

REVISION OF SCHRADERA (RUBIACEAE–SCHRADEREAE) IN MALESIA

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SUMMARY

A taxonomic revision of the Asiatic taxa of *Schradera* Vahl (formerly known as *Lucinaea* DC.) is presented. 16 species are recognized. Two new species (*S. grandiflora*, *S. pseudonervulosa*) are described from Borneo. The new name *S. elmeri* is published for the Philippine endemic previously known as *Lucinaea involucrata*. Two new subspecies are recognized in *S. korthalsiana* (subsp. *korthalsiana* and subsp. *robusta*) and three in *S. membranacea* (subsp. *membranacea*, subsp. *flagellarioides*, and subsp. *parvifolia* comb. & stat. nov.).

INTRODUCTION

In a recent paper (Puff et al., 1993), the conclusion had been reached that the Asiatic (Malesian) genus *Lucinaea* DC. cannot be upheld but is to be included in the genus *Schradera* Vahl which was previously thought to be neotropical. At that time, the two genera were formally merged, but no new combination of any Asiatic species was published because only a selection of the available material had been studied.

The present revision of the Asiatic taxa is to be seen as a follow-up to this earlier article.

MATERIAL AND METHODS

Material from the following herbaria was studied: AAU, BM, BRUN, GH, HBG, K, KEP, L, SAN, SING, W, WU (abbreviations according to Holmgren et al., 1990).

A note on distribution ranges and maps: The Kort Mapping System, Version 10.2.1995, a computer programme provided by Bertel Hansen, Botanical Museum, Copenhagen, was used to draw the included distribution maps. As longitude and latitude of collecting localities could not always be established (especially of some Sumatran and New Guinean localities), it is to be noted that the distribution maps provided may not in all cases reflect the complete range of a taxon. A full listing of specimens seen is, however, appended for each taxon.

SCHRADERA

Schradera Vahl, *Eclog. Amer.* 1 (1796) 35 & t. 5, nom. cons., non *Schradera* Heister ex Medicus (1791), nec Willd. (1798); DC., *Prodr.* 4 (1830) 443; A. Rich., *Mém.* (1830) 149; Hook. in Benth. & Hook., *Gen. Pl.* 2 (1873) 66; K. Schum. in Engl. & Prantl, *Nat. Pflanzenfam.* 4, 4 (1891) 64; Standl., *Publ. Field Mus. Nat. Hist., Bot. Ser.* 7 (1930) 40; (1931) 383; 13 (6) (1936)

74; Steyerl., Fl. Venezuela 9 (1) (1974) 429; Dwyer, Ann. Missouri Bot. Gard. 67 (1980) 490. — Typus generis: *Schradera capitata* Vahl, nom. superfl. = *Fuchsia involucrata* Swartz (1788) = *Schradera involucrata* (Swartz) K. Schum.

Urceolaria Willd. in Cothenius, Disp. Veg. Meth. (1790) 10; J.F. Gmel., Syst. Nat. 2 (1791) 390, nom. rejic. vs. *Schradera* Vahl. — Typus generis: *Urceolaria exotica* J.F. Gmel. = *Schradera exotica* (J.F. Gmel.) Standl.

Lucinaea DC., Prodr. 4 (1830) 368; Endl., Gen. Pl. (1838) 558 ('*Lucianea*'); Korth., Nederl. Kruidk. Arch. 2 (1851) 166; Miq., Fl. Ind. Bat. 2 (1857) 197; Ann. Mus. Bot. Lugd.-Bat. 4 (1869) 187 ('*Lucinea*'); Hook. in Benth. & Hook., Gen. Pl. 2 (1873) 67; Fl. Brit. India 3 (1880) 93; Baill., Hist. Pl. 7 (1880) 455; K. Schum. in Engl. & Prantl, Nat. Pflanzenfam. 4, 4 (1891) 64; Boerl., Handl. Fl. Nederl. Ind. 2, 1 (1891) 56. — Typus generis: *Lucinaea morindae* DC., nom. superfl. = *Morinda polysperma* Jack (1820) = *Lucinaea polysperma* (Jack) K. Schum.

Uncariopsis Karsten, Linnaea 30 (1859) 152; Hook. in Benth. & Hook., Gen. Pl. 2 (1873) 67. — Typus generis: *Uncariopsis suaveolens* Karsten = *Schradera suaveolens* (Karsten) Steyerl.

Scandent *epiphytic shrubs*, older stems usually clinging to tree trunks by means of adventitious roots produced in rows along the internodes; ultimate, fertile branches usually unattached to the host plants (and then normally without adventitious roots); seldom plants also terrestrial. *Leaves* opposite, petiolate, blades coriaceous to (less commonly) membranaceous, glabrous or variously hairy, venation brochidodromous. *Stipules* interpetiolar, fused below to form a basal sheath and free above, ovate to (broadly) triangular to \pm linear, entire or seldom bifid at the tip, occasionally large and foliaceous, basally with colleters on the adaxial side; usually caducous. *Inflorescences* on short to \pm long, mostly straight peduncles, capitate to capitate-globose; solitary or sometimes 2–6 together in an umbel-like arrangement; terminal and sometimes also seemingly axillary (because the inflorescences are pushed aside by sylleptically growing renewal shoots; sympodial-monochasial branching); mostly many-flowered, but occasionally few- or even 1-flowered; subtended by an inconspicuous to conspicuous, \pm dish- to cup-shaped involucre. *Flowers* heterodistylous, 3–5-merous. Calyx made up of a short cylindrical tube, truncate above (distinct calyx lobes absent); usually quite fleshy in nature. Corolla funnel-shaped, the tube shorter to longer than the spreading to recurved lobes (tubes of long-styled morphs often longer than in short-styled morphs); lobe apices \pm hood-like; outside of corolla always glabrous, inside mostly with stiff, straight hairs at and around the throat, frequently also a ring of soft, curled hairs in the tube; occasionally hairy scales present on the inside of the tube. Stamens with linear and \pm sagittate anthers (often with short apical connective appendages), dorsimedi- or basifixed, filaments filiform or sometimes broadened, occasionally hairy, short (anthers entirely included in the tube in long-styled morphs) or longer (anthers fully or at least semi-exserted in short-styled morphs). Gynoecium bicarpellate (very rarely and atypically tricarpellate), with a common style, glabrous, a little hairy or (seldom) densely hairy (indumentum often different in long- and short-styled morphs; the latter often less hairy), and a bi- (very rarely tri-)lobed stigma beset with very short to longish papillae; stigma lobes included in the tube in short-styled, \pm exserted to distinctly exserted in long-styled morphs; ovary bilocular (very rarely trilocular), multiovulate, placentas large, attached to middle of septum. Roof of the ovary with a ring-like, conspicuous, persistent disk. *Fruits* baccate, fruit wall soft, parenchymatic, with numerous raphide-containing idioblasts; crowned by persistent disk and calyx, the latter as fleshy as the fruit. *Seeds* numerous, small (usually \pm 1 mm), laterally compressed, \pm irregularly shaped (variously angular to suborbicular); exotesta cells

± rectangular to polygonal, with thickened radial walls; embryos small, embedded in copious endosperm.

Pollen — Small to medium-sized, 24–42 µm (non-acetolyzed; 17–26 µm in acetolyzed material), oblate spheroidal to spheroidal, 2–3(–4)-porate to -brevicolporate, exine reticulate to microreticulate (lumina 0.5–1.5 µm in diam.), heterobrochate, with or without suprategal elements; pollenkitt present; binucleate.

Pollen-dimorphism related to heterostyly: in long-styled morphs exine microreticulate without any suprategal elements or with just a few suprategal scabrae on the muri, brochi often smaller than in short-styled morphs; in short-styled morphs exine reticulate with suprategal scabrae on the muri or without any suprategal elements,

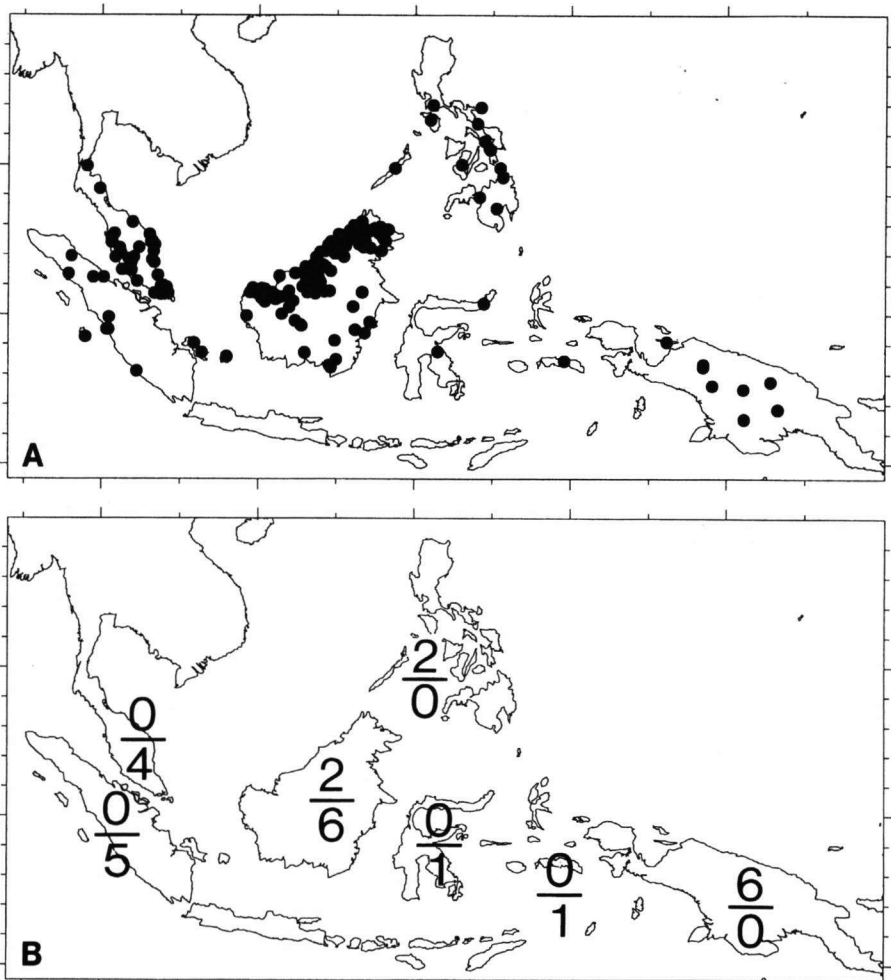


Fig. 1. A: distribution of *Schradera* Vahl in Malaysia. — B: species density (above the hyphen the number of endemic, below it the number of non-endemic species in each island or island group; infraspecific taxa not considered).

brochi often larger than in long-styled morphs. This pollen dimorphism does, however, not appear to be universally present. — See Puff & Buchner (1998) for further details.

Chromosome number — Diploid; $x = n = 11$ (data from 1 Asiatic and 1 South American species; Puff et al., 1993).

Distribution — Southeast Asia (Fig. 1A, Table 1): from Sumatra, Peninsular Thailand and Peninsular Malaysia to Borneo, the Philippines, Sulawesi, Moluccas (Seram) and New Guinea.

Table 1. Distribution of *Schradera* in Southeast Asia. — Sequence of taxa as in the text. (E): endemic to an island (group).

	Sumatra	Pen. Malaysia (* + Pen. Thailand)	Borneo	Sulawesi	Seram	Philippines	New Guinea
<i>S. polysperma</i>	+	+	+				
<i>S. grandiflora</i>			+				
<i>S. monocephala</i>						+	
<i>S. membranacea</i>							
subsp. <i>membranacea</i>	+	+	+				
subsp. <i>flagellarioides</i>			+				
subsp. <i>parvifolia</i>			+				
<i>S. novoguineensis</i>							+
<i>S. montana</i>	+		+	+			
<i>S. pentacme</i>			+				
<i>S. korthalsiana</i>							
subsp. <i>korthalsiana</i>	+	+	+				
subsp. <i>robusta</i>			+				
<i>S. elmeri</i>						+	
<i>S. nervulosa</i>	+	+	+				
<i>S. pseudonervulosa</i>			+		+		
<i>S. ledermannii</i>							+
<i>S. acutifolia</i>							+
<i>S. schlechteri</i>							+
<i>S. monantha</i>							+
<i>S. ramiflora</i>							+
Summary:							
<i>Schradera</i> species							
endemic	0	0	2	0	0	2	6
non-endemic	5	4	6	1	1	0	0
(infraspecific taxa not considered)							

The highest concentration of taxa (species and subspecies) is found in Borneo, followed by New Guinea (in contrast to Borneo, however, all of its species are endemic) (Fig. 1B, Table 1).

Many species tend to have wide distribution ranges (Peninsular Malaysia – Sumatra – Borneo), although there are exceptions, e.g., the New Guinean endemics, or *S. pentacme* (only in some high mountains of Sabah and Sarawak). The widely distributed species often show starting local differentiation; in most cases morphological differences are too vague to deserve taxonomic recognition, in some they are recognized as geographical (ecological) subspecies. In some widely distributed species, there are \pm distinct morphological ‘forms’ (not formally recognized) which show up independently in different parts of their ranges.

New Caledonia is now no longer part of the genus’ distribution range, and the number of taxa recorded for New Guinea is drastically lower than previously believed (cf. map, Fig. 11b in Puff et al., 1993, which had been based on literature data only) because several species described as ‘*Lucinaea*’ proved to be *Morinda*.

Critical remarks — The above generic description is based primarily on Asiatic material; a detailed investigation of the New World taxa may require some modification of the generic diagnosis.

Field notes, particularly on the plant’s habit, are often unreliable, inaccurate, and even highly misleading. Not uncommonly, information on the host tree – rather than the *Schradera* growing on it – is given. Too superficial field observation lead to descriptions of the plants as ‘trees’ or ‘treelets’. In order to avoid any confusion, habit information has been omitted from the species descriptions (except for taxa observed in the field by C.P.).

KEY TO THE ASIATIC SPECIES AND SUBSPECIES

Taxa with variable characters (e.g., inflorescences solitary or in an umbel-like arrangement) are keyed out more than once. Characters not easily seen in herbarium specimens (e.g., the soon deciduous stipules which are sometimes even no longer present on the youngest parts) are avoided as much as possible.

- 1a. Inflorescences 1–4-flowered. — New Guinea only 2
- b. Inflorescences more-flowered (if few-flowered, plants neither with the characters given in couplets 2 and 3 nor occurring in New Guinea) 4
- 2a. Leaf blades 15–50 mm and petioles 5–10 mm long 3
- b. Leaf blades 80–100 mm and petioles 10–22 mm long on long shoots (smaller on abbreviated short shoots); inflorescences 2–4-flowered; corolla > 10 mm long 13. *S. acutifolia*
- 3a. Leaf blades 15–35 mm long; inflorescences 2–4-flowered 14. *S. schlechteri*
- b. Leaf blades 40–50 mm long on long shoots (smaller on abbreviated short shoots); inflorescences always one-flowered 15. *S. monantha*
- 4a. Inflorescences cauli(rami)florous. — New Guinea 16. *S. ramiflora*
- b. Inflorescences terminal (and pseudo-axillary) 5
- 5a. Stipules large and leaf-like, 20–35 × 10–25 mm 6
- b. Stipules smaller, never distinctly leaf-like 7

- 6a. Inflorescences usually 10–20-flowered; inside of corolla lobes and throat hairy, corolla tube without scales on the inside. — Borneo, Moluccas (Seram) 11. **S. pseudonervulosa**
- b. Inflorescences 30–40-flowered; corolla lobes and throat glabrous, inside of tube with broadly triangular, pubescent scales (1 × 1 mm) near base. — New Guinea only 12. **S. ledermannii**
- 7a. Inflorescences 2–6, in an umbel-like arrangement 8
- b. Inflorescences solitary 11
- 8a. Leaves thin, membranaceous, reddish in dried material; flowers small, corolla always < 10 mm long 4a. **S. membranacea** subsp. **membranacea**
- b. Leaves thick, coriaceous; flowers often larger, corolla seldom < 10 mm long 9
- 9a. Peduncles 10–15 mm long; corolla 22–28 mm long; stipules ovate, 4–6 mm long. — Borneo only 2. **S. grandiflora**
- b. Peduncles usually 20–50 mm long, corolla up to 22 mm long, never longer; stipules broadly ovate or triangular 10
- 10a. Stipules broadly ovate; corolla 15–22 mm long; style densely hairy (in long-styled) or with few hairs (in short-styled morphs). — Philippines only 3. **S. monocephala**
- b. Stipules triangular; corolla < 15 mm long; style with few hairs (in long-styled) or completely glabrous (in short-styled morphs). — From Sumatra, Peninsular Thailand and Peninsular Malaysia to Borneo 1. **S. polysperma**
- 11a. Leaves thin, membranaceous; flowers small, corolla always < 10 mm long . . 12
- b. Leaves thick, coriaceous 14
- 12a. Leaves 23–58 × 11–22 mm, elliptic, glabrous on both sides, length to width ratio 2–4:1; petioles, stipules and peduncles glabrous; peduncles (1–)3–4 mm long. — Borneo 4b. **S. membranacea** subsp. **parvifolia** (large-leaved forms)
- b. Leaves longer, lanceolate or linear-lanceolate, length to width ratio > 3:1 . 13
- 13a. Leaves long linear-lanceolate, (60–)90–120 × (12–)15–21 mm, length to width ratio 4–6.5:1; inflorescences 5–10 mm in diam. — Borneo 4c. **S. membranacea** subsp. **flagellarioides**
- b. Leaves lanceolate, 60–105(–120) × 22–35 mm, length to width ratio 3–4:1; inflorescences 10–15 mm in diam. — New Guinea 5. **S. novoguineensis**
- 14a. Leaves 23–38 × 11–16 mm, length to width ratio 2–2.5:1, elliptic, glabrous on both sides; petioles, stipules and peduncles glabrous; peduncles (1–)3–4 mm long. — Borneo . . 4b. **S. membranacea** subsp. **parvifolia** (small-leaved forms)
- b. Leaves > 40 mm long 15
- 15a. Stipules large, 10–20 mm long, broadly triangular, often soon caducous; inflorescences 10–30 mm in diam.; corolla 14–19 mm long; fruits 5–8 mm in diam.; lower leaf surface often with black dots 10. **S. nervulosa**
- b. Stipules < 10 mm long 16
- 16a. Corolla > 15 mm long 17
- b. Corolla < 15 mm long 18
- 17a. Peduncles 20–50 mm long; corolla 15–22 mm long; stipules broadly ovate. — Philippines only 3. **S. monocephala**
- b. Peduncles 10–15 mm long; corolla 22–28 mm long; stipules rounded or broadly triangular. — Borneo only 2. **S. grandiflora**

- 18a. Inflorescences 5–10-flowered, involucre small and inconspicuous; corolla 9–13 mm long; leaf margins recurved, lower leaf surface, \pm yellowish with black dots. — Borneo only **7. *S. pentacme***
 b. Not this combination of characters 19
- 19a. Involucre conspicuous, higher than half the diameter of an inflorescence; leaves 55–80 \times 20–35 mm, margins recurved, lower surface with black dots. — Philippines only **9. *S. elmeri***
 b. Involucre inconspicuous, less than half the diameter of an inflorescence; leaf margins flat. — Not in the Philippines 20
- 20a. Leaf blades usually only up to 30 mm wide, lower surface occasionally with black dots; peduncles (5–)10–20(–30) mm long **6. *S. montana***
 b. Leaf blades usually 30–60 mm wide, lower surface with black dots; peduncles 5–10 mm long 21
- 21a. Petioles 10–15 mm long; inflorescences 5–10 mm in diam., 5–10-flowered ..
 **8a. *S. korthalsiana* subsp. *korthalsiana***
 b. Petioles 15–25 mm long; inflorescences 10–15 mm in diam., 10–20-flowered
 **8b. *S. korthalsiana* subsp. *robusta***

THE TAXA

A note on the arrangement of taxa: Morphological character state combinations allow the distinction of five informal ‘species groups’, namely:

1. *Schradera polysperma* Group:

Characterized by thick coriaceous leaves, inflorescences often in an umbel-like arrangement, and relatively large flowers. — Species 1–3.

2. *Schradera membranacea* Group:

Characterized by thin membranaceous leaves and small, mostly relatively few-flowered inflorescences. — Species 4–5.

3. *Schradera montana* Group:

Characterized by relatively small flowers. — Species 6–9.

4. *Schradera nervulosa* Group:

Characterized by relatively large leaves and stipules, the latter often leaf-like. — Species 10–12.

5. Group of isolated New Guinean endemics:

A possibly heterogeneous group of taxa without obvious close alliances to the other Asiatic species. Characterized by either few- to 1-flowered inflorescences and a long-/short-shoot differentiation (sometimes accompanied by \pm dimorphic leaves) (Species 13–15), or by unique rami- to cauliflorous inflorescences (Species 16). — Species 13–16.

1. *Schradera polysperma* (Jack) Puff, Buchner & Greimler, *comb. nov.* — Fig. 2

Morinda polysperma Jack, Mal. Misc. 1 (1820) 14; Roxb., Fl. Ind. (ed. Carey & Wallich) 2 (1824)

204. — Type: *Jack* (holo ?CAL; CAL did not respond to a loan request), Singapore.

Lucinaea polysperma (Jack) K. Schum. in Engl. & Prantl, Nat. Pflanzenfam. 4, 4 (1891) 64.

- Lucinaea morindae* DC., Prodr. 4 (1830) 368; Miq., Fl. Ind. Bat. 2 (1857) 198; Ann. Mus. Bot. Lugd.-Bat. 4 (1869) 187; Hook., Fl. Brit. India 3 (1880) 93; King [Materials Fl. Malay. Penins. XX] in J. As. Soc. Bengal 72 (1903) 179; Ridl., Fl. Malay Penins. 2 (1923) 56. — Type: no specimens cited; ?perhaps 'Penang et Singapore', 1822, *Wallich Cat.* 8437 (K) [p.p. as '*L. morinda*'].
- Lucinaea paniculata* King, J. As. Soc. Bengal 72 (1903) 177; Ridl., Fl. Malay Penins. 2 (1923) 56. — Types: *Scortechini* (holo ?CAL); *King's coll.* 2164 (holo, ?CAL) Malaysia, Perak. — See Critical remarks.
- Lucinaea billitonensis* Valetton, Ic. Bogor. 3 (3) (1908) 117 & pl. 268, p.p. [‘forma *bancana*’, nomen; Banca (= Bangka), Koba, *Teijsmann '179'* (BOG 18654) (lecto L, selected here); excl. Billiton (= Belitung) Isl., *Ham '178'* & '62' — see *S. montana*!]. — See Critical remarks.
- Lucinaea microphylla* Merr., Mitt. Inst. Allg. Bot. Hamburg 7 (1937) 286. — Type: Borneo, Kalimantan ('West Borneo'), Sungai Bika, 50 m, Jan. 5, 1925, in swamp forest, *Winkler [Hans] 1430* (holo HBG; iso HBG, second sheet).
- Lucinaea labuanensis* Ridl., nom. nud. [labelled as 'types' in K: Borneo, Labuan, *Motley 224* (K, one as '*Barber*')]; see Critical remarks].

