Ridley 4895*, [Malaysia], Selangor, Langat, 1 July 1889 (lectotype CAL [CAL0000031870], designated by Turner, Gard. Bull. Singapore 71 (2019) 53).

Treelet or shrub to 1 m tall. **Twigs** drying a mottled light brown with a soft, scurfy surface and scattered persistent adpressed pale hairs, fine longitudinal wrinkles may be found on older twigs. **Stipules** inconspicuous, broadly triangular, apex acute, base generally aligned to upper (apical) side of petiole base, with adpressed pale hairs on outside, sometimes dense. **Leaves:** lamina oblong-elliptic or oblong-obovate, 12–26 × 3–8.5 cm, apex acuminate, base cuneate,

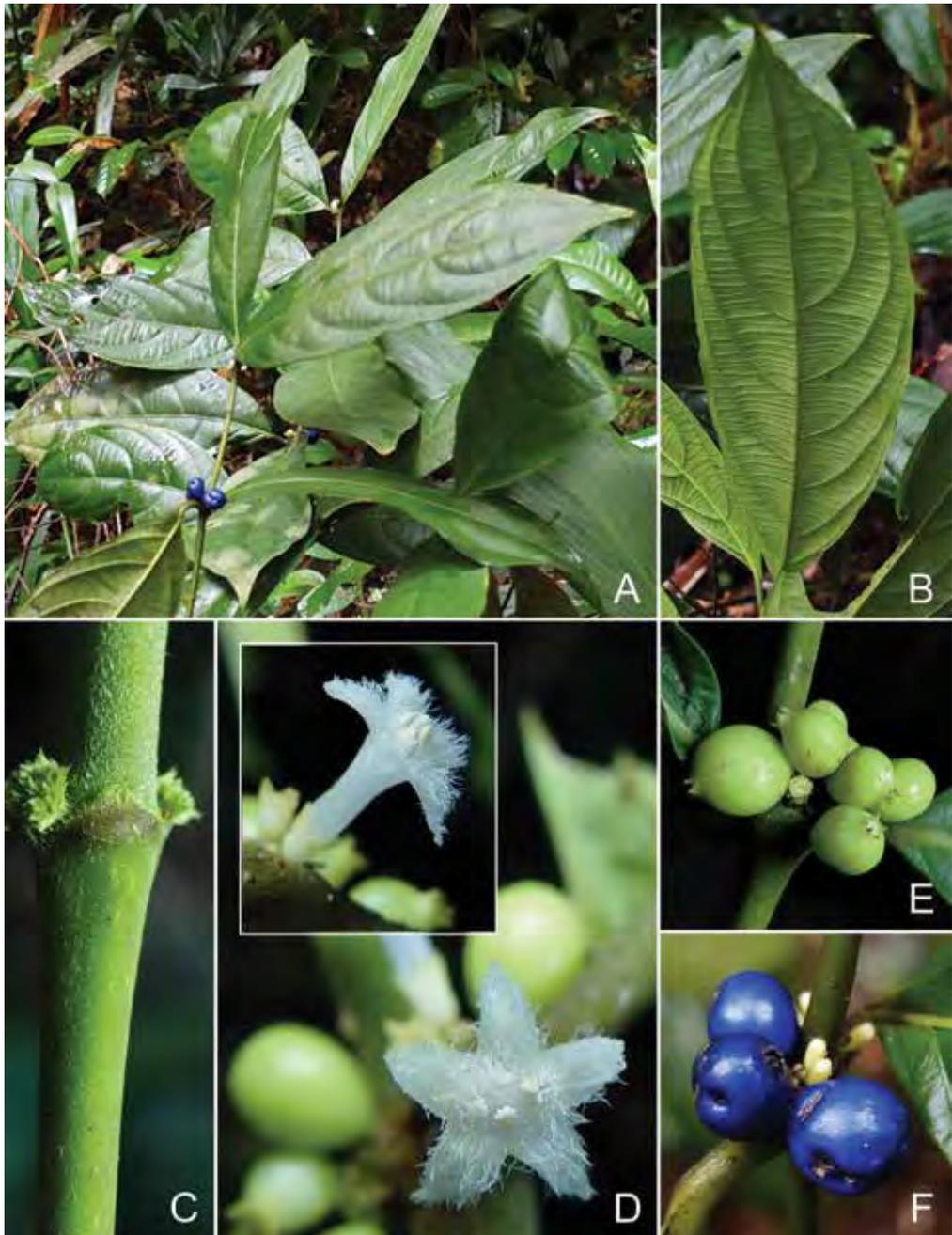


Figure 41. *Lasianthus reticulatus* Blume. **A.** Leafy branch with fruits. **B.** Lower leaf surface. **C.** Stipules. **D.** Flower, front view. Inset: Flower, side view. **E.** Young fruits. **F.** Fully ripe fruits, partly damaged by insects. (From Singapore, Butkit Timah Nature Reserve, *Leong-Škorničková et al. SING2015-103*. Photos: J. Leong-Škorničková).

chartaceous, drying brown, grey-brown or grey, generally darker and browner above, with pale nerves below, midrib above in dry leaves a distinctive pale narrow ridge or flange, secondary veins more or less flush, midrib below prominent, rounded, secondary veins raised, glabrous above except perhaps for some pale appressed hairs extending a very short way up from the top of the petiole, below although appearing glabrous to the naked eye, magnification reveals many short erect hairs along midrib and nerves, secondary veins 5–9 pairs, with those in apical half often looping distinctly, reticulations strongly and densely scalariform and more or less orthogonal to midrib; petiole 7–18 mm long, 1–2 mm wide, narrowing rather abruptly into lamina midrib, surface drying brown, minutely bumpy, scurfy with appressed pale hairs, sometimes dense. **Inflorescences** axillary, bracts inconspicuous. **Flowers** subsessile; pedicel plus hypanthium c. 1 mm long, drying brown with scattered pale brown hairs; calyx cupular, tube c. 0.5 mm long, with pale brown hairs outside, calyx lobes 5, triangular to linear, c. 1 mm long, 0.5–0.3 mm wide at base, densely pale-brown hairs outside; corolla tube c. 4 mm long, c. 0.7 mm wide, drying brown with scattered minute pale hairs outside, corolla lobes 5, triangular, c. 1.5 mm long, 0.5 mm wide at base, inside densely covered with very fine white hairs that extend up from throat of corolla. **Fruits** (possibly immature) subsessile, irregularly globose, 6–7 mm long, 5 mm diam., often drying laterally asymmetric, minutely bumpy, pale brown, glabrous except for a few pale hairs near apex; pyrenes 5, lunar, 5–6 mm long, 2 mm wide, convex face minutely bumpy.

Distribution. From southern Thailand to Sulawesi and the Philippines. In Singapore it persists on Bukit Timah (*Leong-Škorničková et al. SING2015-103*, 6 Apr 2015, SING [SING0213872]; *Ho et al. BT2017-014*, 21 Mar 2017, SING [SING0239380]) but in the past was collected from Nee Soon (*Maxwell 78-70*, 2 Apr 1978, SINU), Chan Chu Kang (*Ridley s.n.*, 1894, SING [SING0012082]) and the Singapore Botanic Gardens' Rain forest (*Ridley 4894*, 1890, BM, CAL).

Ecology. Jungle undergrowth.

Provisional conservation assessment. Globally not assessed. Listed (under *Lasianthus maingayi*) as Nationally Extinct in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 54, 175, 194) but, due to its recent rediscovery in Bukit Timah Nature Reserve (Ho et al., Gard. Bull. Singapore 70 (2018) 48), it is assessed here as Critically Endangered (CR/D).

8. *Lasianthus ridleyi* King & Gamble

(Henry Nicholas Ridley, 1855–1956, prolific botanist
and first Director of Singapore Botanic Gardens)

J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 115; Ridley, Fl. Malay Penins. 2 (1923) 154; Wong, Tree Fl. Malaya 4 (1989) 371; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 157; Turner, Gard. Bull. Singapore 45 (1993) 200; Tan et al., Gard. Bull. Singapore, Suppl. 3 (1995) 46, 47; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 432; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 54, 175, 222; Turner &

Chua, Checkl. Vasc. Pl. Sp. Bukit Timah Nat. Res. (2011) 69; Zhu et al., *Blumea* 57(1) (2012) 79. **Type:** *Ridley 3620a*, Singapore, Bukit Mandai, 1892 (holotype CAL [CAL0000031868]). **Fig. 42.**

Lasianthus reticulatus Blume var. *polydasys* Miq., Ann. Mus. Bot. Lugduno-Batavi 4, fasc. 8 (1869) 248. **Type:** *Korthals s.n.*, [Indonesia], Sumatra (lectotype L [L0305485], designated by Turner, Gard. Bull. Singapore 71 (2019) 53; possible isoelectotype L [L0305487]).

Lasianthus singaporensis King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 117; Ridley, Fl. Malay Penins. 2 (1923) 159; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 158. **Type:** *Ridley 9095*, Singapore, Bukit Timah, 19 September 1897 (lectotype SING [SING0059268], designated by Turner, Gard. Bull. Singapore 71 (2019) 53; isoelectotype CAL [CAL000031866]).

Lasianthus maingayi Hook.f. var. *hirtus* Ridl., Fl. Malay Penins. 2 (1923) 160, as '*hirta*'. **Type:** *Ridley s.n.*, [Malaysia], Negri Sembilan, Bukit Tangga, December 1920 (lectotype K [K000763939], designated by Turner, Gard. Bull. Singapore 71 (2019) 54; isoelectotype SING [SING0059761]).

Treelet or shrub to 2 m tall. **Twigs** densely pubescent with multicellular, pointed, more or less erect hairs to at least 1 mm long, glabrescent in oldest parts, drying pale golden brown. **Stipules** small, acute triangular, densely hairy. **Leaves:** lamina elliptic, more rarely ovate or obovate, (11–)16–21 × (4–)4.5–7.5 cm, base cuneate to rounded, sometimes slightly unequal, apex variably acuminate, chartaceous, drying brown, grey-brown or grey above (green in recent collections), and rather shiny with midrib sometimes a straw-coloured line; grey or grey-brown below with main nerves straw-coloured, glabrous above except for some hairs extending up from the petiole at the base, below with short hairs along nerves (a lens may be required to see them) and scattered on lower lamina surface, midrib slightly sunken to very slightly raised above in dry leaves, prominent below, secondary veins more or less flush above, raised beneath, secondary veins 5–9 pairs, arching forward with distal nerves often widely spaced (more than 2 cm apart) and ultimately curving in towards midrib, reticulations scalariform; petiole 5–12 mm long, 1–2 mm wide, densely pubescent. **Inflorescences** axillary with many linear bracts bearing multicellular hairs to c. 1 mm long. **Flowers** more or less sessile; pedicel plus hypanthium c. 1 mm long, widening distally; calyx campanulate, tube c. 0.2 mm long, lobes 4 or 5, triangular 0.6–1 mm long, 0.7–1 mm wide, with scattered hairs outside, glabrous within; corolla tube c. 4 mm long, 0.8 mm diam., glabrous outside, drying dark brown, corolla lobes 4, c. 1 mm long, 1 mm wide at base, densely covered in ribbon-like white hairs inside and in mouth of corolla tube, scattered hairs near apex outside. **Fruits** subsessile, ripening blue, irregularly ellipsoidal, 7–8 mm long, 5–6 mm diam., base more or less conical, lumpy, drying pale to dark brown; pyrenes 4, packed around a relatively large central void basally, lunar, c. 7 × 2–3 × 2–3 mm, convex face with irregular bumps.

Distribution. Peninsular Malaysia, Sumatra and Borneo. In Singapore it has been collected recently from Bukit Timah (*Ho et al. BT 2016-002*, 5 Jan 2016, SING [SING0232309]; *Chua et al. NRS 306*, 10 Apr 1992, SING [SING0037491], SINU), MacRitchie (*Gwee SING2009-592*, 15 Dec 2009, SING [SING0138168]), Mandai (*Lai LJ 267*, 1997, SING [SING0008020]) and Nee Soon (*Samsuri et al. NES 129*, 15 Jul 2003, SING [SING0045835]). Historically there are records for Bukit Panjang, Pasir Panjang, Woodlands, Kranji and the Singapore Botanic Gardens' Rain Forest.

Ecology. Forest understorey.

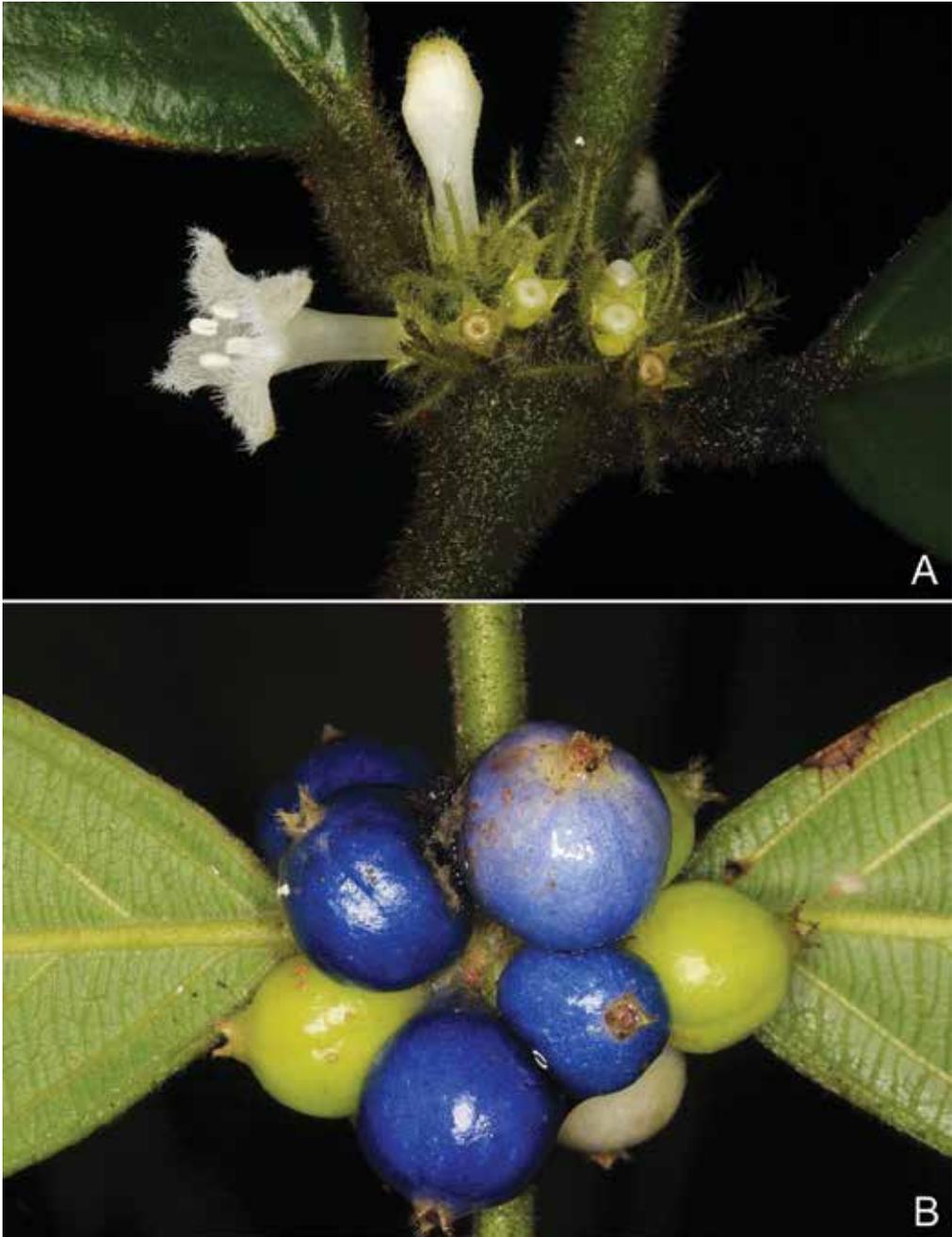


Figure 42. *Lasianthus ridleyi* King & Gamble. **A.** Flowers and young fruits. **B.** Ripe and unripe fruits. (From Singapore, Bukit Timah Nature Reserve. Photos: W.F. Ang).

Provisional conservation assessment. Globally not assessed. Listed as Vulnerable (VU/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 54, 175, 222) but assessed here as Endangered (EN/D).

9. *Lasianthus scabridus* King & Gamble

(Latin, *scabridus* = rough, rugged, scabby; referring to the leaf surface)

J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 111; Ridley, Fl. Malay Penins. 2 (1923) 152; Wong, Tree Fl. Malaya 4 (1989) 370; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 157; Turner, Gard. Bull. Singapore 45 (1993) 200; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 433; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 54, 175, 207. **Synonym:** *Lasianthus griffithii* Wight var. *scabridus* (King & Gamble) H.Zhu, Blumea 57(1) (2012) 46. **Type:** Ridley 6463, [Malaysia], Johor, Tanjong Bunga, 1894 (lectotype SING [SING0059269], designated by Wong, Arbor. Rubiac. Malaya (1988) 113; isolectotype K [K000763943]).

Treelet. **Twigs** glabrous, drying brown to black, rather shiny and finely longitudinally striate. **Stipules** broadly ovate, glabrous or with some hairs on the margin near apex. **Leaves:** lamina oblong-elliptic, 18–23 × 5–6.5 cm, apex acuminate, base cuneate, often slightly unequal, chartaceous, drying brown or grey-brown above, brown below, hirsute on nerves and lamina surface above and below, hairs multicellular, to 2 mm long or more, under high magnification tapeworm-like basally and with a long fine point, generally giving scabrid feel to lamina which is usually bullate between nerves, midrib slightly raised above, at least as a central ridge, prominent below, secondary veins immersed to slightly sunken above (accentuated by bullate lamina), raised beneath, as are higher orders of venation, secondary veins 11–12 pairs, arching forward and looping obscurely, reticulations clear, particularly from below, subscalariform; petiole 15–17 mm long, 1 mm wide, drying blackish with long hairs, with a short ridge at base connecting the base of the stipules. **Inflorescences** axillary, largely hidden by broad stipules, containing many linear-lanceolate bracts 5–6 mm long, c. 0.5 mm wide, densely covered on margins and one face with ribbon-like, brown, multicellular hairs, c. 1 mm long. **Flowers** more or less sessile, difficult to distinguish pedicel, hypanthium and calyx; calyx tubular, 1–1.5 mm long, glabrous outside, lobes 5, triangular, 0.7–1 mm long, 0.5 mm wide at base, dense fringe of ribbon-like multicellular hairs along margin; corolla tube 5–7 mm long at anthesis, glabrous outside, drying dark brown, corolla lobes 5, triangular 1–1.5 mm long, c. 1 mm wide, with scattered multicellular hairs near apex outside, tip curved in, lobes spreading at anthesis, mouth of corolla filled with dense pale ribbon-like hairs with pointed apex. **Fruits** sessile, top-shaped, pentagonal in outline, c. 3 mm long, 4 mm diam., pyrenes c. 10.

Distribution. Peninsular Malaysia, Sumatra and Borneo. In Singapore only known from one old collection from Jurong Road (*Burkill SFN 713*, 27 Jan 1915, BM, K, SING [SING0012095]).

Ecology. Forest understorey.

Provisional conservation assessment. Globally not assessed. Listed as Critically Endangered (CR/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 54, 175, 207) but, with no collections since 1915, it must be presumed Nationally Extinct.

Taxonomy. Zhu et al. (Blumea 57(1) (2012) 46) reduced *Lasianthus scabridus* to a variety of *L. griffithii*. The affinity of the two taxa is clear, but *Lasianthus scabridus* is very consistent morphologically and quite readily distinguished from *L. griffithii* by a number of characters (refer to key). I therefore prefer to maintain recognition at species rank.

10. *Lasianthus stipularis* Blume

(Latin, *stipul-* = blade, *-aris* = pertaining to, resembling; with stipules)

Bijdr. Fl. Ned. Ind., pt 16 (1826–1827) 997; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 112; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 99; Ridley, Fl. Malay Penins. 2 (1923) 152; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1342; Wong, Tree Fl. Malaya 4 (1989) 368; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 157; Turner, Gard. Bull. Singapore 45 (1993) 200; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 433; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 54, 175, 194; Turner & Chua, Checkl. Vasc. Pl. Sp. Bukit Timah Nat. Res. (2011) 69; Zhu et al., Blumea 57(1) (2012) 86. **Synonyms:** *Mephitidia stipularis* (Blume) DC., Prodr. 4 (1830) 453. – *Nonatelia stipularis* (Blume) Kuntze, Revis. Gen. Pl. 1 (1891) 291. **Type:** *Blume* 674, [Indonesia], Java, Salak (lectotype L [L0000708], designated by Turner, Gard. Bull. Singapore 71 (2019) 54; isolectotype L [L0000709]).

Lasianthus stipularis Blume var. *novaguineensis* Valetton, Nova Guinea 8 (1911) 498. **Type:** *Versteeg* 1228, [Indonesia], New Guinea, fluv. Noordrivier (lectotype L [L0305625, L0305626, L0305627 – i.e. a single specimen over three sheets], designated by Turner, Gard. Bull. Singapore 71 (2019) 54; isolectotypes K [K000777085, K000777084], U [U0247139]).

Shrub to 2 m tall. **Twigs** glabrous, drying dark brown, often laterally compressed and grooved when young, finely longitudinally striate. **Stipules** broadly ovate, glabrous or with a ciliate upper margin, drying dark brown, with shallow rim connecting the pair on each side running around the base of the petiole. **Leaves:** lamina typically obovate or oblong-obovate, (10–)14.5–19 × 3.5–5.5 cm more rarely elliptic, base cuneate, apex with a short, sharp acumen, glabrous except for a (sparse) fringe of hairs on the margin of the leaf apex generally only visible with a lens, membranous to chartaceous, drying grey, grey-brown or brown, upper lamina with a distinctive irregular honeycomb or snakeskin patterning visible under magnification (×10 or higher) particularly near major veins, midrib raised above in dry leaves, at least as a central ridge, prominent below, secondary veins more or less flush above, slightly raised below, secondary veins (8–)10–13 pairs, arching forward and looping obscurely within margin, reticulations visible, particularly from below, subscalariform; petiole 9–19 mm long, 1 mm wide, glabrous, drying dark brown. **Inflorescences** axillary, almost entirely hidden by large stipules, bracts lanceolate, densely brown hairy on all surfaces. **Flowers** pedicellate; calyx with 4 lobes; corolla tube c. 2 mm long, corolla lobes 4, c. 1 mm long. **Fruits** subsessile, c. 5–6 mm diam., with 4 or 8 longitudinal ridges, topped by persistent calyx; pyrenes 4, drying

straw-coloured, lunar but broader basally, c. 5 mm long, 2 mm wide, flat faces smooth, convex face sculpted with two distinct ridges along margins.

Distribution. Myanmar and Thailand to New Guinea. In Singapore apparently not collected since 1906 (Bukit Timah, *Ridley 12548*, 1906, SING [SING0012098]; Bukit Panjang, *Ridley 12541*, 1906, SING [SING0012101]), with the earlier collections all from Bukit Timah.

Ecology. Forest understorey.

Provisional conservation assessment. Globally not assessed. In Singapore presumed Nationally Extinct.

11. *Lasianthus venosus* Blume

(Latin, *venosus* = conspicuously veined; referring to the leaves)

Bijdr. Fl. Ned. Ind., pt 16 (1826–1827) 990; Zhu et al., *Blumea* 57(1) (2012) 91. **Synonyms:** *Mephitidia venosa* (Blume) DC., *Prodr.* 4 (1830) 453. – *Nonatelia venosa* (Blume) Kuntze, *Revis. Gen. Pl.* 1 (1891) 291. **Type:** *Blume* 887, [Indonesia], Java (lectotype L [L0000711], designated by Turner, *Gard. Bull. Singapore* 71 (2019) 54).

Lasianthus pterospermus Wight, *Calcutta J. Nat. Hist.* 6 (1846) 510; King & Gamble, *J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist.* 73(3) (1904) 125; Ridley, *J. Straits Branch Roy. Asiat. Soc.* 33 (1900) 99; Ridley, *Fl. Malay Penins.* 2 (1923) 160; Wong, *Tree Fl. Malaya* 4 (1989) 368; Turner, *Gard. Bull. Singapore* 45 (1993) 200; Turner, *Gard. Bull. Singapore* 47 (1997 [‘1995’]) 432; Tan et al. in Davison et al. (ed.), *Singapore Red Data Book*, ed. 2 (2008) 240; Chong et al., *Checkl. Vasc. Pl. Fl. Singapore* (2009) 54, 175, 194. **Synonyms:** *Mephitidia pterosperma* (Wight) Walp., *Ann. Bot. Syst.* 2 (1852) 762. – *Nonatelia pterosperma* (Wight) Kuntze, *Revis. Gen. Pl.* 1 (1891) 291. **Type:** *Griffith s.n.*, [Malaysia], Malacca (holotype K [K000763920], fide Noltie, *Bot. Robert Wight* (2005) 416).

Lasianthus singalensis Miq., *Ann. Mus. Bot. Lugduno-Batavi* 4, fasc. 8 (1869) 247. **Type:** *Korthals s.n.*, [Indonesia], Sumatra (lectotype L [L0057495], designated by Turner, *Gard. Bull. Singapore* 71 (2019) 55; possible isotype L [L0057496]).

Shrub. **Twigs** drying rather dull brown, glabrous to naked eye but magnification generally reveals persistent scattered short adpressed pale hairs. **Stipules** triangular with adpressed brownish hairs outside. **Leaves:** lamina oblong-ovate, oblong-elliptic or oblong-obovate, 10–19.5 × 3.5–5.5 cm, apex acuminate, base obtuse to cuneate, membranous to chartaceous, drying brown, grey-brown or grey, generally paler below, midrib above slightly raised in dry leaves, secondary veins flush or very slightly raised, midrib prominent below, secondary veins raised, generally glabrous in appearance but under magnification adpressed hairs may be seen near lamina base and along midrib margins above, and on midrib and major nerves below and scattered on lower lamina surface, secondary veins 8–11 pairs, arching forward, reticulations predominantly scalariform; petiole 4–6 mm long, 1 mm wide, with inconspicuous short adpressed pale hairs, often with a slight raised rim around base. **Inflorescences** axillary, bracts inconspicuous. **Flowers** shortly pedicellate, pedicel plus hypanthium c. 1.5 mm; calyx tube cupuliform, 2–3 mm long, widening distally, drying dark brown with scattered pale pointed

hairs, calyx lobes 5, acute triangular, 2–3 mm long, c. 1 mm wide at base with pointed pale hairs outside, densest near apex, scattered hairs inside; corolla tube c. 5 mm long, drying dark brown, more or less glabrous, corolla lobes 5, triangular, c. 3 mm long, 1 mm wide at base, apex inflexed, a few very short pale hairs outside, inside with very short pale hairs along margins and many flattened, kinked pale multicellular hairs extending up from throat of corolla tube. **Fruits** sessile, 9–10 mm long, 8–9 mm across, drying pyriform with 5 distinct longitudinal ridges from base to apex with intervening ridges in the upper half, drying dark brown to black with brownish hairs apically and on persistent calyx; pyrenes 5, 8–9 mm long, c. 3 mm wide, like a heart-shaped piece of card folded centrally lengthwise with a seed placed in the fold at the upper end, the flat walls smooth and drying golden brown.

Distribution. Peninsular Malaysia, Sumatra and Borneo. The only record for Singapore is an old collection from Chan Chu Kang (*Mat 6711*, 1894, SING [SING0012092]).

Ecology. Forest understorey.

Provisional conservation assessment. Globally not assessed. In Singapore presumed Nationally Extinct.

25. LECANANTHUS Jack

(Greek, *lecan-* = a wine-bowl, *-anthus* = flower; referring to the corolla shape)

Malayan Misc. 2(7) (1822) 83; Wallich in Roxburgh, Fl. Ind. 2 (1824) 319; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’]) 179; Ridley, Fl. Malay Penins. 2 (1923) 57; Henderson, Malayan Nat. J. 6(1) (1950) 210; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1347; Wong, Arbor. Rubiac. Malaya (1988) 11 (in clavi); Wong, Tree Fl. Malaya 4 (1989) 328 (in clavi); Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 157; Puff et al., Blumea 43 (1998) 337. **Type:** *Lecananthus erubescens* Jack.

Epiphytic shrubs or woody climbers. Young **stems** with 2 longitudinal ribs or wings along the interpetiolar medians of internodes, and frequently also 2 additional longitudinal ribs or wings just below the petioles. **Stipules** ovate, free or basally fused. **Leaves** in (sub-)decussate pairs. **Inflorescences** heads of several to many flowers, terminal and sometimes pushed to a lateral position by a developing axillary shoot, subtended by a dish- to cup-shaped involucre. **Flowers** bisexual, heterodistylous; calyx 2-lobed; corolla tubular to slightly infundibular, with 5(–6) valvate lobes; stamens 5(–6), anthers included in long-styled flowers, exerted in short-styled flowers; style slender; stigma linear, 2-lobed, included in short-styled flowers, exerted in long-styled flowers; ovary 2-locular; ovules many in each ovary locule, attached to the septum; disk annular and conspicuous. **Fruits** berry-like, ovoid to subglobose, in heads. **Seeds** many, suborbicular to polygonal, laterally compressed.

Distribution. A genus of 3 species in the Malay Peninsula (including Peninsular Thailand, Peninsular Malaysia and Singapore), Sumatra and Borneo. In Singapore 1 native species.

Ecology. Lowlands, especially swampy sites.

Lecananthus erubescens Jack

(Latin, *erubescens* = blushing; referring to the occasionally pink-tinged white corolla)

Malayan Misc. 2(7) (1822) 83; Wallich in Roxburgh, Fl. Ind. 2 (1824) 319; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 94; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 ['1903']) 179; Ridley, Fl. Malay Penins. 2 (1923) 57; Henderson, Malayan Nat. J. 6(1) (1950) 210; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1347; Wong, Arbor. Rubiac. Malaya (1988) 11 (in clavi); Wong, Tree Fl. Malaya 4 (1989) 328; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 157; Turner, Gard. Bull. Singapore 45 (1993) 200; Turner, Gard. Bull. Singapore 47 (1997 ['1995']) 434; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 54, 175, 194; Puff et al., Blumea 43 (1998) 339; Lim et al., Gard. Bull. Singapore 70 (2018) 79, fig. 7. **Type:** *Jack s.n.*, [Indonesia], Sumatra (neotype U [U1571727], designated here).

Slender woody climber or epiphyte, stems to several meters long. Young **stem** internodes with 2–4 longitudinal ribs or narrow wings. **Stipules** ovate to broad-triangular, basally fused, 8–15 × 3–4 mm, glabrous to hairy outside, caducous. **Leaves:** lamina elliptic, lanceolate or broad-ovate, 6–15.5 × (2.3–)4–6.5 cm, apex acuminate to cuspidate, base cuneate to gradually tapering, membranaceous to chartaceous, mostly glabrous but sometimes with short straight and curly hairs on the lower leaf surface along midrib, veins and on the lamina, secondary veins 7–10 pairs, flat and inconspicuous on the upper leaf surface, prominent on lower leaf surface; petioles 5–20 mm long. **Inflorescences** subglobose, ovoid or ellipsoid heads of several to many flowers, terminal and sometimes pseudo-axillary by development of an adjacent axillary shoot, 1–3 × 1–2.2 cm, subtended by a dish-shaped glabrous or hairy involucre; peduncle 3–10 mm long, typically recurved, minutely hairy. **Flowers** heterodistylous; calyx greenish to pale pink or purple, tubular and flaring out into 2 unequal lobes; corolla white to creamy, pink or lilac, tubular to lightly infundibular, tube 4–5 mm long, lobes 5, lanceolate, 3–4 × 1–2 mm, apices hooded; stamens 5, anthers linear, c. 2 mm long, filaments to 2 mm long in short-styled flowers, c. 1 mm long in long-styled flowers; style with long ascending hairs, c. 2 mm long in short-styled flowers, 6 mm long in long-styled flowers; stigma c. 1 mm long in short-styled flowers, c. 0.5 mm long in long-styled flowers; ovary 2–3 mm diam., glabrous. **Fruits** ovoid to subglobose, 4–5 × 3–4 mm. **Seeds** less than 1 mm long.

Distribution. As for the genus. In Singapore recorded from Sungei Jurong (*Ridley s.n.*, 1894, SING [SING0012111]), Choa Chu Kang (*Ridley 3814*, 1890, SING [SING0012110]), Mandai Road (*Corner s.n.*, Jul 1930, SING [SING0012114]) and Nee Soon (*Leong et al. SING2015-276*, 28 Oct 2015, SING [SING0225274]).

Ecology. Freshwater swamp forest.

Provisional conservation assessment. Globally not assessed. Listed as Nationally Extinct in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 54, 175, 194) but, due to its recent rediscovery in Nee Soon (Lim et al., Gard. Bull. Singapore 70 (2018) 79), it is assessed here as Critically Endangered (CR/D).

Vernacular name. *Achar achar* (Malay).

Taxonomy. Although Jack stated that his taxon was recorded from Bencoolen in Sumatra, there are no specimens that might be original material at the E, G and K herbaria; indeed, nearly all of his material was lost in a fire (Merrill, J. Arnold Arbor. 33 (1952) 199). The neotype sheet designated here is the only one found of Jack's material of this species, although it is a mere leafy branch.

26. MITRACARPUS Zucc.

(Greek *mitra*- = a cap, *-carpus* = fruit; the top part of the fruit dehisces like a cap)

in Schult. & Schult.f., Mant. 3 (1827) 210; Ridsdale, Revis. Handb. Fl. Ceylon 12 (1998) 329; Puff et al., Rubiac. Thailand (2005) 196, pl. 3.4.11. **Type:** *Mitracarpus scaber* Zucc.

Herbs, annual or perennial. **Stipules** persistent, interpetiolar and fused to leaf bases, fimbriate. **Leaves** opposite, subsessile. **Inflorescences** terminal and axillary, many-flowered sessile globose heads. **Flowers** 4-merous, bisexual, sessile; calyx lobes usually unequal in pairs; corolla white, inside glabrous or hairs at throat; lobes valvate; stamens 4, inserted in corolla throat, included or exerted; ovary 2-locular, ovules 1 in each locule, placenta axile; style included or exerted, stigmas 2, linear. **Fruits** circumscissile capsules. **Seeds** 2, ventral surface with an X-shaped groove.

Distribution. About 30 species widespread in tropical and subtropical North, Central and South America, with one species widely naturalised in tropical Africa, Asia and Oceania. In Singapore 1 naturalised species.

Mitracarpus hirtus (L.) DC.

(Latin, *hirtus* = hairy; almost all parts have hairs)

Prodr. 4 (1830) 572; Ridsdale, Revis. Handb. Fl. Ceylon 12 (1998) 330; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 434; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 61, 175, 267. **Basionym:** *Spermacoce hirta* L., Sp. Pl., ed. 2, 1 (1762) 148. **Type:** *Browne s.n.*, Jamaica (lectotype LINN [Herb. Linn. no. 125.8], designated by Verdcourt, Kew Bull. 30 (1975) 318). **Fig. 43.**

Annual herb to 80 cm tall, stems hairy to various extents. **Stipule** sheath to 3 mm, setae longer. **Leaves:** lamina elliptic, to 50 × 20 mm, base cuneate, apex acute; slightly hairy on both surfaces, denser on lower surface; subsessile. **Inflorescences** to 20 mm diam. **Flowers** numerous, subtended by linear bracteoles; calyx with 2 lobes to 2.5 mm long, the others 2–1.5 mm long; corolla white, glabrous outside, tube to 2 mm long, with a band of hairs inside, lobes to 1 mm long; stamens usually slightly exerted from corolla tube, anthers tiny; style to 1.5 mm long, stigmas linear, to 0.5 mm long. **Capsules** subglobose, c. 1 mm diam., sparsely hairy. **Seeds** dark brown, c. 0.8 mm long.

Distribution. Native to the Neotropics; naturalised in tropical Africa, Asia and Oceania. In Singapore recorded from Telok Paku (*Sinclair 10768*, 27 Dec 1964, SING [SING0228908])

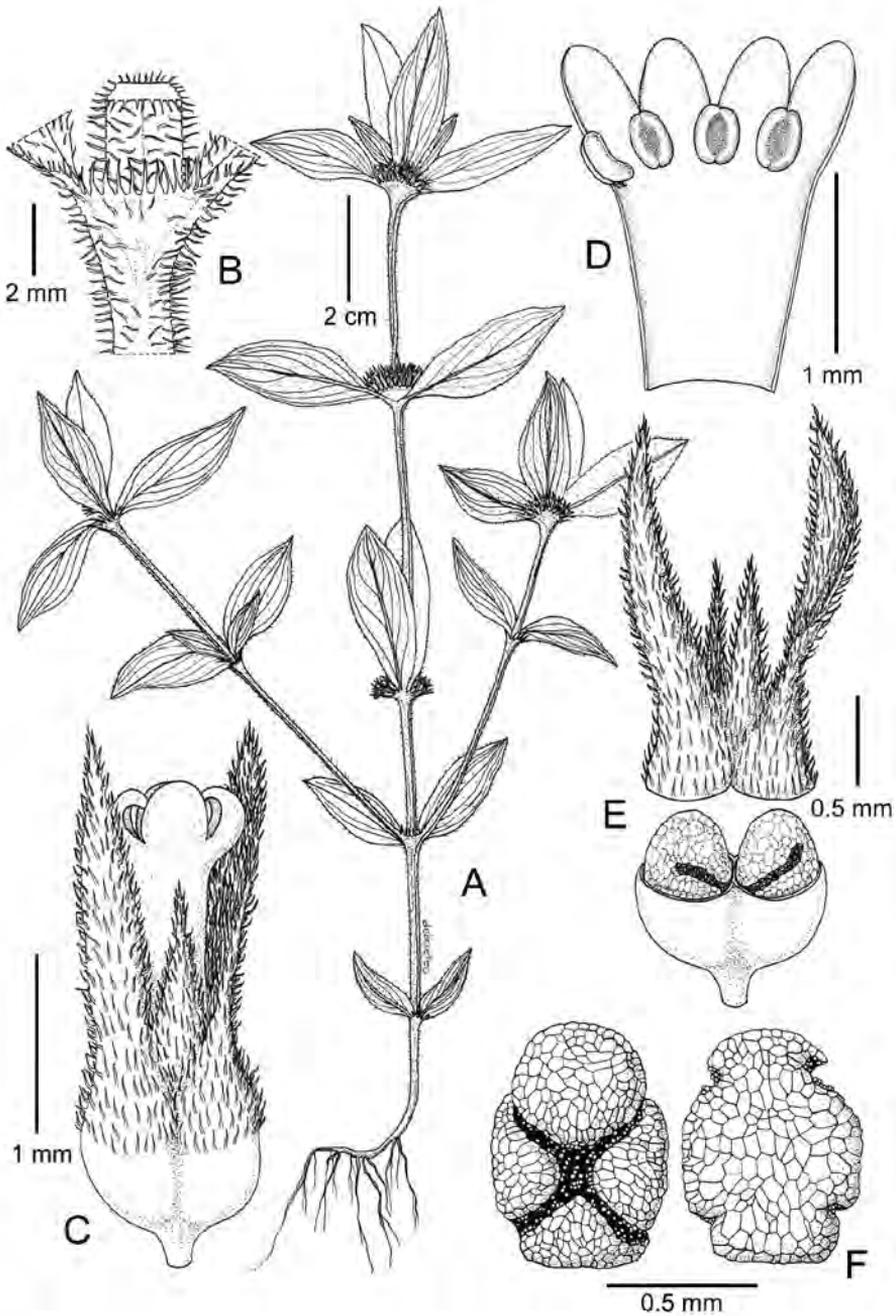


Figure 43. *Mitracarpus hirtus* (L.) DC. **A.** Habit. **B.** Stipule showing fimbriate margin. **C.** Flower showing calyx with two longer and two shorter lobes (one hidden). **D.** Inner side of cut-open corolla. **E.** Capsule showing circumscissile dehiscence and seeds. **F.** Seed, ventral (left, with X-shaped groove) and dorsal views. (From Singapore, A, B, from Teluk Paku Road, *Sinclair 10768*; C–F from Kallang Riverside Park, *Chen LCMJ 2018-055*. Drawn by D. Teo).

and Bidadari Cemetery (*Turner et al. BC5*, 3 Apr 2002, SING [SING0044888]; *Gwee et al. BC19*, 4 Jun 2003, SING [SING0044896]).

Ecology. Open spaces, in grassland and on sandy soils.

Provisional conservation assessment. Globally Least Concern (LC). Not native in Singapore.

Notes. There is some debate regarding whether this taxon should be called *Mitracarpus hirtus* or *M. villosus* (Sw.) DC. (see Nicholson, *Taxon* 26 (1977) 569 for discussion) but most modern authors use *M. hirtus*. Easily separated from similar looking *Spermacoce* species by its circumscissile capsule.

There are many synonyms listed for this species in online databases.

27. MORINDA L.

(Latin, *morus* = a mulberry, *indicus* = of India or the Indies;
likeness of the fruit-heads to mulberries)
Mengkudu (Malay)

Sp. Pl. 1 (1753) 176; King & Gamble, *J. Asiat. Soc. Bengal*, Pt. 2, *Nat. Hist.* 73(3) (1904) 86, p.p.; Ridley, *Fl. Malay Penins.* 2 (1923) 117, p.p.; Burkill, *Dict. Econ. Prod. Malay Penins.*, ed. 2, 2 (1966) 1515, p.p.; Wong, *Malayan Nat. J.* 38 (1984) 89, p.p.; Corner, *Wayside Trees Malaya*, ed. 3, 2 (1988) 640; Wong, *Arbor. Rubiac. Malaya* (1988) 129, p.p.; Wong, *Tree Fl. Malaya* 4 (1989) 376, p.p.; Keng, *Concise Fl. Singapore*, vol. 1, *Gymn. Dicot.* (1990) 157, p.p.; Puff et al., *Rubiaceae Thailand* (2005) 112, pl. 3.1.34, p.p.; Razafimandimbison & Bremer, *Adansonia*, sér. 3, 33 (2011) 297; Kesonbuaa & Chantaranonthai, *Science Asia* 39 (2013) 331. **Type:** *Morinda royoc* L., lectotype designated by Hitchcock, *Nom. Prop. Brit. Bot.* (1929) 132.

Sarcopygme Setch. & Christoph., *Occas. Pap. Bernice Pauahi Bishop Mus.* 11(5) (1935) 4. **Type:** *Sarcopygme pacifica* (Reinecke) Setch. & Christoph. (= *Morinda pacifica* (Reinecke) Razafim. & B. Bremer).

Small trees or shrubs. Branches each consisting of a sympodial series of 2-node segments (modules), each segment with the apex flowering or not. **Stipules** triangular to obovate. **Leaves** decussate in arrangement, at the proximal node of each branch segment fully developed and in a pair, those at the distal node of each branch segment fully developed on the lower side only and not developed on the upper side. **Inflorescences** stalked heads of flowers with fused calyx tubes, typically solitary, terminating the 2-node branch segments, pushed to the upper side of the branch by development of the next segment and therefore pseudo-lateral, appearing leaf-opposed owing to development of leaves on the lower side of the branch only. **Flowers** bisexual, 4- or 5-merous; calyx tube short, often subtruncate; corolla salver-shaped, corolla tube hairy or not at the throat; corolla lobes 4 or 5; stamens inserted in the throat, anthers dorsifixed, partly exserted; stigma bifid; ovary 2- or 4-locular; ovule placentation sub-basal, one per locule. **Infructescences** fleshy heads of fused fruits forming a syncarp. **Seeds** obovoid or kidney-shaped.

Distribution. Worldwide c. 40 species, found throughout the tropical regions. In Singapore 2 native species.

Taxonomy. Traditionally, a broad circumscription of this genus was accepted, including arborescent and climbing forms characterised by capitate inflorescences and syncarpous fruits. However, recent molecular phylogenetic studies by Razafimandimbison et al. (Molec. Phylogenet. Evol. 52 (2009) 879–886) have demonstrated that such a delimitation makes the genus highly paraphyletic. Razafimandimbison & Bremer (Adansonia, sér. 3, 33 (2011) 283–309) established a narrower circumscription of *Morinda*, rendering it monophyletic. *Morinda* now mainly includes arborescent taxa (including *Morinda citrifolia* L. and *M. elliptica* (Hook.f.) Ridl. below), and most taxa with lianescent or climbing habit have been transferred to *Gynochthodes* Blume.

Notes. The branch architecture and leaf development in *Morinda* is interesting and characteristic of the genus. Each branch is composed of a series of progressively higher-order segments and thus sympodial in structure. Each branch segment consists of a proximal node bearing a pair of fully developed leaves and a distal node bearing a single fully developed leaf on the lower side of the branch only. The inflorescence then appears leaf-opposed as the flowering head is pushed to the upper side of the branch by the development of the new segment in the axil of the fully developed leaf on the lower side of the branch (Fig. 44).

Key to *Morinda* species

1. Leaves broadly elliptic to obovate, tertiary veins on the lower leaf surface indistinct and usually not conspicuously raised; fruiting heads generally larger, about 21–35 mm long, mostly ellipsoid, ripening yellowish to whitish **1. *M. citrifolia***
 Leaves narrowly to broadly elliptic, tertiary veins on the lower leaf surface distinct and usually prominent; fruiting heads generally smaller, about 16–20 mm long, mostly subglobose to ovoid, ripening black **2. *M. elliptica***

1. *Morinda citrifolia* L.

(Latin, *citri*- = citrus, *-folia* = leaves; with leaves resembling those of the citrus)

Sp. Pl. 1 (1753) 176, nom. cons.; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 97; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 86; Ridley, Fl. Malay Penins. 2 (1923) 117; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1518; Wong, Malayan Nat. J. 38 (1984) 94; Corner, Wayside Trees Malaya, ed. 3, 2 (1988) 640; Wong, Arbor. Rubiac. Malaya (1988) 131; Wong, Tree Fl. Malaya 4 (1989) 377; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 157, fig. 125.8; Turner, Gard. Bull. Singapore 45 (1993) 200; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 434; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 62, 175, 195; Razafimandimbison et al., Taxon 60 (2011) 607. **Type:** *Tirvengadam* 624, Sri Lanka, Southern Province, Galle District, Galle Road, 34/7 Magonna, 5 October 1974 (holotype K [K000265592], conserved type designated by Razafimandimbison et al., Taxon 60 (2011) 607; isotypes L [L2931993], PDA). **Fig. 45A.**

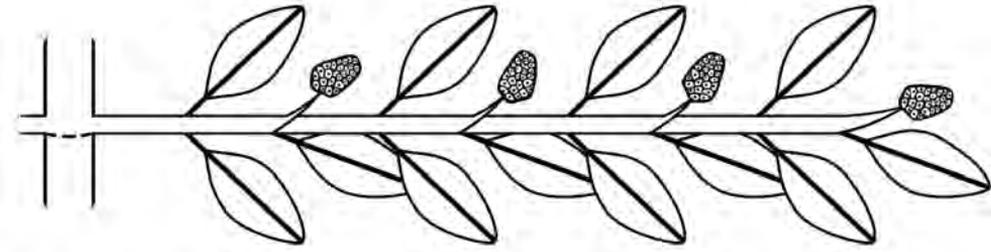


Figure 44. Schematic of *Morinda* L. branch architecture and leaf development: each branch is composed of a sympodial series of 2-node segments or modules, each module consisting of leaves that are decussate in arrangement and fully developed at proximal nodes but only developed on the lower side at the distal nodes. The inflorescence terminates such a segment but is pushed aside and upwards by development of the next segment, and hence appears lateral in position. (Drawn by W.W. Seah).

Morinda zollingeriana Miq., Fl. Ned. Ind. 2, fasc. 2 (1857) 243. **Type:** *Horsfield s.n.*, Indonesia, Java (lectotype K [K000763780], designated here).

Morinda tomentosa auct. non B. Heyne: Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240.

Small tree, to about 9 m tall. **Bark** grey-brown, shallowly fissured in mature specimens. **Stipules** usually obtuse, sometimes triangular, shortly jointed at the edges. **Leaves:** lamina broadly elliptic to obovate, (7.5–)12–25.5 × (2.6–)3.7–11(–14.8) cm, apex acute to obtuse, base obtuse, chartaceous to subcoriaceous, glabrous on both surfaces, midrib slightly sunken above, raised below, secondary veins 6–9 pairs, usually with densely hairy domatia in their axils on the lower leaf surface, tertiary veins reticulate, indistinct, usually not conspicuously raised below; petioles (4–)6–25 mm long. **Flowering heads** solitary, 7–12 mm across, peduncles 15–24 mm long. **Flowers** white; corolla tube 10–12 mm long, glabrous outside, densely hairy at the throat inside; corolla lobes 4 or 5, each 5–6 mm long. **Fruiting heads** ellipsoid, 21–35 mm long, ripening yellowish to whitish.

Distribution. India to continental Southeast Asia and Malesia. In Singapore it has been recorded in Changi (*Ridley s.n.*, 1890, SING [SING0230754]), the Central Catchment (*Turner et al. NRS 669*, 30 Apr 1992, SING [SING0037452]), Jurong (*Whitmore 17*, 25 Jan 1957, SING [SING0230748]), Kranji (*Ridley 5667*, 1893, SING [SING0230747]) as well as on some offshore islands like Pulau Jong (*Holtum s.n.*, 11 Jun 1924, SING [SING0230753]) and Pulau Biola (*Burkill & Kiah HMB. 455*, 29 Mar 1956, SING [SING0230751]). It is also present on Pulau Ubin, Pulau Subar Darat, Pulau Subar Laut, Pulau Tekukor as well as St John's Island and has been recently collected from more urbanised areas such as Coney Island, modern-day Kranji and Sembawang.

Ecology. In Singapore found in coastal areas, offshore islands, swampy areas, as well as lowland secondary forest. In the Malay Peninsula, it is common on seashores and in the coastal lowlands, as well as cultivated in villages and gardens.

Provisional conservation assessment. Globally Least Concern (LC). Erroneously listed as Nationally Extinct in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240, under *Morinda tomentosa*) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 62, 175, 195), presumably because the 1992 collection from the Central Catchment Nature Reserve was not included in their assessments. Beyond that collection, which was the last to have reproductive material, there are also leafy branch vouchers from elsewhere including Pulau Ubin. Given the frequent spontaneous occurrences of this species throughout Southeast Asia, including at disturbed sites, but considering that coastal habitats in Singapore have been much modified, the occurrence of the species in Singapore should be monitored. It is assessed here as Endangered (EN/D) in Singapore.

Uses. The species, known commercially as noni or Indian mulberry, is of great economic importance as it is not only a significant source of traditional medicine across the tropics but also a source of food (fruits), dyes (bark) and firewood.

Taxonomy. The name of this taxon has been conserved with the establishment of a conserved type. Razafimandimbison & Bremer (*Adansonia*, sér. 3, 33 (2011) 308) provide a full list of synonyms although here we list only those relevant to our region typified by material that matches the Singapore taxon well.

Notes. The description above applies to the species as found in Singapore. There is some variation, especially in the size of the flowering and fruiting heads, elsewhere in its range.

2. *Morinda elliptica* (Hook.f.) Ridl.

(Latin, *ellipticus* = elliptic; referring to the leaf shape)

J. Straits Branch Roy. Asiat. Soc. 79 (1918) 86; Ridley, Fl. Malay Penins. 2 (1923) 118; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1519; Wong, Malayan Nat. J. 38 (1984) 94; Corner, Wayside Trees Malaya, ed. 3, 2 (1988) 640; Wong, Arbor. Rubiac. Malaya (1988) 132; Wong, Tree Fl. Malaya 4 (1989) 377; Turner, Gard. Bull. Singapore 47 (1997 [¹⁹⁹⁵]) 435. **Basionym:** *Morinda citrifolia* L. var. *elliptica* Hook.f., Fl. Brit. India 3, fasc. 7 (1880) 156; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 87. **Type:** *Gomez s.n.* [EIC 8434], [Myanmar], Tavoy (lectotype K-W [K001125507], designated here). **Fig. 45B.**

Morinda tinctoria auct. non Noronha: Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 97.

Small tree, to about 16 m tall. **Bark** grey-brown, regularly and narrowly fissured. **Stipules** broadly triangular. **Leaves:** lamina narrowly to broadly elliptic, 9.2–19 × 3.8–7.6 cm, apex acute to acuminate, base cuneate, chartaceous to subcoriaceous, glabrous on both surfaces, midrib sunken above, raised below, secondary veins 6–10(–11) pairs, sometimes with densely hairy domatia in their axils on the lower leaf surface, tertiary veins reticulate, distinct, prominent below; petioles 6–20 mm. **Flowering heads** solitary, 5–11 mm across, peduncles 20–55 mm long. **Flowers** white; corolla tube 5–9 mm long, glabrous outside and inside; corolla lobes 4 or 5, each 6 mm long, completely white; heterostylous. **Fruiting heads** subglobose to ovoid, 16–20 mm long, ripening black.



Figure 45. *Morinda citrifolia* L. **A.** Fruiting branch. Inset: Flowering and fruiting head with one open flower. *Morinda elliptica* (Hook.f.) Ridl. **B.** Flowering leafy branch. Inset: Flower. (From Singapore, A exact locality uncertain; B from Chestnut Avenue. Photos: A (incl. inset), B (inset), X.Y. Ng; B (main photo), W.W. Seah).

Distribution. Myanmar, Thailand and Peninsular Malaysia. In Singapore now only known from urban areas such as the Bidadari Cemetery (*Gwee et al. BC23*, 4 Jun 2003, SING [SING0044900]; *Turner et al. BC7*, 03 Apr 2002, SING [SING0044889]), Mount Vernon Cemetery (*Tang et al. 1314*, 14 Sep 1999, SING [SING0037306]) and Pulau Ubin (*Lai SING2010-094*, 6 Jun 2015, SING [SING0222188]). It was previously recorded from Geylang (*Teruya 1307*, 1930, SING [SING0230750]) and several unspecified localities (*Wallich s.n.* [EIC 8420D], 1822, K [K000763809]; *Cantley s.n.*, SING [SING0235509]).

Ecology. Open sites and lowland secondary forest.

Provisional conservation assessment. Globally Least Concern (LC). Not listed by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2, 2008) nor Chong et al. (Checkl. Vasc. Pl. Fl. Singapore, 2009) but, considering that most of the recent collections are from urban areas that are prone to disturbance and rapid change, *Morinda elliptica* is assessed here as Vulnerable (VU/D) in Singapore.

28. MUSSAENDA L.

(from Sinhala name *mussenda*)

Balik adap (Malay)

Sp. Pl. 1 (1753) 177; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’]) 181; Ridley, Fl. Malay Penins. 2 (1923) 58; Jayaweera, J. Arnold Arbor. 44 (1963) 111, 232; Jayaweera, J. Arnold Arbor. 45 (1964) 101; Backer & Bakhuizen van den Brink, Fl. Java (Spermatoph.) 2 (1965) 328; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1543; Puff et al., Rubiac. Thailand (2005) 160; Chantaranonthai, Thai Forest Bull., Bot. 43 (2015) 51; Alejandro et al., Ann. Missouri Bot. Gard. 101 (2016) 457. **Type:** *Mussaenda frondosa* L.

Belilla Adans., Fam. Pl. 2 (1763) 159. **Synonym:** *Mussaenda* L. sect. *Belilla* (Adans.) DC., Prodr. 4 (1830) 370. **Type:** Not designated.

Landia Comm. ex Juss., Gen. Pl. (1789) 201, nom. illeg. non Dombey (1784). **Type:** *Mussaenda arcuata* Poir., neotype designated by Turner, Gard. Bull. Singapore 71 (2019) 55.

Aphaenandra Miq., Fl. Ned. Ind. 2, fasc. 2 (1857) 341. **Type:** *Aphaenandra sumatrana* Miq. (= *Mussaenda uniflora* Wall. ex G. Don).

Asemanthia Ridl., Bull. Misc. Inform. Kew 1939(10) (1940 [‘1939’]) 599. **Type:** *Asemanthia coccinea* Ridl. (= *Mussaenda sabahensis* Govaerts).

Generally scandent shrubs or woody climbers, more rarely erect shrubs or treelets, or creeping subshrubs. **Twigs** generally terete to slightly compressed, generally glabrescent, lenticellate with bark easily peeled. **Stipules** interpetiolar, often bifid, with colleters at base internally. **Leaves** opposite, decussate, generally petiolate and pubescent to some degree, domatia absent; leaves of the last node before inflorescence generally relatively small, often more hirsute and sessile. **Inflorescences** terminal or terminal and axillary in upper leafy nodes, cymose corymbs, sessile or pedunculate, few- to many-flowered, bracts caducous. **Flowers** hermaphrodite, often heterostylous, 5-merous, subsessile to pedicellate; calyx cupular to

tubular, lobes lanceolate, triangular or spine-like, often with 1 (rarely all) expanded as a stipitate calycophyll (petal-like structure), frequently very large and white-cream or pink-red, more showy than the corolla, with 5–9 longitudinal veins; corolla typically tubular or infundibuliform, often dilating distally around androecium, villose in throat, yellow or orange (rarely red or white), lobes valvate reduplicate in bud (i.e. lobes meeting edge on with centres folded inwards), apically acuminate, typically shorter than the calyx tube; stamens included, inserted in corolla tube, generally distally, typically higher in the tube in short-styled morphs; ovary 2-locular, many ovules per locule, stigma included or exerted. **Fruits** fleshy berries, pedicellate, globose to ellipsoidal, ripening purple-black, calyx lobes or scars of calyx lobes visible apically. **Seeds** numerous, tiny, angular.

Distribution. Currently about 130 species recognised across tropical Africa (Madagascan species transferred to *Bremeria* Razafim. & Alejandro) and Asia. In Singapore 2 native species but only one is extant. There are also Cantley collections of *Mussaenda villosa* Wall. ex G. Don and what seems to be the Indo-Chinese *Mussaenda cambodiana* Pierre ex Pit. in the Singapore herbarium with ‘Flora of Singapore’ labels but no exact localities given. These species are excluded until more conclusive evidence of their presence in Singapore is found.

Uses. The main use of plants of this genus is as horticultural ornamentals. An extensive array of hybrids and cultivars is available for the larger tropical garden, many of which are in cultivation in Singapore.

Notes. The expanded sepals of many *Mussaenda* species have been variously referred to as cataphylls, calycophylls and semaphylls. The first term refers to leaf-like structures that are not primarily photosynthetic, the second to leaf-like structures derived from the calyx and the third to leaf-like structures that act as attractants to pollinators. All of these terms are clearly applicable to the petaloid sepals of *Mussaenda*. Here calycophyll is used as it emphasises the morphological origin of the structure and it has been commonly used in the Rubiaceae literature.

Key to *Mussaenda* species

1. Calycophylls (petaloid sepals) generally present; corolla tube to 25 mm long at anthesis, corolla lobes to 5 mm long; berries to 12 mm long **1. *M. glabra***
Calycophylls always absent; corolla tube more than 25 mm long, corolla lobes more than 15 mm long; berries at least 18 mm long **2. *M. maingayi***

1. *Mussaenda glabra* Vahl

(Latin, *glaber* = glabrous, hairless; probably referring to the generally glabrous foliage)

Symb. Bot. 3 (1794) 38; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’]) 185; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 93; Ridley, Fl. Malay Penins. 2 (1923) 61; Jayaweera, J. Arnold Arbor. 44 (1963) 263; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966)

1544; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 158, fig. 125.9; Turner, Gard. Bull. Singapore 45 (1993) 201; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 435; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 62, 175, 217; Chantaranonthai, Thai Forest Bull., Bot. 43 (2015) 55. **Synonym:** *Mussaenda frondosa* L. var. *glabra* (Vahl) Miq., Fl. Ned. Ind. 2, fasc. 2 (1857) 213. **Type:** *Collector unknown s.n.*, ‘India Orientalis’ (lectotype C [C10018260], designated by Jayaweera, J. Arnold Arbor. 44 (1963) 265). **Fig. 46, 47.**

Mussaenda frondosa auct. non L.: Wallich, Numer. List no. 6520 (1832). Based on *Wallich s.n.* [EIC 6250A] (K-W).

Mussaenda penangensis Miq., Fl. Ned. Ind. 2, fasc. 2 (1857) 214. **Type:** *Wallich s.n.* [EIC 6251A], [Malaysia], Penang (lectotype L [L0843026], designated by Turner, Gard. Bull. Singapore 71 (2019) 55).

Mussaenda glabra Vahl var. *puberula* King, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’]) 186. **Type:** *Schomburgk 43*, Singapore, 1859 (lectotype K [K001129410], designated by Chantaranonthai, Thai Forest Bull., Bot. 43 (2015) 55).

Mussaenda andersonii Soumen K. Basu & T.K. Paul, J. Bombay Nat. Hist. Soc. 86 (1990 [‘1989’]) 430. **Type:** *Anderson 163*, India, Sikkim, Kolwong, 9 May 1862 (holotype CAL).

Scrambling shrub or climber. **Twigs** terete or faintly angled, glabrous, or sometimes with more or less erect short pale or brown hairs, drying brown, red-brown or black with conspicuous and abundant pale lenticels, longitudinally elongate, sometimes slightly raised. **Stipules** bifid, densely hairy outside. **Leaves:** lamina elliptic or ovate-elliptic, 7–17 × 2–7.5 cm, apex acuminate, base cuneate, chartaceous, drying dark grey-green, brown to almost black above, grey or grey-brown with main nerves brown to black, midrib and secondary veins more or less flush above, midrib distinctly raised and secondary veins slightly raised below, scattered adpressed hairs on nerves above, denser covering of often longer hairs on nerves below, sometimes with scattered hairs on lower lamina surface, secondary veins 6–9 pairs, arching forward but not looping, secondary veins irregularly scalariform, clear from below; petiole 2–15 mm long, 1 mm wide, often drying laterally compressed with a channel adaxially and pale hairs. **Inflorescences** terminal, generally branching trichotomously, at least basally, but becoming more congested at higher orders, axes generally sparsely covered with erect to decumbent brown or pale hairs, bracts ovate-lanceolate or triangular, 7–8 × 2–3 mm, apically trifid or with lateral points appearing as a pair of distinct teeth below acute apex, drying red brown with pale hairs outside, hairs restricted to distal regions within. **Calycophylls** (absent on some specimens), creamy white, drying pale brown, broadly ovate to rotund, 5.5–11 cm long, 3–10 cm wide, apex rounded to broadly and shortly acuminate, base ultimately shortly cuneate, 5–6 main nerves, with hairs on nerves, denser abaxially, stalk to 3 cm long, 1 mm wide, pale hairy. **Flowers** with colour changing from whitish to yellow during development, briefly red at anthesis and then becoming bright orange; pedicel 2–3 mm long, c. 0.5 mm wide, drying blackish with pale hairs; hypanthium c. 3 mm long, 1.5 mm wide, drying blackish with pale hairs; calyx lobes triangular, 3–6 mm long, 0.8–1.5 mm wide at base, apex long-tapered acute, drying red-brown, pale hairy outside, hairs less dense inside; corolla tube cylindrical, to 25 mm long at anthesis, 0.5 mm wide at base, close to anthesis widening in distal region at about point of stamen insertion in short-styled morph, outside hairs increasing in density distally, mouth of corolla tube with dense ribbon-like yellow hairs, corolla lobes in bud united

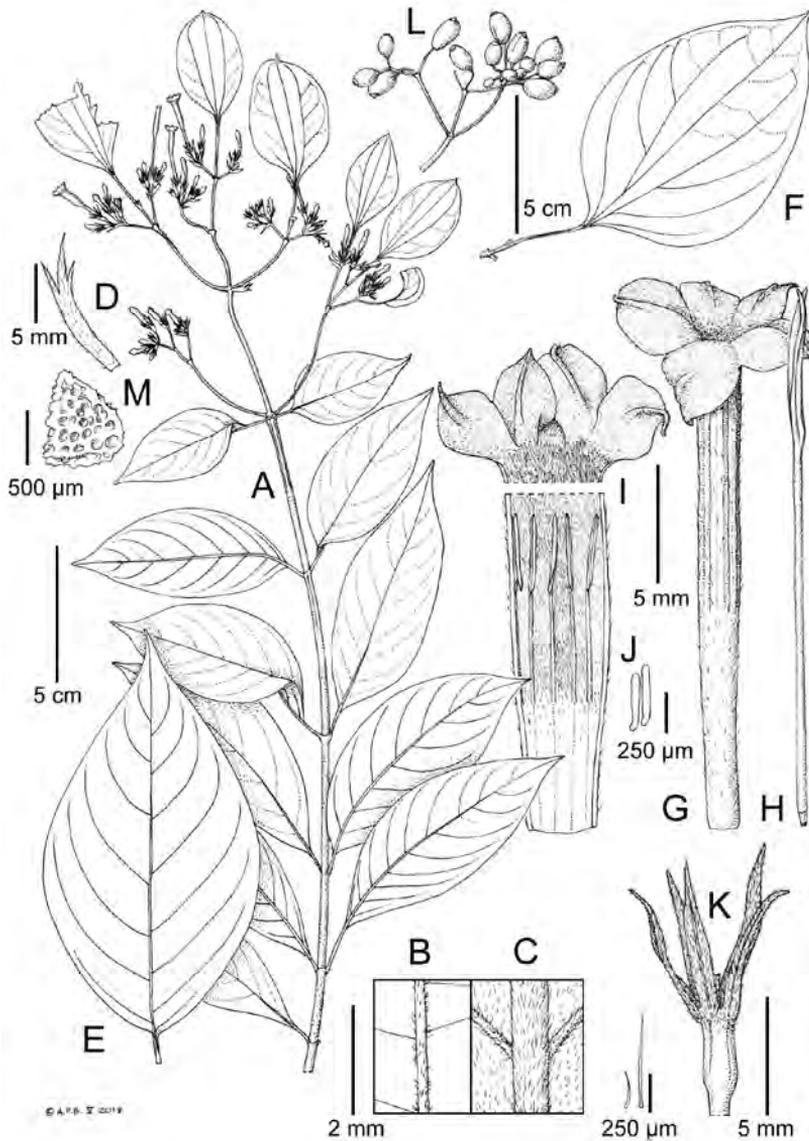


Figure 46. *Mussaenda glabra* Vahl. **A.** Habit. **B.** Leaf adaxial surface at midrib. **C.** Leaf abaxial surface at midrib; with detail of abaxial leaf hairs (left = lamina, right = midrib) shown outside to the right. **D.** Trifold bract from base of inflorescence branch. **E.** Leaf from large-leaved specimen. **F.** Calycophyll from specimen with large calycophylls. **G.** Corolla tube. **H.** Style and stigma. **I.** Lobes and proximal portion of the corolla tube opened out. **J.** Thick hairs with curved bases from adaxial surface of distal portion of corolla tube. **K.** Base of flower with intact calyx and basal portion of style. **L.** Infructescence. **M.** Seed. (From Singapore, A–D from Changi, *Teruya* 2173; E from Jurong, *Goodenough* 5661; F from Chua Chu Kang, *Corporal* s.n [SING0030385]; G–K from Nee Soon, *Yeo et al.* SING2012-143; L–M from Chan Chu Kang, *Ridley* s.n [SING0030370]. Drawn by A. Brown, reproduced with the kind permission of the Director and the Board of Trustees, Royal Botanic Gardens, Kew).

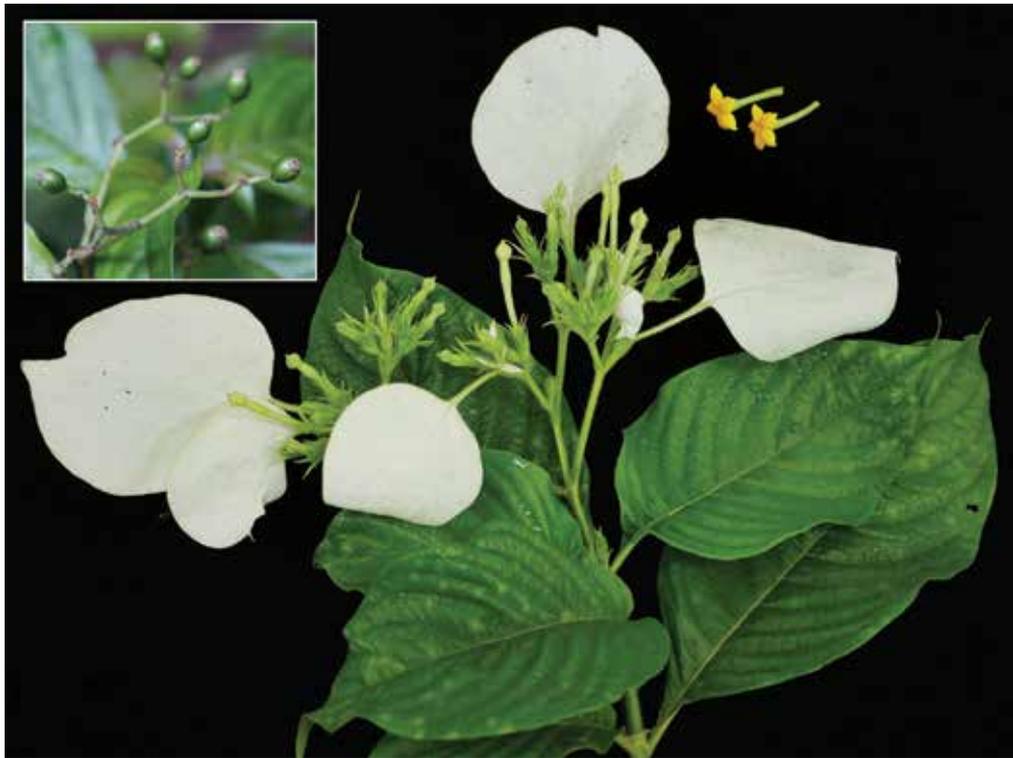


Figure 47. *Mussaenda glabra* Vahl. Terminal inflorescence with flowers in bud and some outer flowers developing calycophylls (conspicuously expanded calyx lobes), plus two detached corollas from open flowers with orange lobes. Inset: Fruits. (Main photo, cultivated in Singapore, Pasir Panjang Nursery, Niissalo *et al.* SING2017-522; inset from Singapore, Nee Soon. Photos: main photo, L.M.J. Chen; inset, X.Y. Ng).

and folded forming a star shape in cross section reminiscent of the head of some screwdrivers; when flower is open corolla lobes reflex but remain united for about half their length, ovate, 3–5 × 3 mm, apex broad with a distinct short apiculus, relatively thick in texture, with adpressed long hairs outside, inside densely covered with very short hairs (or tiny papillae in long-styled morph). **Fruits** berries, ovoid, 6–12 mm long, 5–9 mm wide, drying matt black or very dark brown, faintly and finely longitudinally wrinkled, topped by more or less circular pale calyx scar; pedicels 3–6 mm long, 1 mm wide. **Seeds** very many, irregular in shape, c. 1 mm long, surface heavily sculpted.

Distribution. Bhutan and India to Peninsular Malaysia. Still found quite widely in Singapore including Nee Soon (*Ang* SING2012-275, 18 Jun 2012, SING [SING0175813]), Upper Peirce (*Lua & Ibrahim* SING2013-090, 21 May 2013, SING [SING0199262]), Bukit Gombak (*Chong* 2, 30 Jul 2013, SING [SING0201055]), the Western Catchment (*Samsuri et al.* WC 65, 27 Apr 2004, SING [SING0054262]) and Pulau Tekong (*Gwee et al.* SING2007-220, 2 Mar 2007, SING [SING0096341]).

Ecology. Generally found at forest edges.

Provisional conservation assessment. Globally Least Concern (LC). Listed as Endangered (EN/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 62, 175, 217).

Notes. There is notable variation in the size of the inflorescence bracts and calyx lobes among specimens from Singapore. The specimens with conspicuous bracts and larger calyx lobes seem less likely to bear calycophylls.

2. *Mussaenda maingayi* (Hook.f.) Hemsl. ex T.Durand & B.D.Jacks.

(Alexander Carroll Maingay, 1836–1869, British surgeon, botanist and magistrate in Malacca, Peninsular Malaysia)

Index Kew., Suppl. 1, fasc. 3 (1903) 284; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 62, 175, 217. **Basionym:** *Acranthera maingayi* Hook.f., Fl. Brit. India 3, fasc. 7 (1880) 92. **Synonym:** *Asemanthia maingayi* (Hook.f.) Ridl., Bull. Misc. Inform. Kew 1939(10) (1940 [‘1939’]) 600. **Type:** *Maingay 2449* [Kew Distribution 940], [Malaysia], Malacca, 16 July 1867–1868 (lectotype K [K000740953], designated by Turner, Gard. Bull. Singapore 71 (2019) 56). **Fig. 48.**

Acranthera griffithii Hook.f., Fl. Brit. India 3, fasc. 7 (1880) 92. **Synonyms:** *Mussaenda griffithii* (Hook.f.) Hemsl. ex B.D.Jacks., Index Kew., Suppl. 1, fasc. 3 (1903) 284. – *Asemanthia griffithii* (Hook.f.) Ridl., Bull. Misc. Inform. Kew 1939(10) (1940 [‘1939’]) 600. **Type:** *Griffith s.n.* [Kew Distribution 3089], East Himalaya (lectotype L [L0000132], designated by Turner, Gard. Bull. Singapore 71 (2019) 56; possible isolectotypes C [×2], GH, L).

Acranthera mutabilis Hemsl., J. Bot. 25 (Jul 1887) 204. **Synonym:** *Mussaenda mutabilis* (Hemsl.) Hemsl., Hooker’s Icon. Pl. 18 [ser. 3, 8], fasc. 1 (Nov 1887) pl. 1718; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’]) 182; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 93, as ‘*variabilis*’; Ridley, Fl. Malay Penins. 2 (1923) 58; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1545; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 158; Turner, Gard. Bull. Singapore 45 (1993) 196; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 435; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240. **Type:** *Wray 91*, [Malaysia], Perak, Waterfall Hill (holotype K [K001129440]; isotype SING [SING0062184]).

