

## REVIEW OF THE GENUS *GYMNOPETALUM* (CUCURBITACEAE)

W.J.J.O. DE WILDE & B.E.E. DUYFJES

Nationaal Herbarium Nederland, Universiteit Leiden branch, P.O. Box 9514,  
2300 RA Leiden, The Netherlands; e-mail: dewilde@nhn.leidenuniv.nl

### SUMMARY

*Gymnopetalum* Arn. is distributed from India to the Moluccas. There are 4 species, including 1 new species, *G. orientale* W.J. de Wilde & Duyfjes, from E Malesia. In *G. integrifolium* (Roxb.) Kurtz 2 new varieties, besides the type-variety, are accepted: *G. integrifolium* var. *penicaudii* (Gagnep.) W.J. de Wilde & Duyfjes (in China) and *G. integrifolium* var. *pectinatum* W.J. de Wilde & Duyfjes (in E Java). A key to the species is presented. The Malesian taxa are fully described.

**Key words:** *Gymnopetalum*, Cucurbitaceae, SE Asia.

### INTRODUCTION

Since the revisions of the genus *Trichosanthes* in the Malesian area and Thailand (Rugayah & De Wilde, 1997, 1999; Rugayah, 1999; De Wilde & Duyfjes, 2004; Duyfjes & Pruesapan, 2004) some poorly collected specimens from E Malesia and assigned to that genus remained undetermined. More recently collected material appeared identical with these specimens by which it became clear that they represented a new species of *Gymnopetalum*, *G. orientale*. In the genus *Gymnopetalum*, which is taxonomically close to *Trichosanthes*, 4 species are now recognized. The type-species of the genus is *G. tubiflorum*, from S India and Sri Lanka; the other 3 species are distributed in SE Asia and Malesia. Two aberrant collections from E Java are included in the widespread *G. integrifolium* as a new variety, var. *pectinatum*. Plants from China (Hainan) of *G. integrifolium* with strongly dentate leaves are recognized as var. *penicaudii*.

Cogniaux (1881) and Cogniaux & Harms (1924) placed *G. tubiflorum* in section *Eugymnopetalum* and the other species in the section *Tripodanthera*. Although *G. tubiflorum*, which is possibly tuberous and has more slender shoots, is rather isolated from the other 3 species, we follow more recent authors (Jeffrey, 1980b; Philcox, 1997) in not maintaining the sections.

The new species *G. orientale* deceptively resembles certain members of *Trichosanthes*, for instance by the presence of a sometimes conspicuous probract on the node, which could be regarded as intermediate between the two genera. A useful and practical floral distinction between both genera, besides the presence or absence of thread-like fringes of the petals (fringed in *Trichosanthes*), is the overall shape of the folded petals in mature bud: short and rounded in *Trichosanthes* and elongate, longer than broad, in *Gymnopetalum*.

Three genera from northern India resemble *Gymnopetalum* on first sight. They are: *Edgaria* C.B. Clarke (differing by straight thecae and few seeds), *Biswarea* Cogn. and *Herpetospermum* Wall. (the latter two differing by petals connate at the bases and  $\pm$  3-valved fruits).

## GYMNOPETALUM

*Gymnopetalum* Arn. (1840) 52; (1841) 278; Endl. (1842) 77; M. Roem. (1846) 17; Miq. (1856) 679; Benth. & Hook.f. (1867) 822; Kurz (1877) 99; C.B. Clarke (1879) 611; Cogn. (1881) 387; Trimen (1894) 246; Gagnep. (1921) 1048; Cogn. & Harms (1924) 177; Chakrav. (1959) 56; Backer (1964) 302; Keraudren (1975) 96; C. Jeffrey (1980a) 52; (1980b) 798; A.M. Lu & Zhi Y. Zhang (1986) 212; S.K. Chen (1995) 345; Philcox (1997) 14. — Lectotype species (Keraudren, 1975): *Gymnopetalum ceylonicum* Arn., nom. illeg. = *Gymnopetalum tubiflorum* (Wight & Arn.) Cogn.  
*Tripodanthera* M. Roem. (1846) 48.  
*Scotanthus* Naudin (1862) 172.

Annual or perennial, climbing or widely-creeping herbs, to 6 m long, frequently rooting at the nodes, subglabrous to densely hairy; monoecious (or seemingly dioecious). *Probract* present or absent. *Tendrils* simple or 2-branched. *Leaves* simple, entire or lobed, base deeply cordate, margin finely dentate; glands not obvious. *Inflorescences* in male: flowers either solitary (or 2) on the nodes, long-pedicelled, or (co-axillary) in an erect several-flowered bracteate raceme, with flowers sessile or short-pedicelled; in female: flowers solitary. *Flowers*: petals white, in bud folded into an elongate body. *Male flowers*: *receptacle* elongate, broadened in upper half and slightly constricted at the throat; *sepals* 5, free; *petals* (almost) free, margin entire or short-fimbriate; *stamens* 3, filaments inserted about halfway up the receptacle-tube, free, short; *anthers* two 2-thecous, one 1-thecous, thecae sigmoid, united into an elongate synandrium, included; *disc* or *pistillode* absent or present, small, as 3 linear ribs, adnate to the base of the tube. *Female flowers*: *ovary* with many horizontal ovules; *perianth* as in male flowers; style long, stigmas 3, oblong or linear; disc not obvious; *staminodes* minute. *Fruits* orange or red, mesocarp yellow, pulp greenish-black. *Seeds* numerous, compressed, not or little ornamented.

A genus of 4 species: one species in S India and Sri Lanka; 3 in N India, S China, east to E Malesia; 2 in Thailand, and 3 in the Malesian area. The genus is rare in regions with an ever-wet climate.

### KEY TO THE SPECIES OF GYMNOPETALUM

- 1a. Plant tuberous, perennial; shoots delicate; stem c. 1 mm diameter. Male raceme slender, bracts linear, small. Petals c. 10 mm long. Seeds truncate at one end. — S India, Sri Lanka . . . . . **4. G. tubiflorum**
- b. Plant without tuber, (sub)annual; shoots stouter, stem c. 2 mm diameter. Male raceme stouter (rachis c. 2 mm diameter), bracts leaf-like, variously lobed. Petals 20–30 mm long. Seeds rounded at both ends . . . . . 2
- 2a. Leaves finely bullate, densely hairy below, at least on the veins. Fruits ellipsoid or globose, rounded at apex, not ribbed. — Widespread . . . . . **2. G. integrifolium**
- b. Leaves not bullate, thinly hairy or subglabrous below. Fruits ellipsoid-fusiform, narrowed at apex, distinctly or faintly ribbed, or not ribbed . . . . . 3

- 3a. Male bracts cuneate or rounded at base, sessile, without glands. Sepals entire or rarely  $\pm$  lobed. Male flowers in raceme pedicellate, pedicels persistent. Fruits distinctly ribbed. — Widespread . . . . . **1. G. chinense**
- b. Male bracts narrowly cuneate at base, subsessile or short-stipitate, with scattered glands below. Sepals deeply lobed. Male flowers in raceme sessile, without pedicels. Fruits not or faintly ribbed. — E Malesia . . . . . **3. G. orientale**

### 1. *Gymnopetalum chinense* (Lour.) Merr. — Fig. 1b, 2

*Gymnopetalum chinense* (Lour.) Merr. (1919) 256; Jeffrey (1980a) 52; A.M. Lu & Zhi Y. Zhang (1986) 213, f. 55: 1–7; S.K. Chen (1995) 345, f. 90: 1–5. — *Evonymus chinensis* Lour. (1790) 156. — Type: *Loureiro* †; lectotype, according to Merrill (1919), preferably to be chosen from *Levine 1108, 1705, or 2183* from Canton (all PNH), but we do not know whether any of this material still exists.

*Bryonia cochinchinensis* Lour. (1790) 595. — *Tripodanthera cochinchinensis* (Lour.) M. Roem. (1846) 48. — *Gymnopetalum cochinchinense* (Lour.) Kurz (1871a) 57; (1871b) 295; Cogn. (1881) 391; Gagnep. (1921) 1049; Cogn. & Harms (1924) 181; Craib (1931) 755; Merr. (1935) 379; Chakrav. (1959) 62; Backer (1964) 302; Keraudren (1975) 97, f. 17: 4–8; C. Jeffrey (1980b) 798; P.H. Hó (1991) 722, f. 2002. — Type: *Loureiro s.n.* (BM), Vietnam.