Scandent *epiphytic shrubs*; old *stems* several m long, clinging to host tree with adventitious roots in rows on internodes; upper shoots hanging away from the host plant, usually without adventitious roots, \pm much-branched, sometimes forming a \pm rounded 'crown' (to c. 1 m or more in diam.). *Branches* generally glabrous, occasionally youngest parts puberulous; bark brown. *Leaves* lanceolate to elliptic-oblong to obovate, (50–)60–90(–120) \times 25–40(–45) mm, base attenuate or \pm rounded, apex attenuate or acute, thickly coriaceous, glabrous, midrib sunken above and raised below and primary lateral veins [(6–)7–8(–12) pairs] slightly raised above and below or hardly discernible; petioles 6–12(–20) mm long, glabrous or occasionally hairy. *Stipules* connate up to 1/2 of their length, free part \pm triangular, 4 \times 2–3 mm, glabrous or occasionally hairy on the outside. *Inflorescences* terminal, typically 3–5 together in an umbel-like arrangement (rarely and very atypically only solitary), sometimes also additional axillary inflorescences below the terminal ones, capitate-globose, 10–20 mm in diam., (5–)10–20-flowered; involucre small, inconspicuous; peduncles (10–)20–35 mm long, straight, glabrous or occasionally hairy. *Flowers* sweetly scented, heterodistylous (occasionally also \pm isostylous?), 3–5-merous. Calyx tubular, truncate, 2–4(–5) mm high, glabrous or occasionally hairy (sometimes rim of calyx ciliate). Corolla white, whitish green, greenish, pale dirty-purplish or purplish green; tube 3–5 mm long (\pm same length in both short- and long-styled morphs), lobes 5–8 mm long, the hooded apex of the lobes 1.5–3 mm long; inside of corolla with stiff, straight hairs at the throat and also along the middle of the lobes (short-styled morph only), and with a ring of soft downwardly curled hairs at or \pm below the insertion point of the filaments. Anthers 1.5–2 \times 0.7–0.9 mm, \pm sagittate, medifixed; filaments 2 mm long and basally beset with curly hairs (long-styled) or 5–6 mm long and basally glabrous (short-styled morph). Style c. 6 mm long, entirely glabrous (short-styled morph) or 7–8 mm long, glabrous below and with very few, upwards curved, short and stiff unicellular hairs above (long-styled morph); stigma lobes 2 mm long, \pm flattened, with inconspicuous papillae. Ovary globose, 2–3 mm in diam. *Fruits* green-white to white when fully mature, \pm globose, (3–)4–5 mm in diam. — Fig. 3, 4f–i, 5a–c, 8a in Puff et al. (1993).

Pollen — Small, 20–22 μ m (acetolyzed), oblate spheroidal, 3-brevicolporate, exine (micro)reticulate, neither long- nor short-styled morph with suprategal elements; binucleate. (From Puff et al., 1993, corrected.) — Fig. 9j, k in Puff et al. (1993).

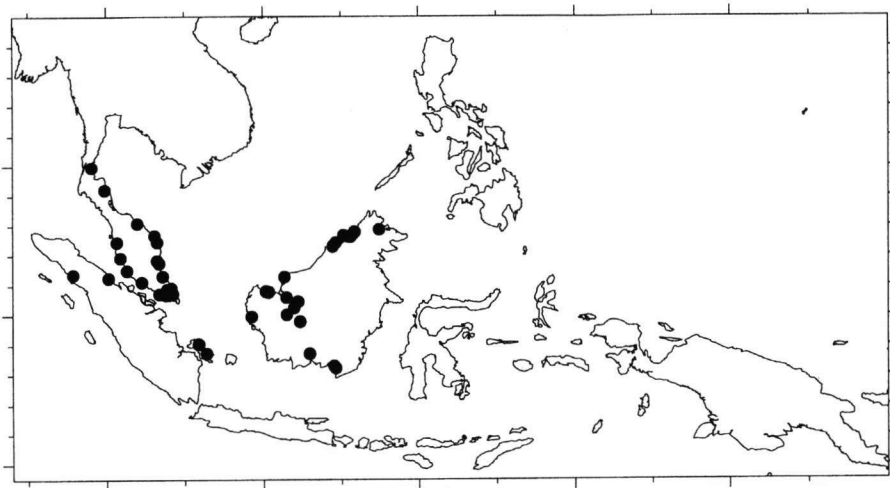


Fig. 2. Distribution of *Schradera polysperma* (Jack) Puff, Buchner & Greimler.

Distribution — From Sumatra, Peninsular Thailand and Peninsular Malaysia to Borneo. Fig. 2.

Habitat & Ecology — Often in or at the edge of peat swamp forests or swamps; in coastal areas in scrub or patches of trees on sandy ground; 0–100(–200) m (?700 m; see Critical remarks). Flowering and fruiting all year round.

Critical remarks — This is perhaps the most common and widely distributed Asiatic *Schradera* species. It is variable in leaf size and shape and also in characters of the fertile region (inflorescence arrangement and number of flowers per inflorescence). It is, therefore, not surprising that several names had previously been applied to *S. polysperma*.

Although the type specimens of *L. paniculata* were not seen (presumably at CAL, which did not respond to a loan request), it seems sufficiently clear from the description that the name refers to specimens of *S. polysperma* with rich inflorescences (i.e., terminal inflorescences in an umbel-like arrangement plus additional inflorescences in the axils of foliage leaves below). According to field observations, both the number of inflorescences per branch and the number of flowers per inflorescence are often variable even within single individuals. ‘*Paniculata*’, therefore, does not deserve taxonomic recognition.

The *Teijsmann* type of *L. billitonensis* from Bangka Island is a rather miserable specimen which does not bear any fertile parts. It, nevertheless, is clear to us that it belongs to *S. polysperma* (the *Ham* types from Belitung belong to *S. montana*). Even when describing the species, Valeton had apparently been aware that his *L. billitonensis* may be heterogeneous: he noted the larger (broader) leaves (as characteristic for *S. polysperma*) in the Bangka specimens. His reference to the ‘up to 3 inflorescences’ must have referred to this specimen, while the included plate (apparently based on the Belitung specimens, i.e., *S. montana*) only shows solitary inflorescences. The label

on the *Teijsmann* collection bears the hand-written addition 'forma *bancana*', a name that was never formally published.

Lucinaea microphylla is merely a small-leaved form of *Schradera polysperma*, connected to the typical form by series of intermediates. '*Microphylla*' forms show up throughout most of the species' distribution range [e.g., Sumatra and Borneo: *Buwalda* 6538 (K), 7693 (K, L), *Meijer* SAN 43782 (K, SAN), *Motley* 659 (K), and others]. Sometimes duplicates from one and the same collection are either 'typical' or '*microphylla*' forms of *S. polysperma* [e.g., *Smythies*, *Wood & Ashton* 5871 (K, KEP, L, SING) from Brunei].

'*Lucinaea labuanensis* Ridley' has never been published. The name has, however, been taken up in several herbaria and been incorrectly applied to various species.

The species appears to be confined to low altitudes, seldom occurring over 100 m. A single collection, e.g., *Kostermans & Anta* 1267 (K, L) from G. Maras on Bangka Island, is labelled as coming from 700 m. It is presumed that it either was collected at 700 feet, or that the label refers to the height of G. Maras but not the actual altitude where the specimen was collected.

Specimens studied:

THAILAND. Peninsular: Surat Thani: Langsuan [Lang Suan R.], Tako, 0 m, *Kerr* 11891 (BM, K). — Nakhon Si Thammarat: Ta Samet, < 50 m, *Kerr* 14333 (BM, K). — Narathiwat: Tak Bai, 0 m, *Pramrasni & Niyomdham* 25 (K); —, Phru Kok Daan, 0 m, *Niyomdham* 836 (K); peat swamp forest NE Sungai Kolok, < 30 m, *Puff & Sridith* 930719-1/2 (AAU, PSU, WU).

MALAYSIA. Peninsular: Perak: Larut, 90–260 m, *King's coll.* 4645 (BM, K, L), 5498 (SING); —, Biah, *Wray* 4211 (K); Taiping [Taiping], *King's coll.* 8482 (BM, K); Hutan Melintang FR [Lower Perak], *Ng FRI* 5706 (K, KEP, L). — Selangor: Klang, Bt. Changgang, *Nur SFN* 33960 (BM, K, L, SING). — Pahang: Pekan, *Ridley* 109 (SING), 1093 (K); Kuantan–Pekan rd., *Symington F.M.S.* 43105 (KEP); Tasek Bera, *Marshall F.M.S.* 35840 (KEP). — Terengganu: [Kg.] Jambu Bongkok, 0 m, *Carrick* [as 'J.C.'] 1599 (K, L, SING); Paya Bukit Bakbeh nr Sebarang Takir, Kuala Trengganu, 0 m, *Sinclair & Kiah bin Salleh SFN* 40734 (BM, K, L, SING). — Malacca (Meleka): Bt. Bruang [= Beruang], *Curtis s.n.* (SING); without locality, *Griffith* 2954 (K), *Maingay* 875 ['1275'] (K). — Johore: Pengkalan Raja, Pontian, *Ngadiman SFN* 36681 (K, KEP, SING); Tg. Penawar, Johore E Coast, 0 m, *Cockburn FRI* 7606 (K, KEP, SING); Kota Tinggi, *Ridley* 15439 (K); Sedili Kechil River, *Corner SFN* 28068 (K, KEP, SING); Kangka Sedili Kechil, *Corner SFN* 28596 (K); Kg. Hubong, Endau, *Kadim & Noor* 293 (K, L, SING). — Uncertain: 'Penang et Singapore', 1822, *Wallich Cat.* 8437 (K). — Borneo: Sarawak: 1st Division, Bako Nat. Park, 0–90 m, *Carrick & Enoch* 79 (K, SING); [near] Kuching, *Haviland* 207 (K), 2983 (SING), *Hewett s.n.* (K); Mt Matang, *Moulton's native coll.* 275 (BM). 2nd Division, Simanggang, 1.5 km from Triso, 3 m, *Anderson S* 9799 (K). 3rd [?] Division, Kelapaan, *Brooke* 8838 (BM, L). 4th Division, Batang Baram, *Anderson S* 2878 (SING). 6th Division, Binatang Distr., Sg. Semup, Pulau Bruit, 0 m, *Anderson S* 5109 (K, L). Labuan, *Motley* 224 (K). — Sabah: Beaufort Distr., Bahi Bahi (Weston), 0 m, *Sidim* 204 [For. Dpt. B.N.B. 2379] (BM); —, Bt. Klias [F.R.], *Dewol Sundaling SAN* 80210 (K, SAN); —, Membakut, Binsolok For. Res., 20 m, *Amin* [Awang Amin, R.A.] *SAN* 102876 (K, SAN); Bangawan [? = Pangawan, Beaufort Distr.], 3 m, *Taha, Md.* 2020 (K); Papar Distr., Mandahan, 10 m, *Amin* [Awang Amin, R.A.] *SAN* 103129 (SAN); —, Kimanis F.R., 5–10 m, *Gibot, A.* ['Aban'] *SAN* 49395 (K), *Sario & Badar SAN* 28520 (K, KEP, L, SAN); Labuk & Sugut Distr. [as 'Sandakan Distr.'], 1 mile north of Sapi Camp, *Meijer SAN* 43782 (K, SAN).

INDONESIA. Sumatra: Atjeh Prov., P.T. Hargas logging concession, S of Sibulussalam-Gelombang rd., c. 16 m, *de Wilde & de Wilde-Duyfjes* 20581 (L); Bila, Labuan-bilik [= Labuhan-bilik], Bila R., 3 m, *Lörzing* 14299 (L); Indragiri Uplands, Kuala Belilas, 'a few m', *Buwalda* 6744 (K); —, rd. from Kota Belilas to Berapit R., 'a few m', *Buwalda* 6667 (K, L); —, Berapit, 'a few m', *Buwalda* 6538 (K). — Bangka: G. Maras, 700 m [? ft.], *Kostermans & Anta* 1267 (K, L); Koba,

Teijsmann '179' (BOG 18654) (L). — **Borneo**: Kalimantan Barat: Sintang, *Teijsmann* 180 ('8329') (L); Sg. Smittouw [Smitau; ? = Semitau], *Hallier* 1262 ('162') (L); Landja, *Main (exped. Polak)* 2037 (L); Pontianak, Sg. Poetat, *Mondih* 70 (K, L); on Sungei Bika, 50 m, *Winkler [Hans]* 1430 (HBG). — Kalimantan Tengah: Sampit, 5 m, *Buwalda* 7693 (K, L). — Kalimantan Selatan: Banjarmasin ['Bangarmassing'], *Motley* 659 (K); Banjarmasin–Martapura rd., km 19, *Polak* 436 (L); –, km 22, 10 m, *Dransfield & Hambali* 4320 (K, L).

BRUNEI. Belait Distr., Batu Patam, summit ridge, *Wong* 1135 (K); –, Badas, *Richards* 5575 (K, L), *Smythies, Wood & Ashton* 5871 (K, KEP, L, SING), *van Niel* 4106 (L); –, Badas, nr Lumut, 5 m, *Coode* 6469 (K), 6471 (K); –, Seria, Badas Stateland Forest, rd. to Lumut LNG, *Mat Salleh et al.* 2437b (K); –, Badas F.R., c. 20 m, *Puff* 890726-1/7 (BRUN, K, WU), 900805-1/2 (BRUN, K, L, WU). Tutong Distr., nr Telamba bridge, Kuala Belait rd., < 100 m, *Jacobs* 5681 (K, L); between Tutong and Danau, *van Niel* 4001 (L), 4059 (L); W Kayangeran F.R., *Brunig* BRUN 1004 (K, L).

2. *Schradera grandiflora* Puff, Buchner & Greimler, *spec. nov.* — Fig. 3, 4

A Schradera polysperma, inter alia, floribus majoribus differt. — Typus: Sarawak, 1st Division, nr Kuching, April 28, 1893, *Haviland* 2961 (holo K; iso K, second sheet).

Branches generally glabrous, occasionally younger parts with short hairs and older parts glabrescent; bark light brown. *Leaves* elliptic-lanceolate or occasionally \pm round, (55–)70–115 \times 30–50 mm (length to width ratio: 1.5–2.3:1), base rounded, apex rounded with acute tip or shortly attenuate, margins recurved, coriaceous, usually glabrous, occasionally upper surface weakly and midrib and lower surface densely hairy, midrib \pm sunken above and raised below, primary lateral veins (7–10 pairs) raised below; petioles 10–14 mm long, usually glabrous, occasionally hairy. *Stipules* connate for up to 3/4 of their length, free part rounded or broadly triangular, 4–6 mm long, glabrous or occasionally hairy outside. *Inflorescences* terminal, solitary (or, rarely, 2 or 3 together in an umbel-like arrangement), capitate-globose, 11–22 mm in diam., 10–15(–20)-flowered; involucre small and inconspicuous; peduncles (5–)10–15 mm

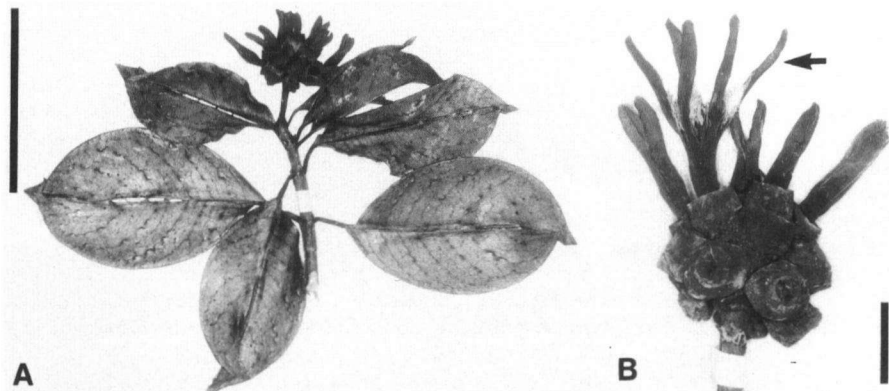


Fig. 3. *Schradera grandiflora* Puff, Buchner & Greimler (portion of the holotype, *Haviland* 2961, K). A: flowering branch. — B: inflorescence, note long, hooded apices of corolla lobes (arrow). — Scale bars: 5 cm (A); 10 mm (B).

long, straight, glabrous or occasionally hairy. *Flowers* heterodistylous, 4- or 5-merous. Calyx tubular, truncate, 3–5 mm high, glabrous or occasionally hairy. Corolla white; tube 8–11 mm long, lobes 15–18 mm long (the hooded lobe apices to 8 mm long), corollas of short-styled morphs (especially lobes) sometimes larger than those of long-styled morphs; inside of corolla with stiff, straight, long (2–3 mm) hairs along the middle of the lobes and with a dense ring of hairs near the base of the tube, the latter probably produced on scales. Anthers 3.5–4 × 1 mm long, ± linear, basi-medifixed; filaments glabrous, 3 mm (long-styled) or 4–5 mm long (short-styled morph). Style 7–9 mm long, entirely glabrous (short-styled morph) or 12 mm long, glabrous below and beset with upwardly directed, short and stiff unicellular hairs above (long-styled morph); stigma lobes 3–5 mm long, ± flattened, with inconspicuous papillae. Ovary globose, 4–5 mm in diam. *Fruits* white when fully mature, ± globose, 6–7 mm in diameter.

Distribution — Endemic to Borneo (Sarawak and Brunei). Fig. 4.

Habitat & Ecology — In swamp forest or kerangas vegetation; ?–100–? m. Flowers in April, August; fruits in June, September.

Critical remark — This new species is easily recognized by its large flowers and the longest corolla lobes with the most conspicuous (longest) hooded corolla lobe apices (Fig. 3B) in all Asiatic taxa of the genus. Apart from the floral characters, it is distinguished from the presumably closely allied *S. polysperma* by its typically solitary inflorescences (Fig. 3A) and larger fruits.

Specimens studied:

MALAYSIA. Borneo: Sarawak: 1st Division, [near] Kuching, *Haviland 2961* (K), *Sabih [for Ridley] s.n.* (K); Kuching Distr., Matang, *Ridley 12290* (K); Bako Nat. Park, Bukit Tambi, *Chai S 34634* (K). 2nd Division, Sebuyau Distr., Lankan lori, 100 m, *Brunig S 4685* (K).

BRUNEI. Tutong Distr., nr Kpg. Danau, *van Niel 4385* (L).

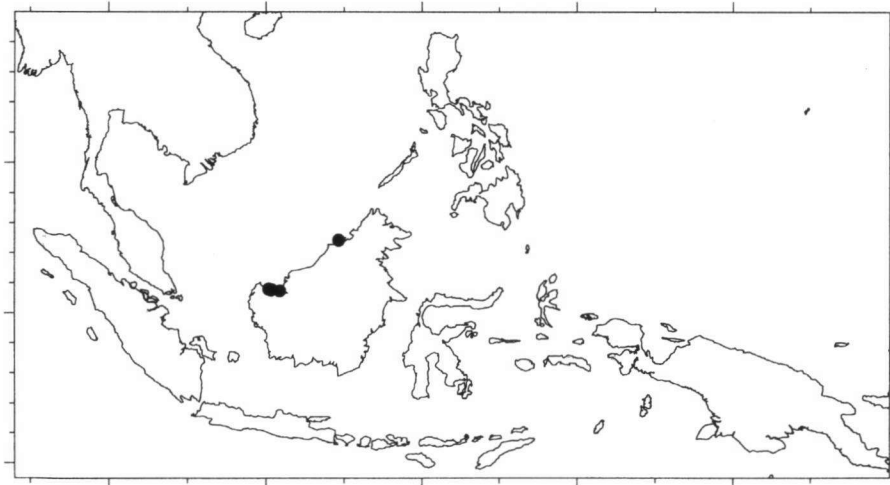


Fig. 4. Distribution of *Schradera grandiflora* Puff, Buchner & Greimler.

3. *Schradera monocephala* (Merr.) Puff, Buchner & Greimler, *comb. nov.* — Fig. 5

Lucinaea monocephala Merr., Philipp. J. Sci., Bot. 5 (1910) 241; Elmer, Leaflet Philipp. Bot. 3 (1911) 997; Merr., Enum. Philipp. Flow. Pl. 3 (1923) 520. — Types: Philippines, Luzon, Laguna Prov., nr Dahican, July 1909, *Ramos B.S. 10034* (holo ?PNH†); neotype chosen here: Laguna Prov., Dahican R., Sept. 1912, *Ramos B.S. 1111* (BM, K).

Lucinaea epiphytica Elmer, Leaflet Philipp. Bot. 5 (1913) 1873; Merr., Enum. Philipp. Flow. Pl. 3 (1923) 520. — Type: Philippines, Agusan Prov., Cabadaran (Mt Urdaneta), *Elmer 14147* (holo ?PNH†).

Branches glabrous, bark light brown. *Leaves* oblong-elliptic to lanceolate or obovate, (50–)80–110 × (15–)27–45 mm, base acute, apex shortly acuminate, margins ± recurved, ± thickly coriaceous, glabrous or occasionally hairy on midrib above and entire lower surface, midrib ± sunken to slightly raised above and prominent below, primary lateral veins (7–10 pairs) usually slightly raised only below; petioles (8–)15–23(–40) mm long, glabrous. *Stipules* connate for up to 1/2 of their length, free part broadly ovate, 5–6 mm long, glabrous. *Inflorescences* terminal, solitary or 2 or 3 together in an umbel-like arrangement, capitate, 15–25 mm in diam., 9–20-flowered; involucre ± conspicuous, glabrous; peduncles 20–40(–50) mm long, straight, glabrous. *Flowers* heterodistylous, 4-merous. Calyx tubular, truncate, 4–5 mm high, glabrous. Corolla white; tube 5–6 mm long (in both long- and short-styled morphs), lobes 9–10 mm (short-styled) or 14–15 mm long (long-styled morph); inside of corolla with ± upwardly directed stiff hairs at the throat and curly hairs along the middle of the corolla lobes (short-styled) or stiff hairy on the lobes only (long-styled morph). Anthers 4 × 1 mm and linear (long-styled) or 2.5–3 × 1 mm and slightly sagittate (short-styled morph), basifixed; filaments fleshy, rather broad and basally pubescent, 2 × 1 mm (long-styled) or 9 × 0.5 mm (short-styled morph). Style 5 mm long and with few stiff, upwardly directed hairs in the upper third (short-styled) or 13 mm long and with many stiff, upwardly directed hairs in the upper third (long-styled morph); stigma lobes 3 mm (short-styled) or 5 mm (long-styled morph) long, filiform to slightly flattened, with short papillae. Ovary subglobose, 3 × 4 mm, glabrous. *Fruits* whitish when fully mature, globose, 6–8 mm in diam.

Distribution — Endemic to the Philippines; widely but scatteredly distributed from the southern half of Luzon southwards. Fig. 5.

Habitat & Ecology — In montane rain forest with *Agathis*; 620–850 m. Flowers from March to September, fruits to November.

Critical remarks — Although the type specimens of both *L. monocephala* and *L. epiphytica* are most likely destroyed, it is clear from the original descriptions and the available herbarium material from the Philippines that only one species is present. For *L. epiphytica*, Elmer had noted a 'quite close' relationship to *L. involucrata*; the present investigations have shown that the latter (as *S. elmeri*, see below) is sufficiently different to be maintained as a second Philippine endemic.

A specimen, apparently from about the same locality as the presumably destroyed holotype of *L. monocephala* and collected by the same collector three years later, has been chosen as neotype.

Specimens studied:

PHILIPPINES. Luzon: Laguna Prov., Dahican R., *Ramos B.S. 1111* (BM, K); Sorsogon Prov., Mt Bulusan, *Sulit PNH 2688* (L), *s.n.* [? = *PNH 2688*] (SING). — Catanduanes: without further

locality information, *Ramos B.S. 30463* (K), *Ramos & Edaño B.S. 75409* (SING). — Mindoro: Mt Yagaw, 850 m, *Conklin 1113* (L). — Biliran: Mt Suiro, 660 m, *Sulit 5330* [*PNH 21529*] (K, L). — Leyte: without further locality information, *Wenzel 803* (BM). — Mindanao: Surigao Prov., without further locality information, *Wenzel 3256* (K), *Ramos & Pascasio B.S. 34731* (K); Lanao Prov., *Roque For. Bur. 30248* (BM, K). — Palawan: Puerto Princesa municip., Mt Beaufort, 620 m, *Ridsdale SMHI 232* (K).