Mussaenda mutabilis (Hemsl.) Hemsl. var. *hirsuta* King, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’]) 182; Ridley, Fl. Malay Penins. 2 (1923) 58. **Synonym:** *Asemanthia maingayi* (Hook.f.) Ridl. var. *hirsuta* (King) A.K.Sinha & B.Mitra, J. Bombay Nat. Hist. Soc. 78 (1981) 427. **Type:** *King’s Collector 225*, [Malaysia], Johore, Gunong Panti, June 1880 (lectotype K [K000740949], designated by Turner, Gard. Bull. Singapore 71 (2019) 56; isolectotypes CAL, K [K0007409548]).

Mussaenda mutabilis (Hemsl.) Hemsl. var. *montana* Ridl., Fl. Malay Penins. 2 (1923) 58. **Synonym:** *Asemanthia maingayi* (Hook.f.) Ridl. var. *montana* (Ridl.) A.K.Sinha & B.Mitra, J. Bombay Nat. Hist. Soc. 78 (1981) 428. **Type:** *Ridley 3215*, [Malaysia], Malacca, Mount Ophir, Padang Batu (lectotype CAL, designated by Sinha & Mitra, J. Bombay Nat. Hist. Soc. 78 (1981) 428; isolectotype SING [SING0240244]).



Figure 48. *Mussaenda maingayi* (Hook.f.) Hemsl. ex T.Durand & B.D.Jacks. Inflorescence with open flowers. Inset: Flowers in advanced bud stage showing valvate reduplicate corolla lobes which meet edge-on with centres folded longitudinally inwards. (From Peninsular Malaysia. Photos: X.Y. Ng).

Scandent shrub, apparently sometimes free-standing. **Twigs** drying reddish brown or dark brown, often with pale, longitudinally elongate lenticels, varying from more or less glabrous to densely, pale brown hairy on young twigs, with hairs sometimes more than 2 mm long. **Leaves:** lamina ovate or elliptic, 5–20 × 2.5–15 cm, apex acute to rounded, ultimately shortly acuminate, base acute to rounded, thinly chartaceous, generally drying dark brown above and a paler brown or grey-brown below, midrib and secondary veins slightly raised below, flush to slightly sunken above in dry leaves, sparsely to densely covered with decumbent, often long, hairs on midrib and veins above and below, sometimes on lower lamina surface also, secondary veins 5–8 pairs, arching forward but not looping distinctly, secondary venation irregularly scalariform, finest reticulations usually more obvious from upper surface, often as pale lines on dark lamina; petiole 4–40 mm long, 1–1.5 mm thick, variably hairy. **Inflorescences** terminal, branching trichotomously, at least basally, though the main central branch usually develops most strongly, variable in degree of development, bracts triangular, 4–6 mm long, 2 mm wide at base, apex sharply acute, sometimes with a tooth to each side, hairy outside and in. **Calycophylls** absent. **Flowers** with pedicels 3–6 mm long, c. 1 mm wide, drying dark brown with pale hairs, hypanthium 4–5 mm long, c. 2 mm wide, sparsely short hairy outside, calyx very briefly connate at base, sepals triangular or linear-lanceolate, 8–15(–28) mm long, 1–2(–3) mm wide, apex acute, pale hairy, more densely so inside, corolla tube 25–40 mm long, 1–1.5 mm wide at base, expanding in upper portion to c. 2 mm wide,

generally much more densely hairy outside on expanded portion, very densely hairy within, corolla lobes broadly ovate-lanceolate, 16–26 × 9–12 mm, apex acute, basally connate to just under half their length, outside with one or two raised longitudinal ridges which bear tiny pale hairs, inside densely but minutely papillate, often with central ridge, mouth of corolla filled with dense, pale, ribbon-like hairs with acute apices that extend a short way up from the base of the corolla lobes. **Fruits** cylindrical to obovoid, 18–20 mm long, 8–10 mm wide, drying black, crowned by brownish raised scar of perianth attachment; pedicels 4–8 mm long, 1–1.5 mm wide. **Seeds** very many, irregular in shape, c. 1 mm long, surface heavily sculpted.

Distribution. Endemic to Peninsular Malaysia and Singapore. In Singapore only known from one old collection (*Goodenough 1643*, Seletar, 25 Aug 1890, SING [SING0012118]). A recent sterile collection from Nee Soon may represent this species (*Chong et al. s.n.*, Nov 2010, SINU).

Ecology. Lowland forest.

Provisional conservation assessment. Globally not assessed. In Singapore presumed Nationally Extinct.

29. MUSSAENDOPSIS Baill.

(pertaining to *Mussaenda* L., Greek, *-opsis* = sight, indicates resemblance; resembling *Mussaenda*)
Malabera bukit (Malay)

Adansonia 12 (1879) 282; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’]) 139; Ridley, Fl. Malay Penins. 2 (1923) 19; Bremekamp, Recueil Trav. Bot. Néerl. 36 (1939) 367; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1545; Wong, Arbor. Rubiac. Malaya (1988) 132.1; Wong, Tree Fl. Malaya 4 (1989) 378; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 158. **Type:** *Mussaendopsis beccariana* Baill.

Creaghia Scort., J. Bot. 22 (1884) 369; Boerlage, Handl. Fl. Ned. Ind. 2(1) (1891) 37. **Type:** *Creaghia fragraeopsis* Scort. (= *Mussaendopsis beccariana* Baill.).

Trees. **Stipules** initially fused except at their apex, interpetiolar at inception, becoming intrapetiolar in position and mostly or completely separating. **Inflorescences** axillary, a conspicuous panicle. **Flowers** hermaphrodite, 4–5-merous; calyx of outer flowers of clusters on the panicle with an enlarged petaloid (show) lobe; corolla hypocrateriform or rotate, the tube conspicuous or subobsolete, inside glabrous; corolla lobes contorted to the right in the bud; stamens as many as corolla lobes, with exerted filaments; stigma bilobed; disk subcupular; ovary 2-locular; ovules numerous, with wing-like outgrowths, placentas large, attached to the septum. **Fruits** septicidal capsules. **Seeds** numerous, subelliptic, winged, the wings more pronounced at each end.

Distribution. A genus of 2 species in Southeast Asia (including *Mussaendopsis celebica* Bremek. endemic to Sulawesi). In Singapore 1 native species.

Taxonomy. The Philippine *Mussaendopsis multiflora* Elmer is *Greeniopsis multiflora* (Elmer) Merr. (Philipp. J. Sci., C 4 (1909) 325). The Peninsular Malaysian *Mussaendopsis malayana* T.Yamaz. is *Steenisia pleurocarpa* (Airy Shaw) Bakh.f. var. *malayana* (T.Yamaz.) K.M.Wong (Gard. Bull. Singapore 62 (2011) 307–311).

Notes. Puff & Igersheim (Flora 189 (1994) 161–178) provide detailed studies of stipule and floral development.

***Mussaendopsis beccariana* Bail.**

(Odoardo Beccari, 1843–1920, Italian naturalist)

Adansonia 12 (1879) 282; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’]) 139; Ridley, Fl. Malay Penins. 2 (1923) 19; Bremekamp, Recueil Trav. Bot. Néerl. 36 (1939) 369; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1545; Wong, Arbor. Rubiac. Malaya (1988) 132.1; Wong, Tree Fl. Malaya 4 (1989) 378; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 158; Turner, Gard. Bull. Singapore 45 (1993) 200; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 436; Puff & Igersheim, Flora 189 (1994) 176; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 62, 175, 217. **Type:** *Beccari* 358, [Malaysia], Sarawak, Kuching, August 1865 (lectotype FI [FI008814], designated here; isolectotypes K [K000760090], P [P05025192]). **Fig. 49.**

Creaghia fragraeopsis Scott., J. Bot. 22 (1884) 370; Boerlage, Handl. Fl. Ned. Ind. 2(1) (1891) 37, 122. **Type:** *Scortechini s.n.*, [Malaysia], Malay Peninsula, Taiping, beside Larut river (holotype BM [BM000945049]).

Trees, to 35 m tall and 2 m girth; bark grey to brown, smooth. **Stipules** intra-petiolar when fully developed, ovate, to 3 cm long, the terminal pair appressed firmly over the terminal bud and initially mostly fused together, later separating, caducous. **Leaves:** lamina broadly elliptic to subrotund, 8–23 × 6–20 cm, apex blunt or very short-cuspidate, base broadly cuneate to rounded, coriaceous, glabrous, secondary veins 6–8 pairs, tertiary veins scalariform between secondary veins and indistinct; petiole 15–27 mm long, 3–4 mm wide. **Inflorescences** axillary, a showy panicle to 20–25 cm long, main branches 1–few pairs, to c. 10 cm long, these further branched. **Flowers** with short pedicels; calyx cup 1–2 mm long, 1.5–2.5 mm wide, densely yellow short-hairy outside, on peripheral flowers of clusters in the panicle the 5 lobes often with one conspicuously enlarged obovate creamy to pale yellow wing 17–27 × 16–20 mm; corolla white, densely yellow downy hairy outside, rotate, tube very short, c. 1 mm long, glabrous inside, corolla lobes (4–)5, c. 2.5 mm long, spreading to reflexed in the open flower; anthers less than 1 mm long, on filaments 2–2.5 mm long, strongly exerted; style hardly 1 mm long; stigma a 2-lobed tiny knob; disk conspicuous, annular; ovary 2-celled; ovules many attached to a spindle-shaped placenta along the ovary crosswall. **Fruits** capsules obovoid, to 2 × 0.5 cm, glabrous, dark brown when mature, splitting septically into 2 from the apex downwards. **Seeds** small, subelliptic, 2–4 mm long, the margin expanded as a narrow wing most pronounced at both ends.



Figure 49. *Mussaendopsis beccariana* Baill. Flowering leafy branch. Inset: Detail of stipules that assume an apparently intra-petiolar aspect during development. (Cultivated in Peninsular Malaysia. Photos: K.M. Wong).

Distribution. Malay Peninsula, Sumatra and Borneo. In Singapore it has been documented in Jurong (*Corner s.n.*, 19 Oct 1932, SING [SING0030390]), Chan Chu Kang (*Goodenough 1850*, 22 Nov 1890, SING [SING0030391]), Nee Soon (*Samsuri et al. NES 203*, 17 Jun 2003, SING [SING0045882]) and Sembawang (*Ridley s.n.*, 1892, SING [SING0030392]).

Ecology. Lowlands, frequent in swamp forest and riverine sites, but also in mixed dipterocarp forest. Puff & Igersheim (*Flora 189* (1994) 161–178) surmised fly pollination in this species, on the basis of the rotate creamy white corollas with practically no corolla tube and a large nectariferous disk. They noted that this would be the first instance of myophily where petaloid calyx lobes are developed as a secondary optical attractant. We have subsequently observed young flowering trees (4–5 m high) of this species in a tree nursery in Johor, Peninsular Malaysia, where the open flowers attracted large numbers of flies.

Provisional conservation assessment. Globally not assessed. Listed as Endangered (EN/D) in Singapore by Tan et al. (in Davison et al. (ed.), *Singapore Red Data Book*, ed. 2 (2008) 240) and Chong et al. (*Checkl. Vasc. Pl. Fl. Singapore* (2009) 62, 175, 217).

Notes. The above measurements are from Singapore material only.

30. MYCETIA Reinw.

(Greek, *myces* = mushroom or other fungus;
referring to the appearance of the spongy fruit-wall)

Syll. Pl. Nov. 2 (1828) 9; Ridley, *Fl. Malay Penins.* 2 (1923) 63; Craib, *Fl. Siam.* 2(1) (1932) 79; Wong, *Arbor. Rubiac. Malaya* (1988) 132.2; Wong, *Tree Fl. Malaya* 4 (1989) 378; Keng, *Concise Fl. Singapore*, vol. 1, *Gymn. Dicot.* (1990) 158; Puff et al., *Rubiaceae. Thailand* (2005) 136, pl. 3.1.46. **Type:** *Mycetia cauliflora* Reinw.

Adenosacme Wall. ex Miq., *Fl. Ned. Ind.* 2, fasc. 2 (1857) 215, nom. illeg. superfl.; Bentham & Hooker, *Gen. Pl.* 2(1) (1873) 69; Hooker, *Fl. Brit. India* 3, fasc. 7 (1880) 95; King & Gamble, *J. Asiat. Soc. Bengal*, Pt. 2, *Nat. Hist.* 72(4) (1904 [¹⁹⁰³]) 196; Ridley, *Fl. Malay Penins.* 2 (1923) 63; Burkill, *Dict. Econ. Prod. Malay Penins.*, ed. 2, 1 (1966) 49. **Type:** *Adenosacme cauliflora* Miq. (= *Mycetia cauliflora* Reinw.).

Treelets, rarely shrubby; stems just behind new growth with smooth, corky or spongy, pale brown to whitish bark. **Stipules** ovate, with an irregular margin, sometimes minutely toothed to bifid at the apex. **Leaves** in subequal pairs to strongly anisophyllous, obovate to oblanceolate; tertiary veins ladder-like between each pair of secondary veins and prominently raised. **Inflorescences** cymes or panicles, terminal to normal leafy shoots or axillary short-shoots (and then apparently axillary), rarely cauliflorous. **Flowers** bisexual, 4–6-merous, heterostylous; calyx lobes triangular or denticulate, in some species fringed with tiny stalked glands; corolla yellow to whitish, tubular, in some species distended at the base, lobes short-ovate and valvate; anthers basifixed, inserted at the lower, middle or upper part of the corolla tube, included in the corolla tube; stigma bifid, included in the corolla tube; ovary 2(–3–4)locular; ovules many in each locule, attached to the lower or middle part of the ovary wall. **Fruits** berries, depressed-globose, slightly to strongly 2-lobed; pericarp white, spongy. **Seeds** wedge-shaped.

Distribution. A genus of about 35 species in Northeast India to South China and western Malasia. In Singapore 1 native species.

Mycetia malayana (G.Don) Craib (of Malaya)

Bull. Misc. Inform. Kew (1914) (1914) 29; Craib, Fl. Siam. 2(1) (1932) 80; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 1 (1966) 49; Wong, Arbor. Rubiac. Malaya (1988) 132.2; Wong, Tree Fl. Malaya 4 (1989) 379; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 158; Turner, Gard. Bull. Singapore 45 (1993) 201; Turner, Gard. Bull. Singapore 47 (1997 ['1995']) 436; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 62, 175, 195. **Basionym:** *Wendlandia malayana* G.Don, Gen. Hist. 3 (1834) 519. **Synonym:** *Adenosacme malayana* (G.Don) Wall. ex Ridl., Fl. Malay Penins. 2 (1923) 63. **Type:** *Wallich s.n.* [EIC 6282], [Malaysia], Penang (lectotype K [K000760581], designated here). **Fig. 50.**

Adenosacme longifolia auct. non (Wall.) Wall. ex Miq.: Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 93.

Treelets, rarely shrubby, to c. 4 m tall; stems just behind new growth with smooth, corky or spongy, pale brown to whitish bark. **Stipules** ovate, with an irregular to jagged margin to cleft at the apex. **Leaves:** lamina obovate to oblanceolate, 9–39 × 2–9.5 cm, apex acute to acuminate or subcaudate, base cuneate, chartaceous, hairy on both surfaces, secondary veins (10–)18–26 pairs, tertiary veins ladder-like between each pair of secondary veins and prominently raised; petioles (4–)18–62 mm long. **Inflorescences** many-branched panicles, terminal to normal leafy shoots, 6–15 cm long, main branches zig-zag due to alternate development of left and right members of successfully higher orders of branching. **Flowers** bisexual, 4–5-merous; calyx lobes triangular, fringed with tiny stalked glands; corolla yellow, tubular, in some species distended at the base, c. 3 mm long, lobes short-ovate and valvate, c. 1 mm long; anthers basifixed, inserted at the lower or middle part of the corolla tube, included in the corolla tube; stigma bifid, included in the corolla tube; ovary 2-loculate; ovules many in each locule, attached to the lower or middle part of the ovary wall. **Fruits** berries, depressed-globose, slightly to strongly 2-lobed, 3–3.5 × 3.5–4.5 mm, white. **Seeds** wedge-shaped.

Distribution. Malay Peninsula (including Peninsular Thailand, Peninsular Malaysia and Singapore) and Borneo (Sarawak). In Singapore known only from Bukit Timah (*Ridley s.n.*, SING [SING0012120]; *Hullett 620*, 13 Apr 1887, SING [SING0012119, SING0012121]; *Collector unknown s.n.*, Jan 1889, SING [SING0269547]; *Holtum SFN 19794*, 12 Nov 1928, SING [SING0269546]).

Ecology. Lowlands to hills, also on limestone elsewhere in the Malay Peninsula.

Provisional conservation assessment. Globally not assessed. In Singapore presumed Nationally Extinct.



Figure 50. *Mycetia malayana* (G.Don) Craib. Leafy shoot with infructescences. Inset: Close-up of fruits. (From Peninsular Malaysia. Photos: K.M. Wong).

31. MYRMECODIA Jack

(Greek, *myrmeco-* = with or related to ants; referring to the ant-inhabited tuber)

Trans. Linn. Soc. London 14(1) (1823) 122; Blume, Bijdr. Fl. Ned. Ind., pt 16 (1826–1827) 1001; De Candolle, Prodr. 4 (1830) 450; Bentham & Hooker, Gen. Pl. 2(1) (1873) 132; Hooker, Fl. Brit. India 3, fasc. 8 (1881) 194; Beccari, Malesia 2 (1884) 95; Ridley, Fl. Malay Penins. 2 (1923) 173; Valetton, Bot. Jahrb. Syst. 61 (1927) 144; Merrill & Perry, J. Arnold Arbor. 26 (1945) 26; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1556; Wong, Arbor. Rubiac. Malaya (1988) 8 (in clavi); Wong, Tree Fl. Malaya 4 (1989) 327 (in clavi); Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 158; Huxley & Jebb, Blumea 37(2) (1993) 271; Puff et al., Rubiac. Thailand (2005) 170, pl. 3.3.3. **Type:** *Myrmecodia tuberosa* Jack.

Lasiosstoma auct. non Schreber: Sprengel, Syst. Veg. (ed. 16) 1 (1824 [‘1825’]) 422, p.p.

Typically tuberous epiphytic plants; tubers rounded, ovoid or cylindrical, often ridged and provided with simple, branched, or stellate spines, inside with complex branched and inter-connecting chambers, the surface with entrance holes (facilitating ants). **Stem(s)** solitary or few, thick; typically with a conspicuous shield-shaped area (‘clypeolus’) around each petiole base. **Stipules** conspicuous, splitting between petioles and along the axillary median, usually persistent just apical to the clypeolus. **Leaves:** lamina subcoriaceous to coriaceous, rarely fleshy. **Inflorescences** axillary, of sessile flowers somewhat sunken in channels between clypeoli or in paired recesses (‘alveoli’). **Flowers** with inconspicuous to hairy bracts together forming clusters; calyx tube short, subtruncate; corolla typically white, tubular, with hairs at varying levels, rarely glabrous, lobes 4, short; anthers usually included within corolla tube, filaments short; styles often in two morphs, short or long (i.e. flowers heterostylous), stigma lobed; locules 2–10, ovules solitary and basal in each locule. **Fruits** fleshy drupes, protruding from their alveolus when mature, white, yellow, orange, or red; pyrenes (2–)4–6(–10).

Distribution. A genus of 26 species in Vietnam, Peninsula Malaysia, Sumatra, Java, Borneo and the Philippines. New Guinea, Australia (Cape York) and the Solomon Islands. The greatest diversity and many localised highland species are in New Guinea. In Singapore 1 native species.

Ecology. Sea level (mangrove and coastal vegetation) to 2400 m, uncommon in the lowlands and more frequent in montane forests; abundant in places in lowland *kerangas* (tropical heath forest) vegetation such as in Borneo and mid-elevation savanna or open sites in Papua New Guinea.

The ant symbiosis with wild *Myrmecodia* plants is most consistently formed with a few species of the *Iridomyrmex* complex and radioactive tracer experiments have demonstrated the transfer of minerals from ant-tenants, as well as absorption and translocation within the plant system (Huxley, New Phytol. 80 (1978) 231–268). As with *Hydnophytum* Jack, the other genus of tuberous ant-epiphytes in the family, tuber cavities with smooth walls are usually where ant-tenants attend their brood, whereas organic debris is mostly accumulated in chambers with warty walls through which their breakdown products can be absorbed (Huxley, New Phytol. 80 (1978) 231–268).

Myrmecodia tuberosa Jack

(Latin, *tuberosus* = tuber-forming)

Trans. Linn. Soc. London 14(1) (1823) 123; Blume, Bijdr. Fl. Ned. Ind., pt 16 (1826–1827) 1001; Hooker, Fl. Brit. India 3, fasc. 8 (1881) 194; Beccari, Malesia 2 (1884) 99, t. 13, 14; Ridley, Fl. Malay Penins. 2 (1923) 173; Merrill & Perry, J. Arnold Arbor. 26 (1945) 26; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1556; Huxley & Jebb, Blumea 37(2) (1993) 276; Turner, Gard. Bull. Singapore 45 (1993) 201; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 436; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 62, 175, 195. **Synonyms:** *Lasiostoma tuberosum* (Jack) Spreng., Syst. Veg. (ed. 16) 1 (1824 [‘1825’]) 423. – *Myrmecodia echinata* Gaudich., Voy. Uranie, fasc. 12 (1830) 472; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 100. **Type:** [Published illustration] Rumphius, Herb. Amboin. 6 (1750) 119, t. 55: fig. 2 lectotype designated by Huxley & Jebb, Blumea 37(2) (1993) 271. **Fig. 51, 52.**

Myrmecodia armata DC., Prodr. 4 (1830) 450; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 158, fig. 125.10. **Type:** *Gaudichaud s.n.*, [Indonesia] Moluccas (G [G00436403], lectotype designated here).

Epiphyte; tubers rounded to ovoid-cylindric, to 40 × 15 cm, usually ridged, spines sparse to dense, unbranched or branched, on ridges, scattered or in groups, 1(–2) cm long. **Stem** typically solitary, erect to upcurved, to c. 30 cm long; the base without clypeoli or alveoli, distal parts with distinct or inconspicuous clypeoli. **Stipules** broadly triangular, deciduous before leaves, to 1.5 cm long, somewhat persistent. **Leaves:** lamina elliptic to oblanceolate, 7.5–21 × 2–8.5 cm, apex acute to acuminate, base cuneate to gradually tapered, subcoriaceous to coriaceous, midrib prominent below, whitish to pale green, secondary veins 10–15 pairs; petioles 3–7 cm long. **Inflorescences** in alveoli to 1.5 cm diam. on mature plants. **Flowers** with hairy bracts to 8 mm long; calyx tube 0.5–3 mm long; corolla tube to c. 10 mm long, c. 1 mm wide, with a ring of hairs near the base of the tube, lobes c. 3–4 mm long; anthers at upper part of and included within corolla tube, filaments c. 0.5 mm long; stigma at the level of anthers or slightly above, 4–5-lobed; ovules 4–6. **Fruits** when mature c. 7 mm long, yellow or orange; pyrenes 4–6.

Distribution. Vietnam, Peninsular Malaysia, Sumatra, Java, Borneo and Ambon. In Singapore recorded from an unspecified locality (*Wallace s.n.*, 1855, K), Sungei Jurong (*Ridley 3854*, 1892, SING [SING0037550]; *Ridley s.n.*, 1894, SING [SING0037552]; *Ridley 1067*, 1896, SING [SING0037551]) and Bukit Timah (*Ridley s.n.*, SING [SING0037549]).

Ecology. This variant has been documented from sea level to 500 m but, naturally, in Singapore has been from low-lying localities.

Provisional conservation assessment. Globally not assessed. In Singapore presumed Nationally Extinct.

Notes. Huxley & Jebb (Blumea 37(2) (1993) 276) regard this taxon as an ochlospecies, with variants combining characteristics not in any way consistently correlated to geography or habitat and not possible to classify as discrete taxonomic entities, i.e. the whole spectrum of variation falls into a continuum. Many synonyms exist due to variants having been described as species (see Huxley & Jebb, Blumea 37(2) (1993) 276) but most of these synonyms are not particularly relevant to the Singapore taxon.

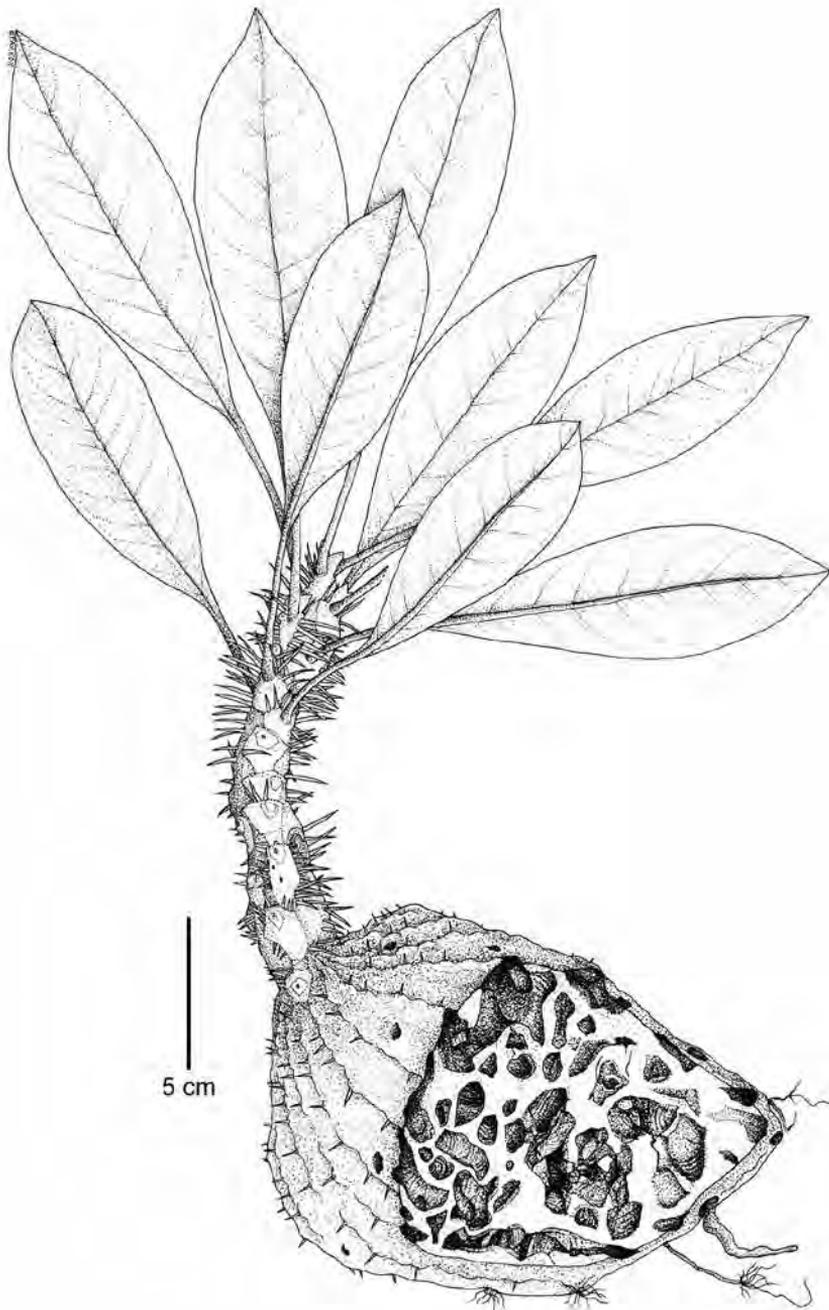


Figure 51. *Myrmecodia tuberosa* Jack. Stem with tuberous base and spines of various lengths; note distinct to inconspicuous clypeoli (shield-shaped areas) around each petiole base on the leafy distal part. Tuber cut open to show complex of branched and inter-connecting chambers with ant holes on the surface. (From Singapore, Sungei Jurong, *Ridley 1067*. Drawn by E. Tay).



Figure 52. *Myrmecodia tuberosa* Jack. Epiphytic habit. Inset: In situ germination of undispersed seeds. (From Sarawak. Photos: K.M. Wong).

The Singapore specimens are practically devoid of flowers or good fruits. The above measurements reflect the morphological variation that was formerly recognised as *Myrmecodia tuberosa* from Vietnam to Java and Borneo.

32. NAUCLEA L.

(Greek, *naus* = ship, *kleio* = close; probably referring to the individual parts of the fruit resembling a ship's hull)

Mengkal (Malay)

Sp. Pl., ed. 2, 1 (1762) 243; Bakhuizen van den Brink, Taxon 19 (1970) 473; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1560, p.p.; Ridsdale, Blumea 24(2) (1979 [‘1978’]) 325; Wong, Arbor. Rubiac. Malaya (1988) 133; Wong, Tree Fl. Malaya 4 (1989) 379; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 158. **Type:** *Nauclea orientalis* (L.) L., lectotype designated by Merrill, J. Wash. Acad. Sci. 5 (1915) 530.

Sarcocephalus auct. non Afzel. ex R.Br.: King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’]) 119; Ridley, Fl. Malay Penins. 2 (1923) 7.

Medium-sized to large trees. **Stipules** ovate to elliptic, plane or (not in Singapore) strongly keeled, appressed together to form a strongly flattened structure enclosing the vegetative terminal bud, caducous or semi-persistent. **Inflorescences** globose flowering heads, 1–3 together at shoot tips or 1(–2) in leaf axils; peduncle slender throughout, not distally swollen, with a distinct node bearing bracts or remaining as a scar at or below its middle. **Flowers** bisexual, 4(–5)-merous; hypanthia laterally fused together; calyx lobes 4(–5), triangular; corolla narrowly trumpet-shaped, corolla lobes 4(–5), ovate-elliptic, the tips contorted in the bud; anthers basifixed, inserted on short filaments at the upper part of the corolla tube and protruding slightly from it; style exserted; stigma spindle-shaped; ovary 2-locular; placentas attached to the upper third of the ovary septum; ovules many in each locule. **Infructescences** globose heads composed of many fused fruits, becoming woody and shallowly pitted and knobby, indehiscent. **Seeds** ovoid to ellipsoid, not winged.

Distribution. About 10 species from Africa through continental Southeast Asia and Malesia to Australia. In Singapore 1 native species.

Uses. As with *Ochreinauclea* Ridsdale & Bakh.f. and *Neonauclea* Merr., the timber of *Nauclea* is referred to as *bangkal* (Malay). It is moderately strong and moderately fine to slightly coarse with interlocking grain, suitable for flooring, furniture and ornaments. Some species have been used in folk medicine.

Taxonomy. The listing (under *Sarcocephalus subditus* (Korth.) Miq.) of *Nauclea subdita* (Korth.) Steud. for Singapore by Ridley (J. Straits Branch Roy. Asiat. Soc. 33 (1900) 90; Fl. Malay Penins. 2 (1923) 8) was based on a Kranji specimen, which is in fact a species of *Neonauclea* (see *Neonauclea kranjiensis* K.M.Wong & W.W.Seah). The differences between *Nauclea* and *Neonauclea* can be seen in the key to genera.

***Nauclea officinalis* (Pierre ex Pit.) Merr. & Chun**

(Latin, *officinalis* = medicinal)

Sunyatsenia 5 (1940) 188; Ridsdale, *Blumea* 24(2) (1979 [‘1978’]) 328; Wong, *Arbor. Rubiac. Malaya* (1988) 134; Wong, *Tree Fl. Malaya* 4 (1989) 380; Keng, *Concise Fl. Singapore*, vol. 1, *Gymn. Dicot.* (1990) 158; Turner, *Gard. Bull. Singapore* 45 (1993) 201; Turner, *Gard. Bull. Singapore* 47 (1997 [‘1995’]) 436; Tan et al. in Davison et al. (ed.), *Singapore Red Data Book*, ed. 2 (2008) 240; Chong et al., *Checkl. Vasc. Pl. Fl. Singapore* (2009) 63, 175, 209. **Basionym:** *Sarcocephalus officinalis* Pierre ex Pit., *Fl. Indo-Chine* 3, fasc. 1 (1922) 26. **Type:** *Pierre s.n.* [Herb. Pierre 605], Cambodia, Thepong Province, Mt Knang-krepeu (lectotype P [P01900239], designated here; isolectotypes A [A00094429], K [K000729849, K000729852], L [L0000838, L2929626, L2929627], P [P01900240, P01900241, P01900242], SING [SING0058056]). **Fig. 53.**

Nauclea brunnea Craib, *Bull. Misc. Inform. Kew* 1931 (1931) 208. **Type:** *Kerr 15572*, Thailand, Nakawn Sritamarat, Kao Luang (lectotype BM [BM000798458], designated here; isolectotypes BK [BK257409], K [K000729850, K000729851]).

Sarcocephalus junghuhnii auct. non Miq.: Ridley, *J. Straits Branch Roy. Asiat. Soc.* 33 (1900) 90; King & Gamble, *J. Asiat. Soc. Bengal*, Pt. 2, *Nat. Hist.* 72(4) (1904 [‘1903’]) 121; Ridley, *Fl. Malay Penins.* 2 (1923) 7.

Medium to large tree, to 30 m tall, 0.7 m girth. **Bark** smooth to cracking and shallowly fissured, greyish to reddish brown, inner bark yellow turning brown to orange on exposure; sapwood pale yellow. **Twigs** drying dark brown. **Stipules** ovate to elliptic, 5–11 × 4–9 mm, plane. **Leaves:** lamina elliptic to obovate, (6.5–)11–19 × (3–)5–14 cm, apex acute, base obtuse to cuneate, chartaceous to subcoriaceous, glabrous on both surfaces except for domatia, midrib slightly sunken above, prominently raised below, drying yellowish brown below, secondary veins (4–)6–9 pairs, slightly sunken above, raised below, often drying yellowish brown below, with domatia in their axils on the lower leaf surface, tertiary veins faintly reticulate; petioles (5–)10–20 mm long. **Flowering heads** in groups of 1–3, each measuring 14–15 mm (across corollas); calyx lobes 4(–5), 1 mm long, densely brown hairy; corolla tube 3 mm long, glabrous, corolla lobes 4(–5), 1 mm long, glabrous; stigma protruding 4 mm from corolla tube. **Fruiting heads** 10–16 mm across, peduncles 18–42 mm long.

Distribution. South China, Thailand, Cambodia, Laos, Vietnam, Peninsular Malaysia, Sumatra and Borneo. In Singapore it is documented for Bukit Timah (*Ridley 6896*, 1895, SING), the Changi-Pulau Ubin area (*Ridley 2847*, 1891, SING [SING0055074]), Seletar (*Ridley 2848*, 1889, SING [SING0055072]), Siglap (*Ridley 3997*, 1892, SING [SING0055076]) and represented by vouchers consisting of leafy branches for various other localities: Nee Soon, Upper Thomson and Sentosa.

Ecology. In Singapore mainly found in lowland forest and some swampy areas; its regeneration has been observed in secondary woodland dominated by *Falcataria moluccana* (Miq.) Barneby & J.W.Grimes (Fabaceae) off Holland Road. In the Malay Peninsula, it is found in lowland to hill forest as well as swampy areas.

Provisional conservation assessment. Globally not assessed. In Singapore Critically Endangered (CR/D).

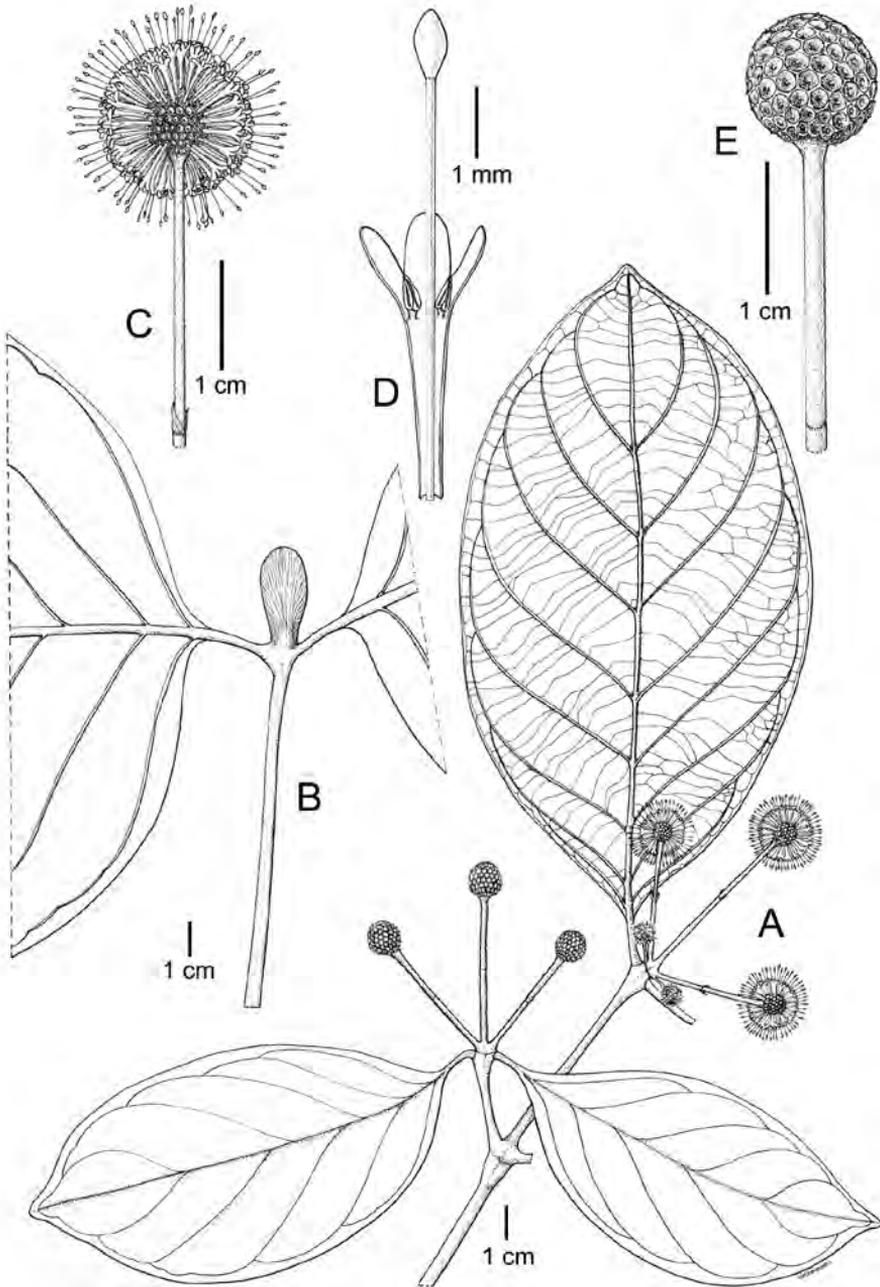


Figure 53. *Nauclea officinalis* (Pierre ex Pit.) Merr. & Chun. **A.** Flowering leafy branch. **B.** Stipules appressed together as a flat structure over the shoot tip. **C.** A globose head of flowers with hypanthia laterally fused. **D.** Longitudinal section of corolla. **E.** Globose woody head of many fused fruits. (From Singapore, A, C, D from Siglap, *Ridley 3997*; B from Sentosa, *Lee et al. SEN 33*; E from Seletar, *Ridley 2848*. Drawn by D. Teo).

Vernacular name. *Cermin air* (Malay).

33. NEOLAMARCKIA Bosser

(Jean-Baptiste Lamarck, 1744–1829, French biologist)

Kelempayan (Malay)

Bull. Mus. Natl. Hist. Nat., B, *Adansonia* 6(3) (1985 [‘1984’]) 247; Wong, *Arbor. Rubiac. Malaya* (1988) 136; Wong, *Tree Fl. Malaya* 4 (1989) 381. **Type:** *Neolamarckia cadamba* (Roxb.) Bosser

Anthocephalus auct. non A.Rich.: Miquel, *Fl. Ned. Ind.* 2, fasc. 1 (1856) 135; King & Gamble, *J. Asiat. Soc. Bengal*, Pt. 2, *Nat. Hist.* 72(4) (1904 [‘1903’]) 122; Ridley, *Fl. Malay Penins.* 2 (1923) 8; Burkill, *Dict. Econ. Prod. Malay Penins.*, ed. 2, 1 (1966) 173; Ridsdale, *Blumea* 24(2) (1979 [‘1978’]) 333; Corner, *Wayside Trees Malaya*, ed. 3, 2 (1988) 624; Puff et al., *Rubiaceae Thailand* (2005) 48, pl. 3.1.2.

Trees. **Stipules** triangular, entire, obvolutely clasping the terminal bud. **Leaves** opposite; lamina elliptic to obovate, subcoriaceous, glabrous; petiolate or sessile. **Inflorescences** terminal, globose solitary heads of flowers, without interfloral bracteoles. **Flowers** bisexual, 5-merous; hypanthia free; calyx infundibular; corolla salverform, the lobes imbricate in the bud; anthers basifixed; ovary 2-locular in lower part and 2- or 4-locular in upper part due to the appearance of a false septum; style exerted, stigma spindle-shaped; ovules many, pendulous. **Fruits** in a globose head; free, individually with an obconical lower part and an ellipsoid upper part, indehiscent, capped by the persistent calyx. **Seeds** trigonal to polygonal, not winged.

Distribution. A genus of 2 species in India, continental Southeast Asia, western Malesia, Sulawesi, Moluccas and New Guinea. In Singapore 1 species, the native status of which is uncertain.

Taxonomy. The type species of the genus, *Neolamarckia cadamba*, was previously but incorrectly widely known as *Anthocephalus chinensis* (Lam.) A.Rich. ex Walp., which is the type species of *Anthocephalus* A.Rich. Bosser (*Bull. Mus. Natl. Hist. Nat.*, B, *Adansonia* 6(3) (1985 [‘1984’]) 247), contended that *Anthocephalus chinensis* originally referred to a Mauritian plant, correctly called *Breonia chinensis* (Lam.) Capuron. Consequently, *Anthocephalus* A.Rich. became a synonym of *Breonia* A.Rich. ex DC. The species in the Malay Peninsula was thus referred to a new generic name with an appropriate type.

Neolamarckia cadamba (Roxb.) Bosser

(from *kadam*, an Indian vernacular name)

Bull. Mus. Natl. Hist. Nat., B, *Adansonia* 6(3) (1985 [‘1984’]) 247; Wong, *Arbor. Rubiac. Malaya* (1988) 136; Wong, *Tree Fl. Malaya* 4 (1989) 381; Turner, *Gard. Bull. Singapore* 47 (1997 [‘1995’]) 436; Chong et al., *Checkl. Vasc. Pl. Fl. Singapore* (2009) 63, 175, 251. **Basionym:** *Nauclea cadamba* Roxb., *Fl. Ind.* 2 (1824) 121. **Synonym:** *Anthocephalus cadamba* (Roxb.) Miq., *Fl. Ned. Ind.* 2, fasc. 1 (1856) 135; Burkill, *Dict. Econ. Prod. Malay Penins.*, ed. 2, 1 (1966) 173. **Type:** Not traced (see Ridsdale, *Blumea* 24(2) (1979 [‘1978’]) 334). **Fig. 54.**



Figure 54. *Neolamarckia cadamba* (Roxb.) Bosser. Typical habit with very upright (orthotropic) stems, opposite and decussate branches on the stem, and distichously arranged leaf pairs on the branches. (From Sabah. Photo: K.M. Wong).

Anthocephalus indicus auct. non A.Rich.: King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’]) 122; Ridley, Fl. Malay Penins. 2 (1923) 8.

Anthocephalus chinensis auct. non (Lam.) A.Rich. ex Walp.: Ridsdale, Blumea 24(2) (1979 [‘1978’]) 333; Corner, Wayside Trees Malaya, ed. 3, 2 (1988) 624; Puff et al., Rubiac. Thailand (2005) 48, pl. 3.1.2.

Medium-sized to large trees to 40 m tall, main branches horizontal and somewhat arranged in tiers; trunk straight, columnar, sometimes with steep buttresses to 2 m tall; bark smooth becoming fissured to cracking and scaly, grey-brown to dark brown. **Stipules** narrowly triangular, 1–2 cm long, entire, obvolvately clasping the terminal bud, each with 2 lateral keels, caducous. **Leaves:** lamina elliptic to obovate, 12–28 × 5–16 cm, apex pointed, base obtuse to rounded or cordate, subcoriaceous, glabrous, secondary veins 11–17 pairs, tertiary veins fine, ladder-like between the secondary veins; petioles (1–)2.5–3.5(–5) cm long. **Inflorescences** with peduncles 1.5–4 cm long, with 1–3 nodes bearing highly reduced bracts; flowering head globose, bearing densely crowded flowers, 2–2.5 cm across calyces, 3–4 cm across corollas, without interfloral bracteoles. **Flowers** subsessile; calyx infundibular, the tube 2–3 mm long, the lobes linear-spathulate, each 1.5–2 mm long and pale hairy at the apex; corolla salver-shaped, yellow, the tube 5–7 mm long, glabrous, the lobes narrowly triangular, 2–2.5 mm long, scantily hairy outside; anthers inserted in the upper part of and protruding from the corolla throat, 1.5–2 mm long; style exserted for 5–7 mm; stigma spindle-shaped, entire, 3–5 mm long; ovary 2-locular in lower part and 4-locular in upper part due to the appearance of a false septum; ovules many, pendulous. **Fruits** in globose heads 2–4 cm across, orange; individual fruits with an obconical lower part and an ellipsoid upper part, 2.5–3 mm long, 1.5–2.5 mm wide, indehiscent, capped by the persistent calyx. **Seeds** trigonal, c. 0.2 mm across, not winged.

Distribution. As for the genus. In Singapore it is recorded from open space at CTE/PIE intersection (*Queck s.n.*, 1 Sep 1999, SING [SING0037553]), Jurong East Street 21, in front of Block 227 (*Gwee SING2009-428*, 29 Sep 2009, SING [SING0138005]) and without locality (*Cantley’s collector s.n.*, SING [SING0037534]). Keng (Concise Fl. Singapore, vol. 1, Gymn. Dicot. 1990) did not include this species. As there were no definite Singapore collections, Turner (Gard. Bull. Singapore 47 (1997 [‘1995’]) 436) documented this as occurring from ‘Johore northwards’.

Ecology. Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 63, 175, 251) listed this species as only in cultivation in Singapore. This may seem doubtful as the species is found throughout Peninsular Malaysia. It is, however, a pioneer or early secondary forest species which prefers open sites or disturbed forest patches with clearings and may have been overlooked in Singapore as the forests became ever more managed. Moreover, its ecology seems more suited to that of a pioneer tree which is relatively short-lived at a site but which is succeeded by seedling establishment at different sites with suitably open conditions, especially given its wind-dispersal. Alternatively, the 1999 and 2009 collections above may represent early naturalisation from originally planted specimens, but the older Cantley collection (with a ‘Flora of Singapore’ label but of unclear provenance and uncertainty about whether it was collected in Singapore at all – see Volume 1) would seem to negate this idea. The species (then as *Anthocephalus chinensis*) was not listed in Anderson (Bot. Gard. Singapore Index Pl., 1912) but was catalogued (under *Neolamarckia cadamba*) by Tay et al. (Checkl. Cult. Pl. Singapore Bot. Gard. (1995) 70) and by Turner (Pl. Singapore Bot. Gard. (2000) 82).

Provisional conservation assessment. Globally not assessed. Assessed here as Data Deficient (DD) in Singapore for the reasons discussed above.

Uses. Since the 1930s, there has been intermittent interest in this species as a fast-growing plantation tree; however, due to its apparently uneven growth performance attributed to possible sensitivity to soil moisture, there has not been much progress. Instead, its congener, *Neolamarckia macrophylla* (Roxb.) Bosser, has recently become a new focus in plantation forestry in Borneo and elsewhere.

Notes. The measurements above are those documented for the species in the Malay Peninsula generally, as there are but few collections from Singapore.

34. NEONAUCLEA Merr.

(Greek, *neo-* = new; derived from the genus name *Nauclea* L.)

Mengkal (Malay)

J. Wash. Acad. Sci. 5 (1915) 538; Bakhuizen van den Brink, Taxon 19 (1970) 476; Ridsdale, Blumea 24(2) (1979 [‘1978’]) 337; Ridsdale, Blumea 34(1) (1989) 184; Wong, Arbor. Rubiac. Malaya (1988) 138; Wong, Tree Fl. Malaya 4 (1989) 382; Puff et al., Rubiac. Thailand (2005) 54, pl. 3.1.5; Seah & Wong, Gard. Bull. Singapore 70 (2018) 289. **Type:** *Neonauclea obtusa* (Blume) Merr., lectotype designated by Bakhuizen van den Brink, Taxon 19 (1970) 476.

Nauclea auct. non L.: King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’]) 122, p.p.; Ridley, Fl. Malay Penins. 2 (1923) 9, p.p.

Trees or shrubs. **Stipules** ovate, elliptic to obovate, often with a rounded apex, adpressed together to form a strongly flattened structure enclosing the vegetative terminal bud, soon falling away or semi-persistent. **Inflorescences** globose flowering heads, typically 1–3, rarely 5–7 together at shoot tips; peduncle slender or stout, distally swollen, with a node bearing a pair of conspicuous bracts that surround the young flowering head at first and separate later, the node eventually remaining as a distinct scar just below the peduncular swelling. **Flowers** bisexual, 5-merous; receptacles usually hairy; hypanthia not fused laterally; calyx lobes with a deciduous apical portion and a persistent to semi-persistent shaft, shafts sometimes fused basally as a short tube or free, apical portion obovate to spatuloid or somewhat clavate, the whole at first longer than the immature corolla, later breaking with corolla elongation variously at the shaft or just below the apical portion; corolla hypocrateriform to narrowly infundibular; corolla lobes imbricate in the bud; anthers basifixed, inserted on short filaments at the upper part of the corolla tube and partially or conspicuously protruding from it; style exserted; stigma globose to obovoid; ovary 2-locular; placentas attached to the upper third of the septum; ovules many in each locule. **Infructescences** globose heads of loose dehiscent fruits; fruits with a hard endocarp, dehiscent septically and loculicidally into 4 from base to apex, the septum at first persistent as a central axis but later also detaching from the receptacle. **Seeds** ellipsoid, somewhat bilaterally compressed, shortly winged at both ends.

Distribution. About 80 species from India through South China and continental Southeast Asia to Malasia. In Singapore 2 native species, 1 endemic.

Ecology. A mainly lowland forest genus.

Uses. The timbers of *Neonauclea* and *Ochreinauclea* Ridsdale & Bakh.f. share the name *bangkal* (Malay) with that of *Nauclea* L. (see there).

Notes. Keng (Concise Fl. Singapore, vol. 1, Gymn. Dicot., 1990) did not record this genus. Turner (Gard. Bull. Singapore 45 (1993) 201), Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 63, 175, 195) recorded *Neonauclea pallida* (Reinw. ex Havil.) Bakh.f. subsp. *malaccensis* (Gand.) Ridsdale which does not occur in Singapore and which we interpret as *N. excelsa* here.

Key to *Neonauclea* species

1. Leaves elliptic to obovate, (5.5–)10–26.2 × (3–)5.6–13 cm; flowering heads 15–17 mm (across calyces) and 30–40 mm (across corollas) **1. *N. excelsa***
Leaves narrowly elliptic, 6–8.5 × 2.5–3.5 cm; flowering heads 6 mm (across calyces) and 13–17 mm (across corollas) **2. *N. kranjiensis***

1. *Neonauclea excelsa* (Blume) Merr.

(Latin, *excelsus* = lofty, high; perhaps referring to the size of the tree)

J. Wash. Acad. Sci. 5 (1915) 539; Ridsdale, Blumea 34(1) (1989) 196; Wong, Arbor. Rubiac. Malaya (1988) 139; Wong, Tree Fl. Malaya 4 (1989) 382; Seah & Wong, Gard. Bull. Singapore 70 (2018) 289. **Basionym:** *Nauclea excelsa* Blume, Bijdr. Fl. Ned. Ind., pt 16 (1826–1827) 1009. **Type:** *Blume s.n.*, Indonesia, Java (lectotype U [U0226663], designated by Seah & Wong, Gard. Bull. Singapore 70 (2018) 289; isolectotypes U [U0226661, U0226662]).

Neonauclea peduncularis (Wall. ex G.Don) Merr., J. Wash. Acad. Sci. 5 (1915) 541; Ridley, Fl. Malay Penins. 5 (1925) 314; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1567. **Basionym:** *Nauclea peduncularis* Wall. ex G.Don, Gen. Hist. 3 (1834) 469. **Synonym:** *Bancales peduncularis* (Wall. ex G.Don) Kuntze, Revis. Gen. Pl. 1 (1891) 276. **Type:** *Porter s.n.* [EIC 6091], [Malaysia], Penang (holotype K-W [K001122992]).

Nauclea purpurascens auct. non Korth.: Ridley, Fl. Malay Penins. 2 (1923) 9.

Neonauclea calycina auct. non (Bartl. ex DC.) Merr.: Ridsdale, Blumea 34(1) (1989) 200, p.p.

Neonauclea pallida (Reinw. ex Havil.) Bakh.f. subsp. *malaccensis* auct. non (Gand.) Ridsdale: Turner, Gard. Bull. Singapore 45 (1993) 201; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 63, 175, 195.

Tree. **Stipules** obovate, to c. 1 × 0.4 cm. **Leaves:** lamina elliptic to obovate, (5.5–)10–26.2 × (3–)5.6–13 cm, apex acute to cuspidate, base cuneate to obtuse, chartaceous to subcoriaceous,

more or less glabrous on both surfaces; midrib sunken above, raised below, secondary veins 7–8(–9), flat to slightly raised above, distinctly raised below, without domatia in their axils on the lower leaf surface, tertiary veins reticulate, indistinct; petioles (5–)10–27 mm long. **Flowering heads** 1–3, terminal, each measuring 15–17 mm (across calyces) and 30–40 mm (across corollas); peduncles (28–)39–60(–70) mm long; receptacles sparsely hairy; interfloral bracteoles absent; hypanthia c. 1 mm long, glabrous; calyx lobes with a deciduous apical portion and a sub-persistent shaft that remains until the fruiting stages, shafts basally free, hairy, apical portion obturbinate, c. 1 mm long, ochre-coloured, papillate, detaching in a mass from the tops or variously along the length of the calyx shafts leaving irregular fragments; corolla funnel-shaped, c. 8 mm long; corolla lobes 1–1.5 mm long, with scattered hairs or glabrescent; anthers c. 1 mm long; style exserted; stigma ovoid. **Fruiting heads** 15–18 mm diam.

Distribution. Myanmar, Andaman Islands, Cambodia, Thailand and Malesia. In Singapore known only from Bukit Timah Road (*Ridley 10797*, 20 Apr 1900, K [K001129435, K001129436, K001129437]; *Ridley s.n.* 1899, K [K001129439]) and Chan Chu Kang (*Ridley 6831*, 1895, K [K001129438]).

Ecology. Lowland forest.

Provisional conservation assessment. Globally not assessed. Listed (under *Neonauclea pallida* subsp. *malaccensis*) as Nationally Extinct in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 63, 175, 195).

Taxonomy. Malayan, Javan and some Bornean specimens previously identified by Ridsdale (Blumea 34(1) (1989) 200) as either *Neonauclea excelsa* or *Neonauclea calycina* (DC.) Merr. are the same species with variable pubescence of the corolla lobes. The name *Neonauclea calycina* is considered to have been misapplied to these provenances and should be restricted to Philippine material (Seah & Wong, Gard. Bull. Singapore 70 (2018) 289–294).

2. *Neonauclea kranjiensis* K.M.Wong & W.W.Seah

(Kranji in Singapore, type locality of the species)

Gard. Bull. Singapore 70 (2018) 289. **Synonym:** *Neonauclea* sp. 2, Wong Tree Fl. Malaya 4 (1989) 383; Turner, Gard. Bull. Singapore 45 (1993) 201; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed 2 (2008) 240. **Type:** *Ridley 6511*, Singapore, Kranji, 1894 (holotype SING [SING0251857]). **Fig. 55.**

Sarcocephalus subditus auct. non (Korth.) Miq.: Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 90; Ridley, Fl. Malay Penins. 2 (1923) 8.

Nauclea subdita auct. non (Korth.) Steud.: Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 159; Turner, Gard. Bull. Singapore 45 (1993) 201; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 63, 175, 195.

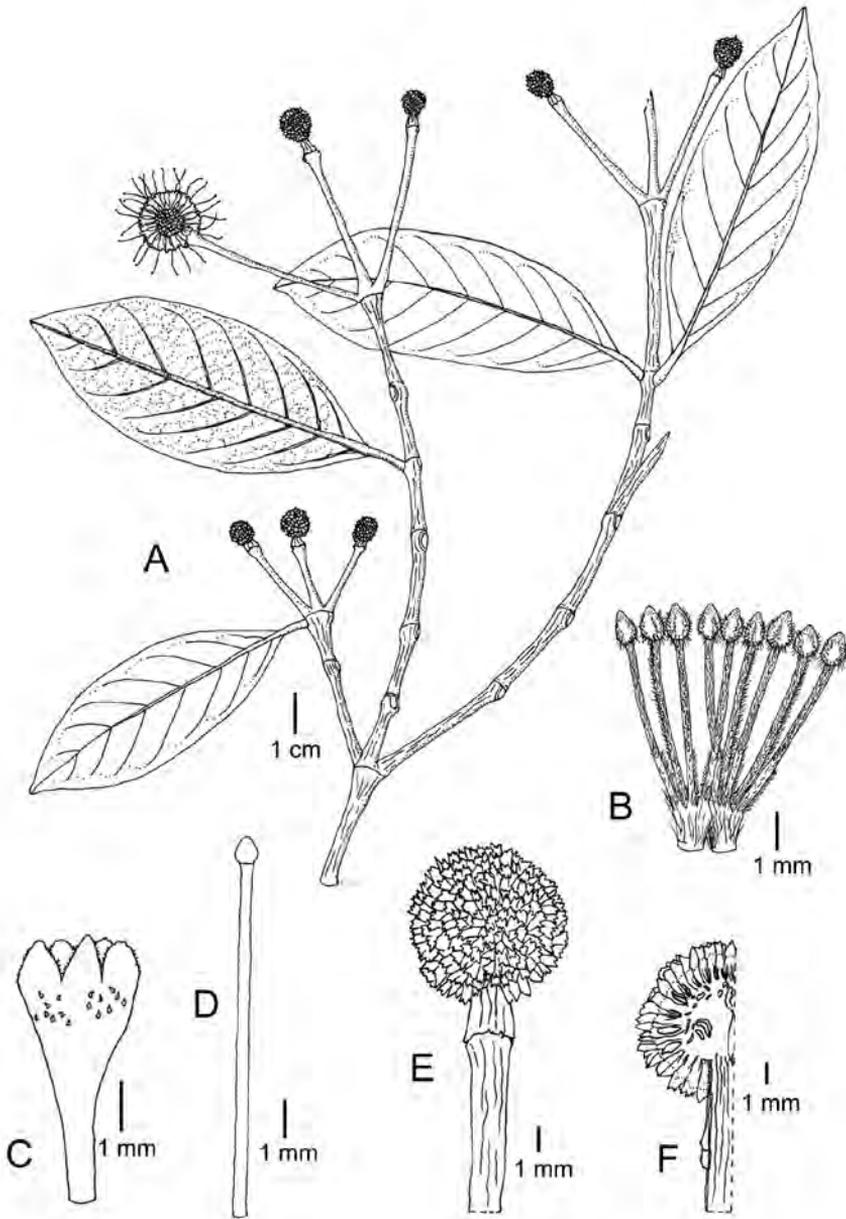


Figure 55. *Neonauclea kranjiensis* K.M.Wong & W.W.Seah. **A.** Flowering and fruiting leafy branch. **B.** Two flowers with reconstructed calyx shafts and laterally free hypanthia. **C.** Corolla showing sparse pubescence. **D.** Style with ovoid stigma. **E.** Fruiting head with individual fruitlets tightly packed together but not laterally fused. **F.** Longitudinal section of fruiting head showing individual (free) fruitlets on a hairy receptacle. (From Singapore, Kranji, *Ridley 6511*. Drawn by E. Tay and reproduced with permission of Gardens' Bulletin Singapore).

Tree. **Stipules** unknown. **Leaves:** lamina narrowly elliptic, 6–8.5 × 2.5–3.5 cm, chartaceous to subcoriaceous, more or less glabrous on both surfaces, secondary veins 7–8, flat to slightly raised above, distinctly raised below, often with glabrous to sparsely hairy domatia in their axils on the lower leaf surface, tertiary veins reticulate, indistinct, apex acute to broadly acuminate, mid rib sunken above, raised below, base cuneate; petioles 5–10 mm long. **Flowering heads** typically in groups of 3, terminal, each measuring 6 mm (across calyces) and 13–17 mm (across corollas); peduncles 15–40 mm long; receptacles densely hairy; interfloral bracteoles absent; hypanthia 1 mm, sparsely hairy; calyx lobes with a deciduous apical portion and a persistent shaft that remains until the fruiting stages, shafts basally free, densely hairy, apical portion obturbinate, 0.7–1 mm, ochre-coloured, papillate, detaching in a mass from the tops or variously along the length of the calyx shafts leaving irregular fragments; corolla funnel-shaped, 4–5.5 mm long; corolla lobes 1–1.5 mm long, with scattered hairs; anthers not seen; style exserted; stigma ovoid. **Fruiting heads** unknown.

Distribution. Apparently only known from Singapore, where it is represented by a single collection from Kranji (*Ridley 6511*, 1894, SING [SING0251857]).

Ecology. The likely habitat for this species would have been freshwater swamp forest or slightly brackish water habitat as these were known to occur in the Kranji area.

Provisional conservation assessment. In Singapore presumed Nationally Extinct and consequently globally extinct.

Notes. Keng (Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 159) reported *Nauclea subdita* (Korth.) Steud. at Bukit Timah but did not cite any specimens and this species is not otherwise known in Singapore. As indicated above, this name has been misapplied by several authors to *Neonauclea kranjiensis* but given the likely habitat of this species (freshwater swamp forest or slightly brackish water habitat) it seems unlikely that it was ever present at Bukit Timah.

35. OCHREINAUCLEA Ridsdale & Bakh.f.

(Greek, *ochrei-* = pale yellow; allied to the genus *Nauclea* L.)

Mengkal (Malay)

Blumea 24(2) (1979 [‘1978’]) 331; Wong, Arbor. Rubiac. Malaya (1988) 144; Wong, Tree Fl. Malaya 4 (1989) 385. **Type:** *Ochreinauclea maingayi* (Hook.f.) Ridsdale.

Sarcocephalus auct. non Afzel. ex R.Br.: King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’]) 119; Ridley, Fl. Malay Penins. 2 (1923) 7.

Medium to large trees. **Stipules** narrowly triangular, obvolute, overlapping around the conical to pyramidal vegetative terminal bud, (semi-)persistent. **Leaves** opposite or more rarely in whorls of threes. **Inflorescences** flowering heads, solitary, terminal; peduncle stout, not distally swollen, with 1–2 nodes with much reduced (sometimes bract-like) leaves and stipules that do not enclose the young flowering heads. **Flowers** bisexual, 5-merous; hypanthia laterally fused

at the apices; calyx lobes oblong to trigonal, persistent; corolla hypocrateriform; corolla lobes ovate-elliptic, imbricate; anthers basifixed, inserted on short filaments at the upper part of the corolla tube and conspicuously protruding from it; style exserted; stigma spindle-shaped; ovary 2-locular; placentas attached to the middle of the septum; ovules many in each locule. **Infructescences** subconical heads composed of partially fused fruits, slowly disintegrating into semi-free fruit portions. **Seeds** elliptic, bilaterally compressed, short-winged at each end.

Distribution. A genus of 2 species, one in India, the other found in the Malay Peninsula (including Peninsular Thailand, Peninsular Malaysia and Singapore), Sumatra and Borneo. In Singapore 1 native species.

Uses. The timbers of *Ochreinauclea* and *Neonauclea* Merr. share the Malay name *bangkal* with *Nauclea* L.

Taxonomy. In a molecular study investigating generic delimitations within the Naucleaceae by Löfstrand et al. (Syst. Bot. 39 (2014) 304–315), *Neonauclea* Merr. was recovered as paraphyletic with respect to *Ludekia* Ridsdale, *Myrmeconuclea* Merr. and *Ochreinauclea*. Earlier, Ridsdale (Blumea 24(2) (1979 [‘1978’]) 307–366) had considered *Ochreinauclea* to be closely related to *Nauclea* L. because of its spindle-shaped stigmas, but that is not the case (the latter is in a different clade with *Neolamarckia* Bosser and *Sarcocephalus* Afzel. ex R.Br.). For the moment, *Ochreinauclea* is maintained as distinct pending better resolution of its relationships.

***Ochreinauclea maingayi* (Hook.f.) Ridsdale**

(Alexander Carroll Maingay, 1836–1869, British surgeon, botanist
and magistrate in Malacca, Peninsular Malaysia)

Blumea 24(2) (1979 [‘1978’]) 332; Wong, Arbor. Rubiac. Malaya (1988) 144; Wong, Tree Fl. Malaya 4 (1989) 385; Turner, Gard. Bull. Singapore 45 (1993) 201; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 437; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 64, 175, 196. **Basionym:** *Nauclea maingayi* Hook.f., Fl. Brit. India 3, fasc. 7 (1880) 27; Ridley, Fl. Malay Penins. 5 (1925) 313; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1562; Corner, Wayside Trees Malaya, ed. 3, 2 (1988) 643. **Synonyms:** *Bancalus maingayi* (Hook.f.) Kuntze, Revis. Gen. Pl. 1 (1891) 276. – *Sarcocephalus maingayi* (Hook.f.) Havil., J. Linn. Soc., Bot. 33 (1897) 33; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 90; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’]) 120; Ridley, Fl. Malay Penins. 2 (1923) 7. **Type:** *Maingay* 1288 [Kew Distribution 823], [Malaysia], Malacca (lectotype K [K000729834], designated by Ridsdale, Blumea 24(2) (1979 [‘1978’]) 332).

Medium to large tree, to 25 m tall, 2 m girth. **Bark** smooth to lenticellate, grey-brown. **Stipules** narrowly triangular, overlapping around the conical to pyramidal vegetative terminal bud, each with 2 lateral keels. **Leaves:** lamina ovate, 10.5–19 × 4.5–9 cm, apex acute, base cuneate to obtuse, chartaceous to subcoriaceous, often drying blackish above, brownish below, glabrous on upper surface, glabrous to pubescent on lower surface, especially on the midrib and secondary veins, midrib sunken above, prominently raised below, secondary veins 8–13

pairs, slightly sunken above, raised below, usually with densely hairy domatia in their axils on the lower leaf surface, tertiary veins reticulate, sometimes indistinct; petioles (10–)15–25 mm long. **Flowering heads** solitary, terminal, each 25–30 mm diam. (across corollas); calyx cups fused at the apices; calyx lobes velvety hairy; corolla trumpet-shaped, 6–10 mm long, corolla lobes 5, ovate, 1–2 mm long, hairy; stigma protruding from the corolla tube. **Fruiting heads** 25–55 mm diam., with conspicuously velvety hairy persistent calyx lobes. **Seeds** 1–2 mm long, flattened, elliptic, short-winged at each end.

Distribution. As for the genus. In Singapore it is represented by one specimen collected from an unspecified locality (*Cantley s.n.*, SING [SING0012122]). However, even though questions often arise as to the correct locality of Cantley collections, Ridley (J. Straits Branch Roy. Asiat. Soc. 33 (1900) 90) mentioned Bukit Timah Road as the locality when he listed the species.

Ecology. Across its range the species is only known from lowland and swamp forest.

Provisional conservation assessment. Globally not assessed. In Singapore presumed Nationally Extinct.

Notes. The description above largely applies to the species as known for the Malay Peninsula in general, as there is but a single fruiting collection for Singapore.

36. OPHIORRHIZA L.

(Greek, *ophio*- = snake, *-rhiza* = root;

from the use of the plant in Sri Lanka for treating snakebites)

Sp. Pl. 1 (1753) 150; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’]) 171; Ridley, Fl. Malay Penins. 2 (1923) 35; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1610; Darwin, *Lyonia* 1(2) (1976) 47; Wong, Arbor. Rubiac. Malaya (1988) 12 (in clavi); Wong, Tree Fl. Malaya 4 (1989) 328 (in clavi); Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 159; Puff et al., Rubiac. Thailand (2005) 190, pl. 3.4.8. **Type:** *Ophiorrhiza mungos* L., lectotype designated by Hitchcock, Nom. Prop. Brit. Bot. (1929) 129.

Ground herbs or more rarely shrubs. **Stipules** variously triangular, ovate, setaceous and undivided, or divided into 2 or more linear lobes. **Leaves** sometimes anisophyllous; lamina mostly ovate to obovate, base usually decurrent on the petiole to some extent. **Inflorescences** terminal, less commonly axillary, helicoid cymes, the branches sometimes apparently dichotomous because they emerge at different levels. **Flowers** arranged secundly on cyme branches, bisexual, uncommonly heterostylous, 5-merous; calyx lobes free or basally fused; corolla tubular, infundibular or hypocrateriform, outside puberulent to glabrous, inside puberulent to glabrous, mostly white, sometimes pink, purple, red or yellow; anthers included or rarely exserted; ovary small, subglobose, mostly ribbed, disk 2-lobed, locules 2, ovules numerous; style filiform, stigma clavate to capitate, 2-lobed. **Fruits** dry coriaceous, loculicidally dehiscent capsules, laterally compressed and broader than long, cordate, obreniform or subtriangular, very rarely subglobose. **Seeds** numerous per locule, dry, rhomboid, smooth.

Distribution. A genus of about 300 species from Sri Lanka and India to China, Japan, Micronesia, Malesia, Queensland and Fiji to the Society Islands. In Singapore 1 native species.

Ecology. There are fewer species in the lowlands than in mid-elevation and montane forests. Most species prefer much shaded, moist environments although the genus is also represented in strand vegetation.

Ophiorrhiza singaporensis Ridl.

(of Singapore)

J. Straits Branch Roy. Asiat. Soc. 61 (1912) 17; Ridley, Fl. Malay Penins. 2 (1923) 39; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1612; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 159; Turner, Gard. Bull. Singapore 45 (1993) 201; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 438; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 65, 176, 196. **Type:** *Hullett 335*, Singapore, Bukit Timah, 1883 (lectotype SING [SING0030403], designated by Turner et al., Gard. Bull. Singapore 70 (2018) 364). **Fig. 56.**

Ophiorrhiza harrisiana auct. non B. Heyne ex Hook.f.: Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 93.

Herb to about 30 cm high, stems densely hairy. **Stipules** setaceous and undivided, hairy (2.5–)4–5 mm long, or sometimes divided into 2–4 linear lobes. **Leaves:** lamina elliptic to lanceolate, (1.8–)6–9(–15) × (0.5–)3–5(–7) cm, members of a pair sometimes conspicuously anisophyllous, apex acuminate, base cuneate and decurrent on the petiole to some extent, membranaceous to chartaceous, upper surface drying dark brown, sparsely hairy to glabrescent, lower surface drying pale greenish brown, with sparse spreading hairs especially on the midrib and veins, secondary veins (6–)8–13(–15) pairs, plane on the upper leaf surface, plane to very slightly prominent on the lower; petioles (3–)8–22(–30) mm long, densely hairy. **Inflorescence** axes hairy; peduncle (8–)10–14(–26) mm long, the branches sometimes apparently dichotomous because they emerge at different levels, (8–)10–15(–25) mm long; pedicels 1–1.5 mm long. **Flowers** arranged secundly on cyme branches, bisexual, uncommonly heterostylous, 5-merous; calyx tube infundibular, 1–1.5 mm long, lobes triangular, c. 0.5 mm long; corolla tubular, c. 4–6 mm long, outside puberulent, lobes ovate to elliptic, c. 2–3 mm long, white; filaments c. 1 mm long, anthers 1.5–2 mm long, included; ovary subglobose; style filiform, stigma clavate, 2-lobed; disk 2-lobed. **Fruits** dry coriaceous, loculicidally dehiscent capsules, laterally compressed and broader than long, cordate, 2.5–3 × 3.5–4.5(–5) mm when mature, hairy. **Seeds** tiny, rhomboid.

Distribution. This is a species of lowland forests in the southern part of the Malay Peninsula (Perak, Negri Sembilan, Johor and Singapore). In Singapore it has been recorded from Jurong, Choa Chu Kang, Kranji (*Ridley s.n.*, 1894, SING [SING0180015]), Nee Soon (*Lee et al. SING2005-04*, 24 Jan 2005, SING [SING0058110]; *Austin SING2012-281*, 19 Jun 2012, SING [SING0175630]), Bukit Mandai, Bukit Timah (*Leong-Škorničková et al. SING2015-102*, 6 Apr 2015, SING [SING0213870, SING0213871]; and also the lectotype above), Changi and Pulau Ubin (*Hullett 424*, 5 Mar 1885, SING [SING0030393]).