*Momordica tubiflora* Roxb. (1814) 70, nom. nud.; (1832) 711; (1978) f. 15; G. Don (1834) 36. — *Scotanthus tubiflorus* (Roxb.) Naudin (1862) 172, f. 3. — Type: *Wallich Cat. 6749* (K-W), India.

*Trichosanthes costata* Blume (1826) 933. — Lectotype (here chosen): *Blume s.n.* barcode L0589632, (L; 2 isotypes in L), Java.

*Gymnopetalum quinquelobum* Miq. (1856) 681. — Type: *Horsfield s.n.* (not seen), Java (Soerakarta).

*Scotanthus porteanus* Naudin (1866) 25. — Type: Cultivated in Huber's botanic garden from seeds from Singapore (P, not seen).

*Gymnopetalum heterophyllum* Kurz (1875) 326. — Type: *Wallich Cat. 6711* (K-W, not seen); *Wall. Cat. 6711* consists in the IDC photos of apparently 5 sheets; it is a mixture with a.o. *Coccinia grandis*, but *6711-E* is missing.

*Trichosanthes laciniata* Ridl. (1911) 107. — Type: *Curtis* in *Ridley 8350* (K, not seen), Malaysia, Langkawi.

*Melothria touchanensis* H. Lév. (1914) 122. — Type: *Bodinier s.n.* (E), China, Kweichow.

*Gymnopetalum cochinchinense* (Lour.) Kurz var. *incisa* Gagnep. (1921) 1050; P.H. Hó (1991) 722, f. 2003. — Lectotype (here chosen): *Leconte & Finet s.n.* (P), Cambodia.

*Gymnopetalum quinquelobatum* Merr. (1938) 70. — Type: *Squires 943* (not seen), southern Annam, near Dalat.

Climbing or creeping, rooting at the nodes, to 6 m long, finely scabrous and sparsely hairy or subglabrous; monoecious. *Leaves*: blade membranous, in outline ovate, or triangular, or  $\pm$  3- or 5-angled or (deeply) lobed, 4–12 cm diam., base deeply cordate, apex acute(-acuminate), margin finely sparsely dentate, blade  $\pm$  sparsely scabrous-pubescent on both surfaces, upper surface not bullate, main nerves 5, subpalmate; glands absent; cystoliths usually faint, or fine; petiole 2–5 cm. *Probract* (minute, caducous or) absent. *Tendrils* simple. *Male flowers*: solitary or in erect racemes 10–25 cm long, bracteate, several-flowered, sometimes co-axillary with a solitary flower; peduncle 4–12 cm long; bracts oblong, 15–20 mm long, (deeply) 2–5-lobed, base cuneate or rounded, sessile, without glands; *flowers* thinly grey pubescent; pedicel 3–7 cm long for solitary flowers, 5–15 mm long in the racemes, faintly articulate with receptacle; *receptacle-tube* narrow, but widened in upper 1/3 where containing the synandrium, 25–35 mm long, 3–4(–5) mm wide at throat, outside and inside  $\pm$  pubescent, throat

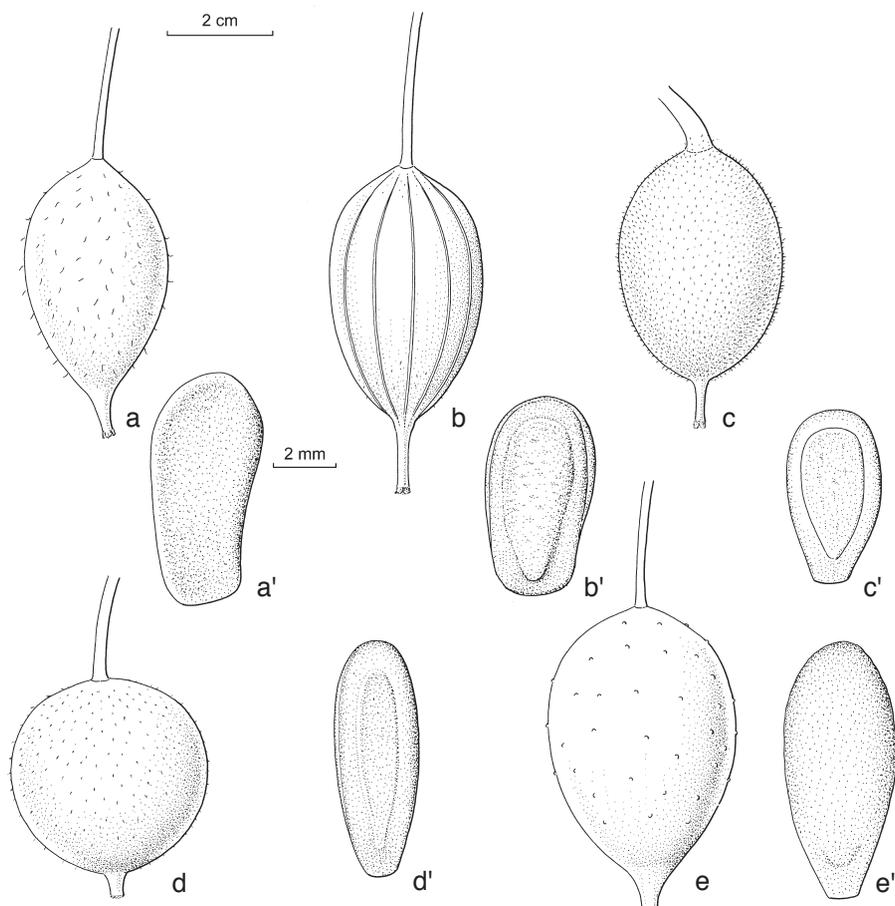


Fig. 1. Fruits and seeds of *Gymnopetalum* species. a, a'. *G. tubiflorum* (Wight & Arn.) Cogn.; b, b'. *G. chinense* (Lour.) Merr.; c, c'. *G. integrifolium* (Roxb.) Kurz var. *pectinatum* W.J. de Wilde & Duyfjes; d, d'. *G. integrifolium* (Roxb.) Kurz var. *integrifolium*; e, e'. *G. orientale* W.J. de Wilde & Duyfjes (a: *Herb. d'Alleizette* 2613; b: *De Wilde & Duyfjes* 21719; c: *De Wilde & Duyfjes* 21693; d: *Pruesapan et al.* KP-74; e: *Verheijen* 3819).

yellow inside; *sepals* linear, rarely  $\pm$  lobed, 6–9 mm long, spreading to recurved, green; *petals* obovate, short-clawed, 20–30 by 12–15 mm, indistinctly veined, somewhat hairy, yellow at base; *stamens* inserted 12–15 mm below receptacle throat, filaments short, synandrium 9–10 by c. 3.5 mm, deeply included, connectives not enlarged; disc (pistillode?) short, 3-lobed. *Female flowers*: perianth as in male flowers; pedicel 0.5–2(–4) cm long; ovary narrowly ellipsoid, 10–12 by 2.5–4 mm, pubescent, (faintly) 10-ribbed; style 18–20 mm long, stigmas 4–6 mm long, included; disc low,  $\pm$  3-lobed, staminodes absent. *Fruits* broadly fusiform, 2.5–5 by 1.5–3 cm, beaked by receptacle remnant, orange-red, glabrescent, sharply 10-ribbed, pulp greenish (brown); fruiting pedicel 1–4 cm long. *Seeds* numerous, oblong,  $\pm$  compressed, 7–8 by 2–3 by 1.5 mm, with marginal groove, faces not ornamented.

