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The genus *Trichosanthes* L. (Cucurbitaceae) in Thailand

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ABSTRACT. *Trichosanthes* (Cucurbitaceae) in Thailand comprises 17 species, seven of which have been described as new here: *T. dolichosperma* Duyfjes & Pruesapan, *T. erosa* Duyfjes & Pruesapan, *T. inthanonensis* Duyfjes & Pruesapan, *T. kostermansii* Duyfjes & Pruesapan, *T. pallida* Duyfjes & Pruesapan, *T. phonsenae* Duyfjes & Pruesapan, and *T. siamensis* Duyfjes & Pruesapan. Two new subspecific entities have been described: *T. pubera* Blume subsp. *rubriflos* (Cayla) Duyfjes & Pruesapan var. *fissisepala* Duyfjes & Pruesapan, and *T. tricuspidata* Lour. subsp. *javanica* Duyfjes & Pruesapan. A key to taxa, descriptions with distributional and ecological data and illustrations are presented.

INTRODUCTION

The results of the present revision of *Trichosanthes* will form part of the forthcoming treatment of the family Cucurbitaceae for the Flora of Thailand. *Trichosanthes* is an Asian genus, extending eastward to Australia. Within the Cucurbitaceae of Thailand, as well as for the whole of Southeast Asia, it is the largest genus, with 17 species in Thailand, and more than 100 species in all. It is a difficult genus, not because the species are unclear, but the herbaria materials are generally insufficient because the species are dioecious, the fragile corollas which bloom at night are difficult to collect, to preserve and to study, and the fruiting collections (fruits are quite often collected) at first sight show little relation to the flowering specimens.

Trichosanthes is known as medicinal, and has recently received comparatively much taxonomic attention in China (Yueh & Cheng, 1974, 1980). The genus has been revised for India by Chakravarty (1959), for Cambodia, Laos and Vietnam by Keraudren (1975), and for the Malesian area by Rugayah & De Wilde (1997, 1999) and Rugayah (1999).

Through intensified field collecting focused on Cucurbitaceae in Thailand several new records and new species could be added. Craib (1931) listed 13 species but several of these had to be relegated into synonymy or to a different genus. In Thai Plant Names (Smitinand 1980, 2001) five and seven species were accepted, respectively.

Trichosanthes specimens are not difficult to recognise in the field; they are climbers with a stoutish habit, mostly branched tendrils, distinctly fringed petals (which they share e.g. with *Hodgsonia*), and often brightly coloured fruits, the size of a hen's or

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goose's egg. Some general morphology of *Trichosanthes*, with emphasis on characters to be used in the determination of the species, is given below. With the treatment of the species, specimens are only cited when few specimens for Thailand are known; for other specimens one is referred to the identification list.

Subdivision of *Trichosanthes*

Trichosanthes, in subfamily Cucurbitoideae, is the largest genus in the family. It has a wide genus concept and comprises more than 100 species in (sub)tropical Asia, to the east as far as (sub)tropical Australia and the Pacific. Centres of species diversity are China and Malesia. For Malesia, Rugayah & De Wilde (1999) and Rugayah (1999) largely followed the subdivision of the genus as proposed by Jeffrey (1980) and some Chinese authors (Yueh & Cheng, 1974) for China, based primarily on characters of the male bracts, and the seeds. The 17 species in Thailand do not allow for original research on the subdivision of the genus, but a survey of their characters made it clear that the species cannot easily be placed in the sections as previously proposed by Yueh & Cheng (1974), Huang et al. (1998) or Rugayah (1999). We are of the opinion that new research comprising all species over the whole range of the genus is needed to arrive at a satisfactory division.

Pruesapan & Van der Ham (in press) investigated pollen of some 40 species, including those of Thailand, and found some resemblance with the existing subdivisions.

CHARACTERS USED IN THE KEY TO THE SPECIES AND IN THE DESCRIPTIONS OF THE SPECIES

Habit

The observation of living plants in the field is useful for the assessment of various aspects of the habit of *Trichosanthes* because these aspects may be not clear from the herbarium specimens. Most species are perennial climbers, often with tuberous roots, and some are annual. Perennial female plants frequently die after fruiting (monocarpous), but new shoots may be produced by the tubers in some species.