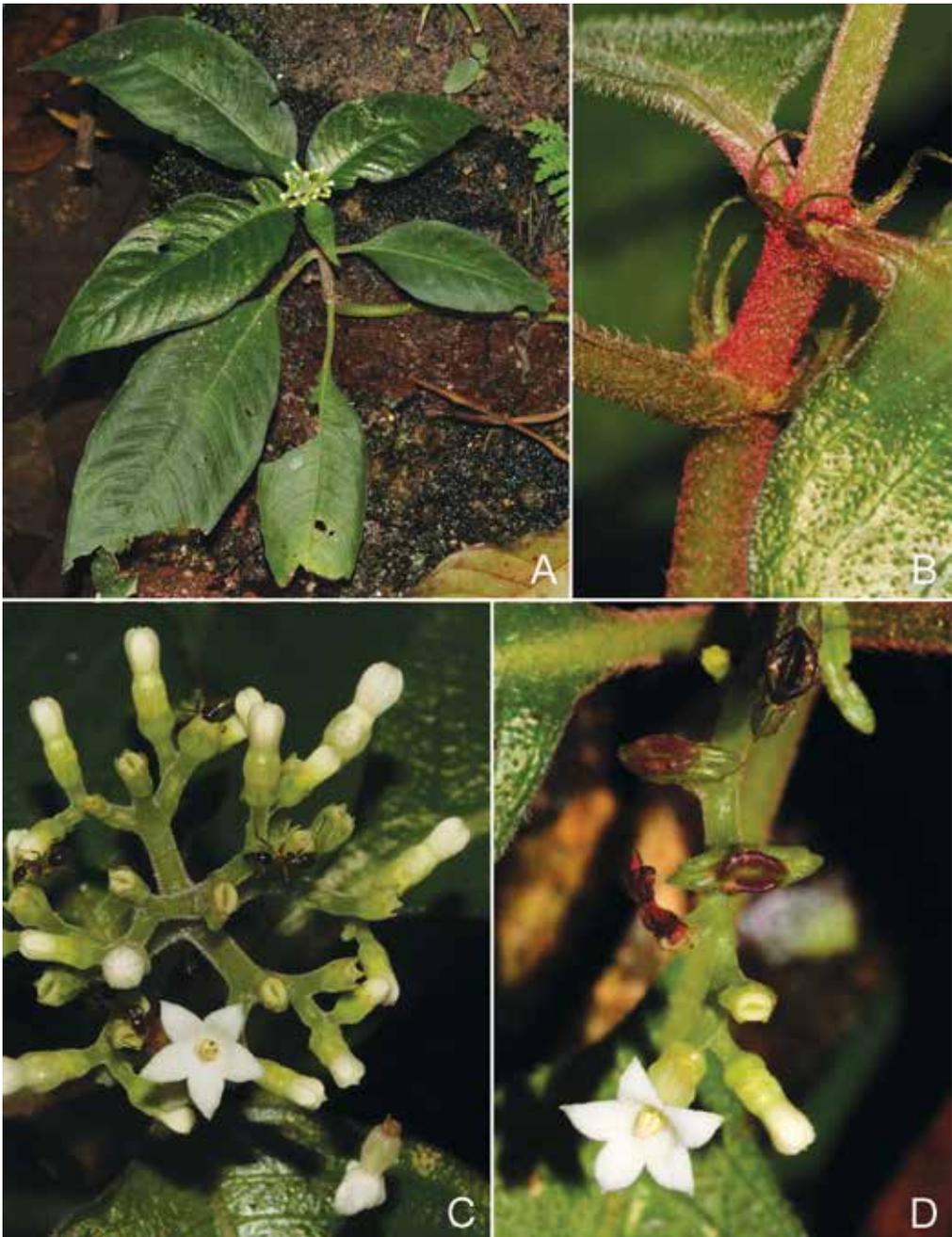


Figure 56. *Ophiorrhiza singaporensis* Ridl. **A.** Habit. **B.** Detail of red hairy stems with setaceous stipules at the nodes. **C.** Inflorescence, from above. **D.** Open flower and laterally compressed fruit capsules. (From Singapore, Bukit Timah Nature Reserve. Photos: X.Y. Ng).

Ecology. Lowland forest.

Provisional conservation assessment. Globally not assessed. The listing of this species as Nationally Extinct in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 65, 176, 196) was an error (see Chong et al., Biodivers. Conserv. 21 (2012) 2589). It is assessed here as Vulnerable (VU/D).

37. OXYCEROS Lour.

(Greek, *oxy-* = sharp, *-ceros* = horn; referring to the spines)

Fl. Cochinch. 1 (1790) 151; Wong, Malayan Nat. J. 38 (1984) 34; Wong, Arbor. Rubiac. Malaya (1988) 17 (in clavi); Wong, Tree Fl. Malaya 4 (1989) 331 (in clavi); Puff et al., Rubiac. Thailand (2005) 154, pl. 3.2.3; Ridsdale, Reinwardtia 12(4) (2008) 289. **Synonym:** *Randia* L. sect. *Oxyceros* (Lour.) DC., Prodr. 4 (1830) 385; Ridley, Fl. Malay Penins. 2 (1923) 70. **Type:** *Oxyceros horridus* Lour.

Randia auct. non L.: King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’]) 203; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 160.

Scrambling shrubs to large climbers; main branches typically ascending or horizontal, with paired subequal recurved axillary spines, or deflexed and with a pair of longer retrorse fang-like axillary spines at the first node and a single shorter recurved spine at the next node, or unarmed. **Stipules** broadly triangular to ovate. **Inflorescences** terminal, cymes or compound cymes. **Flowers** bisexual; calyx infundibular, lobes short; corolla salverform, glabrous outside, hairy inside at the upper part of the tube, lobes 5, overlapping to the left in the bud; anthers exserted; style exserted; ovary 2-locular, ovules numerous, placentation axile. **Fruits** subglobose to ellipsoid, wall thin. **Seeds** many, subellipsoid to polygonal.

Distribution. A genus of 12 species in India, Sri Lanka, continental Southeast Asia and Malesia. In Singapore 4 native species.

Key to *Oxyceros* species

1. Main branches deflexed and with a pair of longer retrorse fang-like axillary spines at the first node and a single shorter recurved spine at the next node 2
 Main branches typically ascending or horizontal, with subequal paired recurved axillary spines 3
2. Calyx 3–4(–5) mm long; corolla lobes (3–)4–5 mm broad; fruits 8–10 mm wide **1. O. bispinosus**
 Calyx 6–11 mm long; corolla lobes typically 8–12 mm broad (seldom narrower); fruits 14–19(–35) mm wide **2. O. drupaceus**

3. Leaves subcoriaceous, tertiary veins on lower surface indistinct; corolla lobes 3–5 mm wide (plants of mangroves, beaches or other coastal sites) **3. *O. longiflorus***
 Leaves chartaceous to subcoriaceous, tertiary veins on lower surface distinct and typically darker than lamina; corolla lobes 5–9 mm wide (plants of inland dryland forests)
 **4. *O. penangianus***

1. *Oxyceros bispinosus* (Griff.) Tirveng.

(Latin, *bi-* = two, *-spinosus* = spines; referring to the paired spines)

Nord. J. Bot. 3 (1983) 466; Ridsdale, Reinwardtia 12(4) (2008) 296. **Basionym:** *Stylocoryna bispinosa* Griff., Not. Pl. Asiat. 4 (1854) 260. **Synonym:** *Randia bispinosa* (Griff.) Craib, Fl. Siam. 2(1) (1932) 99. **Type:** *Griffith 869* (not traced; Ridsdale (Reinwardtia 12(4) (2008) 296) noted that there seems to be no type specimen of *Griffith 869* at Kew, only *Griffith 856*).

Stylocoryna junghuhniana Miq., Ann. Mus. Bot. Lugduno-Batavi 4, fasc. 8 (1869) 237. **Synonym:** *Randia junghuhniana* (Miq.) Bakh.f. in Backer, Bekn. Fl. Java 15 (1956) 89. **Type:** *Junghuhn s.n.*, [Indonesia], Java? (holotype L [L0057617]).

Randia uncaria Elmer, Leaf. Philipp. Bot. 1 (1906) 30; Merrill, Enum. Philipp. Fl. Pl. 2 (1923) 529; Merrill & Perry, J. Arnold Arbor. 25 (1944) 202. **Type:** *Elmer 7001*, Philippines, Luzon, Bataan, Mt Mariveles, November 1904 (lectotype K [K000763037], designated here; isolectotypes E [E00504413], NY [NY00133084]).

Randia fragrantissima Ridl., J. Straits Branch Roy. Asiat. Soc. 50 (1908) 115; Ridley, Fl. Malay Penins. 2 (1923) 75; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 160. **Synonym:** *Oxyceros fragrantissimus* (Ridl.) K.M.Wong, Malayan Nat. J. 38 (1984) 43; Turner, Gard. Bull. Singapore 45 (1993) 201; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 438; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240, as ‘*fragrantissima*’; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 65, 176, 217. **Type:** *Ridley 5664*, Singapore, Gardens’ Jungle [Singapore Botanic Gardens’ Rain Forest] (lectotype SING [SING0001133], designated by Wong, Malayan Nat. J. 38 (1984) 43).

Randia williamsii Elmer, Leaf. Philipp. Bot. 3 (1911) 1004. **Type:** *Elmer 12475* [erroneously given as 12474 in protologue], Philippines, Sibuyan, May 1909 (lectotype NY [NY00133085] designated here; isolectotype K [K000742977]).

Liana; main branches deflexed and with a pair of longer retrorse fang-like axillary spines at the first node and typically also a single shorter recurved spine at the next node. **Stipules** broadly triangular, 2–3 mm long, usually with a 1–2 mm long acumen. **Leaves:** lamina ovate to elliptic, 8–17(–23) × 3–7 cm, apex acute to acuminate, base broadly to narrowly cuneate, margin plane, subcoriaceous, glabrous on both surfaces, secondary veins (4–)7–9(–11) pairs, mostly plane or raised (seldom impressed) on upper surface, tertiary veins usually faint, domatia in axils of secondary veins glabrous; petioles 9–23 mm long. **Inflorescences** cymes with very short branches, up to 3 cm long. **Flowers** many crowded together in a cyme; calyx campanulate, 3–4 mm long, lobes short-triangular to lanceolate, 1–1.5 mm long, sparsely appressed-pubescent to glabrescent; corolla not known for Singapore material, elsewhere the tube (4–)15–32 mm long, glabrous, lobes elliptic (4–)9–12(–17) × (2–)4–5 mm, glabrous; filaments short, anthers

linear, 4–6 mm long; style exerted, c. 5 mm long, stigma clavate, bilobed. **Fruits** ellipsoid to ovoid, 10–12 × 8–10 mm.

Distribution. India, continental Southeast Asia, Malay Peninsula, Sumatra, Java, Borneo, Philippines, Sulawesi, New Guinea and the Aru Islands. In Singapore recorded from Mandai (*Yeo et al. SING2012-210*, 17 May 2012, SING [SING0182100]), Bukit Timah (*Ridley 13022*, 1908, SING [SING0001112]), MacRitchie (*Gwee SING2009-648*, 15 Dec 2009, SING [SING0138148]), Upper Seletar, Singapore Botanic Gardens' Rain Forest (*Ali Ibrahim et al. SING2017-001*, 4 Jan 2017, SING [SING0230819, SING0230820]), Changi and Pulau Tekong (*Ridley s.n.*, 1891, SING [SING0207034]).

Ecology: In lowland forest.

Provisional conservation assessment. Globally not assessed. Listed (under *Oxyceros fragrantissimus*) as Endangered (EN/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 65, 176, 217) but, with several recent collections, it is assessed here as Vulnerable (VU/D).

Taxonomy. We have excluded from the synonymy some names given by Ridsdale (*Reinwardtia* 12(4) (2008) 296) for this species. *Randia longiflora* Lam. var. *harmandiana* Pierre ex Pit. (Fl. Indo-Chine 3, fasc. 2 (1923) 235) (*Balansa* 2659, Tonkin, 7 April 1888, lectotype P [P00836431], designated here; isolectotype P [P00836432]) is excluded because its corolla tube is very short and hardly exceeds the calyx tube. Also excluded from the synonymy are *Randia curtisii* King & Gamble (J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 ['1903']) 208) (*Curtis* 3590, Pulau Pinang, Batu Ferengy, March 1901, lectotype SING [SING0001132]), first step designated by Wong, Malayan Nat. J. 38 (1984) 43, second step designated by Ridsdale, *Reinwardtia* 12(4) (2008) 296; isolectotype SING [SING0059552]), because that taxon's corolla tube is shorter, 4–7(–10) mm long, and the leaves have distinct tertiary venation, and *Randia incurva* Ridl. (J. Straits Branch Roy. Asiat. Soc. 79 (1918) 79) (*Curtis* 818, lectotype SING [SING0001134] designated here; isolectotypes SING [SING0059630, SING0059631]) (= *Oxyceros curtisii* (King & Gamble) K.M.Wong, not in Singapore). Otherwise, the circumscription of *Oxyceros bispinosus* largely follows Ridsdale (*Reinwardtia* 12(4) (2008) 296) in accepting a wide range of variation.

2. *Oxyceros drupaceus* (C.F.Gaertn.) Ridsdale

(Latin, *drupaceus* = drupe-like; referring to the fruits)

Reinwardtia 12(4) (2008) 296. **Basionym:** *Posoqueria drupacea* C.F.Gaertn., Suppl. Carp., fasc. 1(2) (1806) 77, t. 195: fig. [1]. **Synonym:** *Randia drupacea* DC., Prodr. 4 (1830) 389. **Type:** *Collector unknown s.n.*, [Indonesia], Java (holotype L ex *carpologica* 5390 [L0001756]). **Fig. 57.**

Tocoyena scandens Blume, Bijdr. Fl. Ned. Ind., pt 16 (1826–1827) 980. **Synonyms:** *Randia scandens* (Blume) DC., Prodr. 4 (1830) 387, nom. illeg. non (Thunb.) Lam. (1789); Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 161. – *Oxyceros scandens* (Blume) Tirveng., Nord. J. Bot. 3 (1983) 466;



Figure 57. *Oxyceros drupaceus* (C.F.Gaertn.) Ridsdale. **A.** Characteristic paired and deflexed spiny primary branches on the stem of a young plant. **B.** Open flowers. *Oxyceros longiflorus* (Lam.) T.Yamaz. **C.** Characteristic paired recurved spines at a branch node; note stipule. **D.** Open flowers. (From Singapore, A from MacRitchie; B from the Western Catchment; C, D cultivated in Pasir Panjang Nursery, originally from Labrador Nature Reserve. Photos: X.Y. Ng).

Wong, *Malayan Nat. J.* 38 (1984) 42; Turner, *Gard. Bull. Singapore* 45 (1993) 202; Turner, *Gard. Bull. Singapore* 47 (1997 [‘1995’]) 438; Tan et al. in Davison et al. (ed.), *Singapore Red Data Book*, ed. 2 (2008) 240; Chong et al., *Checkl. Vasc. Pl. Fl. Singapore* (2009) 65, 176, 196. **Type:** *Blume s.n.*, [Indonesia], Java (lectotype L [L0057578], designated by Wong, *Malayan Nat. J.* 38 (1984) 42; isolectotypes L [L0057579, L0057580, L0057581, L0057582; U0044119], P [P02274603, P02274604, P02274605]).

Gardenia curvata Teijsm. & Binn., *Natuurk. Tijdschr. Ned.-Indië* 3 (1852) 327. **Synonyms:** *Griffithia curvata* (Teijsm. & Binn.) Kurz, *J. Bot.* 4 (1875) 326. – *Randia curvata* (Teism. & Binn.) Valetton, *Icon. Bogor.* 2 (1904) t. 146; Backer & Bakhuizen van den Brink, *Fl. Java (Spermatoph.)* 2 (1965) 311. **Type:** Not traced.

Randia clarkei King & Gamble, *J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist.* 72(4) (1904 [‘1903’]) 213; Ridley, *Fl. Malay Penins.* 2 (1923) 72. **Type:** *Wallich s.n.* [EIC 8284D], [Penang or Singapore], 1849 (lectotype K [K000742992], designated by Wong, *Malayan Nat. J.* 38 (1984) 53; possible isolectotypes BM [BM000945250], P [P02141508]).

Liana; main branches deflexed and with a pair of longer retrorse fang-like axillary spines at the first node and typically also a single shorter recurved spine at the next node. **Stipules** triangular, 2–5 mm long. **Leaves:** lamina ovate to elliptic, 8–16.5 × 3.5–7.2 cm, subcoriaceous, glabrous on both surfaces, apex acute to cuspidate, base broadly cuneate, margin recurved in dried material, secondary veins (4–)6–7 pairs, mostly impressed on upper surface, tertiary nerves usually faint, domatia in axils of secondary veins glabrous; petioles 8–16 mm long. **Inflorescences** cymes, up to 1.5 cm long. **Flowers** few in a cyme; calyx campanulate, 6–11 mm long, lobes minutely denticulate, 0.5–1 mm long, glabrous except for minutely hairy lobe margins; corolla not known for Singapore material, elsewhere the tube (30–)35–50 mm long, glabrous, lobes elliptic (12–)15–25(–30) × (4–)8–10(–12) mm, glabrous; filaments short, anthers linear, 4–6 mm long; style exserted, c. 5 mm long; stigma clavate, bilobed. **Fruits** subglobose to ovoid, (14–)25–40 × 14–19(–35) mm.

Distribution. Andaman and Nicobar Islands, Malay Peninsula, Sumatra, Java and southern Borneo. In Singapore this species has been collected from Jurong (*Corner SFN 26180*, 19 Feb 1933, SING [SING0207033]), Mandai (*Gwee SING2010-894*, 9 Dec 2010, SING [SING0153625]) and Bukit Timah (*Ridley s.n.*, 5 Apr 1894, SING [SING0172369]).

Ecology: In lowland forest.

Provisional conservation assessment. Globally not assessed. Listed (under *Oxyceros scandens*) as Nationally Extinct in Singapore by Tan et al. (in Davison et al. (ed.), *Singapore Red Data Book*, ed. 2 (2008) 240) and Chong et al. (*Checkl. Vasc. Pl. Fl. Singapore* (2009) 65, 176, 196) but rediscovered in Mandai in 2010 and assessed here as Critically Endangered (CR/D).

3. *Oxyceros longiflorus* (Lam.) T. Yamaz.

(Latin, *longi-* = long, *-florus* = flower; referring to the conspicuous corolla tubes)

J. Jap. Bot. 45 (1970) 339; Wong, *Malayan Nat. J.* 38 (1984) 39; Ridsdale, *Reinwardtia* 12(4) (2008) 294; Turner, *Gard. Bull. Singapore* 45 (1993) 202; Turner, *Gard. Bull. Singapore* 47 (1997 [‘1995’]) 438;

Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240, as '*longiflora*'; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 65, 176, 223. **Basionym:** *Randia longiflora* Lam., Encycl. 3, fasc. 1 (1789) 26; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 94; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’]) 212; Ridley, Fl. Malay Penins. 2 (1923) 73; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 161. **Synonyms:** *Gardenia multiflora* Willd., Sp. Pl., ed. 4, 1(2) (1798) 1231, nom. illeg. superfl. – *Posoqueria multiflora* Blume, Bijdr. Fl. Ned. Ind., pt 16 (1826–1827) 980, nom. illeg. superfl. – *Randia multiflora* Koord. & Valetton, Meded. Lands Plantentuin 59 (1902) 88 [Bijdr. Boomsort. Java 8 (1902) 88]. **Type:** *Sonnerat s.n.*, [Indonesia], Java (holotype P-LA [P00308485]).

Griffithia palembanica Miq., Fl. Ned. Ind., Eerste Bijv., fasc. 3 (1861) 541. **Type:** *Junghuhn HB3703*, [Indonesia, Sumatra], Palembang, Meranjat (lectotype U [U0005899] designated here; isolectotype L [L0000985]).

Randia longiflora Lam. var. *ovoidea* Pit., Fl. Indo-Chine 3, fasc. 2 (1923) 235. **Type:** *Pierre 1091*, [Vietnam], Saigon, April 1871 (lectotype P [P02141505], designated here; isolectotype P [P02141506]).

Randia fasciculata auct. non DC.: Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 94.

Shrubby scrambler or slender liana. Main branches typically ascending or horizontal, with subequal paired recurved axillary spines. **Stipules** triangular, 2.5–5 mm long. **Leaves:** lamina ovate to elliptic, (2.4–)10–14 × (1.2–)5.5–7 cm, subcoriaceous, glabrous on both surfaces, apex acute to acuminate, base broadly cuneate, margin plane, secondary veins (4–)7–8 pairs, mostly plane on upper surface, tertiary nerves indistinct, domatia absent in axils of secondary veins; petioles 4–8(–10) mm long. **Inflorescences** cymes up to 1.5 cm long. **Flowers** few to many in a cyme; calyx campanulate, 3–5 mm long, lobes minutely denticulate, 0.5–1(–1.5) mm long, glabrous to puberulent; corolla tube (12–)17–25 mm long, glabrous, lobes elliptic (8–)10–14 × 3–5 mm, glabrous; filaments short, anthers linear, 3–4 mm long; style exserted, 2–5 mm long; stigma clavate, bilobed. **Fruits** subglobose to ellipsoid, 10 × 8–10 mm.

Distribution. Continental Southeast Asia, Malay Peninsula, Sumatra, Java, Lesser Sunda Islands and Borneo. In Singapore recorded from the Western Catchment, Sungei Buloh (*Goodenough 2415*, 16 Sep 1891, SING [SING0030419]), Changi, Coney Island, Labrador, Tanjung Irau (*Turner 99-105*, 21 Aug 1999, SING [SING0037307]), Pulau Ubin (*Ali Ibrahim et al. SING2011-284*, 27 Jul 2011, SING [SING0182039]), Pulau Tekong (*Samsuri et al. 179*, 6 Dec 2001, SING [SING0039855]) and Pulau Semakau (*Bazilah et al. SING2014-041*, 27 Feb 2014, BKF, E, K, L, SING [SING0231937]).

Ecology. In mangroves, beaches or other coastal sites.

Provisional conservation assessment. Globally not assessed. Listed as Vulnerable (VU/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 65, 176, 223).

Taxonomy. In his account of the Singapore flora, Ridley (J. Straits Branch Roy. Asiat. Soc. 33 (1900) 94) recorded *Randia fasciculata* DC. as a thorny shrub, common near the sea, giving Changi, Pasir Panjang, Balestier plain and Teluk Kurau as localities. Later, when Ridley (Fl. Malay Penins. 2 (1923) 73) reviewed his *Randia fasciculata*, he omitted mention of any

Singapore material. At both the Kew and Singapore herbaria, we have also not managed to trace Singapore material of this taxon, which was subsequently renamed *Fagerlindia fasciculata* (DC.) Tirveng. and then *Benkara fasciculata* (DC.) Ridsdale. We conclude that Ridley (1900) made a mistake in recording *Randia fasciculata* for Singapore and suspect he was referring to *Oxyceros longiflorus* (despite listing that separately under the name *Randia longiflora*) as we do not know of any other thorny Rubiaceae common near Singapore coastlines.

4. *Oxyceros penangianus* (King & Gamble) Tirveng.

(of Penang)

Nord. J. Bot. 3 (1983) 466; Wong, Malayan Nat. J. 38 (1984) 39; Turner, Gard. Bull. Singapore 45 (1993) 202; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 438; Ridsdale, Reinwardtia 12(4) (2008) 293; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 65, 176, 196. **Basionym:** *Randia penangiana* King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’]) 213; Ridley, Fl. Malay Penins. 2 (1923) 72; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 161. **Type:** *Curtis* 927, [Malaysia], Penang, Government Hill (lectotype SING [SING0001137], designated by Wong, Malayan Nat. J. 38 (1984) 39; isolectotypes CAL, K [K000742985, K000742986], P [P02141507], SING [SING0055870], US [US00955888]).

Canthium angulosum auct. non Wall.: Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 94.

Liana; main branches typically ascending or horizontal, with subequal paired recurved axillary spines. **Stipules** narrow-triangular, 2.5–3.5 mm long. **Leaves:** lamina broadly elliptic, (4–)5–9(–12) × (2–)4–6(–7) cm, chartaceous to subcoriaceous, glabrous to sparsely pubescent on the lower surface, apex cuspidate to short-caudate, base broadly to narrowly cuneate, margin plane, secondary veins (3–)4–5 pairs, mostly plane to raised or sometimes sunken on upper surface, tertiary nerves fine but distinct on lower surface, domatia in axils of secondary veins hairy; petioles 4–9 mm long. **Inflorescences** cymes, up to 1 cm long. **Flowers** few to many in a cyme; calyx campanulate, 6–9 mm long, lobes triangular, 1–2 mm long, glabrous; corolla tube (20–)24–33 mm long, glabrous, lobes broadly ovate 15–16 × 5–9 mm, glabrous except for densely hairy basal central part on the inner surface; filaments short, anthers linear, 4–6 mm long; style exserted, 2–4 mm long; stigma clavate, bilobed. **Fruits** subglobose, 10–12(–15) mm diam.

Distribution. Only known from Peninsular Malaysia and Singapore. In Singapore recorded from the Singapore Botanic Gardens’ Rain Forest (*Ahmed in Ridley* 1236, 1915, SING [SING0141757]; *Hullett* 93, 1884, SING [SING0001124]; *Ridley s.n.*, 4 Sep 1889, SING [SING0001125]; *Ridley s.n.*, Feb 1894, SING [SING0001123]) and from an unspecified locality (*Cantley* 266, SING [SING0012123]).

Ecology. Across its range in inland dryland lowland rain forests.

Provisional conservation assessment. Globally not assessed. In Singapore presumed Nationally Extinct.

38. PAEDERIA L.

(Greek, *paederos* = opal; referring to the opal-like translucency of fruits in some species)

Mant. Pl. 1 (1767) 7, 52; Richard, Mém. Rubiac. (1830) 114; Bentham & Hooker, Gen. Pl. 2(1) (1873) 25, 133; Hooker, Fl. Brit. India 3, fasc. 8 (1881) 195; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 95; Ridley, Fl. Malay Penins. 2 (1923) 173; Backer & Bakhuizen van den Brink, Fl. Java (Spermatoph.) 2 (1965) 346; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1648; Wong, Arbor. Rubiac. Malaya (1988) 8 (in clavi); Wong, Tree Fl. Malaya 4 (1989) 326 (in clavi); Puff, Opera Bot. Belg. 3 (1991) 207; Puff et al., Rubiac. Thailand (2005) 162, pl. 3.2.7. **Type:** *Paederia foetida* L.

Scrambling shrubs or climbers, bruised tissue with foetid smell. **Stipules** triangular to rounded, entire or bifid at the apex. **Leaves** decussate or in whorls of 3–4. **Inflorescences** axillary or terminal, thyrsoid, sometimes (not in Southeast Asia) with coloured bracts present, many- to few-flowered. **Flowers** (4–)5(–6)-merous, white to pinkish with a dark red to maroon centre; calyx mostly without a tubular base, lobes minute or long; corolla cylindric, infundibular or campanulate, often fenestrate at the base, outside glabrous, inside hairy at least at the throat, lobes valvate; anthers mostly included, inserted at different levels in the corolla tube, some or all exserted; ovary 2(–3)-locular, with a single erect anatropous ovule in each locule, disk conspicuous. **Fruits** subglobose to compressed ovoid-ellipsoid, exocarp thin, brittle, dehiscent. **Seeds** (1–)2(–3), laterally compressed and with a conspicuous circular wing all around formed from the fruit endocarp, or hemispherical and unwinged within a thin endocarp casing.

Distribution. A genus of 30 species in the tropics and subtropics worldwide with the greatest diversity in Madagascar and Southeast Asia. In Singapore 2 native species.

Taxonomy. Puff (Opera Bot. Belg. 3 (1991) 195, 207) accepts three subgenera, of which *Paederia* L. subg. *Lecontea* (A.Rich.) Puff (with some or all anthers exserted) is restricted to Africa and Madagascar. In the Malay Peninsula and Singapore, *Paederia* L. subg. *Paederia* (unwinged, hemispherical seed units) is represented by *Paederia foetida* and *Paederia* L. subg. *Alatopaederia* Puff (conspicuously winged, flattened seed units) is represented by *P. verticillata* Blume; these have included anthers.

Notes. Igersheim & Puff (Opera Bot. Belg. 3 (1991) 89–102) have demonstrated that the dispersal units ('diaspores') issuing from the ripe fruits comprise seeds that are in fact encased within a thin endocarp layer, which in *Paederia* subg. *Alatopaederia* also develops as a conspicuous wing all around the seed.

Key to *Paederia* species

1. Fruits subglobose, 4–6(–7) mm diam., each seed in a sub-hemispherical unit with its endocarp casing not developing into conspicuous wings; corolla dirty pink or lilac, greyish-lilac or purplish, the tube without basal splits, lobe margins conspicuously wavy **1. *P. foetida***
Fruits laterally flattened, (7–)8–12(–14) mm diam., each seed in a conspicuously flattened unit with its endocarp casing developing into a conspicuous subcircular wing; corolla deep blood red, dull purplish to greenish red, the tube often with basal splits, lobe margins not conspicuously wavy **2. *P. verticillata***

1. *Paederia foetida* L.

(Latin, *foetidus* = foul-smelling; referring to the smell of bruised tissue)

Mant. Pl. 1 (1767) 52; Gaertner, Suppl. Carp., fasc. 1(2) (1806) 84, t. 195: fig. [3]; Blume, Bijdr. Fl. Ned. Ind., pt 16 (1826–1827) 968; De Candolle, Prodr. 4 (1830) 471; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 100; Ridley, J. Straits Branch Roy. Asiat. Soc. 35 (1901) 89; Ridley, Fl. Malay Penins. 2 (1923) 173; Craib, Fl. Siam. 2(2) (1934) 225; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1649; Corner & Watanabe, Ill. Guide Trop. Pl. (1969) 707; Puff, Opera Bot. Belg. 3 (1991) 207; Turner, Gard. Bull. Singapore 45 (1993) 202; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 439; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 65, 176, 229. **Type:** *Collector unknown s.n.*, ‘India’ (lectotype LINN [Herb. Linn. no. 294.1], designated by Puff, Opera Bot. Belg. 3 (1991) 211). **Fig. 58.**

Gentiana scandens Lour., Fl. Cochinch. 1 (1790) 171. **Synonym:** *Paederia scandens* (Lour.) Merr., Contr. Arnold Arbor. 8 (1934) 163; Keng, Gard. Bull. Singapore 38 (1985) 160; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 159, fig. 125.11. **Type:** *Loureiro s.n.*, ‘Cochinchina et China’ (lectotype P [P00150838], designated by Puff, Opera Bot. Belg. 3 (1991) 211).

Slender climber. **Stipules** ovate to triangular, 1.5–5 × 2–3 mm, apex occasionally bifid, caducous. **Leaves** decussate, very rarely also in whorls of 3; lamina ovate to elliptic (or even linear, not in Singapore), apex acute to acuminate, base rounded, cordate or hastate, less commonly cuneate, membranaceous to subcoriaceous, both surfaces variously pubescent to glabrous, secondary veins (4–)5–7 pairs; petioles (5–)60–90 mm long. **Inflorescences** panicles, from c. 10 cm to over 100 cm long, partial inflorescences mostly in pairs, ultimate branches of the partial inflorescences usually cyme-like and scorpioid; main axes subtended by green leaf-like bracts of decreasing size towards the inflorescence apex or linear bracts throughout. **Flowers** with pedicels 1–2 mm long, (4–)5(–6)-merous; calyx tube very short, glabrous to sparsely pubescent, lobes narrow-triangular to rounded, to c. 1 mm long; corolla dirty pink or lilac, greyish lilac or purplish, densely short-hairy outside, tube cylindric to campanulate, 5–17 mm long, 2–5(–6) mm wide, without basal splits, dense-hairy at the throat, lobes 1–3 mm long, 1.5–3 mm wide, ovate-elliptic, margins wavy; anthers 2–2.5 mm long, inserted at different levels around the middle of the corolla tube, included; style with stigma 4–15 mm long; ovary 2-locular, glabrous to sparsely pubescent; disk conical. **Fruits** subglobose, 4–7 mm diam. **Seeds** within a sub-orbicular, ellipsoidal or sub-hemispherical structure encased by the fruit endocarp 3–5.5 mm diam.

Distribution. Northeastern India, southern Bhutan, eastern Nepal, Bangladesh, China, Korea, Japan, continental Southeast Asia, Malesia (except New Guinea) and Christmas Island. Also naturalised in the Mascarenes, Hawaiian islands and southern U.S.A. In Singapore recorded from Kranji (*Sinclair SFN 10879*, 10 Apr 1966, E, K, L, SING [SING0207041]), Upper Peirce (*Gwee SING2009-690*, 22 Dec 2009, SING [SING0144495]), Dalvey Estate (*Sinclair SFN 10834*, 23 Sep 1965, E, FI, K, L, SING [SING0207039, SING0207040]), Lorong Lada Hitam, secondary forest (*Lua SING2015-II*, 8 Apr 2015, SING [SING0213878]) and Tyersall Road (*Puff 880708-1/1*, 8 Jul 1988, WU).

Ecology. Forest margins, woodland or open vegetation types, sandy or rocky sea coasts, disturbed or secondary vegetation, hedges and roadsides. Elsewhere also in montane habitats.



Figure 58. *Paederia foetida* L. Inflorescences bearing flowers with dirty pink or lilac centres. (From Singapore, National University of Singapore campus. Photo: L. Neo).

Provisional conservation assessment. Globally Least Concern (LC). In Singapore also Least Concern (LC).

Uses. Widely used medicinally.

Notes. The synonymy of this species is extensive but mostly does not apply to Southeast Asia. The typification is also complex; see Puff (*Opera Bot. Belg.* 3 (1991) 210).

2. *Paederia verticillata* Blume

(Latin, *verticillatus* = arranged in a whorl; referring to the leaf arrangement)

Bijdr. Fl. Ned. Ind., pt 16 (1826–1827) 968; DC., Prodr. 4 (1830) 471; Hooker, Fl. Brit. India 3, fasc. 8 (1881) 195; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 97; Ridley, Fl. Malay Penins. 2 (1923) 174; Keng, Gard. Bull. Singapore 38 (1985) 160; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 159; Puff, *Opera Bot. Belg.* 3 (1991) 282; Turner, Gard. Bull. Singapore 45 (1993) 202; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 439; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240; Chong et al., *Checkl. Vasc. Pl. Fl. Singapore* (2009) 65, 176, 196. **Type:** *Blume 752*, [Indonesia], Java, ‘in mont. Salak’ (lectotype L [L0000999], designated here; isolectotypes L [L0001000, L0001001, L0001002, U0006099]).

Slender climber. **Stipules** triangular, 0.6–1.3 × 0.3–0.6 mm, caducous. **Leaves** in whorls of 3–4 or sometimes decussate; lamina ovate to elliptic, apex acuminate, base cuneate to rounded, coriaceous, upper surface glabrous, lower surface glabrous to pubescent, secondary veins (5–)6–7(–8) pairs; petioles (15–)20–75 mm long. **Inflorescences** panicles, c. 30–100 cm long, partial inflorescences mostly in whorls of 3, ultimate branches of the partial inflorescences usually widely divaricate; main axes subtended by green leaf-like bracts of decreasing size towards the inflorescence apex. **Flowers** subsessile when terminal, pedicels of lateral flowers to c. 1.5 mm long, 5-merous; calyx tube very short, glabrous to sparsely pubescent, lobes triangular, hardly 1 mm long; corolla deep blood red, dull purplish to greenish red, sparsely short-hairy to scabrid outside, tube cylindrical to infundibular, to c. 10 mm long, 1.5–3.5(–4) mm wide, often (not always) with basal splits, dense-hairy at the throat, lobes 1.5–2.5 mm long, less than 2 mm wide, broad-triangular, margins not conspicuously wavy; anthers 2–2.5 mm long, inserted at different levels above the middle of the corolla tube, included; style with stigma 5–10 mm long; ovary 2-locular, glabrous to sparsely pubescent; disk conical. **Fruits** laterally compressed, subrotund in shape, 7–14 mm diam. **Seeds** within a flattened subcircular winged structure formed by the fruit endocarp 5–8 mm diam.

Distribution. Peninsular Malaysia, Sumatra western Java, Borneo, Sulawesi and the Philippines. In Singapore it has been collected from Sungei Morai (*Ridley 2835*, BM, K, SING [SING0012125]), Chan Chu Kang (*Ridley 3647*, 1892, K, SING [SING0012126]), Choa Chu Kang (*Ridley 6825*, 1895, SING [SING0012128]), Bukit Panjang (*Mat s.n.*, 1894, SING [SING0012124]) and Bukit Timah (*Ridley 6469*, 1894, BM, SING [SING0012127]).

Ecology. Primary and disturbed or secondary forest, shaded clearings, along paths, roads and rivers.

Provisional conservation assessment. Globally not assessed. In Singapore presumed Nationally Extinct.

39. PAVETTA L.

(from *pawatta*, a Malayali vernacular name)
Jarum-jarum (Malay)

Sp. Pl. 1 (1753) 110; Hooker, Fl. Brit. India 3, fasc. 7 (1880) 149; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 83; Ridley, Fl. Malay Penins. 2 (1923) 99; Craib, Fl. Siam. 2(2) (1934) 166; Bremekamp, Repert. Spec. Nov. Regni Veg. 37 (1934) 1; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1707; Wong, Arbor. Rubiac. Malaya (1988) 145; Wong, Tree Fl. Malaya 4 (1989) 386; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 159; Puff et al., Rubiac. Thailand (2005) 90, pl. 3.1.23. **Type:** *Pavetta indica* L.

Shrubs, treelets or small trees. **Stipules** triangular, typically cuspidate or with apical keels, each pair fused basally at the edges. **Leaves** typically developing dark, wart-like bacterial nodules in their tissue. **Inflorescences** mostly compound cymes terminal to normal leafy shoots or axillary, the peduncles elongated and sometimes bearing leaf-like bracts subtending the first branch pair. **Flowers** fragrant; hypanthium obconic; calyx limb often cup-like or tubular, subtruncate or with 4 cusps or triangular to ovate lobes; corolla white, mostly salverform to infundibular, tube glabrous or hairy inside and outside, lobes 4, contorted in the bud; stamens inserted at the corolla throat, exserted and reflexed in the open flower; ovary 2-locular, ovules solitary in each locule, attached to the middle of the ovary septum; style very long-exserted, exserted portion much longer than corolla lobes and glabrous, included portion scantily to densely hairy; stigma narrowly spindle-shaped; disk annular. **Fruits** globose to obovoid, with a single pyrene consisting of 1(–2) seeds.

Distribution. Old World tropics, possibly 400 species. In Singapore 1 native species.

Taxonomy. There are no recent revisions of the genus for Southeast Asia or Malesia as a whole. Like *Ixora*, *Pavetta* is characterised by corollas with 4 lobes and a single ovule in each ovary locule; *Pavetta* can be told apart by the exserted part of the style being much longer than the corolla lobes and leaves which (in all Malay Peninsula and most other Southeast Asian species) develop dark wart-like bacterial nodules in their tissues (in *Ixora* the exserted part of the style is generally not longer than the corolla lobes and the leaves are not known to develop such nodules).

***Pavetta wallichiana* Steud. ex Craib**

(Nathaniel Wallich, 1786–1854, Superintendent of the Calcutta Botanic Gardens)

Fl. Siam. 2(2) (1934) 171, p.p.; Bremekamp, Repert. Spec. Nov. Regni Veg. 37 (1934) 84; Wong, Arbor. Rubiac. Malaya (1988) 150 (in clavi); Wong, Tree Fl. Malaya 4 (1989) 388 (in clavi); Turner, Gard. Bull. Singapore 45 (1993) 202; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 439; Tan et al. in Davison et

al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 67, 176, 223. **Synonyms:** *Pavetta canescens* R.Br. in Wallich, Numer. List no. 6181 (1831–1832), nom. nud. – *Pavetta indica* L. var. *canescens* Ridl., Fl. Malay Penins. 2 (1923) 100. **Type:** *Wallich s.n.* [EIC 6181], Singapore, 1822 (lectotype K [K001123242]), designated by Turner et al., Gard. Bull. Singapore 70 (2018) 365). **Fig. 59.**

Pavetta peninsularis Bremek., Repert. Spec. Nov. Regni Veg. 37 (1934) 84. **Type:** *Wallich s.n.* [EIC 6180], [Malaysia], Penang, 1822 (holotype K [K001123241]).

Pavetta indica auct. non L.: Hooker, Fl. Brit. India 3, fasc. 7 (1880) 150, p.p.; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 97; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 84, p.p.; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1707, p.p.; Corner, Wayside Trees Malaya, ed. 3, 2 (1988) 644, p.p.; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 159.

Pavetta tomentosa auct. non Roxb. ex Sm.: Ridley, Fl. Malay Penins. 2 (1923) 100; Craib, Fl. Siam. 2(2) (1934) 170; Bremekamp, Repert. Spec. Nov. Regni Veg. 37 (1934) 113, p.p.; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1708.

Pavetta sylvatica auct. non Blume: Bremekamp, Repert. Spec. Nov. Regni Veg. 37 (1934) 86, p.p.

Treelets or small trees to 4 m tall; young stem internodes glabrescent to puberulent. **Stipules** triangular, 3–5 mm long, 2–3.5 mm wide, cuspidate or with apical keels 1–1.5 mm long. **Leaves:** lamina 4.5–21 × 1.5–6.5 cm, elliptic to obovate or oblanceolate, apex acute or acuminate to cuspidate, base cuneate, midrib prominent on both surfaces, secondary veins (5–)8–10 pairs, looping near leaf margin, prominent on both surfaces, tertiary veins laxly reticulate, glabrescent to puberulent or pubescent on midrib or all veins below, sometimes also above; leaf tissue developing scattered dark, wart-like bacterial nodules; petioles (0.5–)1–2.5 mm long. **Inflorescences** terminal to normal leafy shoots or axillary, to 6–14 cm long, many-flowered; peduncles (2–)4–10 cm long, puberulent, branches to 3–4 orders, puberulent, first-order branches 1.5–2 cm long proximally, progressively shorter distally. **Flower** pedicel 2–6 mm long, puberulent; hypanthium c. 1 mm long, 0.5–1 mm wide, puberulent; calyx limb cup-like, to c. 1 mm long, puberulent, with 4 triangular lobes less than 0.5 mm long; corolla white, salverform, tube (9–)13–16 mm long, 0.5–1 mm wide, glabrous outside, lobes narrowly elliptic to oblanceolate, 3.5–6 mm long, 1–1.5 mm wide; stamens with inconspicuous filaments, anthers 3.5–5 mm long; ovary subglobose, c. 0.5 mm long; style exserted from corolla throat for (9–)11–17 mm; stigma narrowly spindle-shaped, 2–2.5 mm long. **Fruits** globose to obovoid, 5–6 mm long, 4–6 mm wide, with a single pyrene consisting of 1(–) seeds.

Distribution. Throughout (and probably endemic to) the Malay Peninsula (including Peninsular Thailand, Peninsular Malaysia and Singapore). It has not been possible to revise the entire spectrum of material through Southeast Asia, but past applications of this name in other provenances have proven to be of different species, just as past applications of the Indian names *Pavetta indica* and *P. tomentosa* to Southeast Indian material have proven to be unjustified. In Singapore it is recorded from Mandai (*Yeo SING2012-445*, 14 Oct 2012, SING [SING0182161]), Nee Soon (*Lai LJ 109*, 1996, SING [SING0008212]), Seletar (*Turner et al. NRS 123*, 5 Apr 1992, SING [SING0251441]), MacRitchie (*Leong et al. SING2015-028*, 4 Feb 2015, SING [SING0213842]) and Chestnut (*Leong et al. SING2015-179*, 23 Jun 2015, SING [SING0231931]). Older collections have come from Chan Chu Kang, Bukit Timah, Jurong, Kranji, Kallang valley, Punggol and Changi.

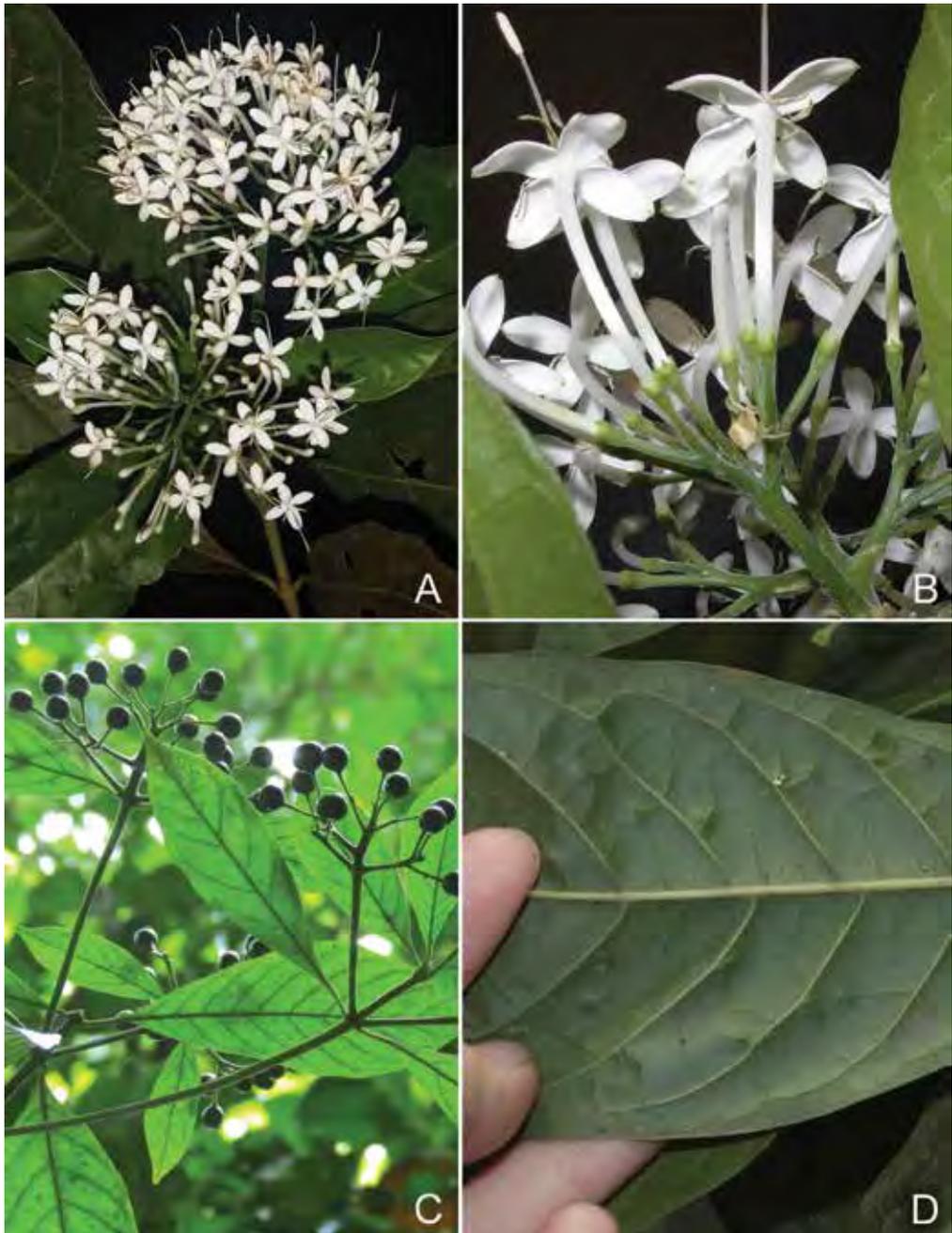


Figure 59. *Pavetta wallichiana* Steud. ex Craib. **A.** Inflorescence. **B.** Close-up of flower cluster. **C.** Fruiting leafy branches; dark bacterial nodules can be seen in leaves held against the brighter background. **D.** Close-up of lower leaf surface with bacterial nodules. (From Singapore, A from MacRitchie, *Ng et al. SING2017-097*; B from Nee Soon; C, D from MacRitchie. Photos: A, X.Y. Ng; B, R.C.J. Lim; C, Y.S. Yeoh; D, L. Neo).

Ecology. In lowland forest but reaching lower montane forest in other parts of its range.

Provisional conservation assessment. Globally not assessed. Listed as Vulnerable (VU/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 67, 176, 223).

Taxonomy. Steudel's name (Nomencl. Bot., ed. 2, 2, fasc. 10 (1841) 279) is invalid (nom. nud.), having no description or diagnosis. Craib (Fl. Siam. 2(2) (1934) 171) provided a short diagnosis in English.

Pavetta tomentosa Roxb. ex Sm. (in Rees, Cycl. 26 (1814 ['1819']) *Pavetta* no. 2) was lectotypified by Turner (Taxon 62 (2013) 158) with *Roxburgh s.n.* (LINN [Herb. Smith 191.2]). This is an Indian plant that has nothing to do with the Malayan taxon here enumerated, although some past authors have tried to apply this name. It has broader leaves with more than 10–12 pairs of secondary veins and corolla tubes only c. 10 mm long in the open flowers.

The name *Pavetta canescens* R.Br. (in Wallich, Numer. List no. 6181, 1831–1832) was not validly published and would anyway have been pre-empted by de Candolle's use for another species, therefore the new name *P. wallichiana*, after the collector, was established.

40. PORTERANDIA Ridl.

(George Porter, 1800–1849, Calcutta-based gardener
and plant-collecting companion to Nathaniel Wallich)
Tinjau belukar (Malay)

Bull. Misc. Inform. Kew 1939(10) (1940 ['1939']) 593; Masamune, Enum. Phan. Born. (1942) 702; Wong, Malayan Nat. J. 38 (1984) 44, p.p.; Wong, Arbor. Rubiac. Malaya (1988) 160; Wong, Tree Fl. Malaya 4 (1989) 392; Puff et al., Rubiac. Thailand (2005) 64, pl. 3.1.10; Zahid & Wong, Edinburgh J. Bot. 67 (2010) 265. **Synonym:** *Randia* L. sect. *Anisophyllea* Hook.f. in Bentham & Hooker, Gen. Pl. 2(1) (1873) 88; Hooker, Fl. Brit. India 3, fasc. 7 (1880) 113, p.p. **Type:** *Porterandia anisophylla* (Jack ex Wall.) Ridl.

Gardenia auct. non J.Ellis: Roxburgh, Fl. Ind. 2 (1824) 536, p.p.; Merrill, J. Straits Branch Roy. Asiat. Soc., Special No. (1921) 563, p.p.

Randia auct. non L.: King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 ['1903']) 209, p.p., Ridley, Fl. Malay Penins. 2 (1923) 71, p.p.; Merrill, J. Straits Branch Roy. Asiat. Soc., Special No. (1921) 563, p.p.; Masamune, Enum. Phan. Born. (1942) 709, p.p.; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1895, p.p.; Corner, Wayside Trees Malaya, ed. 3, 2 (1988) 645, p.p.; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 160, p.p.

Gynodioecious, rarely gynomonocious trees; branches opposite and decussate on the trunk, sympodial in development; proximal parts of the branch system forming forks just below inflorescences (with an odd number of internodes in between any two consecutive forks), distal portions (at the crown periphery) forming sympodial series of 2-internode segments with the inflorescences pushed to one side of the developing sympodium. **Stipules** interpetiolar, fused along the edges to form a cylindrical tube, the inner surface always hairy but bearing 1–few rows of colleters at the basal part. **Leaves** opposite, those occurring just below

flowering points in the branch system frequently anisophyllous; lamina typically obovate, sometimes elliptic, glabrous or hairy. **Inflorescences** terminal but appearing lateral along distal portions of the branch system (i.e. the crown periphery) because of displacement to one side during sympodial branch development, cymose, bearing either bisexual or female flowers; conspicuously branched when bisexual, unbranched (mostly) or branched to only 2–3 orders (in a few species) when female. **Flowers** small, typically less than 2 cm long; calyx 5-lobed; corolla hypocrateriform, tube subcylindric, creamy white, outer surface covered by thick, stiff and bristle-like hairs, inner surface with scattered hairs near the middle or lower part, lobes 5; stamens attached near or above the middle of the corolla tube, included, anthers pollen-bearing in the bisexual but empty in the female, dehiscent and releasing pollen in the bisexual flower just prior to floral opening, the pollen deposited and presented on the immature stigmatic head as the flower opens; style subcylindric; stigma 2-lobed; ovary 2-loculate in both bisexual and female flowers; ovules many, placentation axile; disc annular. **Fruits** large (typically 2–5 cm across), subglobose to ellipsoid, 2-loculate. **Seeds** many, lens-shaped to rounded, slightly flattened; testa surface areolate.

Distribution. A genus of 22 species in the Malay Peninsula, Sumatra, Borneo and Sulawesi. Borneo, with 19 species, is the centre of diversity. In Singapore 1 native species.

Taxonomy. Ridley (Bull. Misc. Inform. Kew 1939(10) (1940 [‘1939’] 593–613), seems to have been the first modern author to significantly recognise distinct genera in the heterogeneous ‘*Randia*’ group, when he established *Porterandia*.

***Porterandia anisophylla* (Jack ex Wall.) Ridl.**

(Greek, *aniso-* = unequal, *-phylla* = leaves; referring to unequal leaf-pairs)

Bull. Misc. Inform. Kew 1939(10) (1940 [‘1939’]) 594; Wong, Malayan Nat. J. 38 (1984) 45, p.p.; Wong, Arbor. Rubiac. Malaya (1988) 160; Wong, Tree Fl. Malaya 4 (1989) 393, p.p.; Turner, Gard. Bull. Singapore 45 (1993) 202; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 440, p.p.; Tirvengadam, Biogeographica (The Hague) 79 (2003) 35; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 72, 176, 223; Zahid & Wong, Edinburgh J. Bot. 67 (2010) 290. **Basionym:** *Gardenia anisophylla* Jack ex Wall. in Roxb., Fl. Ind. 2 (1824) 561. **Synonyms:** *Randia anisophylla* (Jack ex Wall.) Benth. & Hook.f., Gen. Pl. 2(1) (1873) 89; Hooker, Fl. Brit. India 3, fasc. 7 (1880) 114; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 94; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’]) 209; Ridley, Fl. Malay Penins. 2 (1923) 77; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1897; Corner, Wayside Trees Malaya, ed. 3, 2 (1988) 647. – *Posoqueria anisophylla* (Jack ex Wall.) Burkill, J. Straits Branch Roy. Asiat. Soc. 73 (1916) 196, 220, nom. nud.; Merrill, J. Arnold Arbor. 33 (1952) 240. **Type:** *Jack & Porter s.n.* [EIC 8399A], [Malaysia], Penang (lectotype K-W [K001125390], designated by Tirvengadam, Biogeographica (The Hague) 79 (2003) 35; isolectotypes BR [BR0000005586400], E [E00438202], K [K000172958, K000172959], L [L0649881]), P [P00836433, P00836434]. **Fig. 60, 61.**

Tree, to 24 m high, to 40 cm diam., not buttressed; bark smooth to fissured to grid-cracked, brown to pale grey to dark grey; shoot tips, distal branch internodes, petioles and leaf veins with erect-suberect hairs. **Stipules** ovate-triangular and fused along the edges to form a tube,

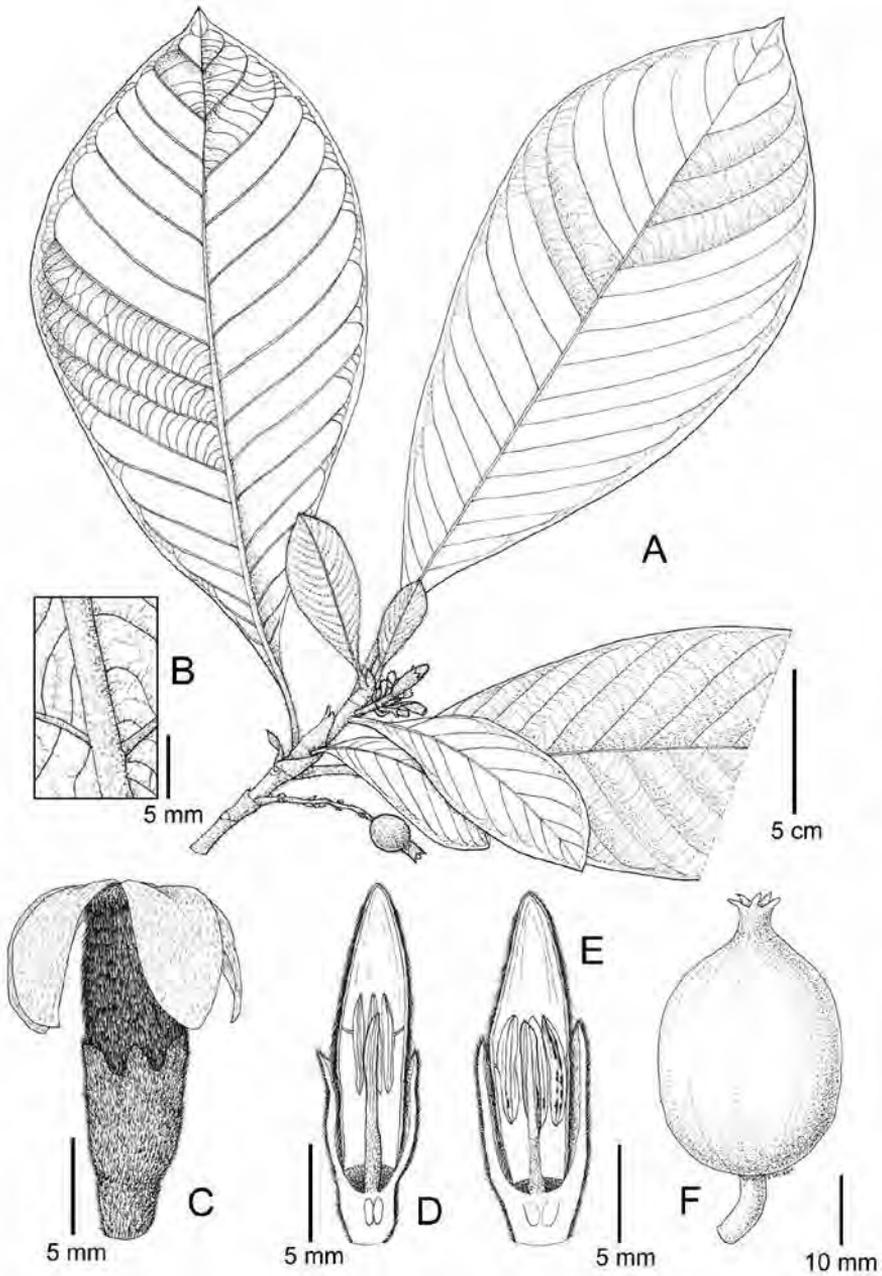


Figure 60. *Porterandia anisophylla* (Jack ex Wall.) Ridl. **A.** Flowering and fruiting leafy branch. **B.** Detail of pubescent lower leaf surface. **C.** Flower showing downward pointing hairs on corolla tube. **D.** Longitudinal section of female flower bud. **E.** Longitudinal section of bisexual flower bud (black masses are pollen). **F.** Fruit. (From Singapore, A, B, E from Mandai, *Lua & Hassan SING2011-033*; C, D, from Bukit Timah Nature Reserve, *Burkill HMB 318*; F from Nee Soon, *Chung SING2012-498*. Drawn by E. Tay).

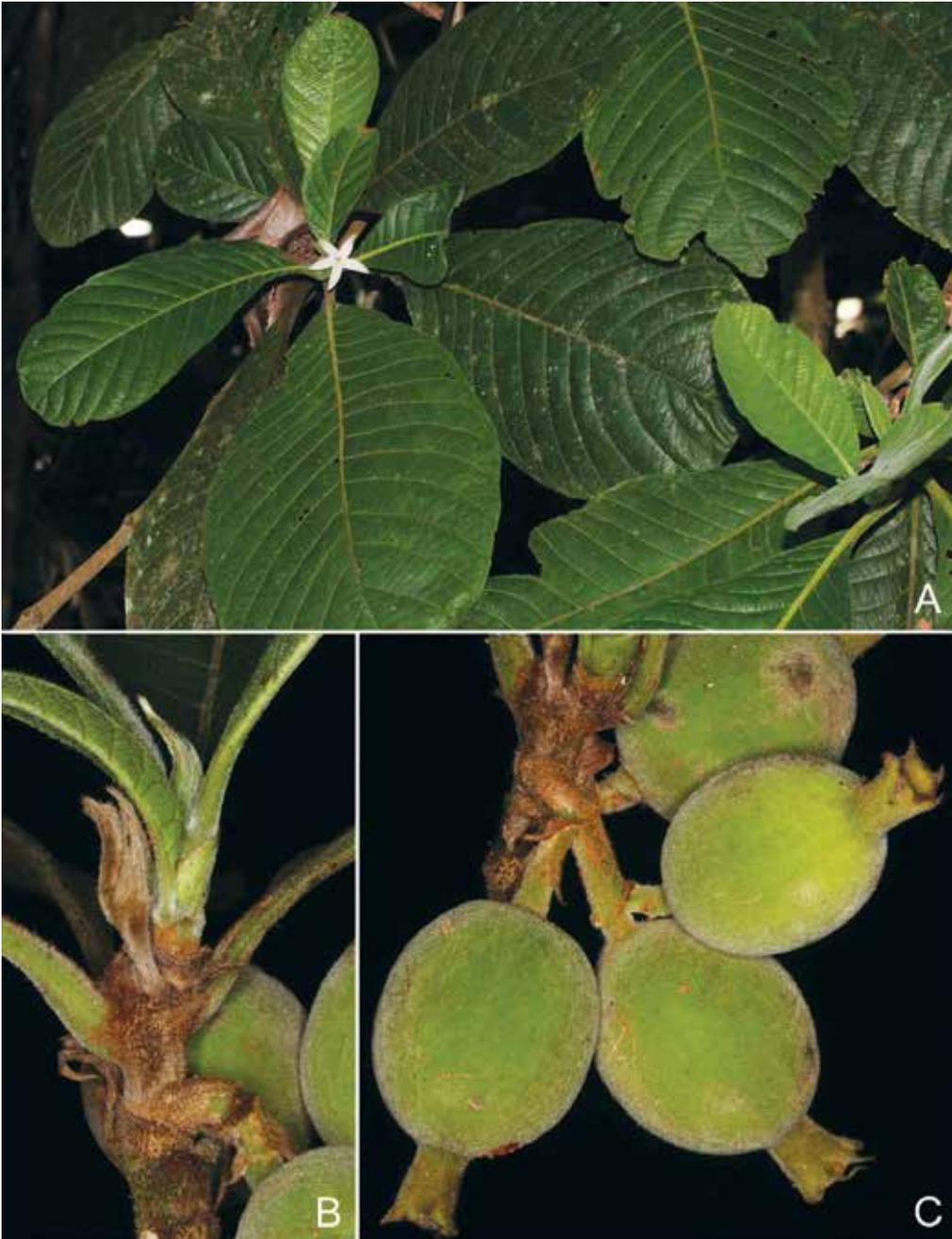


Figure 61. *Porterandia anisophylla* (Jack ex Wall.) Ridl. **A.** Flowering leafy branches. **B.** Stipules. **C.** Fruits. (From Singapore, Nee Soon. Photos: X.Y. Ng).

1–2.2 cm long, densely hairy. **Leaves:** lamina obovate to elliptic, (9–)13–30(–34) × 4–17 cm, apex acute to obtuse to short-cuspidate, base cuneate, chartaceous to thin-coriaceous, lamina upper surface slightly hairy to subglabrous, lower surface sparsely to densely spreading-hairy, midrib on upper surface flattened to slightly raised, sparsely to densely hairy, on lower surface distinctly prominent, sparsely to densely hairy, secondary veins 12–19 pairs, on upper side flattened to slightly raised, on lower side distinctly prominent, tertiary venation sub-scalariform to a much-branched network; petiole 1–2.5(–3.2) cm long, 1.5–4 mm thick. **Bisexual inflorescences:** peduncle (0.5–)1.2–2.3 cm long; compact, with (3–)4–5 distinct branching orders, the first-order branches 5–12 mm long, the second-order branches 3–6 mm long, the third-order branches 2–4 mm long; bracts on ultimate/penultimate cyme branches triangular to linear; **flowers** 15–19(–45) per cyme, usually in 1–3 clusters; pedicels 2–3.5 mm long, 2–3 mm thick; calyx tube/limb densely covered in erect hairs, lobes narrow-triangular to broad-triangular to linear, 1–2.5(–3) mm long; corolla hypocrateriform, the tube 8–11.5 mm long, 2.5–3 mm wide at the throat, with a conspicuous inflated part just below the throat, outer surface totally covered by downward-pointing hairs, corolla lobes narrowly ovate to elliptic, 5–8 mm long; anthers 4–5 mm long, with pollen; style 4–6 mm long, stigma 4–5 mm long. **Female inflorescences:** peduncle 0.5–1(–1.3) cm long; sparsely branched, with 1(–2) distinct branching orders, the first-order branches 3–5 mm long, the second-order branches 0–3 mm long; bracts on ultimate/penultimate cyme branches triangular to linear, less than 1/3 the length of the flower calyx; **flowers** 5–9(–12) per cyme; pedicels 2–3 mm long, 2–3.5 mm thick; calyx tube/limb densely covered by hairs, lobes triangular to narrowly triangular, 1–2 mm long; corolla hypocrateriform, the tube 11–15 mm long, 3–5 mm wide at the throat, with a conspicuous inflated part just below the throat, outer surface totally covered in downward-pointing hairs, corolla lobes narrowly ovate to elliptic, 8–10 mm long; anthers 3–4 mm long, without pollen; style 5–8 mm long, stigma 6–7 mm long. **Fruits** sub-globose to ellipsoid, 2–3.5(–4) × 2–3 cm, irregularly longitudinally ridged, short-tomentose when young, becoming glabrous; mature fruiting stalk developing from bisexual inflorescence 2–4 cm long, or if developing from unbranched female inflorescence 1–2 cm long. **Seeds** 2–4 × 3–6 mm.

Distribution. Peninsular Malaysia and Sumatra. In Singapore it is recorded from Mandai (*Lua & Hassan SING2011-033*, 17 Feb 2011, SING [SING0153726, SING0153727]), MacRitchie (*Leong-Škorničková et al. SING2013-051*, 22 Mar 2013, SING [SING0196532]), Nee Soon (*Chung SING2012-498*, 23 Nov 2012, SING [SING0193756]); *Nura et al. NK 215*, 26 Feb 1995, KEP, SING [SING0030445]) and Bukit Timah (where the most collections come from, including *Burkill 318*, 23 Aug 1955, K, L, SING [SING0030446]). Other older Singapore collections include those from Sungei Jurong, Upper Peirce, Seletar, Bedok and Changi.

Ecology. Lowland primary and disturbed forest. In the Bukit Timah long-term dynamics study plot, recruitment was strongly clustered in forest gaps (LaFrankie et al., *Forest Trees Bukit Timah* (2005) 141). In Peninsular Malaysia, *Porterandia anisophylla* and *P. scortechinii* (King & Gamble) Ridl. are apparently never co-occurring although both are secondary forest and forest fringe or gap species, possibly because their resource dependencies do not overlap; their eco-physiological distinctions are as yet unclear and should repay further study.

Provisional conservation assessment. Zahid & Wong (*Edinburgh J. Bot.* 67 (2010) 290) proposed a global conservation assessment of Least Concern (LC) but, if more areas of primary

and secondary forests continue to be replaced by agriculture or development, the species could qualify as Near Threatened (NT) within the next decade. In Singapore it is listed as Vulnerable (VU/D) by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 72, 176, 223).

Taxonomy. *Porterandia anisophylla* and *P. scortechinii* (Sumatra, Malay Peninsula) are the only species with downward-pointing hairs on the corolla tubes (all the other species have upward-pointing hairs).

Notes. Bisexual and female cymes can occur on the same branch.

41. PRISMATOMERIS Thwaites

(Greek, *prismato-* = serrated, *-meris* = part; referring to the calyx)

Hooker's J. Bot. Kew Gard. Misc. 8 (1856) 268; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 90; Ridley, Fl. Malay Penins. 2 (1923) 116; Ridley, Bull. Misc. Inform. Kew 1939(10) (1940 ['1939']) 600; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1840; Johansson, Opera Bot. 94 (1987) 22; Corner, Wayside Trees Malaya, ed. 3, 2 (1988) 644; Wong, Arbor. Rubiac. Malaya (1988) 163; Wong, Tree Fl. Malaya 4 (1989) 393; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 159; Puff et al., Rubiac. Thailand (2005) 118, pl. 3.1.37. **Type:** *Prismatomeris albidiflora* Thwaites.

Morinda L. sect. *Dibrachia* Baill., Bull. Mens. Soc. Linn. Paris 1 (1879) 205; Schumann in Engler & Prantl, Nat. Pflanzenfam. 4(4) (1891) 138. – *Zeuxanthe* Ridl., Bull. Misc. Inform. Kew 1939(10) (1940 ['1939']) 609. **Type:** *Morinda beccariana* Baill. (= *Prismatomeris beccariana* (Baill.) J.T.Johanss.).

Shrubs or trees. Young branch internodes with two conspicuous longitudinal ridges along interpetiolar median. Colleters copious at the base of the adaxial side of the stipules, right above the base of petioles and along margins of bracts. **Stipules** generally triangular in shape and usually cleft or divided into two smaller triangular lobes at the apex. **Leaves** decussate on orthotropic shoots, distichous on plagiotropic shoots. **Inflorescences** terminal on shoots or on short lateral branchlets, typically sessile, rarely pedunculate, generally cymose or subumbellate with 1–many flowers. **Flowers** hermaphrodite; pedicellate or occasionally sessile or subsessile, pedicels glabrous or pubescent; calyx bell- to cup-shaped, limb frequently denticulate, sometimes nearly truncate, calyx rim and teeth glabrous or minutely pubescent, sometimes with colleters; corolla salver-shaped, glabrous to sparsely pubescent outside, white; ovary 2-locular (plants usually di-heterostylous). **Fruits** drupes, globose or subglobose, sometimes capped with persistent calyx remnants. **Seeds** half spherical to nearly spherical.

Distribution. About 15 species, from Northeast India, Sri Lanka, South China, continental Southeast Asia, western Malesia and the Philippines. In Singapore 2 native species.

Taxonomy. Although Bentham & Hooker (Gen. Pl. 2(1) (1873) 117) first included *Prismatomeris* in the tribe Morindeae, later Ruan (Acta Phytotax. Sin. 26 (1988) 443–449) proposed the genus be placed in its own tribe, Prismatomerideae, citing significant differences in morphological characters between this genus and other members of the Morindeae.

Robbrecht et al. (*Blumea* 35(2) (1991) 307–345) and Igersheim & Robbrecht (*Opera Bot. Belg.* 6 (1993) 61–80) then included three Southeast Asian genera, *Gentingia* J.T.Johanss. & K.M.Wong, *Motleyia* J.T.Johanss. and *Rennellia* Korth., regarded by Johansson & Wong (*Blumea* 33 (1988) 351–356) as closely related to *Prismatomeris*, in the new tribe. Most recently, Razafimandimbison et al. (*Molec. Phylogenet. Evol.* 52 (2009) 879–886) have maintained the present status of the Prismatomerideae based on their molecular phylogenetic studies of the Morindeae.

Key to *Prismatomeris* species

1. Leaves with laxly reticulate tertiary veins which are more-or-less raised below; calyx with colleters along the margin or in between lobes **1. *P. glabra***
 Leaves with minutely reticulate tertiary veins which are immersed in the lamina below; calyx margin without protruding colleters **2. *P. tetrandra***

1. *Prismatomeris glabra* (Korth.) Valetton

(Latin, *glaber* = glabrous, hairless; referring to the inflorescence)

Bot. Jahrb. Syst. 44 (1910) 569; Ridley, *Bull. Misc. Inform. Kew* 1939(10) (1940 [‘1939’]) 604; Johansson, *Opera Bot.* 94 (1987) 54; Wong, *Arbor. Rubiac. Malaya* (1988) 164; Wong, *Tree Fl. Malaya* 4 (1989) 395; Turner, *Gard. Bull. Singapore* 45 (1993) 202; Turner, *Gard. Bull. Singapore* 47 (1997 [‘1995’]) 440; Tan et al. in Davison et al. (ed.), *Singapore Red Data Book*, ed. 2 (2008) 240; Chong et al., *Checkl. Vasc. Pl. Fl. Singapore* (2009) 72, 176, 217. **Basionym:** *Coffea glabra* Korth., *Ned. Kruidk. Arch.* 2(4) (1851) 254. **Type:** *Korthals s.n.*, [Indonesia], Borneo, Kalimantan, South prov., Martapura (lectotype L [L0001052], designated by Johansson, *Opera Bot.* 94 (1987) 54). **Fig. 62.**

Prismatomeris neurophylla (Miq.) Ridl., *Bull. Misc. Inform. Kew* 1939(10) (1940 [‘1939’]) 606. **Basionym:** *Coffea neurophylla* Miq., *Fl. Ned. Ind.* 2, fasc. 7 (1859) 1079. **Type:** *Horsfield s.n.*, [Indonesia], Sumatra, South prov., Bangka, Mentulang (lectotype K [K000763854], designated by Johansson, *Opera Bot.* 94 (1987) 54; isolectotypes K [K000763855], U [U00006159]).

Prismatomeris lepidophloia (Miq.) Ridl., *Bull. Misc. Inform. Kew* 1939(10) (1940 [‘1939’]) 601. **Basionym:** *Coffea lepidophloia* Miq., *Fl. Ned. Ind.*, *Eerste Bijv.*, fasc. 3 (1861) 548. **Type:** *Teijsmann 19347*, [Indonesia], Sumatra, South prov., Bangka, Mentulang, Batu Balai, Muntok (lectotype U [U0006161], designated by Johansson, *Opera Bot.* 94 (1987) 54; isolectotypes BO, L [L0001051]).

Prismatomeris malayana auct. non Ridl.: Ridley, *J. Fed. Malay States Mus.* 10 (1920) 142; Ridley, *Fl. Malay Penins.* 2 (1923) 116, p.p.; Burkill, *Dict. Econ. Prod. Malay Penins.*, ed. 2, 2 (1966) 1840, p.p.; Keng, *Concise Fl. Singapore*, vol. 1, *Gymn. Dicot.* (1990) 159, p.p.

Prismatomeris tetrandra auct. non (Roxb.) K.Schum.: Merrill, *J. Straits Branch Roy. Asiat. Soc.*, *Special No.* (1921) 581, p.p.; Keng, *Concise Fl. Singapore*, vol. 1, *Gymn. Dicot.* (1990) 159, p.p., fig. 125.12.

Shrub or small tree, to 5 m tall. **Stipules** triangular, divided into two smaller triangular lobes at the tip, not persistent. **Leaves:** lamina elliptic to ovate or obovate, 3.9–18.5 × 1.2–5.6 cm, apex



Figure 62. *Pristomeris glabra* (Korth.) Valet. Flowering leafy branches. Inset: Open flowers and flower bud. (From Singapore, Bukit Timah Nature Reserve, *Lua et al. SING2018-453*. Photos: W.W. Seah).

acuminate, sometimes rounded at the tip, base cuneate, chartaceous to subcoriaceous, drying slightly darker yellowish brown above than below, glabrous on both surfaces, midrib raised above and below, secondary veins 5–10, usually prominently raised below, tertiary veins laxly reticulate, more or less raised below; petioles 1–14 mm long. **Inflorescences** cymose, each with 1–11 flowers arranged into an umbel-like structure. **Flowers:** calyx 1–3 mm long, 0.5–2.0 mm wide, denticulate, calyx teeth triangular, small and sometimes inconspicuous, with colleters along the margin of each tooth or in between two; corolla 10–29 mm long, thin, corolla tube 6–19 mm long, corolla lobes 4–5, 4–11 mm long; pedicels 5–15 mm long. **Fruits** subglobose, c. 7.7–8.5 mm across.