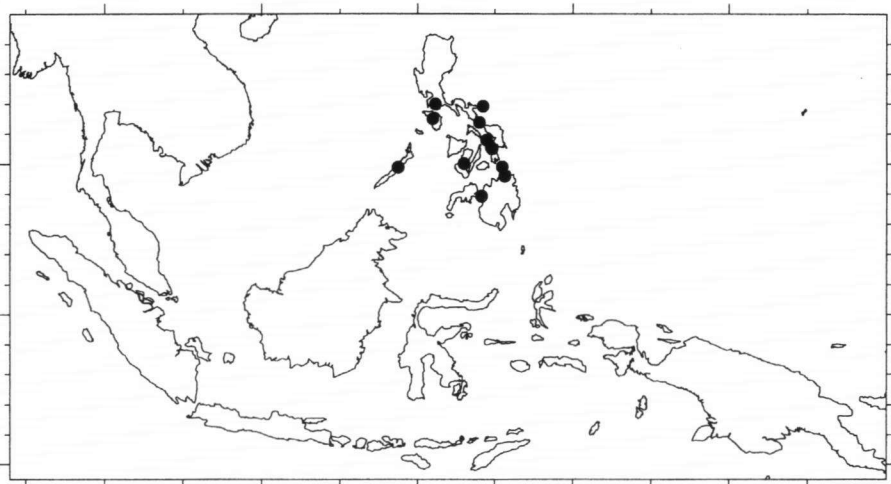


Fig. 5. Distribution of *Schradera monocephala* (Merr.) Puff, Buchner & Greimler.

4. *Schradera membranacea* (King) Puff, Buchner & Greimler, *comb. nov.*

Lucinaea membranacea King, J. As. Soc. Bengal 72 (1903) 178; Ridl., Fl. Malay Penins. 2 (1923) 56. — Types: Malaysia, Perak, *Scortechini 283* (lecto K, selected here); *Wray 832* (K, syn.), 177 (K, syn., as '1177'), *Scortechini 603* (L, syn., as '603a'); *King's coll. 762* (K, syn.), 10152 (BM, K, syn.); syntypes not seen: *Curtis 2016*, *Ridley 5543*, *Scortechini 47, 283*, *Wray 3998*.

Branches with few fine white hairs to pubescent when young, older parts glabrescent; bark brown. *Leaves* (narrowly) lanceolate, ovate-lanceolate, elliptic or occasionally obovate, 23–140(–190) × 11–60(–70) mm, narrowed to the base or occasionally base rounded, apex long acuminate or acute, thin, membranaceous, entirely glabrous or rusty pubescent below, midrib and primary lateral veins (7–9 pairs) usually slightly raised above and below, blades typically reddish in dried material; petioles 3–10 mm long, pubescent or occasionally glabrous. *Stipules* connate for up to 1/2 of their length, free part triangular, broadly triangular, or ovate, occasionally with bifid tip, 2–8(–12) mm long, pubescent or occasionally glabrous. *Inflorescences* terminal, solitary or occasionally up to 3(–6) together in an umbel-like arrangement, capitate-globose, 4–15 mm in diameter, 2–20-flowered; involucre small and inconspicuous; peduncles (1–)3–22(–30) mm long, straight, pubescent or occasionally glabrous. *Flowers* heterodistylous, 5-merous. Calyx tubular, truncate, 2–3 mm high, glabrous. Corolla white, creamy-white, pale dirty lilac, light reddish brown, reddish, pinkish or greenish (some-

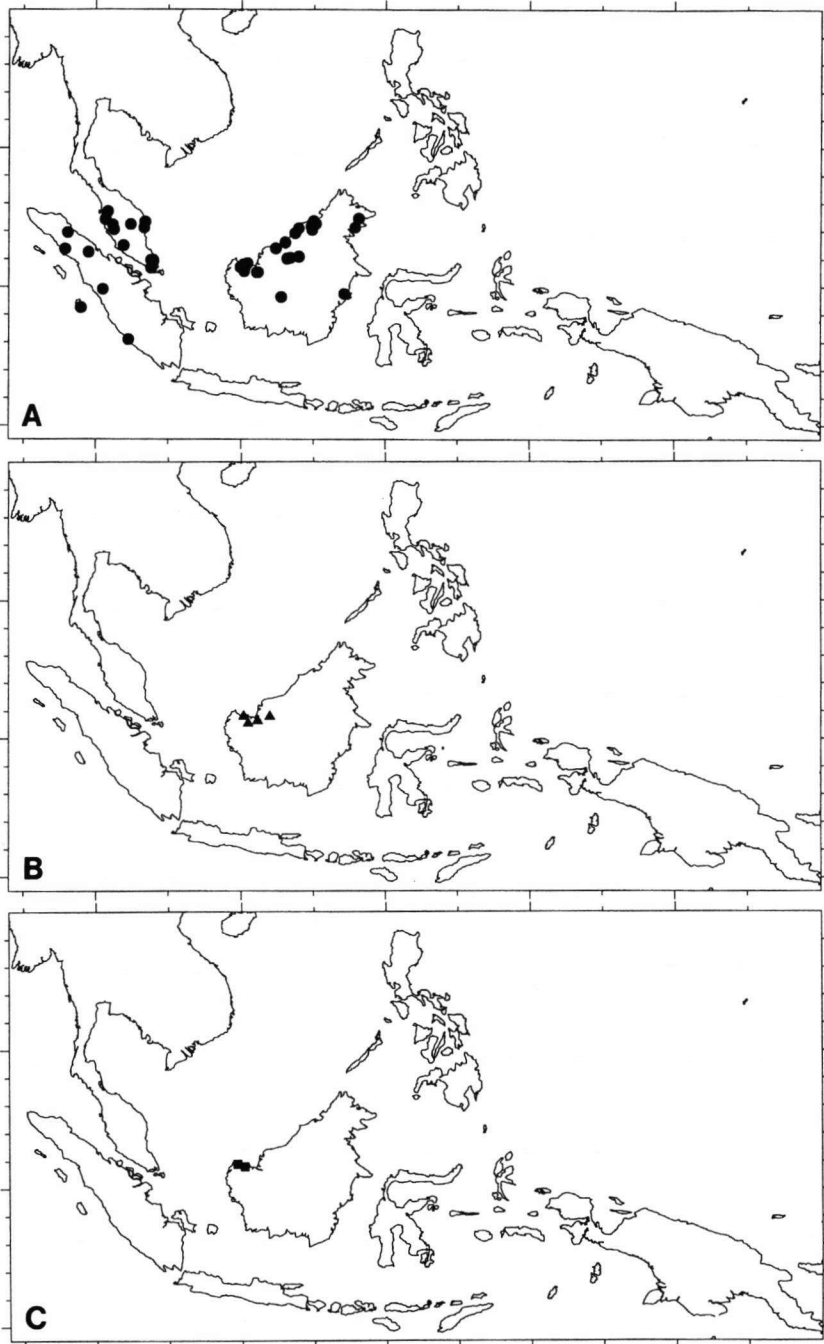


Fig. 6. Distribution of *Schradera membranacea* (King) Puff, Buchner & Greimler. A: subsp. *membranacea*. — B: subsp. *parvifolia* (W.W. Sm.) Puff, Buchner & Greimler. — C: subsp. *flagellarioides* Puff, Buchner & Greimler.



Fig. 7. Leaf sizes and shapes in *Schradera membranacea* (King) Puff, Buchner & Greimler. — A & B: subsp. *membranacea*; A, 'typical' (Puff *et al.* 900818-1/7, WU); B, \pm approaching subsp. *flagellarioides* (Ashton S 17947, SAN). — C: subsp. *flagellarioides* Puff, Buchner & Greimler (Haviland s. n., K). — D & E: subsp. *parvifolia* (W.W. Sm.) Puff, Buchner & Greimler; D, 'typical' (Haviland 678, K, portion of syntype); E, approaching subsp. *flagellarioides* (Awa & Paie S 45661, L). — Scale bar: 10 cm (all the same magnification).

times reddish or reddish violet in bud); tube 4–5 mm long, lobes 2–4 mm long (\pm the same size in short- and long-styled morphs); inside of corolla with stiff, straight, upwardly directed hairs at the throat and immediately below with a ring of soft, downwardly curled. Anthers 1–2 \times 0.5 mm, linear and with apical connective appendage (long-styled) or \pm sagittate and without apical connective appendage (short-styled morph), basifixed; filaments < 1 mm (long-styled) or 1.5–3 mm long (short-styled morph), glabrous except for a few curly hairs near their base. Style 2–3 mm long, glabrous or with upwardly directed, short and stiff unicellular hairs (short-styled morph) or 5 mm long, glabrous below and densely beset with upwardly directed, short and stiff unicellular hairs above (long-styled morph); stigma lobes 1.5–2.5 mm long, filiform and with long papillae (short-styled) or flattened, with inconspicuous, short papillae and often somewhat shorter (long-styled morph). Ovary globose, 1–2 mm in diameter, glabrous. *Fruits* white, pinkish, orange-red or purple-red when fully mature, \pm globose, 3–4 mm in diam.

Distribution — From Sumatra and Peninsular Malaysia to Borneo.

Critical remarks — The investigation of the available herbarium material revealed that it is not possible a) to reliably separate the Sarawakan *L. parvifolia* W.W. Smith and '*L. flagellarioides* Ridley' [a nom. nud.; see below] from *S. membranacea* s. str., and b) to draw a clear-cut line between *parvifolia* and *flagellarioides*. It was, therefore, considered to be the best solution to recognize them as subspecies of *membranacea*.

Schradera membranacea (the species as a whole) is characterized by small, relatively few-flowered inflorescences and small flowers.

a. subsp. membranacea — Fig. 6A, 7A, B, 8

Scandent *epiphytic shrubs*; old *stems* several m long, < 10 mm in diam., clinging to host tree with adventitious roots in rows on internodes; upper shoots hanging away from the host plant, usually without adventitious roots, \pm little-branched, not forming a \pm distinct 'crown'. *Leaves* elliptic or occasionally obovate, (70–)90–160(–190) \times (20–)25–60(–70) mm [length to width ratio (1.5–)2.5–5:1], lower surface hairy (especially veins) or occasionally entirely glabrous; petioles 5–10 mm long, pubescent or occasionally glabrous. *Stipules* (4–)5–8(–12) mm long, occasionally with bifid tip, often pubescent. *Inflorescences* solitary or up to 3(–6) together in an umbel-like arrangement, capitate-globose, 4–15 mm in diameter, 10–20-flowered; peduncles 10–20(–30) mm long, pubescent.

Distribution — From Sumatra and Peninsular Malaysia to Borneo. Fig 6A.

Habitat & Ecology — In alluvial forest, swampy and riparian forest, in mixed dipterocarp forest, seldom in submontane forest or mossy forest; also in 'heath'-forest and kerangas vegetation with *Shorea albida*; 0–600 m [one collection: 1500 m]. Flowering and fruiting all year round.

Critical remarks — Widely distributed and rather variable in leaf size and shape (cf. Fig. 7A, B & 8) and also in inflorescence arrangement (solitary or a few together).

In Sarawak, the morphological delimitation of subsp. *membranacea* from both subsp. *parvifolia* and subsp. *flagellarioides* (see below) is not always entirely clear-cut. The latter two, however, appear to differ ecologically (occurring almost always at much higher altitudes than subsp. *membranacea*), although further verification is needed (habitat notes, in general, are too poor to be entirely certain).

Specimens studied:

MALAYSIA. Peninsular: Kedah: Bt. Kuala Kelang, G. Bintang (Kedah–Perak boundary), *Haniff 21102* (SING). — Perak: Goping, *King's coll.* 762 (BM, K); Maxwell's Hill, *Ridley 5543* (BM); –, 4th mile, 600 m, *Shah & Sidek 1119* (K, L, SING); Taiping Hills, 500 m, *Haniff 13203* (K), *Ridley 11442* (K); Tea Gardens [Taiping], *Curtis 1337* (K, SING); Tapa[h], *Wray 832* (K); Relau Tajau, *Wray 1777* (K); without locality, *King's coll.* 10152 (BM, K), *Scortechini 283* (K), 603a (L), s.n. (K). — Selangor: Semenyih, *Hume 7905* (SING); Sungai Lalang Kajang, *Symington F.M.S. 24186* (SING). — Pahang: Sungai Tahan [? Taman Negara Nat. P.], *Kiah SFN 31922* (K, SING); Sg. Handerek, Ulu Serau, *Osman SFN 28302* (KEP, SING). — Terengganu: Kemaman Distr., Alu Kajang, B. Kajang, *Corner SFN 30596* (KEP, L, SING); Sungai Paka, *Symington F.M.S. 26843* (KEP). — Johore: Sungai Kayu, *Kiah SFN 32030* (K, KEP, SING); Mawei [Mawai]–Sedili new road, *Chew 219* (K, L, SING); Sungai Kayu Ara, Mawai–Jemaluang rd., *Corner s.n.* (SING). — Peninsular Malaysia, without locality, *without collector F.M.S. 24186* (KEP). — **Borneo:** Sarawak: 1st Division, Bako Nat. Park, *D. Awa & Othman Ismawi S 47038* (K); –, Telok Asam, 20–90 m, *Anderson S 25117* (K), *Carrick & Kassim 529* (SING), *Chai & Paie S 17831* (K), *Purseglove 5532* (K, L, SING), 4939 (K, L, SING), *Weber 790910-1/4* (WU); –, Telok Tajor, *Ashton S 17947* (K, L, SAN, SING); –, Tg. Limau forest, 0–60 m, *Carrick & Enoch 391* (K); –, Lintang path, *Paie S 38521* (K, KEP, L, SAN); –, Tanjong Melano, 46 m, *Ching [Yi Puan Ching] S 42196* (K, KEP, SAN); [near] Kuching, *Haviland 206 [Y']* (BM, K, L), *Hewett s.n.* (K), *Sabih [for Ridley] s.n.* (K); Kuching Distr., Matang, *Ridley 11748* (K); path to Matang, *Haviland 1757* (K); Bau Distr., G. Raja, km 27, Bau–Lundu rd., 380 m, *Ching [Yi Puan Ching] & Jegong S 46005* (K); Serian Distr., S. Sabal Tapang, 50 m, *Paie S 16965* (K). 2nd Division, path to G. Silantek, Ulu Sg. Silantek Kiri, 85th Mile, Sri Aman, 300 m, *Paie S 42585* (K, KEP, L, SAN); path to Kpg. Kara, Kpg. Pungur Tapang, 95th Mile, Sri Aman, *Paie S 42730* (K, KEP, L, SAN). 3rd Division, Rumah Ternenggong, Begrih, Bawang, Balingian, 10 m, *Chai S 19461* (K, L, SAN, SING). 4th Division, Miri Distr., Lambir Proposed National Park, *Murshidi S 24107* (K, L, SAN, SING); –, Lambir National Park, Mile 18, *Chai S 39424* (K, KEP, L, SAN); –, Nyabau catchment area, Bintulu, 90 m, *Sibat ak Luang S 24573* (K, KEP, SAN); –, Ulu Sg. Sekaloh, Niah R., *Wright S 29134* (KEP); Baram Distr., G. Mulu National Park, *Anderson S 39398* (AAU, K, KEP, L); –, Ulu Sg. Sekaloh, Sg. Mentawai, *Chai S 39714* (K, KEP, L, SAN); –, Entoyut R., *Hose 386* (K); N. Setungan, Ulu Segan, 10 m, *Sipi Tawi, J. S 22009* (K, L, SAN). 5th Division, Limbang Distr., Ulu Sg. Ensungai, Madamit, *Rena, G. et al. S 42945* (K, KEP, L, SAN); Maputi, *Brooke 10141* (L). 7th Division, Kapit Distr., Bt. Sampandai, Ulu Sampurau, Melinau, 1500 m, *Paie S 40924* (K, KEP, L, SAN); N. Semperaja, Ulu Mujong, Balleh, 180 m, *Othman bin Haron S 19913* (K, KEP, L, SAN, SING); Batu Laga Plateau, Batang Rejang, 300 m, *Mohtar S 48208* (K, KEP). Not traced: Niah, *Haviland & Hose 206/O* (W). Without locality, *Beccari 33* (K), 'native collector' 216 (K, L), 1235 (K). — Sabah: Lahad Datu Distr., G. Silam, nr Lahad Datu, 400–600 m, *Puff & Buchner 920417-3/1* (SAN, WU); Tawau Distr., Luasong S.F. logging area, *Krispinus, F. SAN 87370* (SAN).

SINGAPORE. Chan Chu Kang, *Ridley s.n.* (BM).

INDONESIA. Sumatra: Atjeh Prov., P.T. Hargas logging concession, S of Sibulussalam-Gelombang rd., c. 50 m, *de Wilde & de Wilde-Duyffes 20715* (L); –, Gunung Leuser Nature Reserves, Sikundur F.R., c. 75 km WNW of Medan, Besitang R., 50–100 m, *de Wilde & de Wilde-Duyffes 19454* (L); E Coast, nr Aek Sordang, Loendoet Concession [S of Asahan R.], Koeloe, *Bartlett 7618* (L); Taram, E of Pajakumbuh, Tjampo R. region, 500–1000 m, *Meijer 6860* (L); Bencoolen [= Benkoelen, Bengkulu], *Brooks s.n.* (K). — Mentawai Isls., Siberut Isl., *Boden Kloss SFN 14507* (K, SING), *Iboet 227* (L, SING). — **Borneo:** Kalimantan Barat: Bukit Raja, 130 m, *Nooteboom 4319* (L). — Kalimantan Timur: Samarinda, Mulawaram Univ. Bot. Garden grounds, 100 m, *Wiriadinata 331* (K, L); Durian Distr., *Grabowsky s.n.* (BM). Without locality, *Lobb s.n.* (BM, K), *Lowe s.n.* (K).

BRUNEI. Belait Distr., on Ulu Ingei, N of Batu Patam, *Wong 1108* (BRUN, K); Tutong Distr., Bukit Bahak, 200 m, *Coode 7088* (K); Temburong Distr., around Temburong R.–Machang R. junction, c. 120–250 m, *Puff et al. 900818-1/7* (BRUN, K, L, WU); –, Bangar–Batu Apas rd., km 2, 10 m, *Smythies, Wood & Ashton SAN 17106* (K, KEP, L, SAN).

**b. subsp. *parvifolia* (W.W. Sm.) Puff, Buchner & Greimler, *comb. et stat. nov.*
Fig. 6B, 7D, E**

Lucinaea parvifolia W. W. Sm., Notes Bot. Gard. Edinb. 8 (1915) 323. — Types: Borneo [Sarawak], without locality, *Beccari 3098* (lecto K, selected here); –, path to Matang, Sept. 21, 1892, *Haviland 678* (BM, K, syn.) [Possibly the collections *Haviland & Hose* ‘= 678’ (BM, second sheet; L), from the same locality but bearing the date Dec. 14, 1894, could also be considered syntypes]; –, without locality, Nov. 1913, *Native collector 136* (E, K, syn.).

Leaves ovate-lanceolate, 23–58 × 11–22 mm (length to width ratio 2–4:1), entirely glabrous; petioles 3–4 mm long, glabrous. *Stipules* 2–3 mm long, glabrous. *Inflorescences* solitary, capitate, c. 5 mm in diam., 2–4-flowered; peduncles (1–)3–4 mm long, glabrous.

Distribution — Endemic to Borneo (Sarawak). Fig. 6B.

Habitat & Ecology — In (sub)montane forest or mossy forest, in swampy forest; 620–1100 m. Flowers and fruits in March to April, September, and November.

Critical remark — Specimens of subsp. *parvifolia* often show rather dimorphic leaves, i.e., ‘typical’ small leaves (< 30 mm long) on lateral branches of a higher order, and larger leaves on long shoots. The latter often approach those of ‘typical’ *flagellarioides*. In some collections, this leaf differentiation is not obvious, and all leaves are of the large size category (cf. Fig. 7E); such specimens may be ± intermediate between subsp. *parvifolia* and subsp. *flagellarioides* (e.g., *Lee S 43247*; K, L, SAN).

Specimens studied:

MALAYSIA. **Borneo:** Sarawak: 1st Division, Kuching Distr., path to Matang, *Haviland 678* [or *Haviland & Hose* ‘= 678’] (BM, K, L); Tebakang area, G. Rawan, 830 m, *D. Awa & Paie S 45554* (K, KEP, L, SAN); –, Bt. Alak, 760 m, *D. Awa & Paie S 45661* (K, KEP, L, SAN) (appr. subsp. *flagellarioides*). 2nd Division, Lubok Antu Distr., Bt. Peninjau, Lanjak-Entimau Protected Forest, 1100 m, *Tong S 33885* (K, KEP, L, SAN); G. Lesong, Lingga, 620 m, *B. Lee S 43247* (K, L, SAN) (± intermediate between subsp. *parvifolia* and subsp. *flagellarioides*). Without locality, ‘*Native collector*’ 136 (K), *Beccari 3098* (K).

c. subsp. *flagellarioides* Puff, Buchner & Greimler, *subsp. nov.* — Fig. 6C, 7C, 8

A subsp. *membranacea* foliis longioribus angustioribusque differt. — Typus: Borneo, Sarawak, Matang, 2000–3000 ft, July 19, 1890, *Hullett s.n.* (holo K).

Lucinaea flagellarioides Ridl., nom. nud. [see Critical remarks].

Leaves (narrowly) lanceolate to narrowly ovate-lanceolate, (60–)90–120 × (12–)15–21 mm (length to width ratio 4–6.5:1), often ± rounded at the base and ± long acuminate at the apex, glabrous above, hairy below (especially on veins); petioles 3–6 mm long, pubescent. *Stipules* 3–5 mm long, pubescent or occasionally glabrous. *Inflorescences* solitary, capitate-globose, 5–10 mm in diam., 10–20-flowered; peduncle 9–22 mm long, pubescent.

Distribution — Endemic to Borneo (Sarawak). Fig. 6C.

Habitat & Ecology — In (sub)montane forest, in forest along watercourses; at 650–1200 m altitude. Flowers and fruits in January, April, July, and October.

Critical remarks — The specimen chosen as the type of the subspecies is the collection that had been labelled in Kew as the ‘type’ of ‘*Lucinaea flagellarioides* Ridley’, a name which, however, had never been published by him.