Sexual condition

Whether a species is monoecious or dioecious can be determined by the presence of male flowers as well as female flowers or fruits on the same herbarium specimen, or preferably by observing living plants. In other genera it may be variable but in *Trichosanthes* most species are dioecious, and only some are monoecious, e.g. *T. cucumerina* and possibly *T. siamensis*.

Indumentum, colour

Trichosanthes species are variously hairy, some are conspicuously villose or strigose, but most are subglabrous or glabrescent when the hairs disappear with age. The hairs may be grey or brown. Most species have a whitish (or black or brown), chalky punctation (cystoliths) originating from hair scars or hair bases, especially on the upper leaf surface, rendering the leaves scabrid. White cystoliths may also occur on stem, petiole and nerves of lower leaf surface in several species. The leaf-bearing stem is greenish, but in some species it is conspicuously red-tinged, a diagnostic character.

Stem

Stem thickness is rather typical for the species and measured in the leafy twigs.

Tendrils

At variance with other scandent-climbing plant families, Cucurbitaceae bear a tendril on each node, and the tendril is never (at least not in subfamily Cucurbitoidae) truly axillary, nor opposite the leaf, but always at some angle with the leaf-petiole. The node, bearing a leaf, a lateral tendril and, when fertile, a flower or an inflorescence, and often a lateral vegetative shoot is very characteristic for Cucurbitaceae, an assemblage which can be called the nodal syndrome (Rugayah & De Wilde, 1997). The morphological origin of the tendril is unknown. In subfamily Cucurbitoidae, to which *Trichosanthes* belongs, the predominantly branched tendrils became spiralling only above the point of branching; the number of branches may be specific. In a few species the tendril is unbranched.

Leaves

Leaves provide various useful characters. In *Trichosanthes* the leaves may be palmately compound (with petiolulate leaflets) or simple, with the blade either entire or variously (deeply) lobed. The lobing may be variable within a species. Hairiness and size, number and situation of glands on the lower surface may provide good characters. Leaves of juvenile plants may be greatly different from those of adult plants. The leaves of juvenile specimens of *T. tricuspidata* and related species are much dissected and look the same.

Probracts

These are nearly always present in *Trichosanthes*, one at each node, and their shape, consistency and presence or absence of glands provide good characters. Characters of the probract have been neglected by most previous authors. The probract can best be seen on young shoots. They can be conspicuous, linear-lanceolate, ovate, concave or flat, or they can be small and caducous; they are absent in some species. The morphological origin of the probract is unknown.

Inflorescences

In the dioecious species of *Trichosanthes*, male flowers are either solitary, or usually arranged into a peduncled bracteate raceme, often with a single male flower co-axillary. Female flowers develop singly at the node. In monoecious plants female flowers can be found singly at the nodes or singly (and developing previously) beside the male raceme; female flowers usually develop later than male flowers. In some species an elongated or straw-like appendage can be found at the node beside the male raceme; it represents the pedicel of an undeveloped or earlier developed single flower.

Peduncle, rachis and bracts.— The peduncle may be slender or (very) stout, and in older male inflorescences the rachis may be thickened, bearing persistent old bracts and pedicels or pedicel scars. In some species (not in Thailand) the rachis is zig-zag.

Bracts can be persistent or caducous, either placed on the rachis or in some species higher-up on the pedicels. They are very different in size, shape and consistency, varying from linear to obovate or rhomboid with the margin entire, dentate or lacineate, glabrous or sparsely to densely hairy, and with or without glands.

Flowers

The flowers, as in most Cucurbitaceae, are unisexual. In most species of *Trichosanthes*, the flowers are (partly) nocturnal, they open in the late afternoon or at night and close before sunrise when the corollas can be found fallen on the ground, but some species e.g. *T. cucumerina* are largely diurnal with flowers open at daytime. The flowers are mostly white, showy and large, possibly pollinated by moths. The perianths of male and female flowers are generally similar.

In the present study, detailed characteristics of the flowers are left out, because of the incomplete material available. Moreover, the flowers are very fragile, and not easy to analyse from boiled dry material.

Pedicel.— The pedicel is mostly persistent, articulate with the flower at the apex. The pedicel of a solitary male or female flower is much longer than the pedicel of flowers in a raceme.

Receptacle tube.— The receptacle is of a tubular shape, widened towards the apex, usually with white (long) hairs inside. In some species, e.g. *T. villosa*, and *T. phonsenae*, the receptacle tube of the male flowers forms a pseudo-ovary, the swollen base of the tube, which contains disk-like structures.