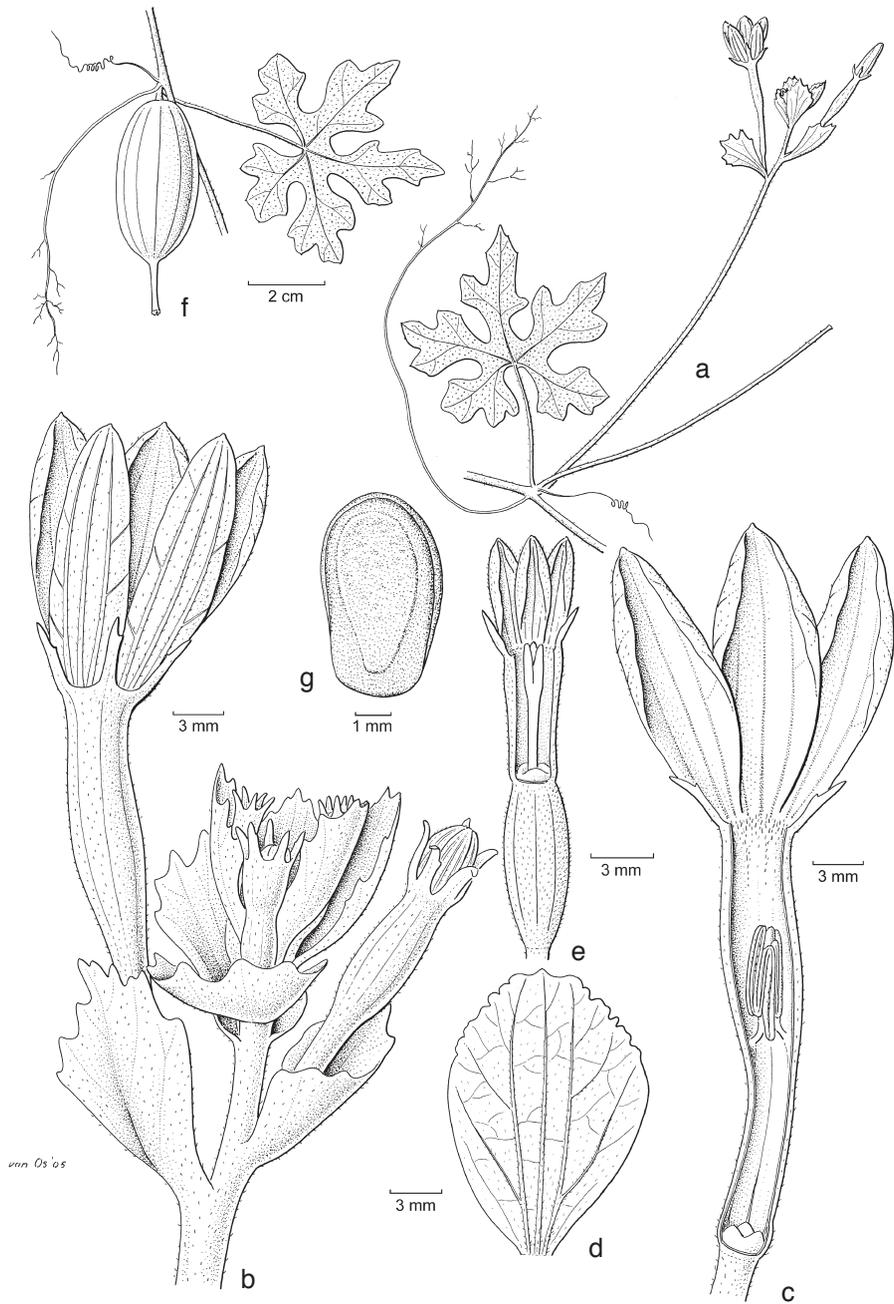


Fig. 2. *Gymnopetalum chinense* (Lour.) Merr. a. Node with male inflorescence, note persistent pedicel of previous co-axillary male flower; b. apex of male raceme; c. male flower, opened, showing 3-lobed disc at the bottom of the receptacle-tube; d. unfolded petal; e. female flower bud, opened, showing disc at the bottom of the receptacle-tube; f. node with mature fruit; g. seed (a, f, g: *De Wilde & Duyfjes* 21719; b–e: *De Wilde & Duyfjes* 21722, both from Bali).

Distribution — Widespread; north-eastern part of India, China, through Indochina, east to Sumatra, Peninsular Malaysia, Borneo, Java, Philippines, Celebes, Lesser Sunda Islands east to Flores.

Habitat & Ecology — Forest edges, clearings, scrub, in hedges and in open fields; at 0–1000 m altitude; flowering and fruiting throughout the year.

Note — The flowers of *G. chinense* open at night and are wilted the following morning.

## 2. *Gymnopetalum integrifolium* (Roxb.) Kurz

*Gymnopetalum integrifolium* (Roxb.) Kurz (1871a) 58; (1871b) 295; C.B. Clarke (1879) 612; Cogn. & Harms (1924) 179; Chakrav. (1959) 60; Keraudren (1975) 100, f. 17; A.M. Lu & Zhi Y. Zhang (1986) 214; P.H. Hô (1991) 722, f. 2004; S.K. Chen (1995) 347; Philcox (1997) 16. — *Cucumis integrifolius* ('*integrifolia*') Roxb. (1832) 724; (1978) f. 23. — *Trichosanthes integrifolia* (Roxb.) Kurz (1877) 99; Cogn. (1881) 386, non Thwaites. — Type: *Wallich Cat.* 6730 (K-W), Burma. *Trichosanthes scabra* Lour. (1790) 589; Gagnep. (1921) 1047; Merr. (1935) 381. — Type: †, Cochinchina.

*Gymnopetalum leucostictum* Miq. (1856) 680; Backer (1964) 302. — Lectotype (here chosen): *Junghuhn s.n.* barcode L0589693 (L) Java, Weltevreden.

*Scotanthus weberi* Naudin (1866) 26. — *Gymnopetalum weberi* (Naudin) Cogn. (1881) 394; Gagnep. (1921) 1053. — Type: cultivated from seeds sent by Weber from Cochinchina to Paris (P?).

*Gymnopetalum monoicum* Gagnep. (1918) 373; (1921) 1052; Cogn. & Harms (1924) 180. — Lectotype (here chosen): *Balansa* 4020 (P), Vietnam (Tonkin).

*Gymnopetalum leucostictum* Miq. var. *grandiflorum* Hochr. (1934) 289. — Type: *Hochreutiner* 2331 (holo G; iso L).

*Gymnopetalum integrifolium* auct. non (Roxb.) Kurz: A.M. Lu & Zhi Y. Zhang (1986) 214, f. 55: 8–10; S.K. Chen (1995) 347, f. 90: 6–8 (= *G. integrifolium* (Roxb.) Kurz var. *penicaudii* (Gagnep.) W.J. de Wilde & Duyfjes).

Climbing or creeping, and rooting at the nodes, to 5 m long, stem (densely) long grey or brownish hairy; monoecious, often seemingly dioecious. *Probract* lanceolate, acute, entire or (deeply) 2- or 3-lobed, (1–)1.5–2.5 cm long, sometimes absent, green-yellow, late-caducous. *Tendrils* simple or unequally 2-branched near the base. *Leaves*: blade circular, or reniform, or broadly ovate in outline, or 5-angular, 2–11 cm diam., base deeply cordate, apex rounded or subacute, margin entire, finely dentate-mucronate or ± coarsely lobulate or wavy-dentate; nerves 5-palmate, reticulation distinct below; blade subglabrous above, densely coarse-pubescent below, at least on the veins, when fresh bullate above; glands absent; cystoliths in older leaves present; petiole 1–5 cm. *Male flowers*: solitary or in bracteate racemes; bracts 1–2 cm long, lobed, base cuneate, sessile; flowers densely grey (to brown) pubescent; pedicel 2–12 cm long for solitary flowers, 1(–2) cm long in the racemes, persistent, at apex faintly articulate; receptacle-tube (strongly) narrowed below insertion of stamens, 15–20(–30) by 6–7 (at throat) mm, outside and inside pubescent, throat inside yellow; *sepals* narrowly triangular, lanceolate, entire or ± lobed, recurved, (4–)5–8 mm long, green; *petals* obovate, ± clawed, c. 2 by 1.5 cm, distinctly veined; *stamens* inserted c. 10 mm below throat; *filaments* 2–2.5 mm long, ± glabrous, synandrium 8–12 by 2–2.5 mm, connectives not enlarged, apex of synandrium flat, narrow, hairy, bright yellow when fresh; disc consisting of 3 short linear bodies adnate to base of the tube. *Female flowers*: solitary, resembling male flowers; pedicel 1–3 cm long; ovary ellipsoid, 8–10 by 6–7

mm, long-pubescent; receptacle-tube cylindrical, c. 10 by 5 mm; style 7–10 mm long, stigmas erect, c. 2 mm long,  $\pm$  included; disc at base of the tube, very low and minute (nectariferous?) or absent; staminodes 3, minute, inserted slightly above base of the tube. *Fruits* short ellipsoid or globose, (2–)3–4 cm long, (orange-)red, at first sparsely hairy, later on glabrous; fruiting pedicel 1–3(–5) cm long. *Seeds* numerous in dark green pulp, (ellipsoid-)oblong,  $\pm$  compressed, 6–9 by 2.5–3 by 1.5–2 mm, faces small, almost smooth, demarcated by groove from broad, rounded margin.

