

LOGANIACEAE

C. Puglisi

R.Br. ex Mart., Nov. Gen. Sp. Pl. 2, fasc. 2 (1827) 133, as ‘Loganieae’, nom. cons.; de Candolle, Prodr. 9 (1845) 1, p.p.; Bentham, J. Proc. Linn. Soc., Bot. 1 (1857) 52, p.p.; Clarke in Hooker, Fl. Brit. India 4, fasc. 10 (1883) 78, p.p.; Solereder in Engler & Prantl, Nat. Pflanzenfam. 4(2) (1892) 19, p.p.; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 74(2) (1908) 598, p.p.; Ridley, Fl. Malay Penins. 2 (1923) 412, p.p.; Leenhouts, Fl. Males., ser. 1, 6(2) (1962) 293, p.p.; Tirel-Roudet, Fl. Cambodge Laos Vietnam 13 (1972) 3, p.p.; Kochummen, Tree Fl. Malaya 2 (1973) 267, p.p.; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 140, p.p.; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 313, p.p.; Wong & Sugau, Tree Fl. Sabah & Sarawak 2 (1996) 189, p.p.; Griffin & Parnell, Fl. Thailand. 6(3) (1997) 197, p.p.; Struwe et al. in Kadereit & Bittrich (ed.), Fam. Gen. Vasc. Pl. 15 (2019) 511. **Type:** *Logania* R.Br., nom. cons.

Strychnaceae DC. ex Perleb, Vers. Arzneikr. Pfl. (1818) 244, as ‘Strychneae’; Struwe et al., Cladistics 10 (1994) 193. **Type:** *Strychnos* L.

Spigeliaceae Bercht. & J.Presl, Prir. Rostlin 1 (1823) 40. **Type:** *Spigelia* L.

Gardneriaceae Wall. ex Perleb, Clav. Class. (1838) 23, as ‘Gardnereae’. **Type:** *Gardneria* Wall.

Antoniaceae Hutch., Fam. Fl. Pl., Dicot., ed. 2 (1959) 375. **Type:** *Antonia* Pohl.

Geniostomaceae Struwe & V.A.Albert, Cladistics 10 (1994) 206. **Type:** *Geniostoma* J.R.Forst. & G.Forst.

Herbs, climbers, shrubs or trees. Hairs simple. Twigs often lenticellate; tendrils or spines can be present. **Leaves** simple, opposite, with sheathing interpetiolar stipules, margin entire. **Inflorescences** terminal or axillary, cymose or thyrsoïd, usually bibracteate and bibracteolate, single- to many-flowered. Flowers tetra- or pentamerous, bisexual, usually actinomorphic. **Calyx** lobate. **Corolla** gamopetalous, often with some indumentum inside the tube. **Stamens** usually as many as the calyx and corolla parts, attached to the corolla tube anywhere from the base to the mouth, alternate to the corolla lobes, included or exserted; anthers bilocular, thecae parallel or slightly divergent, dehiscing longitudinally. **Pistil** superior, ovary usually bicarpellate, placentation axile or parietal. **Fruit** capsular or baccate, one- to many-seeded.

Distribution. The Loganiaceae consist of 13 genera and c. 420 species distributed throughout the world’s tropics and subtropics and, with the exception of Europe and South America, extend into the warm temperate regions. In Singapore there are 4 genera and 8 species. Of these, one species is exotic and the only endemic is presumed extinct. The family has undergone numerous changes in circumscription since it was established. The most significant of these changes with relevance to Singapore is the removal of *Fagraea* Thunb. to Gentianaceae (Struwe et al., Cladistics 10 (1994) 175).

Address: Singapore Botanic Gardens, National Parks Board, Singapore.

Doi: 10.26492/foS13.2019-03; 19 October 2019 (online & press).

Ecology. Most Southeast Asian species of Loganiaceae are found in the lowlands in wet tropical climates. The species found in this region are all characterised by small and fragrant flowers and are presumably pollinated by insects. The seed dispersal mechanism varies across the family; the local species are likely reliant on wind (*Spigelia*, *Mitrasacme* Labill., *Norrisia* Gardner) and animals (*Strychnos*).

Uses. Many Loganiaceae, especially *Strychnos*, contain toxic alkaloids and are used primarily in the preparation of poisons such as curare (mostly in the New World) and strychnine (in Asia, from *S. nux-vomica* L. and *S. ignatii* P.J.Bergius). Local plants employed in medicine include *Spigelia anthelmia* L. (vermifuge and febrifuge) and *Strychnos ignatii* (tonic and aphrodisiac). *Norrisia* is used as a low value timber (Burkill, Dict. Econ. Prod. Malay Penins. 2 (1935) 1561).

Taxonomy. This treatment follows the circumscription of the Loganiaceae in APG IV (Bot. J. Linn. Soc. 181 (2016) 1–20). Earlier circumscriptions of the family were significantly different (Backlund et al., Amer. J. Bot. 87 (2000) 1029–1043) and included genera subsequently removed to different orders, such as *Buddleja* L. (Scrophulariaceae, Lamiales) or *Sanango* G.S.Bunting & Duke (tentatively in Gesneriaceae, Lamiales) to name a few, or to different families in the Gentianales, as is the case of *Fagraea* Thunb. (Gentianaceae) and *Gelsemium* Juss. (Gelsemiaceae). At present, there are no taxonomic accounts of the Loganiaceae sensu APG IV.

Key to genera

1. Small herbs; at least the upmost leaf pair (sub)sessile, venation pinnate or inconspicuous 2
Climbers, shrubs or trees; all leaves petiolate, venation pinnate or 3–5-nerved 3
2. Leaves < 1 cm long, venation inconspicuous; flower 4-merous, white with yellow-orange longitudinal stripes in the corolla tube **1. Mitrasacme**
Leaves >1 cm long, venation pinnate; flower 5-merous, white with pink-magenta longitudinal markings in the corolla **3. Spigelia**
3. Trees; leaf venation pinnate; inflorescences terminal; stamens entirely exserted **2. Norrisia**
Climbers or shrubs; leaf venation 3–5-nerved; inflorescences axillary or terminal; stamens with at least the filaments included **4. Strychnos**

1. MITRASACME Labill.

(Greek, *mitra*- = mitre, a type of headpiece, *-acme* = apex;
referring to the mitre-shaped corolla)

Nov. Holl. Pl. 1 (1805) 35, t. 49; Brown, Prodr. Fl. Nov. Holland. (1810) 452; Don, Gen. Hist. 4 (1837) 172; de Candolle, Prodr. 9 (1845) 9; Bentham, J. Proc. Linn. Soc., Bot. 1 (1857) 63, 91; Miquel, Fl. Ned.

Ind. 2(3) (1857) 361; Bentham in Bentham & Hooker, Gen. Pl. 2(2) (1876) 790; Clarke in Hooker, Fl. Brit. India 4, fasc. 10 (1883) 79; Solereder in Engler & Prantl, Nat. Pflanzenfam. 4(2) (1892) 35; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 74(2) (1908) 599; Ridley, Fl. Malay Penins. 2 (1923) 413; Leenhouts, Bull. Jard. Bot. État Bruxelles 32 (1962) 440; Leenhouts, Fl. Males., ser. 1, 6(2) (1962) 378; Tirel-Roudet, Fl. Cambodge Laos Vietnam 13 (1972) 78; Conn et al., Fl. Australia 28 (1996) 29; Griffin & Parnell, Fl. Thailand 6(3) (1997) 221; Gibbons et al., Telopea 18 (2015) 495; Struwe et al. in Kadereit & Bittrich (ed.), Fam. Gen. Vasc. Pl. 15 (2019) 521. **Type:** *Mitrasacme pilosa* Labill.

Small herbs with branching stems. **Leaves** opposite and decussate, sometimes forming pseudowhorls of 4 or in rosettes, sessile or nearly so; stipules small and sheathing. **Inflorescences** terminal or subterminal, single- to few-flowered. **Calyx** 4-merous, campanulate, sepals partially fused. **Corolla** 4-merous, campanulate, urceolate or salver-shaped. **Stamens** 4, attached to the inside of the corolla tube, often at the base, included; anthers dorsifixed, thecae parallel, dehiscing longitudinally. **Pistil** superior or semi-inferior; ovary glabrous, bilocular, ovules many; styles 2, apically connate, persistent in fruit; stigma capitate or bilobed. **Fruit** a capsule, (sub)globose, bilocular, dehiscing apically. **Seeds** many, minute.

Distribution. The genus consists of over 55 species, mostly endemic to Australia. The overall distribution extends from temperate Asia to New Caledonia. One species in Singapore.

Ecology. Globally typically found in open places, from sea level to 3000 m. In Singapore only once collected in an urban setting.

Taxonomy. The genus lacks a global revision, although most of it was revised by Conn et al. (Fl. Australia 28 (1996) 29–57). The species occurring outside of Australia are accounted for in the published regional Floras, including Leenhouts (Fl. Males., ser. 1, 6(2) (1962) 378–387) and in an updated checklist by Gibbons et al. (Telopea 18 (2015) 495–502). Conn et al. (Fl. Australia 28 (1996) 29–57) divided the Australian taxa into three subgenera; under this classification, the only Singaporean species belongs to subgenus *Mitrasacme*.

Mitrasacme pygmaea R.Br.

(Latin, *pygmaeus* = pygmy, dwarf; referring to the small size of the plant)

Prodr. Fl. Nov. Holland. (1810) 453; Don, Gen. Hist. 4 (1837) 172; de Candolle, Prodr. 9 (1845) 11; Bentham, J. Proc. Linn. Soc., Bot. 1 (1857) 92; Banks & Sol., Ill. Austral. Pl. Cook's Voy. 2 (1901) t. 108; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 74(2) (1908) 599; Ridley, Fl. Malay Penins. 2 (1923) 413; Leenhouts, Bull. Jard. Bot. État Bruxelles 32 (1962) 452; Leenhouts, Fl. Males., ser. 1, 6(2) (1962) 382; Tirel-Roudet, Fl. Cambodge Laos Vietnam 13 (1972) 84; Conn et al., Fl. Australia 28 (1996) 37; Griffin & Parnell, Fl. Thailand 6(3) (1997) 221; Gibbons et al., Telopea 18 (2015) 500. **Type:** *Brown s.n.*, Australia, Queensland, Port Clinton, 22 August 1802 (holotype BM [BM001209147]). **Fig. 1**

Mitrasacme capillaris Wall. in Roxburgh, Fl. Ind. 1 (1820) 420; Bentham, Hooker's J. Bot. Kew Gard. Misc. 5 (1853) 55. **Type:** *Wallich s.n.* [EIC 4348], Nepal, 1821 (lectotype K-W [K001038781], designated by de Candolle, Prodr. 9 (1845) 12).