Sepals.— The five sepals are free, narrowly triangular, ovate, narrowly ovate, or narrowly elliptic with a long-acute apex; the margin is entire or dentate or (coarsely) lacineate or lobed. These characters are of important taxonomic value, but one should be aware that in some species the sepals of female flowers are entire, whereas in male flowers they are dentate or lancineate.

Corolla.— The colour of the five petals is white, in some species pinkish(-red) or only the veins or the threads are reddish; the throat of the corolla is often yellow. The petals have long (rarely short) filiform threads or dissections on the margin (fimbriate), with a very thin and delicate texture. The shape of the entire part of the petals is oblong-

ovate or obovate-cuneiform, and this part is usually finely hairy (rarely glabrous). The difference in shape of the entire part possibly has taxonomic significance, but here we have not used this. Typically rhomboid petals are found in e.g. *T. kerrii, T. phonsenae* and *T. villosa* (figs. 2, 3, 4), and typically oblong-ovate petals in e.g. *T. cucumerina* and *T. ovigera*.

Male flowers.— All species have three stamens, inserted in the receptacle tube towards the throat, or in some species at the base. The filaments are free, (very) short, glabrous or hairy. The anthers have S-shaped anther cells (thecae), two anthers are 2-thecous, one 1-thecous. In the Thai species they are connate (or rarely connivent, *T. phonsenae*) into a cylindrical body (synandrium), usually with stiff hairy appendages at the apex and between the thecae.

Female flowers.— The style is long, slender, with three stigmas and glabrous or hairy. The inferior ovary is wholly hairy, or glabrescent or glabrous, globose or ellipsoid of shape, three celled with three parietal placentas and numerous horizontal ovules.

Fruits

The fruit is indehiscent, various in size and shape, globose, ovoid or ellipsoid, rarely cylindrical (3–15 cm long; snake-like, to ca. 100 cm long in *T. cucumerina* var. *anguina*). Some species have a short beak at the apex which is a persistent part of the receptacle tube. Fruits are smooth or hairy when young, and hairy mature fruits occur in *T. kerrii* and *T. phonsenae*, as well as in some Chinese species. The texture of the exocarp is leathery or thinly woody, the colour mostly red or orange-red, in some species with yellow or paler longitudinal stripes, or the fruit is green with whitish bands. The pericarp is either thin or thick, with the mesocarp softer, yellow or white. The soft pulp inside contains the seeds and has a colour characteristic of the species or a group of species, i.e. whitish or reddish, or green-black. Whitish pulp may be sweet, the green-black pulp is very bitter. The fruiting pedicel (size, and surface) may provide diagnostic characters.

Seeds (Fig. 1).

Characteristics of the seeds are often decisive for the identification of *Trichosanthes* to species. The seeds are numerous, horizontal, and often densely packed. They can be turgid or compressed, rarely more or less terete. The colour is grey, black or brown. The seeds are smooth or finely sculptured on the faces, with a markedly broad or narrow margin, or they are unmargined, with the very edge entire, or undulate, or gnawed (*T. erosa*). In turgid seeds (*T. ovigera*) there is a marked broad belt around the middle, the belt being the margin of the seed as in other species, and the bulging sides are protrusions of the faces. Compressed seeds are usually elliptic in outline; the apex is rounded, obtuse or acute or rarely emarginate; the base is broadly rounded, truncate or cuneate, rarely acuminate; the edge can be rounded or square in cross-section.