**Distribution** — Widespread, with 2 varieties. India, Sri Lanka, S China, south-east to the Philippines and Lesser Sunda Islands east to Sumbawa; not known from Sumatra and Borneo.

**Habitat & Ecology** — Roadsides, disturbed places; at 0–1000 m altitude; flowering and fruiting throughout the year.

**Notes** — 1. The watery slimy blackish pulp enveloping the seeds does not taste bitter.

2. The presence of a male raceme in collections from Java appeared much less frequent in *G. integrifolium* (only c. 20%) as compared to those in *G. chinense* (c. 60%).

#### KEY TO THE VARIETIES

- 1a. Bracts of male raceme (irregularly) shallowly or deeply few- or many-lobed or  $\pm$  irregularly narrowly laciniate. *Fruits* globose . . . . . 2
- b. Bracts of male raceme regularly  $\pm$  fine-laciniate in upper half. *Fruits* ellipsoid. — E Java . . . . . **b. var. pectinatum**
- 2a. Leaves subentire; subcircular in outline, margin entire or shallowly dentate. Male sepals entire or shallowly few-lobed. — Widespread . . . . . **a. var. integrifolium**
- b. Leaves  $\pm$  5-angular or 3–5-lobed to c. 1/3 of its length; (sub)ovate in outline, margin (irregularly) coarsely dentate. Male sepals long and narrowly lobed. — Hainan . . . . . **c. var. penicaudii**

**a. var. integrifolium** — Fig. 1d, 3, 4c–e

*Leaf blade* subcircular in outline or 3–5-angular, margin entire or shallowly dentate. *Bracts of male raceme* variously rather few-lobed. *Sepals* narrow-triangular, lanceolate, entire or shallowly few-lobed. *Fruits* (sub)globose, 2–3(–4) cm diam., glabrescent.

**Distribution** — As the species, but possibly not in China.

**Note** — *Puudjaa* 83 (Thailand) has female flowers in a short raceme.

**b. var. pectinatum** W.J. de Wilde & Duyfjes, *var. nov.* — Fig. 1c, 4a, b

A varietate typico in bracteis masculinis regulariter anguste laciniatis, fructibus ellipsoideis distinctus. — **Typus:** *W.J. de Wilde & Duyfjes* 21692 (L), E Java.

*Leaf blade* subcircular or angular in outline, margin (sub)entire. *Bracts of male raceme* with upper margin regularly, finely, densely laciniate. *Sepals* subentire or shallowly few-lobed. *Fruits* ellipsoid with obtuse apex, c. 4 cm long, finely hairy, not ridged.

**Distribution** — E Java; known only from the type.

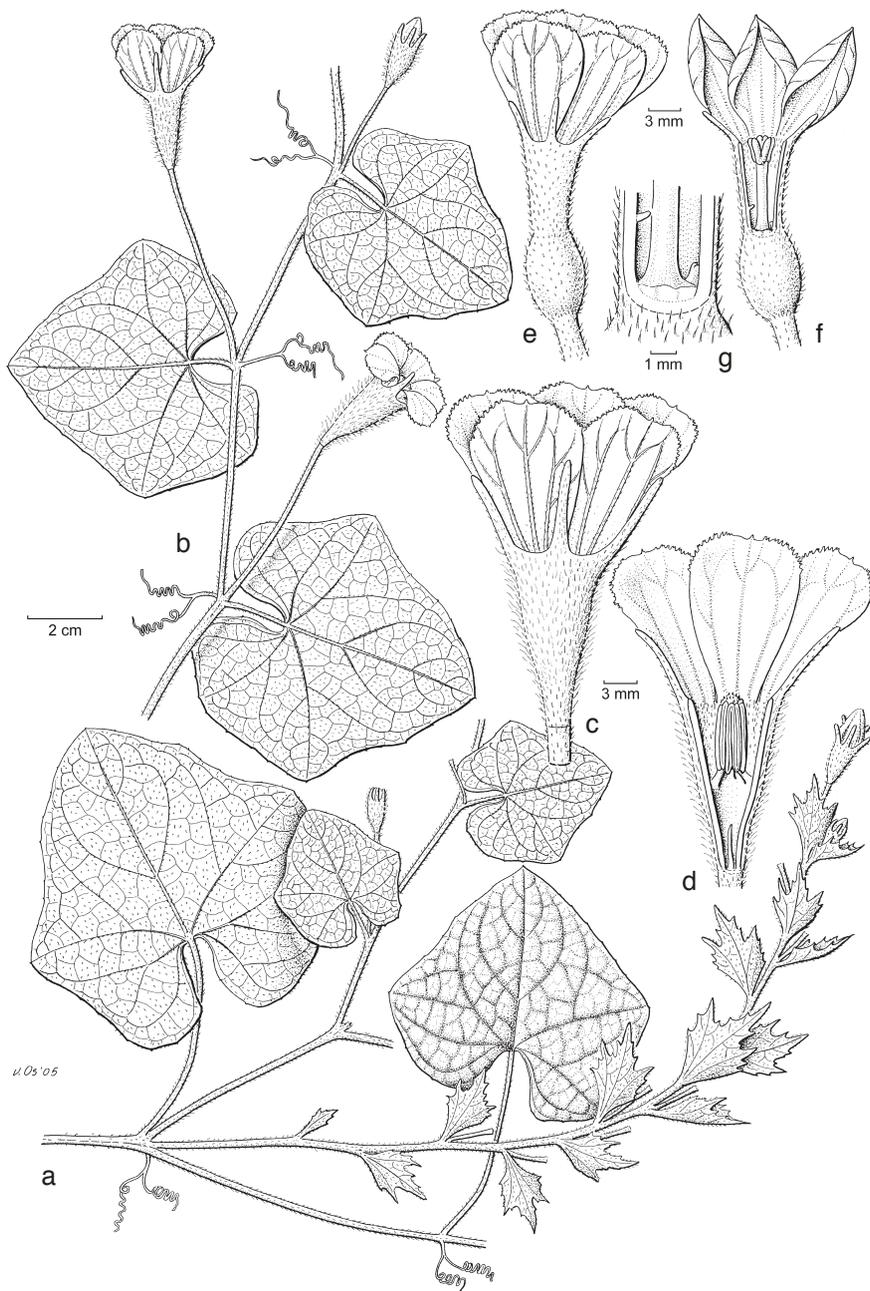


Fig. 3. *Gymnopetalum integrifolium* (Roxb.) Kurz var. *integrifolium*. a. Twig with one male raceme, and one solitary male flower in bud; b. twig with solitary male flowers; c. male flower; d. male flower opened; e. female flower; f. female flower opened; g. detail of female flower showing base of style with traces of staminodes at disc (a: Phonsena, De Wilde & Duyfjes 3515; b: d'Alleizette s.n., barcode L0589688; c–g: De Wilde & Duyfjes 22269).