Mitrasacme chinensis Griseb., Nov. Actorum Acad. Caes. Leop.-Carol. Nat. Cur., Suppl. 1, 19 (1843) 51. **Type:** *Meyen s.n.*, China, Cap Syng-moon, August (B, presumed lost).

Mitrasacme malaccensis Wight, Icon. Pl. Ind. Orient. 4(4) (1850) 15, t. 1601. **Synonym:** *Mitrasacme pygmaea* R.Br. var. *malaccensis* (Wight) Hara, J. Jap. Bot. 30 (1955) 24. **Type:** *Griffith s.n.*, [Malaysia], Malacca (holotype K [K000450680]).

Mitrasacme polymorpha R.Br. var. *parishii* C.B. Clarke in Hooker, Fl. Brit. India 4, fasc. 10 (1883) 80. **Type:** *Parish 137*, [Myanmar], Tavoy, 1839 (holotype K [K000883397]).

Mitrasacme polymorpha R.Br. var. *grandiflora* Hemsl., J. Linn. Soc., Bot. 26 (1889) 118. **Synonym:** *Mitrasacme pygmaea* R.Br. var. *grandiflora* (Hemsl.) Leenh., Bull. Jard. Bot. État Bruxelles 32 (1962) 455. **Type:** *Playfair 125*, China, Guangdong, Pakhoi, April 1883 (lectotype K [K000883399], designated by Leenhouts, Bull. Jard. Bot. État Bruxelles 32 (1962) 455).

Mitrasacme lutea H.Lév., Repert. Spec. Nov. Regni Veg. 4 (1907) 331, nom. illeg. non F. Muell. (1858). **Type:** *Bodinier 1060*, China, Guangdong, 13 March 1895 (holotype E [E00284736]).

Androsace tonkinensis Bonati, Bull. Soc. Bot. Genève, sér. 2, 5 (1914) 298. **Type:** *Bois 219*, [Vietnam], Tonkin, Yen the a Nha Nam, 13 December 1902 (holotype P [P00639990]).

Mitrasacme polymorpha auct. non R.Br.: Clarke in Hooker, Fl. Brit. India 4, fasc. 10 (1883) 80, p.p.; Ridley, Fl. Malay Penins. 2 (1923) 413, p.p.; Forbes & Hemsley, J. Linn. Soc., Bot. 26 (1889) 118.

Distribution. India to Japan to New Caledonia and throughout Southeast Asia.

Taxonomy. Two varieties are currently recognised of which one, *Mitrasacme pygmaea* R.Br. var. *confertifolia* Tirel, is in China, Cambodia and Vietnam and the type variety is throughout the range of the species.

var. *pygmaea*

Small erect herb to 15 cm high, branched at the base. **Stem** sparsely hirsute, delicate, internodes 0.3–1.2 cm long, or rarely absent and two leaf pairs forming a pseudowhorl of 4 opposite and decussate leaves. **Leaves** (sub)sessile, interpetiolar stipule a limb of thin, sparsely ciliate tissue; lamina narrowly lanceolate to elliptic, 3.5–8 × 1.8–2.5 mm, base attenuate, apex acute to obtuse, glabrous above and beneath, venation obscure above, only the midrib visible beneath. **Inflorescence** terminal or subterminal, 1–4-flowered, glabrescent; peduncle 7–10 cm long; bracts sessile, lanceolate, apex acute, 1.5–2.4 × 1–1.1 mm; pedicels inconspicuous in the central flower of the cyme, 0.5–1 cm long in the lateral. **Calyx** 1.6–2.5 mm long, 4-merous, fused for at least half of its length, glabrous; lobes lanceolate-triangular, apex acute. **Corolla** c. 5.3 mm long, thin, campanulate, glabrous outside, hairy inside, more densely so at mouth where longer hairs are present; tube c. 4.5 mm; lobes c. 0.8 × 1.3 mm. **Stamens** attached c. 1 mm above corolla base; filaments c. 2.5 mm; anthers entirely inserted, c. 0.7 × 0.4 mm. **Pistil** c. 3.5 mm long; ovary globose, 0.8–1 mm long; styles two at base, merging into one apically, c. 2.7 mm long overall, upper part c. 1.7 mm long; stigma capitate or clavate. **Fruit** a globose capsule, 2–2.5 mm diam., dehiscent apically between the two persistent styles. **Seeds** not seen.

Distribution. India to Japan to New Caledonia and throughout Southeast Asia. In Singapore only once collected in Sembawang (*Lee et al. LA18*, 29 May 2003, SING [SING0045034]).

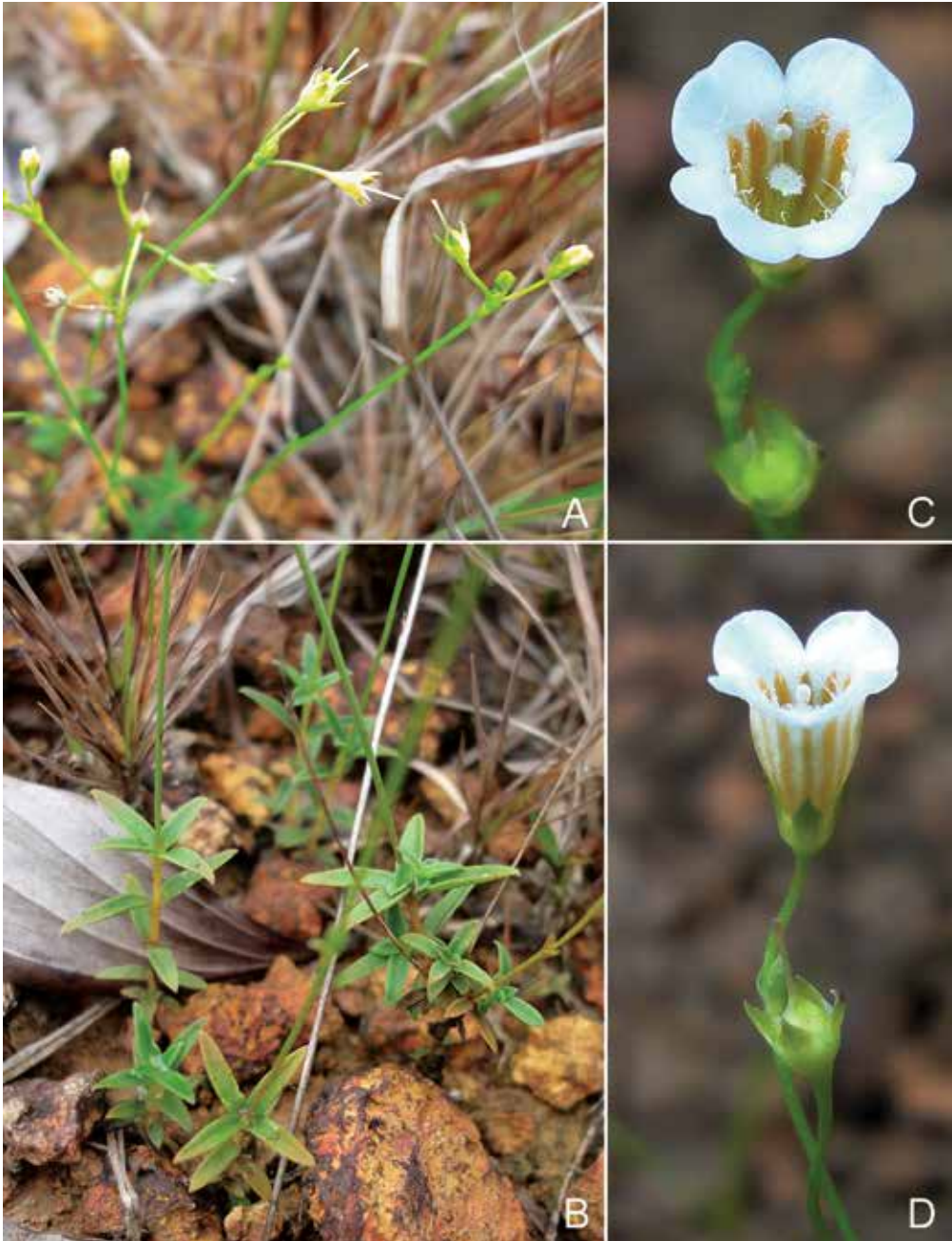


Figure 1. *Mitrasacme pygmaea* R.Br. var. *pygmaea*. **A.** Inflorescences. **B.** Habit. **C.** Apical view of the flower showing details of the indumentum at the mouth of the corolla and the colour inside the tube, the stamens and stigma. **D.** Side view of the corolla. (From Singapore, Sembawang. Photos: K.H. Ong).

Ecology. Globally, a lithophyte in open areas at all elevations. In Singapore only once collected in an urban setting.

Provisional conservation assessment. Globally Least Concern (LC) as it is very widespread and not observed to be in decline. In Singapore possibly Critically Endangered (CR/D) as the population size would appear to be of fewer than 50 plants. There is a possibility, however, that the species is not native which would account for it only having been relatively recently collected for the first time and in an urban environment.

Vernacular name. *Pygmy bishop's hat* (English).

Notes. There are a number of synonyms of *Mitrasacme pygmaea* in the literature that could not be verified but none of these names have been applied to Singaporean or Malaysian material. Their publications postdate the protologue of *Mitrasacme pygmaea* and have no effect on the correct application of the name.