Distribution. Peninsular Malaysia, Sumatra and Borneo (Kalimantan and Sarawak). In Singapore documented from Bukit Timah (*Lua et al. SING2018-453*, 30 Apr 2018, SING [SING0267381]), Chan Chu Kang (*Ridley 6150*, Apr 1894, SING [SING0016465]), Changi (*Ridley s.n.*, 19 May 1891, SING [SING0030505]), MacRitchie (*Maxwell 81-157*, 2 Jul 1981, SING [SING0030507]) and Sungei Buloh (*Ridley s.n.*, 1894, SING [SING0030504]).

Ecology. Across its range, found predominantly in primary lowland evergreen forests as well as heath forests (kerangas), frequently on sandy soils, and occasionally in montane evergreen forests up to 1200 m. In Singapore known from lowland mixed dipterocarp forest, swampy areas, and coastal habitats.

Provisional conservation assessment. Globally not assessed. Listed as Endangered (EN/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 72, 176, 217).

Notes. The description above applies to the species as found in Singapore. There is some variation in the length of the calyx and pedicel for the species as found elsewhere.

2. *Prismatomeris tetrandra* (Roxb.) K. Schum.

(Greek, *tetra-* = four, *-andra* = males; the flowers were first described with 4 stamens)

in Engler & Prantl, Nat. Pflanzenfam. 4(4) (1891) 138, p.p.; Ridley, Bull. Misc. Inform. Kew 1939(10) (1940 [‘1939’]) 602; Johansson, Opera Bot. 94 (1987) 23; Corner, Wayside Trees Malaya, ed. 3, 2 (1988) 645. **Basionym:** *Coffea tetrandra* Roxb., Fl. Ind. 2 (1824) 193. **Type:** [Unpublished illustration] Icones Roxburghianae no. 2123 (lectotype K, designated by Johansson, Opera Bot. 94 (1987) 23). **Fig. 63.**

Prismatomeris albidiflora auct. non Thwaites: Hooker, Fl. Brit. India 3, fasc. 7 (1880) 159, p.p.; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 97.

Distribution. Northeast India, Bangladesh, South China, Myanmar, Thailand, northern Vietnam, Peninsular Malaysia, Anambas Islands and the Philippines (Luzon).

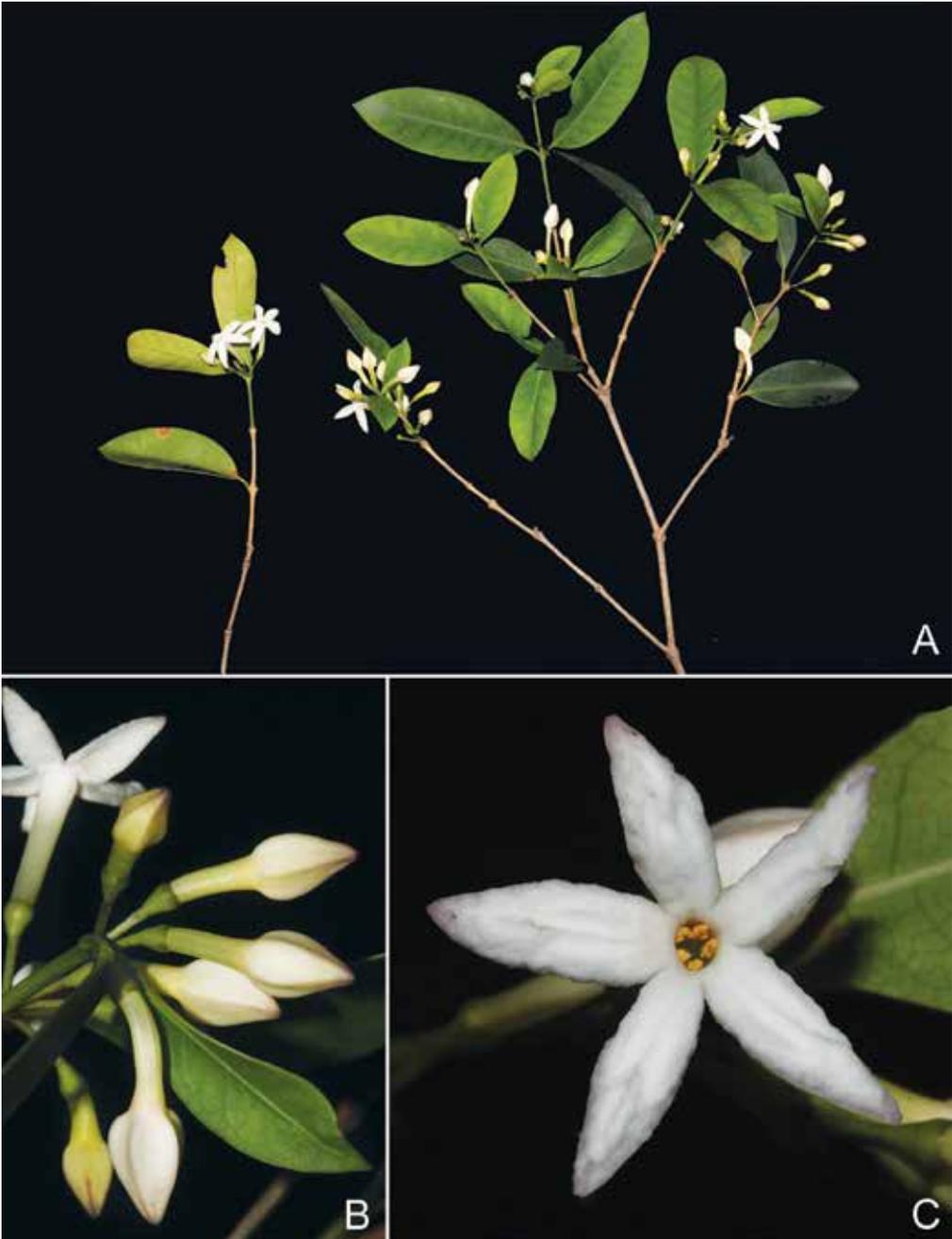


Figure 63. *Pristomeris tetrandra* (Roxb.) K.Schum. **A.** Flowering leafy branches. **B.** Flower buds. **C.** Open flower. (Cultivated in Singapore, Pasir Panjang Nursery, originally from a nursery in Thailand. Photos: X.Y. Ng).

subsp. **malayana** (Ridl.) J.T.Johanss.
(of Malaya)

Opera Bot. 94 (1987) 29; Wong, Arbor. Rubiac. Malaya (1988) 165; Wong, Tree Fl. Malaya 4 (1989) 395; Turner, Gard. Bull. Singapore 45 (1993) 202; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 440; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 72, 176, 217. **Basionym:** *Prismatomeris malayana* Ridl., J. Fed. Malay States Mus. 10 (1920) 142; Ridley, Fl. Malay Penins. 2 (1923) 116, p.p.; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1840, p.p. **Type:** *Kloss 6647*, [Thailand], West Coast and islands of Peninsular Siam, Delisle Island off Ranong (lectotype K [K001067637], designated by Johansson, Opera Bot. 94 (1987) 29).

Prismatomeris parviflora Ridl., Bull. Misc. Inform. Kew 1939(10) (1940 [‘1939’]) 605, p.p. **Type:** *Ridley 15000*, [Malaysia], Perlis, Chupeng, March 1910 (holotype K [K000763870]; possible isotypes BM [BM000945390], SING [SING0058843]).

Prismatomeris albidiflora auct. non Thwaites: Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 97; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 90, p.p.

Treelet or shrub, to 5–6 m tall. **Stipules** triangular, divided into two smaller triangular lobes at the tip. **Leaves:** lamina broadly elliptic to ovate, (3–)3.5–14.1 × 1.2–5.4 cm, apex acuminate, base cuneate to obtuse, chartaceous to subcoriaceous, drying darker brown above, lighter brown below, glabrous on both surfaces; midrib raised above and below, secondary veins 5–7, slightly raised to sometimes inconspicuous below, anastomosing near the margin, tertiary veins minutely reticulate, relatively distinct but not raised below; petiole 2–9 mm long. **Inflorescences** cymose, each with 3–10 flowers arranged into an umbel-like structure. **Flowers:** calyx 1–2 mm long, 2 mm wide, denticulate, calyx teeth triangular, small but conspicuous, without colletes; corolla 16–28 mm long, fleshy, corolla tube 10–19 mm long, corolla lobes usually 5, 6–9 mm long; pedicels 7–22 mm long. **Fruits** 5–6 mm across, capped with persistent calyx remnants.

Distribution. Mainly found in southern Myanmar, southern Thailand, Peninsular Malaysia and the Anambas Islands. Some individuals have also been recorded from the lowland to montane forests of northeastern and eastern Thailand, southern Laos and southern Vietnam. In Singapore it is represented by two collections, an old one from an unspecified locality (*Lobb 318*, 1846, BM n.v., K, G n.v.) and a recent one from Pulau Ubin (*Ali Ibrahim SING2008-366*, Sep 2008, SING [SING0146642]).

Ecology. Across its range, known from a variety of forest types and habitats including humid and dry evergreen forests, scrublands as well as on sand dunes, sandstone, and limestone, to c. 500 m. In Singapore the species has also been introduced from Thailand for use as an ornamental plant. Although the 1846 specimen is likely to be from a native tree, it is unclear whether the recent collection from Pulau Ubin is from a native tree or an introduced cultivated one.

Provisional conservation assessment. Globally not assessed. Listed as Endangered (EN/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 72, 176, 217), however, with only

two collections known, and the uncertainty as to whether the recent collection is from a wild or cultivated plant, the species is assessed here as Critically Endangered (CR/D).

Taxonomy. This is the only subspecies found in Peninsular Malaysia and Singapore, the other subspecies, *Prismatomeris tetrandra* subsp. *tetrandra*, is found elsewhere.

Notes. The description above largely applies to the species as known for the Malay Peninsula in general, as there are but two flowering collections for Singapore.

42. PSYCHOTRIA L.

(Linnaeus derived *Psychotria* from Patrick Browne's name *Psychotrophum*, which in turn comes from the Greek, *psycho-* = to breathe, blow, chill, *-trophum* = growing in; a plant delighting in cool places)

Syst. Nat., ed. 10, 2 (1759) 929, nom. cons.; Ridley, Fl. Malay Penins. 2 (1923) 127; Backer & Bakhuizen van den Brink, Fl. Java (Spermatoph.) 2 (1965) 328; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1852; Sohmer, Bishop Mus. Bull. Bot. 1 (1988) 1; Sohmer, Revis. Handb. Fl. Ceylon 6 (1988) 327; Wong, Tree Fl. Malaya 4 (1989) 396; Puff et al., Rubiac. Thailand (2005) 96; Sohmer & Davis, Sida, Bot. Misc. 27 (2007) 1. **Synonym:** *Uragoga* Baill., Adansonia 12 (1879) 223, nom. illeg. superfl. **Type:** *Psychotria asiatica* L.

Myrstiphyllum P.Browne, Civ. Nat. Hist. Jamaica (1756) 152, nom. rej. **Type:** Not designated.

Psychotrophum P.Browne, Civ. Nat. Hist. Jamaica (1756) 160, nom. rej. **Type:** Not designated.

Mapouria Aubl., Hist. Pl. Guiane 1 (1775) 175. **Synonym:** *Psychotria* L. sect. *Mapouria* (Aubl.) Benth., Vidensk. Meddel. Dansk Naturhist. Foren. Kjøbenhavn 1852 (1853) 32. **Type:** *Mapouria guianensis* Aubl. (= *Psychotria mapourioides* DC.).

Grumilea Gaertn., Fruct. Sem. Pl. 1 (1788) 138. **Type:** *Grumilea nigra* Gaertn. (= *Psychotria nigra* (Gaertn.) Alston).

Psathura Comm. ex Juss., Gen. Pl. (1789) 206. **Synonyms:** *Uragoga* Baill. sect. *Psathura* (Comm. ex Juss.) Baill., Adansonia 12 (1879) 328. – *Nonatelia* Aubl. sect. *Psathura* (Comm. ex Juss.) Kuntze, Revis. Gen. Pl. 1 (1891) 291. **Type:** *Psathura borbonica* J.F.Gmel., neotype designated by Bremekamp, Verh. Kon. Ned. Akad. Wetensch., Afd. Natuurk., Sect. 2, 54(5) (1963) 172 (= *Psychotria borbonica* (J.F.Gmel.) Razafim. & B.Bremer).

Antherura Lour., Fl. Cochinch. 1 (1790) 144. **Type:** *Antherura rubra* Lour. (= *Psychotria rubra* (Lour.) Poir.).

Hylacium P.Beauv., Fl. Oware 2, fasc. 19 (1819) 83. **Type:** *Hylacium owariense* P.Beauv. (= *Psychotria owariensis* (P.Beauv.) Hiern).

Coffea L. sect. *Straussia* DC., Prodr. 4 (1830) 502. **Synonyms:** *Straussia* (DC.) A.Gray, Proc. Amer. Acad. Arts 4 (1858) 42. – *Uragoga* Baill. sect. *Straussia* (DC.) Baill., Adansonia 12 (1879) 327. **Type:** *Straussia kaduana* (Cham. & Schltdl.) A.Gray, lectotype designated by Schumann in Engler & Prantl, Nat. Pflanzenfam. 4(4) (1891) 112 (= *Psychotria kaduana* (Cham. & Schltdl.) Fosberg).

Suteria DC., Prodr. 4 (1830) 536. **Synonyms:** *Uragoga* Baill. sect. *Suteria* (DC.) Baill., *Adansonia* 12 (1879) 326. – *Psychotria* L. sect. *Suteria* (DC.) Müll.Arg. in Martius, Fl. Bras. 6(5), fasc. 84 (1881) 222, 265. **Type:** *Suteria calycina* (Lindl.) DC. (= *Psychotria lindleyana* Müll.Arg.).

Myrstiphylla Raf., Sylva Tellur. (1838) 148. **Type:** *Myrstiphylla rigida* Raf. (= *Psychotria myrstiphyllum* Sw.).

Delpechia Montrouz., Mém. Acad. Imp. Sci. Lyon, Sect. Sci., sér. 2, 10 (1860) 221. **Type:** *Delpechia floribunda* Montrouz., lectotype designated by Barrabé et al., *Adansonia*, sér. 3, 35 (2013) 290 (= *Psychotria montrouzieri* Barrabé & J.Florence).

Douarrea Montrouz., Mém. Acad. Imp. Sci. Lyon, Sect. Sci., sér. 2, 10 (1860) 222. **Type:** *Douarrea speciosa* Montrouz., lectotype designated by Barrabé et al., *Adansonia*, sér. 3, 35 (2013) 290 (= *Psychotria avenis* Pancher ex Prain).

Camptopus Hook.f., Bot. Mag. 95 (1869) sub t. 5755. **Synonym:** *Cephaelis* Sw. ser. *Camptopus* (Hook.f.) Benth. & Hook.f., Gen. Pl. 2(1) (1873) 128. **Type:** *Camptopus mannii* Hook.f. (= *Psychotria camptopus* Verdc.).

Aucubaephyllum Ahlb., Bot. Zeitung (Berlin) 36 (1878) 113. **Type:** *Aucubaephyllum lioukiense* Ahlb. (= *Psychotria asiatica* L.).

Cremocarpon Boivin ex Baill., Bull. Mens. Soc. Linn. Paris 1 (1879) 192. **Type:** *Cremocarpon boivinianum* Baill. (= *Psychotria boiviniana* (Baill.) Razafim. & B.Bremer).

Megalopus K.Schum., Bot. Jahrb. Syst. 28 (1900) 490. **Type:** *Megalopus goetzei* K.Schum. (= *Psychotria megalopus* Verdc.).

Calycodendron A.C.Sm., Bernice P. Bishop Mus. Bull. 141 (1936) 154. **Type:** *Calycodendron pubiflorum* (A.Gray) A.C.Sm. (= *Psychotria pubiflora* (A.Gray) Fosberg).

Eumorphanthus A.C.Sm., Bernice P. Bishop Mus. Bull. 141 (1936) 157. **Type:** *Eumorphanthus fragrans* A.C.Sm. (= *Psychotria eumorphanthus* Fosberg).

Pyragra Bremek., Candollea 16 (1958) 174. **Type:** *Pyragra obtusifolia* Bremek. (= *Psychotria antakaranensis* Razafim. & B.Bremer).

Apomuria Bremek., Verh. Kon. Ned. Akad. Wetensch., Afd. Natuurk., Sect. 2, 54(5) (1963) 88. **Type:** *Apomuria mollis* Bremek. (= *Psychotria sylvieana* Razafim. & B.Bremer).

Trigonopyren Bremek., Verh. Kon. Ned. Akad. Wetensch., Afd. Natuurk., Sect. 2, 54(5) (1963) 105. **Type:** *Trigonopyren pauciflorus* Bremek. (= *Psychotria alaotra* Razafim. & B.Bremer).

Trees, shrubs, subshrubs or scandent shrubs climbing with adventitious roots; raphides present in tissues. **Twigs** terete or angled. **Stipules** interpetiolar, entire or bifid, caducous (leaving stipular scar sometimes with colleters) to persistent. **Leaves** opposite, generally petiolate. **Inflorescences** terminal or more rarely axillary, pedunculate or sessile. **Flowers** hermaphrodite, often heterostylous, 4–6-merous, sessile or pedicellate; calyx salverform to tubular, truncate or lobed; corolla generally white, tube often dilating distally, hairy in throat, lobes valvate in bud, reflexing at anthesis; stamens exerted or included, inserted toward base of corolla tube; ovary

bilocular, each locule with a solitary basal ovule, style included or exerted. **Fruits** globose to ellipsoidal drupes ripening red, black or white; pyrenes 2, circular to elliptical in outline, generally planoconvex, often with 1–5 clearly defined longitudinal ridges on the convex surface, often lacking marginal preformed germination slits. **Seeds** 1 per pyrene, endosperm ruminant.

Distribution. Some 2000 species found throughout the tropical and subtropical regions of the world. In Singapore 15 native species, of which only 7 appear to be extant.

Ecology. Generally plants of the forest understorey from lowlands to mountaintops.

Taxonomy. Given the many species it includes, there have, over the years, been various attempts to split off parts of *Psychotria* as separate genera or remove misplaced elements. A recent example of the latter is the recognition of what is now called *Eumachia* (Taylor et al., *Candollea* 72 (2017) 289–318). However, the general recent trend, largely based on molecular phylogenies, has been toward an evermore inclusive concept of *Psychotria*, which is reflected in the extensive generic synonymy cited above. Indeed, the concept of *Psychotria* as a single united genus for tribe Psychotrieae has had support (Nepokroeff et al., *Syst. Bot.* 24 (1999) 5–27; Razafimandimbison et al., *Amer. J. Bot.* 101 (2014) 1102–1126). This would expand the list of generic synonyms to include all the epiphytic ant-plants (*Hydnophytum*, *Myrmecodia*, *Myrmephytum*, *Myrmedoma*, *Squamellaria* and *Anthorrhiza*) and various other Asia-Pacific genera (*Amaracarpus*, *Calycosia*, *Dolianthus*, *Hedstromia* and *Streblosa*). The transfer of species names for these reductions has not been made and it seems unlikely that considering the ant-plants as species of *Psychotria* will be readily accepted by users of plant names.

Key to *Psychotria* species

1. Scandent plants climbing by means of adventitious roots from the ascending stem; fruits ripening white 2
Erect shrubs or shrublets without adventitious roots; fruits ripening yellow to red or black, but not white 11
2. Leaves and twigs (excluding inflorescence axes) glabrous 3
Leaves and/or twigs with some hairs 7
3. Leaves with secondary veins 4–5 pairs; inflorescences branching regularly and many times to form open structure; fruits to 4 mm long, pyrenes not ribbed or ridged
..... **12. *P. polycarpa***
Leaves with secondary veins generally 6 or more pairs; inflorescences congested; fruits 6 mm or more long, pyrenes distinctly ribbed or ridged 4
4. Inflorescences of densely packed heads of more or less sessile flowers; fruits subsessile, stalk to 1 mm long **8. *P. morindiflora***
Inflorescences of heads or more laxly branched aggregations of pedicellate flowers; fruits distinctly stalked, stalk 3 mm long or more 5

5. Leaves generally coriaceous, shiny, often drying with main nerves raised on both surface; pyrenes with 5 distinct ridges **10. P. pachyphylla**
 Leaves generally chartaceous, not shiny, drying with main nerves flush or immersed on at least one surface; pyrenes with 4 clear ribs 6
6. Leaves generally drying dark; inflorescences of heads of flowers; calyx lobes c. 0.5 mm long; fruits with stalks 9 mm or more long **11. P. penangensis**
 Leaves generally drying pale; inflorescences not heads of flowers; calyx lobes 1 mm or more long; fruits with stalks to 6 mm long **13. P. ridleyi**
7. Leaf base acutely cuneate and decurrent to petiole 8
 Leaf base obtuse to rounded, not notably decurrent to petiole 9
8. Calyx lobes 2 mm long or more **5. P. maingayi**
 Calyx lobes less than 0.5 mm long **14. P. sarmentosoides**
9. Leaves thinly chartaceous, secondary veins difficult to discern, lamina to 3 cm wide, petiole to 7 mm long **15. P. scortechinii**
 Leaves chartaceous to subcoriaceous, secondary veins distinct, lamina generally exceeding 3 cm wide, petiole generally longer than 7 mm 10
10. Largest leaves on specimen not exceeding 5 cm wide, petiole to 15 mm long; pyrenes with no clear ribs or ridges **9. P. ovoidea**
 Largest leaves on specimen exceeding 5 cm in width, petiole more than 20 mm long; pyrenes with 3 or 4 distinct ridges **2. P. deltata**
11. Leaves and young twigs densely hairy; axillary inflorescences of dense heads **4. P. helferiana**
 Leaves and young twigs glabrous to sparsely hairy; terminal inflorescences not in heads 12
12. Leaves with 8–10 pairs of secondary veins, petiole to 10 mm long **1. P. angulata**
 Leaves with 11–19 pairs of secondary veins, petiole more than 10 mm long 13
13. Midrib distinctly raised above in dry leaves; fruits drying cross-shaped when viewed end-on, pyrenes with one prominent dorsal ridge **3. P. griffithii**
 Midrib slightly raised to slightly sunken above; fruits drying more or less rounded when viewed end-on, pyrenes with more than one dorsal ridge 14
14. Petiole not with a distinct ridge or lip around base on distal side; flowers arranged in threes with a sessile flower (or fruit) in the fork between a pair of flowers on ultimate axis branches, calyx truncate with scarcely distinguishable lobes **7. P. megacoma**
 Petiole with a distinct ridge or lip around base on distal side; flowers not obviously arranged in threes with a sessile flower (or fruit) in the fork between a pair of flowers on ultimate axis branches, calyx distinctly lobed **6. P. malayana**

1. *Psychotria angulata* Korth.

(Latin, *angulatus* = with angles, angled;
to what this refers is uncertain, possibly the stems)

Ned. Kruidk. Arch. 2(4) (1851) 243; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 98; Ridley, Fl. Malay Penins. 2 (1923) 138; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 159; Wong, Tree Fl. Malaya 4 (1989) 398; Turner, Gard. Bull. Singapore 45 (1993) 202; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 440; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 73, 176, 210. **Synonym:** *Uragoga angulata* (Korth.) Kuntze, Revis. Gen. Pl. 2 (1891) 959. **Type:** *Korthals s.n.*, [Indonesia], Borneo, [Kalimantan] (lectotype L [L0843037], designated by Turner, Gard. Bull. Singapore 71 (2019) 58).

Chassalia perforata Miq., Fl. Ned. Ind., Eerste Bijv., fasc. 3 (1861) 546. **Synonym:** *Uragoga angulosa* Kuntze, Revis. Gen. Pl. 1 (1891) 299. **Type:** *Teijsmann s.n.*, [Indonesia], Bangka (lectotype L [L0484307], designated by Turner, Gard. Bull. Singapore 71 (2019) 58).

Psychotria griffithii Hook.f. var. *angustifolia* Ridl., Fl. Malay Penins. 2 (1923) 137. **Type:** *Ridley 15823*, [Malaysia], Lankawi, Burau Woods, April 1911 (lectotype K [K001067640], designated by Turner et al., Gard. Bull. Singapore 70 (2018) 370).

Shrub to 2 m tall. **Twigs** drying brown or grey, glabrous, finely longitudinally striate, often with distinct longitudinal round-topped ridges running from the centre of the node between the petioles on each side. **Leaves:** lamina typically oblanceolate, more rarely elliptic-obovate or lanceolate, 7–18 × 2–5.5(–7) cm, apex shortly acuminate, base acutely cuneate with lamina decurrent to petiole almost to its base, chartaceous to subcoriaceous, glabrous, drying brown, grey-brown or grey, often an attractive reddish chestnut, shiny above, duller beneath, midrib slightly raised above in dry leaves, longitudinally striate, sometimes with a deeper central furrow, secondary veins slightly raised above, midrib prominent below with some distant longitudinal striations, secondary veins slightly raised, secondary veins 8–10 pairs arching forward and looping well within margin, often with small pouch-like domatia in axils of secondary veins, reticulations obscure; petiole 4–10 mm long, 1 mm wide, often with a fine groove running round point of attachment to stem. **Inflorescences** terminal, pedunculate, peduncle 2–6 cm long, primary branching trichotomous with central branch branching trichotomously again almost immediately giving a 5-branched structure, primary branches 1–2 cm long at anthesis, ultimately bearing groups of more or less sessile flowers, inflorescence axes drying brown, laterally compressed, finely longitudinally striate, glabrous except at nodes where dense red-brown hairs occur. **Flowers** more or less sessile; calyx tube c. 1 mm long, rather thin, calyx lobes broadly triangular 0.3–0.5 × 1 mm, glabrous except sometimes for a few short hairs near margin; corolla tube c. 3.5 mm long, c. 1 mm wide at mouth, more or less glabrous outside, corolla lobes 1–1.5 mm long, 0.5–0.7 mm wide, with scattered hairs inside and out. **Fruits** sessile, globose to ovoid, c. 7–8 mm long, 6.5 mm diam., glabrous, drying black or dark brown, shiny and coarsely wrinkled, topped by persistent calyx; pyrenes 2, 6 × 5 × 2.5 mm, with one central ridge on convex face, pyrene surface irregularly bumpy.

Distribution. Myanmar to Borneo and Java. Not collected in Singapore since the nineteenth century when Ridley collected it from Changi (*Ridley s.n.*, 6 Apr 1889, SING [SING0012129];

Ridley 2864, 7 Oct 1890, SING [SING0012130]; *Ridley s.n.*, 1894, SING [SING0037362]) and the Singapore Botanic Gardens' Rain Forest. (*Ridley s.n.*, 1894, SING [SING0037363]).

Ecology. Forest understorey, perhaps favouring drier sites.

Provisional conservation assessment. Globally not assessed. Listed as Critically Endangered (CR/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 73, 176, 210) but, with no collections since 1894, it must be presumed Nationally Extinct.

2. *Psychotria deltata* I.M.Turner

(Latin, *deltatus* = delta-shaped; referring to the deltoid leaves)

Phytotaxa 361 (2018) 185. **Type:** *Burkill SFN 7041*, Singapore, Reservoir woods, 28 March 1921 (holotype SING [SING0030565]). **Fig. 64.**

Scandent shrub. **Twigs** drying red-brown, brown or dark brown, finely longitudinally striate, generally glabrous though youngest parts occasionally with short hairs. **Leaves:** lamina ovate to elliptic, notable for some specimens with more or less ovate-triangular (deltoid) leaves, 8–17 × 3–10 cm, base truncate to cuneate, generally ultimately shortly decurrent to petiole, apex shortly acuminate, chartaceous to subcoriaceous, drying a uniform shade of light to dark brown, rather shiny above, main veins darker on lower surface, midrib flush to slightly sunken above in dry leaves, generally with a central longitudinal furrow, secondary veins slightly raised to slightly sunken above, midrib and secondary veins prominent below, glabrous above, dense covering of more or less erect brown hairs on main nerves below with a uniform tomentum of broad-based, tapering, more or less erect hairs on lower lamina which give an appearance of many minute red-brown spots on the lower lamina in older material and a slightly rough feel, secondary veins 7–9 pairs, curving forward and looping distinctly within the margin, coarse reticulations generally visible in dry leaves; petiole 25 mm long, 1–1.5 mm wide, drying blackish, longitudinally wrinkled with very short brown hairs. **Inflorescences** rather small in comparison to the vegetative shoot, sessile to subsessile, primary branching trichotomous, branches not exceeding 2 cm long, each bearing a dense head of more or less sessile flowers, inflorescence axes drying laterally compressed, densely short brown or red-brown hairy. **Flowers** with pedicels to c. 1 mm long, calyx tube c. 0.3 mm long, calyx lobes c. 0.7 × 0.5 mm, drying black with scattered red-brown hairs outside. **Infructescences** to 4 cm long. **Fruits** more or less globose, subsessile, c. 8 mm diam., drying strongly ribbed when immature, with brown or red-brown hairs, surmounted with persistent calyx; pyrenes 2, flat-faced, with 3 or 4 central ridges on convex side, 6 × 5–5.5 × 2 mm.

Distribution. Endemic to Peninsular Malaysia (Johor) and Singapore. In Singapore apparently still widespread in the Central Catchment with recent collections from Mandai, Seletar (*Gwee SING2009-532*, 1 Dec 2009, SING [SING0138044]), Chestnut (*Gwee SING2008-303*, 26 Aug 2008, SING [SING0114846]) and MacRitchie (*Gwee SING2010-365*, 9 Feb 2010, SING [SING0144852]). Earlier locations include Sungei Buloh, Bukit Timah (*Maxwell 77-107*, 3

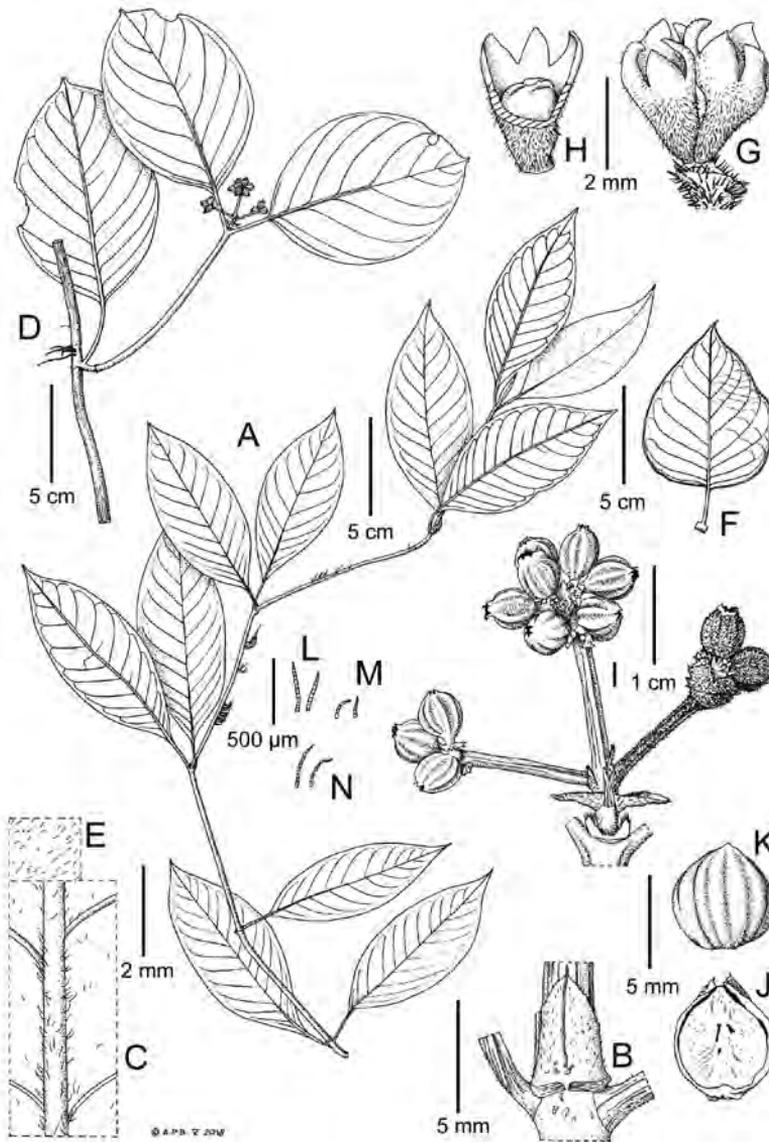


Figure 64. *Psychotria deltata* I.M. Turner. **A.** Habit of juvenile climbing shoot. **B.** Stipule. **C.** Abaxial leaf surface. **D.** Shoot bearing infructescence arising from climbing stem. **E.** Abaxial leaf surface. **F.** A deltoid leaf. **G.** Flowers after corollas have dropped attached to terminal part of inflorescence axis. **H.** Flower with part of calyx excised to show interior. **I.** Infructescence; indumentum only shown on right-hand branch. **J.** Pyrene showing flat inner face. **K.** Pyrene showing outer convex face with ridging. **L.** Detail of midrib hairs. **M.** Detail of hairs on lower lamina. **N.** Detail of hairs on inflorescence axis. (A–C, L from Singapore, MacRitchie, *Gwee SING2010-365*; D, E, I, M, N from Peninsular Malaysia, *Imin FRI 74681*; F from Singapore, Central Catchment Nature Reserve, *Burkill SFN 7041*; G, H from Singapore, Chan Chu Kang, *Ridley s.n.* [SING0030558]; J, K from Singapore, Bukit Timah Nature Reserve, *Teruya 3132*. Drawn by A. Brown, reproduced with the kind permission of the Director and the Board of Trustees, Royal Botanic Gardens, Kew).

Mar 1977, SINU), Chan Chu Kang (*Ridley s.n.*, Oct 1889, SING [SING0030558]), Singapore Botanic Gardens' Rain Forest and Sungei Morai.

Ecology. Found in forests including old secondary.

Provisional conservation assessment. Globally not assessed. Taxonomic confusion led to this species being overlooked so it has not had a conservation assessment before. It is assessed here as Endangered (EN/D) in Singapore.

3. *Psychotria griffithii* Hook.f.

(William Griffith, 1810–1845, English botanist known for his work in India and Malaya)

Fl. Brit. India 3, fasc. 7 (1880) 171; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 98; Ridley, Fl. Malay Penins. 2 (1923) 137; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1852; Wong, Tree Fl. Malaya 4 (1989) 399; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 159; Turner, Gard. Bull. Singapore 45 (1993) 203; Tan et al., Gard. Bull. Singapore, Suppl. 3 (1995) 48; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 441; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 73, 176, 210; Turner & Chua, Checkl. Vasc. Pl. Sp. Bukit Timah Nat. Res. (2011) 70. **Synonym:** *Uragoga malaccensis* Kuntze, Revis. Gen. Pl. 2 (1891) 956. **Type:** *Griffith s.n.* [Kew Distribution 3044], [Malaysia], Malacca, Ayer Panas (lectotype K [K000777141], designated by Turner, Gard. Bull. Singapore 71 (2019) 58). **Fig. 65.**

Shrub to 2 m tall. **Twigs** glabrous, drying brown or grey brown, youngest dark brown, finely longitudinally striate, a faint ridge running each side of the twig from the centre of node between the leaf pair may be seen on upper nodes. **Leaves:** lamina elliptic, obovate or oblanceolate, 11.5–28 × 3.5–11 cm, base cuneate, apex shortly acuminate, chartaceous to subcoriaceous, glabrous, typically drying lead-grey with contrasting straw-coloured main venation but specimens with grey-brown and brown leaves also occur, midrib raised above, flat-topped, longitudinally striate sometimes with a deeper central furrow, secondary veins flush to slightly raised above, midrib below prominent, secondary veins raised, secondary veins (8-)11–16 pairs, arching forward more or less in parallel and looping indistinctly within lamina margin, generally slightly decurrent to midrib sometimes with very small domatium in axil, visible as scarcely more than a pinprick hole; petiole 12–28 mm long, 1–3 mm wide. **Inflorescences** terminal, pedunculate, peduncle 1.5–4.5 cm long at anthesis, 4–5 primary branches 1.5–3 cm long, ultimately branching several times more to bear closely spaced groups of flowers, sometimes a central branch develops most strongly leading to an almost spicate structure, inflorescence axes drying laterally compressed, striate and bearing very short red-brown tomentum. **Flowers** more or less sessile; calyx tube c. 1 mm long, calyx lobes broadly triangular c. 0.4 mm long, 0.6 mm wide, glabrous or with a few very short red-brown hairs outside; corolla tube c. 2 mm long, c. 1.5 mm wide at mouth, glabrous externally, corolla lobes triangular, c. 2 mm long, 1 mm wide at base. **Fruits** subsessile, pyriform to ovoid, 10–13 mm long, 6–8 mm diam., drying dark brown to black, shiny, drying 4-ribbed, cross-shaped end-on with orthogonal pairs of thick and thin flanges; pyrenes 2, with one prominent, flat-sided central ridge on convex side, 11–12 × 7–7.5 × 3.5 mm.

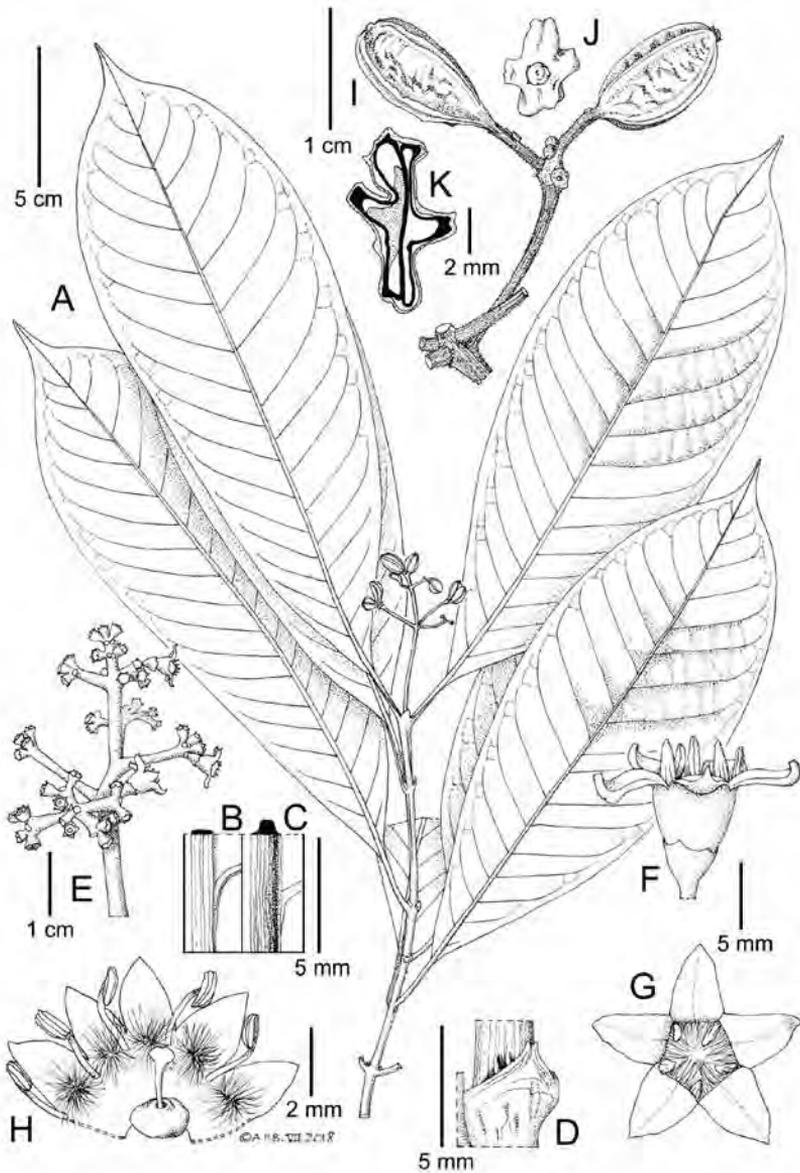


Figure 65. *Psychotria griffithii* Hook.f. **A.** Habit with indication of bullate nature of leaf lamina. **B.** Adaxial midrib and profile. **C.** Abaxial midrib and profile. **D.** Stipule. **E.** Inflorescence (from photograph). **F.** Flower, side view (from photograph). **G.** Flower, front view (from photograph). **H.** Flower with corolla opened out to show attached stamens and disk and style. **I.** Part of infructescence with attached fruits. **J.** Apical view of mature fruit showing cross-shaped outline. **K.** Transverse section of mature fruit showing two pyrenes. (From Singapore, A–C from Bukit Timah Nature Reserve, *Lua et al.* SING2014-319; D from Bukit Timah Nature Reserve, *Ridley 2867*; H–K from Pulau Ubin, *Hullett 848*. Drawn by A. Brown, reproduced with the kind permission of the Director and the Board of Trustees, Royal Botanic Gardens, Kew).

Distribution. Endemic to the Malay Peninsula. Recent collections in Singapore are restricted to Bukit Timah (*Lua et al.*, SING2014-319, 3 Jul 2014, SING [SING0213814]; *Leong et al.* SING2013-356, 14 Nov 2013, SING [SING0201485]; *Chen LCMJ200*, 2 May 1998, SING [SING0042728]). Historically specimens have come from Pulau Ubin (*Ridley* 2872, Mar 1890, SING [SING0012138]), Kranji and Bukit Mandai (*Ridley s.n.*, 1892, SING [SING0012136]).

Ecology. Forest understorey.

Provisional conservation assessment. Globally not assessed. Listed as Critically Endangered (CR/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 73, 176, 210).

Notes. A distinctive broad-leaved shrublet notable for the large black fruits that dry with four distinct ridges.

4. *Psychotria helferiana* Kurz

(Jan Vilém (Johann Wilhelm) Helfer, 1810–1840, Prague-born medical doctor, explorer and naturalist)

J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 41 (1872) 314; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 91; Ridley, Fl. Malay Penins. 2 (1923) 134; Wong, Tree Fl. Malaya 4 (1989) 396; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 159; Turner, Gard. Bull. Singapore 45 (1993) 203; Tan et al., Gard. Bull. Singapore, Suppl. 3 (1995) 48; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 441; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 73, 176, 210; Turner & Chua, Checkl. Vasc. Pl. Sp. Bukit Timah Nat. Res. (2011) 71. **Synonym:** *Uragoga helferiana* (Kurz) Kuntze, Revis. Gen. Pl. 2 (1891) 960. **Type:** *Helfer s.n.*, Burma [Myanmar], Tenasserim (lectotype CAL, designated by Deb & Gangopadhyay, J. Econ. Taxon. Bot., Add. Ser. 7 (1989) 113; isolectotypes DD, K [×2]). **Fig. 66.**

Unbranched treelet to 2 m tall, can be mistaken for an understorey herb. **Twigs** generally densely covered in long red-brown or brown multicellular hairs, drying laterally compressed, older twigs becoming glabrescent, longitudinally wrinkled. **Leaves:** lamina generally elliptic, less often ovate-elliptic or obovate, 12–31 × 4.5–13.5 cm, base broadly cuneate, apex cuneate to shortly acuminate, membranous, drying shades of dark brown, more rarely grey-brown, midrib flush to slightly raised above, densely covered in pale or red-brown multicellular hairs drying laterally compressed, secondary veins flush to slightly raised above, upper lamina with uniform covering of decumbent to adpressed red-brown multicellular hairs, midrib prominent below covered with more or less erect red-brown multicellular hairs, secondary veins slightly raised, lower lamina with more or less uniform covering of multicellular hairs with a round base, secondary veins 7–13 pairs, arching forward, not looping clearly, domatia absent, reticulations obscure; petiole to 2–6.5 cm long, 2 mm wide, densely hairy. **Inflorescences** axillary, pedunculate, peduncle to 2 cm long, though may appear sessile in early development, primary branching trichotomous with further branches bearing densely packed globular heads of flowers, inflorescence branches densely hirsute with long multicellular hairs often appearing as striped in black or brown and white under magnification. **Flowers** pedicellate, pedicel 1.5–2 mm long, densely covered in long, multicellular hairs; calyx tube c. 0.5 mm long, calyx lobes

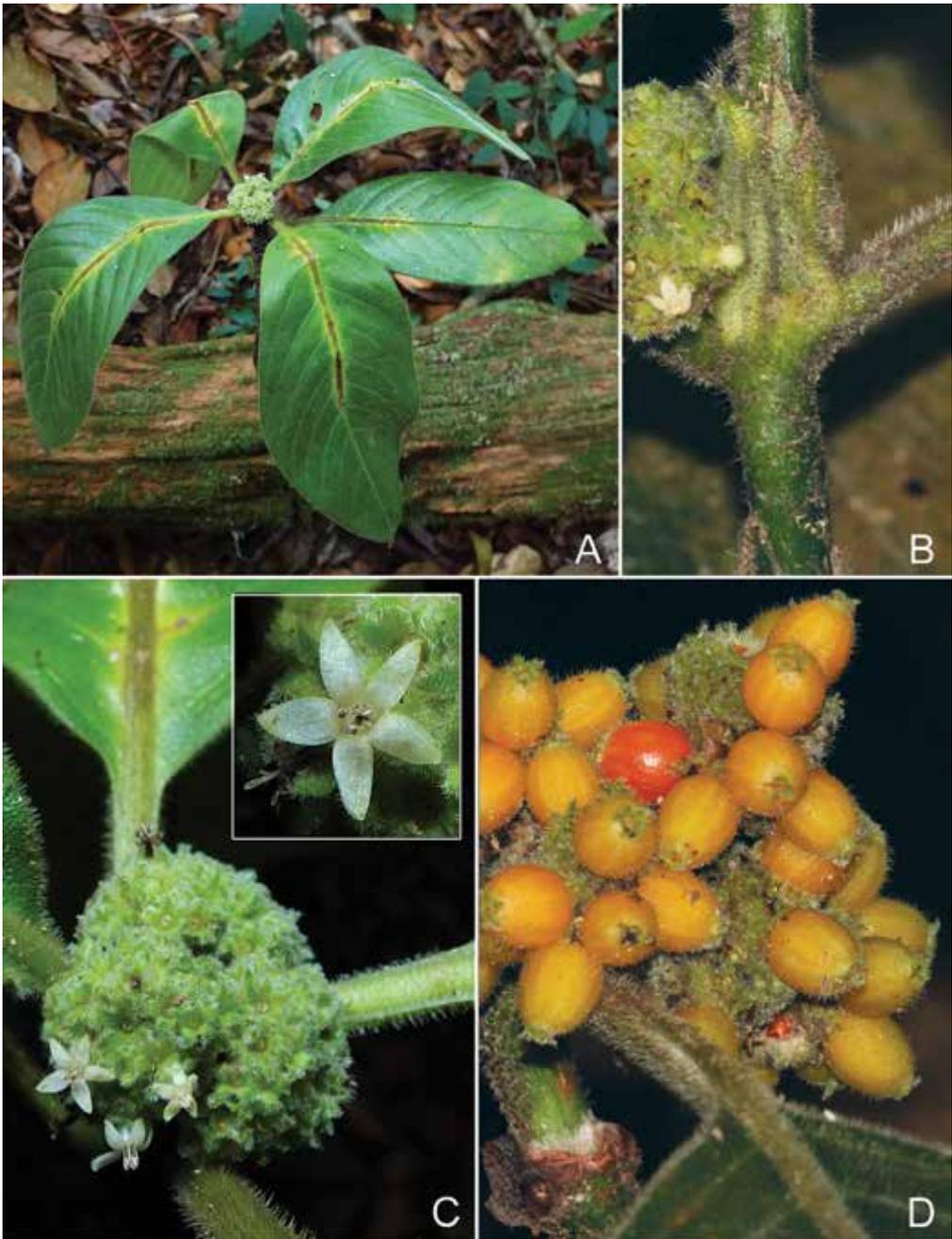


Figure 66. *Psychotria helferiana* Kurz. **A.** Habit. **B.** Stipules. **C.** Inflorescence with densely packed globular heads of flowers. Inset: detail of flower, front view. **D.** Nearly mature fruits. (From Singapore, A, D from Nee Soon, *Leong-Škorničková SING2015-040*; B, C from MacRitchie. Photos: A, D, J. Leong-Škorničková; B, C, X.Y. Ng).

c. 1.5 mm long, 1 mm wide at base, calyx densely covered with red-brown multicellular hairs inside and out; corolla tube c. 1.5 mm long, c. 0.5 mm wide at mouth, with scattered long red-brown hairs outside, corolla lobes ovate-lanceolate, apex acute, 1.3–1.4 mm long, 0.5–0.6 mm wide, with relatively long, red-brown hairs outside, glabrous within. **Fruits** sessile, ovoid, 8–9 mm long, 5–6 mm wide, drying dark brown with long red-brown multicellular hairs; pyrenes 2, $7.5 \times 5 \times 2.5$ mm, with 1 or 2 central ridges on convex side.

Distribution. Bangladesh to Peninsular Malaysia. In Singapore it has been collected from Bukit Timah (*Tang & Sidek 1052*, 14 Nov 1995, SING [SING0064115]) and various sites in the Central Catchment (*Gwee SING2009-676*, 22 Dec 2009, SING [SING0144114]; *Lee et al. SING2008-74*, 13 Mar 2008, SING [SING0105458]). There are also old collections from Chua Chu Kang (*Goodenough 184*, 16 Mar 1889, K, SING [SING0030511]), Tanjong Gul (*Goodenough s.n.*, 1891, SING [SING0030515]), Rogie (*Hullett 372*, Feb 1884, SING [SING0030525]) and the Singapore Botanic Gardens' Rain Forest.

Ecology. Forest understorey.

Provisional conservation assessment. Globally not assessed. Listed as Critically Endangered (CR/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 73, 176, 210) but assessed here as Endangered (EN/D).

Notes. Unlikely to be confused with any other *Psychotria* species in Singapore. The general hairiness and axillary capitate inflorescences readily distinguish the species.

5. *Psychotria maingayi* Hook.f.

(Alexander Carroll Maingay, 1836–1869, British surgeon, botanist and magistrate in Malacca, Peninsular Malaysia)

Fl. Brit. India 3, fasc. 7 (1880) 166; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 98; Ridley, Fl. Malay Penins. 2 (1923) 131; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 160; Turner, Gard. Bull. Singapore 45 (1993) 203; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 441; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 73, 176, 210; Turner & Kumar, Phytotaxa 361 (2018) 189. **Synonym:** *Uragoga maingayi* (Hook.f.) Kuntze, Revis. Gen. Pl. 2 (1891) 961. **Type:** *Maingay 2689*, Singapore, September 1867 (lectotype K [K000777158], designated by Turner & Kumar, Phytotaxa 361 (2018) 189).

Saprosma ridleyi King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 100. **Type:** *Ridley 6474*, Singapore, Ang Mo Kio, 1894 (holotype CAL [CAL0000016584]; probable isotype SING [Ridley 6473, SING0012145]).

Climber. **Twigs** more or less terete, drying pale brown, finely, longitudinally striate, young parts with often dense, pale or brownish, short erect hairs. **Stipules** connate forming a short tube with a rather irregular top. **Leaves:** lamina generally narrowly elliptic to obovate, $4.5\text{--}10 \times 1\text{--}4$ cm, base typically acutely cuneate, apex sharply acuminate, chartaceous to subcoriaceous, fleshy,

drying brown to dark brown above, generally paler, greyer brown below, midrib slightly raised to slightly sunken above, generally with central sharp-sided groove, below midrib raised, secondary veins immersed above, flush to slightly raised below, generally glabrous above, though pale idioblasts in upper lamina surface may give the impression of small adpressed hairs, sometimes with erect hairs along midrib below and scattered on lower lamina, lamina surface often appearing honeycombed or pinpricked under magnification, margin drying incurved on lower surface, secondary veins 6–12 pairs but often obscure, arching forward and looping within margin; petiole 3–6 mm long, 1 mm wide. **Inflorescences** terminal, pedunculate, peduncle 0.5–3.5 cm long, primary branching trichotomous, branches c. 1 cm long at anthesis but apparently elongating considerably as the fruits develop, axes densely pale erect hairy. **Flowers** with pedicel 1–2 mm long, c. 0.5 mm wide, densely pale erect hairy, hypanthium conical, c. 1 mm long, 1 mm wide at top, densely covered with erect pale hairs outside; calyx connate at base to c. 1 mm, lobes ovate or ovate-lanceolate, 2–4 mm long, 1–2 mm wide at base, drying dark brown, more or less glabrous within, hairy outside, often with pale idioblasts; corolla basally connate for about 1 mm, with dense pale hairs in mouth of tube, lobes triangular, c. 2 mm long, 1 mm wide at base, drying brown with pale colleters, outside with erect pale hairs near apex, inside more or less glabrous. **Fruits** globose, ripening white, to 10 mm long, c. 8 mm wide, drying longitudinally ridged, with uniform tomentum of pale erect hairs, stalk 1–3 mm long, calyx persisting; pyrenes 2, flat-faced with 3 (or rarely 4) longitudinal central ridges on convex face, $6 \times 5 \times 2$ mm.

Distribution. Endemic to the Malay Peninsula. In Singapore it still occurs in MacRitchie (*Yeoh SING2013-009*, 22 Dec 2012, SING [SING0192224]), Nee Soon (*Leong et al. SING2016-019*, 27 Jan 2016, SING [SING0236433]) and Seletar (*Turner et al. NRS 626*, 30 Apr 1992, SING [SING0037475]). Earlier collections came from locations including Pasir Panjang, end of Jurong Road, Kranji (*Ridley 5670*, 1893, SING [SING0012144]) and Ang Mo Kio woods (*Ridley 6473*, 1894, SING [SING0012145]).

Ecology. In forests.

Provisional conservation assessment. Globally not assessed. Listed as Critically Endangered (CR/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 73, 176, 210) but assessed here as Endangered (EN/D).

6. *Psychotria malayana* Jack

(of Malaya)

Malayan Misc. 1(1) (1820) 3; Wong, Tree Fl. Malaya 4 (1989) 397; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 159; Turner, Gard. Bull. Singapore 45 (1993) 203; Tan et al., Gard. Bull. Singapore, Suppl. 3 (1995) 48; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 441; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 73, 176, 210, p.p.; Turner & Chua, Checkl. Vasc. Pl. Sp. Bukit Timah Nat. Res. (2011) 71, p.p. **Synonyms:** *Psychotria aurantiaca* Wall. in Roxburgh, Fl. Ind. 2 (1824) 165, nom. illeg. superfl. – *Grumilea aurantiaca* Miq., Fl. Ned. Ind. 2, fasc. 2 (1857) 296, nom. illeg. superfl. – *Uragoga malayana*

(Jack) Kuntze, Revis. Gen. Pl. 2 (1891) 961. **Type:** *Jack s.n.* [EIC 8329A], [Malaysia], Penang, 1819 (lectotype K-W [K001125258], first step designated by Merrill, *Webbia* 7 (1950) 322, second step designated by Turner, *Gard. Bull. Singapore* 70 (2018) 285).

Psychotria stipulacea Wall. in Roxburgh, *Fl. Ind.* 2 (1824) 164; Ridley, *J. Straits Branch Roy. Asiat. Soc.* 33 (1900) 98; Ridley, *Fl. Malay Penins.* 2 (1923) 140; Keng, *Concise Fl. Singapore*, vol. 1, *Gymn. Dicot.* (1990) 160. **Synonym:** *Uragoga stipulacea* (Wall.) Kuntze, Revis. Gen. Pl. 1 (Nov 1891) 301, nom. illeg. non (Blume) K.Schum. (Aug 1891). **Type:** *Jack s.n.* [EIC 8329A], [Malaysia], Penang, 1819 (lectotype K-W [K001125258], designated by Turner, *Gard. Bull. Singapore* 70 (2018) 286).

Twigs drying light to dark brown, often red-brown, finely longitudinally striate, sometimes more roughly wrinkled or almost smooth, glabrous. **Stipules** often 1 cm long or more, apically rounded. **Leaves:** lamina lanceolate or elliptic to oblanceolate, 18–33 × 5–12 cm, apex shortly acuminate, base cuneate with lamina generally forming narrow decurrent wing to petiole, often extending to near petiole base, chartaceous, drying chestnut brown to blackish, glabrous, midrib slightly sunken to slightly raised above in dry leaves, secondary veins more or less flush to lamina surface, midrib raised below, secondary veins slightly raised below, secondary veins 11–15 pairs, arching forward and looping obscurely, sometimes with pin-prick domatia in axils, reticulations generally obscure; petiole 1–4 cm long, 2–3 mm wide, drying brown, longitudinally wrinkled, with a raised rim running round the petiole base proximally. **Inflorescences** terminal, pedunculate, peduncle 1.5–5 cm long at anthesis, primary branching trichotomous though the central branch may branch again close to the first node, inflorescence axes drying brown, laterally compressed, longitudinally striate with tomentum of very short, erect pale hairs; inflorescence generally broader than tall with lateral branches to 2–6.5 cm long at anthesis, main branches branching repeatedly, ultimately bearing closely spaced groups of flowers. **Flowers** subsessile to pedicellate; pedicel plus hypanthium 1–1.5 mm long, with very short, erect pale or light brown hairs; calyx tube c. 0.5 mm long, calyx lobes 0.3–0.5 mm long, 0.6–0.7 mm wide, light-brown hairy outside, glabrous within; corolla tube 1.5–2 mm long, widening distally, glabrous externally, corolla lobes 1–1.5 mm long, 0.5–1 mm wide, relatively thick particularly near apex, glabrous outside, long white hairs in throat of corolla tube. **Infructescences** with branches to 7 cm long. **Fruits** ovoid to globose, 4.5–6 mm long, 4–5 mm diam., drying chocolate brown, strongly ridged, sometimes with tiny pimples, stalk 1–3 mm long, persistent calyx at apex; pyrenes 2, drying pale straw-coloured, 6 × 4.5 × 2.5 mm, convex face with 5 or 6 distinct ribs.

Distribution. From Thailand to Java and Borneo. In Singapore represented by a single old collection from Bukit Timah (*Ridley 9122*, 1897, SING [SING0030530]).

Ecology. Forest understorey.

Provisional conservation assessment. Globally not assessed. Listed as Critically Endangered (CR/D) in Singapore by Tan et al. (in Davison et al. (ed.), *Singapore Red Data Book*, ed. 2 (2008) 241) and Chong et al. (*Checkl. Vasc. Pl. Fl. Singapore* (2009) 73, 176, 210) but, as the only record for Singapore dates from 1897, it must be presumed Nationally Extinct.

7. *Psychotria megacoma* Miq.

(Greek, *mega-* = large, great, wide, *-coma* = tuft of hair or leaves;
referring to the relatively large leaves of this species)

Fl. Ned. Ind. 2, fasc. 2 (1857) 284. **Synonym:** *Uragoga megacoma* (Miq.) Kuntze, Revis. Gen. Pl. 2 (1891) 961. **Type:** *Junghuhn s.n.*, [Indonesia], Java (lectotype L [L0281713], designated by Turner, Gard. Bull. Singapore 70 (2018) 286). **Fig. 67.**

Psychotria valetonii Hochr., Candollea 5 (1934) 266. **Type:** *Blume s.n.*, [Indonesia], Java (holotype G-DC [G00667566]).

Grumilea aurantiaca Miq. var. *lutescens* Miq., Fl. Ned. Ind. 2, fasc. 2 (1857) 297. **Synonym:** *Psychotria aurantiaca* Wall. var. *lutescens* (Miq.) Boerl., Handl. Fl. Ned. Ind. 2(1) (1891) 138. **Type:** *Zollinger 173*, [Indonesia], Java (lectotype L [L.2947299], designated by Turner, Gard. Bull. Singapore 70 (2018) 286).

Grumilea aurantiaca Miq. var. *subplumbea* Miq., Fl. Ned. Ind. 2, fasc. 2 (1857) 297. **Synonym:** *Psychotria aurantiaca* Wall. var. *subplumbea* (Miq.) Boerl., Handl. Fl. Ned. Ind. 2(1) (1891) 138. **Type:** *Junghuhn s.n.*, [Indonesia], Java, [Gunung] Gede der fehr. 3–5000 ft [914–1524 m] (lectotype L [L0281723], designated by Turner, Gard. Bull. Singapore 70 (2018) 286; possible isolectotypes L [L2947239], U [U1580519]).

Psychotria aurantiaca auct. non Wall.: Blume, Bijdr. Fl. Ned. Ind., pt 16 (1826–1827) 962.

Psychotria malayana auct. non Jack: Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 98; Ridley, Fl. Malay Penins. 2 (1923) 139; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 160, p.p.; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 73, 176, 210, p.p.; Turner & Chua, Checkl. Vasc. Pl. Sp. Bukit Timah Nat. Res. (2011) 71, p.p.

Psychotria sp. 9 of Wong, Tree Fl. Malaya 4 (1989) 398; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 444; Turner & Chua, Checkl. Vasc. Pl. Sp. Bukit Timah Nat. Res. (2011) 71.

Treelet or shrub to 2 m tall. **Twigs** hollow, drying light brown or grey-brown, youngest parts sometimes with dense tomentum of very short red-brown hairs only visible under magnification, finely longitudinally striate, older parts often drying laterally compressed and irregularly longitudinally wrinkled. **Leaves:** lamina ovate-elliptic to obovate-elliptic, 13–31 × 4.5–13 cm, base cuneate, apex shortly acuminate, chartaceous to subcoriaceous, drying dark brown to black, more rarely light brown or grey-brown, upper surface generally shiny, lower surface matt and often minutely dotted with pale or red-brown spots, midrib flush to slightly raised above, drying with a central furrow, secondary veins more or less flush above, midrib prominent below, secondary veins raised below, glabrous above, with hairs on midrib and main nerves below with scattered hairs on lower lamina surface, secondary veins 11–19 pairs, arching forward and looping within margin, reticulations faintly visible from below; petiole 2–3 cm long, 2–3 mm wide. **Inflorescences** terminal, pedunculate, peduncle 1–1.5 cm long at anthesis, generally with 5 primary branches 3–5 cm long, each branching several times more, inflorescence axes drying red-brown, finely longitudinally striate, angled, particularly the central main branch, with dense but very short brown hairs requiring magnification to see, ultimately bearing flowers in triplets, a larger central flower with branches on each side terminated by a single smaller flower each. **Flowers** subsessile, drying blackish (more rarely red-brown) with scattered red-brown hairs; pedicel plus hypanthium c. 1 mm long; calyx tube



Figure 67. *Psychotria megacoma* Miq. **A.** Flowering leafy shoot. **B.** Part of inflorescence with open flowers. **C.** Part of infructescence. (Cultivated in Singapore, Pasir Panjang Nursery, originally from a nursery in Indonesia. Photos: X.Y. Ng).

infundibuliform, rather thin, 2–3 mm long, c. 2.5 mm wide at mouth, calyx lobes scarcely discernible, tube mouth simply slightly wavy; corolla tube c. 6 mm long, 2 mm wide at mouth, corolla lobes c. 3 mm long, 1.5 mm wide at base. **Fruits** more or less sessile, ovoid, 8–9 mm long, c. 7 mm diam., drying dull black with persistent calyx forming a flat-topped widening ring at apex; pyrenes 2, $8.5 \times 7 \times 3$ mm, convex side with a broad flat rim apically and one or two faint ridges centrally.

Distribution. Malay Peninsula, Sumatra, Java and Borneo. In Singapore known only from a few old collections from Jurong (*Ridley 8422*, Mar 1891, SING [SING0045678]), Bukit Mandai (*Ridley 6556*, 1894, SING [SING0045681]), Bukit Timah (*Ridley 6468*, 1894, K, SING [SING0030529]), Bukit Panjang (*Ridley 12530*, 1906, K, SING [SING0045682]) and the Singapore Botanic Gardens' Rain Forest (*Ahmad s.n.*, 13 Mar 1926, SING [SING0000737]).

Ecology. Forest understorey.

Provisional conservation assessment. Globally not assessed. In Singapore presumed Nationally Extinct.

Notes. Turner (*Gard. Bull. Singapore 70* (2018) 283–288) provides a summary of the reasons for including the Singapore collections under the name *Psychotria megacoma*, though, as is the case for many local species of *Psychotria*, a detailed regional revision is still required.

8. *Psychotria morindiflora* Wall. ex Hook.f.

(Latin, *morindi-* = pertaining to genus *Morinda* L., *-flora* = flower; with flowers like *Morinda*)

Fl. Brit. India 3, fasc. 7 (1880) 166, as '*morindaeflora*'; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 98, as '*morindaeflora*'; Ridley, Fl. Malay Penins. 2 (1923) 131, as '*morindaeflora*'; Turner, Gard. Bull. Singapore 47 (1997 [1995]) 442; Turner & Kumar, Phytotaxa 361 (2018) 189. **Synonym:** *Uragoga morindiflora* (Wall. ex Hook.f.) Kuntze, Revis. Gen. Pl. 2 (1891) 961. **Type:** *Wallich s.n.* [EIC 8438A], Singapore, October 1822 (lectotype K-W [K001125515], designated by Turner & Kumar, Phytotaxa 361 (2018) 189).

Climber. **Twigs** drying pale to dark brown, terete, glabrous, generally smooth but sometimes with very fine longitudinal wrinkles. **Leaves:** lamina elliptic, more rarely ovate or obovate, 5.5–12 × 2.5–6.5 cm, base cuneate, apex acuminate, chartaceous to coriaceous, glabrous throughout, drying chestnut brown to almost black, sometimes shiny above, midrib flush to slightly raised above in dry leaves, often with a central longitudinal furrow, midrib raised below, secondary veins flush to slightly raised on both surfaces, secondary veins 6–7 pairs, arching forward and looping obscurely within margin, reticulations mostly obscure; petiole 3–22 mm long, 1 mm wide, glabrous, sometimes with horizontal cracks near base. **Inflorescences** more often sessile than pedunculate, with 3 or 5 dense heads of flowers, the upper three often drying as a trident with incurved side branches, main branch 3–6 cm long, inflorescence axes often drying laterally compressed, longitudinally furrowed, with very short brown or red-brown hairs, sometimes dense. **Flowers** densely packed into head, more or less sessile; pedicel plus hypanthium c. 0.5 mm long; calyx tube c. 0.25 mm long, sparsely, very short brown hairy

outside, calyx lobes broadly triangular c. 0.25 mm long, 0.5 mm wide, very short brown hairy outside, more or less glabrous within; corolla tube c. 2 mm long, 1.5 mm wide, more or less glabrous outside, densely white hairy in mouth, corolla lobes linear lanceolate, c. 1.5 mm long, 0.5–0.8 mm wide, apex inturned. **Infructescences** of similar dimensions to inflorescences. **Fruits** globose 6–7 mm long, 5 mm diam., sessile, stalk to 1 mm long, young fruits strongly ribbed; pyrenes 2, flat-faced with three longitudinal ridges centrally on convex face, $6.5 \times 5 \times 2.5$ mm.

Distribution. Endemic to the Malay Peninsula. In Singapore it was collected by Ridley from MacRitchie (*Ridley 13321*, 1908, K, SING [SING0030563]; *Ridley s.n.*, Nov 1892, SING [SING0030554]), Changi (*Ridley s.n.*, 1891, SING [SING0030564]) and Chan Chu Kang (*Ridley s.n.*, 1894, SING [SING0064281]). More recent records are all from Nee Soon (*Lim et al. NRS 770*, 6 May 1992, SINU).

Ecology. Lowland forests.

Provisional conservation assessment. Globally not assessed. It is assessed here as Critically Endangered (CR/D) in Singapore.

9. *Psychotria ovoidea* Wall. ex Hook.f.

(Latin, *ovoideus* = ovoid; possibly referring to the shape of the fruit)

Fl. Brit. India 3, fasc. 7 (1880) 166; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 98; Ridley, Fl. Malay Penins. 2 (1923) 130; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 160; Turner, Gard. Bull. Singapore 45 (1993) 203; Tan et al., Gard. Bull. Singapore, Suppl. 3 (1995) 48, fig. 5; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 442; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 73, 176, 223; Turner & Chua, Checkl. Vasc. Pl. Sp. Bukit Timah Nat. Res. (2011) 71; Turner & Kumar, Phytotaxa 361 (2018) 189. **Type:** *Wallich s.n.* [EIC 8383], Singapore, 1822 (lectotype K-W [K001125361], designated by Turner & Kumar, Phytotaxa 361 (2018) 189; possible isoelectotypes CGE, K-W [K001125360]). **Fig. 68A.**

Climber or creeper. **Twigs** more or less terete, smooth, drying brown, with persistent tomentum of more or less erect, though rarely perfectly straight, red-brown or dark brown, apparently multicellular, hairs. **Leaves:** lamina ovate, elliptic or obovate, $4\text{--}8 \times 2\text{--}5$ cm, base rounded, truncate or obtuse, lamina not decurrent to petiole, apex obtuse to shortly acuminate, chartaceous to subcoriaceous (often looking more leathery than they feel – at least when dry), drying pale grey, grey-brown, brown or dark brown above, grey to brown below, often with main nerves a distinctly redder brown, midrib more or less flush above, sometimes with a central furrow in dry leaves, prominent below, secondary veins immersed above, raised below, with scattered hairs along midrib above, particularly near base, though sometimes dense, typically with dense red-brown hairs along midrib below, sparser on veins and scattered on lamina surface, upper lamina often drying with minute irregular wrinkles, surface pinpricked and often with a very uniform covering of minute black dots, margin inrolled on lower surface, secondary veins 5–8 pairs, arching forward and looping obscurely within lamina, reticulations obscure from both



Figure 68. *Psychotria ovoidea* Wall. ex Hook.f. **A.** Fruiting leafy branch. *Psychotria polycarpa* (Miq.) Hook.f. **B.** Juvenile climbing stem. **C.** Open flowers. **D.** Fruits. (From Singapore, A from Bukit Timah Nature Reserve; B–D from Nee Soon. Photos: W.F. Ang).

surfaces; petiole 4–15 mm long, 1 mm wide, densely hirsute. **Inflorescences** pedunculate or sessile, peduncle to 2 cm long, primary branching trichotomous, 1.5–3 cm long, subsequent branches very short giving strongly congested appearance, inflorescence axes densely brown or red-brown hairy. **Flowers** subsessile; pedicel plus hypanthium 0.5–1 mm long, c. 0.5 mm wide, densely pale or red-brown hairy; calyx tube c. 0.5 mm long, widening distally, 1–1.5 mm wide at mouth, densely pale or brown hairy outside, calyx lobes ovate 0.4–0.7 mm long, c. 0.5 mm wide, densely pale or brown hairy outside, more or less glabrous within; corolla tube c. 2 mm long, widening rapidly from base, c. 1.5 mm wide at mouth, densely short pale hairy outside, dense white hairs in throat, corolla lobes triangular, 1.2–1.5 mm long, c. 1 mm wide at base, very slightly incurved at apex tip, densely short brown hairy outside, more or less glabrous within. **Fruits** globose to ovoid, c. 5 mm long, 4 mm diam., though often collected with smaller, immature fruits, scattered short brown hairs on berry, stalk 2–4 mm long, calyx persists with persistent tomentum outside; pyrenes 2, flat-faced, no discernible ribs or ridges on convex side, $4 \times 3.5 \times 1.5$ mm.

Distribution. Malay Peninsula and Borneo. In Singapore recent collections are from the Central Catchment (*Lua SING2014-219*, 4 May 2015, K, SING [SING0212394]; *Lee et al. SING2006-08*, 6 Sep 2006, SING [SING0079552]; *Gwee SING2010-109*, 19 Jan 2010, SING [SING0144678]) and Tyersall. Earlier records include Bukit Timah (*Maxwell 81-224*, 19 Nov 1981, SING [SING0172372], SINU), Singapore Botanic Gardens' Rain Forest, Jurong (*Ridley s.n.*, Jan 1889, SING [SING0030542]), Bajau and Tanglin.

Ecology. Lowland forests.

Provisional conservation assessment. Globally not assessed. Listed as Vulnerable (VU/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 73, 176, 223) but assessed here as Endangered (EN/D).

10. *Psychotria pachyphylla* (King & Gamble) Ridl.

(Greek, *pachy-* = thick, fat, *-phylla* = leaf; thick-leaved)

Fl. Malay Penins. 2 (1923) 129; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 442; Turner & Kumar, Phytotaxa 361 (2018) 190. **Basionym:** *Psychotria sarmentosa* Blume var. *pachyphylla* King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 74(1) (1906 [‘1905’]) 6. **Type:** *Curtis 2215*, [Malaysia], Penang, Government Hill, July 1890 (lectotype K [K000777164], designated by Turner & Kumar, Phytotaxa 361 (2018) 190).

Climber. **Twigs** drying red-brown to black, more rarely pale brown or green-brown, often darker in youngest parts, finely longitudinally striate, glabrous. **Leaves:** lamina ovate or ovate-elliptic, 6–12 × 4–8 cm, base obtuse to acute, ultimately decurrent to petiole, apex acuminate, chartaceous to thick-fleshy coriaceous, glabrous, drying light yellow-green to blackish, generally very shiny, particularly above, midrib and secondary veins generally raised on both surfaces in dry leaves, midrib finely longitudinally striate, often with a central

furrow above, secondary veins 7–8 pairs, running out more or less straight and parallel at a relatively high angle to the midrib before arching forward to loop clearly within the margin, slightly decurrent to midrib at base, some coarse reticulations generally visible in dry leaves, at least from above; petiole 10–20 mm long, 1–2 mm wide, drying brown, finely longitudinally striate. **Inflorescences** varying from sessile to pedunculate (peduncle to 3 cm long), primary branching trichotomous with the central branch most developed, 2–5 cm long, axes drying laterally compressed, longitudinally striate and with very short red-brown or pale yellowish hairs, densest on ultimate branches. **Flowers** with pedicel plus hypanthium 1–1.5 mm long, c. 0.5 mm wide, with very short red-brown or pale hairs; calyx tube c. 0.5 mm long, widening distally, appearing salverform after corolla has dropped, calyx lobes broadly triangular, 0.3–0.5 mm long, 0.5–0.7 mm wide, short red-brown hairs in upper portion outside, more or less glabrous within; corolla tube c. 1.5 mm long, c. 2 mm across at throat, densely short brown hairy outside, long pale hairs dense in throat, corolla lobes triangular c. 1.5 mm long, 1 mm wide, apex inturned, short brown hairy outside, glabrous within. **Infructescences** sessile to pedunculate (peduncle to 5 cm long), main branches 4–5 cm long. **Fruits** ellipsoidal, 7–9 mm long, 5–6.6 mm wide, drying blackish, some very short hairs near apex with is crowned by persistent calyx, fruit stalk 4–5 mm long, c. 1 mm wide; pyrenes 2, flat-faced with 3 central longitudinal ridges on the convex side, c. $9 \times 6.5 \times 2.5$ mm.