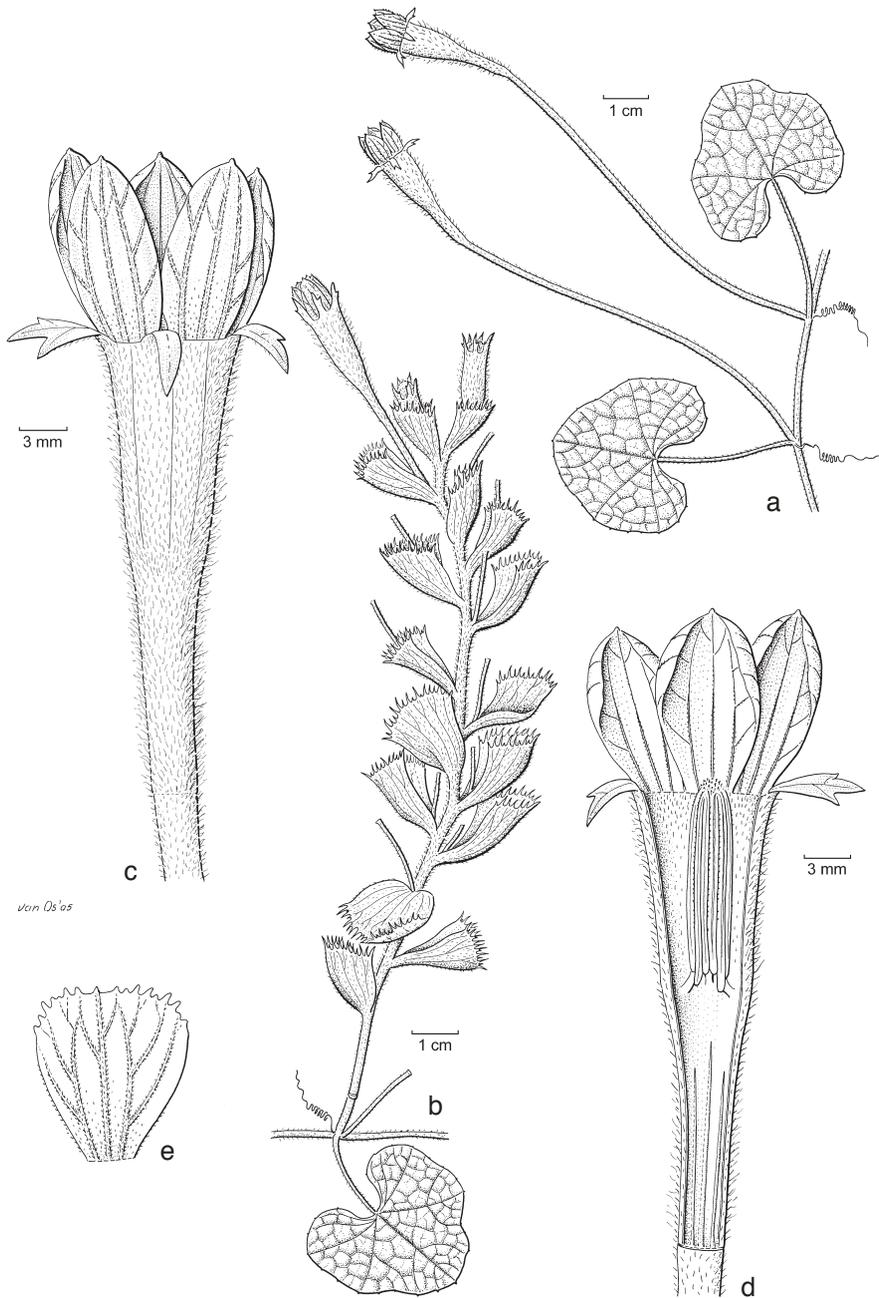


Fig. 4. *Gymnometalum integrifolium* (Roxb.) Kurz var. *pectinatum* W.J. de Wilde & Duyfjes. a. Portion of twig with solitary male flowers; b. node with male raceme. — *Gymnometalum integrifolium* (Roxb.) Kurz var. *integrifolium*. c, d. Male flower from outside and opened respectively, note the disc composed of 3 linear bodies; e. unfolded petal (a, b: De Wilde & Duyfjes 21692, type; c–e: Murata, Fukuoka & Sukasdi J1421).

Habitat & Ecology — Among grasses on sawah-dike on clay soil; at sea level.

Note — The status of var. *pectinatum* is unclear. The finely incised male bracts give the plant a very distinct aspect. The ellipsoid fruit is unique and suggests a relationship with *G. chinense*; the fruit in the latter species is ridged, with a tapered apex. Possibly var. *pectinatum* is of hybrid origin.

**c. var. penicaudii** (Gagnep.) W.J. de Wilde & Duyfjes, *comb. nov.*

*Gymnopetalum penicaudii* Gagnep. (1918) 374; (1921) 1050, f. 17: 1–4. — Lectotype (here chosen): *Pénicaud 43* (P), Hainan.

*Gymnopetalum integrifolium* auct. non (Roxb.) Kurz: A.M. Lu & Zhi Y. Zhang (1986) 214, f. 55: 8–10; S.K. Chen (1995) 347, f. 90: 6–8.

*Leaf-blade* ± 5-angular or lobed to c. 1/3 of its length, (sub)ovate in outline, margin coarsely dentate. *Bracts of male raceme* ± irregularly narrowly lacinate. *Sepals* oblong, usually with some narrow and long side-lobes. *Fruits* globose, c. 2.5 cm diam., glabrescent.

Distribution — Hainan; possibly a wider distribution in S China.

**3. *Gymnopetalum orientale*** W.J. de Wilde & Duyfjes, *spec. nov.* — Fig. 1e, 5

*A Gymnopetalum chinensi* in habitu crassiore, receptaculi masculini tubo 3.5–7 cm longo, sepalis masculinis lonis lateralibus longis, pistillodio absentis distinctus. — Typus: *De Wilde & Duyfjes 21937* (holo L), Indonesia, Lombok.

Climber to 5 m long, minutely hairy, subglabrescent; stem c. 2 mm diameter. *Probract* absent or various in size, (ob)ovate, up to 1 cm long, irregularly sharp-dentate, glandular. *Tendrils* (simple or) unequally 2-branched in lower half. *Leaves*: blade membranous, ovate or subcircular in outline, 6–14 cm diam., usually (3–)5 sharp-angular or (deeply) lobed, base deeply cordate, margin (finely) dentate, petiole and veins minutely scabrid-hairy on both surfaces, blade above scabrous by cystoliths; petiole 2.5–7(–9) cm long. *Inflorescences*: male flowers either solitary with pedicel 2–6 cm long, or usually a solitary flower co-axillary with a later developing long-peduncled few- to 20-flowered raceme, 10–30 cm long, with the flowers bracteate and (sub)sessile, with a scar and not a persistent pedicel; bracts subpersistent or (later) caducous, rhomboid or ovate in outline, 10–15 by c. 10 mm, sharply 5(–7)-angular or -lobed, up to half its length, glandular below, subsessile or with a stipe up to 5 mm long; rachis 5–20 cm long, peduncle 5–13 cm long, c. 2 mm diam.; female flowers solitary. *Male flowers*: (sub)glabrous, but petals minutely hairy especially on the veins; receptacle-tube 3.5–7 cm long, tapering, at throat 5–8 mm wide; *sepals* ± recurved, lanceolate or long-triangular, 5–15 mm long, in basal portion with few long (linear-oblong) patent lobes to 9 mm long; *petals* obovate-oblong, 20–30 mm long, apex 1–2 mm mucronate, margin crenulate-lobate, at base with some fringes to 5 mm long; stamens inserted c. 15 mm below the throat in the receptacle-tube, filaments 2–3 mm long, synandrium 10–12 by 2–4 mm; disc consisting of 3 elongate, acute, carnosse bodies 3–15(–20) mm long, adnate to the basal portion of the receptacle-tube; pistillode absent. *Female flowers*: pedicel 10–20 mm long; ovary narrowly ellipsoid, 7–16 by 2–3 mm, harshly minutely hairy (hairs c. 0.1 mm long), faintly 6–8-ribbed; receptacle-tube c. 30 mm