2. NORRISIA Gardner

(Sir William Norris, 1795–1859, Recorder of Penang and plant collector)

Kayu karkaras (Malay)

Hooker's J. Bot. Kew Gard. Misc. 1 (1849) 326; Miquel, Fl. Ned. Ind. 2, fasc. 3 (1857) 358; Bentham in Bentham & Hooker, Gen. Pl. 2(2) (1876) 796; Clarke in Hooker, Fl. Brit. India 4, fasc. 10 (1883) 85; Solereder in Engler & Prantl, Nat. Pflanzenfam. 4(2) (1892) 37; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 74(2) (1908) 601; Ridley, Fl. Malay Penins. 2 (1923) 414; Burkill, Dict. Econ. Prod. Malay Penins. 2 (1935) 1561; Leenhouts, Fl. Males., ser. 1, 6(2) (1962) 341; Kochummen, Tree Fl. Malaya 2 (1973) 274; Wong & Sugau, Tree Fl. Sabah & Sarawak 2 (1996) 220; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 141; Struwe et al. in Kadereit & Bittrich (ed.), Fam. Gen. Vasc. Pl. 15 (2019) 520. **Type:** *Norrisia malaccensis* Gardner

Trees. Twigs hairy. **Leaves** opposite, petiolate; interpetiolar stipule reduced to an ochrea. **Inflorescence** terminal or subterminal, cymose, many times compound and dense, densely tomentose; bracts present and highly variable in size; bracteoles present, and often one of a pair reduced; pedicels very short, flowers often subsessile. **Calyx** quincuncial, almost divided to base, lobes small. **Corolla** 5-merous, trumpet-shaped, fragrant. **Stamens** attached to the corolla mouth, entirely exserted, glabrous; anthers basifixed, thecae parallel, dehiscing longitudinally. **Ovary** globose to oblong, densely hairy at least apically, bilocular, placentation axile, ovules many; style thin and caducous; stigma inconspicuous. **Fruit** a bivalved capsule, each valve splitting into two. **Seeds** few to many, narrowly spindle-shaped.

Distribution. The genus consists of two species occurring in Peninsular Malaysia, Singapore, Sumatra, Borneo and the Philippines. One species in Singapore.

Ecology. Lowland forest, in swamps or along river banks. The flowers are pollinated by insects and the seeds dispersed by wind.

Taxonomy. The two species of *Norrisia*, *N. malaccensis* and *N. major*, can be distinguished by the indumentum of the midrib on the upper leaf surface (present in *N. major*, absent in *N. malaccensis*), the venation (lower secondary veins distinctively looping in *N. malaccensis*, not much so in *N. major*), and in the size of the flowers and fruit (larger in *N. major*, as the name suggests). However, some of the specimens from Peninsular Malaysia present somewhat intermediate features and it is possible that hybrids occur in areas of sympatry, or that perhaps the variability of *Norrisia* needs to be better understood.

***Norrisia major* Soler.**

(Latin, *major* = greater; referring to the larger fruit)

in Engler & Prantl, Nat. Pflanzenfam. 4(2) (1892) 37, as '*maior*'; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 74(2) (1908) 602; Leenhouts, Fl. Males., ser. 1, 6(2) (1962) 341; Kochummen, Tree Fl. Malaya 2 (1973) 274; Turner, Gard. Bull. Singapore 45 (1993) 127, as '*maior*'; Wong & Sugau, Tree Fl. Sabah & Sarawak 2 (1996) 221; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 141; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 226, as '*maior*'; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 64, 144, 209, as '*maior*'). **Synonym:** *Norrisia malaccensis* Gardner var. *major* (Soler.) Ridl., Fl. Malay Penins. 2 (1923) 414. **Type:** *Griffith s.n.*, [Malaysia], Malacca (lectotype K [K000450717, K000450718; exsiccata 3, 4, 5], first step lectotypification Wong & Sugau, Tree Fl. Sabah & Sarawak 2 (1996) 221, second step here). **Fig. 2.**

Norrisia malaccensis auct. non Gardner: Clarke in Hooker, Fl. Brit. India 4, fasc. 10 (1883) 85, p.p.; Bentham in Bentham & Hooker, Gen. Pl. 2(2) (1876) 796, p.p.; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 114, p.p.; Burkill, Dict. Econ. Prod. Malay Penins. 2 (1935) 1561 p.p.

Tree to at least 30 m high, twigs hairy, sparsely to densely lenticellate, ridged. **Leaves:** petioles hairy, 3–8 mm long; lamina lanceolate, elliptic or ovate, occasionally obovate, 3.7–9.8 × 1.4–4.3 cm, base acute to broadly acute, apex obtuse or broadly acute to acuminate, upper surface hairy along midrib, at least basally, glabrous elsewhere except for the sparsely ciliate margin, lower surface hairy along the veins, glabrescent to very sparsely hairy elsewhere on lamina, secondary veins 4–8 pairs. **Inflorescence** terminal or subterminal, thyrsoïd, many times compound, tightly congested, many-flowered, bi-bracteate, hairy throughout; peduncle 2.5–5 cm long; bracts almost as large as leaves or smaller but never inconspicuous, hairy beneath, glabrescent to sparsely hairy above, triangular; pedicels strongly reduced; bracteoles 1 or 2 pairs, sometimes 1 of each pair is reduced, 0.4–0.5 × 0.3–0.5 mm, tightly clasping the receptacle, densely hairy outside, triangular, sessile, glabrous inside, margin ciliate. **Calyx** divided almost to base, densely tomentose on both sides; lobes triangular to ovate, 0.4–0.7 × 0.4–0.6 mm. **Corolla** 8.5–10 mm long, pale yellow, fragrant, fleshy, hairy outside, trumpet-shaped; tube 6.5–7.5 mm long, glabrous inside, sparsely hirsute outside; lobes lanceolate, 2–2.2 × 1.1–1.2 mm, c. 0.3 mm thick, outside more sparsely hairy than the tube, inside glabrescent distally, densely hairy at mouth (long hairs vs hispid elsewhere) forming a ring at the base of the petals. **Stamens** arising between corolla lobes, entirely exerted, glabrous; filaments white flushed pink-red around the base and middle, 4.5–5.5 mm long, 0.1–0.2 mm diam.; anthers 0.5–0.7 × 0.6–0.7 mm. **Pistil** c. 8.5 mm long; ovary green and very densely golden hairy especially above the level of the calyx, 0.7–0.8 mm long, 0.35 mm diam., shortly stipitate;

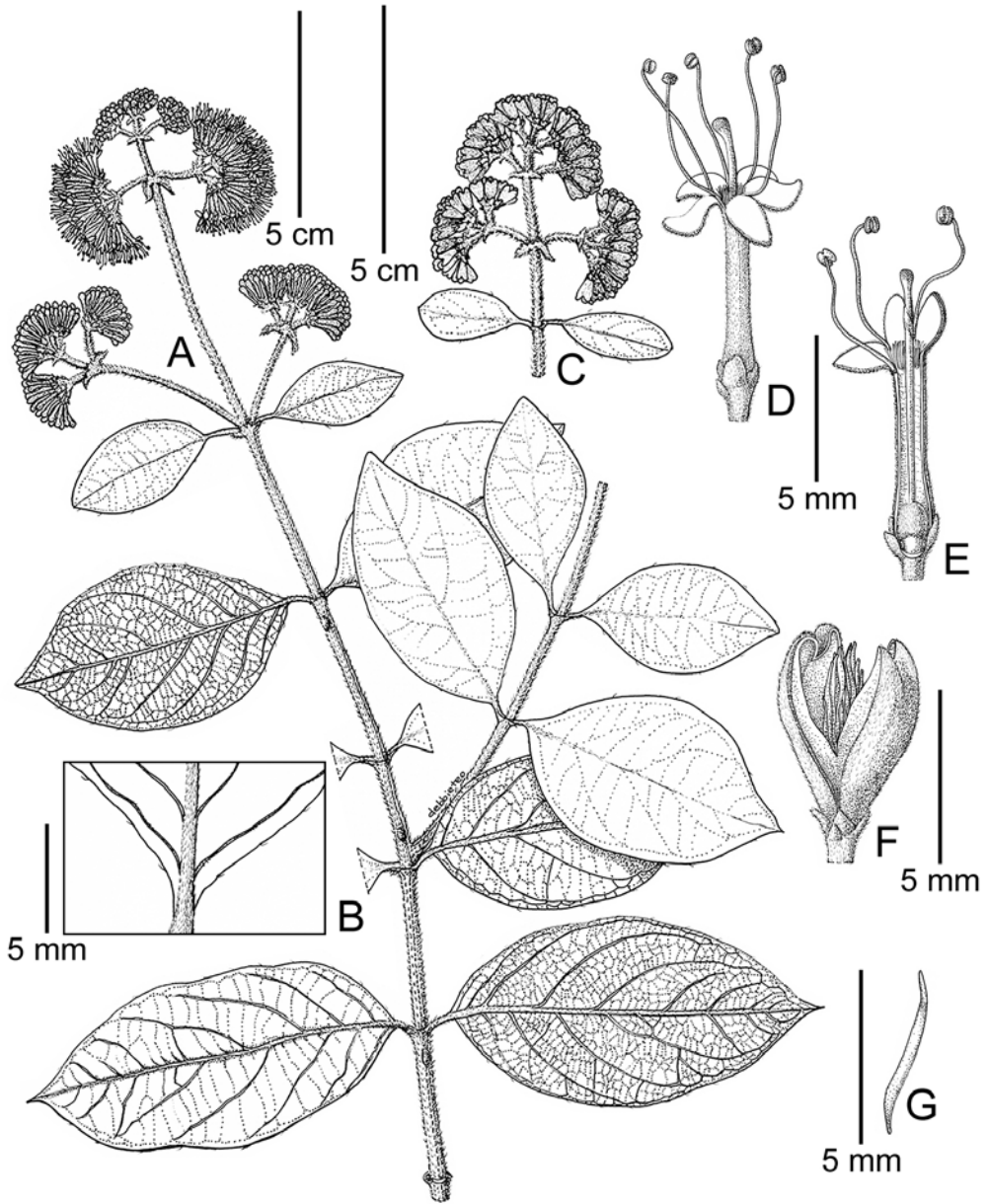


Figure 2. *Norristia major* Soler. A. Habit. B. Detail of the leaf base. C. Detail of the inflorescence. D. Whole flower. E. Dissected flower. F. Dehiscent fruit. G. Seed. (From Singapore, Pulau Tekong, *Lua SING2015-213*. Drawn by D. Teo).

style easily detached from the ovary, c. 7.8 mm long, glabrous, shorter and thicker than the stamens, exerted; stigma capitate and papillose. **Fruit** 5–11 mm long, fusiform to obovoid, narrow at the base, bivalvate, each valve incised, densely hairy. **Seeds** many, irregularly linear, 1.8–4.5 × 0.1–0.4 mm.