Distribution. Malay Peninsula and Borneo. In Singapore only known from a handful of early collections with definite localities of Tanjong Gul (*Ridley s.n.*, 1891, SING [SING0030561]), Pongol (*Ridley s.n.*, 1904, SING [SING0064280]) and Bukit Mandai (*Ridley 8432*, 1897, SING [SING0030562]).

Ecology. Lowland forests.

Provisional conservation assessment. Globally not assessed. In Singapore presumed Nationally Extinct.

11. *Psychotria penangensis* Hook.f.

(of Penang)

Fl. Brit. India 3, fasc. 7 (1880) 175; Ridley, Fl. Malay Penins. 2 (1923) 132; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 160; Turner, Gard. Bull. Singapore 45 (1993) 203; Tan et al., Gard. Bull. Singapore, Suppl. 3 (1995) 48; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 442, as ‘*penangiana*’; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 73, 176, 223; Turner & Chua, Checkl. Vasc. Pl. Sp. Bukit Timah Nat. Res. (2011) 71; Turner & Kumar, Phytotaxa 361 (2018) 190. **Synonym:** *Uragoga penangensis* (Hook.f.) Kuntze, Revis. Gen. Pl. 2 (1891) 962. **Type:** *Maingay 3297*, [Malaysia], Penang, top of Government Hill, 17 Feb 1867/1868 (lectotype K [K000777154], designated by Turner & Kumar, Phytotaxa 361 (2018) 190).

Climber. **Twigs** drying pale grey or grey-brown, terete, glabrous, very finely longitudinally wrinkled, younger parts generally darker brown to blackish, often drying with an irregular cross section. **Leaves:** lamina elliptic, oblong-elliptic or obovate, 7–13 × 3.5–7 cm, base ultimately cuneate, apex generally rounded and apiculate, sometimes obtuse and shortly

acuminate, chartaceous to subcoriaceous, drying grey, grey-brown or grey-green above, brown or grey-green below, glabrous, midrib flush to slightly sunken above, often drying with a narrow central furrow, midrib raised below near base but often more or less flush in upper half, secondary veins immersed above, flush to slightly raised below, pale idioblasts often visible on lamina surface above and below, secondary veins 8 pairs, arching forward and looping obscurely within margin, reticulations obscure from both surfaces; petiole 16–26 mm long, 2 mm wide, drying blackish, glabrous. **Inflorescences** pedunculate, more rarely sessile, peduncle 0–6 cm long, primarily trichotomous with central axis trichotomous again to give five branches bearing congested heads of pedicellate flowers, largest branches in an inflorescence 3–4 cm long, axes drying dark brown to blackish, glabrous or with very short pale hairs (only visible under magnification). **Flowers** with pedicel 1–1.5 mm long, c. 0.5 mm wide, angular, covered with very short pale hairs, hypanthium c. 1 mm long, dense pale hairy outside; calyx tube c. 0.5 mm long, widening distally, sparsely pale hairy outside, 2–3 mm across at mouth, calyx lobes broadly triangular, c. 0.5 mm long, 1 mm wide, sparsely short pale hairy inside and out; corolla tube c. 3 mm long, 1.5 mm wide, very short pale hairy outside, corolla lobes lanceolate, c. 2 mm long, c. 0.5 mm wide, apex turned in, densely short pale hairy outside. **Infructescences** with axes considerably longer than flowering stage, peduncle often exceeding 5 cm in length, main branches 5–11 cm long. **Fruits** fruits ellipsoidal, c. 9 mm long, 6 mm wide, crowned by persistent calyx, drying ribbed with surface coarsely wrinkled, more or less glabrous; stalk of mature berries 9–13 mm long, c. 1 mm wide; pyrenes 2, flat faced with four ribs on the convex side, c. 11 × 6.5 × 3.5 mm.

Distribution. Endemic to the Malay Peninsula. In Singapore only known from a recent collection from Upper Seletar (*Lua SING2012-292*, 6 Jul 2012, K, SING [SING0178899]).

Ecology. Lowland forests.

Provisional conservation assessment. Globally not assessed. Listed as Vulnerable (VU/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241) and (Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 73, 176, 223), however, their assessments were certainly based on many misidentified specimens. *Psychotria penangensis* is assessed here as Critically Endangered (CR/D).

12. *Psychotria polycarpa* (Miq.) Hook.f.

(Greek, *poly-* = many, *-carpa* = fruits; with many fruits)

Fl. Brit. India 3, fasc. 7 (1880) 165; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 98; Turner & Kumar, Phytotaxa 361 (2018) 191. **Basionym:** *Grumilea polycarpa* Miq., Fl. Ned. Ind. 2, fasc. 2 (1857) 295. **Synonyms:** *Uragoga polycarpa* (Miq.) Kuntze, Revis. Gen. Pl. 2 (1891) 962. – *Psychotria obovata* Wall. ex Ridl., Fl. Malay Penins. 2 (1923) 129, nom. illeg. non Ruiz & Pavon (1799), nec (Oerst.) Hemsl. (1881); Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 160; Turner, Gard. Bull. Singapore 45 (1993) 203; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 442; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241. **Type:** *Junghuhn s.n.*, [Indonesia], Sumatra, Padang, Apenberg (lectotype L [L0001230], designated by Turner & Kumar, Phytotaxa 361 (2018) 191). **Fig. 68B–D.**

Scrambling shrub. **Twigs** more or less terete, drying pale yellow-brown to dark red-brown, relatively smooth with the occasional slight longitudinally ridge or wrinkle, glabrous. **Leaves:** lamina chartaceous to subcoriaceous, drying grey or brown to dark brown, often quite shiny, glabrous on both surfaces, midrib and laterals more or less flush above, slightly raised below, midrib drying longitudinally wrinkled on both surfaces, margin inrolled below, lamina elliptic or rotund to obovate, 4–7.5 × 2–4 cm (juvenile shoots with even smaller and noticeably narrower leaves), base acute-cuneate to obtuse, apex shortly acuminate, secondary veins 4–5 pairs, arching forward and looping well within margin, higher orders of venation generally obscure; petiole 6–16 mm long, 1 mm wide, more or less glabrous. **Inflorescences** terminal, sessile to pedunculate, peduncle 0–40 mm long, primarily trichotomous with main branches 3–6 cm long at anthesis, ultimate axes with very short brown tomentum. **Flowers** with pedicel very short, c. 0.25 mm long, 0.25 mm wide, covered with very short brown hairs, hypanthium c. 0.25 mm long, 0.25 mm wide at base, short brown hairy; calyx short brown hairy outside, tube c. 0.5 mm long, lobes broadly triangular, c. 0.2 mm long, 0.5 mm wide; corolla tube 2–2.5 mm long, widening distally, c. 1.5 mm across at mouth, short pale brown hairy outside, lobes triangular 1–1.5 mm long, 0.5 mm wide at base, densely short, pale brown hairy outside, cobwebby within, dense white hairs in mouth of tube. **Infructescences** with main branches to 10 cm long, lateral branches similarly developed making infructescence relatively wide. **Fruits** ellipsoidal, 3–4 mm long, 2.5 mm wide, glabrous, drying dark brown with pale colleters, irregularly coarsely wrinkled, not ridged, calyx persistent surrounding raised disc, fruits subsessile, stalk to 0.5 mm long; much larger fruits (8–9 mm across) found on some specimens apparently galled; pyrenes 2, flat-faced, convex side with no discernible ridges or ribs, 3.5–4 × 2.5–3.5 × 1.5–2 mm.

Distribution. Southern Thailand to Borneo. In Singapore although widely collected, the most recent is from Upper Peirce in 1992 (*Gan et al. NRS 1148*, 27 May 1992, SINU). Other locations include Chan Chu Kang (*Ridley 5669*, 1893, BM, SING [SING0030535]), Alexandra Road (*Ridley 5746*, 1893, BM, SING [SING0030532]), Changi Beach (*Ridley s.n.*, 1893, BM), Chua Chu Kang (*Ridley s.n.*, 9 Nov 1899, SING [SING0030533]) and Mandai (*Jabil & Kassim 2006*, 17 Nov 1958, SINU).

Ecology. Lowland forests.

Provisional conservation assessment. Globally not assessed. Listed (under *Psychotria obovata*) as Critically Endangered (CR/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241). Also assessed here as Critically Endangered (CR/D).

Vernacular name. *Akar chinta mula* (Malay; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 98).

13. *Psychotria ridleyi* King & Gamble

(Henry Nicholas Ridley, 1855–1956, prolific botanist
and first Director of Singapore Botanic Gardens)

J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 74(1) (1906 [‘1905’]) 9; Ridley, Fl. Malay Penins. 2 (1923) 133; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 160; Turner, Gard. Bull. Singapore 45 (1993) 203; Tan et al., Gard. Bull. Singapore, Suppl. 3 (1995) 48; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 442; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 73, 176, 210; Turner & Chua, Checkl. Vasc. Pl. Sp. Bukit Timah Nat. Res. (2011) 71; Turner & Kumar, Phytotaxa 361 (2018) 191. **Type:** *Hullett 811*, [Malaysia], Malacca, Mount Ophir [Johor, G. Ledang], April 1888 (lectotype K [K000777151], designated by Turner & Kumar, Phytotaxa 361 (2018) 191).

Grumilea umbellata Miq., Fl. Ned. Ind. 2, fasc. 2 (1857) 295. **Synonym:** *Uragoga umbellifera* Kuntze, Revis. Gen. Pl. 2 (1891) 958. **Type:** *Junghuhn s.n.*, [Indonesia], Sumatra, Hochankola, Waldregion 1–3000 ft [305–914 m] (lectotype L [L0057612], designated by Turner & Kumar, Phytotaxa 361 (2018) 191).

Mussaenda membranacea King, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’]) 187. **Type:** *Goodenough 1639*, Singapore, Chan Chu Kang, 1 June 1890 (lectotype CAL [CAL0000029895], designated by Turner & Kumar, Phytotaxa 361 (2018) 191).

Psychotria kunstleri King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 74(1) (1906 [‘1905’]) 6; Ridley, Fl. Malay Penins. 2 (1923) 132. **Type:** *Scortechini* (syntype n.v.), [Malaysia], Perak; *King’s Collector 1886* (syntype n.v.), [Malaysia]; *King’s Collector 4953* (syntype n.v.), [Malaysia]; *King’s Collector 6588* (syntype n.v.), [Malaysia]; *Wray 2230* (syntype n.v.), [Malaysia]; *Forbes 2823* (syntype BM, CAL, K), [Indonesia], Sumatra.

Climber. **Twigs** glabrous, typically drying pale straw-coloured, with younger parts sometimes grey-green with abundant pale colleters as lengthways dashes. **Stipules** often present, at least near inflorescence, clearly bicuspid, with dense idioblasts. **Leaves:** lamina elliptic to elliptic-obovate, 4–14 × 1.5–5.5 cm, base cuneate, apex shortly acuminate, membranous to chartaceous, glabrous, generally drying fairly uniform pale shades of green, grey-green or brown, random dashes of pale idioblasts can generally be seen under magnification on lamina surface above or below, midrib slightly raised above in dry leaves though becoming flush near apex, sometimes drying with narrow central furrow, raised below, secondary veins more or less flush on both surfaces, secondary veins 5–8 pairs, generally difficult to distinguish in dry leaves, reticulations obscure; petiole 10–40 mm long, 1 mm wide. **Inflorescences** very shortly pedunculate, peduncle c. 4 mm long, primarily trichotomous with the central branch developing most strongly, to 2 cm long, axes drying laterally compressed, shallowly ridged, with tomentum of very short pale hairs densest on distal branches. **Flowers** with pedicel plus hypanthium 1–2 mm long; calyx cup-like, tube c. 0.5 mm long, c. 2 mm wide at mouth, densely very short pale hairy outside, calyx lobes triangular 1–1.2 mm in length and width, very short pale hairy outside, hairs sparser within; corolla tube c. 1 mm long, long pale hairs in throat, corolla lobes ovate, c. 1 × 1 mm, pale hairy outside. **Infructescences** considerably bigger than inflorescences, branches 3–8 cm long with developed fruit. **Fruits** ellipsoidal, 9–10 mm long, c. 7.5 mm wide, drying strongly ribbed, pale grey-green with abundant idioblasts, tiny white hairs near apex, crowned by persistent calyx, stalk 3–6 mm long, c. 1 mm wide, drying longitudinally furrowed, with very short pale hairs; pyrenes 2, flat-faced, convex side with 4 ribs, c. 8 × 7 × 4 mm.

Distribution. Malay Peninsula and Sumatra. In Singapore it is known from MacRitchie (*Leong et al. MR 2014-046*, 12 Aug 2014, SING [SING0205871]) and Bukit Timah (*Mhd Shah & Ali MS 4206*, 16 Dec 1982, SING [SING0037474, SING0045702]) and there are historic records from Chan Chu Kang (type of *Mussaenda membranacea* cited above) and the Singapore Botanic Gardens' Rain Forest (*Ridley s.n.*, 1906, BM).

Ecology. Lowland forests.

Provisional conservation assessment. Globally not assessed. Listed as Critically Endangered (CR/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 73, 176, 210). Given the paucity of recent collections, it is also assessed here as Critically Endangered (CR/D).

14. *Psychotria sarmentosoides* Valetton

(Latin, *-oides* = like, resembling; resembling the related species *Psychotria sarmentosa* Blume)

Icon. Bogor. 3 (1909) t. 292; Turner & Kumar, Phytotaxa 361 (2018) 193. **Type:** *No. 658*, [Indonesia], Java, cult. in Hort. Bot. Bogor. sub XVII.C.115 (lectotype L [L0001256], designated by Turner & Kumar, Phytotaxa 361 (2018) 193).

Psychotria sarmentosa auct. non Blume: Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 98; Ridley, Fl. Malay Penins. 2 (1923) 131; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1854; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 160; Turner, Gard. Bull. Singapore 45 (1993) 203; Turner, Gard. Bull. Singapore 47 (1997 [*1995']) 443; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 73, 176, 210.

Creeper and climber with adventitious roots. **Twigs** more or less terete, drying pale yellowish brown, finely longitudinally striate, generally glabrous except for short brown hairs on youngest parts. **Leaves:** lamina elliptic to obovate, 4–10 × 1.2–4.5 cm, base acutely cuneate, apex acute to acuminate with fairly sharp point, chartaceous, drying pale grey, brown or olive green, midrib flush to slightly raised above, often with fine longitudinal ridges, at least near base, in dry leaves, below raised, secondary veins flush above, slightly raised below, more or less glabrous above, often with more or less erect brown hairs along midrib below and sometimes scattered on lower lamina, margin inrolled below in dry leaves, secondary veins, 6–10 pairs, arching forward and looping within margin, coarse reticulations generally visible from both surfaces in dry leaves; petiole 4–15 mm long, 1 mm wide, with short brown hairs. **Inflorescences** terminal, pedunculate, peduncle to 3 cm long, primary branching trichotomous with central branch shorter than the lateral ones, sometimes with internodes very short basally, lateral branches to 3 cm long, axes angular and longitudinally ridged, covered in short erect brown hairs. **Flowers** subsessile, with pedicel to 1 mm long (difficult to distinguish pedicel and hypanthium), c. 0.5 mm wide, densely covered with very short brown hairs; calyx tube c. 0.5 mm long, densely short brown hairy outside, lobes triangular, 0.2–0.3 mm long, 0.5 mm wide, short brown hairy outside, more or less glabrous within, densely covered externally with very short pale hairs in bud, but becoming glabrous at anthesis; corolla tube 2–2.5 mm long, 1.5 mm wide, lobes acute triangular, c. 1.5 mm long, 0.5 mm wide at base, tips often incurved

and thickened. **Fruits** drying ellipsoid to obovoid, c. 4 mm long, 3 mm wide, longitudinally ridged, more or less glabrous; stalk 1–2 mm long; pyrenes 2, flat-faced with 3 or 4 prominent ridges on convex face, c. 5 × 3 × 2 mm.

Distribution. Thailand and Peninsular Malaysia. In Singapore the species was collected in various locations by Ridley, including Changi (*Ridley* 2875, 1891, BM, K, SING [SING 0030583]), Seletar (*Ridley* 2874, 1891, SING [SING0030574]), Kranji (*Ridley* 14177, 1909, BM, K, SING [SING0030581]), Woodlands (*Ridley s.n.*, 1903, SING [SING0030582]) and Bukit Mandai (*Ridley s.n.*, 1889, SING [SING0030579]), but there have been no collections since 1909.

Ecology. Lowland forests.

Provisional conservation assessment. Globally not assessed. Listed (under *Psychotria sarmentosa*) as Critically Endangered (CR/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 73, 176, 210) but, with no collections since 1909, it must be presumed Nationally Extinct.

15. *Psychotria scortechinii* King & Gamble

(Benedetto Scortechini, 1845–1886, Italian priest and botanist)

J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 74(1) (1906 [‘1905’]) 7; Ridley, Fl. Malay Penins. 2 (1923) 130; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 443; Turner & Kumar, Phytotaxa 361 (2018) 193. **Type:** *Kunstler* 897, [Malaysia], Perak, Goping, October 1880 (lectotype CAL [CAL000024819], designated by Turner & Kumar, Phytotaxa 361 (2018) 193).

Psychotria cantleyi Ridl., J. Straits Branch Roy. Asiat. Soc. 61 (1912) 24; Ridley, Fl. Malay Penins. 2 (1923) 130; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 158; Turner, Gard. Bull. Singapore 45 (1993) 202; Tan et al., Gard. Bull. Singapore, Suppl. 3 (1995) 48; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 441; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 73, 176, 210; Turner & Chua, Checkl. Vasc. Pl. Sp. Bukit Timah Nat. Res. (2011) 70. **Type:** *Lake & Kelsall s.n.*, [Malaysia], Johore, Mount Austin, Kwala Sembong, 1892 (lectotype SING [SING0234543], designated by Turner & Kumar, Phytotaxa 361 (2018) 193).

Climber. **Twigs** drying a light red-brown, finely longitudinally striate, glabrous. **Leaves:** lamina ovate, ovate-lanceolate or narrowly elliptic, 3.5–7 × 1.5–3 cm, base obtuse to more or less rounded, apex acute and acuminate, thinly chartaceous, drying brown to dark brown, generally darker above, midrib more or less flush above, sometimes drying with a narrow central furrow, secondary veins more or less immersed above, midrib prominent below, secondary veins raised, glabrous above, with scattered long hairs on midrib below, secondary veins 5–6 pairs, arching forward and looping within margin, reticulations faint to obscure in dry leaves; petiole 3–7 mm long, 1 mm wide. **Inflorescences** small and relatively few-flowered, to 2 cm long at anthesis, lateral branches weakly developed, axes drying laterally

compressed, longitudinally ridged, with very short brown hairs. **Flowers** with pedicel plus hypanthium c. 1 mm long, more or less glabrous; calyx cup-like, tube c. 0.5 mm long more or less glabrous externally, calyx lobes triangular, 0.6–0.7 mm long, 0.4–0.6 mm wide, more or less glabrous; corolla tube c. 3 mm long, glabrous externally, lobes triangular c. 1.5 mm long, 1 mm wide at base, glabrous outside, minutely hairy along margin inside. **Infructescences** to 4 cm long. **Fruits** more or less globose, c. 7 mm diam., drying ridged, glabrous, stalk to 2 mm long, 0.7 mm wide; pyrenes 2, flat-faced with 4 or 5 longitudinal ridges on convex side, 8–8.5 × 5 × 2.5 mm.

Distribution. Endemic to the Malay Peninsula. Only known from a single collection in Singapore at Chan Chu Kang (*Ridley s.n.*, 1892, SING [SING0030510]).

Ecology. Lowland forest.

Provisional conservation assessment. Globally not assessed. Listed (under *Psychotria cantleyi*) as Critically Endangered (CR/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 73, 176, 210) but, as the only record for Singapore dates from 1892, it must be presumed Nationally Extinct.

43. PSYDRAX Gaertn.

(Greek, *psydrax* = blister, pustule; probably alluding to the knobby pyrenes)

Tulang-tulang (Malay)

Fruct. Sem. Pl. 1 (1788) 125, t. 26: fig. 2; Bridson, Kew Bull. 40 (1985) 687; Wong, Arbor. Rubiac. Malaya (1988) 174; Wong, Tree Fl. Malaya 4 (1989) 399; Puff et al., Rubiac. Thailand (2005) 124, pl. 3.1.40; Mahyuni et al., Floribunda 5 (2018) 322; Wong & Mahyuni, Reinwardtia 17 (2018) 77. **Type:** *Psydrax dicoccos* Gaertn.

Mesoptera Hook.f. in Bentham & Hooker, Gen. Pl. 2(1) (1873) 130; Hooker, Fl. Brit. India 3, fasc. 7 (1880) 136; Schumann in Engler & Prantl, Nat. Pflanzenfam. 4(4) (1891) 92; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 63; Ridley, Fl. Malay Penins. 2 (1923) 127. **Type:** *Mesoptera maingayi* Hook.f. (= *Psydrax maingayi* (Hook.f.) Bridson).

Trees, shrubs, rarely (but not in Southeast Asia) lianas; arborescent taxa with rather straight trunks and evenly spaced decussate pairs of horizontal main branches; side branches along the main branch usually in pairs, alternate pairs with one branch horizontal on one side and the other branch deflexed, the remaining branch-pairs each with a branch horizontal on the opposite side and the other branch deflexed. **Stipules** typically with a prolonged keeled cusp or slightly broadened apical lobe. **Leaves** distichously arranged along branches, commonly with glabrous or hairy domatia in the axils of secondary veins on the lower surface. **Flowers** (4–)5-merous, in sessile to pedunculate umbellate cymes or clearly branched cymes; bracts and bracteoles (in Southeast Asian taxa) typically small or inconspicuous; calyx with a subtruncate or lobed limb; corolla tube subcylindric to infundibular, pubescent at the throat, inside typically with a ring of deflexed hairs, lobes valvate, reflexed; anthers and filaments of similar length, strongly

reflexed and completely exerted from the corolla throat; stigma 2-lobed, with a conspicuous basal recess, clearly exerted on a long style; ovary 2-locular, ovules solitary in each locule; disk glabrous or pubescent. **Fruits** obovoid to subglobose, slightly compressed, often bilobed; pyrenes somewhat plano-convex. **Seeds** one in each pyrene.

Distribution. A genus of approximately 100 species in tropical Africa, Asia, Australasia and the Pacific. In Singapore 4 native species.

Taxonomy. Prior to the work of Bridson (Kew Bull. 40 (1985) 687–725), and Wong (Arbor. Rubiac. Malaya (1988) 174–186a), the Malay Peninsula species, 14 in all, were mostly placed in *Canthium* s.l., often misidentified as *Canthium didymum* C.F.Gaertn. and *C. dicoccum* (Gaertn.) Merr. *Canthium* Lam. s.s. is distinct by its mostly scrambling and climbing habit, axillary spines, and flowers that are solitary, fasciculate or in cymes borne in the axils of leaves on normal shoots, as well as in the axils of both normal leaves and scale- or bract-like reduced leaves found on axillary brachyblasts (short-shoots).

Keng (Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 152) recorded *Psydrax maingayi* (Hook.f.) Bridson for Singapore (as an alternative name under *Canthium diocccum* [sic]) but this was based on the collection *Sinclair SFN 39530* which is actually a specimen of *Psydrax undulatifolius*. *Psydrax maingayi* does not occur in Singapore but Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 73, 176, 210) subsequently listed it as Critically Endangered (CR/D). The latter's listing of *Psydrax nitidus* (Craib) K.M.Wong (as '*nitida*') follows misidentifications of Singapore collections. Wong (Arbor. Rubiac. Malaya (1988) 174; Tree Fl. Malaya 4 (1989) 399) has noted that this species is only known from Peninsular Thailand and northwestern Peninsular Malaysia.

Notes. We treat the genus as masculine, although it has elsewhere been incorrectly treated as feminine and neuter.

As Singapore material of the several species recorded is scanty, the species descriptions include measurements from throughout their ranges, not just for Singapore. The inflorescences are commonly susceptible to witches' broom; when galled, they are more copiously branched, the ultimate branches bearing multiple bracts arranged in clusters or whorls but no flowers.

Key to *Psydrax* in Singapore

1. Leaves with upper surface drying glossy to slightly glossy; corolla lobes longer than the tube 2
 Leaves with upper surface drying matt; corolla lobes shorter than to equalling the tube ...
3
2. Leaf margins plane **2. P. lucidulus**
 Leaf margins consistently wavy or undulate **4. P. undulatifolius**

3. Midrib on leaf upper surface prominent; inflorescences more laxly branched to 3(–4) orders, main branches 3–5 mm long; corolla lobe inner surface densely minutely hairy becoming glabrescent **1. *P. approximatus***
 Midrib on leaf upper surface channelled; inflorescences very compact, visibly branched only to 2 orders, main branches up to 1 mm long only; corolla lobe inner surface glabrescent except for dense hairs at the throat also occupying the lobe mid-base
 **3. *P. sumatranus***

1. *Psydrax approximatus* (Korth.) Mahyuni & K.M.Wong

(Latin, *approximatus* = close to; referring to *Canthium* where it was uncertainly placed)

Reinwardtia 17 (2018) 79. **Basionym:** *Canthium approximatum* Korth., Ned. Kruidk. Arch. 2(4) (1851) 234. **Synonym:** *Plectronia approximata* (Korth.) Merr., J. Straits Branch Roy. Asiat. Soc., Special No. (1921) 566. **Type:** *Korthals s.n.*, [Indonesia], Borneo, [Kalimantan], Banjarmassing [Banjarmasin] (lectotype L [L0000146], designated here).

Canthium didymum auct. non C.F.Gaertn.: Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 96; Ridley, Fl. Malay Penins. 2 (1923) 126, p.p.

Psydrax sp. 11 of Wong, Arbor. Rubiac. Malaya (1988) 185; Wong, Tree Fl. Malaya 4 (1989) 402 (in clavi); Turner, Gard. Bull. Singapore 45 (1993) 203; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 445; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241.

Psydrax sp. 4 of Coode et al., Checkl. Flow. Pl. Gymn. Brunei (1996) 263.

Small tree to 15 m tall; bark smooth to fissured. **Stipules** with a broad triangular base 1–2 mm long and keeled apical cusp 1–2.5(–6) mm long. **Leaves:** lamina ovate to elliptic, 5–8.5(–10) × 3.5–5.5 cm, apex apiculate, to c. 1.5 cm long, base cuneate, margin plane to very remotely undulate, subcoriaceous, upper surface matt in dried material, secondary veins 4–5 pairs, midrib and secondary veins raised on both surfaces, tertiary veins inconspicuous; petioles (4–)7–13 mm long. **Inflorescences** with peduncle 2–2.5 mm long, densely scabrid, visibly branched to 3(–4) orders, main branches 3–5 mm long, densely scabrid. **Flowers** with pedicels 2–3.5 mm long, densely scabrid; calyx and hypanthium c. 1 mm long, including 5 lobes c. 0.1–0.2 mm long, densely hairy all over; corolla tube 2–2.5(–3) mm long, lobes 1.5–2.5 mm long, both outer and inner surfaces densely minute-hairy becoming glabrescent, throat with erect hairs partly exsert; filaments 0.5–1.5 mm long, anthers 1.5–2 mm long, the whole reflexed and exserted; style exserted for 3–5 mm from corolla throat; stigma 0.8–1 mm long. **Fruits** compressed obovoid, typically bilobed, 7–10 × 3–8 mm; pedicels 4–10 mm long. **Pyrenes** rugose.

Distribution. Malay Peninsula, Sumatra and Borneo. In Singapore it has been recorded from Serangoon Road (*Ridley s.n.*, 1905, SING [SING0030587]), Pulau Ubin (*Ali Ibrahim et al. GW 21*, 9 Jun 2003, SING [SING0045689]; *Ali Ibrahim & Lai SING2011-478*, Nov 2011, SING [SING0182032, SING0182033]) and Pulau Tekong (*Koh SING2011-394*, 6 Oct 2011, SING [SING0166313]).

Ecology. Freshwater and mangrove swamps, and brackish water vegetation.

Provisional conservation assessment. Globally not assessed. Despite being naturally widespread, the habitats in which this species occurs have been very prone to disturbance and land-use transformation. It was listed (under ‘*Psyrax* sp. 11 of Wong’) as Critically Endangered (CR/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241) but is assessed here as Vulnerable (VU/D).

2. *Psyrax lucidulus* (Miq.) Mahyuni & K.M.Wong

(Latin *lucidulus* = somewhat shining; referring to the slightly glossy upper leaf surface)

Reinwardtia 17 (2018) 82. **Basionym:** *Vangueria lucidula* Miq., Fl. Ned. Ind., Eerste Bijv., fasc. 3 (1861) 544. **Synonym:** *Canthium lucidulum* (Miq.) Miq., Ann. Mus. Bot. Lugduno-Batavi 4, fasc. 8 (1869) 254. **Type:** *Teijsmann 4000*, [Indonesia], Sumatra, Palembang, Muara Enim, Gunung Megang (lectotype BO [B0-1321867], designated here).

Psyrax nitidus auct. non (Craib) K.M.Wong: Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241, as ‘*nitidum*’; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 73, 176, 223, as ‘*nitida*’.

Psyrax sp. 10 of Wong, Arbor. Rubiac. Malaya (1988) 185; Wong, Tree Fl. Malaya 4 (1989) 404; Turner, Gard. Bull. Singapore 45 (1993) 203; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 445; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241.

Small to medium tree to 28 m tall, developing buttresses to 1.5 m high; bark smooth to slightly flaky or fissured. **Stipules** with a broad triangular base 2.5–4 mm long and keeled apical cusp 1–2 mm long. **Leaves:** lamina ovate to elliptic, 3.4–8.1(–10.5) × 1.2–2.6(–4.7) cm, apex apiculate with blunt tip, to 0.4–1 cm long, base cuneate to obtuse, margin plane, chartaceous, upper surface slightly glossy in dried material, secondary veins 5–6 pairs, midrib flat on upper surface, raised on lower surface, secondary veins flat to slightly raised on upper surface, raised on lower surface, tertiary veins inconspicuous; petioles 3–6(–10) mm long. **Inflorescences** with peduncle 2–4(–5) mm long, sparsely scabrid to glabrescent, compact and visibly branched to 1(–2) orders only, main branches 1.5–2.5 mm long, sparsely scabrid to glabrescent. **Flowers** with pedicels 2–3 mm long, sparsely scabrid to glabrescent; calyx and hypanthium 1–1.5 mm long, including 5 triangular lobes 0.1–0.2 mm long, sparsely hairy to glabrescent all over; corolla tube c. 1 mm long, lobes c. 1.5 mm long, both outer and inner surfaces densely minute-hairy becoming glabrescent, throat with dense exserted erect hairs; filaments c. 0.5 mm long, anthers c. 1.5 mm long, the whole reflexed and exserted; style exserted for 2.5–3 mm from corolla throat; stigma c. 1 mm long. **Fruits** compressed obovoid, typically bilobed, 8–12 × 5–9 mm; pedicels 7–10 mm long. **Pyrenes** rugose.

Distribution. Peninsular Malaysia (most west coast states as well as Johor and Kelantan), Sumatra and Borneo. In Singapore collected in fruit in Seletar (*Nura et al. NK 180*, 17 Nov 1994, SING [SING0064110, SING0064111]) and with young inflorescences at MacRitchie (*Chua & Nagarajan YK 2005-04*, 17 Mar 2005, SING [SING0058116]). Other gatherings

of this species, of leafy branches only, include from Nee Soon (*Samsuri et al. NES 259*, 26 Aug 2003, SING [SING0046271]), Mandai (*Gwee et al. SING2009-07*, 6 Jan 2009, SING [SING0116936, SING0137305]) and Chestnut Avenue (*Gwee et al. SING2008-196*, 20 May 2008, SING [SING0113867]).

Ecology. Lowland forest.

Provisional conservation assessment. Globally not assessed. This naturally widespread species is found mainly in the lowlands which have been particularly prone to disturbance and land-use transformation. It was listed as Vulnerable (VU/D) in Singapore by Tan et al. (in Davison et al. (ed.), *Singapore Red Data Book*, ed. 2 (2008) 241, under *Psydrax nitidus*) and Chong et al. (*Checkl. Vasc. Pl. Fl. Singapore* (2009) 73, 176, 223, under *Psydrax nitida*) but also listed as Endangered (EN/D) under a separate entry for '*Psydrax* sp. 10 of Wong' (Tan et al. in Davison et al. (ed.), *Singapore Red Data Book*, ed. 2 (2008) 241). It is assessed here as Vulnerable (VU/D) in Singapore.

3. *Psydrax sumatranus* (Miq.) Mahyuni

(of Sumatra)

Floribunda 5 (2018) 328. **Basionym:** *Canthium sumatranum* Miq., *Fl. Ned. Ind.* 2, fasc. 2 (1857) 254. **Type:** *Junghuhn s.n.*, [Indonesia], Sumatra (holotype L [L0000193]).

Canthium dicocum (Gaertn.) Merr. var. *impolitum* Craib, *Fl. Siam.* 2(1) (1932) 138. **Type:** *Kerr 14759*, Siam [Thailand], Songkhla, Wang Zai, 24 March 1928 (lectotype K [K000763708], designated here; isoelectotypes BK [SN257325], BM [BM000945461]).

Psydrax sp. 5 of Wong, *Arbor. Rubiac. Malaya* (1988) 182; Wong, *Tree Fl. Malaya* 4 (1989) 403; Turner, *Gard. Bull. Singapore* 47 (1997 [‘1995’]) 444.

Small tree to 15 m tall; bark smooth, cracked or fissured. **Stipules** with a broad triangular base 1–2 mm long and keeled apical cusp 2–7 mm long. **Leaves:** lamina ovate to elliptic, 5–11 × 2.5–5.7 cm, apex acute to acuminate to cuspidate, base cuneate, margin plane, coriaceous, upper surface matt in dried material, secondary veins 3–5 pairs, midrib channelled on upper surface, raised on lower, secondary veins channelled to flat on upper surface, raised on lower, tertiary veins inconspicuous; petioles (3–)6–10 mm long. **Inflorescences** with peduncle 1–2 mm long, densely scabrid, very compact and branched to 2 orders only, main branches up to 1 mm long only, densely scabrid. **Flowers** with pedicels 3–5 mm long, densely scabrid; calyx and hypanthium c. 1 mm long, including 5 lobes c. 0.1–0.2 mm long, densely hairy only at lobe apices, otherwise glabrescent; corolla tube 2–2.5 mm long, lobes 1.5–2 mm long, outside glabrescent, inner surface glabrous except for dense hairs at mid-base, throat with erect hairs partly exerted; filaments c. 1 mm long, anthers 0.8–1 mm long, the whole reflexed and exerted; style exerted for 2.5–3.5 mm from corolla throat; stigma 0.7–0.8 mm long. **Fruits** compressed obpyriform, ovoid or obcordate, typically bilobed, 5–7 × 4–8 mm; pedicels 5–14 mm long. **Pyrenes** rugose.

Distribution. Peninsular Thailand, Peninsular Malaysia (Penang, Perak, Terengganu, Pahang and Johor) and Sumatra. In Singapore known only by old collections from Chan Chu Kang (*Ridley 271*, 1889, SING [SING0095448]; *Ridley 358*, 1889, SING [SING0095447]).

Ecology. Across its range in a wide variety of forest habitats.

Provisional conservation assessment. Globally Vulnerable VU A2(c). Possibly the most common species of the genus in Southeast Asia as it occurs in most forest types up to c. 1500 m, but, due to widespread land-use changes and habitat reduction, it is assessed here as Globally Vulnerable. In Singapore presumed Nationally Extinct.

Taxonomy. The type collection by Junghuhn does not have inflorescences or fruits and consists of only a leafy twig. There is some variability: outside the Malay Peninsula, the corolla tube can vary from broadly cylindrical to wide-infundibular, and corolla lobes can vary from glabrescent to densely hairy on the outer surfaces.

4. *Psydrax undulatifolius* K.M.Wong & Mahyuni

(Latin, *undulatus* = wavy, *-folius* = -leaved)

Reinwardtia 17 (2018) 78. **Type:** *Ridley 6475*, [Malaysia], Johor, Sungei Ban, 1894 (holotype SING [SING0189442]).

Psydrax maingayi auct. non (Hook.f.) Bridson: Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 152; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 73, 176, 210; Turner & Chua, Checkl. Vasc. Pl. Sp. Bukit Timah Nat. Res. (2011) 71.

Psydrax sp. 1 of Wong, Arbor. Rubiac. Malaya (1988) 180; Wong, Tree Fl. Malaya 4 (1989) 402; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 444.

Small tree to 20 m tall, bark smooth becoming fissured. **Stipules** with a broad triangular base 1–1.5 mm long and keeled apical cusp 2–3.5 mm long. **Leaves:** lamina elliptic, (2.5–)7–10(–13) × (1–)2.3–4(–5.5) cm, apex cuspidate to apiculate, to c. 1.2 cm long, base cuneate, margin conspicuously wavy or corrugate, subcoriaceous, upper surface glossy in dried material, secondary veins 3–4(–6) pairs, midrib and secondary veins raised on both surfaces, tertiary veins inconspicuous; petioles 3–8(–12) mm long. **Inflorescences** with peduncle 1–2 mm long, densely scabrid, very compact and visibly branched to 1(–2) orders only, main branches 1–1.5 mm long, densely scabrid. **Flowers** with pedicels (1.5–)5–8 mm long, densely scabrid; calyx and hypanthium 1–1.5 mm long, including 5 lobes c. 0.2–0.3 mm long, sparsely to densely hairy all over; corolla tube 1.5–2 mm long, lobes 2–2.5 mm long, both scattered suberect pale-hairy on the outer surfaces, the lobes with fine indumentum over the inner surface; filaments c. 1 mm long, anthers 1–1.5 mm long; style exerted for c. 3 mm from the corolla throat; stigma 0.5–0.8 mm long. **Fruits** obovoid to subglobose, not conspicuously bilobed, 5–7 × 5–8 mm; pedicels 6–10 mm long. **Pyrenes** rugose.

Distribution. Peninsular Malaysia. In Singapore known only from Bukit Timah (*Hill H.314*, 15 Apr 1970, SING [SING0189481]) and Sungei Hantu opposite Pulau Sarimbun (*Sinclair SFN 39530*, 28 Mar 1953, SING [SING0239956]).

Ecology. Lowland evergreen forest and rocky coasts.

Provisional conservation assessment. Globally Vulnerable VU A2(c) on account of habitat reduction in the lowlands. Listed (under *Psydrax maingayi*) as Critically Endangered (CR/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 73, 176, 210) but, with no collections since 1970, it must be presumed Nationally Extinct.

44. SAPROSMA Blume

(Greek, *sapro-* = putrid, rotten, *-osma* = smell;
referring to the smell of bruised tissue)

Bijdr. Fl. Ned. Ind., pt 16 (1826–1827) 956; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 98; Ridley, Fl. Malay Penins. 2 (1923) 169; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1997; Corner, Wayside Trees Malaya, ed. 3, 2 (1988) 650; Wong, Arbor. Rubiac. Malaya (1988) 194; Wong, Tree Fl. Malaya 4 (1989) 407; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 161; Puff et al., Rubiac. Thailand (2005) 108, pl. 3.1.32. **Type:** *Saprosma arborea* Blume, lectotype designated by Ridsdale, Revis. Handb. Fl. Ceylon 12 (1998) 306.

Shrubs or small trees, foetid when bruised. **Stipules** broadly triangular, edges fused, entire to 2–multi-fid, with pale stiff bristle-like structures (colleters) along the base on the inner side exposed at the nodes and long-persistent after the stipules tear or fall away. **Leaves** opposite or in whorls of threes. **Inflorescences** cymes sometimes with condensed axes and then resembling a tight head of flowers, mostly terminal to short branches comprising 1(–few) modular units each of which has a proximal leafless node and a distal node with a leaf pair. **Flowers** bisexual or (functionally?) unisexual, green, white or yellow; calyx obconical, limb truncate or with 4–5 triangular to linear lobes; corolla tube short-cylindric or infundibular, the throat hairy; corolla lobes 4–5, ovate, valvate in bud, margins inflexed; anthers dorsifixed, inserted on short filaments at the corolla throat or lower down, exerted or not; stigma 2-lobed, exerted or not; ovary 2-locular; ovules 1 in each locule, basally attached, erect. **Fruits** globose to ellipsoid, smooth, ripening crimson, blue, purple or black, sometimes with a white-waxy bloom; pyrenes 2 (or 1 by abortion). **Seeds** ellipsoid or plano-convex.

Distribution. About 45 species in South Asia and Indo-Malesia. In Singapore 1 native species.

Taxonomy. In a molecular analysis, Rydin et al. (Taxon 58 (2009) 793) recovered *Saprosma* sister to the Paederieae; its tribal position is not quite certain yet.

Saprosma glomerulata King & Gamble

(Latin, *glomerulatus* = gathered in a head-like cluster; referring to the flowers)

J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 98; Ridley, Fl. Malay Penins. 2 (1923) 170; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1998; Corner, Wayside Trees Malaya, ed. 3, 2 (1988) 650; Wong, Arbor. Rubiac. Malaya (1988) 194; Wong, Tree Fl. Malaya 4 (1989) 407; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 161; Turner, Gard. Bull. Singapore 45 (1993) 203; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 445; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241, as ‘*glomerulatum*’; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 77, 176, 211, as ‘*glomerulatum*’. **Type:** *Ridley 10931*, Singapore, Bukit Timah, 1900 (lectotype SING [SING0012166], designated here). **Fig. 69.**

Treelet or small tree to 4 m tall; stems and leaves foetid when bruised; ultimate twig internodes sometimes slightly flattened, older twigs often with pale corky-flaky bark. **Stipules** elliptic to ovate, to 12 mm long, short-bifid at the apex, basally thickened and drying pale coriaceous, glabrous outside, sparsely short-hairy inside, with a row of colleters to c. 3 mm long lining the inner edge of the stipule base and which are long-persistent as pale bristle-like structures revealed when the distal part of the stipule is torn or falls away. **Leaves:** lamina elliptic to obovate, 5–18 × 2.5–6 cm, apex cuspidate to caudate, base cuneate, chartaceous to thin-coriaceous, glabrous on both surfaces, midrib channelled above, prominent below, secondary veins 5–8(–12) pairs, flat to impressed above, prominent below, tertiary veins reticulate-subscalariform, slightly prominent on both surfaces; petioles 3–4 mm long, c. 1 mm diam. **Inflorescences** very condensed, sessile, 3–5-flowered; bracts 2–several, ovate, 3–4 mm long, bifid at their apices. **Flowers** sessile; calyx cupular, 1–1.5 mm long, subtruncate to weakly 4-lobed, subglabrous to minutely hairy especially on the margin; corolla subrotate, pale green to cream, tube 1–1.5 mm long, 1–1.5 mm wide, glabrous, lobes 4, elliptic-ovate, c. 2 mm long, c. 1.5 mm wide at the base, minutely hairy, throat with pale hairs; stamens 4, inserted at corolla throat or lower down, filaments c. 1 mm long, white, glabrous, anthers c. 0.5 mm long, introrse, glabrous; ovary ovoid-subglobose, style c. 1–1.5 mm long, stigma 2-lobed, hairy. **Fruits** subglobose to ovoid, 5–7 mm long, 6–7 mm wide, glabrous, green ripening dark blue to purple-black.

Distribution. Endemic to the Malay Peninsula and recorded in most states of Peninsular Malaysia. In Singapore it has been recorded only from Bukit Mandai (*Goodenough s.n.*, 14 Apr 1890, SING [SING0012167]), where it is possibly extinct, and Bukit Timah, where populations are well-conserved (e.g. *Maxwell 82-133*, 6 Apr 1982, SING [SING0012163]; *Tang & Sidek 1009*, 17 Oct 1995, SING [SING 0054754]; *Lai LJ 35*, 20 Sep 1996, SING [SING0012168]; *Chen LCMJ 201*, 24 Dec 2002, SING [SING0042722]; *Lua et al. SING2019-153*, 12 Mar 2019, SING [SING0270387, SING0270388, SING0270389]).

Ecology. Lowland to lower montane forest.

Provisional conservation assessment. Globally not assessed. Listed as Critically Endangered (CR/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 77, 176, 211).

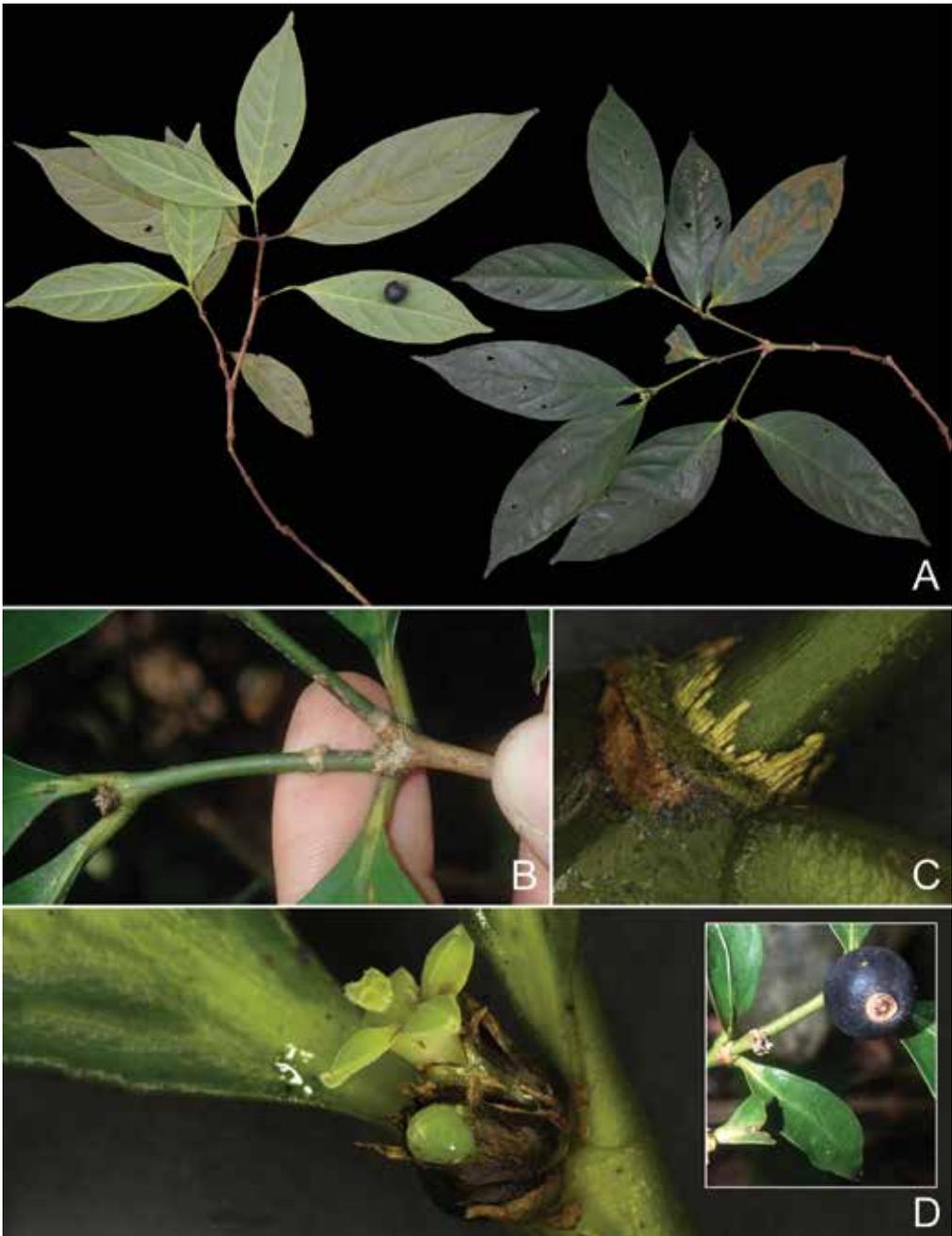


Figure 69. *Saprosma glomerulata* King & Gamble. **A.** Leafy branches. **B.** Detail of two axillary branches, each showing the basic modular unit of branch elongation comprising a proximal leafless node and a distal node with a leaf pair. **C.** Node with the distal part of a stipule fallen away, revealing a row of stiff pale colleters attached to the inner base of the stipule. **D.** Flower bud and open flower. Inset: Ripe fruit. (From Singapore, Bukit Timah Nature Reserve, *Lua et al. SING2019-153*. Photos: A, W.H. Lim; B, D (inset), H.K. Lua; C, D (main photo), S.L. Koh).

Taxonomy. *Saprosma arborea* Blume from Java, typified by *Blume s.n.*, Java, ‘Kayou Kaki toutan’ (lectotype L [L0001317], designated here), has a superficial resemblance but only 3–5 pairs of leaf secondary veins, much longer (10–16 mm long) petioles and more pronounced leaf cauda.

Notes. There seems to be some variability in whether the stamens and styles are included or exerted. This is probably due to short-styled and long-styled forms (alternatively, functionally male and female flowers) being present but there is insufficient flowering material for this to be conclusive.

45. SCHRADERA Vahl

(Heinrich Adolph Schrader, 1767–1836, German botanist)

Eclog. Amer. 1 (1796) 35, t. 5, nom. cons.; De Candolle, Prodr. 4 (1830) 443; Richard, Mém. Rubiac. (1830) 149; Bentham & Hooker, Gen. Pl. 2(1) (1873) 66; Schumann in Engler & Prantl, Nat. Pflanzenfam. 4(4) (1891) 64; Puff et al., Blumea 43 (1998) 287; Puff et al., Rubiac. Thailand (2005) 158, pl. 3.2.5. **Type:** *Schradera capitata* Vahl (= *Schradera involuocrata* (Sw.) K.Schum.).

Lucinaea DC., Prodr. 4 (1830) 368; Endlicher, Gen. Pl., fasc. 7 (1838) 558, as ‘*Lucinaea*’; Korthals, Ned. Kruidk. Arch. 2(4) (1851) 166; Miquel, Fl. Ned. Ind. 2, fasc. 2 (1857) 197; Miquel, Ann. Mus. Bot. Lugduno-Batavi 4, fasc. 6 (1869) 187, as ‘*Lucinea*’; Bentham & Hooker, Gen. Pl. 2(1) (1873) 67; Hooker, Fl. Brit. India 3, fasc. 7 (1880) 93; Schumann in Engler & Prantl, Nat. Pflanzenfam. 4(4) (1891) 64; Boerlage, Handl. Fl. Ned. Ind. 2(1) (1891) 56; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’]) 178; Ridley, Fl. Malay Penins. 2 (1923) 55; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1391; Wong, Arbor. Rubiac. Malaya (1988) 11 (in clavi); Wong, Tree Fl. Malaya 4 (1989) 328 (in clavi); Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 157. **Type:** *Lucinaea morinda* DC. (= *Schradera polysperma* (Jack) Puff et al.).

Epiphytic shrubs with slender stems, older stems climbing by adventitious roots, young stems smooth or irregularly finely ridged. **Leaves** in distichous pairs. **Stipules** ovate-triangular to linear, basally fused. **Inflorescences** heads of several to many flowers, terminal and sometimes pushed to a lateral position by a developing axillary shoot, subtended by a shallow dish- to cup-shaped involucre. **Flowers** bisexual, heterodistylous; calyx tube truncate; corolla tubular to slightly infundibular, with 3–5 valvate lobes, the apices hood-like, inside with stiff hairs at the throat and a ring of soft curly hairs slightly below; stamens 3–5, anthers included in long-styled flowers, exerted in short-styled flowers; style slender; stigma linear, 2-lobed, included in short-styled flowers, exerted in long-styled flowers; ovary 2-locular; ovules many in each ovary locule, attached to the septum; disk annular and conspicuous. **Fruits** berry-like, ovoid to subglobose, in heads. **Seeds** many, suborbicular to polygonal, laterally compressed.

Distribution. About 55 species in New World and Asian tropical regions. It is largely unrevised for the New World. In Southeast Asia there are 16 species in the Malay Peninsula, Sumatra Borneo, the Philippines, Sulawesi, Moluccas and New Guinea. In Singapore 2 native species.

Ecology. Lowlands to montane forests; in the lowlands found in a variety of forest types including mixed dipterocarp forest, *kerangas* (tropical heath) forest, alluvial and swamp forest.

Key to *Schradera* species

1. Leaves membranaceous to chartaceous; flowers smaller, corolla less than 10 mm long **1. *S. membranacea***
 Leaves thick-coriaceous; flowers larger, corolla mostly longer than 10 mm **2. *S. polysperma***

1. *Schradera membranacea* (King) Puff et al.(Latin, *membranacea* = membranous; referring to the thin leaves)

Blumea 43 (1998) 300; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 78, 176, 211. **Basionym:** *Lucinaea membranacea* King, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’]) 178; Ridley, Fl. Malay Penins. 2 (1923) 56; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1391; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 157; Turner, Gard. Bull. Singapore 45 (1993) 200; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 434; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240. **Type:** *Scortechini* 283, [Malaysia], Perak (lectotype K [K000740702], designated by Puff et al., Blumea 43 (1998) 300). **Fig. 70.**

Distribution. Malay Peninsula, Sumatra and Borneo.

subsp. *membranacea*

Epiphytic shrub with diffuse, climbing or dangling stems. **Stipules** ovate to broad-triangular, 4–8 × 3–4 mm, occasionally with bifid apex, pubescent outside. **Leaves:** lamina elliptic to obovate, 7–12 × 2–5.5 cm, apex acuminate to caudate or cuspidate, base cuneate to gradually tapering, membranaceous to chartaceous, mostly pubescent on the lower leaf surface to subglabrous, secondary veins 7–10 pairs, flat and inconspicuous on the upper leaf surface, prominent on lower leaf surface; petioles 5–10 mm long. **Inflorescences** solitary heads or several subglobose heads together, each 4–15 mm diam., of 10–20 flowers; peduncle 10–20 mm long, pubescent. **Flowers** 5-merous; calyx greenish to pink-suffused, tubular, truncate, 2–3 mm high, glabrous; corolla greenish or creamy white to pale pink, tubular to slightly infundibular, tube 4–5 mm long, lobes 2–4 mm long; anthers linear, c. 1–2 mm long, filaments less than 1 mm long in long-styled flowers, 1.5–3 mm long in short-styled flowers; style 2–3 mm long in short-styled flowers, c. 5 mm long in long-styled flowers; stigma c. 1.5–2 mm long in short-styled flowers, c. 0.5 mm long in long-styled flowers; ovary 1–2 mm diam., glabrous. **Fruits** subglobose, 3–4 mm diam.

Distribution. Malay Peninsula, Sumatra and Borneo. In Singapore it has been collected from Choa Chu Kang (*Ridley s.n.*, 1890, SING [SING0146094]), Mandai Road (*Corner s.n.*, Jul 1930, SING [SING0146093]), Kranji (*Ridley s.n.*, 1901, SING [SING0146097]), Bukit Timah (*Ridley 10832*, 28 Jul 1900, SING [SING0146096]), Nee Soon (*Leong et al. SING2016-018*, 27 Jan 2016, SING [SING0232211]) and several other places.



Figure 70. *Schradera membranacea* (King) Puff et al. **A.** Branch with fruit. **B.** Young fruiting head. **C.** Ripe fruiting head. (From Singapore, Nee Soon, Ang et al. *SING2012-239*. Photos: W.F. Ang).

Ecology. In alluvial and swamp forest.

Provisional conservation assessment. Globally not assessed. Listed as Critically Endangered (CR/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 78, 176, 211).

Taxonomy. Puff et al. (Blumea 43 (1998) 287–335) recognised two other subspecies: subsp. *parvifolia* (W.W.Sm.) Puff et al. and subsp. *flagellarioides* Puff et al., both endemic to Sarawak in Borneo and found above 600 m in swampy or (sub)montane forest.

2. *Schradera polysperma* (Jack) Puff et al.

(Latin, *poly-* = many, *-sperma* = seeds; with many seeds)

Blumea 43 (1998) 293. **Basionym:** *Morinda polysperma* Jack, Malayan Misc. 1(1) (1820) 14; Roxburgh, Fl. Ind. 2 (1824) 204. **Synonyms:** *Lucinaea morindae* DC., Prodr. 4 (1830) 368, nom. illeg. superfl.; Hooker, Fl. Brit. India 3, fasc. 7 (1880) 93; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 93, as '*Lucinea morinda*'; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 ['1903']) 179; Ridley, Fl. Malay Penins. 2 (1923) 56; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 157; Turner, Gard. Bull. Singapore 45 (1993) 200; Turner, Gard. Bull. Singapore 47 (1997 ['1995']) 434, as '*morinda*'; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 240, as '*morinda*'. – *Lucinaea polysperma* (Jack) K.Schum. in Engler & Prantl, Nat. Pflanzenfam. 4(4) (1891) 64. – *Schradera morindae* Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 78, 176, 198, nom. inval., as '*morinda*' **Type:** Wallich s.n. [EIC 8437], [Penang or Singapore], 1822 (neotype K-W [K000740708], designated here; isoneotypes K-W [K000740707, K001125511, K001125512]).

Lucinaea paniculata King, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 ['1903']) 177; Ridley, Fl. Malay Penins. 2 (1923) 56. **Syntypes:** *Scortechini*, [Malaysia], Perak (CAL? n.v.); *King's Collector 2164*, [Malaysia] Perak (CAL? n.v.).

Epiphytic shrub with diffuse, climbing or scandent stems. **Stipules** broad-triangular, 4 × 2–3 mm, apex acute, glabrous to pubescent outside. **Leaves:** lamina elliptic to lanceolate or obovate, apex acuminate to caudate or cuspidate, base cuneate to gradually tapering, (50–)60–90(–120) × 25–40(–45) cm, thick-coriaceous, glabrous, secondary veins 6–12 pairs, flat to slightly raised on both leaf surfaces; petioles 6–12(–20) mm long. **Inflorescences** 3–5 subglobose heads together, each 10–20 mm diam., of (5–)10–20 flowers; peduncle (10–)20–35 mm long, glabrous to pubescent. **Flowers** 3–5-merous; calyx tubular, truncate, 2–5 mm high, glabrous to pubescent; corolla greenish or creamy white to pale purplish, tubular to slightly infundibular, tube 3–5 mm long, lobes 5–8 mm long; anthers linear, 1.5–2 mm long, filaments 2 mm long in long-styled flowers, 5–6 mm long in short-styled flowers; style c. 6 mm long in short-styled flowers, 7–8 mm long in long-styled flowers; stigma c. 2 mm long; ovary 2–3 mm diam., glabrous. **Fruits** subglobose, 3–5 mm diam.

Distribution. Peninsular Thailand, Peninsular Malaysia, Sumatra and Borneo. In Singapore apparently known only from Jack and Wallich collections and not collected since 1822. Keng (Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 157) stated that Jack collected this species

from Thomson Road; it is unclear how this was determined as John Thomson, Chief Engineer of the Straits Settlements and credited with construction of many roads, including Thomson Road, first arrived in Singapore in 1838.

Ecology. In its range, often found in swamp forests or coastal areas.

Provisional conservation assessment. Globally not assessed. In Singapore presumed Nationally Extinct.

Taxonomy. De Candolle (Prodr. 4 (1830) 368) did not cite specimen material for his *Lucinaea morindae* but adopted the species epithet because the species had earlier been placed in *Morinda*. His taxon is likely based on *Wallich s.n.* [EIC 8437], which appears to be a composite of collections from Singapore and Penang. Here we select one of four sheets at the Kew herbarium as the neotype of *Morinda polysperma* Jack. The syntypes of *Lucinaea paniculata* King, which Puff et al. (Blumea 43 (1998) 293) have determined to be synonymous with *Schradera polysperma*, are not at K or SING and are likely to be at CAL.

Notes. The measurements above are from across the range of the species.

46. SCYPHIPHORA C.F.Gaertn.

(Greek, *scyphi* = cup, *-phora* = bearing; probably referring to the stipular structures)
Chengam (Malay)

Suppl. Carp., fasc. 1(2) (1806) 91, t. 196: fig. [2]; Hooker, Fl. Brit. India 3, fasc. 7 (1880) 125; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’]) 227; Ridley, Fl. Malay Penins. 2 (1923) 88; Watson, Malayan Forest Rec. 6 (1928) 84, 185, pl. 43; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 2022; Corner, Wayside Trees Malaya, ed. 3, 2 (1988) 650; Wong, Arbor. Rubiac. Malaya (1988) 197; Wong, Tree Fl. Malaya 4 (1989) 408; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 161; Puff & Rohrhofer, Opera Bot. Belg. 6 (1993) 143; Puff et al., Rubiac. Thailand (2005) 82, pl. 3.1.19. **Type:** *Scyphiphora hydrophylacea* C.F.Gaertn.

Trees. **Stipules** fused to form a short-cupular structure. **Inflorescences** axillary, cymose. **Flowers** hermaphrodite, 4(–5)-merous; calyx limb subtruncate; corolla subcylindric, glabrous outside, hairy inside at the throat; corolla lobes contorted to the left in bud, recurved in the open flower; stamens as many as corolla lobes, inserted at the corolla throat; stigma 2-branched, slightly exerted; disk annular, lobed; ovary 2-locular; ovules 2 in each locule, one pendulous, one ascending, attached to a middle transverse placenta. **Fruits** drupaceous, subcylindric; pyrenes 2. **Seeds** subcylindric.

Distribution. Only 1 species in Madagascar, India, Sri Lanka, Andaman Islands, Malesia, western Pacific islands (including New Caledonia) and northern Australia. Native in Singapore.

Taxonomy. Earlier inferences based on morphology (e.g. Puff & Rohrhofer, Opera Bot. Belg. 6 (1993) 143–172) had led workers to conclude that *Scyphiphora* was most closely associated with the Gardenieae s.l. Razafimandimbison et al. (Taxon 60 (2011) 941–952) have demonstrated

that, in fact, it is one of several monotypic genera (together with *Glionnetia* Tirveng. from the Seychelles, *Jackiopsis* Ridsdale from Southeast Asia and *Trailliaedoxa* W.W.Sm. & Forrest from East Asia) that form a paraphyletic assemblage basal to the Vanguerieae alliance, possibly implying they are sole representatives of their respective lineages.

Scyphiphora hydrophylacea C.F.Gaertn.

(pertaining to *Hydrophyllum* L., Latin, *-acea* = resembling,
having nature of; resembling the genus *Hydrophyllum*)

Suppl. Carp., fasc. 1(2) (1806) 91, t. 196: fig. [2]; Hooker, Fl. Brit. India 3, fasc. 7 (1880) 125; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 95; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 ['1903']) 228; Ridley, Fl. Malay Penins. 2 (1923) 88; Watson, Malayan Forest Rec. 6 (1928) 84 pl. 43; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 2022; Corner, Wayside Trees Malaya, ed. 3, 2 (1988) 650; Wong, Arbor. Rubiac. Malaya (1988) 197; Wong, Tree Fl. Malaya 4 (1989) 408; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 161; Puff & Rohrhofer, Opera Bot. Belg. 6 (1993) 143; Turner, Gard. Bull. Singapore 45 (1993) 204; Turner, Gard. Bull. Singapore 47 (1997 ['1995']) 446; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 78, 176, 230. **Type:** [Published illustration] Gaertner, Suppl. Carp., fasc. 1(2) (1806) 91, 196: fig. [2]. **Fig. 71.**

Epithinia malayana Jack, Malayan Misc. 1(1) (1820) 12. **Type:** *Jack s.n.*, Singapore (lectotype L [L0001344], designated here).

Hydnophytum costatum Drake, J. Bot. (Morot) 9 (1895) 240. **Type:** *Balansa 685*, [Vietnam], Tonkin, August 1885 (lectotype P [P00836559], designated here).

Shrubs or small trees reaching 6 m high, sometimes with small stilt roots; bark grey to brownish, cracking to slightly scaly or fissured. Twigs and leaf-stalks bright red when young; buds resinous, the youngest leaf pair adpressed together. **Stipules** a short-cupular structure, to 2 mm high, margin hairy. **Leaves:** lamina obovate, 2–7 × 1–4 cm, apex blunt, base cuneate, margin recurved, coriaceous, glabrous, secondary veins 6–8 pairs, indistinct on both sides; petiole 5–20 mm long. **Inflorescences** axillary, cymose, peduncle short. **Flowers** subsessile, in groups of three on the inflorescence; calyx tube to 5 mm long, with 4 indistinct blunt tips; corolla glabrous outside, pink, the tube to 5 mm long and pale hairy inside at the throat, the lobes 4(–5), ovate, recurved, valvate, to 3 mm long; anthers brown, to 2 mm long, on short filaments, exerted in the opened flower; style pink, 6 mm long, stigma exerted, 2-lobed, 2–3 mm long; disc annular. **Fruits** ellipsoid, to 10 × 5 mm, with 6–10 longitudinal ridges, calyx cup persistent, green turning yellowish, with 2 parts containing 2 seeds each.

Distribution. As for the genus. In Singapore it had been documented by older collections on the main island at Jurong, Chan Chu Kang, Kranji, Pasir Ris, Changi, Ulu Pandan, Pasir Panjang, Geylang and Tanjong Katong. More recent collections are from smaller islands, including Pulau Ubin (*Gwee et al. 170*, 14 Jan 2003, SING [SING0042935]), Pulau Pawai (*Yang & Chua SYF12*, 7 Nov 2006, SING [SING0096389]), Pulau Seking, Pulau Senang (*Hassan et al. SING2012-289*, 30 Jun 2012, SING [SING0179363]), Pulau Tekong (*Samsuri et al. 174*, 6 Dec 2001, SING [SING0039850]) and Pulau Unum (*Boo SING2011-119*, 10 Mar 2011, SING [SING0158260]).



Figure 71. *Scyphiphora hydrophylacea* C.F.Gaertn. **A.** Flowering leafy branches. **B.** Inflorescence from a leaf axil. **C.** Young infructescences. **D.** Mature fruits. (Cultivated in Singapore, Gardens by the Bay. Photos: X.Y. Ng).

Ecology. Mangrove areas and seashores. The flowers are protandrous, the pollen deposited on the unreceptive style-stigma structure (Secondary pollen presentation (SPP)) before the female phase (Puff & Rohrhofer, *Opera Bot. Belg.* 6 (1993) 143), implicating insect pollination (Almazol & Cervancia, *J. Nat. Stud.* 12(1) (2013) 39–47). Nonetheless, self-pollination (and self-compatibility) can be present to a degree as part of a mixed mating system (Raju & Rajesh, *J. Threat. Taxa* 6(14) (2014) 6668–6676). The wide coastal distribution range is probably correlated with drift dispersal of the buoyant fruits. Notwithstanding, the occurrence of *Scyphiphora hydrophylacea* seems patchy along mangrove fringes and shores. The stems are often submerged at high tides.

Provisional conservation assessment. Razafimandimbison et al. (*Taxon* 60 (2011) 941) proposed a global conservation assessment of Near Threatened (NT) because, despite the extensive range of this species, there is much degradation and conversion of its coastal habitat. In Sri Lanka low fruit production and a lack of healthy seedlings have been attributed to possible inbreeding depression in small isolated populations (Hettiarachchi & Jayaratne, online article 2016). *Scyphiphora hydrophylacea* was listed as common in Singapore by Chong et al. (*Checkl. Vasc. Pl. Fl. Singapore* (2009) 78, 176, 230) but is assessed here as Vulnerable (VU/D).

Notes. The above measurements given are for the species as known in the Malay Peninsula, as fertile Singapore material is rather scanty.

47. SINGAPORANDIA K.M. Wong

(of Singapore; related to *Randia*)

Sandakania 21 (2016) 53. **Type:** *Singaporandia macrophylla* (R.Br. ex Hook.f.) K.M.Wong.

Randia L. sect. *Euclinia* DC., *Prodr.* 4 (1830) 341, p.p.; Bentham & Hooker, *Gen. Pl.* 2(1) (1873) 89, p.p.; Hooker, *Fl. Brit. India* 3, fasc. 7 (1880) 114, p.p.; Schumann in Engler & Prantl, *Nat. Pflanzenfam.* 4(4) (1891) 76, p.p.

Randia L. sect. *Grandiflorae* Ridl., *Fl. Malay Penins.* 2 (1923) 71, p.p.

Randia auct. non L.: Koorders & Valetton, *Meded. Lands Plantentuin* 59 (1902) 88 [Bijdr. Boomsort. Java 8 (1902) 88]; King & Gamble, *J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist.* 72(4) (1904 [‘1903’]) 215, p.p.; Burkill, *Dict. Econ. Prod. Malay Penins.*, ed. 2, 2 (1966) 1895, p.p.; Corner, *Wayside Trees Malaya*, ed. 3, 2 (1988) 645, p.p.; Keng, *Concise Fl. Singapore*, vol. 1, *Gymn. Dicot.* (1990) 161.

Rothmannia auct. non Thunb.: Bremekamp, *Proc. Kon. Ned. Akad. Wetensch. C* 60(1) (1957) 7, p.p.; Wong, *Malayan Nat. J.* 38 (1984) 46; Wong, *Arbor. Rubiac. Malaya* (1988) 191; Wong, *Tree Fl. Malaya* 4 (1989) 324; Kochummen, *Tree Fl. Pasoh Forest* (1997) 385, p.p.

Treelet to small tree, sometimes shrub-like. **Branches** typically opposite and decussate, each typically consisting of a single segment with only 2 vegetative nodes and terminated by an inflorescence, very exceptionally extended by an axillary branch of similar (modular) structure from the proximal node of the first segment. **Stipules** interpetiolar, free, persistent,

inner surface hairy with 3–4 rows of colleters at the basal part; apex long-acuminate. **Leaves** developing as a single pair from the proximal node of a branch, completely vestigial at the distal node. **Inflorescences** compact, much-reduced cymes, 1–3-flowered. **Flowers** bisexual; calyx limb cup-shaped, lobes 5–6; corolla infundibular, inside speckled down the tube, with hairy zone covering part of the tube from below the level of the anthers; corolla lobes 5, contorted to the left in the bud; anthers 5, inserted at the upper 1/3 of the corolla tube, fully included within; style and stigma included but reaching just below the corolla mouth and the level of the anthers; ovules many, in axile placentation. **Fruits** ellipsoid, baccate. **Seeds** many, ellipsoid.

Distribution. A genus of 1 species restricted to western Malesia, naturally occurring from Peninsular Malaysia to Sumatra. Native in Singapore.

Taxonomy. *Rothmannia* Thunb. has had a contentious circumscription but Wong & Pereira (Sandakania 21 (2016) 21–64) have summarised the evidence from morphology and palynology, which, taken together with the results of a limited molecular analysis, amply demonstrates that *Rothmannia* should be restricted to a group in Africa (including its type species) which has right-contorted corolla lobes. Among the Asiatic members of this complex, all of which have left-contorted corolla lobes, taxon sampling for molecular phylogenetic analyses is as yet too scanty for perceptive insights into phylogenetic structure, so that morphological distinction among groups of taxa have still been the main taxonomic consideration. Besides *Singaporandia*, the Asiatic genera in this complex include *Kochummenia* K.M.Wong and *Ridsdalea* J.T.Pereira & K.M.Wong.

Notes. A Singapore specimen collected in 1822 is also on the type sheet in Wallich's East India Company Herbarium at Kew. Its name also recalls the historical connection to *Randia*, the genus in which the type species was first placed. The branching and whole-plant architecture is quite unique among the *Rothmannia* alliance and perhaps also among the Rubiaceae in general.

Singaporandia macrophylla (R.Br. ex Hook.f.) K.M.Wong

(Greek, *macro-* = long or large, *-phylla* = leaf; with large leaves)

Sandakania 21 (2016) 54. **Basionym:** *Randia macrophylla* R.Br. ex Hook.f., Fl. Brit. India 3, fasc. 7 (1880) 114; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 94; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’]) 215; Ridley, Fl. Malay Penins. 2 (1923) 78; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1897; Corner, Wayside Trees Malaya, ed. 3, 2 (1988) 648; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 161. **Synonym:** *Rothmannia macrophylla* (R.Br. ex Hook.f.) Bremek., Proc. Kon. Ned. Akad. Wetensch. C 60(1) (1957) 7; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1897; Wong, Malayan Nat. J. 38 (1984) 46; Wong, Arbor. Rubiac. Malaya (1988) 192; Wong, Tree Fl. Malaya 4 (1989) 324; Kochummen, Tree Fl. Pasoh Forest (1997) 385; Turner, Gard. Bull. Singapore 45 (1993) 203; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 445; LaFrankie et al., Forest Trees Bukit Timah (2005) 142; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 75, 176, 223. **Type:** *Wallich s.n.* [EIC 8304A], [Penang or Singapore], 1822 (lectotype K-W [K001125196]), designated by Wong, Malayan Nat. J. 38 (1984) 46). **Fig. 72, 73.**

Typically treelet or shrub-like, sometimes a small tree, frequently with horizontal stem portions on or below the ground, producing erect above-ground shoots reaching 5 m (rarely 8 m) high, typically to 4 cm diam. Bark brownish black; twigs scabrid to hispid. **Stipules** broadly triangular, 15–17 mm long, 7–8 mm wide, sparsely hispid to pubescent outside, apex long-acuminate, 8–12 mm long. **Leaves** in decussate pairs on the stem, in just one pair at the proximal node on each branch and completely vestigial at the distal node; lamina oblanceolate to obovate or elliptic, (14–)18–35 cm × 3.5–13.5 cm, apex acute to acuminate, acumens 0.5–1 cm long, base symmetric, cuneate to sometimes unequal, chartaceous to thin-coriaceous when dry, upper surface sparsely pubescent, glabrescent to glabrous, lower surface scabrid to hispid, midrib on upper side slightly raised, sparsely pubescent, on lower side distinctly raised, pubescent, velvety hairy to hispid, secondary veins 10–21 pairs, on upper side flat to sunken, glabrous to sparsely pubescent, on lower side raised, pubescent to hispid, tertiary venation visible as a much-branched network between pairs of secondary veins; petiole rarely subobsolete, to c. 12 mm long, 2–3 mm thick, hispid to pubescent. **Inflorescences** compact, much reduced cymes, 1–3-flowered; peduncle subobsolete, to 2 mm long, 3–4 mm thick, pubescent to velvety hairy; bracts broadly ovate, 7–8 mm long, 3–5 mm wide, pubescent to hispid hairy. **Flowers** with very short pedicels to 4 mm long, 3–4 mm thick; calyx tube 6–15 mm long, 5–7 mm wide, pubescent, velvety to hispid, hairs suberect to erect, surface visible; calyx limb cup-shaped; calyx lobes 5–6, narrowly triangular, 12–30 mm long, pubescent to hispid hairy; corolla infundibular, the tube white, sometimes with maroon tinge at the base on the outside, the tube 9–15 cm long, (20–)30–55 mm wide at the throat, 3–5 mm wide at the base, maroon-purple speckled inside, outer surface pubescent to hispid hairy, inner surface with hairy zone covering part of the tube from below the level of the anthers, corolla lobes ovate with acute apex, 2.5–5.5 cm long, 1.5–2.5 cm wide, outside pubescent on the uncovered half of the lobes, inside glabrous; anthers 20–25 mm long; style smooth, glabrous, stigma fusiform, slightly ribbed when dried, style and stigma 80–140 mm long, included but reaching just below the corolla mouth and the level of the anthers. **Fruits** ellipsoid, 4–7 cm long, 2–3.5 cm wide, hispid when young becoming pubescent; fruit wall 1–2 mm thick; peduncle 0.5–3 cm long, 3–5 mm thick. **Seeds** ellipsoid, 5–8.5 × 6–8 mm.