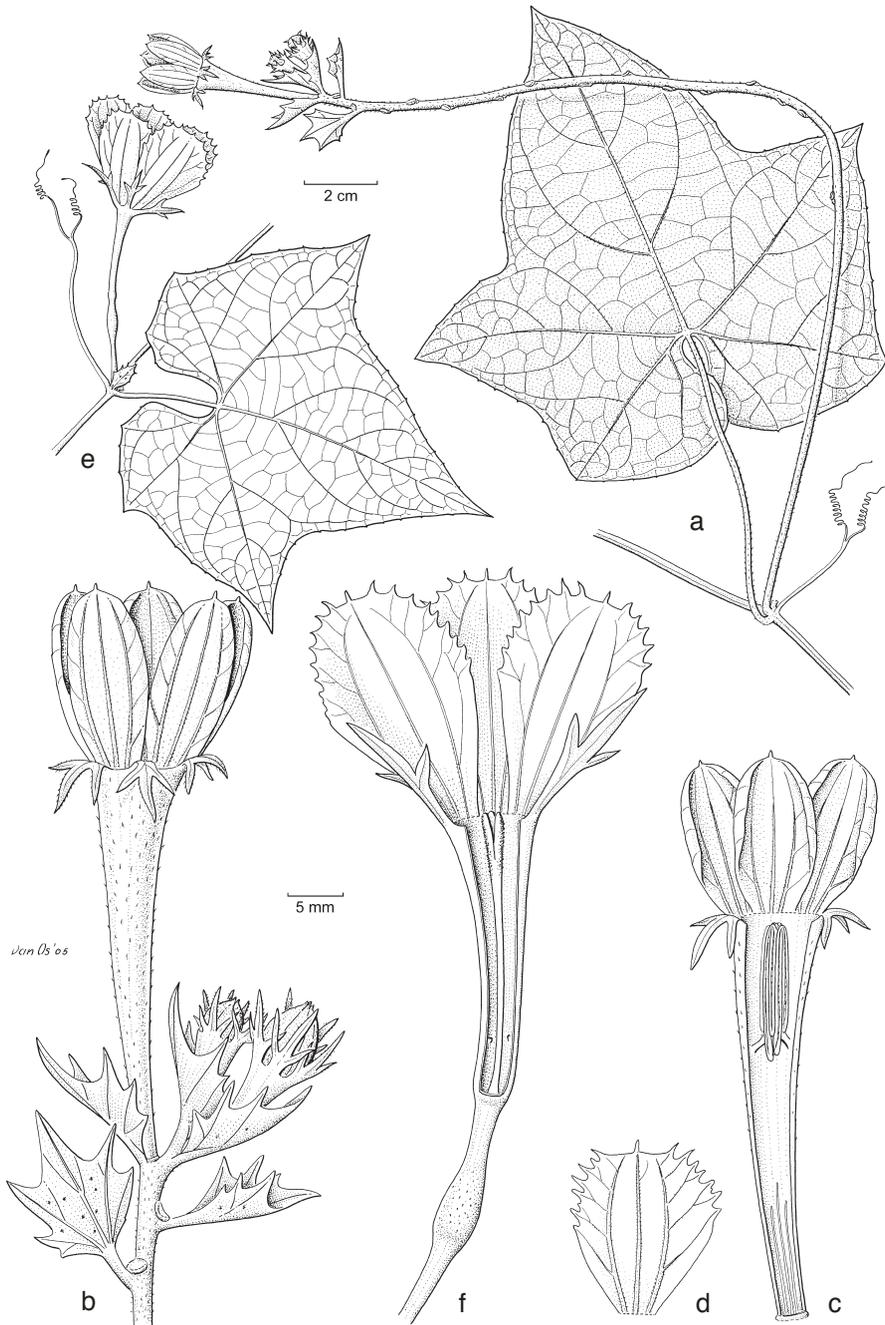


Fig. 5. *Gymnopetalum orientale* W.J. de Wilde & Duyfjes. a. Node with male inflorescence; b. apex of male inflorescence; c. male flower, opened, note disc composed of linear thickenings adnate to the receptacle-tube; d. unfolded petal; e. node with female flower, and probract; f. female flower, opened (a–d: Wiering 1811; e, f: Schmutz 4301).

long; sepals (5–)10 mm long, with a few side-lobes; petals c. 20 mm long; style 15(–20) mm long, stigmas included, c. 10 mm long, 3-lobed at apex; disc absent; staminodes minute, inserted c. 5 mm above base of the tube. *Fruits* (after *Verheijen 3819*): ellipsoid-fusiform, c. 5 by 3.5 cm, shortly beaked at apex, orange or red, harshly fine-hairy, glabrescent, sometimes with scattered wartlets, faintly ribbed (?); fruiting pedicel 2–7 cm long. *Seeds* numerous, long pear-shaped, acutish at one end, 7–8 by 3.5 by 2.5–3 mm, not margined, faces very shallowly verrucose-rugose.

Field-notes — Petals white; flowers opening (Flores) between 23.30 h and 24.00 h, with a spicy odour, visited by midges; flowers (Lombok) still expanded at 12.00 h. Fruits eaten by crows; fruit pulp colour not recorded.

Distribution — E Malesia: Celebes, Lesser Sunda Islands, Moluccas (Seram, Babar Island).

Habitat & Ecology — Climber in scrub-edge; damp sites; at 25–1500 m altitude; flowering mainly June to January; fruiting in February.

Note — *Gymnopetalum orientale* resembles *G. chinense*, but the latter is less robust in all parts. The disc in the male flowers, consisting of carnosely elongate bodies adnate to the receptacle-tube is similar to those in most of *Trichosanthes*. *Gymnopetalum orientale* is reminiscent of *Trichosanthes quinquangulata* because of its leaf size and shape, its lobed sepals and sometimes ± fringed petals.

Specimens examined:

*De Wilde & Duyffjes 21937* (male), *21938* (male), both Lombok (both L); *Eyma 2496* (male), W Ceram (BO); *Forsten 12* (male), Celebes, Tondano (L); *Kostermans & Wirawan 787* (male & fr.), Flores (K); *Schmutz 316* (male), *4761* (male), both W Flores, *4301* (female & fr.), (all L); *Schouten 93* (female), Flores (L); *Van Borssum Waalkes 3111* (male & fr.), Babar Island (BO, K, L; bracts & sepals very narrowly acuminate); *Verheijen 755* (male), *756* (male), *3544* (male), *3819* (male & fr.), *5382* (male), all Flores (all L); *Wieringa 1811* (male), Flores (WAG).

#### 4. *Gymnopetalum tubiflorum* (Wight & Arn.) Cogn. — Fig. 1a

*Gymnopetalum tubiflorum* (Wight & Arn.) Cogn. (1881) 388; Cogn. & Harms (1924) 178; Philcox (1997) 15. — *Bryonia tubiflora* Wight & Arn. (1834) 347. — *Gymnopetalum ceylonicum* Arn. (1840) 52; (1841) 278, nom. illeg. — *Gymnopetalum wightii* Arn. var. *zeylanicum* (Arn.) Trimen (1894) 246. — Type: *Rottler s.n.* ex Herb. Klein in Herb. Wight Cat. 1118, February 1796 (holo K; iso E, several duplicates), Ceylon, Trincomalee; see note 1 & 4.

*Gymnopetalum wightii* Arn. (1840) 52; (1841) 278; Thwaites (1859) 127; C.B. Clarke (1879) 611; Cogn. (1881) 389; Cogn. & Harms (1924) 179; Trimen (1894) 246, t. 43; Gamble (1919) 530; Chakrav. (1959) 59; C. Jeffrey (1980b) 798. — Type: *Wight 1146* (K), Ceylon.

Distribution — S India and Sri Lanka.

Notes — 1. The specimen *Wallich Cat. 6724*, without precise locality, is possibly a duplicate of the type-collections of *Gymnopetalum tubiflorum*, as suggested in Wight & Arnott's (1834) note under *Bryonia tubiflora*; the there mentioned *Wallich Cat. 6703* is a *Mukia*, whereas *Wallich Cat. 6724* (named '?*Cucurbita umbellata* Wall.', which is a *nomina nudum*) is the sole representative of *G. tubiflorum* in Wallich's Catalogue.

According to Philcox (1997: 16), part of the material annotated as *Thwaites CP 1625* (in PDA), also originates from *Rottler s.n.* ex Herb. Klein.

2. We have seen only a limited number of collections from Sri Lanka (see below), but we follow Philcox's (1997) opinion that *G. tubiflorum* and *G. wightii* are synonyms. Cogniaux (1881) and Cogniaux & Harms (1924), following Arnott (1840), recognised

two species: *G. tubiflorum* with deeply lobed leaves and the receptacle-tube subglabrous and *G. wightii* with undivided (or shallowly lobed) leaves and the receptacle-tube densely hairy. The differences mentioned need further study; see also note 3.