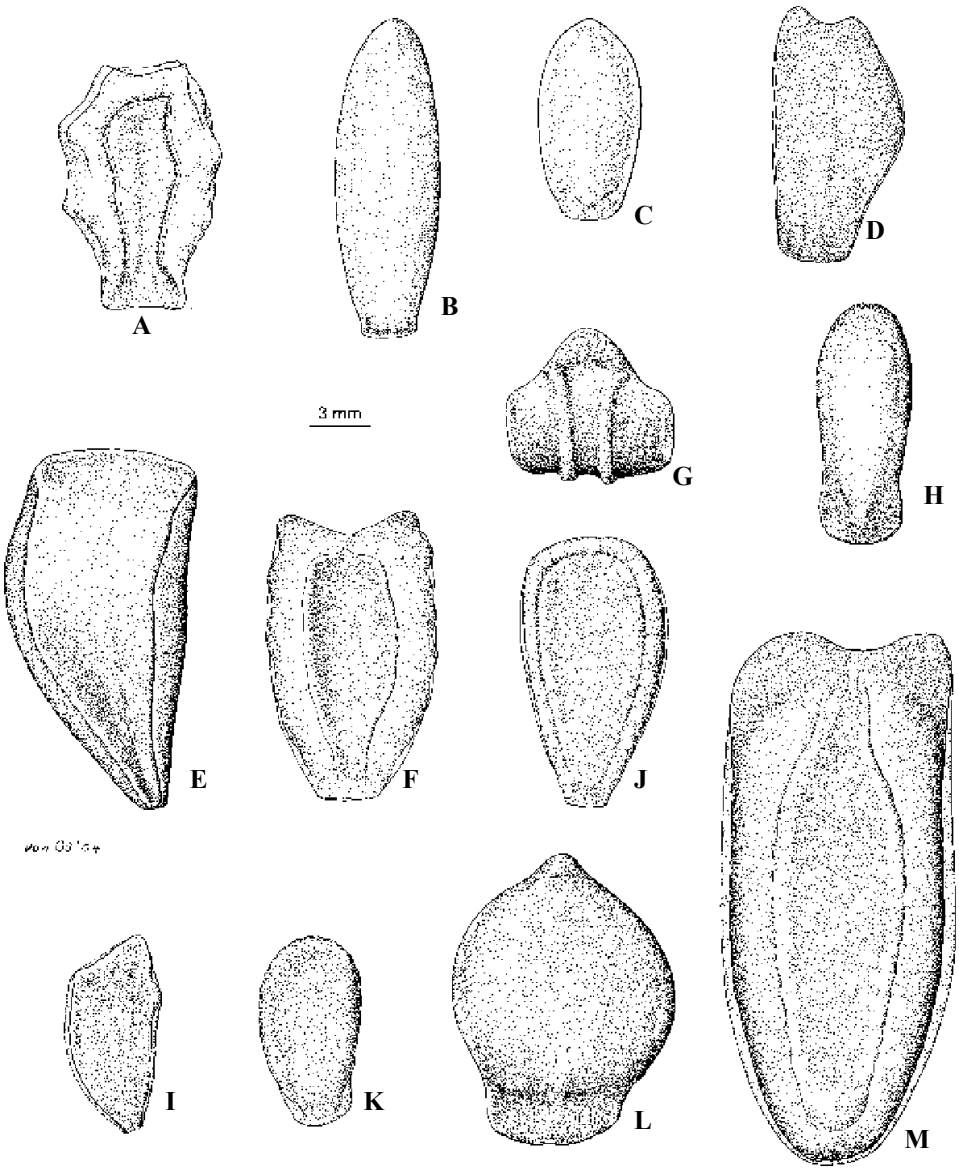

Figure 1. Seeds of various species of *Trichosanthes* in Thailand: A. *T. cucumerina* L. subsp. *cucumerina*; B. *T. dolichosperma* Duyfjes & Pruesapan; C. *T. dunniana* H. Lév.; D. *T. erosa* Duyfjes & Pruesapan; E. *T. inthanonensis* Duyfjes & Pruesapan; F. *T. kerrii* Craib; G. *T. ovigera* Blume; H. *T. pubera* Blume subsp. *rubriflos* (Cayla) Duyfjes & Pruesapan; I. *T. quinquangulata* A. Gray; J, K. *T. tricuspidata* Lour. subsp. *tricuspidata*; L. *T. wawrae* Cogn.; M. *T. villosa*. A: *Meebold* 3171; B: *Shimizu et al*. T11779; C: *Chayamarit et al*. 1622; D: *Niyomdham* 4485; E: *Phonsena et al.* 3958; F: *Phonsena et al.* 3969; G: *Phonsena et al*. 3521; H: *Phonsena et al*. 3914;I: *Koonkhunthod et al*. 326; J: *Pooma et al.* 2672; K: *Maxwell* 87-1224; L: *Avé* 94; M: *Phonsena et al.* 3518. Drawn by Jan van Os.