Distribution. Peninsular Malaysia, Sumatra, Borneo and the Philippines. In Singapore recent collections have been made from Pulau Tekong (*Samsuri et al.* 271, 3 Jan 2002, SING [SING0039933]), Nee Soon (*Samsuri et al.* NES 76, 8 Jul 2003, SING [SING0045784]) and Mandai (*Gwee SING2010-202*, 26 Jan 2010, SING [SING0146607]). Previously recorded also from Changi (*Ridley s.n.*, 1893, SING [SING0038046]) and the Singapore Botanic Gardens' Rain Forest (*Ridley s.n.*, 1895, K).

Ecology. Primary and secondary lowland forests, along river banks or swamps, or in coastal secondary forest behind mangroves.

Provisional conservation assessment. Globally Least Concern (LC). Listed (under *Norrisia maior*) as Critically Endangered (CR/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 226) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 64, 144, 209).

Uses. The wood is light and used as a low grade timber for temporary constructions (Burkill, Dict. Econ. Prod. Malay Penins. 2 (1935) 1561).

Vernacular name. *Kayu karkaras* (Malay).

Notes. The trees are reported to be buttressed (Leenhouts, Fl. Males., ser. 1, 6(2) (1962) 342). A specimen cited by King & Gamble (J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 74(2) (1908) 602), *Ridley 6828* from Singapore, could not be traced.

In line with the recommendation of Art. 60.6 of the International Code of Nomenclature for algae, fungi, and plants (Turland et al. (ed.), Regnum Veg. 159, 2018), the correct spelling of the specific epithet is *major*. This replaces the original spelling adopted by Solereder and most commonly used in literature, which is *maior*.

The lectotype is part of a mixed collection with two barcodes.

3. SPIGELIA L.

(Adriaan van den Spiegel, or Spigelius, 1578–1625, a Flemish physician and botanist)

Worm grass, West Indian pinkroot (English)

Sp. Pl. 1 (1753) 149; Linnaeus, Gen. Pl., ed. 5 (1754) 74; Brown in Martius, Nov. Gen. Sp. Pl. 2, fasc. 2 (1827) 124; de Candolle, Prodr. 9 (1845) 3; Bentham, J. Proc. Linn. Soc., Bot. 1 (1857) 62; Bentham in Bentham & Hooker, Gen. Pl. 2(2) (1876) 790; Solereder in Engler & Prantl, Nat. Pflanzenfam. 4(2) (1892) 32; Leeuwenberg, Acta Bot. Neerl. 10 (1961) 460; Leenhouts, Fl. Males., ser. 1, 6(2) (1962) 377; Fernández Casas, Collect. Bot. (Barcelona) 24 (1998) 338; Struwe et al. in Kadereit & Bittrich (ed.), Fam. Gen. Vasc. Pl. 15 (2019) 522. **Type:** *Spigelia anthelmia* L.

Pseudospigelia W.Klett, Bot. Arch. 3 (1923) 135. **Type:** *Pseudospigelia polystachya* (Klotzsch) W.Klett (= *Spigelia polystachya* Klotzsch).

Annual or rarely perennial herbs to subshrubs, branching. **Leaves** opposite, petiolate or subsessile, the bases connected, forming a short interpetiolar sheath, sometimes the two apical whorls adjoining and forming a pseudo-whorl of four; lamina pinnately-veined. **Inflorescence** terminal, unilateral spikes, flowers subsessile. **Calyx** 5-merous, divided almost to base, lobes narrow, persistent in fruit. **Corolla** 5-merous, infundibuliform, with lobes shorter than the tube. **Stamens** 5, adnate to the tube, usually included; anthers sub-basifixed, thecae parallel or slightly divergent, dehiscing longitudinally. **Ovary** bilocular; style partially persistent in fruit; stigma expanded. **Fruit** bilocular, each carpel sub-spherical and bivalved, with circumscissile base. **Seeds** rugose and irregular, ejected explosively.

Distribution. 60–70 species native to the American tropics and subtropics and one species naturalised in western Africa and western Malesia, including Singapore.

Ecology. Open, disturbed areas.

***Spigelia anthelmia* L.**

(Greek, *anti-* = against, *-helmia* = worms;
referring to its use as a vermifuge)

Sp. Pl. 1 (1753) 149; Brown in Martius, Nov. Gen. Sp. Pl. 2, fasc. 2 (1827) 130; de Candolle, Prodr. 9 (1845) 7; Solereder in Engler & Prantl, Nat. Pflanzenfam. 4(2) (1892) 34; Leeuwenberg, Acta Bot. Neerl. 10 (1961) 461; Leenhouts, Fl. Males., ser. 1, 6(2) (1962) 378; Fernández Casas, Collect. Bot. (Barcelona) 24 (1998) 339; Fernández Casas, Adumbr. Summae Ed. 31 (2009) 1; Julius et al., Phytotaxa 129 (2013) 43; Chen et al., Gard. Bull. Singapore 70 (2018) 98. **Type:** *Collector unknown s.n.*, Brazil, Cajenna, cultivated Hortus Uppsala (lectotype LINN [Herb. Linn. no. 210.2], designated by Leeuwenberg, Acta Bot. Neerl. 10 (1961) 464). **Fig. 3.**

Spigelia nervosa Steud., Flora 26 (1843) 764. **Synonym:** *Spigelia anthelmia* L. var. *nervosa* (Steud.) Progel in Martius, Fl. Bras. 6(1), fasc. 45 (1868) 262. **Type:** *Hostmann & Kappler 505*, Suriname, 1843 (lectotype P [P00506318], designated here; isolectotypes BM [BM000757909, BM000797508], G [G00368313], GH [GH00107104], K [K000573369], LE n.v., MO n.v., P [P00506319, P00506320], S, W n.v.).

Herb, erect, to c. 50(–130) cm high, branching from the basal nodes. **Stem** grooved at base, less so above, with a very sparse fine indumentum or glabrescent, internodes 1–18 cm long; interpetiolar stipule fully clasping the stem between petioles, 0.2–1.5 mm long, glabrous, thinly chartaceous, apex rounded, sometimes seemingly obtuse or incised. **Leaves** decussate, the basal leaves petiolate and each pair on clearly separate nodes, the two upmost nodes adjoining and resembling a pseudowhorl of 4 sessile leaves; petioles of the basal leaves 1–6(–10) mm long; lamina chartaceous, lanceolate to narrowly so, the basal leaves smaller, 2–5 × 0.8–3 cm, the upper 3–9 × 0.8–3.1(–5) cm, base attenuate, apex acute, indumentum of hispid, conical hairs pointing towards the apex, sparse on the upper surface, more abundant along the margin, and sparsely present only along the main veins on the lower surface of the

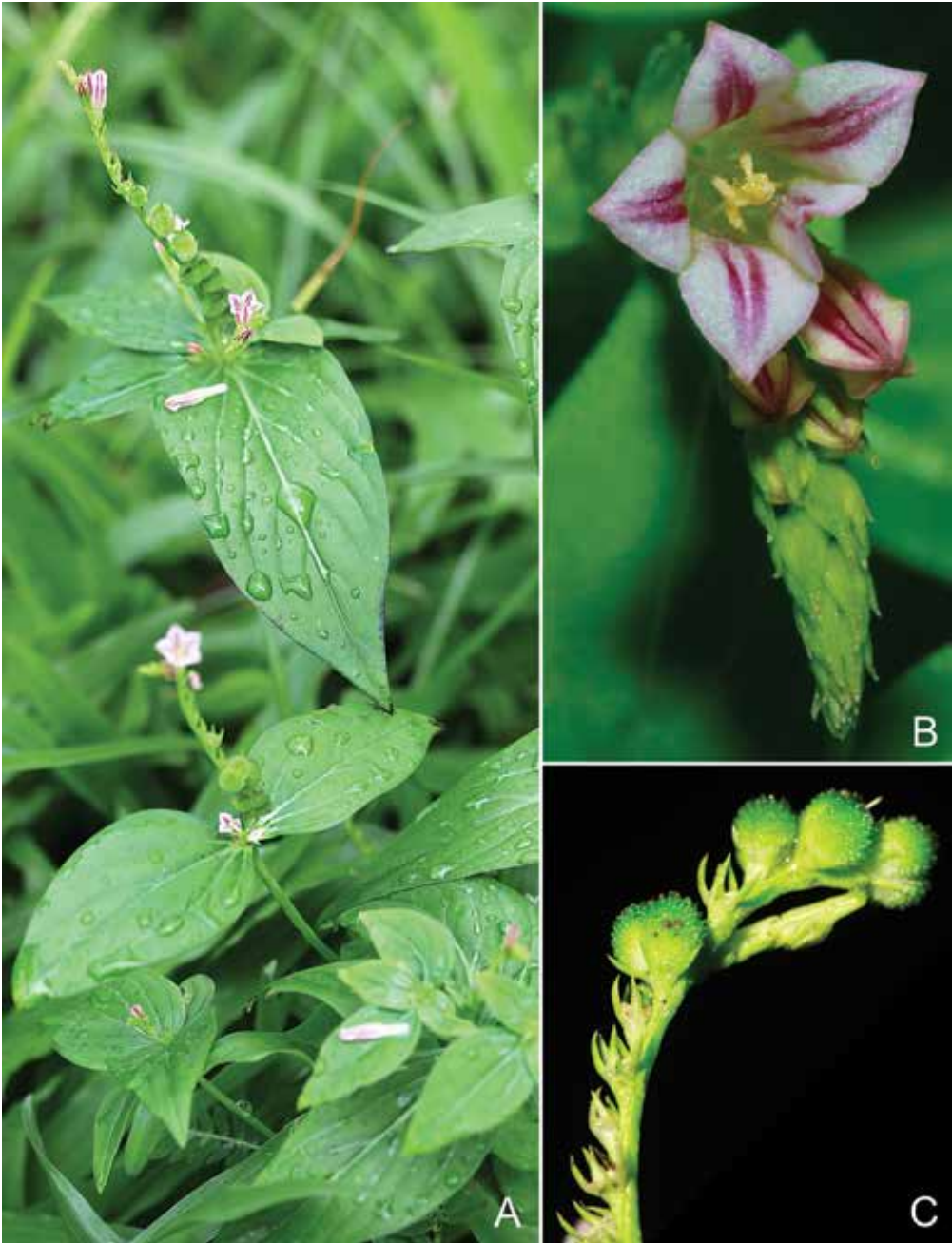


Figure 3. *Spigelia anthelmia* L. **A.** Habit. **B.** Apical view of the flower. **C.** Infructescence. (From Singapore, Bishan Park. Photos: L.M.J. Chen).