Distribution. Peninsular Malaysia, central Sumatra, and the Riau Islands. In Singapore it has been recorded from Nee Soon (*Samsuri et al. NES 250*, 26 Aug 2003, SING [SING0046572]), Bukit Timah (*Hardial 358*, 7 Jan 1965, SING [SING0033743]; *Lai LJ 468*, 20 Jun 1995, SING [SING0019931]; *Maxwell 77–94*, 24 Feb 1977, L) and MacRitchie (*Maxwell 79–12*, 7 Nov 1979, L; *Sinclair s.n.*, 8 Dec 1950, L). There are older collections from Chan Chu Kang, Ang Mo Kio and Changi. In the Bukit Timah long-term dynamics study plot, the population seems stable over time, with recruitment and mortality roughly in balance (LaFrankie et al., *Forest Trees Bukit Timah* (2005) 142).

Ecology. In understorey of forest.

Provisional conservation assessment. Globally not assessed. Listed (under *Rothmannia macrophylla*) as Vulnerable (VU/D) in Singapore by Tan et al. (in Davison et al. (ed.), *Singapore Red Data Book*, ed. 2 (2008) 241) and Chong et al. (*Checkl. Vasc. Pl. Fl. Singapore* (2009) 75, 176, 223).



Figure 72. *Singaporandia macrophylla* (R.Br. ex Hook.f.) K.M. Wong. **A.** Habit, showing characteristically short branches bearing only a single leaf pair before termination by flowering. **B.** Lower leaf surfaces. **C.** Detail of branch apex at flowering. **D.** Detail of node with stipule. (From Singapore, Mandai. Photos: J. Leong-Škormičková).

Notes. With large showy flowers that are produced regularly, this species may be a good prospect for ornamental horticulture. Although the infundibular corolla shape of *Singaporandia macrophylla* is superficially similar to that of *Euclinia longiflora* Salisb. (the type species of the African *Euclinia* Salisb.), also cultivated in Singapore and Malaysia as an ornamental, the



Figure 73. *Singaporandia macrophylla* (R.Br. ex Hook.f.) K.M.Wong. **A.** Newly opened flower showing internal maroon-purple speckling and pollen masses deposited on the outside of the as-yet unreceptive stigmatic head; this is the initial male phase of the flowers. **B.** Longitudinal section of corolla of an older flower, showing the spent anthers, and the receptive and conspicuously longitudinally lobed stigmatic head; this is the female phase. (From Singapore, A from Mandai; B from Nee Soon. Photos: A, J. Leong-Škorničková; B, X.Y. Ng).

latter differs from members of the *Rothmannia* complex including *Singaporandia* in having tetrad pollen grains instead of single grains; chaffy instead of firm stipules; and leaves which are simultaneously deciduous instead of longer-persistent leaves.

48. SPERMACOCE L.

(Greek, *sperma* = seed, *akoki* = acorn; derivation uncertain but possibly referring to the shape of the fruits, which in certain species resemble flat acorns)

Sp. Pl. 1 (1753) 102; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 93; Pitard, Fl. Indo-Chine 3, fasc. 4 (1924) 438; Ridsdale, Revis. Handb. Fl. Ceylon 12 (1998) 332; Puff et al., Rubiac. Thailand (2005) 194, pl. 3.4.10; Chen & Taylor, Fl. China 19 (2011) 325. **Type:** *Spermacoce tenuior* L., lectotype designated by Britton & Brown, Ill. Fl. N. U.S., ed. 2, 3 (1913) 256.

Borreria G.Mey., Prim. Fl. Esseq. (1818) 79, nom. cons.; Ridley, Fl. Malay Penins. 2 (1923) 175; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 1 (1966) 356; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 152. **Type:** *Borreria suaveolens* G.Mey. (typ. cons.)

Herbs, annual or perennial, stems usually 4-angled, prostrate to erect. **Stipules** partly fused with petiole and forming a sheath, its upper margin fimbriate. **Leaves** decussate, occasionally crowded thus appearing whorled; petiole short, the leaves usually appearing sessile. **Inflorescences** sessile, terminal or axillary, several to many-flowered inflorescences, subtended by 1 or more pairs of leaves. **Flowers** sessile, intermixed with numerous pales; calyx more commonly 4-lobed, sometimes 2-lobed, the lobes persisting on the fruiting capsule; corolla 4-lobed, valvate, most commonly white in Singapore, occasionally shades of pink or mauve; stamens 4, alternating with corolla lobes, most commonly exerted, sometimes included, anthers dorsifixed, introrse, opening by longitudinal slits; ovary 2-locular, each locule with a single ovule attached to the middle of a lamella, the 2 lamellas fused together to form a septum dividing the ovary; style filiform, most commonly exerted, sometimes included; stigma capitate or 2-lobed; nectary disc on top of ovary and surrounding the base of the style often with a papillose surface. **Fruits** generally 2-valved capsules dehiscently from the apex downwards, valves remaining joined basally, the one exception (in Singapore) being *S. ocymifolia* Willd., where usually only one valve dehisces, and from the base. **Seeds** 2, reticulate, rarely rugose, with a ventral groove, raphides present around margin of groove; seed outline (dorsal or ventral view) oblong, elliptic or obovate.

Distribution. A genus of about 275 species (but see notes) occurring throughout the tropics, rarely extending to temperate zones, with 8 species in Singapore. Five of the Singapore species are introduced and naturalised from the American tropics (*S. latifolia* Aubl., *S. exilis* (L.O.Williams) C.Adams ex W.C.Burger & C.M.Taylor, *S. ocymifolia*, *S. remota* Lam. and *S. verticillata* L.), *S. ocymoides* Burm.f. and *S. parviceps* (Ridl.) I.M.Turner are native, while *S. hispida* L. is native to Asia but whether it is native or introduced in Singapore is uncertain. Some of the naturalised species have not been collected for quite some time and it is unclear if they still occur in Singapore.

Ecology. Herbs, erect or prostrate, almost exclusively found in open areas.

Notes. Current research on the tribe Spermacoaceae shows that *Spermacoce* is polyphyletic. Therefore, synonyms of *Spermacoce* are not listed above, except for *Borreria* in order to account for the use of this name in the older literature. The type species of *Borreria* does not resolve together with *Spermacoce* and that genus will likely eventually be resurrected. Here, the names in *Spermacoce* are used pending a settled resolution to this issue. There are at least 20 generic synonyms of *Spermacoce* listed in American and African treatments using the current delimitation.

Key to *Spermacoce* species

1. Calyx (and capsule) 2-lobed 2
Calyx (and capsule) 4-lobed (*S. parviceps* inflorescences have a mixture of 2-, 3- and 4-lobed) 3
2. Corolla less than 1 mm long; stamens and style included or at most only slightly exceeding top of corolla tube **1. *S. exilis***
Corolla greater than 1.5 mm long; stamens and style exerted, often exceeding corolla lobes **8. *S. verticillata***
3. Dorsal seed surface transversely rugose 4
Dorsal seed surface reticulate or almost smooth 5
4. Leaves broadly elliptic, to 25 mm long; corolla to 1 mm long **5. *S. ocymoides***
Leaves lanceolate, to 60 mm long, corolla > 1.8 mm long **7. *S. remota***
5. Mericarps of capsule dehiscent (tardily) from base **4. *S. ocymifolia***
Mericarps dehiscent (relatively quickly, always some open) from apex 6
6. Seeds deeply reticulate **6. *S. parviceps***
Seeds shallowly reticulate to almost smooth 7
7. Ventral groove deep and extending under seed-coat margin, seed relatively hollow
..... **3. *S. latifolia***
Ventral groove shallow, seed not hollow **2. *S. hispida***

1. *Spermacoce exilis* (L.O.Williams) C.D.Adams ex W.C.Burger & C.M.Taylor

(Latin *exilis* = small, slender; probably referring to the small flowers)

Fieldiana, Bot., new ser., 33 (1993) 316; Chen & Taylor, Fl. China 19 (2011) 327; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 446; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 81, 176, 273. **Basionym:** *Borreria exilis* L.O.Williams, Phytologia 28 (1974) 227. **Synonym:** *Borreria gracilis* L.O.Williams, Phytologia 26 (1973) 487, non Scheele (1844), nec Miq. ex Hook.f. (1881). **Type:** *Howell 10178*, Costa Rica, Cocos Island, Wafer Bay (holotype F [F0068510F]). **Fig. 74A.**

Spermacoce mauritiana Gideon, Kew Bull. 37 (1983) 547. **Replaced synonym:** *Borreria repens* DC., Prodr. 4 (1830) 544. **Type:** *Sieber Fl. Maurit. II. 144*, Mauritius (lectotype G-DC [G00316672], designated by Smith & Darwin, Fl. Vit. Nova 4 (1988) 373; isolectotypes GOET, H, HAL, P [×2]).

Borreria setidens auct. non (Miq.) Bold.: Ridley, Fl. Malay Penins. 2 (1923) 177; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 1 (1966) 357; Turner, Gard. Bull. Singapore 45 (1993) 195; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 152.

Annual herb, prostrate or spreading, stems with four prominent ciliate wings. **Leaves:** lamina broadly elliptic, 10–35 × 6–15 mm, glabrous or with scattered hairs on veins below. **Inflorescences** terminal and axillary, to 8 mm wide. **Flowers:** calyx lobes 2, narrowly triangular, to 1 mm long; corolla white, 0.4–0.8 mm long, outside glabrous, inside with a few short hairs near lobe apices, tube to 0.5 mm long, lobes to 0.3 mm long; stamens included, anthers 0.1 mm long, filaments shorter, attached near top of corolla tube; style included, stigma shortly bilobed. **Capsules** glabrous, part of septum lamellas remaining attached to valves at dehiscence. **Seeds** obovate or elliptic, to 1 × 0.5 mm, brown, seed-coat surface reticulate.

Distribution. Native to the Neotropics; naturalised in many parts of Africa, Asia and Oceania. In Singapore recorded from Chan Chu Kang (*Ridley s.n.*, 1894, SING [SING0072750]), Chua Chu Kang (*Ridley s.n.*, 1894, SING [SING0072747]) and Pasir Panjang (*Ridley 8101*, 1896, SING [SING0072754]). Whether it is still present in Singapore is uncertain.

Ecology. Slightly wetter parts of open disturbed areas, also on margins of streams.

Provisional conservation assessment. Globally Least Concern (LC). Not native in Singapore.

2. *Spermacoce hispida* L.

(Latin, *hispidus* = with coarse rigid erect hairs; referring to the hairs on the leaves)

Sp. Pl. 1 (1753) 102; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 100; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 93; Pitard, Fl. Indo-Chine 3, fasc. 4 (1924) 439; Sivar. & R.V.Nair, Taxon 35 (1986) 366; Ridsdale, Revis. Handb. Fl. Ceylon 12 (1998) 338; Chen & Taylor, Fl. China 19 (2011) 328. **Synonym:** *Borreria hispida* (L.) K.Schum. in Engler & Prantl, Nat. Pflanzenfam. 4(4) (1891) 144; Ridley, Fl. Malay Penins. 2 (1923) 175; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 152. **Type:** Herb. Hermann 1: 15, no. 62, Sri Lanka (lectotype BM, designated by Verdcourt, Kew Bull. 30 (1975) 307).

Spermacoce articularis L.f., Suppl. Pl. (1782 [‘1781’]) 119; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 446; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 81, 176, 273. **Synonym:** *Borreria articularis* (L.f.) F.N.Williams, Bull. Herb. Boissier, sér. 2, 5 (1905) 956; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 152; Turner, Gard. Bull. Singapore 45 (1993) 195. **Type:** *Collector unknown s.n.*, cultivated in Uppsala (lectotype LINN [Herb. Linn. no. 125.6], designated by Verdcourt, Fl. Trop. E. Africa, Rubiaceae (Pt 1) (1976) 362).

Perennial prostrate herb. **Leaves:** lamina elliptic, 10–35 × 3–15 mm, hispid. **Inflorescences** terminal and axillary, few-flowered. **Flowers:** calyx lobes green, narrowly triangular, to 1.5

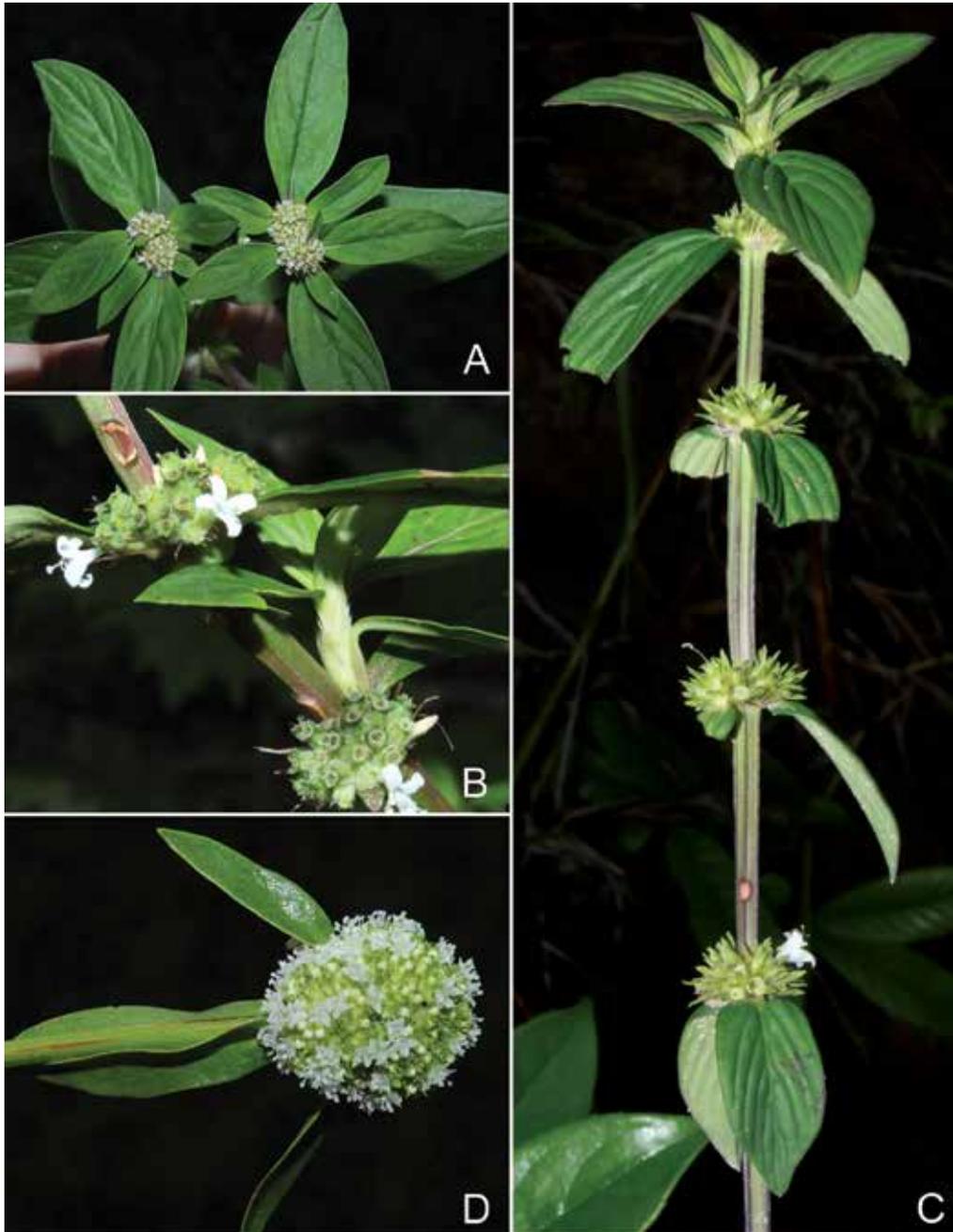


Figure 74. Inflorescences of *Spermacoce* species. **A.** *Spermacoce exilis* (L.O.Williams) C.D.Adams ex W.C.Burger & C.M.Taylor. **B.** *Spermacoce ocymifolia* Willd. **C.** *Spermacoce latifolia* Aubl. **D.** *Spermacoce verticillata* L. (From Brazil. Photos: R. Salas).

mm long; corolla pale mauve to purple, 3–14 mm long, outside glabrous except for a few hairs near lobe apices, inside with a band of dense moniliform hairs near middle of tube, tube to 12 mm long, lobes to 2 mm long; stamens exerted, not exceeding corolla lobes, anthers to 0.7 mm long, shorter than the filaments; style equal to or slightly exceeding corolla lobes, stigma bilobed. **Capsules** with hairs on upper half, septum usually remaining erect and undamaged as valves dehisce. **Seeds** obovate or elliptic, to 2.2×1.2 mm, dark brown to almost black, seed-coat surface reticulate.

Distribution. The type is from India and the species is naturalised in many parts of Africa, Asia and Oceania, but see notes. In Singapore it is known from Changi (*Ridley 135*, 16 Feb 1889, SING [SING0072452]; *Nur 29739*, 18 Aug 1935, SING [SING0072448]), Chua Chu Kang (*Ridley 6715*, SING [SING0060104]), Geylang (*Teruya 1265*, 22 May 1930, SING [SING0037443]) and Pulau Ubin (*Furtado 18339*, 31 Jul 1927, SING [SING0072453]).

Ecology. Open disturbed areas.

Provisional conservation assessment. Due to the taxonomic uncertainties around this species no meaningful conservation assessment is possible. Therefore, assessed as Data Deficient (DD) in Singapore.

Notes. Sivarajan & Nair (Taxon 35 (1986) 363) regarded *Spermacoce hispida* as being restricted to southern India and said the more widespread similar species (but also occurring in India) is to be called *Spermacoce articularis* L.f. The Singapore specimens appear to belong to a single species but some characteristics match those of *Spermacoce articularis* and others those of *S. hispida* (according to the list by Sivarajan & Nair (Taxon 35 (1986) 366), of how the two species differ). Previous authors had regarded *Spermacoce articularis* as a synonym of *Spermacoce hispida*. Further studies of this complex are needed to ascertain where the Singapore material belongs but here the broad concept of *Spermacoce hispida* is followed.

3. *Spermacoce latifolia* Aubl.

(Latin, *lati-* = broad, *-folia* = leaves; with broad leaves)

Hist. Pl. Guiane 1 & 3 (1775) 55, t. 19: fig. 1; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 446; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 81, 176, 268. **Synonym:** *Borreria latifolia* (Aubl.) K.Schum. in Martius, Fl. Bras. 6(6), fasc. 101 (1888) 61, t. 80; Ridley, Fl. Malay Penins. 2 (1923) 175; Henderson, Malay. Wild Fls., Dicot. (1959) 229. **Type:** *Aublet s.n.*, French Guiana (lectotype MA [MA317165], designated by Delprete, Taxon 64 (2015) 395). **Fig. 74C.**

Borreria alata auct. non (Aubl.) DC.: Corlett, J. Biogeogr. 15 (1988) 662; Keng, Concise Fl. Singapore, vol 1. Gymn. Dicot. (1990) 152; Turner, Gard. Bull. Singapore 45 (1993) 195.

Annual herb, prostrate or spreading. **Leaves:** lamina broadly elliptic, 20–75 × 10–35 mm, hispid, venation on lower surface conspicuously raised. **Inflorescences** terminal and axillary, few-flowered. **Flowers:** calyx lobes green, triangular, to 1.8 mm long; corolla white or mauve, 3–4 mm long, tube to 3 mm long, glabrous except for a band of moniliform hairs inside near

middle, lobes to 1 mm long, outside glabrous or an occasional hair near apex, inside usually some scattered hairs; stamens exserted, not exceeding corolla lobes, anthers to 0.5 mm long; style equal to or exceeding corolla lobes, divided at top into 2 short linear stigmas. **Capsules** with hairs mostly restricted to upper half, part of septum lamellas remaining attached to valves at dehiscence. **Seeds** brown, obovate or elliptic, to 3×1.8 mm, ventral groove broad and deeply sunken; seed-coat surface reticulate.

Distribution. Native to the Neotropics, naturalised in many parts of Africa, Asia and Oceania. In Singapore recorded from Geylang (*Ridley s.n.*, Dec 1920, SING [SING0060103]; *Teruya 2147*, 20 Dec 1932, SING [SING0037440]) and Tanglin (*Chinaya s.n.*, 18 Sep 1942, SING [SING0156974]). Whether it is still present in Singapore is uncertain.

Ecology. In neighbouring regions it is common in wetter parts of open disturbed areas. It also occurs in open and evergreen forests.

Provisional conservation assessment. Globally Least Concern (LC). Not native in Singapore.

Notes. *Spermacoce latifolia* has sometimes been treated as a synonym of *S. alata* Aubl. and vice versa but a recent study by Wiersema et al. (Castanea 82 (2017) 114–131) has demonstrated that they are morphologically distinct and have different ecology and distributions. *Spermacoce alata* is a non-weedy, forest-dwelling species restricted to northern South America whereas *S. latifolia* is a weedy species with a preference for sunny and/or disturbed places that is native and widespread in Central and South America and naturalised in Asia and elsewhere. Other research has shown that neither species belongs in the genus *Spermacoce* but they have yet to be formally transferred to another genus.

4. *Spermacoce ocymifolia* Willd.

(Latin, *ocimi*- = pertaining to *Ocimum* L., which in turn is derived from ancient name for basil, *-folia* = leaves; leaves resembling those of basil)

in Roemer & Schultes, Syst. Veg., ed. 15 bis, 3 (1818) 530. **Synonyms:** *Hemidiodia ocymifolia* (Willd.) K. Schum. in Martius, Fl. Bras. 6(6), fasc. 101 (1888) 30. – *Diodia ocymifolia* (Willd.) Bremek., Recueil Trav. Bot. Neerl. 31 (1934) 305; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 153; Turner, Gard. Bull. Singapore 45 (1993) 196; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 421; Ridsdale, Revis. Handb. Fl. Ceylon 12 (1998) 327; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 34, 174, 266 – *Borreria ocymifolia* (Willd.) Bacigalupo & Cabral, Opera Bot. Belg. 7 (1996) 307. **Type:** *Rudolphi s.n.*, West Indies (B-W [B-W02609 010] [status not determined]). **Fig. 74B.**

Herb or subshrub, up to 1.5 m tall. **Leaves:** lamina narrowly elliptic, to 80×30 mm, moderately to sparsely minutely hispid on both surfaces. **Inflorescences** terminal and axillary, usually many-flowered. **Flowers:** calyx lobes broadly triangular, very short, to 0.5 mm long; corolla white, tube to 2 mm long, glabrous except for a band of short hairs inside below base of stamen filaments, lobes to 2 mm long; stamens exserted, not exceeding corolla lobes; style not exceeding corolla lobes, stigma capitate or not. **Capsules** with hairs mostly restricted to upper half, splitting from base into two mericarps. **Seeds** narrowly oblong, to 3×1.3 mm, brown, seed-coat surface minutely reticulate, with obscure transverse depressions.

Distribution. Native to the Neotropics, naturalised in parts of Africa, India, continental Southeast Asia, Malesia and the Solomon Islands. Many specimens from Singapore have been identified as *Spermacoce ocymifolia*, only later to be reidentified as other species and at present there is only one verified collection from Singapore, collected at Tengah New Town (Lua *et al.* SING2018-516, 27 Feb 2018, SING [SING0265690]).

Ecology. Occurs in a variety of habitats, usually at low altitudes on fairly exposed plains or hills.

Provisional conservation assessment. Globally Least Concern (LC). Not native in Singapore.

Notes. This species belongs with a clade that includes the type species of the genus *Borreria*, *B. suaveolens*. That genus is likely to be resurrected, albeit with a different suite of characters from those that originally separated it from *Spermacoce*.

5. *Spermacoce ocymoides* Burm.f.

(Greek, *ocim-* = pertaining to *Ocimum* L., which in turn is derived from ancient name for basil, *-oides* = like; with a resemblance to basil)

Fl. Ind. (1768) 34; Pitard, Fl. Indo-Chine 3, fasc. 4 (1924) 441; Chong *et al.*, Checkl. Vasc. Pl. Fl. Singapore (2009) 81, 177, 268. **Synonyms:** *Borreria ocymoides* (Burm.f.) DC., Prodr. 4 (1830) 544; Turner, Gard. Bull. Singapore 45 (1993) 195. – *Bigelovia ocymoides* (Burm.f.) Miq., Fl. Ned. Ind. 2, fasc. 2 (1857) 335. – *Tardavel ocymoides* (Burm.f.) Hiern, Cat. Afr. Pl. 1(2) (1898) 504. **Type:** *Kleynhoff s.n.*, [Indonesia], Java (lectotype G, designated by Verdcourt, Fl. Trop. E. Africa, Rubiaceae (Pt 1) (1976) 361).

Bigelovia laevicaulis Miq., Fl. Ned. Ind. 2, fasc. 2 (1857) 335. **Synonym:** *Borreria laevicaulis* (Miq.) Ridl., J. Straits Branch Roy. Asiat. Soc. 86 (1922) 298; Ridley, Fl. Malay Penins. 2 (1923) 176; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 152, fig. 125.1; Turner, Gard. Bull. Singapore 45 (1993) 195; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 446. **Type:** *Junghuhn s.n.*, [Indonesia], Java (lectotype U, designated here; isolectotype L).

Annual herb, prostrate or spreading. **Leaves:** lamina broadly elliptic, 7–25 × 5–15 mm, glabrous or with scattered hairs on veins below and margin. **Inflorescences** terminal and axillary, to 5 mm wide. **Flowers:** calyx lobes narrowly triangular, length variable on individual flowers, longest to 1 mm; corolla white, to 1 mm long, lobes to 0.9 mm, much longer than tube, outside glabrous, inside with a few short hairs near lobe apices; stamens exserted, but much shorter than corolla lobes; style not exceeding stamens. **Capsules** with scattered hairs throughout, part of septum lamellas remaining attached to valves at dehiscence. **Seeds** obovate or elliptic, to 1.4 × 0.8 mm, dark brown, seed-coat surface rugose.

Distribution. Vietnam, Laos, Thailand, Malaysia, Indonesia and the Philippines. In Singapore only known from old collections from Geylang (*Ridley s.n.*, Feb 1898, SING [SING0072749]; *Ridley s.n.*, 31 Jan 1899, SING [SING0072748]).

Ecology. Unknown in Singapore although a weedy species elsewhere.

Provisional conservation assessment. Globally Least Concern (LC). This species was listed as naturalised in Singapore by Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 81, 177, 268) but it is likely to have been native in Singapore. It is assessed here as Nationally Extinct.

Notes. There are many additional synonyms but these are not listed here pending a more thorough taxonomic revision.

6. *Spermacoce parviceps* (Ridl.) I.M.Turner

(Latin *parvi*- = small, *-ceps* = heads; referring to the small inflorescences)

Novon 6 (1996) 222; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 446. **Basionym:** *Borreria parviceps* Ridl., J. Straits Branch Roy. Asiat. Soc. 86 (1922) 299; Ridley, Fl. Malay Penins. 2 (1923) 176. **Type:** *Ridley s.n.*, [Malaysia], Negri Sembilan, Bukit Tangga Pass, 23 December 1920 (first step lectotype SING, designated by Turner, Novon 6 (1996) 222; second step lectotype SING [SING0058047], designated here; isolectotype SING [SING0058046]).

Annual erect herb, stems sometimes winged, glabrous. **Leaves:** lamina narrowly elliptic to elliptic, to 30 × 10 mm, long hairs on both surfaces, more on upper surface than lower, not dense. **Inflorescences** terminal and axillary, many flowered. **Flowers:** calyx glabrous, 2–4-lobed, lobes narrowly triangular, often unequal in length, to 1 mm long; corolla white, less than 1 mm long, lobes generally longer than tube, glabrous except for a band of hairs on lobes above anthers; stamens included, or slightly exceeding throat; style not exceeding stamens, stigma obscurely 2-lobed. **Capsules** with lamellas disintegrating at dehiscence. **Seeds** elliptic or oblong, to 1 × 0.4 mm, dark, almost black, seed-coat surface deeply reticulate.

Distribution. Endemic to Peninsular Malaysia and Singapore. In Singapore known from Telok Paku (*Burkill 10012*, 25 Dec 1922, SING [SING0072751]) and Bedok (*Sinclair SFN 40640*, 18 Jun 1955, SING [SING0072753]).

Ecology. Unknown in Singapore although in other regions it prefers open, marshy areas.

Provisional conservation assessment. Globally not assessed. In Singapore presumed Nationally Extinct.

Notes. The seed coat is deeply pitted, easily separating it from the shallower seed coat reticulation of the other *Spermacoce* species in Singapore, and the hairs on the leaves are much longer than those of the other species.

7. *Spermacoce remota* Lam.

(Latin *remotus* = scattered, not close together; possibly referring to stem nodes)

Tabl. Encycl. 1, fasc. 2 (1792) 273; Chen & Taylor, Fl. China 19 (2011) 329. **Synonym:** *Borreria remota* (Lam.) Bacigalupo & E.L.Cabral, Darwiniana 37(3-4) (1999) 334. **Type:** *Martin s.n.*, 'E Domingo' [Dominican Republic] (lectotype P-LA [P00308646], designated by Bacigalupo & Cabral, Darwiniana 37(3-4) (1999) 334).

Spermacoce assurgens Ruiz & Pav., Fl. Peruv. 1 (1798) 60, t. 92b; Turner, Gard. Bull. Singapore 47 (1997 ['1995']) 446; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 81, 176, 268. **Synonym:** *Borreria assurgens* (Ruiz & Pav.) Griesb., Abh. Königl. Ges. Wiss. Göttingen 24 (1879) 156. **Type:** [Published illustration] Ruiz & Pavon, Fl. Peruv. 1 (1798) t. 92b, lectotype designated by Smith & Darwin, Fl. Vit. Nova 4 (1988) 373.

Borreria laevis auct. non (Lam.) Griseb.: Turner, Gard. Bull. Singapore 45 (1993) 195.

Spermacoce laevis auct. non Lam.: Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 81, 176, 268.

Perennial herb, erect or spreading, to 40 cm tall. **Leaves:** lamina narrowly elliptic, 15–60 × 6–16 mm, scattered scabrid hairs near margin, otherwise glabrous. **Inflorescences** terminal and axillary, to 10 mm wide. **Flowers:** calyx lobes green, narrowly triangular, less than 1 mm long; corolla white, 1.8–2.4 mm long, outside glabrous except for a few hairs near lobe apices, inside with scattered moniliform hairs at top of tube and lower part of lobes, tube to 1.4 mm long, lobes to 1.1 mm long; stamens exserted, filaments almost as long as corolla lobes but curling up to leave anthers situated near base of lobes, anthers to 0.4 mm long; style as long as corolla lobes, stigma capitate. **Capsules** with hairs on upper half, septum usually remaining erect and undamaged at dehiscence. **Seeds** elliptic, to 2 × 0.8 mm, yellowish brown to dark brown, seed-coat surface conspicuously rugose and faintly reticulate.

Distribution. Native to the Neotropics, naturalised in many parts of Africa, Asia and Oceania. In Singapore recorded from Mount Zion, the old railway line near Bukit Timah (*Gwee SING2011-398*, 5 Oct 2011, SING [SING0166318]), Pulau Ubin (*Furtado 18343*, 31 Jul 1927, SING [SING0072454]), Geylang (*Teruya 1272*, Jul 1930, SING [SING0037441]), Sembawang, MacRitchie (*Burkill HMB.700*, 2 Jul 1956, SING [SING0033740]), Bidadari Cemetery (*Gwee et al. BC 18*, Jun 2003, SING [SINF0044909]) and Coney Island.

Ecology. Open disturbed areas (e.g. roadsides, clearings in forests).

Provisional conservation assessment. Globally Least Concern (LC). Not native in Singapore.

Notes. In the Neotropical literature there is an extensive list of synonyms.

8. *Spermacoce verticillata* L.

(Latin *verticillatus* = arranged in a whorl; referring to the leaves which often appear to be in whorls)

Sp. Pl. 1 (1753) 102; Ridsdale, Revis. Handb. Fl. Ceylon 12 (1998) 334. **Synonyms:** *Borreria verticillata* (L.) G.Mey., Prim. Fl. Esseq. (1818) 83. – *Bigelovia verticillata* (L.) Spreng., Syst. Veg. (ed. 16) 1

(1824 [‘1825’]) 404. – *Tardavel verticillata* (L.) Hiern, Cat. Afr. Pl. 1(2) (1898) 508. **Type:** [Published illustration] of ‘*Spermacoce verticillis globosis*’ in Dillenius, Hort. Eltham. 2 (1732) 369, t. 277: fig. 358, lectotype designated by Rendle, J. Bot. 72 (1934) 331. **Fig. 74D.**

Annual erect herb to 80 cm. **Leaves:** lamina linear or narrowly elliptic, 20–120 × 2–9 mm, some scabrid hairs near margins, otherwise glabrous. **Inflorescences** terminal and axillary, to 15 mm wide. **Flowers:** calyx lobes 2, green, triangular, to 1.3 mm long; corolla white, 1.5–2.5 mm long, tube to 1.5 mm long, glabrous except for a band of moniliform hairs inside near middle, lobes to 1 mm long, outside glabrous or with an occasional hair near apex; stamens exerted, equal to or exceeding corolla lobes, anthers to 0.5 mm long; style equal to or slightly exceeding corolla lobes, stigma bilobed. **Capsules** with hairs mostly restricted to upper half, part of septum lamellas remaining attached to valves at dehiscence. **Seeds** oblong, to 2 × 0.5 mm, dark brown, seed-coat surface reticulate.

Distribution. Native to the Neotropics, naturalised throughout the tropics of Africa, Asia and Australia. In Singapore recorded from the Western Catchment (*Samsuri et al. WC 36*, 21 Apr 2004, SING [SING0054296]; *Bazilah et al. SNB 1*, 30 Jul 2014, SING [SING0213731]) and Choa Chu Kang (*Lee & Leong SING2006-116*, 11 Dec 2006, SING [SING0090278]).

Ecology. Open disturbed areas.

Provisional conservation assessment. Globally Least Concern (LC). Not native in Singapore.

Notes. There is a large number of synonyms in the Neotropical literature, some of which are not cited here.

The seeds of *Spermacoce verticillata* are long and narrow, the length-to-width ratio much larger than the other *Spermacoce* species in Singapore, and the capsule is correspondingly long and narrow.

49. TARENNA Gaertn.

(from *tarana*, a Ceylonese vernacular plant name)

Fruct. Sem. Pl. 1 (1788) 139; Ridley, Fl. Malay Penins. 2 (1923) 102; Craib, Fl. Siam. 2(1) (1932) 87; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 2163; Corner, Wayside Trees Malaya, ed. 3, 2 (1988) 651; Wong, Arbor. Rubiac. Malaya (1988) 198; Wong, Tree Fl. Malaya 4 (1989) 409; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 161; Puff et al., Rubiac. Thailand (2005) 94, pl. 3.1.25. **Type:** *Tarenna zeylanica* Gaertn.

Chomelia L., Opera Var. (1758) 210, nom. rej. **Synonym:** *Webera* Schreb., Gen. Pl., ed. 8[a], 2 (1791) 794, nom. illeg. superfl.; Hooker, Fl. Brit. India 3, fasc. 7 (1880) 101; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 64. **Type:** *Rondeletia asiatica* L., lectotype designated by Dandy, Taxon 18 (1969) 470 (= *Tarenna asiatica* (L.) Kuntze ex K.Schum.).

Stylocoryna auct. non Cav.: King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’]) 198; Ridley, Fl. Malay Penins. 2 (1923) 108.

Trees or treelets, sometimes shrubby. Twigs terete or often with 4 conspicuous longitudinal ridges and squarish in cross-section. **Stipules** triangular to ovate, often with a conspicuous apical cusp, the edges of a pair fused together at the base. **Leaves** glabrous or hairy, lower surface with domatia present or not in the axils of secondary veins. **Inflorescences** terminal, a cyme or panicle, erect or pendulous. **Flowers** bisexual, 5-merous; calyx cupular, lobes triangular or ovate or linear; corolla tube hairy at the throat inside, lobes contorted in the bud, sometimes with apiculate tips divergent in the bud, horizontal to reflexed at anthesis; anthers inserted at the corolla throat, dorsifixed, strongly exerted in the open flower; stigma linear, the 2 lobes mostly coherent, conspicuously exerted; ovary 2-locular; ovules solitary to many in each locule, placentation axile; disc conspicuous. **Fruits** subglobose to ovoid, berry-like. **Seeds** 1–several or many in each locule, angular.

Distribution. Nearly 200 species (Mabberley, Mabberley’s Pl. Book, ed. 3 (2008) 842) in the Old World tropics, including India, continental Southeast Asia and Malesia. In Singapore 7 native species.

Notes. There is a specimen of *Tarenna longifolia* (G.Don) Ridl. in SING [SING0230119] attributed to *Cantley’s collector s.n.* on an old ‘Flora of Singapore’ label, without locality and date. It is highly uncertain that this was collected in Singapore, especially when Wong (Arbor. Rubiac. Malaya (1988) 198; Tree Fl. Malaya 4 (1989) 409) considers the species as endemic to Penang and Perak and no other Singapore specimens exist. It is included in the key but as it is dubious for Singapore it is given in italics and not further described.

Key to *Tarenna* species

1. Mature inflorescences pendulous 2
 Mature inflorescences erect 3
2. Leaves oblanceolate with long-caudate apex; lower leaf surface uniformly short hispid;
 corolla lobes not more than 3/4 of corolla tube *T. longifolia* (see notes above)
 Leaves elliptic, obovate or ovate with cuspidate apex; lower leaf surface subglabrous,
 with scattered minute hairs on midrib and veins; corolla lobes equal to or longer than
 corolla tube **5. *T. odorata***
3. Corolla lobes not more than 3/4 the length of the corolla tube 4
 Corolla lobes equalling or longer than the corolla tube 8
4. Upper leaf surface hairy 5
 Upper leaf surface glabrous 6
5. Stipules with pale margin in dried material; inflorescence axes and calyx with distinct
 erect-spreading hairs **4. *T. mollis***
 Stipules entirely brown in dried material; inflorescence axes and calyx subglabrous or
 with scattered short appressed hairs **2. *T. costata***

6. Leaves glabrous or sparsely puberulent on lower midrib 7
 Leaves distinctly hairy all over lower leaf surface **1. T. adpressa** (in part)
7. Twigs 4-angled; corolla tube 16–20 mm in length **3. T. fragrans**
 Twigs terete; corolla tube less than 15 mm in length **1. T. adpressa** (in part)
8. Lower leaf surface rough with scattered hairs; calyx lobes broadly triangular, sparsely
 hairy without ciliate margins; corolla lobes with apiculate tips divergent in bud stage
 **7. T. stellulata**
 Lower leaf surface smooth and glabrous; calyx lobes ovate with ciliolate margins; corolla
 lobes without apiculate tips. **6. T. ridleyi**

1. *Tarenna adpressa* (King) Merr.

(Latin, *adpressus* = pressed against a surface;
 referring to the hairs on the lower surface of the leaves)

Philipp. J. Sci. 17 (1921 [‘1920’]) 472; Corner, Gard. Bull. Straits Settle. 10 (1939) 51, as ‘*adpressa*’; Corner, Wayside Trees Malaya, ed. 3, 2 (1988) 651, as ‘*adpressa*’; Wong, Arbor. Rubiac. Malaya (1988) 206 (in clavi); Wong, Tree Fl. Malaya 4 (1989) 411 (in clavi); Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 161; Turner, Gard. Bull. Singapore 45 (1993) 204; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 447; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 85, 177, 212. **Basionym:** *Stylocoryna adpressa* King, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’]) 200, p.p.; Ridley, Fl. Malay Penins. 2 (1923) 110, p.p. **Type:** *Derry in Curtis 3699*, [Malaysia], Perak, Larut Hill, 1900 (lectotype SING [SING0239351], designated here; isolectotypes SING [SING0239352, SING0239353]).

Stylocoryna adpressa King var. *papillulosa* King, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’]) 200. **Synonym:** *Tarenna papillulosa* (King) Ridl., Fl. Malay Penins. 2 (1923) 103, as ‘*papillosa*’. **Type:** *Ridley 2879*, [Malaysia], Johore, Tanah Runto (lectotype SING [SING0062109], designated by Wong, Arbor. Rubiac. Malaya (1988) 206).

Tarenna lancifolia Ridl., Fl. Malay Penins. 5 (1925) 316. **Type:** *Haniff & Nur SFN 4954*, [Malaysia], Kedah, Kedah Peak, 4 August 1919 (lectotype SING [SING0058436], designated by Ng & Wong, Gard. Bull. Singapore 70 (2018) 307; isolectotype K [K001067652]).

Treelet or shrub. Stems terete. **Stipules** triangular, 2–6 mm long, entirely brown when dry, pubescent. **Leaves:** lamina oblanceolate to narrowly elliptic, (6–)10–12(–15) × (1.8–)2–4.5(–5) cm, apex shortly acuminate, base cuneate, margin recurved when dry, thin-coriaceous, glabrous on upper surface, densely hairy on midrib and secondary veins on lower surface, secondary veins 6–10 pairs, tertiary veins inconspicuous; petioles 15–20 mm long. **Inflorescences** a compound cymes, 3–4 cm long, erect, peduncle 0.1–0.7 cm long, densely pubescent. **Flowers** with pedicels 1–3 mm long, densely pubescent; calyx including tube 1–2 mm long, densely hairy, lobes broad-triangular, c. 0.5 mm long, densely pubescent; corolla tube 5–8 mm long, densely short-pubescent, lobes lanceolate, 3–4 mm long (c. half the length of the tube), apex rounded; anthers inserted at the corolla throat, 2–3 mm long, reflexed and completely exerted; style and stigma strongly exerted for 5–11 mm from corolla throat. **Fruits** globose, to 5 mm diam.

Distribution. Malay Peninsula. In Singapore it has been recorded from Bajau (*Ridley 4968*, 1892, SING [SING0012169]), Tampines (*Ridley 5961*, Feb 1894, SING [SING0012170]) and an unclear locality, Sungei Barih (*Goodenough 3885*, 1892, SING [SING0012171]).

Ecology. Across its range in lowland and peat-swamp forests to c. 500 m.

Provisional conservation assessment. Globally not assessed. Listed as Critically Endangered (CR/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 85, 177, 212) but, with no collections since 1894, it must be presumed Nationally Extinct.

Notes. In King's original description, he mentioned 'midrib with short sparse stiff adpressed pale hairs', a character which is apparently found in only one collection of the original material (*Wolferstan s.n.*, Apr 1900, Lumut, SING [SING0270386]) but which has been redetermined as *Tarenna maingayi* (Hook.f.) Merr.

2. *Tarenna costata* (Miq.) Merr.

(Latin, *costatus* = ribbed; referring to the conspicuous secondary veins in the leaves)

Philipp. J. Sci. 17 (1921 ['1920']) 472; Corner, Wayside Trees Malaya, ed. 3, 2 (1988) 651; Wong, Arbor. Rubiac. Malaya (1988) 219; Wong, Tree Fl. Malaya 4 (1989) 415; Turner, Gard. Bull. Singapore 45 (1993) 204; Turner, Gard. Bull. Singapore 47 (1997 ['1995']) 447; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 85, 177, 212. **Basionym:** *Stylocoryna costata* Miq., Fl. Ned. Ind. 2, fasc. 2 (1857) 203; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 ['1903']) 201; Ridley, Fl. Malay Penins. 2 (1923) 109. **Synonyms:** *Webera costata* (Miq.) Hook.f., Fl. Brit. India 3, fasc. 7 (1880) 103; Boerlage, Handl. Fl. Ned. Ind. 2(1) (1891) 129, isonym. **Type:** *Teijsmann*, [Indonesia], Sumatra (not traced).

Treelet or shrub up to 6 m tall. Stems 4-angled. **Stipules** triangular, 3–6 mm long, entirely brown when dry, pubescent. **Leaves:** lamina obovate, (7.5–)10–13(–15) × (3.5–)5.5–6.5(–7) cm, apex shortly acuminate, base cuneate, margin entire, coriaceous, sparsely hairy on upper surface, densely hairy on midrib and secondary veins on lower surface, secondary veins 8–12 pairs, tertiary veins distinct, running parallel to midrib; petioles 15–20 mm long. **Inflorescences** compound cymes, 3.5–5 cm long, erect, peduncle 0.1–0.5 cm long, subglabrous with short adpressed hairs. **Flowers** with pedicels 3–5 mm long, subglabrous; calyx including tube c. 2 mm long, subglabrous, lobes broad-triangular, c. 0.5 mm long, densely pubescent; corolla tube 5–6 mm long, densely short-pubescent, lobes lanceolate, 3–4 mm long (more than half the length of the tube), apex rounded; anthers inserted at the corolla throat, 4–5 mm long, reflexed and completely exerted; style and stigma strongly exerted for 8–9 mm from corolla throat. **Fruits** globose, to 5 mm diam.

Distribution. Peninsular Thailand, Peninsular Malaysia, Sumatra and Borneo. In Singapore it has been recorded from several localities in the Central Catchment (e.g. *Corner*, 15 Jan 1937, SING [SING0030609]); *Samsuri SA 1339*, 28 Dec 1976, SING [SING0030610]; *Maxwell 82-240*, 26 Aug 1982, SING [SING0030612]).

Ecology. Across its range in lowland to hill forest.

Provisional conservation assessment. Globally not assessed. Listed as Critically Endangered (CR/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 85, 177, 212).

Notes. The description above applies to the species as known for the Malay Peninsula in general, as there are no flowering specimens for Singapore.

3. *Tarenna fragrans* (Blume) Koord. & Valeton

(Latin, *fragrans* = fragrant; referring to the flowers)

Meded. Lands Plantentuin 59 (1902) 77 [Bijdr. Boomsoort. Java 8 (1902) 77]; Corner, Wayside Trees Malaya, ed. 3, 2 (1988) 652; Wong, Arbor. Rubiac. Malaya (1988) 220; Wong, Tree Fl. Malaya 4 (1989) 411 (in clavi); Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 161; Turner, Gard. Bull. Singapore 45 (1993) 204; Turner, Gard. Bull. Singapore 47 (1997 ['1995']) 447; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 85, 177, 218. **Basionym:** *Wahlenbergia fragrans* Blume, Cat. Gew. Buitenzorg (1823) 115. **Synonyms:** *Stylocoryna fragrans* Blume, Bijdr. Fl. Ned. Ind., pt 16 (1826–1827) 982; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 ['1903']) 201; Ridley, Fl. Malay Penins. 2 (1923) 108. – *Ceriscus fragrans* (Blume) Nees, Flora 8 (1825) 116. – *Webera fragrans* (Blume) Hook.f., Fl. Brit. India 3, fasc. 7 (1880) 103. **Type:** *Blume s.n.*, [Indonesia], Java (lectotype L [L0057731], designated here; possible isolectotype LE [LE00017502]). **Fig. 75, 76.**

Treelet or shrub to 5 m tall. Stems 4-angled. **Stipules** triangular, 3–7 mm long, brown with pale margins when dry, pubescent. **Leaves:** lamina elliptic to obovate, (8–)9–11(–13.5) × (2–)3.5–6 cm, apex acuminate, base cuneate, coriaceous, glabrous on both surfaces, secondary veins 7–10 pairs, tertiary veins inconspicuous; petioles 7–10 mm long. **Inflorescences** compound cymes, 3–6 cm long, erect, peduncle c. 0.5 cm long, glabrous. **Flowers** with pedicels 2–5 mm long, with scattered hairs; calyx including tube c. 2 mm long, sparsely hairy, lobes broad-triangular, pale when dry, c. 1 mm long, densely pubescent; corolla tube 15–18 mm long, densely pubescent, lobes lanceolate, 4–5 mm long (less than half the length of the tube), apex rounded; anthers inserted at the corolla throat, 2–3 mm long, reflexed and completely exerted; style and stigma strongly exerted for 11–15 mm from corolla throat. **Fruits** globose, to 5 mm diam.

Distribution. Peninsular Malaysia, Sumatra, Java and Borneo. In Singapore it has been recorded from the Western Catchment (*Samsuri et al. WC9*, 30 Mar 2004, SING [SING0053911]), Tanglin (*Ridley 3617a*, 1892, SING [SING0030618]), Kranji (*Ridley 1878a*, 1891, SING [SING0030620]), Changi (*Ridley 3617b*, Jul 1894, SING [SING0030619]), Pulau Tekong (*Gwee et al. SING2007-229*, 5 Mar 2007, SING [SING0093470]) and other offshore islands, including St John's Island, Sisters' Islands, Pulau Jong and Pulau Ubin.

Ecology. Across its range in lowland forest at swampy sites or along riverbanks.



Figure 75. *Tarenna fragrans* (Blume) Koord. & Valeton in full bloom. (Cultivated in Singapore Botanic Gardens. Photo: X.Y. Ng).

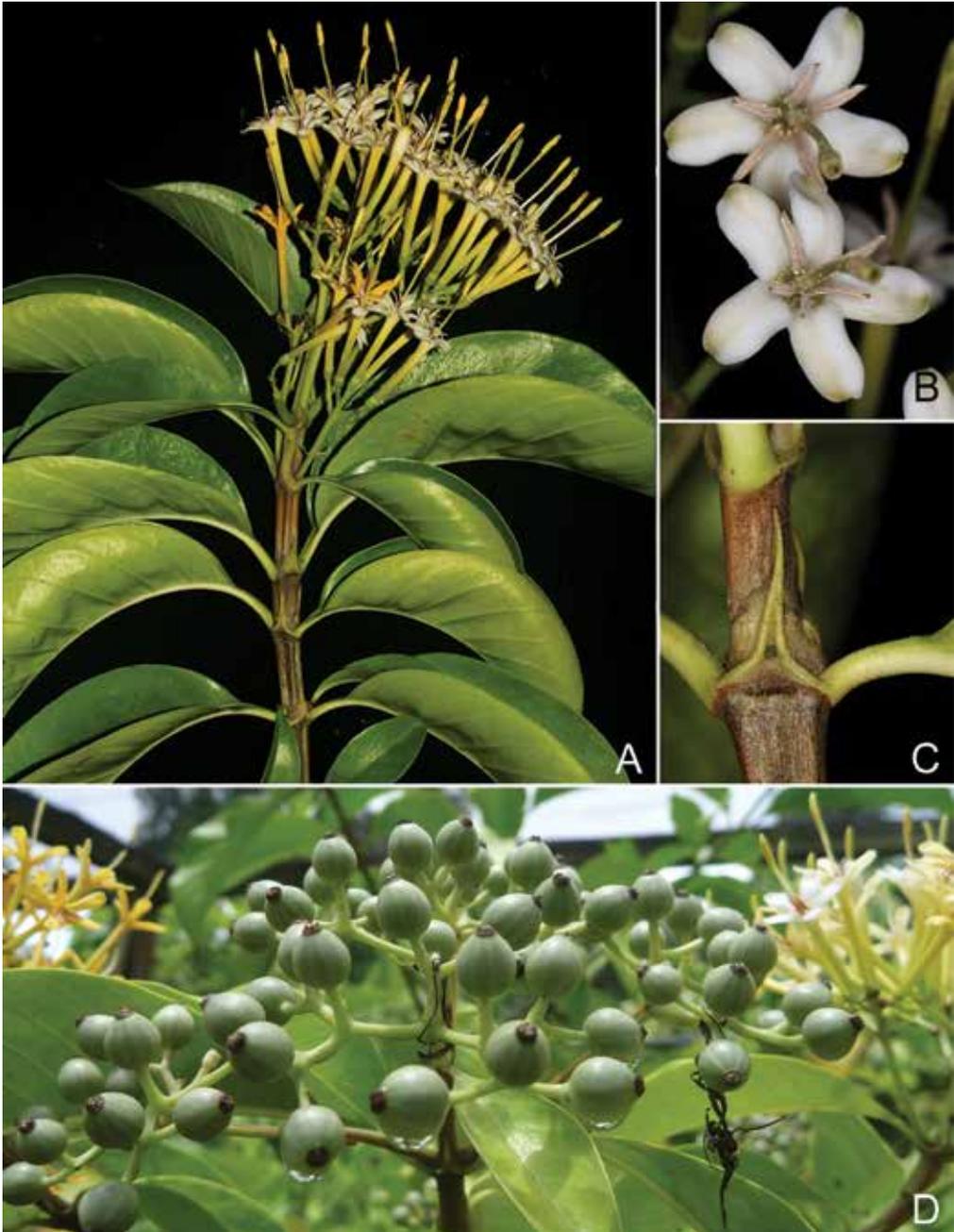


Figure 76. *Tarenna fragrans* (Blume) Koord. & Valeton **A.** Flowering leafy branch. **B.** Open flowers. **C.** Detail of stipule. **D.** Fruits. (Cultivated in Singapore, Pasir Panjang Nursery, originally from a nursery in Thailand. Photos: A–C, X.Y. Ng; D, W.F. Ang).

Provisional conservation assessment. Globally not assessed. Listed as Endangered (EN/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 85, 177, 218).

Vernacular name. The species has been recorded with the Malay name *Jarum-jarum*, in common with *Pavetta* species.

4. *Tarenna mollis* (Wall. ex Hook.f.) B.L.Rob.

(Latin, *mollis* = soft, pliant; referring to the hairs on the leaves)

Proc. Amer. Acad. Arts 45 (1910) 405; Corner, Wayside Trees Malaya, ed. 3, 2 (1988) 652; Wong, Arbor. Rubiac. Malaya (1988) 221; Wong, Tree Fl. Malaya 4 (1989) 416; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 161; Turner, Gard. Bull. Singapore 45 (1993) 204; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 447; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 85, 177, 212. **Basionym:** *Webera mollis* Wall. ex Hook.f., Fl. Brit. India 3, fasc. 7 (1880) 104. **Synonym:** *Stylocoryna mollis* (Wall. ex Hook.f.) King, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’]) 202; Ridley, Fl. Malay Penins. 2 (1923) 109. **Type:** *Maingay s.n.* [Kew Distribution 894], [Malaysia], Malaya (lectotype K [K001129463], designated here; isoelectotypes FI [FI008842], K [K001129465], L, LE [LE0017300]).

Treelet or shrub to 6 m tall. Stems 4-angled. **Stipules** broadly triangular, 5–7 mm long, brown with pale margins when dry, pubescent. **Leaves:** lamina broadly elliptic to obovate, (7.5–)12–20(–25) × (3–)4.5–8(–9.5) cm, apex acuminate, base cuneate, coriaceous, densely hairy on both surfaces, secondary veins 9–18 pairs, tertiary veins inconspicuous; petioles 10–20 mm long. **Inflorescences** compound cymes, 3–5.5 cm long, erect, peduncle c. 0.5 cm long, densely pubescent with distinct erect-spreading hairs. **Flowers** with pedicels 2–3 mm long, densely pubescent; calyx including tube c. 2 mm long, densely pubescent, lobes broad-triangular, brown when dry, c. 1 mm long, densely pubescent; corolla tube c. 10 mm long, densely pubescent, lobes lanceolate, 4–5 mm long (about half the length of the tube or slightly less), apex rounded; anthers inserted at the corolla throat, 1–2 mm long, reflexed and completely exserted; style and stigma strongly exserted for 7–13 mm from corolla throat. **Fruits** globose, 5–7 mm diam.

Distribution. Peninsular Malaysia and Sumatra. In Singapore it has been recorded from Bukit Timah (*Ngadiman SFN 35551*, 21 Jun 1938, K; *Noor MN1015*, 10 Mar 1970, SING [SING0037381]), the Central Catchment (*Corner s.n.*, 1 Apr 1939, SING [SING0030634]), Tanglin (*Ridley s.n.*, Sep 1905, SING [SING0030631]) and the Singapore Botanic Gardens’ Rain Forest (*Ridley 4915*, 1893, K).

Ecology. Across its range in lowland to lower montane forest up to c. 1100 m.

Provisional conservation assessment. Globally not assessed. Listed as Critically Endangered (CR/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 85, 177, 212).

5. *Tarenna odorata* (Roxb.) B.L.Rob.

(Latin, *odoratus* = having a smell; referring to the fragrant flowers)

Proc. Amer. Acad. Arts 45 (1910) 405; Ridley, Fl. Malay Penins. 2 (1923) 105; Wong, Arbor. Rubiac. Malaya (1988) 202 (in clavi); Wong, Tree Fl. Malaya 4 (1989) 410 (in clavi); Turner, Gard. Bull. Singapore 45 (1993) 204; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 448; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 85, 177, 212. **Basionym:** *Webera odorata* Roxb., Fl. Ind. 2 (1824) 535; Hooker, Fl. Brit. India 3, fasc. 7 (1880) 102; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 68. **Type:** [Unpublished illustration] Icones Roxburghianae no. 2458 [as ‘2459’ on drawing] (lectotype K, designated here). **Fig. 77A, B.**

Webera grandifolia Hook.f., Fl. Brit. India 3, fasc. 7 (1880) 105; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 68. **Synonym:** *Tarenna grandifolia* (Hook.f.) Ridl., Fl. Malay Penins. 2 (1923) 104; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 161. **Type:** *Griffith 2796*, [Malaysia], Malacca (lectotype K [K001129457], designated here).

Tarenna longifolia auct. non (G.Don) Ridl.: Corner, Gard. Bull. Straits Settlem. 10 (1939) 52, p.p.

Treelet or shrub to 2 m tall. Stems 4-angled. **Stipules** broadly triangular, 5–7 mm long, brown when dry, pubescent. **Leaves:** lamina elliptic to obovate to ovate, (14–)17–32.5(–35) × (4.5–)9–11(–13) cm, apex cuspidate, base cuneate, coriaceous, glabrous on upper surface, subglabrous on midrib and secondary veins on lower surface, secondary veins 12–20 pairs, tertiary veins inconspicuous; petioles 10–40 mm long. **Inflorescences** compound cymes, 13–17 cm long, pendulous, peduncle (6.5–)8–11(–16) cm long, densely pubescent. **Flowers** with pedicels 2–7 mm long, densely pubescent; calyx including tube c. 2 mm long, densely pubescent, lobes broad-triangular, brown when dry, c. 1 mm long, densely pubescent; corolla tube 4–5 mm long, densely pubescent, lobes lanceolate, 5–7 mm long (longer than the tube), apex rounded; anthers inserted at the corolla throat, 5–7 mm long, reflexed and completely exerted; style and stigma strongly exerted for 8–11 mm from corolla throat. **Fruits** globose, to 5 mm diam.

Distribution. Malay Peninsula. In Singapore it has been recorded from Bukit Timah (*Khaleque MAK4*, 29 Dec 1970, SING [SING0037485]), the Central Catchment (*Ang SING2012-238*, 12 May 2012, SING [SING017381]), West Coast (*Burkill 258*, 23 Dec 1914, SING [SING0030648]) and Changi (*Goodenough s.n.*, date illegible, SING [SING0030647]).

Ecology. Across its range in lowland forests, including swampy ground.

Provisional conservation assessment. Globally not assessed. Listed as Critically Endangered (CR/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 85, 177, 212).

6. *Tarenna ridleyi* (H.Pearson ex Ridl.) Ridl.

(Henry Nicholas Ridley, 1855–1956, prolific botanist
and first Director of Singapore Botanic Gardens)

Fl. Malay Penins. 2 (1923) 106, p.p.; Wong, Arbor. Rubiac. Malaya (1988) 208 (in clavi); Wong, Tree Fl. Malaya 4 (1989) 412 (in clavi); Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 161; Turner, Gard. Bull. Singapore 45 (1993) 204; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 448; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 85, 177, 198. **Basionym:** *Webera ridleyi* H.Pearson ex Ridl., J. Straits Branch Roy. Asiat. Soc. 35 (1901) 88; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 66, p.p. **Type:** *Ridley 6147*, Singapore, Chan Chu Kang (lectotype SING [SING0058438], designated by Wong, Arbor. Rubiac. Malaya (1988) 208; isolectotypes K [K001129506, K001129507]).

Treelet or shrub to 2 m tall. Stems 4-angled. **Stipules** broadly triangular, 5–7 mm long, brown when dry, glabrous. **Leaves:** lamina elliptic to obovate, (12–)12.5–18(–20) × (3–)4–6.5(–7) cm, apex acuminate, base cuneate, chartaceous, glabrous on both surfaces, secondary veins 6–12 pairs, tertiary veins inconspicuous; petioles 10–40 mm long. **Inflorescences** compound cymes, 7–12 cm long, erect, peduncle c. 5 cm long, glabrous. **Flowers** with pedicels 1–4 mm long, glabrous; calyx including tube c. 4 mm long, glabrous, lobes broad-triangular, brown with pale margins when dry, glabrous with ciliolate margins, c. 2 mm long; corolla tube c. 3 mm long, glabrous, lobes lanceolate, 5–7 mm long (longer than the tube), apex rounded; anthers inserted at the corolla throat, 1–2 mm long, reflexed and completely exerted; style and stigma strongly exerted for 3–5 mm from corolla throat. **Fruits** globose, to 5 mm diam.

Distribution. Malay Peninsula. In Singapore it has been recorded from Mandai (*Ridley 177*, 30 Mar 1899, SING [SING0030649]).

Ecology. Across its range in lowland to hill forest up to c. 1000 m.

Provisional conservation assessment. Globally not assessed. In Singapore presumed Nationally Extinct.

Notes. The description above applies to the species as known for the Malay Peninsula in general, as there are no fruiting specimens collected in Singapore.

7. *Tarenna stellulata* (Hook.f.) Ridl.

(Latin, *stellulatus* = divergent and star-like;
referring to the spreading corolla lobe tips in the bud)

Fl. Malay Penins. 2 (1923) 106; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 2163; Corner, Wayside Trees Malaya, ed. 3, 2 (1988) 653; Wong, Arbor. Rubiac. Malaya (1988) 208 (in clavi); Wong, Tree Fl. Malaya 4 (1989) 412 (in clavi); Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 162; Turner, Gard. Bull. Singapore 45 (1993) 204; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 448; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 85, 177, 212. **Basionym:** *Webera stellulata* Hook.f., Fl. Brit. India 3, fasc. 7 (1880) 104; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 65. **Type:** *Maingay*

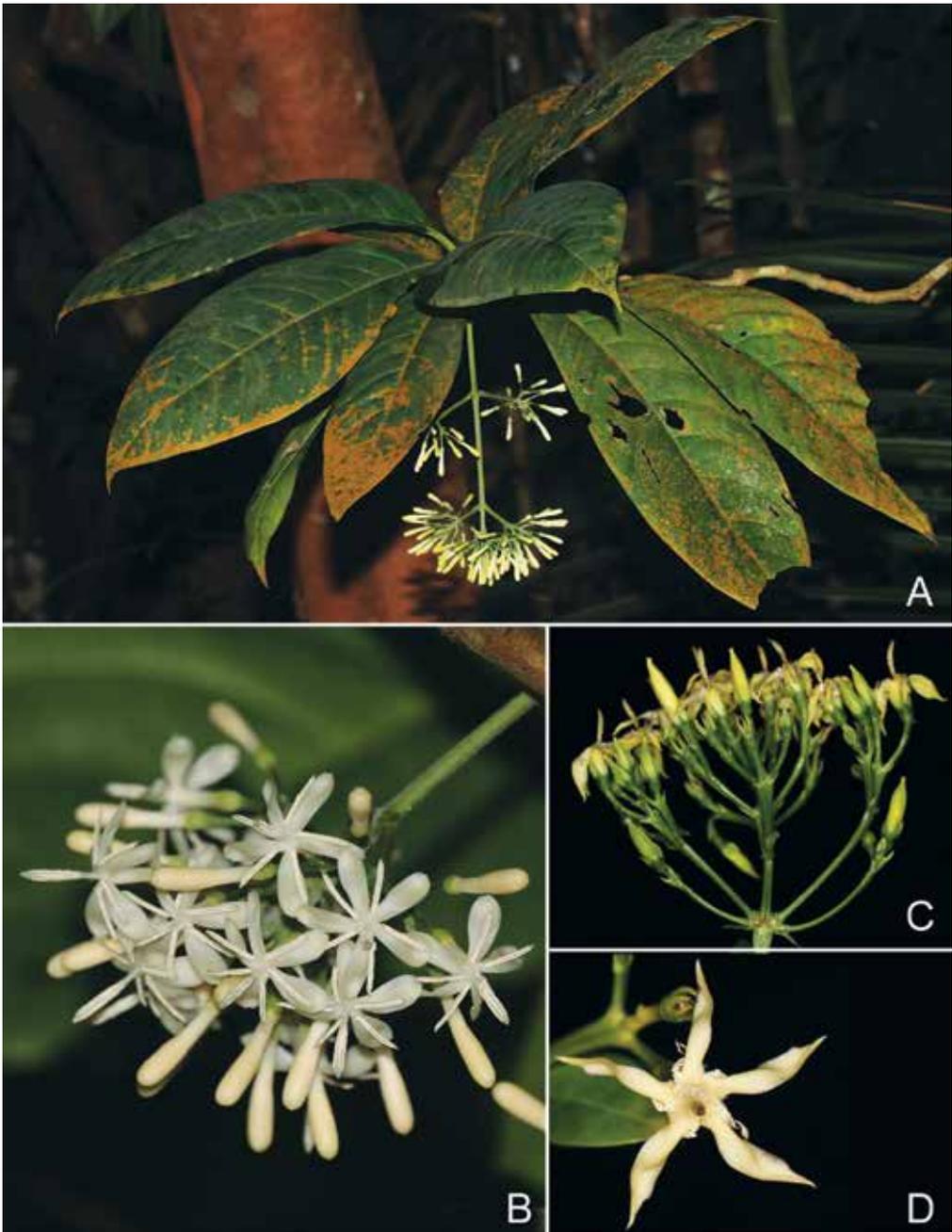


Figure 77. *Tarenna odorata* (Roxb.) B.L.Rob. **A.** Leafy branch with inflorescence. **B.** Open flowers. *Tarenna stellulata* (Hook.f.) Ridl. **C.** Inflorescence. **D.** Open flower. (A, B from Singapore, Nee Soon; C, D cultivated in Singapore, Pasir Panjang Nursery, originally from a nursery in Thailand. Photos: X.Y. Ng).

3121 [Kew Distribution 850], [Malaysia], Malacca, 1867–68 (lectotype K [K001129462], designated by Wong, Arbor. Rubiac. Malaya (1988) 208; isolectotype L [L0057725]). **Fig. 77C, D.**

Treelet or shrub to 4 m tall. Stems terete. **Stipules** broadly triangular, 5–7 mm long, brown when dry, pubescent. **Leaves:** lamina broadly elliptic to obovate, 16–18 × 5.5–7 cm, apex acuminate, base cuneate, coriaceous, glabrous on upper surface, sparsely pubescent on lower surface, secondary veins 8–9 pairs, tertiary veins inconspicuous; petioles 20–35 mm long. **Inflorescences** compound cymes, c. 5 cm long, erect, peduncle c. 8 cm long, sparsely pubescent. **Flowers** with pedicels 1–2 mm long, sparsely pubescent; calyx including tube c. 1 mm long, glabrous, lobes broad-triangular, brown when dry, c. 1 mm long, sparsely pubescent; corolla tube 4–5 mm long, subglabrous, lobes lanceolate, 5–7 mm long (longer than the tube), apex apiculate, divergent in bud stage; anthers inserted at the corolla throat, 3–4 mm long, reflexed and completely exerted; style and stigma strongly exerted for 7–10 mm from corolla throat. **Fruits** globose, 5–7 mm diam.

Distribution. Peninsular Thailand and Peninsular Malaysia. In Singapore it appears to have been only recorded from Woodlands (*Ridley 11645*, 1903, K, SING [SING0030650]).

Ecology. Across its range in lowland to mountain forest up to 1200 m.

Provisional conservation assessment. Globally not assessed. Listed as Critically Endangered (CR/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 85, 177, 212) but, as the only record dates from 1903, it must be presumed Nationally Extinct.

Notes. The description above applies to the species as known for the Malay Peninsula in general, as there is only one single flowering specimen in Singapore.

50. TIMONIUS DC.

(from *timon*, an Amboinese vernacular name)

Prodr. 4 (1830) 461, nom. cons.; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 52; Ridley, Fl. Malay Penins. 2 (1923) 112; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 2201; Corner, Wayside Trees Malaya, ed. 3, 2 (1988) 653; Wong, Kew Bull. 43 (1988) 491; Wong, Arbor. Rubiac. Malaya (1988) 222; Wong, Tree Fl. Malaya 4 (1989) 417; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 162; Puff et al., Rubiac. Thailand (2005) 128, pl. 3.1.42. **Type:** *Timonius rumphii* DC. (= *Timonius timon* (Spreng.) Merr.).

Burneya Cham. & Schldl., Linnaea 4 (1829) 189, nom. rej. **Type:** *Burneya forsteri* Cham. & Schlecht., lectotype designated by Darwin, Allertonia 2 (1979) 9. (= *Timonius polygamus* (G.Forst.) Robinson).

Helospora Jack, Trans. Linn. Soc. London 14(1) (1823) 127, t. 4: fig. 3, nom. rej. **Type:** *Helospora flavescens* Jack (= *Timonius flavescens* (Jack) Baker).

Polyphragmon Desf., Mém. Mus. Hist. Nat. 6 (1820) 5, t. 2, nom. rej. **Type:** *Polyphragmon sericeum* Desf. (= *Timonius timon* (Spreng.) Merr.).

Trees. **Stipules** triangular, entire, caducous. **Leaves** membranous to coriaceous, tertiary veins mostly transversely parallel and running almost perpendicular to the midrib, rarely reticulate. **Inflorescences** axillary, fundamentally cymose. **Flowers** unisexual (plants dioecious); female flowers solitary or 3–many; male flowers 3–many; hypanthium in females subglobose, in males obconical, smaller; limb 4-dentate to subtruncate, the lobes hardly 2 mm long, rarely ovate and conspicuous; corolla yellow or cream-coloured, tube cylindric, glabrous inside, hairy outside, lobes 4, mostly valvate or very slightly overlapping at the base (in one species 5 in male flowers, 6–8 in females and conspicuously imbricate); stamens 4 or as many as corolla lobes, dorsifixed at the throat, in males normal and slightly exerted, in females empty and included; stigma 4-lobed (6–8 in one species), in females exerted, in males poorly formed and included; ovary many-locular; ovules solitary in each locule, pendulous. **Fruits** globose to ellipsoid, smooth or longitudinally lobed, less than 10 mm (in one species to nearly 20 mm) across, pale pubescent to glabrescent all over; pyrenes many, cylindric, separate from one another and only in one species immersed in a hard matrix; seeds cylindric.

Distribution. Around 250 species from the Seychelles and Sri Lanka eastwards into Malesia, Taiwan, Australia and the Pacific. In Singapore 4 native species.

Taxonomy. Two of the 14 Malay Peninsula species, both of which have been recorded for Singapore, were considered somewhat aberrant in *Timonius* by Wong (Kew Bull. 43 (1988) 491), namely *T. wrayi*, because of its reticulate leaf venation, conspicuous ovate calyx lobes, larger (10–18 mm diam.) fruits, and pyrenes immersed in a hard matrix, and *T. finlaysonianus* (Wall. ex G.Don) Hook.f., because of its imbricate corolla lobes of increased number (5 in male flowers, 6–8 in females). The relationships of these taxa to *Timonius* s.s. have not been phylogenetically investigated.

Key to *Timonius* species

1. Leaf undersurfaces completely covered by dense silvery appressed hairs **3. T. wallichianus**
 Leaf undersurfaces with lamina distinctly visible, not covered completely by any hairs that are present 2
2. Leaf venation with tertiary veins transversely parallel and running almost perpendicular to the midrib **2. T. flavescens**
 Leaf venation reticulate 3
3. Calyx lobes ovate, 5–8 mm long; corolla lobes 4, valvate; fruit 10–18 mm across; pyrenes immersed in a hard matrix **4. T. wrayi**
 Calyx lobes broadly triangular or poorly developed, up to 1 mm long; corolla lobes 5 in male flowers, 6–8 in female flowers, imbricate; fruit 7–10 mm across; pyrenes immersed in a soft tissue **1. T. finlaysonianus**

1. *Timonius finlaysonianus* (Wall. ex G.Don) Hook.f.