TRICHOSANTHES

L., Sp. Pl. 2: 1008. 1753; Benth. & Hook. f., Gen. Pl. 1: 821. 1867; C. B. Clarke in Hook. f., Fl. Brit. Ind. 2: 606.1879; Cogn. in A. & C. DC., Monogr. Phan. 3: 351. 1881; E. G. O. Müll. & Pax in Engl., Natürl. Pflanzenfam. 4(5): 31. 1894; Gagnep., Fl. Gén. Indoch. 2: 1037. 1921; Craib, Fl. Siam. Enum. 1: 751. 1931; Chakrav., Rec. Bot. Surv. India 17: 28. 1959; C. H. Yueh & C. Y. Cheng, Acta Phytotax. Sin. 12(4): 415–448. 1974; Keraudren in Aubrév. & J. F. Leroy, Fl. Camb., Laos, Viêt-Nam 15: 75. 1975; S. K. Chen in A. M. Lu & S. K. Chen, Fl. Reip. Pop. Sin. 73(1): 218–257. 1986; S. K. Chen in C. Y. Wu, C. Chen & S. K. Chen, Fl. Yunnan. 6: 351–376. 1995; Rugayah & W. J. de Wilde, Reinwardtia 11(4): 227–280. 1999; Rugayah, *Trichosanthes* (Cucurbitaceae) in Malesia: 61 1999.— Type: *Trichosanthes anguina* L.— *Involucraria* Ser., Mém. Soc. Phys. Genèv. 3(1): 25, t. 5. 1825.

Small or large climbers, perennial or rarely annual; glabrous or hairy; cystoliths usually obvious. *Probracts* present or absent. *Tendrils* (simple or) 2–5(–9)-branched. *Leaves*: blade simple, entire or lobed, or compound, 3–5-foliolate, margin with sparse minute teeth ca. 1 mm long; usually with glands. *Flowers* dioecious, rarely monoecious; petals usually finely hairy, white or rarely pink, or red veined, margin long-fimbriate. *Male inflorescences*: flowers solitary or mostly in bracteate, peduncled raceme (sometimes with one solitary flower co-axillary); female flower solitary at the nodes. *Male flowers*: pedicel distinct; bracts usually on the rachis, large or small (rarely absent), with or without glands; receptacle tube tubular, mostly widened towards apex; sepals 5, entire, dentate or lobed; petals 5 (corolla deeply 5-partite or lobes free), fimbriate with long filiform hairs; stamens 3, inserted in the receptacle tube near the throat, included; filaments short, free; anthers two 2-thecous, one 1-thecous, mostly united into elongate truncate synandrium, thecae linear, S-shaped; pistillode or disc present as 3 linear bodies at base of receptacle tube. *Female flowers*: perianth similar to male flowers; ovary globose or (ovoid-)ellipsoid, or (long) fusiform, ovules numerous, horizontal; style slender, stigma deeply 3(–5)-lobed; staminodes absent. *Fruits* pendent, indehiscent, ovoid, ellipsoid or (sub)globose (or cylindrical), 3–15(–100 in *T. cucumerina* var. *anguina*) cm long, fleshy-pulpy inside; exocarp leathery or woody, red or green, paler striped, smooth, glabrous or hairy; mesocarp white or yellowish (sometimes fibrous); pulp greenish black, white or reddish. *Seeds* numerous, horizontal, mostly densely packed, very various of shape, little or much compressed, or turgid with two inflated sides, usually margined, edge entire, crenate or undulate, faces not or little sculptured.

About 100 species, throughout subtropical and tropical eastern Asia: from India, S China and Japan, through Malesia, east to tropical Australia and Fiji.

KEY TO THE SPECIES

1. Leaves compound, 3-foliolate **17. T. wawrae**
1. Leaves simple, entire or lobed 2
2. Probract absent (check on young shoots) 3
3. Male bracts less than 2 mm long. Leaf base with broad sinus. Seeds thickish, with edge undulate. Monoecious **1. T. cucumerina**
3. Male bracts much longer than 2 mm, entire or incised (lobed). Leaf base with narrower sinus. Seeds with edge smooth, or notched, or undulate. Plants usually dioecious 4