large apical leaves, the basal leaves glabrescent beneath, Secondary veins 3–4 pairs in the basal leaves, apical leaves with 5–7 pairs, of which 2–3 pairs arising from the leaf base, all steeply ascending. **Inflorescence** many-flowered terminal spikes, to 15 cm long, with flowers distichously arranged on one side of the floral stem; flowers subsessile; bracteoles 1.5–2 mm long. **Calyx** 2.2–3 mm long, lobes divided to base, narrowly lanceolate, apex acute, margin ciliate with a minute prickle-like indumentum also very sparsely present on the outer surface, glabrous inside. **Corolla** c. 5 mm long, green at the tube base, above white with two narrow reddish pink stripes along the axis of each petal, campanulate, glabrous; tube c. 3.9 mm; lobes c. 1.1 × 1.3 mm (in bud), broadly triangular, apex minutely apiculate. **Stamens** attached to the corolla tube c. 1.3 mm above base, inserted; filaments green, thicker and appendaged at base, c. 2 mm long; anthers yellow, 1.1 × 0.4 mm. **Pistil** c. 4.5 mm long; ovary green, globose, c. 0.3 mm long; style c. 1 mm long, white, persistent; stigma narrowly turbinate, white, c. 3.2 mm long, the upper half with numerous white projections. **Fruit** composed of two globose valves, 3–5 × 5–6 mm, squarrose, the valves splitting from each other and each into two parts at dehiscence, with a circumscissile rhombic portion of the base persistent; bracts and calyx persistent in fruit. **Seeds** 2–5 per valve, deeply rugose, irregularly shaped, 1.2–1.8 mm across, ejected explosively at dehiscence.

Distribution. Native to tropical America, from Florida and Mexico to Peru and Brazil. Naturalised in tropical Africa and Southeast Asia. Widespread in Singapore, where it has been collected at Changi Village (*Ali Ibrahim AI 704*, 29 Jun 2006, SING [SING0074915]), Choa Chu Kang (*Lee & Leong SING2006-112*, 11 Dec 2006, SING [SING0090281]), Hougang (*Ho & Yeo SING2018-408*, 7 Apr 2018, SING [SING0241815]), Bishan (*Chen SING2017-695*, 16 Nov 2017, SING [SING0232228]) and the Central Catchment (*Ho & Yeo SING2017-821*, 24 Dec 2017, SING [SING0232237]).

Ecology. Open or disturbed areas.

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

Uses. *Spigelia anthelmia* is used medicinally as a febrifuge and vermifuge. The plant, however, is toxic and overdosing can have serious adverse effects on humans. *Spigelia anthelmia* is also used as a rat poison and cockroach repellent (Van Valkenburg in Lemmens & Bunyaphrathasara (ed.), PROSEA 12(3) 379).

Vernacular name. *Wormgrass* (English).

Notes. The description here is from the limited Singaporean material but note that Leenhouts (Fl. Males., ser. 1, 6(2) (1962) 378) reports the corolla of *Spigelia anthelmia* to be larger: tube 6.5–15 mm long, lobes 2–2.5 mm long.

The name *Spigelia anthelmia* has numerous synonyms, most of which are illegitimate names which are omitted here. Among the validly published names now in synonymy, typification is incomplete. As the material is all of Neotropical origin, unavailable for the present study, and irrelevant for the purpose of this account, no attempts are made to designate suitable types. Records of synonyms and type information can be found in Leeuwenberg (*Acta Bot. Neerl.* 10 (1961) 461), Gibson (*Fieldiana, Bot.* 24 (8/4) (1969) 293) and Fernández Casas (*Adumbr. Summae Ed.* 31 (2009) 2).

4. STRYCHNOS L.

(Greek, *strukhnos*, name associated with poisonous Solanaceae)

Ipoh akar (Malay)

Sp. Pl. 1 (1753) 189; Linnaeus, Gen. Pl., ed. 5 (1754) 86; de Candolle, Prodr. 9 (1845) 12; Bentham in Bentham & Hooker, Gen. Pl. 2(2) (1876) 797; Clarke in Hooker, Fl. Brit. India 4, fasc. 10 (1883) 86; Solereder in Engler & Prantl, Nat. Pflanzenfam. 4(2) (1892) 37; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 74(2) (1908) 612; Hill, Bull. Misc. Inform. Kew 1917 (1917) 121; Ridley, Fl. Malay Penins. 2 (1923) 422; Burkill, Dict. Econ. Prod. Malay Penins. 2 (1935) 2091; Leenhouts, Fl. Males., ser. 1, 6(2) (1962) 343; Leeuwenberg, Meded. Landbouwhogeschool Wageningen 69 (1969) 17; Tirel-Roudet, Fl. Cambodge Laos Vietnam 13 (1972) 12; Griffin & Parnell, Fl. Thailand 6(3) (1997) 208; Struwe et al. in Kadereit & Bittrich (ed.), Fam. Gen. Vasc. Pl. 15 (2019) 523. **Type:** *Strychnos nux-vomica* L.

Rouhamon Aubl., Hist. Pl. Guiane 1 (1775) 93; de Candolle, Prodr. 9 (1845) 17. **Type:** *Rouhamon guianensis* Aubl. (= *Strychnos guianensis* (Aubl.) Mart.).

Ignatia L.f. Suppl. Pl. (1782) 20; de Candolle, Prodr. 9 (1845) 18. **Type:** *Ignatia amara* L.f. (= *Strychnos ignatii* P.J.Bergius).

Curare Kunth ex Humb., Voyage de Humboldt et Bonpland, Première Partie, Relation Historique, 2 (1819) 549. **Type:** *Strychnos curare* (Kunth) Benth. (= *Strychnos guianensis* (Aubl.) Mart.).

Narda Vell., Fl. Flumin. (1829 [‘1825’]) 108. **Type:** *Narda spinosa* Vell. (= *Strychnos brasiliensis* (Spreng.) Mart.).

Atherstonea Pappe, Silva Cap. ed. 2 (1862) 29. **Type:** *Atherstonea decussata* Pappe (= *Strychnos decussata* (Pappe) Gilg.).

Climbers, sometimes shrubs. **Stems** often with tendrils or thorns, single or paired; intrapetiolar stipule reduced to a scar. **Leaves** opposite, petiolate, node swollen by the petiole base; lamina chartaceous or coriaceous, venation 3–5- to 7-nerved, with lateral pairs of main veins arising from the leaf base or from the lower portion of the midrib, secondary venation subtle but conspicuous, reticulate. **Inflorescences** axillary or terminal, thyrsoid, often compound, floral axes terete or somewhat angular, bracts and bracteoles sessile. **Calyx** 5-merous, lobes almost completely divided to base, often ciliate. **Corolla** 5-merous, campanulate or tubular, small and pale coloured, usually hairy outside, lobes thickened at the tip, often spreading or reflexed, the inside of the corolla can have different types of indumentum, including long, soft hairs towards the base or the centre of the tube, or bristle-like fascicles of hairs at the base of the lobes. **Stamens** attached to the corolla tube, inserted or exerted, with or without indumentum; anthers basifixed, thecae often parallel, dehiscent longitudinally. **Ovary** (1–) 2-locular, ovules many. **Fruit** a berry, globose or ellipsoid, with coriaceous pericarp. **Seeds** 1 to many, more or less lenticular.

Distribution. The genus consists of c. 200 species distributed across the tropics and subtropics. Four species known in Singapore but two sterile specimens in SING (see *Incertae sedis*) likely belong to a different species, unidentifiable without fertile parts.

Ecology. Forests at low elevations, often reaching the canopy. The flower is likely insect pollinated, the seeds are probably dispersed by animals, likely birds.

Taxonomy. The Asian species have tentatively been divided into sections based on the relative lengths of the corolla tube and lobes, and on the indumentum inside the corolla (Hill, 1917). These subdivisions have not, however, been universally accepted (e.g. Leenhouts, Fl. Males., ser. 1, 6(2) (1962) 343–361) and the genus remains in need, both at a regional and global scale, of thorough taxonomic accounts. A detailed study of *Strychnos ignatii* and *Strychnos axillaris* Colebr., both species complexes rather than natural species, is especially necessary.