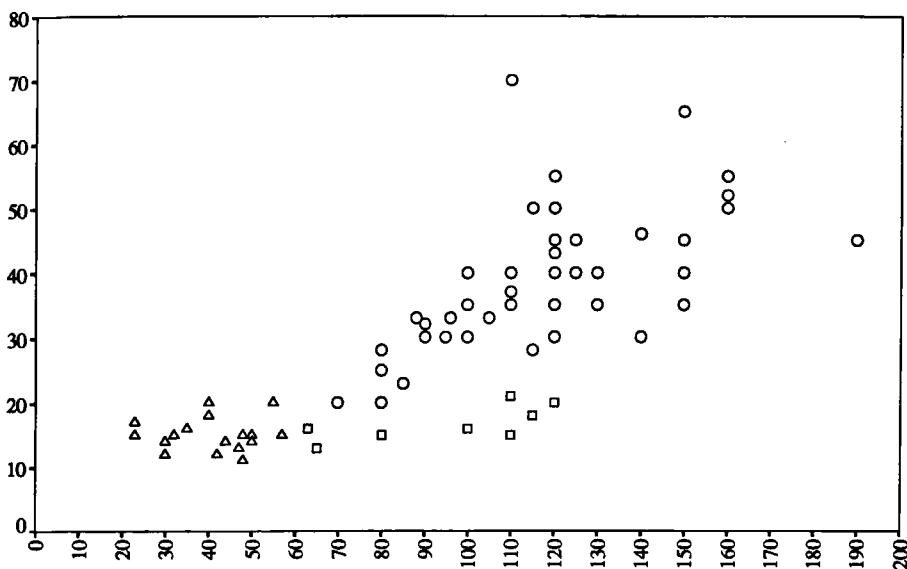


Fig. 8. Leaf blade lengths and widths (in mm) of *Schradera membranacea* (King) Puff, Buchner & Greimler subsp. *membranacea* (O), subsp. *parvifolia* (W.W. Sm.) Puff, Buchner & Greimler (Δ), and subsp. *flagellarioides* Puff, Buchner & Greimler (□).

While 'typical' *flagellarioides* is very distinct and easily recognized by the long narrow leaves, various collections gradually approach 'typical' *membranacea*, so that a clear-cut distinction between the two is not possible (see Fig. 8). Moreover, 'typical' *flagellarioides* is also connected by a series of \pm intermediate collections with 'typical' *parvifolia* (see also subsp. *parvifolia*, above).

Specimens studied:

MALAYSIA. Borneo: Sarawak: 1st Division, Kuching Distr., Matang, 650–1000 m, *Hullett s.n.* (K), *Ridley s.n.* (BM, K); –, Mt Matang, 700 m, *Clemens & Clemens 7832 [S 22319]* (K); proposed Matang Nat. Park, Ulu Sg. Rayu, *B. Lee S 54071* (K, KEP); Lundu Distr., G. Pueh ['Mt Poi'], 1200 m, *Clemens & Clemens 7292 [S 20273]* (K), *Paie S 13618* (K). Without locality, *Beccari 1666* (K), *Haviland s.n.* (K).

5. *Schradera novoguineensis* (Valeton) Puff, Buchner & Greimler, *comb. nov.*

Fig. 9

Lucinaea novoguineensis Valeton in Lorentz, Nova Guinea, Bot. 8 (1911) 462; 14 (1925) 273 & t. 30, f. G [as '*novaguineensis*']. — Type: SW New Guinea [Irian Jaya], *Metroxylon* swamp on Noord River, June 10, 1907, *Versteeg 1212* (holo L; iso K).

Branches glabrous; bark dark brown. *Leaves* lanceolate to oblong-lanceolate, 60–105 (–120) \times 22–35 mm (length to width ratio 3–4:1), base cuneate-attenuate, apex acuminate-acute, thin, membranaceous, glabrous, upper surface dark brown, lower

surface reddish brown, midrib slightly sunken to \pm raised above and prominent below and primary lateral veins [5–7(–10) pairs] raised below; petioles 7–12 mm long, glabrous. *Stipules* forming a basal sheath, free part ovate-oblong, 5 mm long, glabrous. *Inflorescences* terminal, solitary, capitate-globose, 10–15 mm in diam., 15–20-flowered; involucre small and inconspicuous; peduncles 15–27 mm long, \pm straight, mostly hairy. *Flowers* heterodistylous (?; only short-styled morph known), 5-merous. Calyx tubular, truncate, 2–3 mm high, glabrous. Corolla white pinkish white (light purplish in bud); tube 2–3 mm long, lobes 2–3 \times 1 mm; inside of corolla with dense, stiff, straight hairs at the throat and the base of corolla lobes, and with a ring of soft, curly, downwardly directed hairs at or \pm below the insertion point of the filaments. Anthers 1.5 \times 0.5 mm, \pm linear, medifixed, without apical connective appendage, exerted; filaments c. 1 mm long, basally beset with curly hairs. Style 1.5–3 mm long, glabrous (? also apically hairy); stigma lobes 0.5 mm long, linear, densely papillose. Ovary globose, 2 mm in diam. *Fruits* \pm globose, c. 3 mm in diam.

Distribution — Endemic to New Guinea (Irian Jaya). Fig. 9.

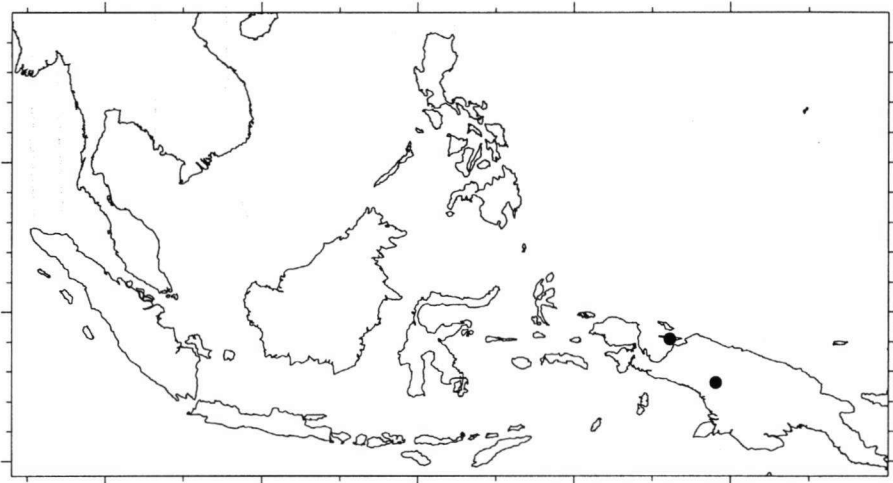


Fig. 9. Distribution of *Schradera novoguineensis* (Valeton) Puff, Buchner & Greimler.

Habitat & Ecology — In *Agathis* forest; in *Metroxylon* swamp; ?–50–? m. Flowers and young fruits in June, August, and October.

Critical remark — In overall appearance, this species quite closely resembles *Schradera membranacea* (subsp. *membranacea*) from Sumatra, Peninsular Malaysia, and Borneo. It is sufficiently different to be maintained as a separate species, however.

Specimens studied:

NEW GUINEA. **Irian Jaya:** Bernhard bivouac, 50 m, *Meijer Drees 466* (L); on Lorentz River [= Noord River], *Versteeg 1212* (K, L). Yapen Island ['Japen, *Agathis* complex Aisau'], *Vink 433* (L).

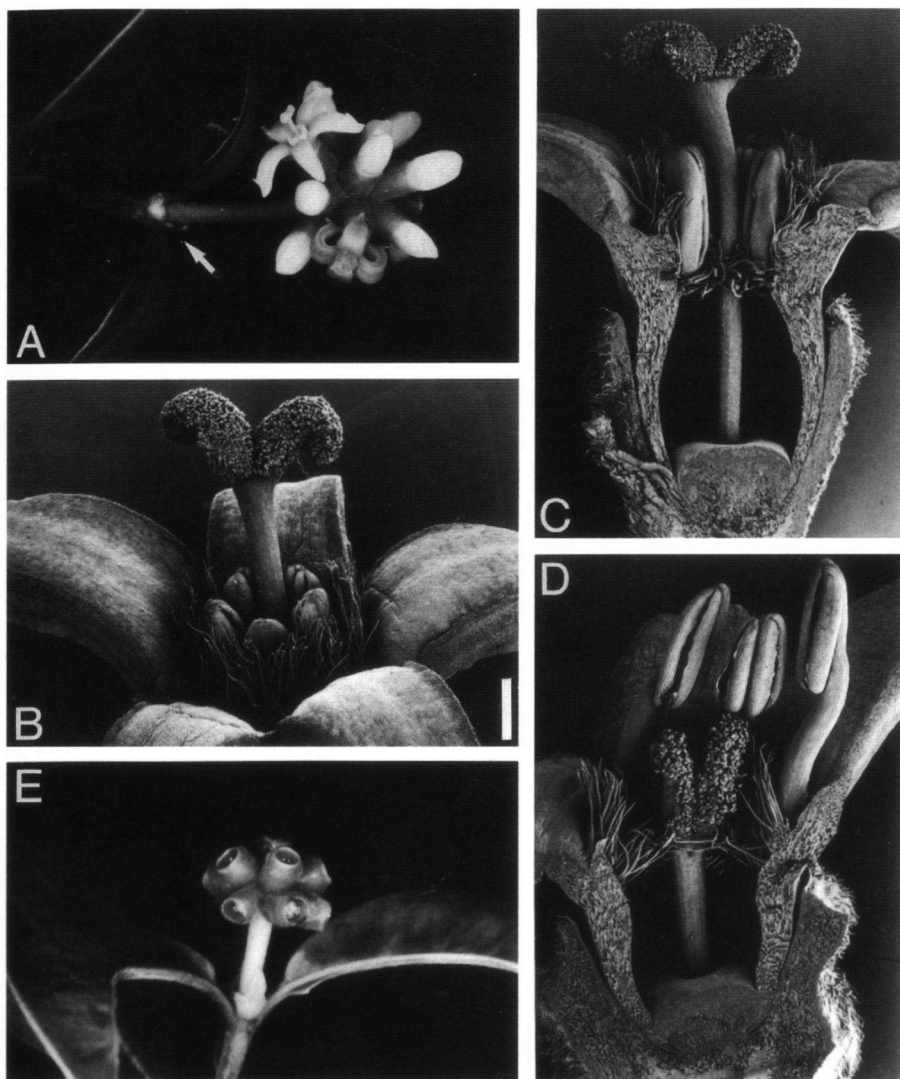


Fig. 10. *Schradera montana* (Korth.) Puff, Buchner & Greimler. — A: inflorescence of long-styled morph, note stipule (arrow). — B & C: long-styled flower in oblique view and in longitudinal section. — D: as C, but short-styled flower; in C & D note \pm scale-like outgrowths near throat, stiff erect hairs at the throat, and softer, \pm curly hairs \pm at insertion point of filaments. — E: fruiting inflorescence. A–D, from *Puff* 950309-1/1 (WU); A, from colour slide series *Puff* SEA-2904-7, E, from series *Puff* SEA-1604-5 (voucher: Puff 920501-1/3, WU). — Scale bar: 1 mm (B = C = D).

6. *Schradera montana* (Korth.) Puff, Buchner & Greimler, *comb. nov.* — Fig. 10, 11

Lucinaea montana Korth., *Nederl. Kruidk. Arch.* 2 (1851) 167; *Miq., Fl. Ind. Bat.* 2 (1857) 198; *Ann. Mus. Bot. Lugd.-Bat.* 4 (1869) 187. — Type: Borneo [Kalimantan Selatan], 'ad montem Pamatton', *Korthals s. n.* (holo L; iso L, second sheet).

Lucinaea billitonensis Valetou, Ic. Bogor. 3 (3) (1908) 117 & pl. 268, p.p. [Billiton (= Belitung) Isl., Ham '178' (L) & '62' (K); excl. Banca (= Bangka), Koba, *Teijsmann* '179' (BOG 18654) – see *S. polysperma!*].

Scandent *epiphytic shrubs*; old stems several m long, to c. 10 mm in diam., clinging to host tree with adventitious roots in rows on internodes; upper shoots hanging away from the host plant, usually without adventitious roots, \pm little-branched, not forming a \pm distinct 'crown'. *Branches* usually hairy when young, but occasionally completely glabrous; bark rough, dirty brown. *Leaves* elliptic-oblong to elliptic-lanceolate, 50–90(–120) \times 16–30(–35) mm, base acute, apex acuminate to long acuminate, \pm thinly coriaceous, usually glabrous altogether, occasionally hairy below (especially on veins), midrib slightly sunken above and raised below and primary lateral veins (6–9 pairs) usually slightly raised only below; petioles 6–10(–15) mm long, glabrous or occasionally hairy. *Stipules* connate for up to 1/2 of their length, free part triangular to linear, (3–)5–8 mm long, usually glabrous, seldom hairy outside. *Inflorescences* terminal, solitary, capitate-globose, 10–15 mm in diam., 10–20(–25)-flowered; involucre small and inconspicuous, hairy or occasionally glabrous, greenish; peduncles (5–)10–20(–30) mm long, straight, hairy or occasionally glabrous. *Flowers* heterodistylous, 4- or 5-merous. Calyx tubular, truncate, 2–4 mm high, hairy or occasionally glabrous. Corolla white, creamy-white, or greenish white (sometimes purplish in bud); tube 3–5 mm long, lobes 4–6 mm long (\pm the same length in short- and long-styled morphs); inside of corolla with stiff hairs at the throat and with a ring of short, curly, soft hairs at or \pm below the insertion point of the filaments. Anthers 2 \times 1 mm, linear, with a short, broadly triangular connective appendage, basifixed; filaments 0.5–1 mm (long-styled) or 4 mm (short-styled morph), glabrous. Style 3 mm (short-styled) or 8 mm long (long-styled morph), glabrous; stigma lobes 1.5–2 mm long, filiform to \pm flattened, beset with long papillae. Ovary globose, 2 mm in diameter, hairy. *Fruits* greenish white, whitish or white when fully mature, hairy or occasionally glabrous, \pm globose, 3–5 mm in diameter.

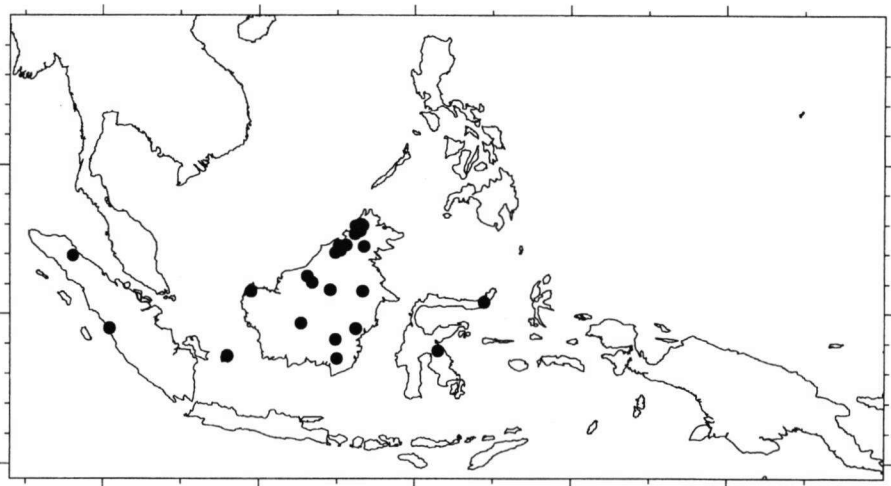


Fig. 11. Distribution of *Schradera montana* (Korth.) Puff, Buchner & Greimler.

Pollen — Small to medium-sized, 24–28 μm^* , oblate spheroidal (P: 24–26 μm^* , E: 26–28 μm^* ; P:E = 0.89–0.92), 3-brevicolporate, exine microreticulate, without any supracteal elements or with just a few scabrae (long-styled morph) or scabrata (short-styled morph); pollenkitt abundant; binucleate. (From *Puff* 950228-1/1.) — Fig. 7 in Puff & Buchner (1998); see also there for further details.

* Non-acetolyzed; acetolyzed pollen smaller, 17–26 μm .

Distribution — Sumatra, Belitung, Borneo (Sarawak, Sabah, Brunei, and Kalimantan), and Sulawesi. Fig. 11.

Habitat & Ecology — In peat swamp forest, in marshy, alluvial forest, in lakeside vegetation (\pm open tree and pandan vegetation), in mixed dipterocarp forest, oak-laurel forest and submontane and mossy forest; (?–)300–2000 m. Flowering and fruiting all year round.

Critical remark — '*Lucinaea billitonensis* Valetton' contains two elements: The *Ham* specimens (from which the plate in Valetton has obviously been drawn) undoubtedly belong to *S. montana*, the *Teijsmann* specimen to *S. polysperma* (see there for further details).

Specimens studied:

MALAYSIA. Borneo: Sarawak: 4th Division, Bt. Mersing, Anap, 300 m, *Sibat ak Luang* S 22399 (SAN); Baram Distr., G. Mulu National Park, 900–1925 m, *B. Lee* S 38080 (K, KEP), S 38801 (K, KEP, L); Baram, *Hose* 50 (BM, K, L); Bario, route to Bt. Lawi, 1290 m, *D. Awa & Lee* S 50572 (K). 5th Division, Limbang Distr., G. Pagon Periuk, *D. Awa & Lee* S 47838 (K, KEP); Bilengki, Bakelalan, 1320 m, *Brooke* 10434 (BM, L). 7th Division, Kapit Distr., Bt. Sampandai, Ulu Sampurau, Melinau, 1600 m, *Paie* S 40883 (K, KEP, L, SAN), S 40885 (K); –, foothills of Bukit Batu Tibang, Balleh / Balang watershed, extreme headwaters of Balleh R., 850 m, *Anderson & Paie* S 28487 (K, L). Without locality, *Beccari* 1364 (K). — Sabah: Sipitang Distr., 6 miles from Mandulang road to Maligan [F.R.], *Y.F. Lee & Dewol* SAN 69867 (K, KEP, SAN); Keningau Distr., Tambulanan For. Res., Yayasan, *Sigin & Amin* [as *Amin & Sigin* in KEP] SAN 69165 (K, KEP, L, SAN); –, SE of Kaingaran village, slopes of Mt Trus Madi, 1160 m, *Wood & Wyatt-Smith* SAN A 4377 (KEP, L, SING); Tambunan Distr., Trus Madi area, 1250–1450 m, *Puff* 950307-1/1 (SAN, WU), 950309-1/1 (SAN, WU); –, Crocker Range, Kinabalu–Tambunan rd., km 59.5–64, 1250–1600 m, *Beaman et al.* 7347 (L), 8249 (K, L), 8386 (L); –, Crocker Range, Rafflesia F.R., 1350 m, *Puff* 950228-1/1 (SAN, WU); Penampang Distr., trail to Kampong Libodon, 1400 m, *Cockburn* SAN 65466 (K, SAN); Ranau Distr., Mile 37, Ranau Road, 1220 m, *Muroh*, K. SAN 42515 (SAN); Mt Kinabalu area, Tenompok, 1520–1650 m, *Clemens & Clemens* 27710 [or '27710A'] (BM, HBG, K, L, SING), 28835 (BM, K, L); –, Penibukan, 1220–2000 m, *Clemens & Clemens* 31710 (K, L), 40735 (BM, K); Kinabalu National Park, Sosopodon F.R., nr Kundassang, 1350–1500 m, *Kokawa & Hotta* 4599 (L); Kundassang North, Halting Bungalow, Sosopodon [F.R.], 1620 m, *Mujin*, M.A. SAN 33799 (K, SAN).

INDONESIA. Sumatra: Atjeh Prov., Gunung Leuser Nature Reserves, G. Bandahara, c. 6 km NE of Kg. Seldok (Alas valley), c. 25 km N of Kutatjane, 1500–1800 m, *de Wilde & de Wilde-Duyffes* 15031 (K, L); Tanang Taloe, 1100 m, *Bünnemeijer* 1033 (L). — **Belitung (Billiton):** without locality, *Ham* '62' (K), *Ham* '178' (L). — **Borneo:** Kalimantan Barat: Mt Semedoem, *Hallier* 695 (K, L, SING); Bukit Raja, 400–1000 m, *Nooteboom* 4634 (L), 4637 (L). — Kalimantan Tengah: nr Djilhi [E of Buntok], *Winkler [Hubert]* 3267 (BM, K, L). — Kalimantan Selatan: 'ad montem Pamatton', *Korthals s.n.* (L). — Kalimantan Timur: Balikpapan Distr., peak of Balikpapan (G. Beratus), 800 m, *Kostermans* 7499 (K, L); West Koetai [Kutei], nr Mt Kemoel [= Kongkemul Mt], 1100–1500 m, *Endert* 3704 (K, L), 3936 (K, L). Not traced: Kalimantan, 3 km N Sambujur village, *Giesen* 130 (L). — **Sulawesi:** Sulawesi Utara, Bolaang Mongondow, Gunung Ambang Nat. Res., Danau Mootat area, 1000 m, *de Vogel & Vermeulen* 7175 (K); S Sulawesi: Balo-Balo Mt, Uwai Toro, *Hennipman* 6157 (K, KEP, L).

BRUNEI. Temburong Distr., Mt Retak area, 1300–1500 m, *Puff & Buchner* 920501-1/3 (BRUN, K, WU); –, Bukit Belalong, 817 m, *Prance* 30606 (K); Bt. Biang, 400 m, *Ashton* 163 (K).

7. *Schradera pentacme* (Stapf) Puff, Buchner & Greimler, *comb. nov.* — Fig. 12

Lucinaea pentacme Stapf, Trans. Linn. Soc. II, Bot. 4 (1894) 174. — Type: Borneo [Sabah], Mt Kinabalu, 6600 ft. [c. 2010 m], *Haviland 1238* (holo K).

Scandent *epiphytic shrubs*; old *stems* several m long, to c. 10 mm in diam., clinging to host tree with adventitious roots in rows on internodes; upper shoots hanging away from the host plant, usually without adventitious roots, \pm little- to much-branched, not forming a \pm distinct 'crown'. *Branches* glabrous or seldom with curly hairs, sometimes slightly ridged; bark thin, corky, whitish or greyish, peeling off early and irregularly. *Leaves* ovate to elliptic, 40–80(–110) \times 20–40 mm, base attenuate, apex attenuate to acute, margins recurved, thickly coriaceous, glabrous or (seldom) hairy on lower surface, \pm yellowish and with black dots below, midrib raised above and below and primary lateral veins (5–7 pairs) raised below; petioles (5–)8–13 mm long, glabrous or seldom hairy below. *Stipules* connate for up to 1/2 of their length, free part \pm ovate to triangular, (3–)5–6 \times 3 mm, glabrous or occasionally hairy on the outside and/or the margins. *Inflorescences* terminal, solitary, capitate, 10–15 mm in diam. (mostly fruiting), 5–10(–15)-flowered; involucre \pm inconspicuous and smallish; peduncle (5–)10–20 mm long, straight, glabrous or occasionally hairy. *Flowers* heterodistylous (occasionally also \pm isostylous?), 5-merous. Calyx tubular, truncate, 3–4 mm high, glabrous. Corolla white, creamy-white, or sometimes bluish or pinkish purplish white in bud; tube 3–4 mm (long-styled) or 7 mm long (short-styled morph), lobes 4–6 \times 1.5–2 mm (the hooded apex of the lobes 2–3 mm long); inside of corolla with stiff straight hairs at the throat and a ring of soft, downwardly curled hairs at or below the insertion point of the filaments. Anthers 1.5–2 \times < 1 mm, sagittate (long-styled) or \pm linear (short-styled morph), medifixed; filaments 0.5–1 mm long and basally with curly hairs or glabrous (long-styled) or 2 mm long and entirely glabrous (short-styled morph). Style 2.5 mm (short-styled morph) or 4 mm long (long-styled morph), glabrous; stigma lobes short (1 mm long), flattened, ascending-spreading and with \pm elongated papillae (long-styled morph) or 2.5 mm long, filiform and with larger papillae (short-styled morph). Ovary \pm subglobose, 2–3 mm in diam. *Fruits* greyish white to ivory when fully mature, globose to subglobose, 4–5 mm in diam.

Distribution — Endemic to Borneo; centred in the Mt Kinabalu area (Sabah) but also in the mountains of the 4th and 5th Division of Sarawak. Fig. 12.