(George Finlayson, 1790–1823, Scottish naturalist and surgeon for the East India Company)

Fl. Brit. India 3, fasc. 7 (1880) 127; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 95; Ridley, Fl. Malay Penins. 2 (1923) 113; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 87, 177, 213. **Basionym:** *Guettarda finlaysoniana* Wall. ex G.Don, Gen. Hist. 3 (1837) 551. **Synonym:** *Timonius jambosella* Thwaites var. *finlaysoniana* (Hook.f.) King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 54, p.p. **Type:** *Wallich s.n.* [EIC 6223], Singapore (holotype K [K000950289]). **Fig. 78A–C.**

Timonius compressicaulis (Miq.) Boerl., Handl. Fl. Ned. Ind. 2(1) (1891) 133; Valetton, Bull. Dept. Agric. Indes Neerl. 26 (1909) 54; Corner, Gard. Bull. Straits Settle. 10 (1939) 54; Corner, Wayside Trees Malaya, ed. 3, 2 (1988) 655; Wong, Kew Bull. 43 (1988) 514; Wong, Arbor. Rubiac. Malaya (1988) 231; Wong, Tree Fl. Malaya 4 (1989) 417 (in clavi); Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 162; Turner, Gard. Bull. Singapore 45 (1993) 204; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 449; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241. **Basionym:** *Polyphragmon compressicaule* Miq., Fl. Ned. Ind. 2, fasc. 2 (1857) 235. **Type:** *Teijsmann s.n.*, [Indonesia], Sumatra, Ciboga (lectotype K [K000763579], first step designated by Wong, Kew Bull. 43 (1988) 514, second step designated here; isolectotype K [K000763578]).

Shrub to small tree to 7 m tall; bark smooth, grey-brown. **Leaves:** lamina elliptic to obovate, 4–18 × 2–8 cm, apex acute, base cuneate, subcoriaceous, glabrous except for scattered short hairs on the main veins below, secondary veins 6–8 pairs, tertiary veins reticulate; petiole 2–5 mm long (the leaves sessile). **Inflorescences** with 7 flowers (sometimes more) and peduncle 5–30 mm long in the male, with a solitary flower on a peduncle 8–30 mm long in the female. **Flowers** with hypanthium c. 2 mm across, scattered short-hairy, limb with 5–6 broadly triangular teeth each hardly 1 mm tall; corolla densely white short-hairy outside, glabrous inside, tube 2.5–3 mm wide, 6–8 mm long, lobes in male flowers 5, in female flowers 6–8, each 3–3.5 mm long. **Fruits** globose, longitudinally 10–14-lobed, 7–10 mm across, capped by the persistent calyx, glabrous; pyrenes many (20–60), ellipsoid, the walls separate from one another; seeds one in each pyrene, ellipsoid to cylindrical.

Distribution. Peninsular Malaysia and adjacent islands, Sumatra, Java and the Philippines. In Singapore known from Pulau Ubin (*Ali Ibrahim et al. AI 157*, 15 Nov 1993, SING [SING0030654]; *Chen & Ali Ibrahim SING2013-255*, 28 Sep 2013, SING [SING0203132]). Previously also collected from Serangoon.

Ecology. Sea-shores and strand forest, also on rocky cliffs.

Provisional conservation assessment. Globally not assessed. Listed as Critically Endangered (CR/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 87, 177, 213).

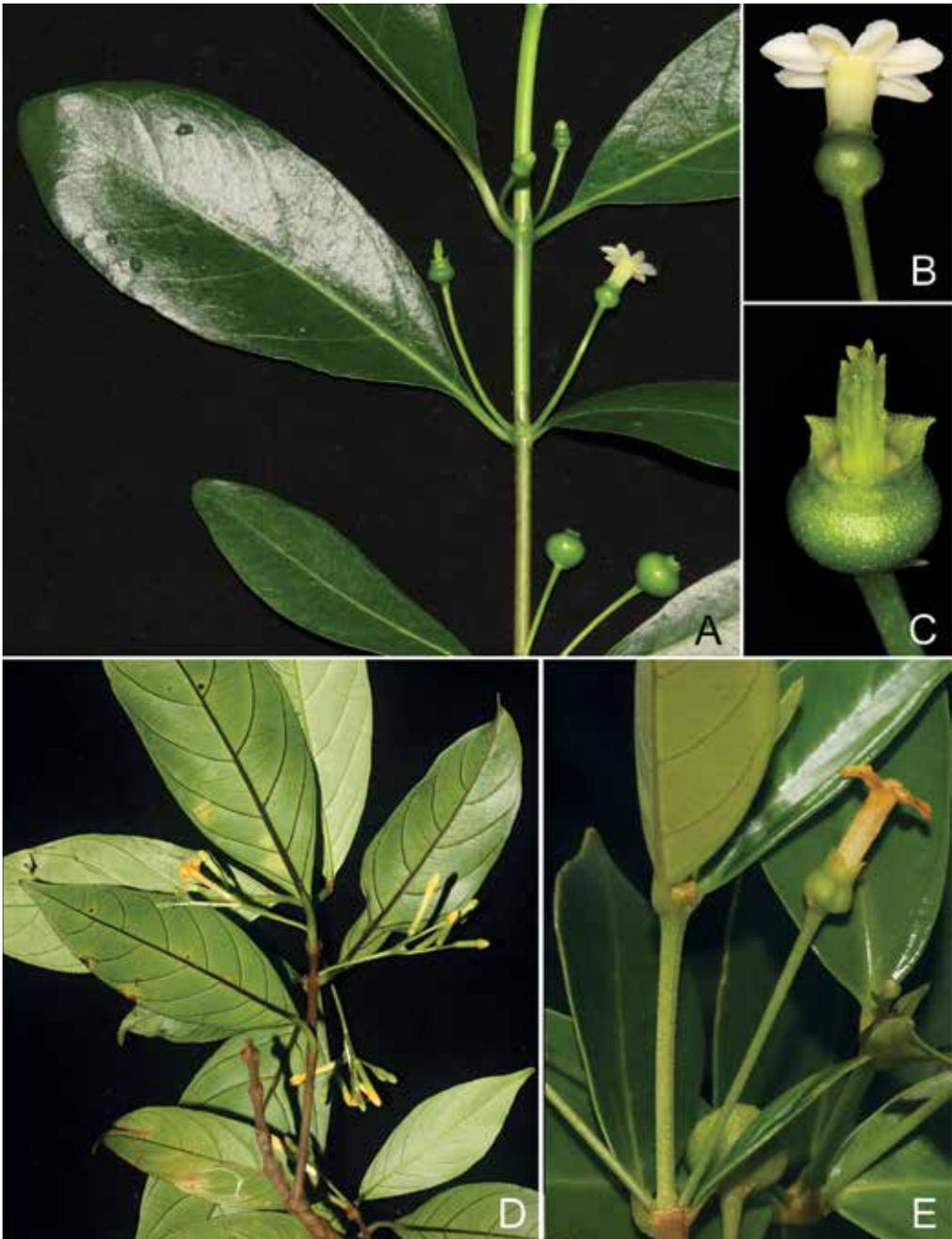


Figure 78. *Timonius finlaysonianus* (Wall. ex G.Don) Hook.f. **A.** Leafy branch with solitary female flowers. **B.** Female flower; note bulbous hypanthium. **C.** Young fruit with still intact stigma with multiple lobes. *Timonius flavescens* (Jack) Baker. **D.** Leafy branch with male inflorescences. **E.** Female flower. (From Singapore, A–C from Pulau Ubin; D, E from Nee Soon. Photos: A, R.C.J. Lim; B–E X.Y. Ng).

2. *Timonius flavescens* (Jack) Baker

(Latin, *flavescens* = yellowish; referring to the flowers)

Fl. Mauritius (1877) 144; Valetton, Bull. Dept. Agric. Indes Neerl. 26 (1909) 34; Corner, Gard. Bull. Straits Settle. 10 (1939) 54; Corner, Wayside Trees Malaya, ed. 3, 2 (1988) 655; Wong, Kew Bull. 43 (1988) 504; Wong, Arbor. Rubiac. Malaya (1988) 227; Wong, Tree Fl. Malaya 4 (1989) 418 (in clavi); Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 162; Turner, Gard. Bull. Singapore 45 (1993) 204; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 449; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 87, 177, 213. **Basionym:** *Helospora flavescens* Jack, Trans. Linn. Soc. London 14(1) (1823) 127, t. 4: fig. 3. **Type:** [Published illustration] Jack, Trans. Linn. Soc. London 14(1) (1823) 127, t. 4: fig. 3, lectotype designated here. **Epitype:** *Teijsmann HB3877*, [Indonesia], Sumatra, Palembang, Ogan Oeloe (epitype U [U1577430]), designated here). **Fig. 78D, E.**

Bohea sericantha f. *glabrior* Miq., Fl. Ned. Ind., Eerste Bijv., fasc. 3 (1861) 545. **Type:** *Teijsmann HB3877*, [Indonesia], Sumatra, Palembang, Ogan Oeloe (holotype U [U1577430]).

Timonius peduncularis Ridl., Fl. Malay Penins. 2 (1923) 113; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 2201. **Type:** *Wallich s.n.* [EIC 6222], Singapore, 1822 (lectotype K-W [K000763583], designated here).

Timonius jambosella auct. non Thwaites: Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 95; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 53.

Tree to about 12 m tall; bole crooked; bark smooth to lenticellate or scaly, grey-brown. **Leaves:** lamina elliptic, 6–20 × 2–7.5 cm, apex pointed, base cuneate, coriaceous, pale short-hairy on the midrib and veins below, secondary veins 4–8 pairs, tertiary veins faintly visible to obscure; petiole 3–15 mm long. **Inflorescences** with 5–7 (rarely 3 or 9) sessile to subsessile flowers and peduncles 5–35 mm long in the male, with a solitary flower (rarely 2–3 flowers) on a peduncle 5–60 mm long in the female. **Flowers** with hypanthium 2–4 mm across in the female, 1–2 mm across in the male, limb 4-dentate; corolla densely yellow hairy in the female, scantily to densely hairy in the male, tube 7–9 mm long in both sexes, 2–3 mm wide in the female, 1–1.5 mm wide in the male, lobes 4, about 3 mm long. **Fruits** globose, distinctly 4-lobed, 7–9 mm across, glabrescent.

Distribution. Seychelles, Sri Lanka, Andaman Islands, Peninsular Malaysia, Sumatra and Borneo. In Singapore recorded from Chan Chu Kang (*Ridley 6149*, 1894, SING [SING0030666]), Mandai Road (*Corner SFN 32524*, 20 Nov 1936, SING [SING0030661]), Nee Soon (*Gwee et al. SING2005-78*, 5 Apr 2005, SING [SING0060948]), Seletar (*Maxwell 82-15*, 24 Jan 1982, SING [SING0030671]), Bukit Timah (*Noor MN1164*, 12 May 1970, SING [SING0055370]), Kranji, Peirce, Teban and Tampines Road.

Ecology. Across its range in coastal and peat swamp forests or on peaty substrates on mountains, or in relatively open areas in the vicinity of such habitats.

Provisional conservation assessment. Globally not assessed. Listed as Critically Endangered (CR/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 87, 177, 213).

Taxonomy. In his protologue, Jack (Trans. Linn. Soc. London 14(1) (1823) 127) only mentioned Sumatra and no original herbarium material can be found but there is an illustration. The illustration, however, is insufficient for identification purposes. Baker merely formalised the combination in *Timonius*. Valetton recognised that *Teijsmann s.n.* [H.B. 3877] is the same species and, as this is from Sumatra, it is suitable for epitypification of Jack's species.

3. *Timonius wallichianus* Valetton

(Nathaniel Wallich, 1786–1854, Superintendent of the Calcutta Botanic Gardens)

Bull. Dept. Agric. Indes Neerl. 26 (1909) 35; Ridley, Fl. Malay Penins. 2 (1923) 116; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 2201; Corner, Wayside Trees Malaya, ed. 3, 2 (1988) 655; Wong, Kew Bull. 43 (1988) 507; Wong, Arbor. Rubiac. Malaya (1988) 229; Wong, Tree Fl. Malaya 4 (1989) 417 (in clavi); Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 162, fig. 125.13; Turner, Gard. Bull. Singapore 45 (1993) 205; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 449; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 87, 177, 231. **Synonym:** *Bobea wallichiana* Korth., Ned. Kruidk. Arch. 2(4) (1851) 211, nom. nud. **Type:** *Wallich s.n.* [EIC 6217], Singapore, 1822 (lectotype K-W [K001123325], designated here; isoelectotypes BR [BR0000005754595], K-W [K001123326], PH [PH00023297]). **Fig. 79.**

Timonius rumphii auct. non DC.: Hooker, Fl. Brit. India 3, fasc. 7 (1880) 127; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 95; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 55.

Tree to 7 m tall; bole straight to crooked, sometimes fluted; bark smooth to cracking-scaly, grey-brown. **Leaves:** lamina elliptic to obovate, 8–20 × 3–7 cm, apex pointed, base cuneate, subcoriaceous, undersurfaces completely covered by dense silvery appressed hairs, secondary veins 9–14 pairs, tertiary veins not visible; petiole 5–15 mm long. **Inflorescences** with many sessile flowers and peduncle 5–15 mm long in the male, with (1–)3–5 sessile flowers and peduncle 5–20 mm long in the female; hypanthium 1.5–2 mm across, yellow short-hairy outside, limb 4-dentate; corolla yellow short-hairy, tube 1.5–3 mm wide, 7–9 mm long, lobes 4, 2.5 mm long. **Fruits** globose to ellipsoid, rarely obovoid, 4-lobed, 4–8 mm across, evenly grey short-hairy.

Distribution. Peninsular Malaysia, Sumatra, Bangka and the Riau Archipelago (including the Anambas Islands). In Singapore recorded from Mandai (*Yeo et al. SING2012-146*, 23 Apr 2012, SING [SING0182087]), Peirce (*Mhd Shah & Sidek MS 4093*, 26 Mar 1981, SING [SING0030674]), MacRitchie (*Samsuri SA 1333*, 16 Dec 1976, SING [SING0030684, SING0030685]), Bukit Timah (*Noor MN 1169*, 12 May 1970, SING [SING0055405]) and Pulau Ubin (*Gwee et al. GAT 389*, 7 Oct 2003, SING [SING0047736]). Also from Chan Chu Kang, Nee Soon, Seletar and Changi.

Ecology. Across its range in secondary forest in lowlands up to about 500 m.

Provisional conservation assessment. Globally not assessed. Listed as Least Concern (LC) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 87, 177, 231).

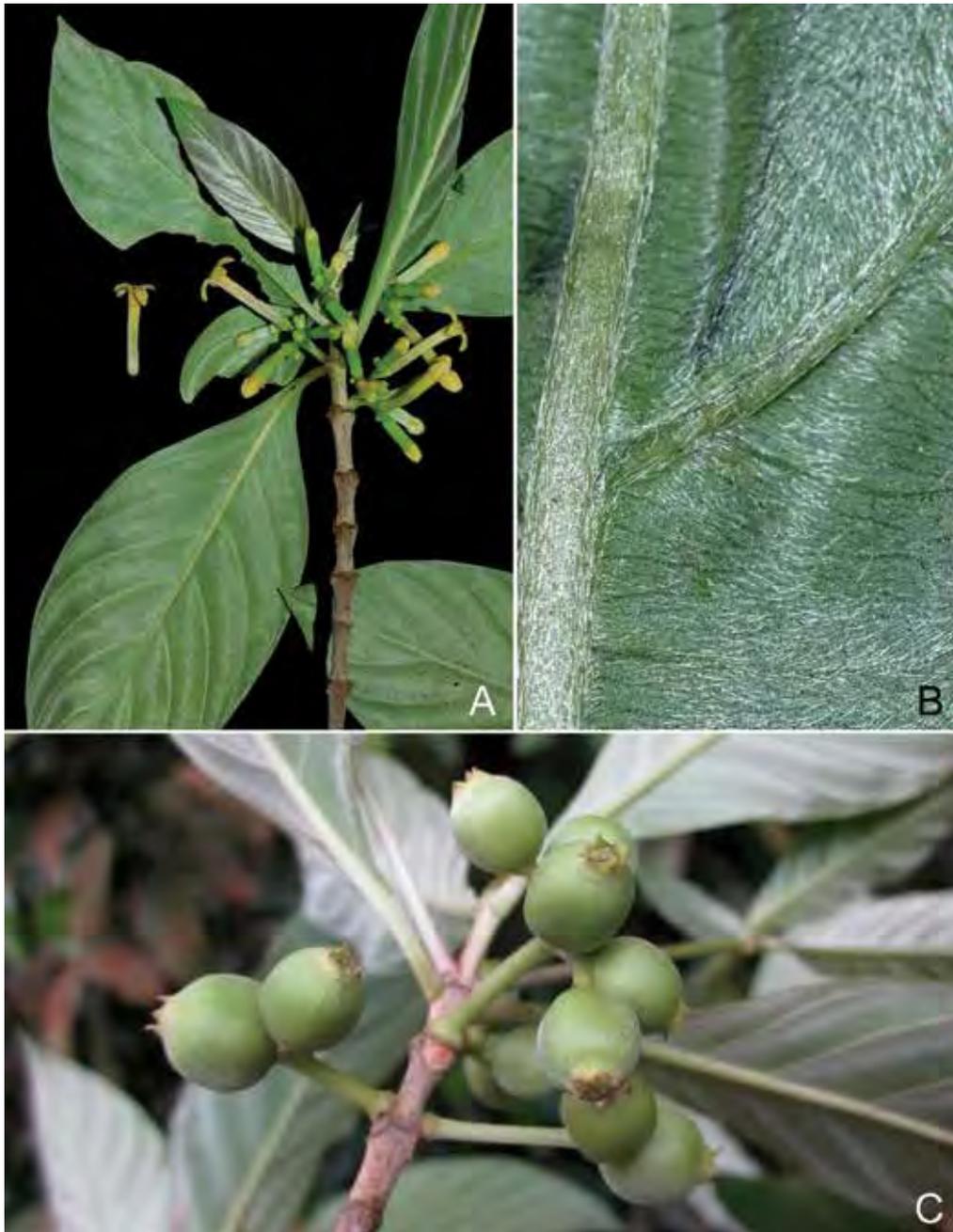


Figure 79. *Timonius wallichianus* Valetton. **A.** Leafy branch with male inflorescences. **B.** Close-up of silvery-hairy lower leaf surface. **C.** Fruits. (From Singapore, A from Nee Soon, *Chen SING2017-778*; B from Nee Soon; C from Nee Soon, *Yeo et al. SING2012-146*. Photos: A, L.M.J. Chen; B, L. Neo; C, C.K. Yeo).

4. *Timonius wrayi* King & Gamble

(Leonard Wray, Jr., 1853–1942, Curator of the Perak Museum 1883–1908)

J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73(3) (1904) 54; Ridley, Fl. Malay Penins. 2 (1923) 115; Wong, Kew Bull. 43 (1988) 512; Wong, Arbor. Rubiac. Malaya (1988) 231; Wong, Tree Fl. Malaya 4 (1989) 419; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 162; Turner, Gard. Bull. Singapore 45 (1993) 205; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 449; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 87, 177, 199. **Type:** *King’s Collector 5168*, [Malaysia], Perak, Larut, November 1883 (lectotype SING [SING0058024], first step designated by Wong, Kew Bull. 43 (1988) 512, second step designated here; isolectotypes SING [SING0058025, SING0058059]).

Tree to about 15 m tall, with a dense conical crown; bole straight, to about 30 cm girth; bark smooth to cracking, grey-brown. **Leaves:** lamina elliptic, 7–25 × 3–11 cm, apex pointed, base cuneate, coriaceous, glabrous except for slight hairiness on the veins below, secondary veins 7–9 pairs, tertiary veins distinct and reticulate; petiole 15–30 mm long. **Inflorescences** with 3–7 flowers and peduncle 3–5 mm long in the male, with a solitary flower on a peduncle 3–5 mm long in the female; hypanthium 2–3 mm across, densely brown hairy, limb with 4 large ovate lobes each 5–8 mm long; corolla densely white-hairy outside, glabrous inside, tube 2–3 mm wide, 6–8 mm long, lobes 4, valvate, each 3–4.5 mm long. **Fruits** globose to ellipsoid, hardly lobed, 10–18 mm across, covered by brown-velvety hairs; pyrenes many in each fruit, with distinctly separate walls but immersed in a hard matrix; seeds one in each pyrene, pendulous, ellipsoid.

Distribution. Endemic to the Malay Peninsula. In Singapore recorded from Sungei Loyang (*Ridley 6699*, 1894, SING [SING0012178]) and Changi (*Ridley s.n.*, 1894, SING [SING0012177]).

Ecology. Across its range in lowland and hill forest to about 650 m.

Provisional conservation assessment. Globally not assessed. In Singapore presumed Nationally Extinct.

51. *UNCARIA* Schreb.

(Latin, *uncus* = hook; referring to the paired hooks in the leaf axils that help the plant climb)

Akar kait-kait, akar kekait, gambir-gambir, gegambir (Malay)

Gen. Pl. 1 (1789) 125, nom. cons.; Haviland, J. Linn. Soc., Bot. 33 (1897) 73; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’]) 127; Ridley, Fl. Malay Penins. 2 (1923) 10; Backer & Bakhuizen van den Brink, Fl. Java (Spermatoph.) 2 (1965) 299; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 2236; Ridsdale, Blumea 24(1) (1978) 68; Puff et al., Rubiac. Thailand (2005) 150; Turner, Webbia 73 (2018) 9; Turner, Gard. Bull. Singapore 70 (2018) 9. **Synonyms:** *Ourouparia* Aubl., Hist. Pl. Guiane 1 (1775) 177, nom. rej. – *Agylophora* Neck. ex Raf., Ann. Gén. Sci. Phys. 6 (1820) 82, nom. illeg. superfl. – *Peckeya* Neck. ex Raf., Ann. Gén. Sci. Phys. 6 (1820) 88, nom. illeg. superfl. – *Uruparia* Raf., Sylva Tellur. (1838) 148, nom. illeg. superfl. **Type:** *Uncaria guianensis* (Aubl.) J.F.Gmel.

Restiaria Lour., Fl. Cochinch. 2 (1790) 639. **Type:** *Restiaria cordata* Lour. (= *Uncaria cordata* (Lour.) Merr.).

Woody climbers with a main orthotropic axis and a series of plagiotropic side branches. **Twigs** and branchlets often quadrangular in cross section, with paired hooks at the nodes. **Stipules** entire or bifid. **Leaves** opposite, entire, often with domatia in the axils of the secondary veins. **Inflorescences** many-flowered, spherical, generally pedunculate and solitary, borne on the modified hooks, more rarely terminal or on branched compound thyrses (not in Singapore species). **Flowers** 5-merous, glabrous or tomentose, sessile or pedicellate, interfloral bracts present or not (absent in Singapore species); calyx tubular to infundibuliform, lobed; corolla long tubular, lobes valvate in bud; stamens inserted near mouth of corolla, opposite lobes, filaments short and glabrous, anthers generally visible between corolla lobes at anthesis; ovary 2-locular, ovules many, basally attached, ascendingly imbricate; style exerted, stigma globose to clavate, sometimes papillate. **Fruits** fusiform capsules with persistent calyx, sessile or more commonly pedicellate, splitting septicidally, longitudinally, initially from apex to base. **Seeds** many, tiny, often minutely sculpted, with ribbed hyaline wings at each end, lower divided and often reduced to a pair of filaments.

Distribution. A total of 36 species distributed throughout the tropics but with most of the diversity (31 species) in the Asia-Pacific region. In Singapore 11 species, 10 of which are native and 1 naturalised.

Ecology. Large climbers of forests and forest margins climbing by grappling of the hooks on the plagiotropic branches on the surrounding vegetation. Evidence of thigmotropic growth in hooks in response to the presence of the branches of mechanical host plants can sometimes be seen on specimens. The species seem relatively tolerant of forest disturbance and can be seen in secondary forest and sprawled over low vegetation. The tiny wind-dispersed seeds may facilitate colonisation of such sites.

Uses. *Uncaria* species are widely used in traditional medicine (Subarnas, PROSEA 12(2) (2001) 568–575; Leon & Lin, Chin. Med. Pl., Herb. Drugs Subs. (2017) 440; Heitzman et al., Phytochemistry 66 (2005) 5–29) due to their astringency. This reflects an abundance and diversity of secondary chemicals including alkaloids and tannins (Phillipson et al., Lloydia 41 (1978) 503–570; Heitzman et al., Phytochemistry 66 (2005) 5–29). Particular attention in terms of phytochemistry and pharmacology has been given to *Uncaria rhynchophylla* (Miq.) Miq. the source of the Chinese traditional medicine *gou teng* (钩藤) ('*Uncariae Ramulus cum Uncis*') (Leon & Lin, Chin. Med. Pl., Herb. Drugs Subs. (2017) 440) and the South American *U. guianensis* and *U. tomentosa* (Willd. ex Schult.) DC. See also notes under *Uncaria gambir* below.

Notes. The morphological nature of the hooks in *Uncaria* remains contentious. Ridsdale (Blumea 24(1) (1978) 43–100) considered them highly modified lateral branches on the plagiotropic shoots that often bear the inflorescences. Puff & Chamchumroon (Thai Forest Bull., Bot. 31 (2003) 65–74) argued that the hooks represent modified inflorescence peduncles. As users of this Flora are more likely to refer to Ridsdale's revision, the term 'lateral shoot (hook)' is used to refer to this structure and 'peduncle' is restricted to the inflorescence-bearing stalk arising from the hook.

Key to *Uncaria* species

1. Upper surface of lamina with curved hairs giving leaf a rough feel; flower heads with peduncle hidden by flowers, flowering head 6 mm across to top of calyces, capsules sessile **11. *U. roxburghiana***
Upper surface of lamina glabrous, not feeling rough; flower heads distinctly pedunculate, flowering head more than 6 mm across to top of calyces, capsules distinctly pedicellate 2
2. Leaves distinctly hairy below 3
Leaves appearing glabrous below (with possible exception of tufts in the axils of the secondary veins) 7
3. Leaves with curly woolly hairs below, at least along main nerves 4
Leaves with straight or curved but not woolly hairs 5
4. Leaves with a conspicuous marginal nerve **3. *U. borneensis***
Leaves lacking a conspicuous marginal nerve **2. *U. attenuata***
5. Leaves with long straight hairs on nerves below, petioles 4–6 mm long **9. *U. lanosa***
Leaves not with long straight hairs on nerves below, petioles 10 mm or more long 6
6. Leaves with a fringe of erect hairs to the sides of the nerves below, secondary veins 3–5 pairs; flower (or fruit) heads on stalks shorter than petioles **7. *U. elliptica***
Leaves not with a fringe of erect hairs to the side of nerves below, secondary veins 8–10 pairs; flower (or fruit) heads on stalks longer than petioles **6. *U. cordata***
7. Lower lamina of leaf with a whitish or silvery look due to tiny white adpressed hairs in random directions on nerves and lamina surface **5. *U. canescens***
Lower lamina of leaf not with a whitish or silvery look 8
8. Leaves at least 7 cm wide, petiole distinctly winged **10. *U. longiflora***
Leaves generally less than 7 cm wide, petiole not distinctly winged 9
9. Tertiary venation of leaves obscure; calyx infundibuliform **8. *U. gambir***
Tertiary venation of leaves distinct; calyx not notably infundibuliform 10
10. Tertiary venation of leaves laxly reticulate, nerves with tiny adpressed white hairs; stipules bifid; flowering heads to 11 mm across to top of calyces and 25 mm across to top of corollas **1. *U. acida***
Tertiary venation of leaves densely reticulate, nerves not bearing tiny adpressed white hairs; stipules entire; flower heads at least 12 mm across to top of calyces and 30 mm across to top of corollas **4. *U. callophylla***

1. *Uncaria acida* (W.Hunter) Roxb.

(Latin, *acidus* = sour, acid; referring to the acid taste of the leaves)

Fl. Ind. 2 (1824) 129; Haviland, J. Linn. Soc., Bot. 33 (1897) 79; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 2237; Ridsdale, Blumea 24(1) (1978) 80; Turner, Gard. Bull. Singapore 45 (1993) 205; Turner, Gard. Bull. Singapore 47 (1997 [1995?]) 450; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 88, 177, 199; Turner, Webbia 73 (2018) 10; Turner, Gard. Bull. Singapore 70 (2018) 11. **Basionym:** *Nauclea acida* W.Hunter, Trans. Linn. Soc. London 9 (1808) 223. **Synonyms:** *Ourouparia acida* (W.Hunter) Baill., Hist. Pl. 7 (1880) 375. – *Uruparia acida* (W.Hunter) Kuntze, Revis. Gen. Pl. 1 (1891) 301. **Type:** *Hunter s.n.*, [Malaysia], Prince of Wales Island [Penang], 1806 (lectotype LINN [Herb. Smith 317.3], designated by Ridsdale, Blumea 24(1) (1978) 81).

Climber. **Twigs** markedly quadrangular to more or less terete, drying from pale brown to black, often very finely longitudinally wrinkled, generally appearing glabrous but adpressed hairs may be found around nodes and very sparsely in between. **Stipules** bifid. **Leaves:** lamina ovate or elliptic, (4–)5–9 × (1.5–)3–7 cm, base acute to truncate or subcordate, apex shortly acuminate, chartaceous to subcoriaceous, drying middle to dark brown, generally darker and more shiny above, midrib and laterals flush above, though sometimes base of midrib above dries with a central raised ridge, midrib prominent below and secondary veins slightly raised, all nerves with tiny adpressed pale hairs, secondary veins 4–5 pairs, arching forward and looping within margin, domatia, often without hairs, sometimes found in axils of secondary veins and also at bifurcations, lax reticulations of tertiary venation distinct; petiole to 4–15 mm long, 1 mm diam., drying dark brown, with pale adpressed hairs, lamina margins extending as round-topped ridges down adaxial face of petiole, occasionally with a raised central ridge. **Inflorescences** solitary and lateral, monstrous forms are regularly collected with shoots with congested small leaves and very irregular floral morphology; lateral shoot (hook) 2–15 mm long (inflorescence often arising from a hooked lateral shoot), peduncle 6–15 mm long, 0.5–0.7 mm thick, densely pale brown hairy, flowering head 10–11 mm across to top of calyces, 20–25 mm to top of corollas. **Flowers** pedicellate; pedicel 1–1.5 mm long, c. 0.5 mm thick, densely pale hairy; hypanthium c. 1 mm long, 1 mm wide, densely pale or brown hairy; calyx tube 0.5–1 mm long, c. 0.5 mm wide, densely pale or brown hairy outside, calyx lobes oblong-ovate, lingulate to spatulate, 0.8 mm long, 0.4–0.8 mm wide, not notably thickened, often spreading, short brown hairy outside, more or less glabrous within; corolla tube 7–8 mm long, c. 0.25 mm wide at base, 1–1.5 mm wide at mouth, short pale hairy outside, corolla lobes oblong-ovate, 1–1.5 mm long, 0.5–0.7 mm wide, short brown or pale hairy outside, inside with very fine pale cobwebbing, plus a few long pale hairs near base centrally; style exerted to 6 mm beyond corolla mouth. **Fruiting heads** to 3–4 cm across, receptacle c. 2 mm diam., pedicels 3–7 mm long, 0.5 mm wide, ascending brown or pale hairs, capsules 9–12 mm long, 1.5–2 mm wide, brown hairy. **Seed** c. 0.5 mm diam., upper wing c. 2 mm long, lower wings c. 1.5 mm long, not filamentous.

Distribution. Continental Southeast Asia to New Guinea. In Singapore there are recent collections from Nee Soon (*Lua SING2011-265*, 10 Aug 2011, SING [SING0165288]), Pasir Laba Camp (*Gwee et al. SING2007-466*, 14 Aug 2007, SING [SING0093692]) and Neo Tiew Lane 3 (*Hassan et al. SING2010-819*, 12 Aug 2010, SING [SING0146721]; *Lua et al. SING2013-175*, 25 Jul 2013, SING [SING0201437]). There are historic records from Pulau Ubin (*Ridley 5671*, SING [SING0030716]).

Ecology. Lowland forest and forest margins.

Provisional conservation assessment. Globally not assessed. Erroneously listed as Nationally Extinct in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 88, 177, 199), presumably because the 2007 collection from Pasir Laba Camp was not included in their assessments. With several collections since then, *Uncaria acida* is assessed here as Endangered (EN/D) in Singapore.

Taxonomy. Two Singapore collections (*Kiah SFN 37146*, Mandai Road, 26 Jul 1940, SING [SING0230756]; *Hullett s.n.*, 1883, SING) seem to represent a form of *Uncaria acida* with thicker leaves. The Singapore specimens are fruiting, but similar specimens from Sarawak in flower have more or less sessile flowers but without the abundant hairs in the mouth of the corolla that characterises *Uncaria acida* (W.Hunter) Roxb. var. *papuana* Valeton, which seems to be a montane taxon in Peninsular Malaysia and Borneo.

2. *Uncaria attenuata* Korth.

(Latin, *attenuatus* = impaired, weak, meagre, reduced in thickness, or become slender; unclear to what this refers)

Verh. Nat. Gesch. Ned. Bezitt., Bot. (1842) 170; Haviland, J. Linn. Soc., Bot. 33 (1897) 83; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’]) 136; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 91; Ridley, Fl. Malay Penins. 2 (1923) 16; Ridsdale, Blumea 24(1) (1978) 79; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 162; Turner, Gard. Bull. Singapore 45 (1993) 205; Tan et al., Gard. Bull. Singapore, Suppl. 3 (1995) 49; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 450; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 88, 177, 199; Turner & Chua, Checkl. Vasc. Pl. Sp. Bukit Timah Nat. Res. (2011) 72; Turner, Webbia 73 (2018) 11. **Synonyms:** *Nauclea attenuata* (Korth.) Walp., Repert. Bot. Syst. 2 (1843) 513. – *Uruparia attenuata* (Korth.) Kuntze, Revis. Gen. Pl. 1 (1891) 301. **Type:** *Korthals s.n.*, [Indonesia], Sumatra, Salaut (lectotype L [L0001488], designated by Ridsdale, Blumea 24(1) (1978) 79).

Uncaria bulusanensis Elmer, Leafl. Philipp. Bot. 9 (1934) 3271. **Type:** *Elmer 14917*, Philippines, Luzon, Province of Sorsogon, Irosin, Mt Bulusan, November 1915 (lectotype L [L001496], designated by Ridsdale, Blumea 24(1) (1978) 79; isolectotypes A, BM, BRIT, CAL, CAS, G, GH, HBG, MICH, MO, NY, U, US).

Climber. **Twigs** generally markedly quadrangular, often drying with longitudinally grooved faces, covered with a dense, short brown pubescence. **Stipules** entire (rarely present on herbarium specimens). **Leaves:** lamina ovate-elliptic to obovate-elliptic 10–14 × 6–8.5 cm, base obtuse or more rarely truncate, apex shortly to very shortly acuminate, chartaceous, typically drying dark brown to black above, brown with darker veins below, often with a silvery wash, midrib and secondary veins flush to slightly sunken above in dry leaves, prominent below, more or less glabrous above except sometimes for very short pale hairs at the base of the midrib, below pubescent with a mix of long and short and straight and curved or crisped hairs on nerves and scattered on lamina, a red-brown woolliness along the nerves is typical,

secondary veins 6–7 pairs, arching forward and looping obscurely within the margin, domatia with dense tuft of red-brown hairs often present in axils of secondary veins, tertiary venation predominantly scalariform; petiole 8–16 mm long, 2 mm wide, with short pale or brown hairs, lamina margins extending as slight ridges down the side of the petiole edging a rather flat face on the adaxial side. **Inflorescences** solitary and lateral, lateral shoot (hook) 7–11 mm long, peduncle 12–15 mm long, 1 mm wide, densely short brown hairy, flowering head 13–14 mm across to top of calyces, 29–32 mm to top of corollas; pedicel 1.5–2 mm long, densely brown hairy; hypanthium c. 1 mm long, 1 mm wide, densely brown hairy; calyx tube infundibuliform, 1.5–2 mm long, c. 1 mm wide at base, 1.5 mm wide at mouth, densely brown hairy outside, calyx lobes ovate, c. 0.5 mm long, 0.5 mm wide, apex acute, incurved, outside brown hairy, inside pale hairs near apex otherwise glabrous; corolla tube 8–9 mm long, c. 0.5 mm wide at base, 2 mm wide at mouth, densely short pale hairy, corolla lobes lingulate to spatulate, 1.5–2 mm long, 1–1.5 mm wide, densely pale or brown hairy outside, more or less glabrous within except for some long hairs centrally near base; style exserted to 6 mm. **Fruiting heads** to 4 cm across, pedicel 4–8 mm long, c. 0.5 mm wide, densely pale brown hairy, fruit fusiform, 7–15 mm long, 2 mm wide, brown or pale hairy. **Seeds** c. 0.5 mm diam., wings 2.5 mm long, lower pair filamentous.

Distribution. Peninsular Malaysia, Sumatra, Java, Borneo and the Philippines. In Singapore only known from a roadside locality near Bukit Timah (*Ridley s.n.*, 8 Jan 1889, SING [SING0012179]), Sungei Jurong (*Ridley s.n.*, 9 Jan 1890, BM) and an unspecified locality (*Cantley 2954*, SING [SING0030690]).

Ecology. Forests and forest edges.

Provisional conservation assessment. Globally not assessed. In Singapore presumed Nationally Extinct.

Notes. *Cantley 2954* has a terminal inflorescence.

3. *Uncaria borneensis* Havil.

(of Borneo)

J. Linn. Soc., Bot. 33 (1897) 84; Ridsdale, *Blumea* 24(1) (1978) 79; Turner, *Gard. Bull. Singapore* 47 (1997 [‘1995’]) 450; Turner, *Webbia* 73 (2018) 9; Turner, *Gard. Bull. Singapore* 70 (2018) 10. **Type:** *Creagh s.n.*, [Malaysia], Borneo, [Sabah], Sandakan, April 1895 (lectotype K [K000730000], designated by Turner, *Webbia* 73 (2018) 12).

Uncaria ferruginea (Blume) DC. var. *mollis* Miq., *Fl. Ned. Ind.*, *Eerste Bijv.*, fasc. 3 (1861) 539. **Type:** *Teijsmann s.n.*, [Indonesia], Sumatra, West Sumatra, Solak (lectotype U, designated by Ridsdale, *Blumea* 24(1) (1978) 79).

Climber. **Twigs** quadrangular, brown velutinous. **Stipules** entire. **Leaves:** lamina elliptic to broadly ovate, 7–14 × 5–11 cm, base obtuse, truncate or subcordate, apex obtuse to shortly and broadly acuminate, chartaceous to stiff, drying brown, grey-brown or dark brown above,

brown or pale brown below with nerves a darker redder brown, midrib and main nerves flush above, prominent below, with nerves raised well above lower lamina surface often giving a tiered appearance, above with dense curly brown hairs on main nerves, below with all nerves and margin densely red-brown woolly, lamina surface often appearing whitish under magnification due to very short pale hairs, papillae or cobwebbing, secondary veins 6–7 pairs, arching forward and running into marginal nerve, domatia absent, tertiary venation distinct and dense scalariform; petiole 10–19 mm long, 1–2 mm wide, more or less terete without any clear ridges, densely brown hairy. **Inflorescences** solitary and lateral, lateral shoot (hook) 18–25 mm long, peduncle 8–10 mm long, 2 mm wide, densely brown hairy, flowering heads very dense, 15–17 mm across to top of calyces, 32–36 mm across to top of corollas. **Flowers** subsessile; pedicels to c. 1 mm long, densely golden brown hairy; hypanthium c. 1 mm long, 1 mm wide, densely golden brown hairy; calyx tube 1.5–2 mm long, c. 1.5 mm wide, densely brown hairy outside, calyx lobes ovate triangular, c. 1 mm long, 1 mm wide, apex tending to curl in, densely brown hairy outside, long straight brown hairs inside; corolla tube 9–12 mm long, c. 0.5 mm wide at base, 2 mm wide at mouth, densely covered in pale hairs, corolla lobes lingulate to obovate, c. 1.5 mm long, 1 mm wide, apex broadly rounded to truncate, densely covered with long silky pale golden brown hairs outside, more or less glabrous within; style exerted to 7 mm from mouth of corolla. **Fruiting heads** to 7 cm across, pedicel 8–20 mm long, 0.5 mm wide, densely golden brown hairy, capsules 8–10 mm long, 3 mm wide, densely golden brown hairy, longitudinally ribbed but generally hidden by tomentum. **Seeds** c. 0.3 mm diam., wings c. 1.5 mm long, lower pair filamentous.

Distribution. Thailand, Peninsular Malaysia, Sumatra and Borneo. In Singapore recently collected from Nee Soon (*Lim SING2013-048*, 23 Mar 2013, SING [SING0194950]). Historical records include Mandai Road (*Ridley s.n.*, 1893, SING) and Seletar (*Mhd Shah & Sidek MS 4070*, 5 Mar 1981, SING [SING0030702]).

Ecology. Forest and forest margins.

Provisional conservation assessment. Globally not assessed. The presence of this species in Singapore was only recently recognised and it is assessed here as Critically Endangered (CR/D).

4. *Uncaria callophylla* Blume ex Korth.

(Greek, *callo-* = beautiful, *-phylla* = leaves; with beautiful leaves)

Verh. Nat. Gesch. Ned. Bezitt., Bot. (1842) 170; Haviland, J. Linn. Soc., Bot. 33 (1897) 80, as '*callophylla*'; Ridsdale, *Blumea* 24(1) (1978) 85; Turner, *Gard. Bull. Singapore* 45 (1993) 205; Tan et al., *Gard. Bull. Singapore, Suppl.* 3 (1995) 49, as '*callophylla*'; Turner, *Gard. Bull. Singapore* 47 (1997 ['1995']) 450; Tan et al. in Davison et al. (ed.), *Singapore Red Data Book*, ed. 2 (2008) 241; Chong et al., *Checkl. Vasc. Pl. Fl. Singapore* (2009) 88, 177, 199; Turner, *Webbia* 73 (2018) 12; Turner, *Gard. Bull. Singapore* 70 (2018) 11. **Synonyms:** *Nauclea callophylla* (Blume ex Korth.) Walp., *Repert. Bot. Syst.* 2 (1843) 513. – *Uruparia callophylla* (Blume ex Korth.) Kuntze, *Revis. Gen. Pl.* 1 (1891) 301. **Type:** *Korthals s.n.*, [Indonesia], Borneo, [Kalimantan], Martapoera [Martapura] (lectotype L [L0001499], designated by Turner, *Webbia* 73 (2018) 12).

Uncaria jasminiflora Wall. ex Hook.f., Fl. Brit. India 3, fasc. 7 (1880) 32; Haviland, J. Linn. Soc., Bot. 33 (1897) 80; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’]) 133; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 91; Ridley, Fl. Malay Penins. 2 (1923) 15; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 2244; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 162. **Synonym:** *Uruparia jasminiflora* (Wall. ex Hook.f.) Kuntze, Revis. Gen. Pl. 1 (1891) 301. **Type:** *Maingay 1428* [Kew Distribution 832], [Malaysia], Malacca, 26 September 1865–1866 (lectotype K [K001129425], designated by Turner, Webbia 73 (2018) 12).

Uncaria jasminiflora Wall. ex Hook.f. var. *macrophylla* King, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’]) 133. **Type:** *Anderson 87*, Singapore, October 1861 (lectotype K [K000729953], designated by Turner, Webbia 73 (2018) 12; isolectotypes BM, P).

Uncaria wrayi King, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’]) 132. **Type:** *Wray 2383*, [Malaysia], Perak, Taiping, July 1888 (lectotype SING [SING0053114], first step designated by Ridsdale, Blumea 24(1) (1978) 85, second step designated by Turner, Webbia 73 (2018) 12; isolectotype SING [SING0053115]).

Uncaria forbesii Wernham, J. Bot. 56 (1918) 68. **Type:** *Forbes 906*, [Papua New Guinea], New Guinea, Mt Meroka, 2500 ft [762 m], April 1886 (holotype BM [BM000945029]; isotype MEL [MEL588871]).

Uncaria avenia Valetton, Bot. Jahrb. Syst. 60 (1925) 59. **Type:** *Ledermann 6702*, [Papua New Guinea], Kaiserin Augusta Fluss, Hauptlager Malu, 20 March 1912 (not traced).

Uncaria luzoniensis Merr., Philipp. J. Sci. 27 (1925) 57. **Type:** *Loher 14457*, Philippines, Luzon, Province of Rizal, Mabiluang, October 1913 (lectotype M [M-0189476], designated by Turner, Webbia 73 (2018) 12; isolectotype L (fragment)).

Uncaria ovalifolia auct. non Roxb.: Ridley, Fl. Malay Penins. 2 (1923) 14.

Climber. **Twigs** quadrangular, generally drying with at least one pair of faces with central depressed grooves and rounded corners, brown with sparse to dense pale or brown short adpressed hairs, branchlets drying darker, generally with many small pale lenticels. **Stipules** entire. **Leaves:** lamina ovate or elliptic, 5–9 × 2.5–4.5 cm base cuneate, generally obtuse, apex characteristically acuminate having a narrow acumen with a rounded end, chartaceous, drying green, olive-green or light brown (dark brown in old specimens), midrib and secondary veins more or less flush on upper surface except midrib near base where it becomes raised with one or a few distinct longitudinal, sharp-edged wrinkles, midrib and laterals raised below, mature leaves on reproductive shoots appearing more or less glabrous except sometimes for hairs in axils of secondary veins below, but scattered short pale hairs may be found along abaxial nerves under magnification and leaves on juvenile foliage can be conspicuously pale hairy on venation, secondary veins 5–7 pairs, arching forward and looping obscurely close to margin, domatia present in axils of secondary veins, sometimes with a tuft of pale hairs obscuring the small pit in the axil, reticulations generally distinct from below and rather dense; petiole 7–15 mm long, 1 mm diam., lamina margin decurrent to petiole, which with the extension of the raised base of the midrib form a distinctive set of three parallel ridges running along the adaxial face of the petiole to its base. **Inflorescences** solitary and lateral, lateral shoot (hook) 15–20 mm long, peduncle 10–16 mm long, c. 1 mm thick, with short brown hairs, flowering head to 12–14 mm across at top of calyces, 30–35 mm to top of corollas. **Flowers** pedicellate; pedicel 1–3 mm long, c. 0.5 mm thick, densely pale brown hairy; hypanthium 1–2 mm long, densely

brown hairy; calyx tube c. 1 mm long, 2 mm wide at top, short brown hairy outside, calyx lobes ovate 1–1.5 × 1 mm, not noticeably thickened, densely, very short hairy outside, more or less glabrous within except for very short hairs near apex; corolla tube 7–10 mm long, c. 0.5 mm wide at base, c. 1.5 mm wide below corolla lobes, long white decumbent hairs outside, corolla lobes broadly obovate to spatulate, c. 1.5 mm long, 1 mm wide, apex truncate, densely pale brown or white hairy outside, glabrous within except for some long pale hairs on a central line near base, some specimens have perianth lobes with small pale or yellowish pustules; anthers c. 1.5 mm long; style exerted to 6 mm beyond mouth of corolla. **Fruiting heads** c. 4.5 cm across, pedicels 7–11 mm long, c. 0.5 mm wide, drying brown, sparsely hairy, capsules 11–16 mm long, 2–3 mm wide, faintly longitudinally ribbed, with sparse short hairs. **Seeds** c. 0.5 mm diam., wings to 2 mm long, lower pair filamentous.

Distribution. Throughout Malesia. In Singapore this appears to be the commonest of the small-leaved species of *Uncaria* with multiple recent collections, though these are mostly sterile. Fertile collections include those from Upper Seletar (*Lua & Hassan SING2012-062*, 7 Mar 2012, SING [SING0174260]), Upper Peirce (*Lai LJ367*, 1998, SING [SING0019866]), Admiralty Park (*Lua et al. SING2012-122*, 16 Apr 2012, SING [SING0173592]), Pasir Laba Camp (*Gwee et al. SING2007-465*, 14 Aug 2007, SING [SING0093691]) and the Western Catchment (*Leong et al. SING2016-048*, 16 Feb 2016, SING [SING0236439]).

Ecology. Forest and forest margins, including secondary forest.

Provisional conservation assessment. Globally Least Concern (LC). Erroneously listed as Nationally Extinct in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 88, 177, 199), presumably because the 2007 collection from Pasir Laba Camp was not included in their assessments. With multiple collections since then, *Uncaria callophylla* is assessed here as Vulnerable (VU/D) in Singapore.

Notes. In the Malay Peninsula, the species is represented by two forms which equate to the names *Uncaria callophylla* and *U. jasminiflora*. In true *Uncaria callophylla*, the leaves have the secondary veins decurrent to the midrib, often with slit-like domatia in the axil, the calyx lobes are generally 2–2.5 mm long, and appear square-ended as the tip folds in at 90°. In *Uncaria jasminiflora*, the secondary veins are not notably decurrent to the midrib, and the domatia are not slit-like, the calyx lobes are generally under 1.5 mm long, and are not square-ended. This distinction is not sufficient to consider them separate species, and when the material from Borneo is examined the differences seem to break down altogether. Although these forms are not formally recognised here, both are present in Singapore.

5. *Uncaria canescens* Korth.

(Latin, *canescens* = to become white or grey, greyish;
referring to the undersides of the leaves)

Verh. Nat. Gesch. Ned. Bezitt., Bot. (1842) 172; Haviland, J. Linn. Soc., Bot. 33 (1897) 80; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’]) 135; Ridley, Fl. Malay Penins. 2

(1923) 16; Ridsdale, *Blumea* 24(1) (1978) 80; Turner, *Gard. Bull. Singapore* 47 (1997 ['1995']) 450; Turner, *Webbia* 73 (2018) 12; Turner, *Gard. Bull. Singapore* 70 (2018) 10. **Synonyms:** *Nauclea canescens* (Korth.) Walp., *Repert. Bot. Syst.* 2 (1843) 513, nom. illeg. non Bartl. (1830). – *Uruparia canescens* (Korth.) Kuntze, *Revis. Gen. Pl.* 1 (1891) 301. **Type:** *Korthals s.n.*, [Indonesia], Sumatra, Melintang (lectotype L [L0001503], designated by Ridsdale, *Blumea* 24(1) (1978) 80; possible isoelectotypes A, K, L [$\times 3$]).

Large climber. **Twigs** more or less quadrangular, generally drying a light grey-brown with moderately dense, short erect white hairs, sometimes with denser, longer, browner hairs at the nodes. **Leaves:** lamina elliptic or ovate-elliptic, 9–16 \times 4–8.5 cm, base cuneate, apex acuminate, chartaceous to thinly subcoriaceous, drying brown to very dark brown above, light brown or silvery grey-brown below with darker brown main nerves, midrib and secondary veins flush to upper surface except base of midrib which may dry with several slightly raised longitudinal ridges, midrib and secondary veins prominent below, above glabrous except for inconspicuous pale hairs along midrib, below with short white hairs on all the nerves and sometimes on lamina surface, often dense but sometimes sparse, mostly appressed in random directions giving the pale cast to the leaf surface, but also erect and curved on the main nerves, secondary veins 5–6 pairs, arching forward and looping within margin, sometimes with small hairy domatia in axils, tertiary venation scalariform, inconspicuous; petiole 10–20 mm long, 1.5–2 mm wide, drying dark brown with inconspicuous short pale hairs, faint longitudinal ridges. **Inflorescences** solitary and lateral, lateral shoot (hook) 5–10 mm long, peduncle 9–16 mm long, 1 mm wide, densely short brown hairy, flower head c. 10 mm across top of calyces, c. 26 mm across at top of corollas. **Flowers** more or less sessile; hypanthium c. 1 mm long, densely pale brown hairy; calyx tube c. 1 mm long, 1 mm wide, densely pale brown hairy outside, calyx lobes ovate-triangular, 1–1.5 mm long, 0.5–1 mm wide, outside with dense short pale hairs, inside glabrous except for short hairs near apex and longer hairs centrally near base; corolla tube 7–9 mm long, covered in long pale hairs, c. 0.5 mm wide at base, 1.5–2 mm wide at top, corolla lobes, lingulate to spatulate, c. 1 \times 1 mm, densely pale hairy outside, glabrous within except for a few long pale hairs near base centrally; style exerted to 6 mm beyond mouth of corolla. **Fruiting heads** to 4 cm across, pedicel 5–10 mm long, c. 0.5 mm wide, densely brown hairy, capsules 8–13 mm long, 2 mm wide, brown hairy. **Seeds** c. 0.5 mm diam., upper wing 2.5–3.5 mm long, lower pair 2–2.5 mm long, finely filamentous.

Distribution. Thailand, Peninsular Malaysia and Sumatra. In Singapore a recent sterile collection from the Chestnut area (*Gwee SING2010-505*, 9 Mar 2010, SING [SING0144688]) is the main evidence for the presence of this species in Singapore. There is an earlier specimen from the Singapore Botanic Gardens (*Nur SFN 26144*, 17 Apr 1929, K, SING [SING0033741]), noting 'huge liana on *Koompassia* tree climbing to 80 ft height, stem to 3 inches diam.' so likely to be a relict of natural vegetation rather than planted.

Ecology. Forest and forest margins, including secondary forest.

Provisional conservation assessment. Globally not assessed. Although not included in previous conservation assessments for Singapore, the species is extant and is assessed here as Critically Endangered (CR/D).

6. *Uncaria cordata* (Lour.) Merr.

(Latin, *cordatus* = cordate, with two equal rounded lobes at base;
referring to the leaf shape)

Interpr. Herb. Amboin. (1917) 479; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 2237; Ridsdale, *Blumea* 24(1) (1978) 74; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 162; Turner, Gard. Bull. Singapore 45 (1993) 205; Tan et al., Gard. Bull. Singapore, Suppl. 3 (1995) 49; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 450; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 88, 177, 218; Turner & Chua, Checkl. Vasc. Pl. Sp. Bukit Timah Nat. Res. (2011) 72; Turner, *Webbia* 73 (2018) 12. **Basionym:** *Restiaria cordata* Lour., Fl. Cochinch. 2 (1790) 639. **Type:** *Loureiro s.n.* [Vietnam], Cochinchina (lectotype BM, designated by Moore, J. Bot. 63 (1925) 289). **Fig. 80.**

Nauclea sclerophylla W.Hunter, Trans. Linn. Soc. London 9 (1808) 223. **Synonyms:** *Uncaria sclerophylla* (W.Hunter) Roxb., Fl. Ind. 2 (1824) 130; Haviland, J. Linn. Soc., Bot. 33 (1897) 78; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’]) 129; Ridley, Fl. Malay Penins. 2 (1923) 12; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 2245; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 163. – *Uruparia pedicellata* (Roxb.) Kuntze var. *sclerophylla* (W.Hunter) Kuntze, Revis. Gen. Pl. 1 (1891) 381. – *Ourouparia sclerophylla* (W.Hunter) K.Schum., Fl. Kais. Wilh. Land (1889) 127. **Type:** *Hunter s.n.*, [Malaysia], Prince of Wales Island [Penang], Sungei Keluan, 1806 (lectotype LINN [Herb. Smith 317.5], designated by Ridsdale, *Blumea* 24(1) (1978) 75).

Nauclea lanosa Poir. in Lamarck, Encycl., Suppl. 4 (1816) 64. **Type:** [Published illustration] Rumphius, Herb. Amboin. 5 (1747) t. 34: fig. 3., lectotype designated by Merrill, Interpr. Herb. Amboin. (1917) 480.

Uncaria pedicellata Roxb., [Hort. Bengal. (1814) 86, nom. nud.] Fl. Ind. 2 (1824) 128; Haviland, J. Linn. Soc., Bot. 33 (1897) 77; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’]) 130; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 91; Ridley, Fl. Malay Penins. 2 (1923) 12. **Synonyms:** *Nauclea pedicellata* (Roxb.) Blume, Bijdr. Fl. Ned. Ind., pt 16 (1826–1827) 1012. – *Uruparia pedicellata* (Roxb.) Kuntze, Revis. Gen. Pl. 1 (1891) 301. **Type:** *Roxburgh s.n.* [EIC 6105B] (lectotype K-W [K001123049], designated by Ridsdale, *Blumea* 24(1) (1978) 75).

Nauclea ferruginea Blume, Bijdr. Fl. Ned. Ind., pt 16 (1826–1827) 1013. **Synonyms:** *Uncaria ferruginea* (Blume) DC., Prodr. 4 (1830) 348. – *Uncaria cordata* (Lour.) Merr. var. *ferruginea* (Blume) Ridsdale, *Blumea* 24(1) (1978) 76; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 450. **Type:** *Blume s.n.*, [Indonesia], Java, Salak (lectotype L [L.2966643], first step designated by Ridsdale, *Blumea* 24(1) (1978) 76, second step designated by Turner, *Webbia* 73 (2018) 13; possible isoelectotype L [L.2966642]).

Uncaria speciosa Wall. ex G.Don, Gen. Hist. 3 (1834) 471. **Synonym:** *Nauclea speciosa* (Wall. ex G.Don) Walp., Repert. Bot. Syst. 2 (1843) 512. **Type:** *Wallich s.n.* [EIC 6106A], Singapore, September 1822 (lectotype K-W [K001123052], first step designated by Ridsdale, *Blumea* 24(1) (1978) 75, second step designated by Turner, *Webbia* 73 (2018) 13; possible isoelectotypes GZU, K-W [×2] [K001123053, K001123053]).

Uncaria nemorosa Korth., Verh. Nat. Gesch. Ned. Bezitt., Bot. (1842) 166. **Synonyms:** *Nauclea nemorosa* (Korth.) Walp., Repert. Bot. Syst. 2 (1843) 512. – *Uruparia nemorosa* (Korth.) Kuntze, Revis. Gen. Pl. 1 (1891) 301. **Type:** *Korthals s.n.*, [Indonesia], Sumatra, Singalang (lectotype L, designated by Ridsdale, *Blumea* 24(1) (1978) 75).

Uruparia multiflora K.Schum. & Lauterb., Fl. Schutzgeb. Südsee (1900 [‘1901’]) 556. **Type:** *Hollrung 639*, [Papua New Guinea], Neu-Guinea, Kaiser Wilhelmsland, Augustafuss, 1887 (lectotype K [K001129430], designated by Ridsdale, *Blumea* 24(1) (1978) 75).

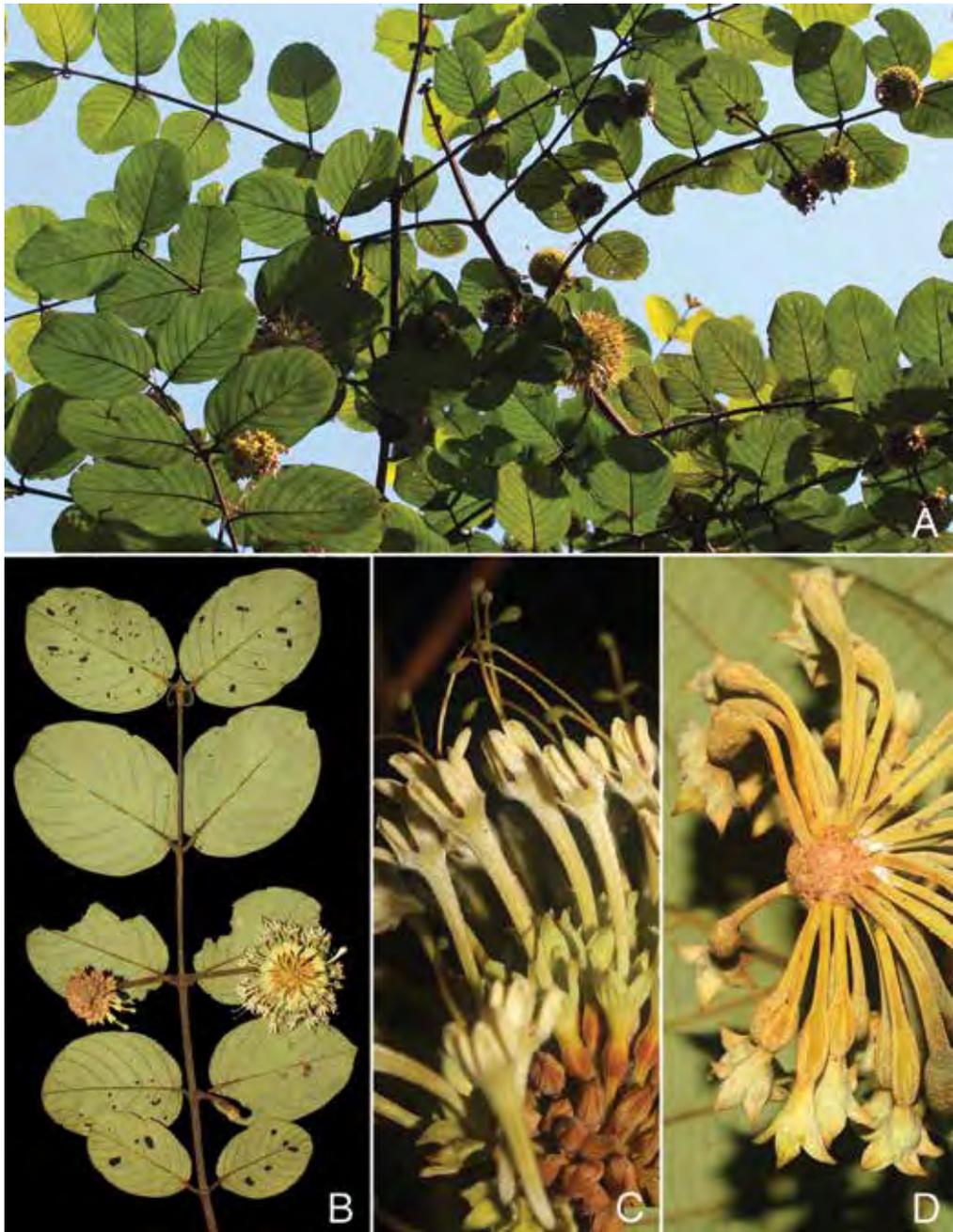


Figure 80. *Uncaria cordata* (Lour.) Merr. **A.** Clambering stems and branches. **B.** Inflorescences. **C.** Open flowers. **D.** Young fruits. (From Singapore, Upper Peirce. Photos: X.Y. Ng).

Uncaria grandifolia Baker, Bull. Misc. Inform. Kew 1896 (1896) 23. **Type:** *Creagh s.n.*, [Malaysia], British North Borneo [Sabah], East Coast (lectotype K [K000729987], designated by Turner, Webbia 73 (2018) 12, stem bearing infructescence only, excluding leafy twig top left [= *Horsfieldia grandis* Hook.f.]; isolectotype BM).

Uncaria intermedia Valetton, Bot. Jahrb. Syst. 60 (1925) 56. **Type:** *Ledermann 7283*, [Papua New Guinea], Neu-Guinea, Sepik-Gebiet, 'Kaiserin Augusta Fluss, Sepik, Pioneerlager, 15 May 1912' (lectotype SING [SING0152383], designated by Ridsdale, Blumea 24(1) (1978) 75).

Uncaria glaucescens Craib, Bull. Misc. Inform. Kew 1931 (1931) 210. **Type:** *Kerr 16997*, Siam [Thailand], Ranawng [Ranong], Kao Pawta Luang Keo, 3 February 1919 (lectotype K [K000729959, K000729960 – a single specimen over 2 sheets], designated by Ridsdale, Blumea 24(1) (1978) 76; isolectotype BM).

Uncaria cordata f. *leiantha* Ridsdale, Blumea 24(1) (1978) 77. **Type:** *Korthals s.n.*, [Indonesia], Borneo, [Kalimantan], Doesson (lectotype L [L0648229], designated by Turner, Webbia 73 (2018) 13).

Uncaria cordata f. *sundaica* Ridsdale, Blumea 24(1) (1978) 76. **Type:** *Collector unknown s.n.*, [Malaysia], Prince of Wales Island [Penang] (holotype K [K001129423]).

Climber. **Twigs** square in cross section, sometimes with rounded corners, generally with dense tomentum of short to long, more or less erect, hairs, occasionally glabrescent. **Stipules** bifid. **Leaves:** lamina ovate to elliptic, 6–20 × 3.5–15 cm, base cordate to rounded, apex rounded to obtuse with a short to very short, broad acumen, chartaceous to stiffly coriaceous, generally drying dark brown or black above, often glossy, brown below, with main veins a darker shade, lower lamina sometimes with a silvery wash or whitish-brown, midrib sunken, flush or slightly raised and secondary veins conspicuously to slightly sunken adaxially, nerves distinctly raised abaxially (with secondary and tertiary veins often appearing to run over the lamina surface), often with nerves of consecutive orders and finally lamina surface at increasing depths giving lower surface a distinct tiered appearance, brown hairs on midrib and sometimes secondary veins above, lower surface pubescent, generally with brown hairs dense on nerves, variable in form (straight, recurved or curly) among plants but fairly consistent on a specimen, sometimes with shorter, pale hairs on the lamina surface or with white papillae or cobwebbing, secondary veins 8–10 pairs, arching forward and running into an inconspicuous marginal nerve, no obvious domatia in axils of secondary veins, tertiary venation scalariform and distinct; petiole 10–20 mm long, 2–3 mm wide, brown hairy. **Inflorescences** solitary and lateral, lateral shoot (hook) 3.5–8 cm long, peduncle 1.5–4 cm long, 2–4 mm thick, densely brown pubescent, 2–6 cm across at top of calyces and 4–10 cm across at top of corollas. **Flowers** with pedicel 2–15 mm long, 1 mm thick, golden brown hairy; hypanthium 2–3 mm long, 2–3 mm wide, densely golden brown hairy; calyx tube infundibuliform, 4–7 mm long, 3–6 mm wide below lobes, densely golden brown hairy outside, densely long pale hairy inside, lobes triangular, 1.5–4 mm long, 1–3 mm wide, apex acute, relatively thick compared to tube, particularly at inner margins, brown hairy outside and inside, shorter hairs on edges; corolla tube 12–26 mm long, c. 1 mm wide at base, 3 mm wide at top, densely pale or golden brown hairy outside with hairs increasing in length distally, corolla lobes (like chubby furry fingers) oblong-ovate or lingulate, 3–5 mm long, 1–2 mm wide, apex obtuse, dense long (to 1.5 mm) pale, golden or red-brown hairs outside, inside drying black or red-brown, glabrous or with a few long pale hairs on a central longitudinal line; style exerted to at least 20 mm beyond mouth of corolla,

stigma distinctly claviform. **Fruiting heads** to 11 cm across, receptacle 7–9 mm diam., 22–30 mm long, 1 mm wide, pale brown more or less erect hairy, capsules 15–18 mm long, 4 mm wide, densely short pale or golden brown hairy, longitudinally ribbed, ribs generally hidden by tomentum. **Seeds** c. 0.5 mm diam., wings c. 3 mm long, lower pair filamentous.

Distribution. Andaman Islands, continental Southeast Asia and Malaysia. In Singapore there are recent collections from Bukit Timah (*Chia & Teo SING2015-070*, 9 Mar 2015, SING [SING0213864]), the Central Catchment (*Lua & Saifuddin SING2013-033*, 20 Feb 2013, SING [SING0200413, SING0203115]), the Western Catchment and Pulau Ubin (*Lai & Ali Ibrahim SING2011-458*, Nov 2011, SING [SING0182004]). Old records include Bukit Arrang, Toas, Jurong Road (*Burkill SFN 4094*, 21 Apr 1919, SING [SING0030686]) and Holland Road (*Burkill s.n.*, 12 Apr 1913, SING [SING0030700]).

Ecology. Forest and forest margins including secondary and degraded areas.

Provisional conservation assessment. Globally not assessed. Listed as Endangered (EN/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 88, 177, 218).

Taxonomy. *Uncaria cordata* is a widespread and variable species but in Singapore it is generally easily distinguished by the large size of all its parts. Ridsdale (*Blumea* 24(1) (1978) 74) dealt with the morphological variability by recognising a series of entities at the ranks of variety and forma. Among Singapore material the type variety, *Uncaria cordata* var. *cordata*, can generally be distinguished from var. *ferruginea* by the nature of the indumentum on the lower lamina. *Uncaria cordata* var. *cordata* has long, straight, erect or angled hairs on the nerves below giving the lower lamina a soft or rough hairy feel whereas *U. cordata* var. *ferruginea* has short, more or less adpressed hairs, giving the lower lamina a smooth feel. In Singapore the two varieties seem to be represented as forma *sundaica* and forma *leiantha* respectively. This unwieldy nomenclature is probably unhelpful to users of the *Flora of Singapore*, so here *Uncaria cordata* is considered as a single variable species.

7. *Uncaria elliptica* R.Br. ex G.Don

(Latin, *ellipticus* = elliptic; presumably referring to the leaf shape)

Gen. Hist. 3 (1834) 471; Tan et al., Gard. Bull. Singapore, Suppl. 3 (1995) 47; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 450; Turner, *Webbia* 73 (2018) 13; Turner, Gard. Bull. Singapore 70 (2018) 10. **Synonym:** *Nauclea elliptica* (R.Br. ex G.Don) Walp., Repert. Bot. Syst. 2 (1843) 512. **Type:** *Finlayson* 39 [EIC 6104B] (lectotype K-W [K001123047], designated by Turner, *Webbia* 73 (2018) 13; isolectotype K).

Uncaria dasyoneura Korth., Verh. Nat. Gesch. Ned. Bezitt., Bot. (1842) 169; Haviland, J. Linn. Soc., Bot. 33 (1897) 82. **Synonyms:** *Nauclea dasyoneura* (Korth.) Walp., Repert. Bot. Syst. 2 (1843) 513. – *Uruparia dasyoneura* (Korth.) Kuntze, Revis. Gen. Pl. 1 (1891) 301. **Type:** *Korthals s.n.*, [Indonesia], Sumatra, Salaut (lectotype L [L0001511], designated by Ridsdale, *Blumea* 24(1) (1978) 82; isolectotypes L [×3]).

Uncaria dasyoneura Korth. var. *thwaitesii* Hook.f., Fl. Brit. India 3, fasc. 7 (1880) 31. **Synonym:** *Uncaria thwaitesii* (Hook.f.) Alston, Ann. Roy. Bot. Gard. (Peradeniya) 11 (1929) 208. **Type:** *Gardner 1212*, Ceylon [Sri Lanka], Hantam (lectotype K [K001129431], designated by Turner, *Webbia* 73 (2018) 14; isolectotype BM).

Uncaria rostrata Pierre ex Pit., Fl. Indo-Chine 3, fasc. 1 (1922) 53. **Type:** *Pierre 1225*, Cambodia, Prov. Tpong, Mt Tamiré, May 1870 (lectotype P [P01900272], first step designated by Ridsdale, *Blumea* 24(1) (1978) 82, second step designated by Turner, *Webbia* 73 (2018) 14; isolectotypes A [$\times 2$], P [$\times 3$]).

Climber. **Twigs** quadrangular, generally drying with faces markedly longitudinally furrowed, glabrous throughout, drying from pale grey to blackish, smooth, finely or quite coarsely longitudinally wrinkled, sometimes with small pale lenticels. **Stipules** entire. **Leaves:** lamina ovate, elliptic to slightly obovate, 7.5–11 \times 4–5.5 cm, base cuneate, truncate or rounded, ultimately briefly decurrent, apex shortly acuminate, chartaceous, drying a consistent and relatively uniform dark to very dark brown above and a light chestnut brown below, midrib and secondary veins flush above, raised below, glabrous above, below with long more or less erect, more or less straight brown or pale hairs, most conspicuous as a sparse fringe to each side of the nerves, secondary veins 3–5 pairs, initially quite straight then curving and looping obscurely, no obvious domatia in axils, tertiary venation more or less scalariform; petiole 17–20 mm long, 1.5–2 mm wide, lamina briefly decurrent to top of petiole as a small cuneate extension with lamina continuing as ridges down each side of the petiole, sometimes twisting in to the centre of the upper face near the base, the midrib sometimes with a central raised ridge when dry that may extend down at least the proximal part of the petiole on the adaxial face, often hairy adaxially. **Inflorescences** solitary and lateral, lateral shoot (hook) 4–7 mm long, glabrous, peduncle 10–13 mm long, 1 mm wide, covered in short adpressed brown hairs, flowering head c. 7 mm across at top of calyces, 20–23 mm at top of corollas. **Flowers** subsessile; hypanthium 1–1.5 mm long, 1 mm wide, densely pale brown hairy; calyx tube infundibuliform, 1–1.5 mm long, c. 0.5 mm wide at base, 1–1.5 mm wide at mouth, with short adpressed pale hairs near base becoming increasing glabrous distally, calyx lobes very broadly ovate, 0.2–0.3 mm long, c. 0.5 mm wide, giving a scalloped edge to the calyx tube, with a few tiny hairs, notably on the margin; corolla tube 6–7 mm long, c. 0.5 mm wide at base, 2 mm wide at mouth, with a fairly sparse covering of ascending, adpressed pale hairs, densest near mouth, corolla lobes lingulate to spatulate, 1–1.5 mm long, c. 1 mm wide, outside with long pale hairs near base giving way to short hairs near apex, glabrous inside; style exerted to 4 mm from mouth of corolla. **Fruiting heads** 5–6 cm across, pedicels 2–5 mm long, c. 0.5 mm wide, pale brown hairy, capsules 11–13 mm long, c. 3 mm wide, pale brown hairy. **Seeds** c. 0.6 mm diam., upper wing 3–4 mm long, lower pair 2.5–3 mm long, filamentous.

Distribution. Sri Lanka, continental Southeast Asia and western Malesia. The only records for Singapore are a couple of Lobb collections (e.g. *Lobb 331*, 1846, K). Lobb's collections are often wrongly localised, but as Singapore lies well within the known range of *Uncaria elliptica*, the record is accepted here.

Ecology. Lowland forest.

Provisional conservation assessment. Globally not assessed. As the only known records of this species in Singapore are from the mid-nineteenth century, the species is presumed Nationally Extinct.

8. *Uncaria gambir* (W.Hunter) Roxb.