Key to *Strychnos* species

1. Leaves with indumentum at least along the main veins, petiole depressed and shallowly sulcate, tendril densely hairy if present **3. *S. pubescens***
 Leaves glabrous or glabrescent, petiole terete and deeply sulcate, tendrils glabrous or glabrescent if present 2
2. Corolla tube much shorter than the lobes, leaf coriaceous, apex often acute to acuminate, inflorescence distinctly pedunculate and many times branched, angular **2. *S. maingayi***
 Corolla tube longer than the lobes, leaf chartaceous, apex often acuminate to caudate, inflorescence shortly pedunculate, few times branched, terete 3
3. Corolla lobes nearly as long as the tube, anthers elliptic and corolla lobes lanceolate **4. *S. ridleyi***
 Corolla lobes much shorter than the tube, anthers oblong, lobes linear **1. *S. ignatii***

1. *Strychnos ignatii* P.J. Bergius

(St Ignatius of Loyola, 1461–1556, the founder of the Roman Catholic Jesuit Order)

Mater. Med. 1 (1778) 146; Hill, Bull. Misc. Inform. Kew 1911 (1911) 281; Hill, Bull. Misc. Inform. Kew 1917 (1917) 200; Merrill, Sp. Blancoan. (1918) 306; Burkill, Dict. Econ. Prod. Malay Penins. 2 (1935) 2095; Leenhouts, Fl. Males., ser. 1, 6(2) (1962) 347; Tirel-Roudet, Fl. Cambodge Laos Vietnam 13 (1972) 30; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 141; Turner, Gard. Bull. Singapore 45 (1993) 127; Griffin & Parnell, Fl. Thailand 6(3) (1997) 214; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 226; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 82, 144, 224. **Synonym:** *Strychnos nova* Thell., Bull. Herb. Boissier sér. 2, 8 (1908) 784. nom. inval. **Type:** [Published illustration] Camelli, Philos. Trans. 21(250) (1699) 88, fig. 4–6, lectotype designated by Tirel-Roudet, Fl. Cambodge Laos Vietnam 13 (1972) 32. **Fig. 4.**

Ignatia amara L.f., Suppl. Pl. (1782 [1781?]) 149; de Candolle, Prodr. 9 (1845) 19. **Type:** Not traced.

Strychnos tieute Lesch., Ann. Mus. Hist. Nat. 16 (1810) 479, t. 23; Steudel, Nomencl. Bot., ed. 2, 2, fasc. 12–13 (1841) 648, as '*ticute*'; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 115; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 74(2) (1908) 621; de Candolle, Prodr. 9 (1845) 13; Hill, Bull. Misc. Inform. Kew 1917 (1917) 200. **Type:** *Leschenault 509*, [Indonesia], Java (lectotype P [P00647627], designated by Bisset et al., Lloydia 36 (1973) 194).



Figure 4. *Strychnos ignatii* P.J.Bergius. **A.** Habit. **B, C.** Detail of the exocarp (fruit wall). **D.** Lower leaf surface. **E.** Upper leaf surface. **F.** Terminal bud. (From Singapore, MacRitchie. Photos: Y.S. Yeoh).

Strychnos ovalifolia Wall. ex G.Don, Gen. Hist. 4 (1837) 65, nom. illeg. non Stokes (1812); de Candolle, Prodr. 9 (1845) 13; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 74(2) (1908) 616; Hill, Bull. Misc. Inform. Kew 1917 (1917) 201; Ridley, Fl. Malay Penins. 2 (1923) 425; Burkill, Dict. Econ. Prod. Malay Penins. (1935) 2097; Bisset et al., Lloydia 36 (1973) 190. **Type:** *Wallich s.n.* [EIC 1592], [Malaysia], Penang, 1822 (lectotype K-W [K001113541], designated here; isolectotype K-W [K001113540]).

Strychnos philippensis Blanco, Fl. Filip., ed. 2 (1845) 61. **Type:** *Recoleta s.n.*, Philippines, Bohol (lost). *Wenzel in Merrill Species Blancoanae 631*, Philippines, Leyte, Jaro (neotype K [K001129549], designated by Bisset et al., Lloydia 36 (1973) 191; isoneotype BM, L [L.2688024]).

Strychnos lanceolaris Miq., Fl. Ned. Ind., Eerste Bijv., fasc. 3 (1861) 551; Hill, Bull. Misc. Inform. Kew 1917 (1917) 144; Leenhouts, Fl. Males., ser. 1, 6(2) (1962) 357. **Type:** *Teijsmann HB3659*, [Indonesia, Sumatra], Palembang, Derma, Enim (lectotype U [U0183735], designated by Bisset et al., Lloydia 36 (1973) 185; isolectotype L [L0005238]).

Strychnos maingayi C.B.Clarke var. *fructuosa* C.B.Clarke in Hooker, Fl. Brit. India 4, fasc. 10 (1883) 88; Hill, Bull. Misc. Inform. Kew 1917 (1917) 143; Bisset et al., Lloydia 36 (1973) 194. **Type:** *Maingay 2286* [Kew Distribution 1038], [Malaysia], Penang, February 1867 (lectotype K [K000450685], designated by Bisset et al., Lloydia 36 (1973) 186).

Strychnos beccarii Gilg, Notizbl. Königl. Bot. Gart. Berlin 1 (1897) 267; Hill, Bull. Misc. Inform. Kew 1911 (1911) 291; Bisset et al., Lloydia 36 (1973) 182. **Type:** *Beccari 1580*, [Malaysia], Sarawak, Mattang, May 1866 (lectotype FI [FI013054], designated here; isolectotypes BO n.v., K [K000906508], L [L0005239], M [M-0183886], P [P00647626]).

Strychnos cuspidata A.W.Hill, Bull. Misc. Inform. Kew 1909 (1909) 359; Hill, Bull. Misc. Inform. Kew 1911 (1911) 288; Hill, Bull. Misc. Inform. Kew 1917 (1917) 199, as '*cnspidata*'. **Type:** *Beccari 1348*, [Malaysia], Sarawak, Kuteing [Kuching], February 1886 (lectotype FI [FI013055], designated here; photo with analysis K).

Strychnos pseudo-tieuté A.W.Hill, Bull. Misc. Inform. Kew 1911 (1911) 287. **Type:** *Curtis 1490*, [Malaysia], Penang, April 1888 (lectotype K [K000450682], designated by Bisset et al., Lloydia 36 (1973) 192; isolectotype SING [SING0065707]).

Strychnos balansae A.W.Hill, Bull. Misc. Inform. Kew 1917 (1917) 200. **Type:** *Balansa 2129*, [Vietnam], Tonkin, [Tung Tien], Vallée de Lankok (Mont Bavi), 9 May 1888 (lectotype K [K000906489], designated by Bisset et al., Lloydia 36 (1973) 181; isolectotypes K [K000906490], L [L0005237], P [P00641202, P00641203, P00641204, P00641205]).

Strychnos hainanensis Merr. & Chun, Sunyatsenia 2 (1935) 306; Tirel-Roudet, Fl. Cambodge Laos Vietnam 13 (1972) 32; Bisset et al., Lloydia 36 (1973) 184. **Type:** *How 70677*, China, Hainan, Yaichow, March–July 1933 (lectotype NY [NY00297497], designated here; isolectotypes A [A00076784], K [K000906436], P [P00641201], US [US00112957]).

Strychnos krabiensis A.W.Hill, Bull. Misc. Inform. Kew 1940 (1940) 199. **Type:** *Kerr 18582*, Siam [Thailand], Krabi, Ao Luk, 10 March 1930 (lectotype K [K000906488], designated by Leenhouts, Fl. Males., ser. 1, 6(2) (1962) 349; isolectotype K [K000906487]). Note: under the same number there are also specimens dated 16 March 1930, otherwise bearing identical label information. It is possible that Kerr mistyped the date. These possible isolectotypes are BK [BK257147], BM [BM001014383], C [C10014024], L [L0005236].

Large climber. **Stem** grey-brown, glabrous, conspicuously or inconspicuously lenticellate, the older stems longitudinally fissured, the younger ridged, internodes 1.5–5 cm long; interpetiolar stipule reduced or to 0.2 mm long, ciliate along the margin; tendrils single, glabrous, can lignify with the stem. **Leaves:** petioles glabrous, 2–9 mm long, sulcate, often drying black; lamina chartaceous, elliptic, 4–11.5 × 2–4 cm, base acuminate, attenuate or shortly attenuate, apex caudate or acuminate, glabrous, 3–5-nerved, the inner pair of lateral veins diverging at the leaf base or shortly above, running close to and parallel to the margin, looping inwards in the upper two thirds, the outer pair of lateral veins, if present, almost inconspicuous and looping, secondary veins distinctly prominent above; lamina and veins often dry black. **Inflorescences** axillary thyrses, 9–12-flowered, shorter than the leaves; peduncle 5–6 mm long, glabrous at base and becoming tomentose across its length; bracts sessile, clasping the base of the floral axis, triangular to ovate, 1–1.5 mm long, apex acute, sparsely tomentose; pedicels 0.5–1.5 mm long, much thicker when in fruit; bracteoles 0.3–0.5 mm long, both parts tomentose. **Calyx** divided to base; lobes triangular to ovate, 0.6–0.9 × 0.8 mm, apex broadly acute to obtuse, glabrous inside, minutely tomentose outside, ciliate along the margin. **Corolla** 6–9.2(–17) mm, narrowly tubular (fully mature material in Singapore not seen); tube 4.8–6.5(–12) mm long, minutely tomentose outside, glabrous inside with the exception of a band of long, soft hairs in the middle-lower part of the tube; lobes linear, 1.2–2.7 × 0.6 mm, c. 0.3 mm thick, apex broadly acute, outside minutely tomentose, inside glabrous and somewhat rugose (at least the re-hydrated material). **Stamens** attached to the corolla mouth; filaments extremely reduced; anthers 1–1.3 × 0.4–0.8 mm, acute or acuminate at the apex, glabrous (although one long hair was seen growing from the back of one anther). **Pistil** 5–8.4 mm long; ovary globose, 0.4–0.8 mm long, 0.4–0.6 mm diam., glabrous; style slender, 5–7.5(–12) mm long, glabrous at base, then sparsely woolly hairy above and shortly and densely tomentose in the upper 2/3; stigma capitate and lobate. **Fruit** coriaceous, globose, 4–7(–12) cm diam., smooth, glabrous. **Seeds** not seen, reported to be numerous, compressed, c. 18–35 × 14–20 × 2–10 mm.