Habitat & Ecology — In (sub)montane, often mossy forest (both in primary and secondary vegetation); 1430–2150 m. Flowering and fruiting from February to October.

Critical remarks \dashv . *Schradera pentacme* was previously thought to be endemic to the Mount Kinabalu area. During the present study, however, a few collections which belong here surfaced from mountains of Sarawak. Some of the Sarawak populations [from both the 4th and 5th Division; e.g., *Awa & Lee S 51138* (K), *Paie S 26374* (K, L, SAN, SING)], only differ from the typical Kinabalu material in having (\pm) hairy young branches, petioles, and lower leaf surfaces rather than being entirely glabrous. Taxonomic recognition does not seem justified as they do not differ in any other characters.

By adding the Sarawak collections to *S. pentacme*, the species becomes a disjunct mountain species. To date, no collections are known from the mountains lying between the known sites (e.g., Crocker range or Trus Madi).

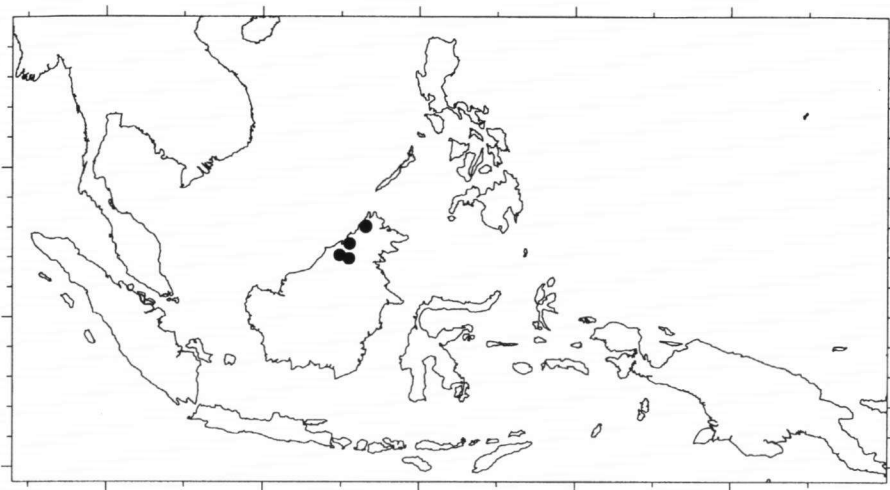


Fig. 12. Distribution of *Schradera pentacme* (Stapf) Puff, Buchner & Greimler.

The species is very close to *S. montana*, and could perhaps be considered a 'high altitude race' of the latter (i.e., might have evolved from '*S. montana* stock'). Nevertheless, it is sufficiently different from typical *S. montana* to be considered a separate species.

Specimens studied:

MALAYSIA. Borneo: Sarawak: 4th Division, Bario, Tama Abu Range, 1750 m, *D. Awa & Lee S 51138* (K); Baram Distr., G. Mulu National Park, 1880 m, *Nielsen 796* (AAU); —, Gunung Mulu west ridge, 1800 m, *Argent & Coppins 1130* (KEP). 5th Division, Lawas Distr., Kota F.R., Ulu Sg. Masia, 1430 m, *Tong & Jugah S 32935* (K, KEP, L, SAN); —, Sungai Belaban, path to G. Murut, 1890 m, *Paie S 26374* (K, L, SAN, SING). — Sabah: Mt Kinabalu, 1960 m, *Fuchs 21050* (K, L), 2010 m, *Haviland 1238* (K); Kinabalu National Park, 2000 m, *Puff 890709-1/8* (WU); Mt Kinabalu (and vicinity), Pinosuk plateau, 1520–1700 m, *Beaman et al. 8762* (K, L), *Chew et al. 2174* (K, L, SAN, SING); —, Tenompok, 1520–1650 m, *Clemens & Clemens 28522* (SING), 29392 (BM, K, L); —, upper Kinabalu, 1830–4120 m, *Clemens & Clemens 29690* (BM, HBG, K, L), 30337 (BM, HBG, K, L); —, Marai Parai, 1520 m, *Clemens & Clemens 35138* (HBG); —, c. 2 km N Lumu Lumu, Kamarangan path (Kota Belud Distr.), 1980 m, *Wood & Wyatt-Smith SANA 4471* (KEP, L, SING); —, Bembangan R. (Mt Kinabalu Exped.), 1580 m, *Chew & Corner 4954* (K, SAN, SING); —, ridge E of East Mesilau River and Mesilau Cave, 1900–2150 m, *Beaman et al. 9562* (K); —, Mesilau hill, 2100 m, *Poore s.n.* (K); —, tributary of Mesilau R., 2000 m, *Collenette 21638* (K, L).

8. *Schradera korthalsiana* (Miq.) Puff, Buchner & Greimler, *comb. nov.*

Lucinaea korthalsiana Miq., Ann. Mus. Bot. Lugd.-Bat. 4 (1869) 187. — Type: Sumatra, *Korthals s.n.* (holo L; iso L, 4 additional sheets).

Lucinaea morinda sensu Korth., Ned. Kruidk. Arch. 2 (1851) 167, non DC., Prodr. 4 (1830) 368.

Branches generally glabrous, rarely youngest parts hairy; bark brown. *Leaves* elliptic to lanceolate or obovate, (50–)70–130 × (25–)30–60 mm (length to width ratio 2–2.7:1), base acute to attenuate, apex shortly acuminate, coriaceous, glabrous, with

black dots on lower surface, midrib and primary lateral veins (9–11 pairs) raised above and below; petioles (5–)10–25(–30) mm long, usually glabrous, rarely hairy. *Stipules* connate for up to 1/4 of their length, free part \pm broadly triangular to ovate, 6–10 mm long, glabrous or rarely hairy outside. *Inflorescences* terminal (and sometimes also pseudo-axillary), solitary, capitate-globose, 5–15 mm in diam., (3–)5–20-flowered; involucre \pm conspicuous, greenish; peduncle 5–10 mm long, straight, hairy or occasionally glabrous. *Flowers* heterodistylous, 5-merous. Calyx tubular, truncate, 2 mm high, glabrous. Corolla white or pale green (sometimes pinkish or pinkish green in bud); tube 5–6 mm long, lobes 4–5 mm long (about the same length in both short- and long-styled morphs); inside of corolla tube with rounded scales near the throat (long-styled) or below insertion point of filaments (short-styled morph), with dense, stiff, upwardly directed hairs at and around the throat in both morphs, and with a ring of soft curly hairs below insertion point of filaments (long-styled) or on the scales (short-styled morph). Anthers 1.5–2 \times 1 mm, \pm linear, basifixed, with (long-styled) or without (short-styled morph) short, triangular apical connective appendage; filaments 1 mm (long-styled) or to 2 mm long (short styled morph), glabrous. Style 3–4 mm (short-styled morph) or 6 mm long (long-styled morph), glabrous; stigma lobes (2; occasionally also 3) short (1.5 mm long), \pm horizontally spreading and with inconspicuous papillae (long-styled morph) or to 3 mm long, ascending and with longish papillae (short-styled morph). Ovary globose, 1–2 mm in diam., occasionally also 3-locular. *Fruits* whitish when fully mature, \pm globose, 3–4 mm in diam.

Distribution — Sumatra, Peninsular Malaysia (Perak) and Borneo.

Critical remarks — *Schradera korthalsiana* is close to *S. montana*, and sometimes not easily separable from the latter. Usually, however, *S. korthalsiana* is distinguished by its wider leaves and shortly stalked capitula.

The species is divided into two subspecies: collections differing from 'typical' *S. korthalsiana* in generally being more robust and having larger leaves are separated as a geographical-ecological subspecies (subsp. *robusta*).

a. subsp. *korthalsiana* — Fig. 13A

Leaf blades up to 100 mm long (rarely more), petioles 10–15 mm long; *inflorescences* 5–10 mm in diam., 5–10-flowered.

Distribution — Sumatra, Peninsular Malaysia (Perak) and Borneo (Sarawak, Sabah, Kalimantan). Fig. 13A.

Habitat & Ecology — In alluvial forest, *Agathis* forest, mixed dipterocarp forest, or in (sub)montane forest (generally, either in primary or disturbed sites); also in kerangas vegetation; 50–1550 m. Flowering and fruiting almost all year round.

Specimens studied:

MALAYSIA. **Peninsular:** Perak: Larut Hill, *Curtis s.n.* (SING). — **Borneo:** Sarawak: 1st Division, near Kuching, *Haviland 1025* (BM, K, L); Kuching Distr., Selang F.R., 30–60 m, *Paie S 8492* (K, L, SING). 4th Division, Ulu Mayeng, Kakus [River], 200 m, *Sibat ak Luang S 21855* (K, L, SAN, SING); Bario, Ulu Baram, path to Kuba'an Pungor Pawan, 1550 m, *Anderson S 20173* (K, L); Baram Distr., G. Mulu National Park, N of Long Berar, *Jermy 13847* (K); Marudi, Ulu Sg. Dapoi, Tinjar, 150 m, *Othman bin Haron & Suib S 23005* (K, L, SAN, SING). 7th Division, Kapit Distr., confluence of Sg. Balleh and Sg. Balang, 340 m, *Ching [Yii Puan Ching] et al. S 52014* (K, KEP); Belaga, hills behind airfield, 150 m, *Ashton S 18260* (K, KEP, L, SAN, SING).

— Sabah: Mt Kinabalu (and vicinity), Ulu Langanani, Mamut R., 1160 m, *Chew et al. 1734* (K, L, SAN, SING); Mt Kinabalu area, Penibukan, 1220–1520 m, *Clemens & Clemens 31197* (BM, HBG, K, L); Kinabatangan Distr., Lamag, nr lake on G. Lotung, SE of Inarat, 430 m, *Cockburn SAN 83156* (K, L).

INDONESIA. **Sumatra:** Asahan, around Hoeta Bagasan, *Rahmat si Boeea 6755* (SING); –, Adian Rindang, vicinity of Hoeta Tomoean Dolok (Toemoean Dolok), *Rahmat si Boeea 8596* (L); –, vicinity of Aek Salabat (NE of Tomoean Dolok, W of Contract Salabat), c. 450 m, *Rahmat si Boeea 9611* (L); Ayer mancior (Ajer mantjoer): Padang Prov., 360 m, *Beccari 672* (K). Without locality, *Korthals s.n.* (L). — **Borneo:** Kalimantan Barat: Gunung Singgeh, Bentiang, Pontianak, 300 m, *Shea 26684* (K). — Kalimantan Timur: W Kutei, Mt Palimasan nr Tabang on Beljan R., 500 m, *Kostermans 13025* (L); –, nr Long Petak, 450 m, *Endert 3532* (K, L).

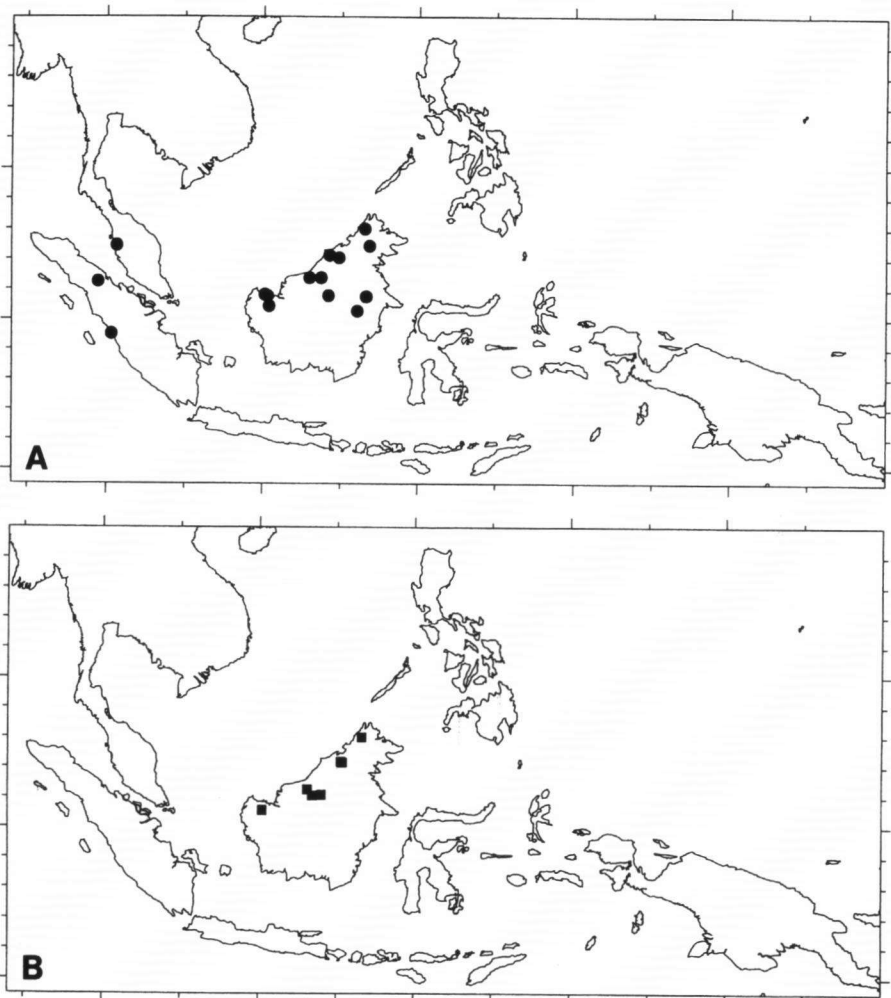


Fig. 13. Distribution of *Schradera korthalsiana* (Miq) Puff, Buchner & Greimler. — A: subsp. *korthalsiana*. — B: subsp. *robusta* Puff, Buchner & Greimler.

b. subsp. *robusta* Puff, Buchner & Greimler, *subsp. nov.* — Fig. 13B

A subsp. *korthalsiana*, inter alia, foliis majoribus differt. — Typus: Brunei: Temburong Distr., North ridge of Bukit Retak between LZ 238 and the summit, Sept. 17, 1988, *Wong 414* (holo BRUN; iso K, KEP, L, SAN).

Scandent *epiphytic shrubs*; old *stems* several m long, to c. 10 mm in diam., clinging to host tree with adventitious roots in rows on internodes; upper shoots hanging away from the host plant, usually without adventitious roots, \pm much-branched, occasionally forming a \pm distinct rounded 'crown' (< 1 m in diam.). *Leaf blades* usually > 100 mm and up to 130 mm long, petioles 15–25 mm long; *inflorescences* 10–15 mm in diam., 10–20-flowered.

Distribution — Endemic to Borneo (Sarawak, Brunei, Sabah). Fig. 13B.

Habitat & Ecology — In (sub)montane forest or mossy forest, in primary hill forest or in stunted ridge forest, in mixed dipterocarp forest; 900–2900 m. Flowers in January, March to July, and September; fruits up to October.

Critical remark — As compared to subsp. *korthalsiana*, subsp. *robusta* has a much more restricted and \pm clearly circumscribed distribution range, being confined to higher mountainous areas of Sarawak, Brunei, and Sabah.

Specimens studied:

MALAYSIA. Borneo: Sarawak: 1st Division, Serian Distr., G. Penrissen, *Paie S 16356* (L, SAN, SING). 4th Div., Bt. Mersing, Ulu Anap, 1000 m, *Ashton S 17662* (K, L). 5th Div., Lawas Distr., Bukit Tebunan, Ulu Trusan, 1450 m, *B. Lee S 52488* (K, KEP). 7th Division, Kapit Distr., Bt. Sampandai, Ulu Sampurau, Melinau, 1119 m, *Manis & Salang S 41196* (K, KEP, SAN), 1600 m, *Paie S 40870* (K, KEP, L, SAN); Batu Laga Plateau, Batang Rejang, 2900 m, *Mohtar S 48242* (K, KEP). — Sabah: Mt Kinabalu area, Penibukan, 1220–1520 m, *Clemens & Clemens 30937* (BM, HBG, K, L); –, Mt Nunkok, 915–1220 m, *Clemens & Clemens 32703* (BM, HBG, K, L).

BRUNEI: Temburong Distr., Bukit Pagon ridge, 1570 m, *Ashton BRUN 1042* (K, L); Gunung Pagon, *Coodé 7503* (K); Gunong Retak, 1300–1350 m, *Johns 6554B* (K), *Puff & Buchner 920501-1/10* (BRUN, K, WU), *920503-1/2* (BRUN, K, WU); North ridge of Bt. Retak between LZ 238 and the summit, *Wong 414* (BRUN, K, KEP, L, SAN); ridge NE Gunong Retak, 1350 m, *Sands 5261* (K).

9. *Schradera elmeri* Puff, Buchner & Greimler, *nom. nov.* — Fig. 14

Lucinaea involucrata Elmer, Leafl. Philipp. Bot. 3 (1911) 997; Merr., Enum. Philipp. Flow. Pl. 3 (1923) 520. — Type: Philippines, Mindanao, Davao Distr., Todaya (Mt Apo), July 1909, *Elmer 11227* (holo ?PNH \dagger ; iso BM, HBG, K, L, W). — See Critical remark.

Branches glabrous, the older parts corky and grey-brown. *Leaves* oblong or elliptic, 55–80 \times 20–35 mm, base acute to subcuneate, apex obtuse to acute, margins recurved, thickly coriaceous, glabrous, with black dots on lower surface, midrib \pm sunken above and raised below, primary lateral veins (5–8 pairs) \pm raised below; petioles 10–18 mm long, glabrous or occasionally hairy. *Stipules* connate for up to 1/2 of their length, free part broadly ovate, 7–10 mm long, glabrous. *Inflorescences* terminal, solitary, capitate, 10–20 mm in diam., 5–10-flowered; involucre conspicuous, cup-shaped, usually > 5 mm high, glabrous; peduncles 5–15 mm long, \pm straight, glabrous. *Flowers* heterodistylous (?; only long-styled morph known), 4-merous. Calyx tubular, truncate, 3–5 mm high, glabrous. Corolla white or creamy-white; tube 4–5 mm long, lobes 4–6 mm long; inside of corolla tube with stiff, unicellular, upwardly directed hairs at

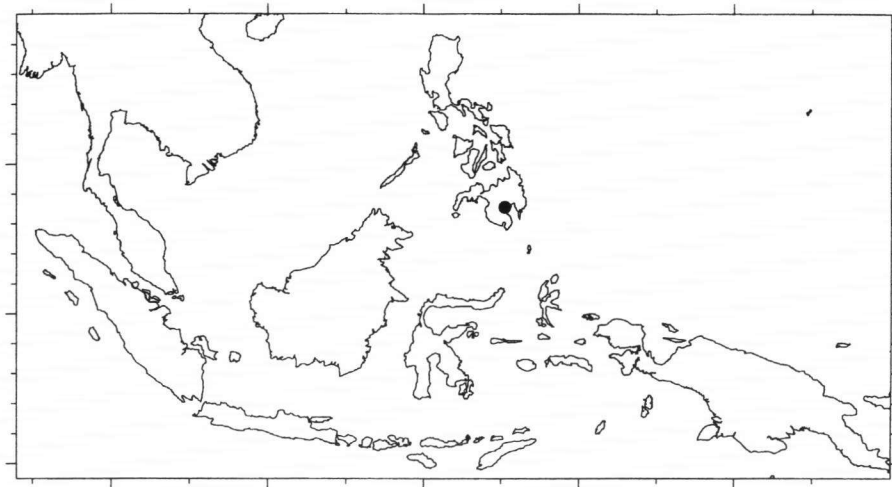


Fig. 14. Distribution of *Schradera elmeri* Puff, Buchner & Greimler.

the throat and curly, soft, downwardly directed hairs in a ring-like arrangement below. Anthers 1.5–2 × 1 mm, linear to ± oblong, dorsi-medifixed, with small, broadly triangular to rounded, apical connective appendage; filaments 0.75–1 mm long, glabrous except for curly hairs near their base. Style 6 mm long, glabrous; stigma lobes 1.5 mm long, spreading, beset with longish papillae. Ovary globose, glabrous, 3 mm in diam. *Fruits* white when fully mature, globose to subglobose, 3–5 mm in diam. — Fig. 4E in Puff et al. (1993).

Distribution — Endemic to the Philippines (Mindanao). Fig. 14.

Habitat & Ecology — In mossy forest; 750–1900 m. Flowers in March, June, July, and October; fruits in March, June, and July.

Critical remark — A nomen novum had to be chosen because the species name is already used for a South American *Schradera* [*S. involucrata* (Swartz) K. Schum., Fl. Brasil. 6 (6): 295 (1889)].

Specimens studied:

PHILIPPINES. Mindanao: Davao Distr., Mt Kampalili, 750 m, *Edaño* 889 [PNH 11592] (L); –, Mt Apo, Lake Linao, *Edaño* PNH 1376 (L); –, Todaya (Mt Apo), *Elmer* 11227 (BM, HBG, K, L, W); Gumate Distr., E slopes of Mt Apo, 1120 m, 'A. N. U.' 1513 (L); Bukidnon Prov., Mt Katanglad, 1900 m, *Sulit* 3291 [PNH 9984] (L); –, Mahilucot R., *Ramos & Edaño* B.S. 38709 (K, L).

10. *Schradera nervulosa* (Stapf) Puff, Buchner & Greimler, *comb. nov.*

Fig. 15–17

Lucinaea nervulosa Stapf, Trans. Linn. Soc. II, Bot. 4 (1894) 174. — Type: Borneo [Sabah], Mt Kinabalu, 7000 ft. [c. 2130 m], *Haviland* 1239 (holo K).

Lucinaea ridleyi King, J. As. Soc. Bengal 72 (1903) 178; Ridl., Fl. Malay Penins. 2 (1923) 56. — Types: Malaysia, Perak, *Ridley* 2923 (lecto K; isolecto BM, selected here); *King's coll.* 5052 (BM, K, syn.), 7836 (BM, K, L, SING, syn.), *Scortechini* 306 (BM, K, syn.); Singapore, *Lobb s.n.* (BM, K, syn.); Borneo [Sarawak], *Beccari* 3505 (K, syn.). — Syntypes not seen: Malaysia, Perak, *King's coll.* 2161, *Scortechini* 639, *Wray* 446.

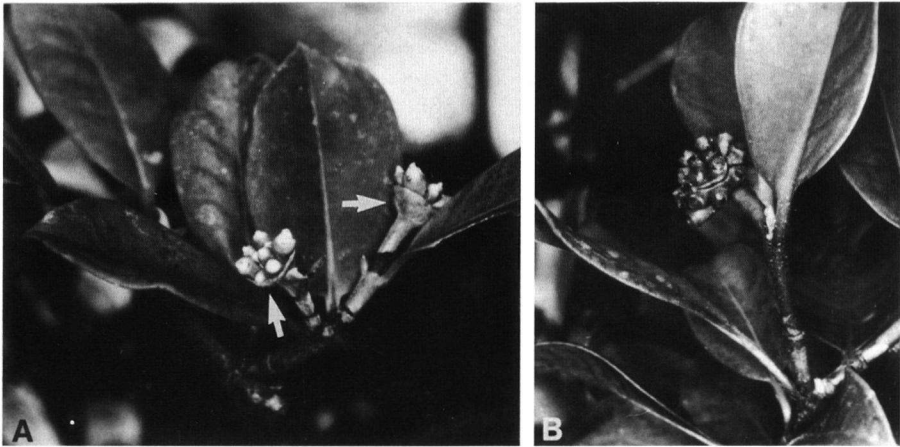


Fig. 15. *Schradera nervulosa* (Stapf) Puff, Buchner & Greimler, shoots with A, young inflorescences (note conspicuous involucre, arrows) and B, with a fruiting inflorescence (involucre no longer clearly discernible). Both from the same plant. From colour slide series Puff SEA-2677-2681 (voucher: Puff 950302-1/1, WU).