3. Cogniaux (1881) and Cogniaux & Harms (1924) described the disc glands or pistillodia for *G. tubiflorum* as 3 in number and 1 mm long and for *G. wightii* as single and 3–4 mm long. We examined only male flowers of *Thwaites CP 1625* (BO), a specimen with unlobed leaves, the receptacle-tube sparsely hairy and with 3 separate fusiform disc glands, c. 2 mm long on slender stipes, c. 1.5 mm long, attached about halfway in the tube, simulating sterile stamens, but it has also a normal androecium in the apical part of the tube. The taxonomic implications of these strongly different forms of disc glands need further study.

4. *Gymnopetalum tubiflorum* seems rare on the Indian subcontinent. Jeffrey (1980b) and previous authors cited several older collections. We have seen none of these collections, but suspect that some may have originated from Sri Lanka. Likely the specimen sent to Wallich, *Wallich Cat. 6724*, is part of the original collection by Rottler (*Wight 1118*) from Sri Lanka as may be inferred from Wight & Arnott's (1834) note; see note 1. Their identification of *Wallich Cat. 6703* is incorrect, as this is a *Mukia*. Jeffrey (1980b: 806) cites 5 Beddome collections from S India, but we have not seen them. The collection *Herb. Wight 314*, Courtallem, August 1835 (E) has not been cited by Jeffrey. Some collections cited by Chakravarty (1959) have not been seen by us. Collections from Sri Lanka, where the species apparently is more frequent, are cited by Philcox (1997).

5. Cogniaux (1881) mentions that the flowers from Sri Lanka are yellow, which is possibly erroneous. Trimen (1894) states that they are white, and earlier and recent collectors from Sri Lanka (Philcox, 1997) record the flowers as white, the same colour as in the other species of *Gymnopetalum*.

#### Specimens examined:

*Herb. d'Alleizette 2613* (fr.), Ceylon (L); *s.n.* (male) (L); *Thwaites CP 1625* (male), (BO); *Walker 1738* (male), (E); *Wallich Cat. 6724*; *Wight 314* (male), India, Courtallem (E); (Rottler ex *Herb. Klein*) *Wight 1118* (male & fr.), Ceylon, Trincomalee, (E, isotype).

#### EXCLUDED NAMES

*Gymnopetalum calyculatum* Miq. (1861) 332; we have not seen the type *Amman* (= *Kurz*) from Bangka, but according to its description – tendrils 3-branched, female flowers with 5 spatulate linear bracts – this is *Cucurbita moschata*.

Two names described from Java, *Gymnopetalum piperifolium* Miq. (1856) 680, type: *Horsfield s.n.*, and *Gymnopetalum horsfieldii* Miq. (1856) 680, type: *Horsfield s.n.*, are both *Thladiantha cordifolia* (Blume) Cogn.

#### ACKNOWLEDGEMENTS

We thank NWO (Netherlands Organization for Scientific Research) for a grant enabling us to visit the Bogor Herbarium in 1996. Curators of A, AAU, BK, BKF, BM, BO, BRI, E, K, KEP, L, P, SING, U, W, and WAG are acknowledged to study Cucurbitaceae in their respective herbaria or sending specimens on loan to Leiden. We also thank Sam Van Hoang (Forestry, Hanoi, Vietnam) and Chue

Yen Kheng (Singapore) who made an assessment of the variation in *G. chinense* and *G. integrifolium* [report not published] during the Training Course of ARCBC in Bogor (2002), which helped determining the status of *G. integrifolium* var. *pectinatum*, described in this paper. As usual Dr. Jan-Frits Veldkamp (Leiden) kindly provided the translations into Latin of the diagnoses of the new taxa, and Jan van Os (Leiden) prepared the beautiful drawings.

## REFERENCES

- Arnott, G.A.W. 1840. Remarks on the fruit of the natural order Cucurbitaceae. *Madras J. Lit. Sci.* 12: 48–54.
- Arnott, G.A.W. 1841. On the Cucurbitaceae. *J. Bot.* 3: 271–280.
- Backer, C.A. 1964. In: C.A. Backer & R.C. Bakhuizen van den Brink Jr., *Flora of Java* 1: 292–307. Noordhoff, Groningen.
- Bentham, G. & J.D. Hooker. 1867. *Genera plantarum* 1: 816–841. Reeve & Co., London.
- Blume, C.L. 1826. *Bijdragen tot de Flora van Nederlandsch Indië* 15: 922–940. Ter Lands Drukkerij, Batavia.
- Chakravarty, H.L. 1959. Monograph on Indian Cucurbitaceae. *Rec. Bot. Surv. India* 17: 1–234.
- Chen, S.K. 1995. *Gymnopetalum*. In: C.Y. Wu, C. Chen & S.K. Chen (eds.), *Flora Yunnanica*. 6: 345–351. Science Press, Beijing.
- Clarke, C.B. 1879. Cucurbitaceae. In: J.D. Hooker, *Flora of British India* 2: 604–635. Reeve & Co., London.
- Cogniaux, C.A. 1881. Cucurbitaceae. In: A. & C. de Candolle, *Monogr. Phan. Prodr.* 3: 325–951.
- Cogniaux, C.A. & H. Harms. 1924. Cucurbitaceae – Cucurbiteae – Cucumerinae. In: A. Engler, *Pflanzenreich* 88, iv.275.2: 1–246. Engelmann, Leipzig.
- Craib, W.G. 1931. Cucurbitaceae. *Florae Siamensis Enumeratio* 1: 750–770. Siam Society, Bangkok.
- De Loureiro, J. 1790. *Flora Cochinchinensis*. Lisboa.
- De Wilde, W.J.J.O. & B.E.E. Duyfjes. 2004. The genus *Trichosanthes* (Cucurbitaceae) in Sabah. *Sandakania* 14: 5–32.
- Don, G. 1834. A general history of the dichlamydeous plants 3: 1–43. Gilbert & Rivington, London.
- Duyfjes, B.E.E. & K. Pruesapan. 2004. The genus *Trichosanthes* L. (Cucurbitaceae) in Thailand. *Thai Forest Bull., Bot.* 32: 76–109.
- Endlicher, S.L. 1842. *Generum plantarum supplementum secundum*: 77. Vienna.
- Gagnepain, F. 1918. Cucurbitacées nouvelles de l'Herbier du Muséum. *Bull. Mus. Hist. Nat. (Paris)* 24: 371–380.
- Gagnepain, F. 1921. Cucurbitacées. *Flore Generale de l'Indo-Chine* 2: 1030–1095. Masson & Cie, Paris.
- Gamble, J.S. 1919. *Flora of the presidency of Madras* 1, 3: 526–543. Adlard & Son, Ltd., London.
- Hô, P.H. 1991. Cucurbitaceae. An illustrated Flora of Vietnam 1, 2: 711–728, f. 1974–2020. Mekong Printing, Santa Ana.
- Hochreutiner, B.P.G. 1934. *Plantae Hochreutineranae*. *Candollea* 5: 287–290.
- Jeffrey, C. 1980a. The Cucurbitaceae of Eastern Asia: 1–60. Royal Botanic Gardens, Kew.
- Jeffrey, C. 1980b. Further notes on Cucurbitaceae V. The Cucurbitaceae of the Indian subcontinent. *Kew Bull.* 34: 789–809.
- Keraudren-Aymonin, M. 1975. Cucurbitacées. In: A. Aubréville & J.-F. Leroy (eds.), *Flore du Cambodge, du Laos et du Viêt-nam* 15: 1–114. Mus. Natl. Hist. Nat., Paris.
- Kurz, S. 1871a. On some new or imperfectly known Indian plants. *J. Asiat. Soc. Bengal* 40: 57–58.
- Kurz, S. 1871b. Über einige neue und unvollkommen bekannte indische Pflanzen. *Flora* 54: 294–295.
- Kurz, S. 1875. Descriptions of new plants from the Nicobar Islands (including a few from the Andaman Islands). *J. Bot.* 13: 326.
- Kurz, S. 1877. Contributions towards a knowledge of the Burmese flora. *J. Asiat. Soc. Bengal* 46, 2: 95–106.