Distribution. Throughout South and Southeast Asia. In Singapore recorded from Bukit Timah (*Gwee et al. SING2009-486*, 24 Nov 2009, SING [SING0144218]) and the Central Catchment (*Gwee et al. SING2010-333*, 9 Feb 2010, SING [SING0145777]). Previously also collected in Changi (*Ridley s.n.*, 1890, SING [SING0013370]).

Ecology. Usually in lowland evergreen forest but recorded elsewhere up to 1500 m.

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) 226) and Chong et al. (*Checkl. Vasc. Pl. Fl. Singapore* (2009) 82, 144, 224).

Uses. The seeds (St Ignatius beans) are used for the extraction of strychnine, and in the Philippines they are used as a tonic (Burkill, *Dict. Econ. Prod. Malay Penins.* 2 (1935) 2092). In Malaysia and Indonesia, the roots are used for fish poison or arrow poison. The bark and seeds are used as a febrifuge in the Philippines (Leenhouts, *Fl. Males.*, ser. 1, 6(2) (1962) 347).

Vernacular name. *St Ignatius' bean* (English).

Taxonomy. There are no infraspecific taxa for this species. The full extent of diversity observed across the distribution range calls for a thorough investigation of the species' circumscription.

2. *Strychnos maingayi* C.B. Clarke

(Alexander Carroll Maingay, 1836–1869, British surgeon,
botanist and magistrate in Malacca, Peninsular Malaysia)

in Hooker, Fl. Brit. India 4, fasc. 10 (1883) 88; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 74(2) (1908) 614; Hill, Bull. Misc. Inform. Kew 1917 (1917) 141; Ridley, Fl. Malay Penins. 2 (1923) 423; Leenhouts Fl. Males., ser. 1, 6(2) (1962) 350; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 141; Turner, Gard. Bull. Singapore 45 (1993) 127; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 226; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 82, 144, 212. **Type:** *Maingay* 1975 [Kew Distribution 1041], [Malaysia], Malacca, 21 March 1865–66 (lectotype K [K000450689], designated by Bisset et al., Lloydia 36 (1973) 186; isolectotype L [L0005249]).

Strychnos laurina auct. non Wall. ex A.DC.: Clarke in Hooker, Fl. Brit. India 4, fasc. 10 (1883) 88; Hill, Bull. Misc. Inform. Kew 1917 (1917) 142. p.p.

Climber. **Stem** light brown, glabrous, lenticellate, sometimes densely so, the older stems sometimes longitudinally fissured, the younger ridged; internodes 3.5–5.5 cm long, interpetiolar stipule reduced to a scar; tendrils absent. **Leaves:** petioles glabrous, 3–8 mm long, sulcate, often drying brown; lamina coriaceous, ovate or elliptic, 4–10 × 3–5.5 cm, base broadly acute to obtuse or subcordate, apex acute to acuminate, rarely caudate, glabrous, upper surface glossy, the lower matt and dull, 3–5-nerved, the inner pair of lateral veins diverging at the leaf base or shortly above, ascending steeply, looping inwards in the upper half, the outer pair of lateral veins, almost inconspicuous and looping, secondary veins visible but only subtly prominent above. **Inflorescences** axillary or terminal thyrses, many times compound and many-flowered, shorter or longer than the leaves; peduncle 1–5 cm long, densely tomentose; bracts sessile, clasping the base of the floral axis, triangular to ovate, 1–2.5 mm long, apex acute, sparsely tomentose; pedicels 0.5–1 mm long, much thicker when in fruit; bracteoles to c. 3.5 mm long, both parts sparsely tomentose. **Calyx** almost divided to base, lobes broadly ovate, c. 0.9 mm long, apex obtuse to rounded, glabrous inside, subglabrous outside, ciliate along the margin. **Corolla** 3–4 mm, rotate, glabrous outside, inside long woolly hairy in the mouth; tube 0.5–1 mm, lobes ovate, apex acute. **Stamens** attached to the corolla mouth; filaments 1.5–2 mm long, glabrous, anthers 0.9–1 mm long, bifid at the base, oblong to lanceolate, slightly acuminate, densely hairy. **Pistil** 2.5–3 mm long; ovary ellipsoid, 0.5 mm, glabrous at the base, densely hairy above; style fairly thick, 2–2.5 mm long, hairy in the basal part; stigma capitate. **Fruits** coriaceous globose or slightly oblong, 0.4–2 × 0.5–2.5 cm minutely punctate, glabrescent. **Seeds** not seen, reportedly 1–2.

Distribution. Peninsular Malaysia. In Singapore recorded from Pulau Ubin (*Gwee* GAT 285, 11 Mar 2003, SING [SING0043548]) and Bukit Timah (*Gwee* SING2010-005, 5 Jan 2010, SING [SING0144497]). Previously recorded from Changi (*Ridley* 5645, 1893, BM, K, SING [SING0013369]).

Ecology. Lowland forest.

Provisional conservation assessment. Globally Endangered (EN B2abiii) due to low Area of Occupancy and habitat degradation. Listed as Critically Endangered (CR/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 226) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 82, 144, 212).

Notes. No flowers were seen in this study. The description of the flowers reported above is adapted from King & Gamble (J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 74(2) (1908) 614), Hill (Bull. Misc. Inform. Kew 1917 (1917) 141, with unnumbered illustration) and Leenhouts (Fl. Males., ser. 1, 6(2) (1962) 350).

3. *Strychnos pubescens* C.B. Clarke

(Latin, *pubescens* = pubescent, downy with short soft hairs; presumably referring to the indumentum of leaves)

in Hooker, Fl. Brit. India 4, fasc. 10 (1883) 89; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 115; King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 74(2) (1908) 620; Hill, Bull. Misc. Inform. Kew 1911 (1911) 292; Hill, Bull. Misc. Inform. Kew 1917 (1917) 166; Ridley, Fl. Malay Penins. 2 (1923) 424; Burkill, Dict. Econ. Prod. Malay Penins. (1935) 2098; Bisset et al., Lloydia 36 (1973) 192. **Type:** *Maingay 1974* [Kew Distribution 1040], [Malaysia], Malacca, 1865–66 (lectotype K [K000450701], designated by Bisset et al., Lloydia 36 (1973) 192; isolectotypes A n.v., BO n.v., L [L0005218, L0005219]). **Fig. 5.**

Strychnos axillaris auct. non Colebr.: Leenhouts, Fl. Males., ser. 1, 6(2) (1962) 358 (incl. fig. 30); Tirel-Roudet, Fl. Cambodge Laos Vietnam 13 (1972) 18; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 141; Turner, Gard. Bull. Singapore 45 (1993) 127; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 226; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 82, 144, 198; Chong et al., Gard. Bull. Singapore 70 (Suppl. 1) (2018) 54.

Climber. **Stem** densely hirsute (yellow to rusty brown hairs in herbarium specimens), inconspicuously lenticellate; internodes 0.9–6 cm long, interpetiolar stipule reduced; tendrils single, as hirsute as the stem, becoming thicker as they coil. **Leaves:** petioles with the same indumentum as the stem, 1–8 mm long, depressed and shallowly sulcate, though the groove is hidden under the indumentum; lamina thinly chartaceous, elliptic to ovate in mature leaves, almost round in younger leaves, 1–10.5 × 0.5–5 cm, base obtuse to acute, or subcordate in young leaves, apex acute or acuminate to caudate, upper surface sparsely hirsute, the three inner main veins hairier, lower surface with short, hispid hairs which, in younger and/or well-dried leaves, produce a dark spot at the base, veins slightly hairier, leaf margin ciliate in young leaves, 5-nerved, the inner pair of lateral veins diverging from the midrib much above the base, the outer pair much thinner, close to the margin and diverging either from the leaf base or further up along the leaf margin; apical leaves sometimes larger than the basal. **Inflorescence** axillary or subterminal, thyrsoid in the first few orders of branching, paniculate terminally, congested and many-flowered, shorter than the subtending leaf; peduncle 0.7–1.2 cm long, hairy as on stem; bracts sessile, clasping the floral stems side to side, triangular, to 1.5 mm long, apex