Scandent *epiphytic shrubs*; old *stems* several m long, to c. 10 mm in diam., clinging to host tree with adventitious roots in rows on internodes; upper shoots hanging away from the host plant, usually without adventitious roots, \pm much-branched, sometimes forming a \pm distinct rounded 'crown' (usually < 1 m in diam.). *Branches* glabrous, rarely youngest parts a little hairy; bark brown, greyish brown, or grey. *Leaves* elliptic to ovate, or obovate, sometimes \pm lanceolate, (70–)80–180 \times 25–100(–110) mm (length to width ratio 1.7–4:1), base \pm rounded to attenuate, apex attenuate to acute, coriaceous, glabrous, with dark spots on lower surface, midrib slightly sunken to raised above and prominent below and primary lateral veins (7–10 pairs) raised above and below; petioles 10–25(–30) mm long, glabrous. *Stipules* connate for up to 1/3 (1/2) of their length, free part broadly triangular, 10–20 mm long, glabrous. *Inflorescences* terminal (and sometimes also pseudo-axillary), solitary, capitate(-globose), 10–30 mm in diam., (5–)10–15(–20)-flowered; involucre conspicuous and \pm cup-like (at least in bud-stage), glabrous, very rarely pubescent, green; peduncles 10–30(–50) mm long, straight, glabrous or occasionally hairy. *Flowers* heterodistylous, 3–5-merous. Calyx tubular, truncate, (3–)4–6 mm high, glabrous. Corolla white, creamy-white, or whitish green (sometimes reddish or purplish white in bud); tube 5–7 mm long, lobes (7–)10–14 mm long (about the same length in short- and long-styled morphs); inside of corolla with stiff, straight hairs at the throat (often on 3-tipped, scale-like outgrowths) and with straight to curly hairs in a ring-like arrangement below (\pm at the insertion point of the filaments). Anthers 2.5–4 \times 1 mm, \pm linear, basifixed, without apical appendages; filaments 1–2 mm (long-styled) or (3–)6–7 mm long (short-styled morph), glabrous. Style 4–7 mm (short-styled) or 10–15 mm long (long-styled morph), glabrous; stigma lobes 3–4 mm long, filiform and with long papillae (short-styled) or \pm flattened and with inconspicuous papillae (long-styled morph). Ovary globose, 2–3 mm in diam. *Fruits* white or creamy white when fully mature, \pm globose, (4–)5–8 mm in diam. – Fig. 6 in Puff & Buchner (1998).

Pollen — Small to medium-sized, 24–28 μm^* , oblate spheroidal (P: 24–26 μm^* , E: 26–28 μm^* ; P:E = 0.89) 3-brevicolarate, exine reticulate to microreticulate heterobrochate, scabrate; pollenkitt abundant; binucleate. (From short-styled morph of *Puff 950307-1/2.*) – See Puff & Buchner (1998) for further details.

* Non-acetolyzed; acetolyzed pollen smaller, 20–24 μm .

Distribution — From Sumatra and Peninsular Malaysia to Borneo. Fig. 16.

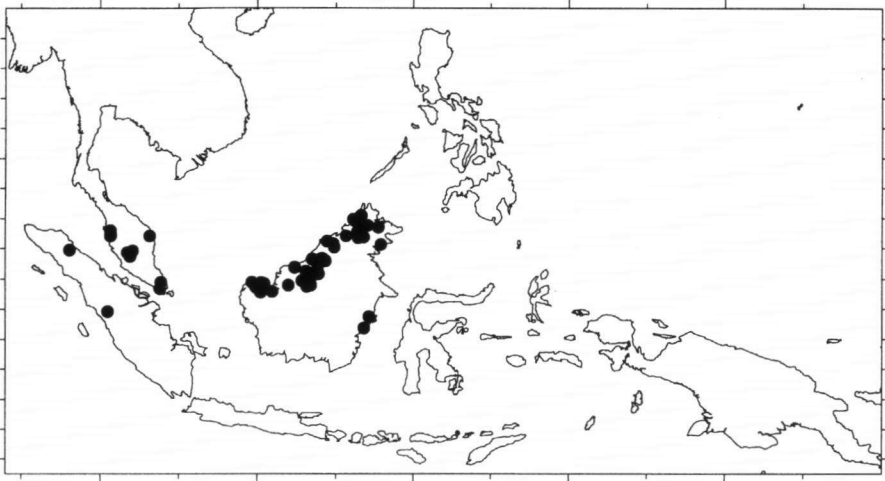


Fig. 16. Distribution of *Schradera nervulosa* (Stapf) Puff, Buchner & Greimler.

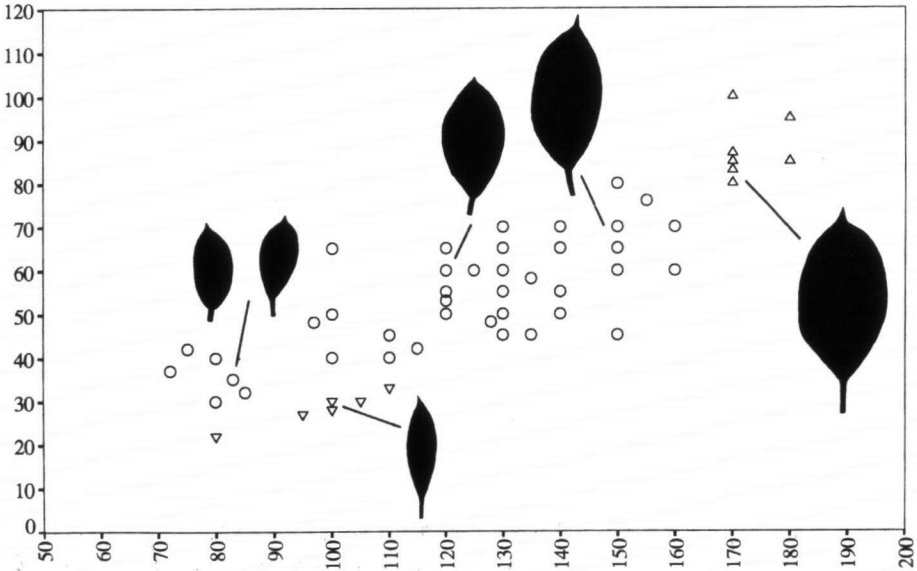


Fig. 17. Leaf blade lengths and widths (in mm) and representative leaf silhouettes of *Schradera nervulosa* (Stapf) Puff, Buchner & Greimler. O: 'typical'; ∇: informal '*angustifolia*' form; Δ: informal '*latifolia*' form.

Habitat & Ecology — In alluvial and swampy forest, in riparian forest, lowland (dipterocarp) forest, mixed dipterocarp forest, mossy submontane forest, and in montane oak-forest (generally, either in primary or disturbed sites); also in 'heath'-forest and kerangas vegetation; ± 0 –1830(–2130) m. Flowering and fruiting all year round.

Critical remarks — An investigation of the types of *L. nervulosa* Stapf (1894) and *L. ridleyi* King (1903) showed that the two are inseparable (previously, the name *L. nervulosa* had frequently been wrongly applied to plants that are now called *S. pseudonervulosa*; see there for further comments).

In *S. nervulosa*, the stipules are mostly relatively large. They, however, tend to fall off very early so that they are often not present on herbarium specimens (e. g., on the type specimen of *S. nervulosa*; for this reason, stipules are not even mentioned in the original description).

This widely distributed species is quite variable in both vegetative and fertile character states. Particularly noteworthy and obvious is the considerable variation in leaf shape and size. Based on leaf characteristics, *S. nervulosa* can informally be divided into three rough, major categories (Fig. 17):

1) 'Typical' *nervulosa*, in which the leaf blades are (70–)100–160 \times (30–)40–80 mm and show a length to width ratio of 2–2.7:1. Specimens with this leaf form are found throughout the species' range.

2) The informal '*angustifolia*' form, in which the leaf blades are, as compared to the 'typical' form, relatively smaller and narrower (80–110 \times 25–35 mm; length to width ratio 3–4:1). This form appears to occur primarily in Peninsular Malaysia and is particularly conspicuous in Pahang [the Fraser Hill area, e. g., *Burkill & Holttum SFN 8681* (K, SING), *Loh FRI 19177* (KEP, L), and others, and the Krau Game Res. (G. Benom), e. g., *Whitmore FRI 3265* (K, KEP, L)].

3) The informal '*latifolia*' form, in which the leaf blades are larger and broader than in the 'typical' form (170–180 \times 80–100 mm), although the length to width ratio (1.7–2:1) does not differ markedly. Collections representing this form occasionally crop up throughout the entire distribution range, although there seems to be a certain concentrating of '*latifolia*' forms in Sarawak [from around Kuching to Bako; e. g., *Brooke 9535* (BM, L, SING), *Chai S 18003* (K, KEP, L, SAN, SING), and others].

Specimens studied:

MALAYSIA. Peninsular: Perak: Larut, 1000–1200 m, *King's coll. 2162* (BM, K); –, 100–250 m, *King's coll. 5052* (BM, K); Taiping Hills, *Ridley 11441* (BM, K); Tea Gardens, Taiping, 600 m, *Ridley 2923* (BM, K); Maxwell's Hill, 1160 m, *Burkill & Haniff SFN 12942* (KEP, SING); Ulu Selama, *Yapp 613* (K); Gunung Batu Pateh, 1150 m, *Wray 1113* (K); Trolak FR, *Chelliah KEP 104686* (K, L); without locality, *King's coll. 7836* (BM, K, L, SING), *Scortechini 306* (BM, K). — Selangor: G. Bungah Buah, *Wong FRI 32232* (K, KEP, L, SING). — Pahang: Fraser Hill [upon Selangor border], 1220–1320 m, *Burkill & Holttum SFN 8681* (K, SING), *SFN 21544* (SING); –, Ulu Jeriau, 1390 m, *Loh FRI 19177* (KEP, L); –, 1200 m, *Nur SFN 10533* (BM, SING); Krau Game Res., G. Benom, 1650 m, *Whitmore FRI 3265* (K, KEP, L). — Terengganu: Jerangau State Land Forest, 50 m, *Hou 777* (KEP, L). — Johore: Gunung Panti, 520 m, *Wong FRI 35267* (KEP); Kota Tinggi Distr., Gunong Panti West, 550 m, *Maxwell 81-180* (AAU, SING). — **Borneo:** Sarawak: 1st Division, Bako Nat. Park, *D. Awa & Paie S 47022* (K, KEP), *Chai S 18003* (K, KEP, L, SAN, SING); –, Tanjong Po Headland, 46 m, *Ching [Yi Puan Ching] S 42165* (K, KEP, L, SAN); near Kuching, *Haviland 84* (K); Kuching, Semengoh Arboretum, *Gary et al. S 37024* (K, KEP, L, SAN); –, G. Santubong East, 130 m, *Bujang S 13499* (K, L); –, Selang F. R., 60 m, *Anderson S 9424* (K, L); –, Matang, 250 m, *Brooke 9535* (BM, L, SING), *Collenette S 829* (K); –, proposed Matang Nat. Park, Ulu Sg. Rayu, 500 m, *B. Lee S 54062* (K, KEP); Lundu Distr., G. Pueh ['Mt

Poi'], 1200 m, *Clemens & Clemens S 20272* (K); —, Bukit Sejarak, Sampadi, 25th mile Bau–Lundu rd., 250 m, *Paie S 26931* (K, L); Bau Distr., G. Raja, 190 m, *Ching [Yii Puan Ching] S 45928* (K, KEP); Serian Distr., G. Penrissen, *Paie S 16380* (K, SAN); below summit ridge of Bungoh range, 860 m, *Anderson S 29044* (L); summit Gunung Siruruh, border Sarawak/Kalimantan, 1250 m, *Ching [Yii Puan Ching] S 55210* (KEP). 1st/2nd Division boundary, G. Buri, 75th mile, *Martin & Ismawi S 36870* (K, KEP, L). 2nd Division, Bukit Senyandang, Lingga, 650 m, *B. Lee S 44050* (K); Lubok Antu Distr., Bt. Lanjak, Lanjak–Entimau Protected Forest, 1260 m, *Chai S 33818* (K). 3rd Division, Rumah Temenggong, Begrih, Bawang, Balingian, 10 m, *Chai S 19452* (K, KEP, L, SAN). 4th Division, Bt. Mersing, Anap, 700 m, *Sibat ak Luang S 22155* (K, L); Tubau, Bukit Skelap [Sekalap], Dataran Tinggi Merurong, 1250 m, *Othman, Yii [Yii Puan Ching] et al. S 48946* (K, KEP); Labang, Ulu Stirau, *Ashton S 18078* (K, KEP, L, SAN); Dulit Range, Sg. Tinjar, 860 m, *D. Awa & Yii [Yii Puan Ching] S 46775* (K, KEP, L), *S 46778* (K, KEP, L); —, Ulu Koyan, 1000 m, *Richards 2486* (K); Baram Distr., Mata Kuching, S of Dulit Range, Ulu Tinjar, 1800 m, *Chai S 34746* (K, KEP); —, Sg. Chipidi, Btg. Tinjar, *Chai S 34659* (K, KEP); —, Long Kerangan, Ulu Sg. Sekiwa, Btg. Tinjar, 150 m, *Tong S 35000* (K, KEP); —, Kelabit Highland, summit of Apo Dari, 1550 m, *Chai S 35923* (K); —, G. Mulu National Park, S of Sungei Melinau, 150 m, *Hansen 128* (K), Melinau gorge, *Mohtar et al. S 49535* (K, KEP); Baram, *Haviland & Hose 134* [= 207E'] (L), *207A [BM: '= 207B']* (BM, K). 5th Division, Maligan Range, path to Merapok, along Sg. Masia, 1220 m, *Paie S 32876* (K, KEP, L). 7th Division, Kapit Distr., Wong Kijang, Ulu Mengiong, Balleh, *Othman, Rantai & Jugah S 56052* (KEP); —, Btg. Baleh, Sg. Libau, Sg. Entulu, Sg. Mengiong, *B. Lee S 54687* (KEP); —, Sungai Marting, Bena Sut, *Othman, Rantai & Jugah S 62148* (KEP); —, Bt. Bakar, Ulu Sg. Yong, 730 m, *Paie S 36306* (K, KEP, L, SAN); —, Batu Laga, Sg. Khabor, 700 m, *Mohtar S 48131* (K, KEP); —, Bt. Pendam, Menyiong, 1000 m, *Othman Ismawi et al. S 41530* (K, KEP, L, SAN); Hose Mts, Bt. Kajang Carapa, 900 m, *Ashton S 19084* (K, KEP, L, SAN, SING); nr Belaga airfield, Segaham range, < 500 m, *Jacobs 5224* (K, L). — Not traced: Sungai Pejawak, *Geh & Samsuri 1110* (SING); Tuil, *Ridley 12468* (BM, K). Without locality, *Beccari 373* (K), *3505* (K). — Sabah: Sipitang Distr., 5 miles from Kg. Mondolong to Kg. Maligan, *Gibot, A. ['Aban'] SAN 100092* (SAN); Pensiangan Distr., Sepulut, Sungai Seliawan, *Mantor, A. SAN 113857* (SAN, WU); —, Sepulut, Saburan River, *Krispinus, F. ['Fidilis'] & Sumbing SAN 106995* (SAN); Keningau Distr., Nabawan, Sungai Millian, *Krispinus, F. SAN 118621* (SAN); —, Nabawan, Sg. Pingas–Pingas Maitland Area, *Mantor, A. SAN 115805* (SAN); Tambunan Distr., Crocker Range, G. Alab Mountain Garden, 1500 m, *Puff 950302-1/1* (SAN, WU); —, trail to Trus Madi summit, 1450 m, *Puff 950307-1/2* (WU); Penampang Distr., Patni to Kg. Longkogungan, km 51, Sunsuron, *Madani & George SAN 119297* (K); —, Tunggol F. R., km 45, Kota Kinabalu rd., *Mantor, A. SAN 115890* (K, SAN); Mt Kinabalu, 2130 m, *Haviland 1239* (K); Mt Kinabalu (and vicinity), eastern shoulder, Camp 1, 920 m, *Chew et al. 1177* (K, L, SAN, SING); —, Mamut Coppermine, *Amin & Jarius SAN 114241* (SAN); —, Mesilau cave, 1830 m, *Mikil, G. SAN 36182* (K, KEP, L, SAN); —, Jalan Liwagu, 1520 m, *Sadaw, F. SAN 42808* (K, L, SAN); —, Kiau View Trail, Taman, 1550 m, *Amin, Zaini & Francis SAN 117273* (K, KEP, SAN); —, Bembangan R. (Mt Kinabalu Exped.), 1520 m, *Chew & Corner 4424* (L, SAN, SING); —, Bt. Burong, *Gibot, A. ['Aban'] SAN 78684* (K, KEP, L, SAN); Ranau Distr., Bt. Tamboyukon, near camp, 1830 m, *Mujin, M.A. SAN 25231* (SAN); Kinabatangan Distr., Lamag, Ulu Sg. Kokan, 90 m, *Dewol Sundaling SAN 92360* (K, KEP, L, SAN); —, Telupid, Bt. Tawai Keramuak, 300 m, *Maidil, Matin & Ahad SAN 108787* (SAN); Tawau Distr., Tawau Hill Forest Reserve, *Gibot, A. ['Aban'] SAN 79778* (SAN); —, path to Hot Spring, *Singh & Gibot, A. ['Aban'] SAN 30116* (K, L, SAN).

SINGAPORE. no locality, *Lobb s. n.* (BM, K).

INDONESIA. **Sumatra:** Atjeh Prov., Gunung Leuser Nature Reserves, G. Bandahara, c. 25 km NNW of Kutatjane, 1400 m, *de Wilde & de Wilde-Duyffes 13021* (KEP, L); Indragiri Uplands, Muara Padjanki, 'a few m', *Buwalda 6491* (K, L, SING); —, Kuala Belilas, 'a few m', *Buwalda 6713* (K); Taram, E of Pajakumbuh, Tjampo R. region, 500–1000 m, *Meijer 6917* (L). — **Borneo:** Kalimantan Timur: Balikpapan Distr., Sg. Wain region, N of Balikpapan, 10 m, *Kostermans 4317* (L); —, Mentawir R., nr Mentawir village, *Kostermans 10062* (K, L, SING); E Kutei, Sg. Bambangan, SE of Samarinda, 20 m, *Kostermans 6114* (K, L); Tarakan, *Meijer 2577* (K, L).

BRUNEI. Tutong Distr., Bukit Bahak, 300 m, *Coode 7035* (K); Andalus F. R., < 5 m, *Ashton BRUN 626* (K, KEP, L, SING), *BRUN 629* (K, KEP, L).

11. *Schradera pseudonervulosa* Puff, Buchner & Greimler, *spec. nov.* — Fig. 18, 19

A Schradera nervulosa, inter alia, stipulis majoribus differt. — Typus: Borneo, Sabah: Kinabalu National Park, mile 35, Ranau, Kiau Trail, 5200 ft., Oct. 15, 1966, *Aban Gibot SAN 56334* (holo SAN; iso K, L).

Lucinaea nervulosa sensu auctt., non Stapf (1894), p.p.

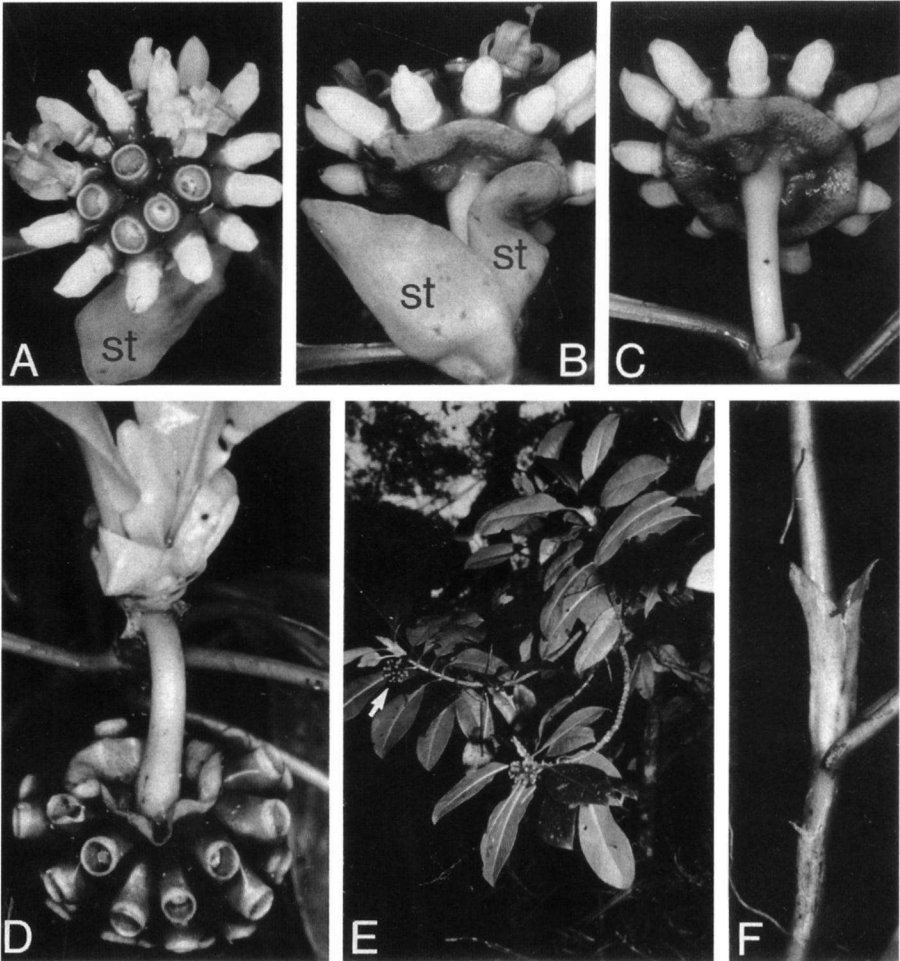


Fig. 18. *Schradera pseudonervulosa* Puff, Buchner & Greimler. — A–C: inflorescence from above, from the side, and from below, note stipule (st) in A & B (removed in C) and large, \pm flat involucre in B & C. — D: fruiting inflorescence, note bent back involucre and starting continuation of growth (sympodial-monochasial branching), i.e., first leaf pair plus stipules of the lateral axis continuing growth. — E: portion of plant, note pseudo-axillary inflorescence (arrow; compare with D). — F: stipule from new growth (young vegetative shoot), note slightly different shape as compared to the stipules from the fertile region (cf. B, D), and also the adventitious roots on the internodes. From colour slide series *Puff SEA-2993-3015* (voucher: *Puff 950311-1/1*, WU).