- Léveillé, A.A.H. 1914–1915. Flore du Kouy-Tchéou. Le Mans.
- Lu, A.M. & Zhi. Y. Zhang. 1986. *Gymnopetalum*. In: A.M. Lu & S.K. Chen (eds.), *Flora Reipublica Popularis Sinica* 73, 1: 212–215. Science Press, Beijing.
- Merrill, E.D. 1919. Additional notes on the Kwangtung flora. *Philipp. J. Sci.* 15: 256.
- Merrill, E.D. 1935. A commentary on Loureiro's "Flora Cochinchinensis". *Trans. Amer. Philos. Soc.* 24: 376–381.
- Merrill, E.D. 1938. New or noteworthy Indo-Chinese plants. *J. Arnold Arbor.* 19: 69–70.
- Miquel, F.A.W. 1856. *Flora Indiae Batavae* 1, 1: 652–683. Van der Post, Amsterdam.
- Miquel, F.A.W. 1861. *Flora van Nederlandsch Indië, eerste bijvoegsel Sumatra*: 130–332. Van der Post, Amsterdam.
- Naudin, C. 1862. Cucurbitacées cultivées au muséum d'histoire naturelle en 1862. *Ann. Sci. Nat., Bot. sér. 4*, 18: 159–208.
- Naudin, C. 1866. Cucurbitacées nouvelles cultivées au muséum d'histoire naturelle en 1863, 1864 et 1865. *Ann. Sci. Nat., Bot. sér. 5*, 5: 5–43.
- Philcox, D. 1997. Cucurbitaceae. In: M.D. Dassanayake & W.D. Clayton (eds.), *A revised handbook to the flora of Ceylon* 11: 8–46. Balkema, Rotterdam.
- Ridley, H.N. 1911. An account of a botanical expedition to lower Siam. *J. Straits Branch Roy. Asiat. Soc.* 59: 15–234.
- Roemer, M.J. 1846. *Peponiferarum. Synopses Monographicae* 2: 1–118. Landes-Industrie-Comptoires, Weimar.
- Roxburgh, W. 1814. *Hortus bengalensis*. Serampore.
- Roxburgh, W. 1832. *Flora Indica* 3: 701–728. Thacker & Co., Calcutta.
- Roxburgh, W. 1978. *Icones Roxburghianae or drawings of Indian plants. Bot. Surv. India, Fasc. 7.*
- Rugayah. 1999. *Trichosanthes (Cucurbitaceae) in Malesia*. Dissertation. Institute Pertanian Bogor.
- Rugayah & W.J.J.O. de Wilde. 1997. *Trichosanthes L. (Cucurbitaceae) in Java. Blumea* 42: 417–482.
- Rugayah & W.J.J.O. de Wilde. 1999. *Conspectus of Trichosanthes (Cucurbitaceae) in Malesia. Reinwardtia* 11: 227–280.
- Thwaites, G.H.K. 1859. *Enumeratio plantarum Zeylaniae: an enumeration of Ceylon plants*: 124–128. Dulau & Co., London.
- Trimen, H. 1894. *A Hand-book to the flora of Ceylon* 2: 242–262, plates 42–44. Dulau & Co., London.
- Wight, R. & G.A.W. Arnott. 1834. *Prodromus Florae Peninsulae Indiae Orientalis* 1: 340–351. Parbury, Allen & Co., London.

## IDENTIFICATION LIST

- 1 = *Gymnopetalum chinense*  
 2a = *Gymnopetalum integrifolium* var. *integrifolium*  
 2b = *Gymnopetalum integrifolium* var. *pectinatum*  
 2c = *Gymnopetalum integrifolium* var. *penicaudii*  
 3 = *Gymnopetalum orientale*  
 4 = *Gymnopetalum tubiflorum*

- Altmann 142: 1 — Ambriansyah AA 1181: 1 — Amdjah 495: 1 — Amin SAN 127148: 1 — Arifin AA 1123: 1 — Atmodjo 393: 1.
- Backer 571: 1; 6510: 2a; 7616: 1; 12118: 1; 16748: 1; 17717: 2a; 23665: 1; 34289: 1; 36215: 1 — Bakhuizen van den Brink Jr. 1260: 1 — Balansa 4020: 2a — Béguin 856: 1 — Beumée A 800: 2a — Bhargava 4689: 1 — Bon 5555: 2a.
- Cuadra A 2155: 1 — Cuong 821: 1 — Curtis in Ridley 8350: 1.
- De Vogel 3823: 1 — De Wilde 21674: 2a; 21692: 2b; 21693: 2b; 21719: 1; 21722: 1; 21738: 2a; 21819: 1; 21892: 1; 21915: 2a; 21937: 3; 21938: 3; 21948: 2a; 22156: 1; 22166: 1; 22180: 2a; 22269: 2a; SAN 144002: 1 — Den Hoed 961: 2a.
- Enoh 274: 1 — Eyma 2496: 3.

- Forbes 228: 1; 1543: 1 — Forsten 12: 3 — Frake PNH 36147: 1 — Fung 20457: 2c.  
Garrett 1488: 1.  
Hallier 4402: 2a; 4435: 1 — Han SAN 59825: 1 — Helfer 36: 1 — Herb. d'Alleizette 2613: 4  
— Hiep NTH 2734: 2a — Hochreutiner 2331: 2a — Holstvoogd 102: 1 — Houwing 793: 1  
— How 72613: 2b.  
Kievits 2121: 1; 8607: 2a — King's collector 10563: 1 — Kobus 8607: 1 — Kokawa 1550: 1  
— Koonthunthod 319: 1 — Koorders 16610: 2a; 21126: 2a; 23000: 2a; 25093: 2a; 27331: 2a;  
28242: 2a; 42523: 2a — Kostermans 787: 3; 1108: 1; 1126: 1 — Koyama 15964: 2a.  
Larsen 32289: 1; 45382: 2a — Lertkusel 41: 2a — Lörzing 12964: 1.  
Maxwell 71-594: 2a; 74-965: 2a; 86-797: 2a; 88-942: 1; 90-851: 1; 90-895: 1; 92-649: 2a; 94-843:  
1; 96-1031: 1; 98-273: 2a; 98-950: 1; 98-1143: 2a — Mirmanto EM (98) 23: 1 — Monyrak  
172: 2a — Murata J 1421: 2a; T 16200: 2a; T 16607: 2a; T 17005: 1; T 17136: 2a; T 17317: 1;  
T 37661: 2a.  
Nakano 99111: 2a — Niyomdham 967: 1.  
Pénicaud 43: 2c — Pereira JTP 700: 1 — Phonsena 3515: 2a; 3976: 1 — Poilane 11322: 2a; 14807:  
2a; 19795: 1; 21374: 1; 27163: 2a; 27530: 1; 27546: 2a; 30074: 2a — Pooma 2490: 1 — Postar  
SAN 106703: 1; SAN 144095: 1 — Posthumus 800: 1 — Pruesapan KP-1: 2a; KP-74: 2a —  
Puudja 83: 2a.  
Ramos BS 36662: 1 — Reinwardt 1766: 1.  
Sarip 18: 1 — Schmutz 316: 3; 4301: 3; 4761: 3 — Schouten 93: 3 — Shimizu T 11778: 2a — Sinclair  
9917: 2a; SF 39423: 2a — Sørensson 2119: 2a; 5976: 1 — Spare SF 36704: 2a — Squires  
943: 1.  
Thwaites CP 1625: 4.  
Van Balgooy 2311: 1; 2985: 1; 7514: 2a — Van Borssum Waalkes 3111: 3 — Van Daalen 393: 1 — Van  
Niel 3946: 1 — Van Slooten 580: 1 — Van Steenis 2475: 2a — Van Vuuren 95: 2a — Verheijen  
755: 3; 756: 3; 3544: 3; 3819: 3; 5382: 3; 5402: 1.  
Walker 1738: 4 — Wallich Cat. 6711: 1; 6724: 4; 6730: 2a; 6749: 1 — Wichian 314: 2a — Wieringa  
1811: 3 — Wight 314: 4; 1118: 4; 1146: 4.