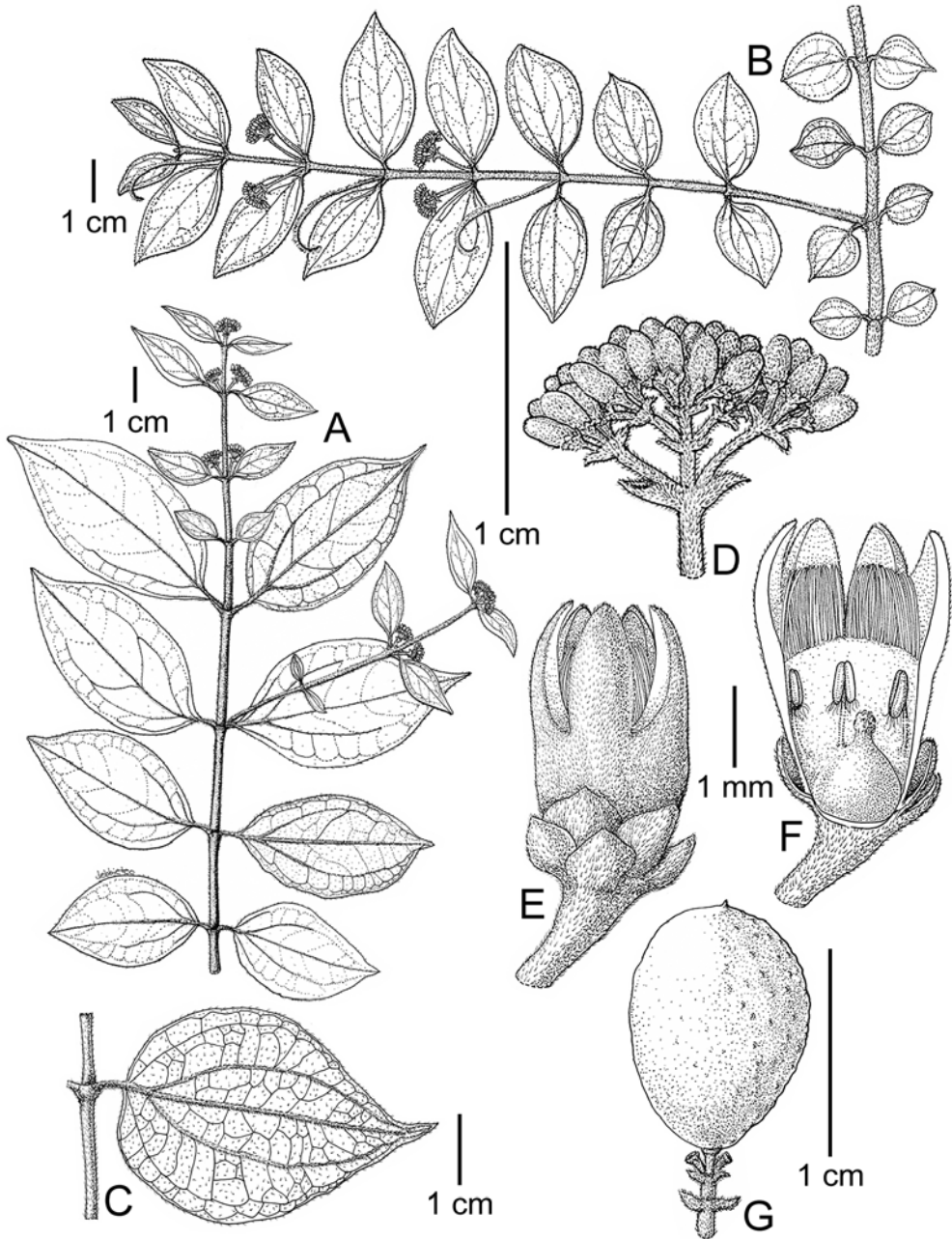


Figure 5. *Strychnos pubescens* C.B. Clarke. **A.** Habit. **B.** Side branch. **C.** Detail of the leaf, abaxial view. **D.** Detail of the inflorescence. **E.** Whole flower. **F.** Dissected flower. **G.** Fruit. (A, C, G from Singapore Botanic Gardens' Rain Forest Ridley 8421; B from Singapore, Nee Soon, *Sinclair 10914*; D–F from Peninsular Malaysia, *Collector unknown RRI 23*. Drawn by D. Teo).

acute, hairy; pedicels and bracteoles strongly reduced. **Calyx** divided to base, quincuncially arranged, lobes elliptic, $0.7 \times 1\text{--}1.1$ mm, apex rounded or obtuse, sometimes irregular, glabrous inside, hairy outside, ciliate at margin. **Corolla** c. 3.5 mm long, campanulate; tube c. 2 mm long; lobes narrowly triangular, c. 1.5×0.7 mm, 0.3 mm thick, minutely papillose outside, glabrous inside except for the mouth with a ring of upwards hairs c. 1 mm long. **Stamens** attached around the middle of the corolla tube, included; filaments 0.2–0.5 mm long, glabrous; anthers $0.6\text{--}0.7 \times 0.3\text{--}0.4$ mm, acuminate at apex, with some soft long hairs at the bottom and sparse short soft hairs near the top, thecae parallel or divergent. Immature **pistil** with a c. 0.5 mm stipe at base; ovary globose, c. 1 mm diam.; style and stigma reduced. **Fruit** ovate to orbicular, shortly apiculate, epicarp sparsely and minutely warty, $9\text{--}13.5 \times 6\text{--}8.5$ mm, uni- or bilocular. **Seeds** lenticular, c. $7 \times 10 \times 1$ mm.

Distribution. Peninsular Malaysia and Borneo. In Singapore the recent collections come from MacRitchie (*Gwee SING2009-755*, 28 Dec 2009, SING [SING0144639]), Nee Soon (*Gwee SING2010-479*, 3 Mar 2010, SING [SING0144745]) and Mandai (*Gwee SING2010-284*, 2 Feb 2010, SING [SING0144271]). Older records extend to Changi (*Goodenough s.n.*, 1892, SING [SING0013360]), Bukit Timah (*Ridley 6317*, 1894, BM, K, SING [SING0013363]) and the Singapore Botanic Gardens' Rain Forest (*Ridley 8421*, 1897, SING [SING0121639]).

Provisional conservation assessment. Globally not assessed due to the need for further taxonomic investigation. Listed (under *Strychnos axillaris*) as Nationally Extinct in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 226) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 82, 144, 198) but, due to recent collections and the estimated number of mature individuals, it is assessed here as Endangered (CR/D).

Vernacular names. *Bedara hutan*, *akar Ipoh* (Malay).

Taxonomy. This species is resurrected from synonymy under *Strychnos axillaris*. The two species differ most noticeably in the overall appearance of the leaves ('dotted' in *Strychnos pubescens*, merely tomentose in *S. axillaris*). The leaves of *Strychnos pubescens* are generally smaller than those of *S. axillaris*; the calyx is glabrous and ciliate in *Strychnos axillaris*, pubescent and ciliate in *S. pubescens*. Leenhouts (Fl. Males., ser. 1, 6(2) (1962) 358) synonymised a number of species from Malaysia and its immediate neighbours into *Strychnos axillaris*, a species originally described from Silhet in Bangladesh. Given the variability in the existing descriptions for the floral characters of these synonyms it is possible that there needs to be further splitting of the broadly recognised *Strychnos axillaris*.

4. *Strychnos ridleyi* King & Gamble

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

King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 74(2) (1908) 621; Hill, Bull. Misc. Inform. Kew 1917 (1917) 167; Ridley, Fl. Malay Penins. 2 (1923) 424; Leenhouts, Fl. Males., ser. 1, 6(2) (1962) 360; Bisset et al., Lloydia 36 (1973) 192; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 141;

Turner, Gard. Bull. Singapore 45 (1993) 127; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 226; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 82, 144, 187. **Type:** *Ridley 6313*, Singapore, Toas [Tuas], 4 May 1894 (lectotype K [K000450697], designated by Bisset et al., *Lloydia* 36 (1973) 192; isolectotype SING [SING0045450]).

Slender shrub/climber. **Stem** almost black, sparsely pubescent, inconspicuously lenticellate, internodes 1.1–5.8 cm long; interpetiolar stipule reduced; tendrils single, glabrescent and lenticellate. **Leaves:** petioles as pubescent as the stem, 3–10 mm long, narrowly sulcate adaxially; lamina chartaceous, ovate, 3–9.5 × 1.5–4.7 cm, base obtuse, apex acuminate to slightly caudate, glabrescent, 3–5-nerved, all nerves diverging from the lamina base, the outer pair of main veins usually inconspicuous and looping. **Inflorescence** axillary, thyrsoid, 3–c. 20-flowered, congested, shorter than the leaf; peduncle 4–7 mm long (reportedly to 1 cm), pubescent; bracts and bracteoles sessile, amplexicaule, triangular, to 1.5 mm long, hairy on both surfaces, densely ciliate; pedicels to 2 mm long, sparsely pubescent. **Calyx** divided to base, lobes broadly triangular-elliptic, 0.6 × 1 mm, apex obtuse to rounded, glabrescent on both surfaces (reportedly hairy inside), ciliate at margin. **Corolla** 2.7–3.5 mm (to 4 mm according to literature), tubular-campanulate; tube 1.8–2 mm long (reportedly 2.5 mm), glabrous outside, sparsely tomentose inside, lobes lanceolate, c. 1.3–1.7 × 0.6–0.7 mm, glabrous outside, densely hairy with upward-pointing hairs inside. **Stamens** attached to the corolla tube just above the ovary, inserted, filaments c. 0.2 mm long, sparsely hairy, anthers c. 0.5–0.6 × c. 0.3 mm, apex acuminate, slightly hairy at base, thecae parallel. **Pistil** immature. **Fruit** and **seeds** not seen.

Distribution. Endemic to Singapore but now presumed extinct. It has been collected in Tuas (*Ridley 6313*, 4 May 1894, SING [SING0045450]). There is a second collection from ‘Pulau Sugei’ (*Goodenough s.n.*, 1891, SING [SING0011374],) although the locality could not be traced.

Provisional conservation assessment. Globally extinct. There are no records of this species outside of Singapore, where it was last collected in 1894.

Notes. The plant dries black and appears shiny throughout.

Incertae sedis

Strychnos cf. axillaris Colebr. – *Ridley 13001*, Singapore, Gardens’ Jungle [Singapore Botanic Gardens’ Rain Forest], 10 Feb 1907 (BM, K, SING [SING0055043, SING0067432]).

This problematic specimen is not in good condition and most diagnostic features are missing. It has previously been assigned to *Strychnos malaccensis* Benth. by Ridley (J. Straits Branch Roy. Asiat. Soc. 33 (1900) 115), Hill (Bull. Misc. Inform. Kew 1917 (1917) 177) and Ridley (Fl. Malay Penins. 2 (1923) 425). It was later ascribed to *Strychnos axillaris* by Leenhouts (Identif. Lists Males. Specimens 18 (Loganiaceae) (1962) 262). The plants have some indumentum along the venation but do not match *Strychnos pubescens*, into which all other Singaporean material formerly assigned to *S. axillaris* has now been placed. The most immediate difference from *Strychnos pubescens* is the more robust architecture and coriaceous

and glossy leaf texture. Correct placement of this collection requires better collections of the same taxon and a reassessment of the *Strychnos axillaris* complex in Peninsular Malaysia.

Strychnos aff. maingayi C.B.Clarke – There are two sterile specimens in SING [SING0145751, SING0144847] which do not fully match any of the other known species. Without any flowering material it is impossible to assign these specimens to species or even to a group of taxa. The stems are lenticellate and without tendrils. The leaf blades are narrowly elliptic to lanceolate with a caudate apex, trinerved with the lateral veins steeply ascending from the base of the lamina, and the leaf is entirely glabrous. The petioles are sulcate and hairy, especially on the abaxial side.