Scandent *epiphytic shrubs*; old *stems* several m long, to c. 20 mm in diam., clinging to host tree with adventitious roots in rows on internodes; upper shoots hanging away from the host plant, usually without adventitious roots, \pm much-branched, forming a \pm rounded 'crown' (to c. 1 m or more in diam.); unattached, ultimate aerial shoots made up of sympodial-monochasial elements (scars of peduncles of old, fallen off inflorescences visible in a pseudo-axillary position). *Branches* usually glabrous or occasionally hairy (then only on the youngest parts); bark reddish, light-brown-greyish, or brownish yellow. *Leaves* lanceolate to \pm elliptic, 130–200 \times 55–100 mm, base attenuate, apex acuminate, thickly coriaceous, usually entirely glabrous, occasionally with short hairs below, occasionally with dark brown or black dots on lower surface, midrib and primary lateral veins (8–12 pairs) raised above and below, higher order venation conspicuously reticulate; petioles (25–)30–55 mm long, glabrous or occasionally shortly hairy below. *Stipules* connate for up to 1/3 of their length, free part \pm ovate, (20–)25–35(–50) \times 10–25 mm, glabrous or occasionally hairy on the outside, large and leaf-like, rather often (partly) enveloping a terminal inflorescence (thus forming a kind of 'second involucre'). *Inflorescences* terminal (and sometimes also pseudo-axillary), solitary, capitate, 15–25 mm in diam., (3–)10–20(–30)-flowered; involucre conspicuous, cup- to flat dish-shaped, margins sometimes \pm irregularly lobed, glabrous or occasionally hairy, (pale) green to whitish green; peduncles (10–)15–25(–30) mm long, straight (when borne terminally on a branch) or rarely curved downwards (when in a pseudo-axillary position lower down a branch), glabrous or occasionally hairy. *Flowers* heterodistylous, 4- or 5-merous. Calyx tubular, truncate, 4–5(–7) mm high, glabrous. Corolla white, whitish, or whitish green (sometimes pinkish lilac tinged in bud); tube 4–5 mm and lobes 6–9 mm long (long-styled morph) or tube 5–7 mm and lobes 8–10 mm long (short-styled morph); inside of corolla with stiff, straight hairs at the throat and base of the corolla lobes and with a ring of soft, downwardly curved hairs at or \pm below the insertion point of the filaments. Anthers 3–4 \times 1 mm, linear to slightly sagittate, basifixed, with a minute triangular connective appendage (in long-styled morph only?); filaments glabrous, 1 mm (long-styled) or 4–5 mm long (short-styled morph). Style 6–7 mm (short-styled) or 8–12 mm long (long-styled morph), glabrous; stigma lobes slightly spreading, 2–3(–4) mm long (long-styled morph and short-styled morph), long papillose. Ovary globose, 3 mm in diam., glabrous. *Fruits* white when fully mature, (sub)globose to \pm ovoidal, 4–6(–7) mm in diameter.

Pollen — Small to medium-sized, 28–32 μm^* , oblate spheroidal (P: 28 μm^* , E: 28–32 μm^* ; P:E = 0.93), 3-brevicolporate, exine microreticulate without scabrae; pollenkitt abundant; binucleate. (From long-styled morph of *Puff 950311-1/1*.) — See Puff & Buchner (1998) for further details.

* Non-acetolyzed; acetolyzed pollen smaller, 20–24 μm .

Distribution — Borneo (Sarawak, Sabah; Kalimantan Barat) and Moluccas (Seram) (see Critical remarks). Fig. 19.

Habitat & Ecology — In montane rain forest (often montane oak forest) or in mixed dipterocarp forest (frequently near streams); also in riverine forest (especially at low altitudes); (20–)100–1830 m (usually > 800 m). Flowering and fruiting nearly all year round.

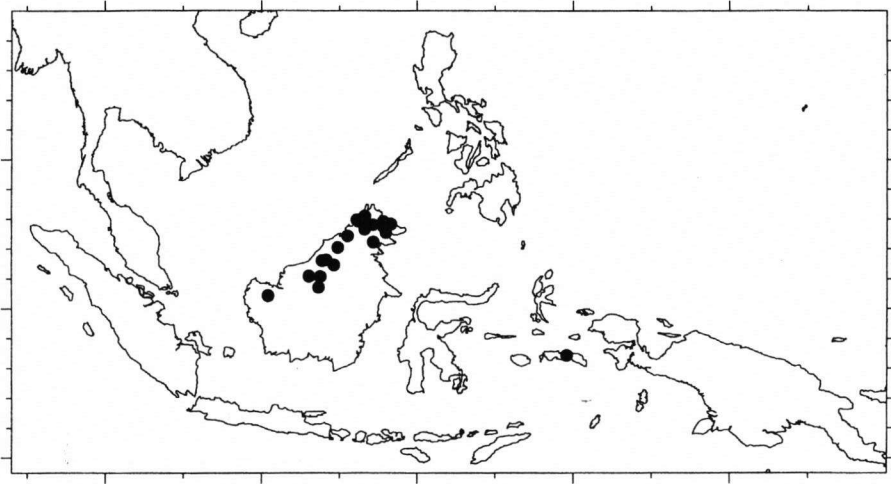


Fig. 19. Distribution of *Schradera pseudonervulosa* Puff, Buchner & Greimler.

Critical remarks — In Sabah (especially the Mt Kinabalu area) and in Sarawak, *S. pseudonervulosa* was very often confused with *S. (L.) nervulosa*. The new species, however, is easily distinguished by its large, foliaceous stipules which are virtually always present on the younger nodes of a shoot. Specimens were taken to be *L. nervulosa* (which was originally described from Mt Kinabalu), but apparently no one has ever checked specimens against the type.

Sometimes, however (especially when specimens are in poor state), the distinction between *S. nervulosa* and *S. pseudonervulosa* is difficult.

A number of collections from Sabah [e.g., *Madani* SAN 83427 (K, KEP, SAN), *SAN 113643* (K, SAN), *Majawat*, *G. et al.* SAN 102444 (K, SAN)] differ from the 'typical', glabrous form in being somewhat hairy (young shoots, leaves, petioles, stipules, peduncles, and involucre). Apart from the presence of an indumentum, there are no other noteworthy differences.

Schradera pseudonervulosa undoubtedly is closely allied to the New Guinean *S. ledermannii*, sharing with it (inter alia) the large, \pm leaf-like stipules, the large inflorescences with a conspicuous, broad, and often \pm flat involucre and the big fruits. Both taxa are essentially montane rain forest species, although some collections are from quite low altitudes.

In this context, the collection *Kornassi 512* (L) from Moluccas (Seram), the only gathering of *S. pseudonervulosa* from outside Borneo (and the only collection of *Schradera* seen from that island), deserves special mention: an extra-critical examination of the fruiting specimen left no doubt that it does indeed belong to this species, in spite of the closer geographical neighbourhood to *S. ledermannii*; there are no indications of it being an intermediate or link between the two species.

Specimens studied:

MALAYSIA. Borneo: Sarawak: 4th Division, Tubau, Bukit Skelap [Sekalap], Dataran Tinggi Merurong, 1250 m, *Othman, Yui [Yui Puan Ching] et al.* S 48943 (K, KEP), S 48983 (K, KEP);

Bario, route to Batu Lawi, 1250 m, *D. Awa et al. S 50476* (K, KEP); Baram Distr., G. Mulu National Park, *Chai S 39556* (K, KEP, L, SAN); –, 1700–1800 m, *Nielsen 884* (AAU, K); –, Lubang Cina, *Mohtar et al. S 49424* (KEP); –, Sungai Terikan, Ulu Mendalam, *Mohtar & Othman Ismawi S 49358* (KEP); –, from Melinau Gorge to Lobang Cina, Ulu Sg. Melinau, *Paie S 36514* (K, KEP, L, SAN). 5th Division, Lawas Distr., Kota F.R., near Sg. Telau, Ulu Lawas, 320 m, *Paie S 27917* (K, L, SAN); –, Bukit Tebunan, Ulu Trusan, 1200 m, *B. Lee S 52457* (K, KEP). 7th Division, Bukit Batu Tiban, Ulu Balleh Protected For., 1000 m, *Ching [Yii Puan Ching] et al. S 52288* (K, KEP); Kapit Distr., Bt. Salong, Ulu Sampurau waterfall, Melinau, 1120–1220 m, *Paie S 25845* (K, L), *S 25886* (K, L, SING); –, Pelagus, *B. Lee S 40219* (K, KEP, L, SAN); Belaga Distr., Dulit Range, Ulu Sg. Kayan, 820 m, *D. Awa & Yii [Yii Puan Ching] S 46721* (K, KEP, L). 7th [?or 4th] Division, R. Julan, Usun Apau plateau, 950 m, *Pickles S 3676* (BM, L, SING). — Sabah: Keningau Distr., Shang Lian, Logging area, Lanas, *Sumbing Jimpin SAN 118425* (KEP, SAN); Tambunan Distr., G. Alab [Crocker Range], 1500 m, *Nooteboom 984* (L, SAN); Penampang Distr., Tunggol F.R., km 45, Kota Kinabalu rd., *Mantor, A. SAN 115768* (K, SAN); –, Togudon/Tungol, km 50, Tambunan–Penampang rd., *Sumbing Jimpin SAN 127771* (SAN); Kinabalu National Park, Ranau Distr., *Gibot, A. ['Aban'] SAN 76565* (K, L, SAN); –, Silou Trail, 1620 m, *Binideh, N. SAN 65159* (L, SAN); –, Kiau Trail, 1580 m, *Gibot, A. ['Aban'] SAN 56334* (K, L, SAN); –, West Trail, 1220 m, *Lajangah, J.K. SAN 44627* (SAN); –, Silau Silau Trail, *Puff 950311–1/1* (WU); –, forest nr Park Headquarters, 1450–1500 m, *Puff & Buchner 920509–1/1* (SAN, WU); –, Mamut Hill, 1400–1650 m, *Kokawa & Hotta 5348* (L); –, Mesilau R. (Mt Kinabalu Exped.), 1520 m, *Chew & Corner 4314* (K, L, SAN, SING); Mt Kinabalu (and vicinity), Ulu Liwagu and Ulu Melisau, 1520 m, *Chew et al. 2878* (K, L, SAN, SING); Mt Kinabalu area, Marai Parai, 1520 m, *Clemens & Clemens 32314* (BM, HBG, L), *33079* (BM, HBG, K, L); Ranau Distr., Bt. Tamboyukon, near camp, 1830 m, *Meijer & Mujin, M.A. SAN 25232* (K, SAN); Kinabatangan Distr., c. 7 km N of Kinabatangan R. at Bt. Garam, 20 m, *Wood SANA 4693* (KEP, L, SING); –, Kota Kinabatangan, Projek Segaliud Lokan, *Majawat, G. et al. SAN 102444* (K, SAN); Sandakan Distr., mile 83, Telupid, 150 m, *Talip, A. & Terimiji SAN 62404* (K, L, SAN); –, Ulu Dusun, mile 30 Labuk Road, 7 m, *Madani SAN 83427* (K, KEP, SAN); Lahad Datu Distr., Danum Valley, Segama West Trail, *Madani SAN 113643* (K, SAN); Tawau Distr., Ulu Sungai Serudong, *Gibot, A. ['Aban'] SAN 31208* (K, KEP, L, SAN).

INDONESIA. Borneo: Kalimantan Barat: G. Bentuang area, 5–10 km N of Masa village, 150 km NE of Pontianak, 250 m, *Burley, Tukirin et al. 2853* (K). — Moluccas: Seram: Roho, 100–200 m, *Kornassi 512* (L).

12. *Schradera ledermannii* (Valeton) Puff, Buchner & Greimler, *comb. nov.*

Fig. 20B, 21

Lucinaea ledermannii Valeton, Bot. Jahrb. Syst. 60 (1925) 82; Merr. & Perry, J. Arnold Arbor. 25 (1944) 198. — Type: NE New Guinea [Papua New Guinea], Kaiserin Augusta R., 1500 m, *Ledermann 12454* (holo B†).

Lucinaea ramiflora Valeton var. *pubinervis* Valeton, Bot. Jahrb. Syst. 60 (1925) 81. — Type: NE New Guinea [Papua New Guinea], Dischore Mt, 1200 m, *Schlechter 19621* (holo B†; iso BM, K, L).

Branches hairy when young, soon glabrescent; bark grey-brown. *Leaves* lanceolate to obovate, 100–160(–180) × 40–60 mm, base long attenuate, apex acuminate or acute, margins recurved, ± thinly coriaceous, glabrous above and hairy below, either only on the veins (especially midrib) or on the entire surface, with black dots on lower surface, midrib and primary lateral veins (8–10 pairs) slightly raised above and below; petioles 20–50 mm long, glabrous. *Stipules* connate for up to 1/2 of their length, free part ovate-lanceolate, 18–25(–30) × 10 mm, usually glabrous, ± leaf-like. *Inflorescences* terminal, solitary, capitate, 20–30 mm in diam., 30–40-flowered; involucre conspicuous, broadly cup-like, occasionally margins irregularly lobed, hairy only when



Fig. 20. A: *Schradera monantha* (Merr. & Perry) Puff, Buchner & Greimler (*Brass 11858*, L, isotype), note differentiation into long shoot and abbreviated lateral shoots. — B: *S. ledermannii* (Valeton) Puff, Buchner & Greimler (*Brass 1240*, L). — Scale bar: 10 cm (both the same magnification).

young; peduncles 5–25 mm long, strongly curved downwards, with reddish light brown hairs. *Flowers* heterodistylous (?; only long-styled known), 4- or 5-merous. Calyx tubular, truncate, 4–6 mm high, glabrous or occasionally hairy outside. Corolla white or whitish green; tube 5–8 mm long, lobes 5–9 mm long; inside of corolla usually glabrous except for densely hairy triangular scales (1 × 1 mm), located c. 1–1.5 mm from the base of the tube. Anthers 2–2.5 × 1–1.5 mm, linear to slightly sagittate, sometimes with a triangular connective appendage; filaments 1–2 mm long, glabrous. Style 8 mm long, glabrous below and upper third papillose or shortly hairy; stigma lobes 2 mm long, oblong, papillose. Ovary ± globose, 5 mm in diam. *Fruits* whitish green when fully mature, ± globose to slightly elongated, 5–7 mm long.

Distribution — Endemic to New Guinea (Irian Jaya and Papua New Guinea).
Fig. 21.

Habitat & Ecology — In montane rain forest; in *Lithocarpus* and *Syzygium* forest with dense, shrubby understory; 850–1500 m. Flowers in January and March to May; fruits in March.

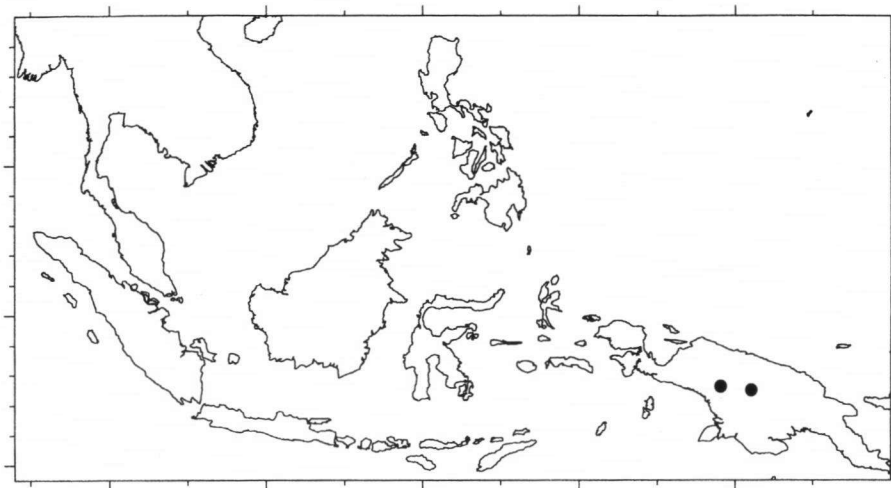


Fig. 21. Distribution of *Schradera ledermannii* (Valeton) Puff, Buchner & Greimler.

Critical remarks — An investigation of the type of *L. ramiflora* var. *pubinervis* indicated that this taxon should be included in *S. ledermannii*; it differs from 'typical' *ledermannii* only in leaf indumentum. In 1944, Merrill & Perry noted the close resemblance between the two taxa but refrained from uniting them because they were misled by the incorrect corolla characteristics for *L. ramiflora* var. *pubinervis* given in Valeton's (1925) key.

Schradera ledermannii shows rather distinct similarities to the essentially Bornean *S. pseudonervulosa* (see there for further comments).

Specimens studied:

NEW GUINEA. **Irian Jaya:** 4 km SW of Bernhard Camp, Idenburg R., 850 m, *Brass 13612* (L); 15 km SW of Bernhard Camp, Idenburg R., 1500 m, *Brass 12400* (BM, L). — **Papua New Guinea:** West Sepik Distr., Telefomin Subdistr., nr Busilmin airstrip, 1500 m, *Barker LAE 67598* (L); —, Mt Entaldam, S of Busilmin airstrip, 1500 m, *Vinas LAE 67032* (GH, K, L); Kaiser-Wilhelmsland, Wälder von Dischore, 1200 m, *Schlechter 19621* (BM, K, L).

13. *Schradera acutifolia* (Valeton) Puff, Buchner & Greimler, *comb. nov.* — Fig. 22

Lucinaea acutifolia Valeton in Lorentz, Nova Guinea, Bot., 14 (1925) 273 & t. 30, f. H, 1–5; Bot. Jahrb. Syst. 60 (1925) 82. — Type: Nord Neu-Guinea [Irian Jaya], 'Mamberamo-Flußgebiet, Rücken zum Doormangipfel', 1420 m, Oct. 3, 1920, *Lam 1478* (holo L; iso K).

Branches differentiated into long shoots (internodes 20–30 mm long) with large leaves and abbreviated lateral shoots with short internodes (5–10 mm) and smaller leaves; branches hairy when young, soon glabrescent, bark light brown. *Leaves* lanceolate to ovate, 80–110 × 18–28 mm on long shoots, 30–50 × 8–10 mm on abbreviated lateral shoots, coriaceous, base long attenuate, apex long acuminate-acute, margins recurved, glabrous or occasionally hairy on midrib below, midrib sunken above and raised below, primary lateral veins not clearly discernible; petioles 10–22 mm long on main branch leaves, 5–10 mm on lateral shoots, glabrous or occasionally hairy below. *Stipules*

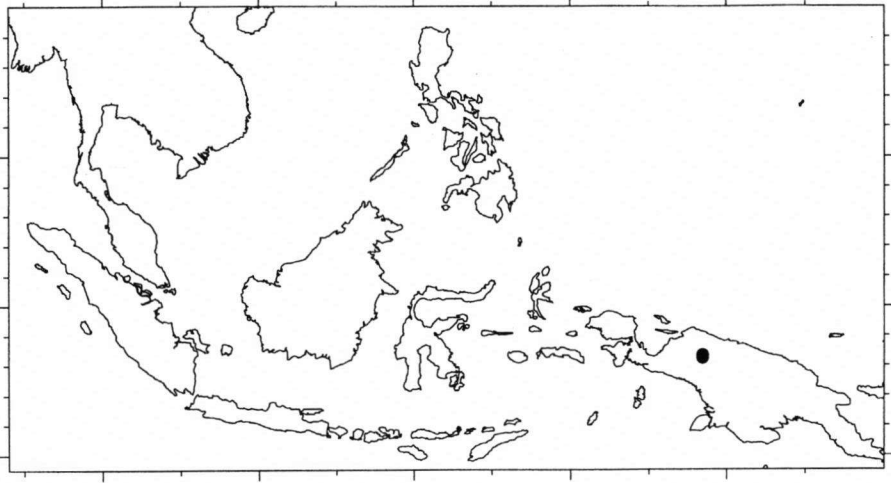


Fig. 22. Distribution of *Schradera acutifolia* (Valeton) Puff, Buchner & Greimler.

connate for up to $3/4$ of their length, free part \pm triangular, 4–10 mm long, glabrous, basally with colleters on the adaxial side. *Inflorescences* terminal, solitary, capitate-globose, 10 mm in diam., 2–4-flowered; involucre conspicuous, glabrous or occasionally hairy at base; peduncles 7–10 mm long, \pm straight or slightly curved, hairy. *Flowers* heterodistylous (?; only long-styled morph known), 5-merous. Calyx tubular, truncate, 3–4 mm high, glabrous or occasionally hairy on the outside and on the rim. Corolla white; tube 12 mm long, lobes 4 mm long; inside of corolla with hairy, upwardly directed scales, c. 1×1 mm, located near the base of the tube; throat glabrous (sometimes also densely hairy?). Anthers 2×1.5 mm, linear to slightly sagittate, basifixed, half exerted from the throat; filaments 1 mm long. Style 13 mm long, glabrous below and shortly papillose hairy above; stigma lobes \pm horizontally spreading, very short (0.5–1 mm long), densely hairy-papillose. Ovary globose, glabrous or occasionally hairy, 2.5 mm in diam. Mature *fruits* unknown.

Distribution — Endemic to New Guinea (Irian Jaya). Fig. 22.

Habitat & Ecology — In mossy forest; 1420–2500 m. Flowers and fruits in October.

Critical remark — Differs from the other New Guinean species with few-flowered inflorescences (*S. monantha*, *S. schlechteri*) in having much longer leaves (on long shoots). The three species, however, seem to form a very closely allied complex.

Specimens studied:

NEW GUINEA. **Irian Jaya:** Mamberamo-Flußgebiet, Rücken zum Doormangipfel, 1420 m, *Lam 1478* (K, L); Nassau Mts, West, 2500 m, *Docters van Leeuwen 10874* (L).

14. *Schradera schlechteri* (Valeton) Puff, Buchner & Greimler, *comb. nov.*

Lucinaea schlechteri Valeton, Bot. Jahrb. Syst. 60 (1925) 81; Merr. & Perry, J. Arnold Arbor. 25 (1944) 198. — Type: NE New Guinea [Papua New Guinea], Dischore Mt, 1300 m, *Schlechter 19667* (holo B \dagger ; iso GH, K, L, SING).

Branches ± indistinctly differentiated into long shoots (internodes 15–40 mm long) and abbreviated lateral shoots with short internodes (5–10 mm) and often somewhat smaller leaves; young parts with curly, light brown hairs, older parts glabrescent; bark grey-brown. *Leaves* obovate to broadly lanceolate or elliptic, 15–35 × 8–15 mm, base long attenuate and apex acute, margins slightly recurved, coriaceous, usually glabrous but occasionally with short hairs below, midrib slightly sunken above and raised below and primary lateral veins (5 or 6 pairs) slightly sunken above or hardly discernible; petioles 6–10 mm long, glabrous or hairy. *Stipules* connate for more than 1/2 of their length, free part triangular, 5–10 mm long, hairy basally and in the median part towards the top. *Inflorescences* terminal, solitary, capitate, 5–10 mm in diameter, 2–4-flowered; involucre conspicuous, broadly cup-like; peduncles 2–6 mm long, straight, glabrous or occasionally hairy. *Flowers* heterodistylous (?; only short-styled known), 4-merous. Calyx tubular, truncate (rim occasionally with minute triangular teeth), 3 mm high (fruiting), glabrous. Corolla colour unknown; tube 3 mm long, lobes 3 mm long; inside of corolla with stiff hairs at the throat. Anthers 1.5–2.5 mm long, ± linear to sagittate, exserted; filaments c. 0.5 mm long. Style 2 mm long, glabrous, stigma lobes c. 1.5 mm long, papillose. Ovary ± globose, 2 mm in diameter. *Fruits* ± globose, 2–3 mm in diameter.

Distribution — Endemic to Papua New Guinea (only known from the type locality; not traced).

Habitat & Ecology — No information available; 1300 m. Flowers in June.

Critical remark — *Schradera schlechteri* and *S. monantha* are obviously very closely allied, sharing (inter alia) the characteristic growth form (long shoots with relatively long internodes and relatively large leaves and short shoots with abbreviated internodes and smaller leaves) and inflorescences with a conspicuous, loose, broadly cup-like involucre. Both species are only known from the type collections, and in our opinion, the only difference lies in the inflorescence (1- vs. 2–4-flowered). To us, it seems very likely that they represent a single taxon. We, however, refrain from formally merging them before additional collections become available which could demonstrate the variation in the numbers of flowers per inflorescence.