(from the Malay name *gambir*)

Fl. Ind. 2 (1824) 126; Haviland, J. Linn. Soc., Bot. 33 (1897) 81; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 ['1903']) 135, as '*Gambier*'; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 91; Ridley, Fl. Malay Penins. 2 (1923) 15; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 2238; Ridsdale, Blumea 24(1) (1978) 82; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 162, fig. 125.14; Turner, Gard. Bull. Singapore 45 (1993) 205; Tan et al., Gard. Bull. Singapore, Suppl. 3 (1995) 44; Turner, Gard. Bull. Singapore 47 (1997 ['1995']) 450; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 88, 177, 269; Turner & Chua, Checkl. Vasc. Pl. Sp. Bukit Timah Nat. Res. (2011) 72; Turner, Webbia 73 (2018) 14. **Basionym:** *Nauclea gambir* W.Hunter, Trans. Linn. Soc. London 9 (1808) 218. **Synonyms:** *Ourouparia gambir* (W.Hunter) Baill., Hist. Pl. 7 (1880) 350. – *Uruparia gambir* (W.Hunter) Kuntze, Revis. Gen. Pl. 1 (1891) 301. **Type:** *Hunter s.n.*, [Malaysia], Prince of Wales Island [Penang] (lectotype LINN [Herb. Smith 317.1], designated by Ridsdale, Blumea 24(1) (1978) 82). **Fig. 81, 82.**

Cinchona kattukambar J.Koenig ex Retz., Obs. Bot. Pug. (1810) 11. **Type:** *Koenig s.n.* (lectotype, or possibly neotype, BM [BM0012522197], designated by Turner, Webbia 73 (2018) 14).

Uncaria gambir (W.Hunter) Roxb. var. *angulata* Wawra, Itin. Princ. S. Coburgi 1 (1883) 118. **Type:** *Wawra Reise d. Prinz. Phil. u. Aug. v. S.-Coburg um die Welt No. 1405*, Ost-Indien, [Malaysia], Pulo-Penang (lectotype W [W0056499] designated by Turner, Webbia 73 (2018) 14; isolectotype W [W0056498]).

Uncaria gambir (W.Hunter) Roxb. var. *latifolia* S.Moore, J. Bot. 62(Suppl.) (1924) 47. **Type:** *Forbes 2078*, [Indonesia], Sumatra, Mt Berastagi, Krohe (lectotype BM [BM001252182], designated by Ridsdale, Blumea 24(1) (1978) 82).

Climber. **Twigs** squarish, glabrous, drying dull, light brown to dark grey, smooth or with occasional sharp-edged longitudinal wrinkles, particularly at corners. **Stipules** entire. **Leaves:** lamina elliptic or ovate-elliptic, 8–13 × 3–7 cm, base cuneate to rounded, ultimately sometimes slightly decurrent to petiole, apex shortly acuminate, chartaceous, generally drying brown, usually darker above, glabrous except for hairs in axils of secondary veins below (under magnification some very tiny hairs may also be found near leaf base and on margin), midrib and secondary veins very slightly sunken in dry leaves above, prominent below, secondary veins 5–6 pairs, arching forward and looping obscurely within margin, hairy domatia in axils, tertiary venation often, but not always, obscure from both surfaces in dry leaves; petiole 5–10 mm long, 1–2 mm thick, drying brown or blackish, wrinkled, with scattered very tiny pale brown hairs (requires magnification to see). **Inflorescences** solitary and lateral, lateral shoot (hook) 2–4 cm long, drying brown and glabrous, peduncle (sometimes hidden by flowers) 3–19 mm long, 1–1.5 mm diam., finely longitudinally wrinkled, short brown hairy, flowering inflorescences 14–17 mm across to top of calyces, 35–40 mm to top of corollas. **Flowers** more or less sessile; hypanthium c. 2.5 mm long, densely long pale brown hairy; calyx tube infundibuliform, c. 2.5 mm long, 1.5–3 mm wide at top, with short adpressed hairs outside, glabrous within, calyx lobes ovate-lanceolate, c. 1.5 mm long, 1 mm wide at base, distinctly thickened centrally and apically with apex generally incurved, outside with dense short pale brown hairs, inside hairs much sparser; corolla tube 9–11 mm long, c. 0.4 mm wide at base, to c. 1 mm wide at apex, drying brown or dark brown with short adpressed white hairs, corolla lobes oblong-obovate, c. 2 mm long, 1.5 mm wide, apex rounded, densely covered with

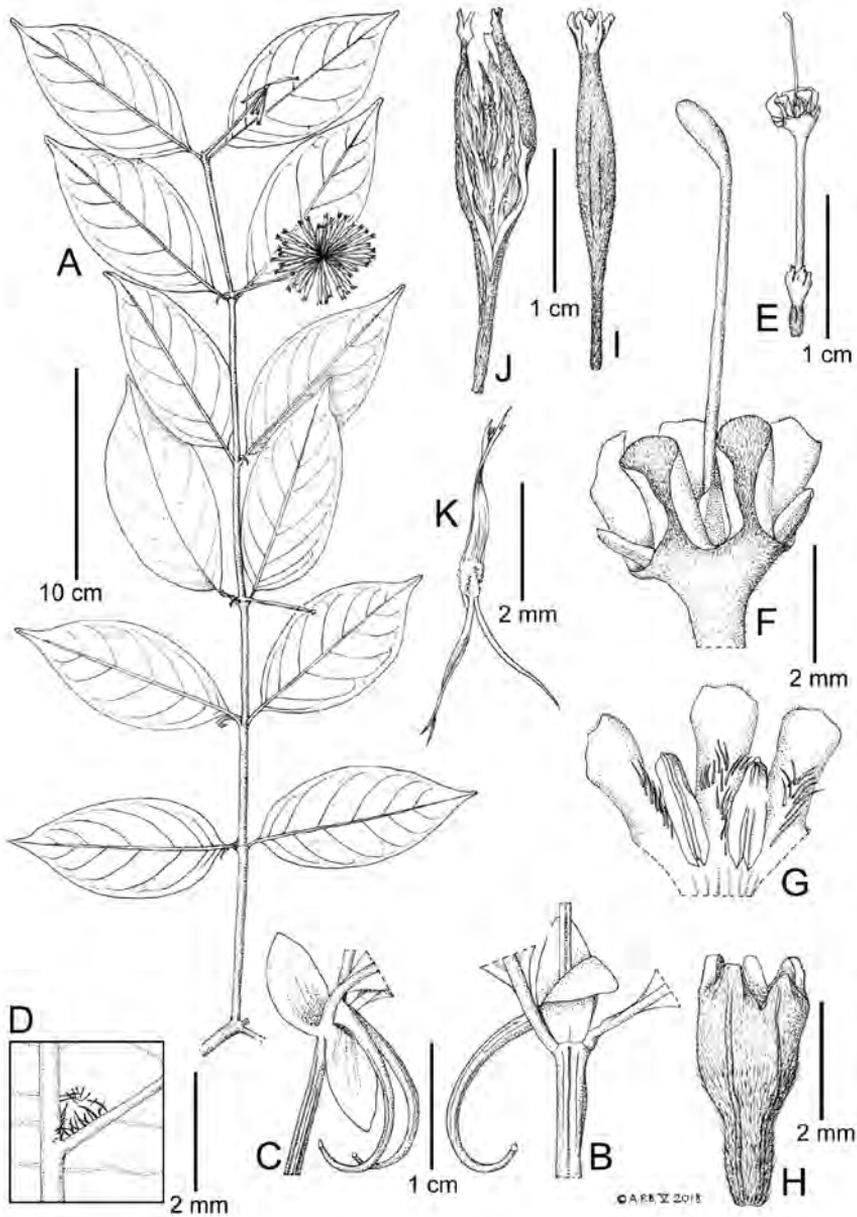


Figure 81. *Uncaria gambir* (W.Hunter) Roxb. **A.** Habit of plant with immature infructescences. **B, C.** Nodes with stipules and lateral shoots (hooks). **D.** Detail of domatium on lamina abaxial surface. **E.** Flower. **F.** Detail of distal portion of flower. **G.** Detail of adaxial surface of three contiguous corolla lobes and associated stamens. **H.** Calyx. **I.** Immature fruit. **J.** Dehiscent fruit. **K.** Seed with three wings. (From Singapore, A, D, I from Mandai, *Lua SING2014-367*; B, C from Upper Seletar, *Gwee et al. SING2008-142*; E–H, J, K from Nee Soon, *Allen s.n. [SING0201746]*. Drawn by A. Brown, reproduced with the kind permission of the Director and the Board of Trustees, Royal Botanic Gardens, Kew).



Figure 82. *Uncaria gambir* (W.Hunter) Roxb. **A.** Leafy branches. **B.** Close-up of flowering head. (From Singapore, Upper Peirce. Photos: X.Y. Ng).

relatively long pale adpressed hairs outside, inside glabrous except for a tuft of pale hairs in centre basally; style exerted up to 10 mm from mouth of corolla. **Fruiting heads** to 7 cm across, receptacle 2.5–3 mm diam., pedicels 8–14 mm long, c. 1 mm wide, drying dark brown with adpressed brown hairs, densest near base, capsules 10–14 mm long, c. 3 mm wide, drying dark brown with adpressed brown hairs, faintly longitudinally ribbed. **Seeds** c. 0.5 mm long, upper wing c. 2 mm long, lower wings filamentous, c. 2 mm long.

Distribution. Peninsular Malaysia, Sumatra, Java and Borneo. In Singapore the gambir plant is still to be found, presumably as a relic of cultivation, at Peirce (*Ang & Lok s.n.*, 22 Mar 2011, SING [SING0158568], SINU), Mandai Road (*Lua SING2014-367*, 23 Oct 2014, SING [SING0213815, SING0215127]) and Seleter (*Tan et al. NRS 1164*, 28 May 1992, SINU).

Ecology. Forest and forest margins.

Provisional conservation assessment. Globally not assessed. Not native in Singapore.

Uses. *Uncaria gambir* is a species of particular prominence in the history of Singapore. This plant has long been cultivated in the region for the extraction of the *getah gambir*, a sticky brown substance included with lime (calcium hydroxide) and *daun sireh* (*Piper betle* L.) as an accompaniment to betelnut (*Areca catechu* L.) when chewed. It is also an effective tanning agent for leather (Ridsdale, PROSEA 3 (1991) 125), a dye substance and a flavouring and colouring product in regional cuisine. The cultivation of gambier, in combination with pepper on a much smaller scale, provided a short-lived economic boom in the early years of Singapore (Jackson, J. Malayan Branch Roy. Asiat. Soc. 38 (1965) 77–105; Corlett, J. Biogeogr. 19 (1992) 411–420). The land for gambier cultivation and the firewood required in the boiling process to extract the product led to the rapid deforestation of much of Singapore Island. The unsustainable agricultural system and the absence of land tenure for the immigrant Chinese (mostly Teochew) farmers encouraged severe environmental degradation, the effects of which are still visible in Singapore today (Corlett, J. Biogeogr. 19 (1992) 411–420).

Vernacular names. *Gambier* (English), *Pokok gambir* (Malay).

9. *Uncaria lanosa* Wall.

(Latin, *lanosus* = full of wool, woolly; referring to the upper leaf surfaces being clothed with long spreading hairs)

in Roxburgh, Fl. Ind. 2 (1824) 131. **Synonyms:** *Nauclea setigera* Blume, Bijdr. Fl. Ned. Ind., pt 16 (1826–1827) 1013. – *Nauclea wallichiana* Spreng., Syst. Veg. (ed. 16) 4(2) (1827) 81, nom. illeg. superfl. – *Uruparia lanosa* (Wall.) Kuntze, Revis. Gen. Pl. 1 (1891) 301. **Type:** *Jack s.n.*, [Malaysia], Penang (lectotype BM [BM00121703], designated by Turner, Webbia 73 (2018) 15).

Distribution. Myanmar to the South Pacific.

Notes. There are 6 varieties recognised, only 1 of which occurs in Singapore.

var. glabrata (Blume) Ridsdale

(Latin, *glabratus* = nearly glabrous;
presumably referring to the relative lack of hairs on the plant)

Blumea 24(1) (1978) 86; Turner, Gard. Bull. Singapore 45 (1993) 205; Tan et al., Gard. Bull. Singapore, Suppl. 3 (1995) 49; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 451; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 88, 177, 213; Turner & Chua, Checkl. Vasc. Pl. Sp. Bukit Timah Nat. Res. (2011) 72; Turner, Webbia 73 (2018) 16. **Basionym:** *Nauclea glabrata* Blume, Bijdr. Fl. Ned. Ind., pt 16 (1826–1827) 1012. **Synonyms:** *Uncaria glabrata* (Blume) DC., Prodr. 4 (1830) 348; Haviland, J. Linn. Soc., Bot. 33 (1897) 85; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’]) 131; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 91; Ridley, Fl. Malay Penins. 2 (1923) 14; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 162. – *Uncaria ferrea* (Blume) DC. var. *glabrata* (Blume) Kuntze, Revis. Gen. Pl. 1 (1891) 301. **Type:** *Blume s.n.*, [Indonesia], Java, G. Seribu (lectotype L [L0001524], designated by Ridsdale, Blumea 24(1) (1978) 86). **Fig. 83.**

Uncaria lobbii Hook.f., Fl. Brit. India 3, fasc. 7 (1880) 33. **Synonym:** *Uruparia lobbii* (Hook.f.) Kuntze, Revis. Gen. Pl. 1 (1891) 301. **Type:** *Lobb 332*, Singapore, [1846] (lectotype K [K000729993], first step designated by Ridsdale, Blumea 24(1) (1978) 87, second step designated by Turner, Webbia 73 (2018) 16; isolectotypes BM [BM000838090], K [K000729992]).

Climber. **Twigs** squarish, branchlets more distinctly quadrangular, drying red-brown or dark brown, finely longitudinally wrinkled, glabrous or with sparse and scattered long brown hairs. **Stipules** bifid. **Leaves:** lamina ovate-elliptic, 5–10 × 2–5 cm, base obtuse, truncate or rounded, apex acute to acuminate, membranous to chartaceous, drying slightly shiny, chestnut or light chestnut brown above, light brown below with lamina paler than nerves, above glabrous or with long (1–1.5 mm) straight, more or less adpressed, hairs along midrib, below with long (0.5–1 mm), straight, brown or pale, more or less adpressed hairs on nerves and lamina margin, densest on midrib, midrib and secondary veins flush to very slightly sunken in dry leaves above, midrib prominent and secondary veins slightly raised below, secondary veins c. 7 pairs, arching forward and looping obscurely within margin, hairy domatia in axils, tertiary venation irregularly scalariform with reticulations visible from below; petiole 4–6 mm long, 0.5–1 mm thick, drying dark brown with sparse or dense long brown hairs. **Inflorescences** apparently always lateral and solitary, lateral shoot (hook) 1.5–3.5 cm long, drying red-brown with scattered long brown hairs (sometimes more hairy than twigs), peduncle 2–12 mm long, c. 1 mm thick, sparsely to densely brown hairy, subtending stipules persistent, flowering inflorescences 9–11 mm across to top of calyces, 30–35 mm across to top of corollas. **Flowers** many, more or less sessile; hypanthium long pale hairy, c. 0.5 mm long; calyx pale and brown hairy outside, glabrous within, tube c. 0.5 mm long, main lobes obovate, c. 1.5 mm long, concave and flat-topped, with small pinnately branched lobes in between; corolla tube 9–11 mm long, c. 0.2 mm wide at base and 0.5 mm at top, drying brown, glabrous, corolla lobes orbicular to spatulate, c. 1.5 × 1 mm, apex rounded, drying brown, mix of short and very short pale hairs outside, particularly near margin, inside a few central longer pale hairs extending up from throat of corolla tube; style exerted 6–9 mm from mouth of corolla. **Fruiting heads** 5–6 cm across, pedicels 3–12 mm long, c. 0.5 mm thick, drying pale brown with scattered long pale hairs, capsules 6–13 mm long, 1.5–2.5 mm wide centrally, drying brown with scattered long pale hairs and slightly raised longitudinal round-topped ribs. **Seeds** c. 0.25 mm diam., upper and lower wings c. 2.5 mm long.



Figure 83. *Uncaria lanosa* Wall. var. *glabrata* (Blume) Ridsdale. **A.** Flowering leafy branches. **B.** Shoots with intact stipules. **C.** Flowering head. (From Singapore, secondary forest along Hillview Avenue, *Ng SING2018-736*. Photos: X.Y. Ng).

Distribution. Peninsular Malaysia, Sumatra, Java and Borneo. In Singapore this taxon has been collected from various sites including Bukit Timah (*Sinclair SFN 37799*, 15 Sep 1948, SING [SING0258791]), Nee Soon (*Maxwell 82–50*, 17 Feb 1982, SING [SING0110200]), Jurong (*Ridley 10739*, K, SING [SING030718]), Bukit Panjang and Bukit Mandai (*Ridley 2846*, 1891, BM, K, SING [SING0030717]). The most recent records are from the Western Catchment and Bukit Batok (*Chong et al. s.n.*, Jun 2010, SINU).

Ecology. Openings and edges of forest.

Provisional conservation assessment. Globally not assessed. Listed as Critically Endangered (CR/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 88, 177, 213).

10. *Uncaria longiflora* (Poir.) Merr.

(Latin, *longi-* = long, *-flora* = flower; long-flowered)

Interpr. Herb. Amboin. (1917) 480; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 2244. **Basionym:** *Nauclea longiflora* Poir. in Lamarck, Encycl., Suppl. 4 (1816) 63. **Type:** [Published illustration], Rumphius, Herb. Amboin. 5 (1747) t. 34: fig. 1, lectotype designated by Merrill, Interpr. Herb. Amboin. (1917) 480.

Distribution. Thailand to New Guinea.

Notes. Two varieties recognised based on whether the wing on the petiole is absent (var. *longiflora*) or present (var. *pteropoda* (Miq.) Ridsdale).

var. *pteropoda* (Miq.) Ridsdale

(Greek, *ptero-* = feather, wing, *-poda* = footed, based; referring to the winged petioles)

Blumea 24(1) (1978) 82; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 162; Turner, Gard. Bull. Singapore 45 (1993) 205; Tan et al., Gard. Bull. Singapore, Suppl. 3 (1995) 49; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 451; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 88, 177, 213; Turner & Chua, Checkl. Vasc. Pl. Sp. Bukit Timah Nat. Res. (2011) 72; Turner, Webbia 73 (2018) 17. **Basionym:** *Uncaria pteropoda* Miq., Fl. Ned. Ind. 2, fasc. 2 (1857) 343; Haviland, J. Linn. Soc., Bot. 33 (1897) 81; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’]) 134; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 91; Ridley, Fl. Malay Penins. 2 (1923) 15. **Synonym:** *Uruparia pteropoda* (Miq.) Kuntze, Revis. Gen. Pl. 1 (1891) 301. **Type:** *Collector unknown s.n.* [Herb. Blume 909], [Indonesia], Sumatra, Priaman (lectotype U [U.1585547], designated by Ridsdale, Blumea 24(1) (1978) 82).

Uncaria laevifolia Elmer, Leaf. Philipp. Bot. 5 (1913) 1902. **Type:** *Elmer 14178*, Philippines, Mindanao, Province of Agusan, Mt Urdaneta, Cabadbaran, October 1912 (lectotype NY [NY00162864]; isolectotypes BO, E, L, NY [NY00162863]).

Climber reaching large size. **Twigs** square, drying brown or blackish, rather smooth, glabrous, at least one pair of the opposite sides with a longitudinal round-bottomed valley. **Stipules** entire. **Leaves:** lamina broadly elliptic, elliptic-obovate to almost round, 16–18(–27) × 7–16 cm, apex obtuse to rounded, very shortly and bluntly acuminate, base broadly cuneate to rounded, ultimately decurrent forming a narrow wing down each side of the petiole to the base, wings ruffled in dry leaves, chartaceous, drying dark brown or grey-brown above, brown, often with a silvery wash, below with main nerves distinctly darker, entirely glabrous, midrib and laterals flush to slightly sunken above in dry leaves, though longitudinal sharp-edged wrinkles in midrib may protrude, midrib and laterals prominent beneath, secondary veins 6–9 pairs, arching forward running close to margin but not clearly looping, dense irregularly sinuous scalariform tertiary venation sometimes more obvious from above, reticulations generally visible from below; petiole 1.5–2.5 cm long (the wings make it difficult to judge the position of the top of the petiole), 2 mm thick, drying dark brown or black, wrinkled, glabrous. **Inflorescences** apparently solitary and lateral, often monstrous, lateral shoot (hook) 7–10 mm long, peduncle 15–18 mm long, 1.5–2 mm thick, densely covered in very short adpressed pale and pale-brown hairs, flowering head 12–13 mm across to top of calyces, c. 3 cm at top of corollas. **Flowers** many, sessile; hypanthium c. 1 mm long, pale hairy outside; calyx tube c. 1.5 mm long, c. 1.5 mm across at top; with short pale hairs outside, calyx lobes ovate-triangular, c. 1 mm long, 0.5 mm wide at base, with short pale hairs outside and near the apex inside, apex ultimately blunt; corolla tube 8–9 mm long, 0.5 mm wide, outside densely covered with pale, irregular hairs, corolla lobes lingulate, c. 1 mm long, 0.5 mm wide, outside with dense long pale hairs, inside glabrous except for a few pale hairs in centre near base, drying brown; stigma exerted 5–7 mm beyond throat of corolla. **Fruiting heads** to 9 cm across, receptacle c. 4 mm across, 7–22 mm long, c. 0.5 mm wide at narrowest, with short pale or brown decumbent hairs, capsules 12–21 mm long, 2–2.5 mm wide at widest, covered with decumbent brown hairs, faint longitudinal ribs. **Seeds** c. 0.75 mm diam., upper wing c. 5 mm long, lower wings reduced to individual filaments, c. 4 mm long.

Distribution. Peninsular Malaysia, Sumatra and Borneo. In Singapore this taxon can be found in the Central Catchment (*Gwee SING2009-693*, 22 Dec 2009, SING [SING0144128]; *Gwee SING2010-728*, 31 Mar 2010, SING [SING0145731]; *Gwee SING2010-319*, 9 Feb 2010, SING [SING0145683]) and Bukit Timah (*Tang & Sidek 992*, 12 Oct 1995, SING [SING0230760]).

Ecology. Forest and areas bordering forest.

Provisional conservation assessment. Globally not assessed. Listed as Critically Endangered (CR/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 88, 177, 213) but, as it is present in a number of protected areas, it is assessed here as Endangered (EN/D).

Taxonomy. A recent sterile collection from Pulau Tekong (*Gwee & Leong SING2008-228*, 2 Mar 2007, SING [SING0109169]) may be *Uncaria longiflora* var. *longiflora* which does not have the winged petiole of *Uncaria longiflora* var. *pteropoda* but further study is necessary before this is confirmed.

11. *Uncaria roxburghiana* Korth.

(William Roxburgh, 1751–1815, Scottish surgeon and botanist,
superintendent of the Calcutta Botanic Garden)

Verh. Nat. Gesch. Ned. Bezitt., Bot. (1842) 172; Haviland, J. Linn. Soc., Bot. 33 (1897) 87; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’]) 128; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 91; Ridley, Fl. Malay Penins. 2 (1923) 11; Ridsdale, Blumea 24(1) (1978) 89; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 162; Turner, Gard. Bull. Singapore 45 (1993) 205; Tan et al., Gard. Bull. Singapore, Suppl. 3 (1995) 49; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 451; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241, as ‘*roxburghiana*’; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 88, 177, 199; Turner & Chua, Checkl. Vasc. Pl. Sp. Bukit Timah Nat. Res. (2011) 72; Turner, Webbia 73 (2018) 18; Turner, Gard. Bull. Singapore 70 (2018) 11. **Synonyms:** *Nauclea roxburghiana* (Korth.) Walp., Repert. Bot. Syst. 2 (1843) 513. – *Uruparia roxburghiana* (Korth.) Kuntze, Revis. Gen. Pl. 1 (1891) 301. **Type:** *Korthals s.n.*, [Indonesia], Sumatra (lectotype L [L0001540], designated by Ridsdale, Blumea 24(1) (1978) 89). **Fig. 84.**

Uncaria brevicarpa Elmer, Leaflet Philipp. Bot. 9 (1934) 3270. **Type:** *Elmer 16842*, Philippines, Luzon, Province of Sorsogon, Irosin, Mt Bulusan, August 1916 (lectotype K [K000760039], designated by Turner, Webbia 73 (2018) 18; isolectotypes A, BM, BO, BRIT, CAL, G, GH, HBG, K, L, MICH, MO, NY, U, US).

Climber. **Twigs** squarish with dense tomentum of short (mostly less than 0.25 mm long), brown, more or less erect hairs, sometimes with a scattering of much longer hairs (>1 mm long). **Stipules** bifid, hairy abaxially. **Leaves:** lamina ovate or ovate-elliptic, (4–)5–7(–11) × 3–5(–7) cm, base cordate to auriculate, apex acute to acuminate, chartaceous, drying chestnut brown above, light brown or light grey-brown below, upper lamina with uniformly spread, relatively stout, apically pointed, brown hairs, c. 0.5 mm long generally curving towards lamina apex giving leaves a distinct rough feel adaxially, particularly if rubbed from apex to base, midrib above with denser covering of the hooked hairs, lower lamina and nerves with many longer (0.5–1 mm) and more slender hairs, generally slightly bent, densest on nerves where shorter hairs also occur, main nerves slightly impressed in dry leaves adaxially, prominent abaxially, secondary veins c. 5 pairs, arching forward and looping obscurely within lamina margin, small hairy domatia present in axils of secondary veins but often obscured by general indumentum, tertiary venation more or less scalariform; petiole 3–7 mm long, 1–1.5 mm wide, densely brown hairy. **Inflorescences** solitary and lateral, whether lateral shoot or peduncle often difficult to distinguish, lateral shoot (hook) 12–30 mm long at flowering, peduncle so short as to be hidden by flower head, to 2 mm long, c. 1 mm thick, brown hairy, flowering head 6 mm across at top of calyces, 26–30 mm at top of corollas. **Flowers** more or less sessile; hypanthium pale hairy, c. 0.5 mm long; calyx green in vivo, pale hairy outside and in, tube c. 0.5 mm long, lobes lanceolate, c. 1 mm long, 0.5 mm wide at base outside; corolla tube pink-red in vivo, 8–12 mm long, c. 0.1 mm wide at base when dry, 0.5 mm at top, drying light brown or red-brown, glabrous outside, corolla lobes pale yellow in vivo, oblong-ovate, 1–1.5 × 1 mm, apex rounded, drying light brown to blackish, glabrous outside to the naked eye, but under magnification minute hairs or papillae may be visible, particularly as a pale margin to lobe, pale hairs in throat of corolla sometimes spreading up centre of lobes adaxially; style exerted by c. 5 mm from mouth of corolla, c. 0.1 mm thick when dry. **Fruiting heads** 13–20 mm across, receptacle c. 2 mm diam.; capsules sessile, 4–8 mm long, 2 mm diam. at



Figure 84. *Uncaria roxburghiana* Korth. **A.** Habit of climbing stems and branches. **B.** Flowering head. Inset: Fruiting head. (From Singapore, A, B from Nee Soon; B (inset) from Mandai, Ang SING2012-279. Photos: A, W.W. Seah; B (main photo), X.Y. Ng; B (inset) W.F. Ang).

widest, drying brown, faintly longitudinally ribbed, with scattered pale hairs. **Seeds** many, c. 0.5 mm long, upper wing c. 1 mm long, lower wings 0.75–1 mm long.

Distribution. Peninsular Malaysia, Sumatra, Borneo and the Philippines. In Singapore this species is known from Nee Soon (*Samsuri et al. NES 381*, 6 Apr 2004, SING [SING0053907]; *Lua et al. SING2011-370*, 9 Sep 2011, SING [SING0166674]; *Yeo et al. SING2012-139*, 23 Apr 2012, SING [SING0179558]); *O’Dempsey SING2013-020*, 13 Feb 2013, SING [SING0194943]) and Mandai (*Ang SING2012–279*, 18 Jun 2012, SING [SING0185450]).

Ecology. Seems to prefer wet forest in Singapore.

Provisional conservation assessment. Globally not assessed. Erroneously listed as Nationally Extinct in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 88, 177, 199), presumably because the 2004 collection from Nee Soon was not included in their assessments. With several collections since then, *Uncaria roxburghiana* is assessed here as Endangered (EN/D) in Singapore.

52. UROPHYLLUM Wall.

(Greek, *uro-* = tail, *-phyllum* = leaf; referring to the conspicuous tail-like prolongation of leaf apices)

in Roxburgh, Fl. Ind. 2 (1824) 184; Hooker, Fl. Brit. India 3, fasc. 7 (1880) 97; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’]) 190; Ridley, Fl. Malay Penins. 2 (1923) 65; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 2252; Wong, Arbor. Rubiac. Malaya (1988) 233; Wong, Tree Fl. Malaya 4 (1989) 420; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 163; Puff et al., Rubiac. Thailand (2005) 134, pl. 3.1.45. **Type:** *Urophyllum villosum* Wall., lectotype designated here.

Axanthes Blume, Bijdr. Fl. Ned. Ind., pt 16 (1826–1827) 1003. **Type:** *Axanthes arborea* Blume. (= *Urophyllum arboreum* (Blume) Korth.).

Aulacodiscus Hook.f. in Bentham & Hooker, Gen. Pl. 2(1) (1873) 71, nom. illeg. non Ehrenb. (1844); Hooker, Fl. Brit. India 3, fasc. 7 (1880) 97; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’]) 189; Ridley, Fl. Malay Penins. 2 (1923) 64. – *Pleiocarpidia* K.Schum. in Engler & Prantl, Nat. Pflanzenfam. Nachtr. 1 (1897) 314; Merrill, Philipp. J. Sci. 20 (1922) 462; Bremekamp, Recueil Trav. Bot. Néerl. 37 (1940) 198; Wong, Arbor. Rubiac. Malaya (1988) 158; Wong, Tree Fl. Malaya 4 (1989) 392. **Type:** *Aulacodiscus premnoides* Hook.f. (= *Urophyllum enneandrum* (Wight) Ridl.).

Maschalocorymbus Bremek., Recueil Trav. Bot. Néerl. 37 (1940) 181. **Type:** *Maschalocorymbus corymbosus* (Blume) Bremek. (= *Urophyllum corymbosum* (Blume) Korth.).

Pravinaria Bremek., Recueil Trav. Bot. Néerl. 37 (1940) 184. **Type:** *Pravinaria leucocarpa* Bremek. (= *Urophyllum leucocarpum* (Bremek.) Smedmark & B.Bremer).

Treelets or small trees; stem typically quite straight (orthotropic), primary branches on the stem opposite and decussate, sub-horizontal (plagiotropic) with leaf pairs all in a single plane; axillary buds usually 1–3 in each leaf axil on the stem, the lowest typically forming a

horizontal branch, the others able to develop new vertical (reiterative or ‘repair’) shoots when the main stem is damaged or leaning. **Stipules** entire to apically cleft, variously shaped. **Leaves** typically with abrupt apical cauda or cuspidate; without domatia in vein axils. **Inflorescences** axillary and paired; a sessile fascicle of pedicellate flowers or pedunculate with cymose to sub-umbellate clusters of flowers at the end of main or side branches, in some species several cm long with a general trichotomously branched appearance. **Flowers** unisexual (plants dioecious but very rare instances of monoecy with apparently female flowers also found on predominantly male plants have been noted); 4–8-merous; calyx subtruncate or with distinct triangular to ovate lobes; corolla with a short cylindrical tube hardly longer than wide, the lobes valvate; anthers on short filaments inserted at the corolla throat, normal in male, empty or reduced in females; stigma 3–8-lobed, lobes erect and close together forming a knoblike or clublike structure in the bud or spreading, slightly protruding from the corolla tube in females, reduced and borne on a short styloidium and totally included within the corolla tube in males; ovary 4–8-loculate; ovules many per ovary locule, inserted on prominent placentas at the inner part of the ovary septa; disk prominent and annular, variously lobed or not. **Fruits** berries, often globose, with a broad annular scar at the top, ripening yellowish orange or red and sometimes finally black. **Seeds** many, rounded.

Distribution. About 120 species in South and Southeast Asia from Myanmar to South China, and Malesia to New Guinea. In Singapore 7 native species.

Taxonomy. Bremekamp (Recueil Trav. Bot. Néerl. 37 (1940) 171–198) proposed splitting the *Urophyllum* group in Southeast Asia into several segregate genera. However, Smedmark & Bremer (Taxon 60 (2011) 1397–1406) demonstrated that molecular evidence did not support the segregation of these genera. A wider circumscription of *Urophyllum* is here adopted following Wong (Arbor. Rubiac. Malaya (1988) 233–242; Tree Fl. Malaya 4 (1989) 420–424).

Some sources have suggested that *Urophyllum glabrum* Wall. is a synonym of *U. arboreum* (Blume) Korth. (e.g. Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 177, 224) but without substantiation. The problem is not only a taxonomic one but also dependent on a more precise typification of the taxa involved. Here the typification of the species concerned is addressed and the conclusion reached that *Urophyllum glabrum* is a distinct species from *U. arboreum*, the latter the correct name for what had been known in the Malay Peninsula as *U. blumeanum* (Wight) Hook.f.

Notes. *Urophyllum villosum* Wall. (in Roxburgh, Fl. Ind. 2 (1824) 185) was the first of two species described by Wallich when he erected the genus. Bremekamp transferred this species to his genus *Maschalocorymbus* but that is now considered synonymous with *Urophyllum*. There is thus no problem with this being recognised as the type species. However, the name *Urophyllum villosum* itself requires lectotypification: *Wallich s.n.* [EIC 8314], Penang, 1822 (lectotype K-W [K001125227], designated here; isolectotypes K-W [K000740725, K001125226, K001125228]). There is an unnumbered collection by Cantley with a ‘Flora of Singapore’ label in the Singapore Herbarium, but with no associated information. Ridley (J. Straits Branch Roy. Asiat. Soc. 33 (1900) 93) doubted it was present in Singapore. As this species is documented by Wong (Arbor. Rubiac. Malaya (1988) 239; Tree Fl. Malaya 4 (1989) 422) as endemic to the northern part of Peninsular Malaysia, it is deemed a dubious record and not enumerated for Singapore in the present treatment.

Key to *Urophyllum* species

1. Leaf tertiary veins typically closely parallel and trending sub-perpendicular to the midrib 2
 Leaf tertiary veins laxly reticulate or conspicuously scalariform (ladder-like) with reticulations in between 3
2. Inflorescence always pedunculate, with 1–2 tiers of few flowers in simple cymose arrangement or more sub-umbellately arranged flowers (leaves glabrous or hairy) **1. *U. arboreum***
 Inflorescence epedunculate, a fascicle of flowers from the leaf axil (leaves hairy on the lower surface, at least on midribs) **7. *U. streptopodium***
3. Leaves visibly hairy on the lower surface **5. *U. hirsutum***
 Leaves glabrous to the naked eye 4
4. Inflorescence with short peduncles (not exceeding 2 cm long) and a terminal sub-umbellate cluster of flowers 5
 Inflorescence typically with longer peduncles (to 3.5–4.5 cm long), and conspicuously 3-branched 6
5. Leaf secondary veins looping, tertiary veins laxly reticulate; stipules broad ovate to triangular, with a prominently thickened ridge-like or inflated base encircling the twig just below the petioles; calyx limb with broad-triangular lobes **4. *U. griffithianum***
 Leaf secondary veins not looping, tertiary veins scalariform with reticulations in between; stipules linear to elliptic, without basal embellishment; calyx limb subtruncate **3. *U. glabrum***
6. Flowers larger (calyx 3–3.5 mm diam.) **2. *U. corymbosum***
 Flowers minute (calyx 1–1.5 mm diam.) **6. *U. malayense***

1. *Urophyllum arboreum* (Blume) Korth.

(Latin, *arboreus* = tree-like; referring to the habit)

Ned. Kruidk. Arch. 2(4) (1851) 194. **Basionym:** *Axanthes arborea* Blume, Bijdr. Fl. Ned. Ind., pt 16 (1826–1827) 1003. **Synonym:** *Wallichia arborea* Reinw., Cat. Gew. Buitenzorg (1823) 55, nom. nud. **Type:** *Reinwardt s.n.*, [Indonesia], Kitjanke gunung (lectotype L [L.2958940], designated here). **Fig. 85.**

Urophyllum blumeanum (Wight) Hook.f., Fl. Brit. India 3, fasc. 7 (1880) 99; Wong, Arbor. Rubiac. Malaya (1988) 234, 236 (in clavi); Wong, Tree Fl. Malaya 4 (1989) 421 (in clavi); Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 163; Turner, Gard. Bull. Singapore 45 (1993) 205; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 451; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 89, 177, 213. **Basionym:** *Axanthes blumeana* Wight, Calcutta J. Nat. Hist. 7 (1847) 145. **Synonym:** *Urophyllum glabrum* Wall. var.



Figure 85. *Urophyllum arboreum* (Blume) Korth. **A.** Habit with erect (orthotropic) stems and near-horizontally spreading (plagiotropic) paired branches with distichous leaf pairs. Inset: Lower leaf surface. **B.** Inflorescences. **C.** Close-up of infructescences. (From Singapore, A from Nee Soon, *Chen et al. SING2017-669*; C, from Nee Soon. Photos: A (main photo), L.M.J. Chen; A (inset), B (incl. inset), J. Leong-Škorničková; C, X.Y. Ng).

blumeanum Ridl., Fl. Malay Penins. 2 (1923) 69, p.p. **Type:** *Griffith s.n.*, [Malaysia], Malacca (lectotype K [K000740827]), designated here).

Urophyllum macrophyllum auct. non (Blume) Korth.: Ridley, Fl. Malay Penins. 2 (1923) 66, p.p.; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 163; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 89, 177, 199.

Urophyllum sp. 2 of Wong, Arbor. Rubiac. Malaya (1988) 235 (in clavi); Wong, Tree Fl. Malaya 4 (1989) 421 (in clavi); Turner, Gard. Bull. Singapore 45 (1993) 206; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241.

Treelet to small tree up to c. 6.5 m tall; twigs glabrous to sparsely appressed- to spreading-hairy. **Stipules** linear to narrowly triangular, entire, (3–)7–16 × 1–1.5 mm, glabrous, caducous at nodes proximal to the newly developed leaves. **Leaves:** lamina elliptic, sometimes oblanceolate, (5.5–)10.5–19.5 × 1.7–4.5(–6.5) cm, apex acute to acuminate or rarely obtuse and with an abruptly attenuated cusp to 12 mm long and 1–2 mm wide, base broadly cuneate, glabrous on both surfaces, midrib flat to raised and narrowly channelled on upper surface, prominent on lower surface, secondary veins (6–)7–10 pairs, flat to slightly raised on upper surface, prominent on lower surface, tertiary veins typically closely sub-parallel and trending sub-perpendicular to midrib, often slightly raised on upper side, prominent on lower side; petioles (5–)10–15 mm long. **Inflorescences** of similar form between male and female plants, in general appearance with a terminal cyme-like cluster of 2–3 flowers or a denser sub-umbellate cluster of flowers, and often an additional fascicle from a lower node on the main axis, with a distinct peduncle (0.1–)0.2–0.5(–0.7) cm long and with scattered fine pale appressed hairs; rachis (main or central axis) (0–)2–4 mm long. **Flowers** on pedicels 1.5–4 mm long and sparsely brown hairy; calyx in the male dish-like, 1–1.5 mm long, 2–2.5 mm diam., without conspicuous hypanthium and with 5 short-triangular lobes hardly 0.5 mm long, in the female with cup-like hypanthium, 1.5–2 mm long, 2–2.5 mm diam. and with triangular lobes c. 0.5 mm long, in both sexes with sparse pale brown appressed minute hairs or glabrescent on the outside; corolla in both sexes with tube 1–1.5 mm long and glabrous on the outside, lobes 5, each 1.5–2 mm long and glabrous on both surfaces, throat congested with pale stiff uniseriate multicellular hairs less than 0.5 mm long; stamens 5, with inconspicuous filaments inserted between corolla lobes and at the throat, exerted, in the male 1–1.5 mm long, less than 0.5 mm wide, bearing pollen, in the female c. 1 mm long, less than 0.5 mm wide, empty; ovary in the male vestigial, in the female well-developed within hypanthium; style in the male rudimentary and less than 0.5 mm long, in the female 1–1.5 mm long, exerted; stigmas in the male not formed, in the female with 5 narrow suberect to spreading lobes c. 0.5 mm long, exerted above the level of the corolla throat hairs; disk in both sexes a 5-lobed annulus. **Fruits** subglobose and sometimes slightly 5-lobed, to 3–5 mm diam., apex with broad circular scar or remains of the calyx limb surrounding the remains of the shrivelled disk; pedicels 3–5 mm long.

Distribution. Peninsular Malaysia, Sumatra, Java and Borneo. In Singapore recorded from Bukit Timah (*Corner SFN 34997*, 19 Jun 1938, SING [SING0270382]), Chestnut Avenue, MacRitchie (*Leong et al. SING2015-019*, 20 Jan 2015, SING [SING0213501]), Upper Peirce, Seletar (*Tan et al. NRS 752*, 6 May 1992, SING [SING0270383]), Holland Road (*Ridley 10371*, 1899, SING [SING0030729]), Mandai and Nee Soon (*Ang et al. SING2012-240*, 12

May 2012, SING [SING0176991]). Other older collections are known from Changi, Chua Chu Kang, Jurong Road, Kranji and Pasir Panjang.

Ecology. Lowland forest including swamp forest. In Peninsular Malaysia also documented from lower montane forest and on limestone.

Provisional conservation assessment. Globally not assessed. Listed (under *Urophyllum macrophyllum*) as Nationally Extinct in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 89, 177, 199). Also listed as Critically Endangered (CR/D) under separate entries for ‘*Urophyllum* sp. 2 of Wong’ (Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241) and *Urophyllum blumeanum* (Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 89, 177, 213). Treating all these names as synonyms, *Urophyllum arboreum* is assessed here as Vulnerable (VU/D) in Singapore.

Notes. Plants are typically either male or female but very rarely (e.g. *Hamzah H6*, Singapore, Bukit Timah, SING [SING0030727]) have female and male flowers in the same cluster, or in separate clusters or inflorescences. Noltie (Bot. Robert Wight (2005) 401) did not locate the Kew material for Wight’s name *Axanthes blumeana*.

2. *Urophyllum corymbosum* (Blume) Korth.

(Latin, *corymbosus* = with flowers arranged in corymbs;
referring to the corymb-like inflorescences)

Ned. Kruidk. Arch. 2(4) (1851) 194; Wong, Arbor. Rubiac. Malaya (1988) 239 (in clavi); Wong, Tree Fl. Malaya 4 (1989) 422 (in clavi); Turner, Gard. Bull. Singapore 45 (1993) 205; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 451; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241. **Basionym:** *Axanthes corymbosa* Blume, Bijdr. Fl. Ned. Ind., pt 16 (1826–1827) 1003. **Synonyms:** *Urophyllum macrophyllum* (Blume) Korth. var. *corymbosa* (Blume) King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’]) 192. – *Maschalocorymbus corymbosus* (Blume) Bremek., Recueil Trav. Bot. Néerl. 37 (1940) 182; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 59, 175, 194. **Type:** *Blume 1445*, [Indonesia], Java (lectotype L [L0057559], designated here; isolectotypes L [L0057557, L0057558, L2924072]).

Urophyllum trifurcum auct. non H. Pearson ex King & Gamble: Ridley, J. Straits Branch Roy. Asiat. Soc. 35 (1901) 88.

Treelet to small tree up to c. 4(–6.5) m tall; twigs glabrous to sparsely appressed to spreading brown-hairy. **Stipules** ovate, entire, 11–15 × 6–8 mm, densely appressed brown-hairy, the basal part inflated as a ring around the node, caducous at nodes proximal to the newly developed leaves. **Leaves:** lamina elliptic to obovate, 15–30 × 4.5–12.5 cm, apex acuminate-caudate or acute to obtuse and with an abruptly attenuated cusp to 15 mm long and 2–3 mm wide, base broadly cuneate, upper surface glabrous, lower surface moderately appressed to spreading pale-hairy on midrib and veins and glabrous on the lamina, midrib channelled on upper

surface, prominent on lower surface, secondary veins (11–)12–16 pairs, flat to channelled on upper surface, prominent on lower surface, tertiary veins scalariform between secondaries; petioles (9–)15–20 mm long. **Inflorescences** of similar form between male and female plants, in general appearance a trichotomously branched compound inflorescence with a distinct peduncle (1.1–)1.5–3.5 cm long and with scattered to dense fine pale appressed to suberect hairs; rachis (main or central axis) 8–15 mm long, with a reduced stipule-like bract between the first branches, the lower two primary branches 7–23 mm long, these axes terminating in closely set and inconspicuous condensed axes branching to a further 1–2 orders and bearing sub-umbellate ultimate clusters of 2–9 flowers each; the rachis and branches all covered in dense short suberect pale brown hairs. **Flowers** on pedicels 2–4 mm long and sparsely to densely suberect brown hairy; calyx in the male dish-like, 2–2.5 mm long, 3–3.5 mm diam., subtruncate, without conspicuous hypanthium lobes, in the female with cup-like hypanthium, 2.5–3.5 mm long, 3–3.5 mm diam. and subtruncate, in both sexes with scattered pale brown appressed minute hairs on the outside; corolla in both sexes with tube c. 1.5 mm long and sparsely to densely covered with pale or brownish minute suberect hairs on the outside, lobes 5, each c. 2.5–3 mm long and glabrous on both surfaces, throat congested with pale stiff uniseriate multicellular hairs c. 1–1.5 mm long; stamens 5, with inconspicuous filaments inserted between corolla lobes and at the throat, exerted, in the male c. 2.5 mm long, c. 0.5–1 mm wide, bearing pollen, in the female c. 1–1.5 mm long, less than 0.5 mm wide, empty; ovary in the male vestigial, in the female well-developed within hypanthium; style in the male rudimentary and less than 0.5 mm long, in the female 1.5–2 mm long, exerted; stigmas in the male not formed, in the female with 5 ovate erect to spreading lobes c. 0.5 mm long, exerted above the level of the corolla throat hairs; disk in both sexes an annular structure. **Fruits** subglobose and often slightly 5-lobed, to 4–6 mm diam., apex with broad circular scar or remains of the calyx limb surrounding the remains of the shrivelled disk; pedicels (1–)3–8 mm long.

Distribution. Peninsular Malaysia, Sumatra, Java and Borneo. In Singapore known from a single collection from Bukit Timah (*Ridley 6824*, 1890, SING [SING0012187]).

Ecology. Across its range this species is known from lowland to lower montane forest.

Provisional conservation assessment. Globally not assessed. In Singapore presumed Nationally Extinct.

3. *Urophyllum glabrum* Wall.

(Latin, *glaber* = glabrous, hairless; referring to the leaves)

in Roxburgh, Fl. Ind. 2 (1824) 186; Hooker, Fl. Brit. India 3, fasc. 7 (1880) 98; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 93; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’]) 194, p.p.; Ridley, Fl. Malay Penins. 2 (1923) 68, p.p.; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 2252, p.p.; Wong, Arbor. Rubiac. Malaya (1988) 241, 242 (in clavi); Wong, Tree Fl. Malaya 4 (1989) 423 (in clavi); Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 163; Turner, Gard. Bull. Singapore 45 (1993) 205; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 451; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241. **Type:** *Wallich s.n.* [EIC

8316], [Malaysia], Pulo Penang, August 1822 (lectotype K [K001125235], designated here; possible isolectotypes BR [BR0000005620937], K [K001125234, K001125237]).

Urophyllum griffithianum auct. non (Wight) Hook.f.: Ridley, Fl. Malay Penins. 2 (1923) 69, p.p.

Treelet to small tree up to c. 4 m tall; twigs glabrous. **Stipules** linear, entire, 6–13 × 1.5–2.5 mm, glabrous to sparsely appressed minute-hairy, caducous at nodes proximal to the newly developed leaves. **Leaves:** lamina elliptic, sometimes oblanceolate, (7.5–)11.5–19 × (3.3–)6–7.5 cm, apex acute to obtuse or rounded and with an abruptly attenuated cusp to c. 15 mm long and 2 mm wide, base broadly cuneate, both surfaces glabrous, midrib channelled on upper surface, prominent on lower surface, secondary veins (7–)8–12 pairs, flat to slightly raised on upper surface, prominent on lower surface, tertiary veins scalariform between secondaries, not conspicuous on upper side, prominent on lower side; petioles 6–15 mm long. **Inflorescences** of similar form between male and female plants, in general appearance with a terminal sub-umbellate cluster of flowers, with a distinct peduncle (0.2–)0.3–1 cm long and with scattered pale appressed fine hairs. **Flowers** on pedicels (1.5–)2.5–5 mm long and sparsely pale appressed fine-hairy; calyx in the male dish-like, 1–2 mm long, 2.5–3 mm diam., subtruncate to faintly 5-cusped, in the female with cup-like hypanthium, 2–2.5(–3.5) mm long, 2–2.5 mm diam. and subtruncate to faintly 5-cusped, in both sexes with sparse pale appressed minute hairs or glabrescent on the outside; corolla in both sexes with tube c. 1.5 mm long and glabrous to sparsely covered with pale or brownish appressed minute hairs on the outside, lobes 5, each c. 1.5 mm long and glabrous on both surfaces, throat congested with pale stiff uniseriate multicellular hairs less than 1.5–2 mm long; stamens 5, with inconspicuous filaments inserted between corolla lobes and at the throat, exerted, in the male c. 1.5 mm long, c. 0.5 mm wide, bearing pollen, in the female c. 1 mm long, less than 0.5 mm wide, empty; ovary in the male vestigial, in the female well-developed within hypanthium; style in the male rudimentary and less than 0.5 mm long, in the female c. 1.5 mm long, exerted; stigmas in the male not formed, in the female with 5 broad spreading lobes c. 0.5–1 mm long, exerted above the level of the corolla throat hairs; disk in both sexes a 5–8-lobed annular structure. **Fruits** subglobose and sometimes slightly 5-lobed, to 5–7 mm diam., apex with broad circular scar or remains of the calyx limb surrounding the remains of the shrivelled disk; pedicels 4–8 mm long.

Distribution. Peninsular Malaysia, Sumatra, Java and Borneo. In Singapore collections have been made from Chan Chu Kang (*Ridley 4907*, Oct 1889, SING [SING0030737]), Kranji, Sungei Buloh (*Ridley s.n.*, 12 Jan 1890, SING [SING0030735]), Bukit Timah (*Ismail & Mishak GC2*, 24 Jun 2003, SING [SING0045707]), Changi Road (*Hullett 5672*, 8 Apr 1893, SING [SING0030736]) and Pulau Ubin (*Ali Ibrahim SING2008-374*, Sep 2008, SING [SING0146650]).

Ecology. Lowland to lower montane forest.

Provisional conservation assessment. Globally not assessed. Listed as Vulnerable (VU/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241).

4. *Urophyllum griffithianum* (Wight) Hook.f.

(William Griffith, 1810–1845, English botanist known for his work in India and Malaya)

Fl. Brit. India 3, fasc. 7 (1880) 98; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 93; Ridley, Fl. Malay Penins. 2 (1923) 69; Wong, Arbor. Rubiac. Malaya (1988) 240 (in clavi); Wong, Tree Fl. Malaya 4 (1989) 423 (in clavi); Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 163; Turner, Gard. Bull. Singapore 45 (1993) 206; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 451; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 89, 177, 224. **Basionym:** *Axanthes griffithiana* Wight, Calcutta J. Nat. Hist. 7 (1847) 147. **Type:** *Griffith s.n.*, [Malaysia], Malacca (lectotype K [K000740826], designated here). **Fig. 86.**

Urophyllum glabrum auct. non Wall.: King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’]) 194, p.p.

Treelet 2–3 m tall; twigs glabrous. **Stipules** broad-ovate, entire, 4–14 × 3.5–6 mm, sparsely appressed fine-hairy, especially along median, to subglabrous, developing a conspicuous narrowly inflated base that encircles the node, caducous at nodes proximal to the newly developed leaves. **Leaves:** lamina elliptic to obovate, 7.5–16.8 × 2.5–6.5 cm, apex acute to acuminate and often with an abruptly attenuated cusp to c. 13 mm long and 1–3 mm wide, base broadly cuneate, both surfaces glabrous, midrib channelled on upper surface, prominent on lower surface, secondary veins (7–)10–12 pairs, slightly prominent on both surfaces, tertiary veins laxly reticulate, slightly prominent on both sides; petioles 5–12 mm long. **Inflorescences** of similar form between male and female plants, in general appearance with a terminal subumbellate cluster of flowers, with a distinct peduncle 0.5–2 cm long and with scattered pale appressed fine hairs. **Flowers** on pedicels 5–8 mm long and sparsely pale appressed hairy; calyx in the male dish-like, 1–2 mm long, 3–3.5 mm diam., subtruncate, in the female with cup-like hypanthium, 2.5–3.5 mm long, 2–3.5 mm diam. and subtruncate, in both sexes with sparse pale brown appressed minute hairs or glabrescent on the outside; corolla in both sexes with tube c. 1.5 mm long and glabrous to sparsely covered with pale or brownish suberect minute hairs on the outside, lobes 5, each c. 2.5–3 mm long and glabrescent on both surfaces, throat congested with pale stiff uniseriate multicellular hairs c. 1.5–2 mm long; stamens 5, with inconspicuous filaments inserted between corolla lobes and at the throat, exerted, in the male c. 2 mm long, c. 0.5 mm wide, bearing pollen, in the female c. 1.5–2 mm long, less than 0.5 mm wide, empty; ovary in the male vestigial, in the female well-developed within hypanthium; style in the male rudimentary and less than 0.5 mm long, in the female c. 1 mm long, exerted; stigmas in the male not formed, in the female with 3–5 broad spreading lobes c. 0.5 mm long, exerted above the level of the corolla throat hairs; disk in both sexes a few-lobed annular structure. **Fruits** subglobose and weakly 5-lobed, to 3.5–5 mm diam., apex with broad circular scar or remains of the calyx limb surrounding the remains of the shrivelled disk; pedicels 5–10 mm long.

Distribution. Peninsular Malaysia, Sumatra and Borneo. In Singapore recorded from Bukit Timah (*Maxwell 82-134*, 16 Apr 1982, SING [SING0030770]), MacRitchie (*Lua & Yee SING2014-150*, 17 Apr 2014, SING [SING0205829]), Chestnut (*Gwee SING2010-566*, 9 Mar 2010, SING [SING0144780]), Seletar (*Turner et al. NRS253*, 9 Apr 1992, SING [SING0270384]), Mandai and Ang Mo Kio (*Ridley 6461*, 1894, SING [SING0030761]).



Figure 86. *Urophyllum griffithianum* (Wight) Hook.f. Inflorescences and intact stipules near the shoot tip. (From Singapore, MacRitchie, Ng & Lim SING2018-774. Photo: X.Y. Ng).

Ecology. Lowland forest.

Provisional conservation assessment. Globally not assessed. Listed as Vulnerable (VU/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 89, 177, 224).

Notes. Noltie (Bot. Robert Wight (2005) 401) suggests one of the two specimens with Wight's herbarium label at Kew is the holotype for Wight's name *Axanthes griffithiana*. However, what he suggests could be possible isotypes includes taxa that are not conspecific: for example, the other sheet at Kew [K000740825], a fruiting specimen, differs in its non-looping leaf secondary veins. Lectotypification is thus necessary and the lectotype designated here has flowering material; Wight's description emphasised flowers.

5. *Urophyllum hirsutum* (Wight) Hook.f.

(Latin, *hirsutus* = hirsute, with coarse stiff hairs; referring to the lower leaf surfaces)

Fl. Brit. India 3, fasc. 7 (1880) 98; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 93; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 ['1903']) 192, p.p.; Ridley, Fl. Malay Penins. 2 (1923) 66; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 2253; Wong, Arbor. Rubiac. Malaya (1988) 236 (in clavi); Wong, Tree Fl. Malaya 4 (1989) 421 (in clavi); Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 163; Turner, Gard. Bull. Singapore 45 (1993) 206; Turner, Gard. Bull. Singapore 47 (1997 ['1995']) 451; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 89, 177, 218. **Basionym:** *Axanthes hirsuta* Wight, Calcutta J. Nat. Hist. 7 (1847) 148. **Type:** *Griffith s.n.*, [Malaysia], Malacca, 1845 (lectotype K [K000740842], designated here). **Fig. 87.**

Treelet to small tree 2–4 m tall; twigs densely suberect pale-brown hirsute. **Stipules** linear, entire, 5–14 × 0.5–1 mm, hirsute on both sides, caducous at nodes proximal to the newly developed leaves. **Leaves:** lamina elliptic to sub-ovate, (3.5–)9–16.5 × (1.3–)3–5.5 cm, apex acuminate-caudate, base broadly cuneate, glabrous on upper surface except for occasionally hairy midrib, sparsely to densely hirsute on veins and lamina on lower side, midrib channelled on upper surface, prominent on lower surface, secondary veins (7–)9–10(–12) pairs, flat on upper side, prominent on lower side, tertiary veins scalariform between secondaries, flat on upper side, slightly prominent on lower side; petioles (3–)5–8 mm long. **Inflorescences** of similar form between male and female plants, in general appearance a (sub-)sessile sub-umbellate cluster of flowers; peduncle 0(–0.2) cm long. **Flowers** on pedicels 0.5–2(–3) mm long and densely suberect to spiky pale to brown hairy; calyx in the male dish-like, 0.5–1 mm long, c. 1 mm diam. and with 4 shallow-triangular lobes, in the female with cup-like hypanthium, c. 1.5 mm long, 2 mm diam. and with 4 triangular lobes c. 0.5 mm long, in both sexes with sparse to dense pale brown suberect to spiky minute hairs on the outside; corolla in both sexes with tube c. 1.5–2 mm long and densely covered with pale or brownish suberect minute hairs on the outside, lobes 5, each c. 1–1.5 mm long and covered with pale or brownish suberect minute hairs on the outside, throat congested with pale flexuous to stiff moniliform multicellular hairs c. 1–1.5 mm long; stamens 5, with inconspicuous filaments inserted between corolla lobes and at the throat, exerted, in the male c. 1 mm long, c. 0.5 mm wide, bearing pollen, in the female

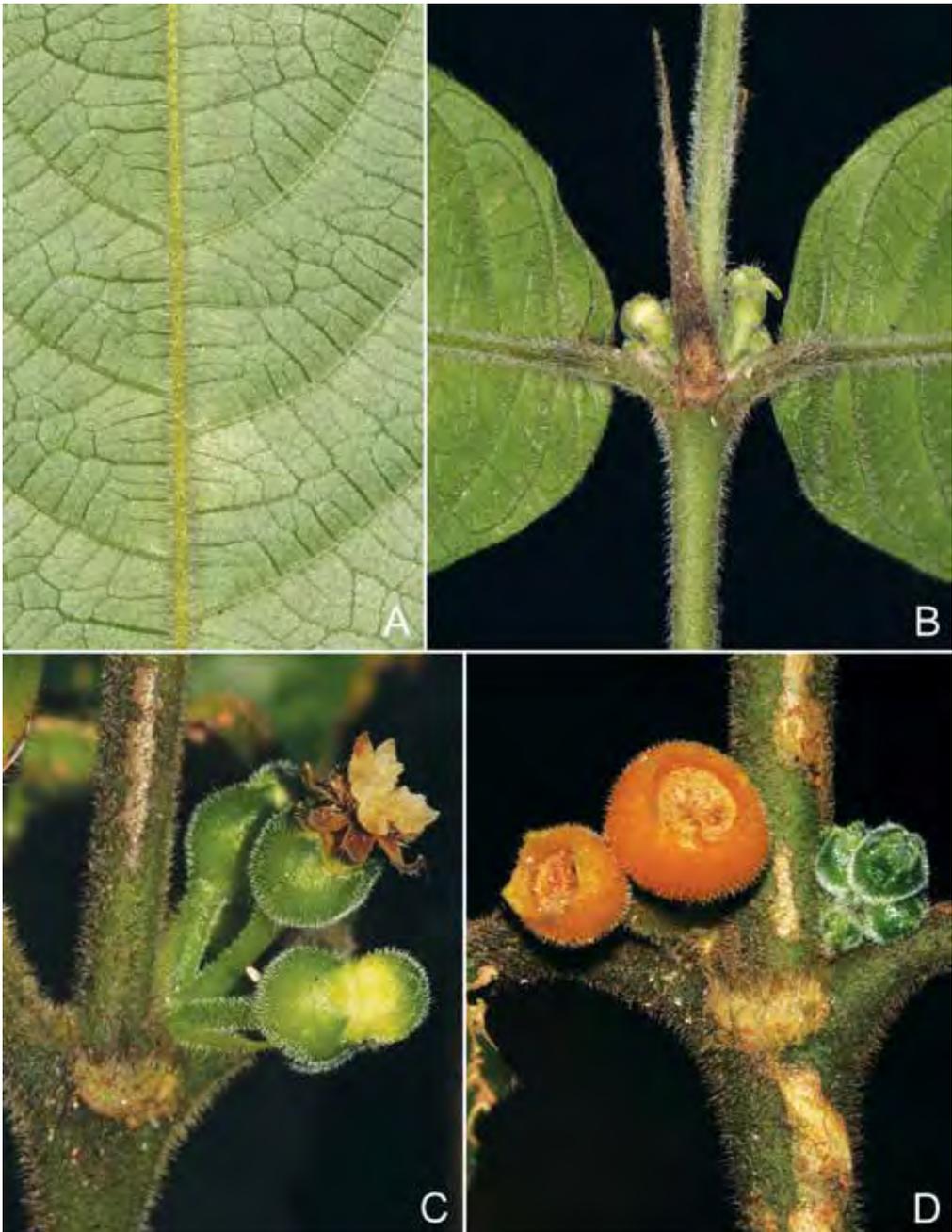


Figure 87. *Urophyllum hirsutum* (Wight) Hook.f. **A.** Midrib and veins on lower leaf surface. **B.** Inflorescences and stipule at a node. **C.** Female inflorescence. **D.** Fruits. (From Singapore, Nee Soon. Photos: X.Y. Ng).

c. 1 mm long, less than 0.5 mm wide, empty; ovary in the male vestigial, in the female well-developed within hypanthium; style in the male rudimentary and less than 0.5 mm long, in the female c. 1.5–2 mm long, exerted; stigmas in the male not formed, in the female with 5 ovate spreading lobes c. 0.5–1 mm long, exerted above the level of the corolla throat hairs; disk in both sexes a 5-lobed annular structure. **Fruits** subglobose and sometimes slightly 5-lobed, to 3–4 mm diam., short-hirsute all over, apex with broad circular scar or remains of the calyx limb surrounding the remains of the shrivelled disk; pedicels 1–3.5 mm long.

Distribution. Endemic to Peninsular Thailand, Peninsular Malaysia and Singapore. In Singapore older collections are known from Bayan, Bidadari, Kranji, Seletar, Sungai Morai and Tuas. The more recent collections include Bukit Timah (*Tang & Sidek 1016*, 19 Oct 1995, SING [SING0076857]), MacRitchie (*Yee et al. SING2014-125*, 1 May 2014, SING [SING0205527]), Upper Peirce (*Tan et al. NRS 1315*, 12 Jun 1992, SING [SING0076860]), the Western Catchment (*Lua SING2011-312*, 31 Aug 2011, SING [SING0166670]) and Mandai (*Gwee et al. SING2009-292*, 10 Mar 2009, SING [SING0120528]).

Ecology. Mainly lowland forest, sometimes in coastal areas.

Provisional conservation assessment. Globally not assessed. Listed as Endangered (EN/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 89, 177, 218) but, with more recent collections, it is assessed here as Vulnerable (VU/D).

Notes. Wight's basionym requires lectotypification as several sheets of uncertain status exist at Kew, as noted by Noltie (Bot. Robert Wight (2005) 401).

6. *Urophyllum malayense* K.M.Wong (of Malaya)

Phytotaxa 373 (2018) 236. **Type:** *Sinclair SFN 37937*, Singapore, MacRitchie Reservoir, east end, 16 January 1949 (holotype SING [SING0030791]).

Urophyllum sp. 10 of Wong, Arbor. Rubiac. Malaya (1988) 242 (in clavi); Wong, Tree Fl. Malaya 4 (1989) 424 (in clavi); Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 452.

Urophyllum trifurcum auct. non H.Pearson ex King & Gamble: Ridley, Fl. Malay Penins. 2 (1923) 68, p.p.; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 163, p.p.; Turner, Gard. Bull. Singapore 45 (1993) 206; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 89, 177, 199.

Treelet to small tree up to c. 10 m tall; stem bark smooth, green at a young stage becoming grey-brown to red-brown; twigs glabrous. **Stipules** linear to ovate or elliptic, entire, 6–17 × (3.5–)6.5–9 mm, glabrous, caducous at nodes proximal to the newly developed leaves. **Leaves:** lamina elliptic, (8–)16–23.5 × (3.5–)7–11.5 cm, apex acute to obtuse and with an abruptly attenuated cusp to 10(–15) mm long and 1–2 mm wide, base broadly cuneate to

rounded, upper surface glabrous, lower surface glabrous except for occasional scattered (microscopic) fine appressed hairs on midrib and secondary veins, midrib flat to slightly channelled on upper surface, prominent on lower surface, secondary veins 9–11 pairs, flat to impressed on upper surface, prominent on lower surface, tertiary veins scalariform with lax reticulations in between; petioles 8–15 mm long. **Inflorescences** of similar form between male and female plants, in general appearance a trichotomously branched compound inflorescence with a distinct peduncle (1.7–)3–4.5 cm long and with scattered fine pale appressed hairs; rachis (main or central axis) 4–9(–13) mm long, with a reduced stipule-like bract between the first branches, the lower two primary branches 6–15 mm long, an upper pair of shorter primary branches often also developed, these branches typically terminating in closely set and inconspicuous condensed axes branching to a further 1–2 orders and bearing sub-umbellate ultimate clusters of many (more than 10) flowers each; the rachis and branches all covered in dense short suberect brown hairs. **Flowers** on pedicels 1–2(–4) mm long and densely suberect brown hairy; calyx in the male dish-like, 0.5 mm long, 1–1.5 mm diam., without conspicuous hypanthium and with triangular lobes 0.2–0.3 mm long, in the female with cup-like hypanthium, 0.7–1 mm long, 1–1.5 mm diam. and with triangular lobes c. 0.5 mm long, in both sexes with dense pale brown suberect minute hairs on the outside; corolla in both sexes with tube c. 1 mm long and sparsely to densely covered with pale or brownish minute suberect hairs on the outside, lobes 5, each c. 1 mm long and sparsely to densely covered with pale or brownish minute suberect hairs on both surfaces, throat congested with pale stiff uniseriate multicellular hairs c. 1 mm long, these hairs occasionally with tips constricted between cells and appearing sub-moniliform; stamens 5, with inconspicuous filaments inserted between corolla lobes and at the throat, exerted, in the male c. 1 mm long, c. 0.3–0.4 mm wide, bearing pollen, in the female c. 0.8 mm long, c. 0.2 mm wide, empty; ovary in the male vestigial, in the female well-developed within hypanthium; style in the male rudimentary and less than 0.5 mm long, in the female 1.5–2 mm long, exerted; stigmas in the male not formed, in the female with 5 narrow spreading lobes c. 0.5 mm long, exerted above the level of the corolla throat hairs; disk in both sexes a 5–10-lobed annular structure. **Fruits** subglobose and often slightly 5-lobed, to 4–6 mm diam., apex with broad circular scar or remains of the calyx limb surrounding the remains of the shrivelled disk; pedicels 4–8 mm long.

Distribution. *Urophyllum malayense* is endemic to Peninsular Malaysia (Terengganu, Pahang and Johor) and Singapore. In Singapore recorded from Changi (*Ridley 4892*, 19 May 1891, SING [SING0270385]) and MacRitchie (*Mhd Shah & Ali MS 3873*, 30 Jun 1976, SING [SING0030738]); *Yeoh YYS 16*, 6 Sep 2015, SING [SING0231993]).

Ecology. Understorey in lowland rain forest.

Provisional conservation assessment. Globally Endangered (EN B2ab(i,ii,iii)). The species is known from scattered collections made across lowland forest areas, much of which have experienced logging or land-use changes, both highly detrimental to understorey plant species, such as in *Urophyllum*. There are no detailed population studies. It was listed (under *Urophyllum trifurcum*) as Nationally Extinct in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 89, 177, 199) but is assessed here as Critically Endangered (CR/D).

Notes. Corner (in *SFN 30167*) noted that the female calyx is green, the corolla pale green, and the style and stigmas white. Sinclair (in *SFN 37937*) recorded that the male petals are white (but this is probably an impression contributed by the white corolla throat hairs and pale hairs over the inner corolla lobe surfaces, which retain their colour even after drying). The fruits are generally noted as yellowish green when fresh.

7. *Urophyllum streptopodium* Wall. ex Hook.f.

(Greek, *strepto-* = twisted, *-podium* = foot; derivation uncertain, possibly from the twisting of petioles to accommodate a single plane of leaf-pairs along lateral branches typical in the genus)

Fl. Brit. India 3, fasc. 7 (1880) 99; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 93; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’]) 193; Ridley, Fl. Malay Penins. 2 (1923) 67; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 2253; Wong, Arbor. Rubiac. Malaya (1988) 238 (in clavi); Wong, Tree Fl. Malaya 4 (1989) 422 (in clavi); Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 163; Turner, Gard. Bull. Singapore 45 (1993) 206; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 452; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 89, 177, 224. **Type:** *Wallich s.n.* [EIC 8317], [Malaysia], Penang (lectotype K [K000740838], designated here; isolectotypes K [K001125239 (only element on the right), K001125241], BR [BR0000005620913]). **Fig. 88.**

Urophyllum hirsutum auct. non (Wight) Hook.f.: King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 72(4) (1904 [‘1903’]) 192, p.p.

Urophyllum umbellulatum auct. non Miq.: Ridley, Fl. Malay Penins. 2 (1923) 68, p.p.

Treelet to c. 4 m tall; twigs densely appressed pale silvery hairy. **Stipules** linear to lanceolate, entire, 4–16 × 1–3 mm, densely appressed pale hairy, caducous at nodes proximal to the newly developed leaves. **Leaves:** lamina elliptic to obovate, (5.5–)12.4–23 × (1.6–)6.5–7.6 cm, apex acuminate to caudate, base cuneate, upper surface glabrous, lower surface densely appressed pale hairy on midrib and secondary veins, sparsely to densely appressed pale hairy on lamina, midrib channelled on upper surface, prominent on lower surface, secondary veins (5–)7–9(–10) pairs, flat to slightly raised on upper surface, prominent on lower surface, tertiary veins typically closely sub-parallel and trending sub-perpendicular to midrib, often slightly raised on upper side, prominent on lower side; petioles (3–)10–18 mm long. **Inflorescences** of similar form between male and female plants, in general appearance a (sub-)sessile sub-umbellate cluster of flowers, peduncle 0(–0.2) cm long. **Flowers** on pedicels 1–4(–5.5) mm long and sparsely to densely appressed silvery hairy; calyx in the male dish-like, c. 0.5 mm long, 1.5 mm diam., without conspicuous hypanthium and with 5 triangular lobes hardly 0.5 mm long, in the female with cup-like hypanthium, c. 2 mm long, 1.5–2 mm diam. and with 5 triangular lobes c. 0.3–0.5 mm long, in both sexes with sparse pale appressed minute hairs on the outside; corolla in both sexes with tube c. 0.5–1 mm long and sparse to densely covered with pale to brownish suberect minute hairs on the outside, lobes 5, each c. 1–1.5 mm long and sparsely covered with appressed pale minute hairs or glabrescent on outer surface, throat congested with pale stiff, crisped to spreading to deflexed uniseriate multicellular hairs c. 0.5–1 mm long; stamens 5, with inconspicuous filaments inserted between corolla lobes and at the throat, exerted, in the male c. 1 mm long, less than 0.5 mm wide, bearing pollen, in the



Figure 88. *Urophyllum streptopodium* Wall. ex Hook.f. Inset: Inflorescence. (From Singapore, Bukit Timah Nature Reserve. Photo: J. Leong-Škorničková).

female less than 0.5 mm long and wide, empty; ovary in the male vestigial, in the female well-developed within hypanthium; style in the male rudimentary and less than 0.5 mm long, in the female c. 2 mm long, exerted; stigmas in the male not formed, in the female with 4–5 ovate spreading lobes c. 0.5–0.8 mm long, exerted above the level of the corolla throat hairs; disk in both sexes a 5–8-lobed annular structure. **Fruits** subglobose and sometimes slightly 5-lobed, to 3–5 mm diam., apex with broad circular scar or remains of the calyx limb surrounding the remains of the shrivelled disk; pedicels 3–5 mm long.

Distribution. Malay Peninsula and Borneo. In Singapore the more recent collections have come from Bukit Timah (*Mhd Shah MS 750*, 7 Sep 1959, SING [SING0030785]), MacRitchie (*Maxwell 81-116*, 4 Jun 1981, SING [SING0030783]) and Nee Soon (*Gwee et al. SING2005-108*, 19 Apr 2005, SING [SING0063909]), with leafy branch vouchers also available from Chestnut Avenue (*Gwee SING2010-721*, 31 Mar 2010, SING [SING0145727]), Nee Soon, Peirce and Upper Seletar. Older collections are also known from Sungai Jurong, Ang Mo Kio and Chan Chu Kang.

Ecology. Lowland to lower montane forest.

Provisional conservation assessment. Globally not assessed. Listed as Vulnerable (VU/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 241) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 89, 177, 224).

Excluded species

For Singapore, the species below are recorded only from Cantley specimens but in each case it is extremely unlikely that the species is found in Singapore at all. The problem of wrongly labelled Cantley specimens is well-known and discussed in the *Flora of Singapore* volume 1, chapter 3.

Mussaenda cf. cambodiana Pierre ex Pit. is a dubious record for Singapore based on a single Cantley specimen at SING. It is otherwise known from continental Southeast Asia and the Cantley specimen may have been from a plant in cultivation.

Mussaenda villosa Wall. ex G.Don is a dubious record for Singapore based on a single Cantley specimen at SING. It is otherwise known from Myanmar, Thailand, Peninsular Malaysia and Borneo. Although from its known distribution it could occur in Singapore, the Cantley collection is insufficient evidence that it does.

Urophyllum villosum Wall. is a dubious record for Singapore based on a single Cantley specimen at SING. Ridley (J. Straits Branch Roy. Asiat. Soc. 33 (1900) 93) also doubted it was present in Singapore. As this species is documented by Wong (Arbor. Rubiac. Malaya (1988) 239; Tree Fl. Malaya 4 (1989) 422) as endemic to the northern part of Peninsular Malaysia, it is not included for Singapore in the present treatment.