15. *Schradera monantha* (Merr. & Perry) Puff, Buchner & Greimler, *comb. nov.*

Fig. 20A, 23

Lucinaea monantha Merr. & Perry, J. Arnold Arbor. 25 (1944) 197. — Type: Netherlands New Guinea [Irian Jaya], 15 km SW Bernhard Camp, Idenburg R., Brass 11858 (holo GH; iso L).

Branches differentiated into long shoots (internodes 20–30 mm long) with large leaves and abbreviated lateral shoots with short internodes (c. 10 mm) and smaller leaves; young parts with short curly hairs, older parts glabrescent; bark grey-brown. *Leaves* lanceolate-elliptic or elliptic to slightly obovate, 40–50 × 15–23 mm on long shoots, 20–30 × 8–12 mm on abbreviated lateral shoots, base cuneate, apex attenuate-acute (long tip), coriaceous, glabrous, with black dots on the lower surface, midrib ± sunken above and ± raised below, primary lateral veins not clearly discernible; petioles 5–10 mm long, glabrous. *Stipules* connate for up to 1/2 of their length, free part ± linear, 7–11 mm long, ± glabrous. *Inflorescences* terminal, solitary, uniflorous; the solitary flowers subtended by a conspicuous, loose, broadly cup-like, glabrous involucre;

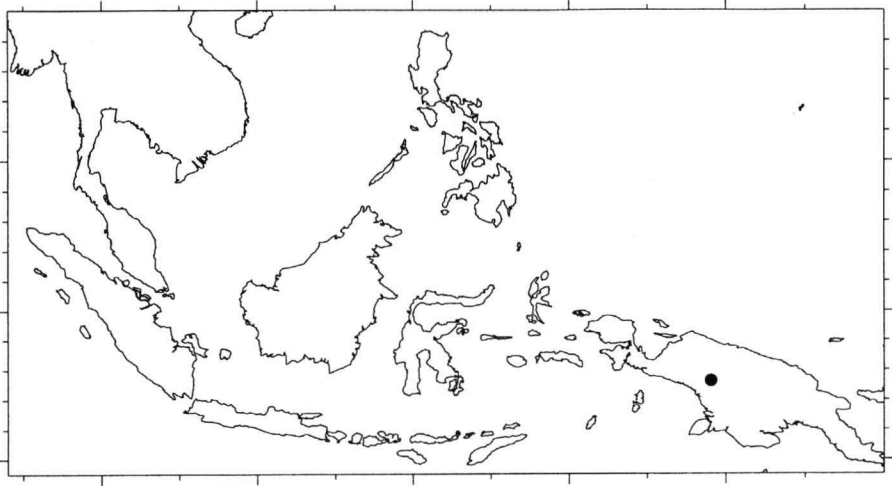


Fig. 23. Distribution of *Schradera monantha* (Merr. & Perry) Puff, Buchner & Greimler.

peduncles 3–5 mm long (to 6–7 mm when in fruit), \pm straight, glabrous. *Flowers* heterodistylous (?; only long-styled known), 4- or 5-merous. Calyx campanulate-tubular, truncate (rim occasionally with 5 minute teeth), 3–4 mm high, glabrous. Corolla white; tube 6 mm long, lobes 5–6 mm long; inside of corolla with curly hairs on triangular scales (0.5×0.5 mm) near the base of the corolla tube. Anthers 2.5–3 mm long, shortly exserted from corolla tube; filaments 1 mm long. Style 7 mm long, glabrous, at the base curved in bud; stigma lobes c. 0.5–1 mm long, densely papillose. Ovary globose, 3 mm in diameter. *Fruits* white when fully mature, \pm globose, 6 mm in diameter.

Distribution — Endemic to New Guinea (Irian Jaya); only known from the type collection. Fig. 23.

Habitat & Ecology — In mossy forest; 1800 m. Flowers and fruits in January.

Critical remark — See comments under *S. schlechteri*.

16. *Schradera ramiflora* (Valeton) Puff, Buchner & Greimler, *comb. nov.* — Fig. 24

Lucinaea ramiflora Valeton in Lorentz, Nova Guinea, Bot. 8 (1911) 462 & t. 71a; 14 (1925) 273.

— Type: SW New Guinea [Irian Jaya], Noord River at Geluks Hill, *Versteeg 1452* (holo L).

Branches glabrous; bark reddish brown to dark brown. *Leaves* obovate-oblong, rarely lanceolate, $95\text{--}145 \times 25\text{--}65$ mm, base acuminate-attenuate, apex acute-acuminate, coriaceous, glabrous, midrib raised above and below and primary lateral veins (8 or 9 pairs) slightly raised at least below; petioles 11–32 mm long, glabrous. *Stipules* connate for up to $3/4$ of their length, free part broadly triangular to ovate, 4–8 mm long, glabrous. *Inflorescences* ramiflorous (on leafless shoot portions) to cauliflorous, solitary, capitate, 10–20 mm in diam., (1–)3–10-flowered; involucre conspicuous, shallowly cup-shaped; peduncles 5–20 mm long, \pm straight, glabrous. *Flowers* heterodistylous (?; only short-styled known), 5- or 6-merous. Calyx tubular, truncate, 4–5(–7) mm

high, glabrous. Corolla whitish green or white; tube 6–11 mm long, lobes 6–10 × 2 mm; inside of corolla with stiff and straight hairs at the throat and a ring of soft, downwardly curled hairs at or ± below the insertion point of the filaments. Anthers 4 mm long, linear to ± oblong, medifixed, without apical connective appendage, exerted; filaments 2 mm long. Style 2.5 mm long, glabrous; stigma lobes 4 mm long, linear to ± oblong, long papillose. Ovary globose, 3–4 mm in diam., glabrous. *Fruits* pale whitish green to yellowish white when fully mature, subglobose to slightly elongated (ovoidal), 12–15 × 8–10 mm.

Pollen — Medium-sized, 42 µm, spheroidal, 3-porate (from Valetton, 1911; non-acetolyzed).

Distribution — Endemic to New Guinea (Irian Jaya and Papua New Guinea). Fig. 24.

Habitat & Ecology — No information available; 820–1220 m. Flowers in June and September; fruits in January and September.

Critical remarks — A very distinct species, as it is the only Asiatic *Schradera* with rami- to cauliflorous inflorescences. Nevertheless, it appears to be allied to *S. monantha* and *S. schlechteri*, with which it shares the conspicuous, rather loose (shallowly cup-shaped) involucre. Moreover, it often tends to have rather few- to sometimes even 1-flowered inflorescences, a character in close agreement with these two species.

At the moment, *Lucinaea ramiflora* Valetton var. *parviflora* Valetton is explicitly excluded from *S. ramiflora*; see 'Doubtful taxa' below.

Specimens studied:

NEW GUINEA. **Irian Jaya:** Lorentz R. [= Noord River] at Geluks Hill, *Versteeg 1452* (L); SE West Irian, Ingembit, rd. to Kombontan, *Reksodihardjo 342* (L). — **Papua New Guinea:** Hunstein Range (Mt Samsei), 1220 m, *Takeuchi 5124* (K); Southern Highlands Distr., 2 km NE of Lake Kutubu, 820 m, *Clunie et al. LAE 63346* (K, L); —, nr Tange, Lake Kutubu, 890 m, *Schodde 2174* (K, L); [upper Fly R. area] Palmer R., 2 miles below junction Black R., *Brass 7140* (K, L).

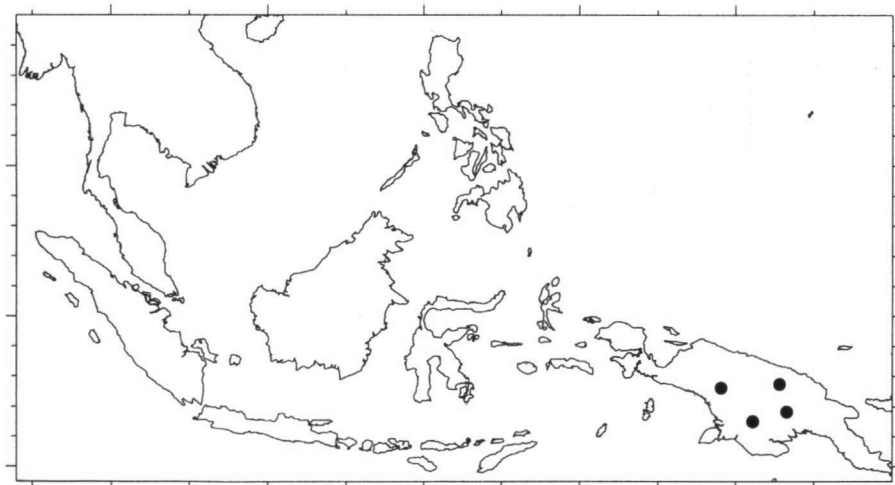


Fig. 24. Distribution of *Schradera ramiflora* (Valeton) Puff, Buchner & Greimler.

DOUBTFUL TAXA

1. *Lucinaea rheedii* Korth., Nederl. Kruidk. Arch. 2 (1851) 167; Miq., Fl. Ind. Bat. 2 (1857) 198. — Type: Borneo [Kalimantan Selatan], 'ad montem Pamatton', *Korthals s.n.* (ubi?).

At present the status of this species remains unclear. Korthals mentioned three *Lucinaea* species [*L. morindae* (as '*L. morinda*'; now *S. polysperma*), *L. montana*, and *L. rheedii*] citing 'Pamatton' as the collecting locality for each of them (only for *L. morindae*, he also listed a Sumatra locality).

In 1857, Miquel accepted these three taxa, although he stated he had neither seen material of *L. montana* nor of *L. rheedii*. Later on [in Ann. Mus. Bot. Lugd.-Bat. 4 (1869) 187] he provided an improved classification, listing the following three species: *L. morindae*, *L. korthalsiana* [which corresponds to *L. morinda* sensu Korthals (1851)], and *L. montana*; he did not mention *L. rheedii*. It is tempting to conclude that the type specimen of *L. rheedii* may be lost (otherwise Miquel should have made some comment on the species!); the only *Korthals* collections from Borneo ['Pamatton'] sent on loan from L are undoubtedly the types of *L. montana*.

The original description of *L. rheedii* is too poor to draw any definite conclusions. The inflorescence characterisation "pedunculis terminalibus, umbellatis; capitulis 3–6 floris" does not really fit any of the accepted taxa. In none of the taxa which produce umbel-like inflorescences are the individual heads so few-flowered.

2. *Lucinaea ramiflora* Valetton var. *parviflora* Valetton, Bot. Jahrb. Syst. 60 (1925) 81. — Syntypes: NE New Guinea [Papua New Guinea], Hunstein Mts, 1050 m, *Ledermann 8422* (holo B⁺); Etappenberg, 850 m, *Ledermann 9066* (holo B⁺).

In 1925, Valetton separated two varieties (var. *parviflora*, var. *pubinervis*) from the 'typical' *Lucinaea ramiflora* (which he called '*ramiflora genuina*'), thus creating what seems to be a very heterogeneous species. Var. *pubinervis* is shown here to belong to *S. ledermannii* (see there). The status of var. *parviflora*, however, is not at all clear. In our opinion, the description is insufficient to decide whether or not this is merely a somewhat smaller-flowered form of *S. ramiflora*. As none of the type specimens of var. *parviflora* were seen (most probably destroyed in Berlin; presumably no duplicates elsewhere), this problem can at present not be solved.

EXCLUDED TAXA

1. *Lucinaea cumingiana* Vidal, Phan. Cuming. Philipp. (1885) 216; Rev. Pl. Vasc. Filip. (1886) 152 = *Morinda parvifolia* Bartl. in DC., Prodr. 4 (1830) 499; Merr., Enum. Philipp. Flow. Pl. 3 (1923) 573.

A reinvestigation of the type specimen in BM (*Cuming 1242*) confirmed Merrill's identification.

2. *Lucinaea forbesii* Wernham, J. Bot. (London) 56 (1918) 71. — Type: New Guinea, Mount Woriwori, c. 5000 ft., *Forbes 712* (holo BM) = *Morinda sp.*, as revealed by a reinvestigation of the type.

3. *Lucinaea klossii* Wernham, Trans. Linn. Soc. II, Bot. 9 (1916) 71; Valetton in Lorentz, Nova Guinea, Bot. 14 (1925) 273. — Type: New Guinea [Irian Jaya], 'Camp VIB, 3900 ft.' [Carstensz Peak (= Pk. Jaya) area, c. S 04° 5' 50", E 137° 12' 50", above Utakwa R.], [*C. Boden*] *Kloss s.n.* (holo BM) = *Morinda sp.*, as revealed by a reinvestigation of the type.
4. *Lucinaea neocaledonica* S. Moore, J. Linn. Soc. Bot. 45 (1921) 328. — Types: New Caledonia, without locality, *Compton 2304* (lecto BM, selected here); Poume, 500 ft., *Compton 2368* (BM, syn.) = *Morinda neocaledonica* (S. Moore) Guillaumin, Arch. Bot. Caen 3 (1930) 44; Johansson, Opera Bot. 122 (1994) 27.
5. *Lucinaea pentandra* Merr., Mitt. Inst. Allg. Bot. Hamburg 7 (1937) 286. — Type: 'West Borneo' [Kalimantan Barat], Sungai Bika, 50 m, Jan. 5, 1925, in swamp forest, [*Hans*] *Winkler 1431* (holo HBG; iso HBG, 2 sheets) = *Lecananthus pentander* (Merr.) Puff, Blumea 43 (1998) 343.
6. *Lucinaea reticulata* Valetton in Gibbs, Contrib. Phytogeogr. and Fl. Arfak Mts (1917) 180. — Type: [New Guinea, Irian Jaya] Arfak Mts, Angi lakes, 7000 ft., *Gibbs 5580* (holo BM) = *Morinda sp.*, Valetton in Lorentz, Nova Guinea, Bot. 14 (1925) 274.
A reinvestigation of the type specimen confirmed Valetton's identification.

Provisionally excluded:

7. *Lucinaea sumatrana* Boerl. & Koord. in Koord.-Schum., Syst. Verz. 2 (1911) 55. — Type: Sumatra, nr Pangkala-dule, 25 m, March 26, 1891, *Koorders 22387* (ubi?).
The rather detailed description seems to indicate that this species belongs to *Lecananthus* Jack and is likely to be identical with *L. erubescens* Jack (see Puff et al., 1998 for details). As the type specimen was not seen (neither amongst the '*Lucinaea*' [*Schradera*] nor the *Lecananthus* material sent on loan from L) there is, however, still some doubt.

ACKNOWLEDGEMENTS

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Valeton, T. 1925. Rubiaceae. Neue Nachträge. In: H.A. Lorentz (ed.), *Nova Guinea*. Vol. 14, Botanique: 229–274. Brill, Leiden.

LIST OF COLLECTIONS

(Numbers and letters between brackets refer to the numbers and letters of the accepted species and subspecies)

- Aban: see Gibot, A. — Amin [Awang Amin, R.A.] SAN 102876, SAN 103129 (1) — Amin & Jarius SAN 114241 (10) — Amin & Sign [or as Sign & Amin] SAN 69165 (6) — Amin, Zaini & Francis SAN 117273 (10) — Anderson S 2878, S 5109 (1), S 9424 (10), S 9799 (1), S 20173 (8a), S 25117 (4a), S 29044 (10), S 39398 (4a) — Anderson & Paie S 28487 (6) — Anonymous (without collector) F.M.S. 24186 (4a) — 'A.N.U.' 1513 (9) — Argent & Coppins 1130 (7) — Ashton 163 (6), BRUN 626, BRUN 629 (10), BRUN 1042, S 17662 (8b), S 17947 (4a), S 18078 (10), S 18260 (8a), S 19084 (10) — Awa, D. & Lee S 47838, S 50572 (6), S 51138 (7) — Awa, D. & Othman Ismawi S 47038 (4a) — Awa, D. & Paie S 45554, S 45661 (4b), S 47022 (10) — Awa, D. & Yii [Yii Puan Ching] S 46721 (11), S 46775, S 46778 (10) — Awa, D. et al. S 50476 (11).
- Barker LAE 67598 (12) — Bartlett 7618 (4a) — Beaman et al. 7347, 8249, 8386 (6), 8762, 9562 (7) — Beccari 33 (4a), 373 (10), 672 (8a), 1364 (6), 1666 (4c), 3098 (4b), 3505 (10) — Binideh, N. SAN 65159 (11) — Boden Kloss SFN 14507 (4a) — Brass 7140 (16), 11858 (15), 12400 (12), 13612 (12) — Brooke 8838 (1), 9535 (10), 10141 (4a), 10434 (6) — Brooks s.n., no date (4a) — Brunig S 4685 (2), BRUN 1004 (1) — Bujang S 13499 (10) — Bünnemeijer 1033 (6) — Burkill & Haniff SFN 12942 (10) — Burkill & Holttum SFN 8681 (10) — Burley, Tukirin et al. 2853 (11) — Buwalda 6491 (10), 6538, 6667 (1), 6713 (10), 6744, 7693 (1).
- Carrick [as 'J.C.'] 1599 (1) — Carrick & Enoch 79 (1), 391 (4a) — Carrick & Kassim 529 (4a) — Chai S 18003, S 19452 (10), S 19461 (4a), S 33818 (10), S 34634 (2), S 34659, S 34746, S 35923 (10), S 39424 (4a), S 39556 (11), S 39714 (4a) — Chai & Paie S 17831 (4a) — Chelliah KEP 104686 (10) — Chew 219 (4a) — Chew & Corner 4314 (11), 4424 (10), 4954 (7) — Chew et al. 1177 (10), 1734 (8a), 2174 (7), 2878 (11) — Ching [Yii Puan Ching] S 42165 (10), S 42196 (4a), S 45928, S 55210 (10) — Ching & Jegong S 46005 (4a) — Ching et al. S 52014 (8a), S 52288 (11) — Clemens & Clemens 7292 [S 20273], 7832 [S 22319] (4c), 27710, 27710A (6), 28522 (7), 28835 (6), 29392, 29690, 30337 (7), 30937 (8b), 31197 (8a), 31710 (6), 32314 (11), 32703 (8b), 33079 (11), 35138 (7), 40735 (6), S 20272 (10) — Clunie et al. LAE 63346 (16) — Cockburn FRI 7606 (1), SAN 65466 (6), SAN 83156 (8a) — Collenette 21638 (7), S 829 (10) — Conklin 1113 (3) — Coode 6469, 6471 (1), 7035 (10), 7088 (4a), 7503 (8b) — Corner SFN 28068, SFN 28596 (1), SFN 30596 (4a), s.n., 7 July 1935 (4a) — Curtis 1337 (4a), s.n., May 1901 (1), s.n., 24 Dec. 1901 (8a).
- Dewol Sundaling SAN 80210 (1), SAN 92360 (10) — Docters van Leeuwen 10874 (13) — Dransfield & Hambali 4320 (1).
- Edaño 889 [PNH 11592] (9), PNH 1376 (9) — Elmer 11227 (9) — Endert 3532 (8a), 3704 (6), 3936 (6).
- Fuchs 21050 (7).
- Gary et al. S 37024 (10) — Geh & Samsuri 1110 (10) — Gibot, A. ['Aban'] SAN 31208 (11), SAN 49395 (1), SAN 56334, SAN 76565 (11), SAN 78684, SAN 79778, SAN 100092 (10) — Giesen 130 (6) — Grabowsky s.n., Feb. 1882 (4a) — Griffith 2954 (1).
- Hallier 695 (6), 1262 ('162') (1) — Ham '62', '178' (6) — Haniff 13203 (4a), 21102 (4a) — Hansen 128 (10) — Haviland 84 (10), 206 ['Y'] (4a), 207 (1), 678 (4b), 1025 (8a), 1238 (7), 1239 (10), 1757 (4a), 2961 (2), 2983 (1), s.n., Jan. 1889 (4c) — Haviland & Hose 134 [= 207E'] (10), 206/O (4a), 207A, 207B (10) — Hennipman 6157 (6) — Hewett s.n., 7 Jan. 1895 (1), s.n., 7 Jan. 1895 (4a) — Holttum SFN 21544 (10) — Hose 50 (6), 386 (4a) — Hou 777 (10) — Hullett s.n., 19 July 1890 (4c) — Hume 7905 (4a).

- Iboet 227 (4a).
 Jacobs 5224 (10), 5681 (1) — Jermy 13847 (8a) — Johns 6554B (8b).
 Kadim & Noor 293 (1) — Kerr 11891, 14333 (1) — Kiah SFN 31922, 32030 (4a) — King's coll. 762 (4a), 2162 (10), 4645 (1), 5052 (10), 5498 (1), 7836 (10), 8482 (1), 10152 (4a) — Kokawa & Hotta 4599 (6), 5348 (11) — Kornassi 512 (11) — Korthals s.n., no date (6), s.n., no date (8a) — Kostermans 4317, 6114 (10), 7499 (6), 10062 (10), 13025 (8a) — Kostermans & Anta 1267 (1) — Krispinus SAN 87370 (4a), 118621 (10) — Krispinus & Sumbing SAN 106995 (10).
 Lajangah, J. K. SAN 44627 (11) — Lam 1478 (13) — Lee, B. S 38080, S 38801 (6), S 40219 (11), S 43247 (4b), S 44050 (10), S 52457 (11), S 52488 (8b), S 54062 (10), S 54071 (4c), S 54687 (10) — Lee, Y.F. & Dewol Sundaling SAN 69867 (6) — Lobb s.n., 1857 (4a), s.n., no date (10) — Loh FRI 19177 (10) — Lörzing 14299 (1) — Lowe s.n., no date (4a).
 Madani SAN 83427, SAN 113643 (11) — Madani & George SAN 119297 (10) — Maidil, Matin, Ahad SAN 108787 (10) — Main (exped. Polak) 2037 (1) — Maingay 875 ['1275'] (1) — Majawat, G. et al. SAN 102444 (11) — Manis & Salang S 41196 (8b) — Mantor, A. SAN 113857 (10), SAN 115768 (11), SAN 115805, SAN 115890 (10) — Marshall F.M.S. 35840 (1) — Martin & Ismawi S 36870 (10) — Mat Salleh et al. 2437b (1) — Maxwell 81–180 (10) — Meijer 2577 (10), 6860 (4a), 6917 (10), SAN 43782 (1) — Meijer & Mujin, M. A. SAN 25232 (11) — Meijer Drees 466 (5) — Mikil, G. SAN 36182 (10) — Mohtar S 48131 (10), S 48208 (4a), S 48242 (8b) — Mohtar & Othman Ismawi S 49358 (11) — Mohtar et al. S 49424 (11), S 49535 (10) — Mondih 70 (1) — Motley 224, 659 (1) — Moulton's native coll. 275 (1) — Mujin, M.A. SAN 25231 (10), SAN 33799 (6) — Muroh, K. SAN 42515 (6) — Murshidi S 24107 (4a).
 Native collector 136 (4b), 216, 1235 (4a) — Ng FRI 5706 (1) — Ngadiman SFN 36681 (1) — van Niel 4001, 4059, 4106 (1), 4385 (2) — Nielsen 796 (7), 884 (11) — Niyomdham 836 (1) — Nootboom 984 (11), 4319 (4a), 4634, 4637 (6) — Nur SFN 10533 (10), SFN 33960 (1).
 Osman SFN 28302 (4a) — Othman, Rantai & Jugah S 56052, S 62148 (10) — Othman, Yii [Yii Puan Ching] et al. S 48943 (11), S 48946 (10), S 48983 (11) — Othman bin Haron S 19913 (4a) — Othman bin Haron & Suib S 23005 (8a) — Othman Ismawi et al. S 41530 (10).
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