4. Leaves villose or velvety on both surfaces 5
5. Tendrils 2-or 3-branched, portion below branching short, ca. 0.5 cm long. Male bracts short, ca. 10 mm long. Fruit hairy (glabrescent); seeds with notched or gnawed margin **6. T. kerrii**
5. Tendrils 4–7(–9)-branched, portion below branching 2–4 cm long. Male bracts 20–40 mm long. Fruit glabrous; seeds with entire margin **16. T. villosa**
4. Leaves short hairy, or scabrous, or glabrous below 6
6. Seeds turgid, with broad belt. Leaves finely hairy, especially below, along the finer veins. Male bracts without glands **8. T. ovigera**
6. Seeds compressed, rarely turgid, without belt. Leaves scabrous or glabrous. Male bracts with glands 7
7. Leaves deeply 5-lobed, scabrous by coarse sparse hairs **10. T. phonsenae**
7. Leaves entire or (shallowly) 3-lobed, glabrous 8
8. Leaf base cuneate or rounded, veins prominent below. Tendrils 2- or 3-branched **15. T. truncata**
8. Leaf base (sub)cordate or hastate, veins less prominent below. Tendrils unbranched 9
9. Leaves membranous, drying pale below; glands 1–1.5 mm diam.; margin entire **9. T. pallida**
9 Leaves chartaceous, drying green below; glands absent or not apparent; margin sparsely finely dentate **13. T. siamensis**

2. Probract present 10
10. Younger stems, leaves and inflorescences green, not reddish tinged. Petals completely white or white with yellow fringes. [Probract not long-linear] 11
11. Seeds narrowly ellipsoid, subterete, hardly compressed, ca. 15 mm long **2. T. dolichosperma**
11. Seeds broader, ± elliptic, usually compressed, 8–18 mm long 12
12. Male bracts (sub)entire 13
13. Seed margin erose, not pointed at one end. Male sepals narrowly triangular, entire. [Probract linear, less than 10 mm long] **4. T. erosa**
13. Seed margin entire, pointed at one end. Male sepals lobed **12. T. quinquangulata**
12. Male bracts lobed or incised 14
14. Leaves pale below **9. T. pallida**
14. Leaves green below 15
15. Leaf glands 2–3 mm diam. **18. T. species** aff. **laceribractea** (no Thai specimens seen)
15. Leaf glands 0.5–1 mm diam. **14. T. tricuspidata**
10. Younger stems, leaves and inflorescences red or reddishly tinged. Petals pale pink, or white with red veins, or with (white) reddish fringes 16
16. Leaves hairy below. Probract slender, long-linear, without glands. **11. T. pubera**
16. Leaves glabrous (or scabrous) below. Probract elliptic or narrowly elliptic, with glands 17
17. Probract ca. 25 mm long **7. T. kostermansii**
17. Probract less than 5–10 mm long 18
18. Seeds flat, 13–16 by 7–8 mm, ca. 2.5 mm thick, margined **5. T. inthanonensis**
18. Seeds only little compressed, 10–12 by 5–7 mm, 3–5 mm thick, smooth, unmargined **3. T. dunniana**

1. Trichosanthes cucumerina L., Sp. Pl. 2: 1008. 1753; Lour., Fl. Cochinch. ed. 1: 588. 1790; Cogn. in A. & C. DC., Monogr. Phan. 3: 357. 1881; Craib, Fl. Siam. Enum. 1: 752. 1931; Rugayah & W. J. de Wilde, Blumea 42: 478. 1997; Rugayah, *Trichosanthes* (Cucurbitaceae) in Malesia: 66. 1999. Type: (Jeffrey 1980): *Pada valam*, in Rheede, Hort. Ind. Malab. 8: 39. 1688.— *T. reniformis* Miq., Fl. Ind. Bat. 1: 675. 1856.— Type: Indonesia, Java, *Horsfield* s.n. (holotype BM).— *T. pedatifolia* Miq., Fl. Ind. Bat. 1: 677. 1856.— Type: Indonesia, Java, *Horsfield* s.n. (holotype BM; isotype U). Fig. 1A.

Climber 2–3 m long (stouter in all parts in var. *anguina*); annual or subperennial; monoecious; with (sparse) minute hairs, partly glabrescent; plant green, not reddish tinged; cystoliths not obvious; stem 1.5–2(–5) mm diam. *Probract* absent. *Tendrils* 2-or 3-branched. *Leaves*: blade either unlobed or shallowly or deeply 3–5(–7)-lobed, membranous, hairy or subscabrous below; suborbicular or broadly ovate in outline, 5–10 (–17) by 6–8(–17) cm, base cordate with broad sinus, the apex acute, the margin entire or finely dentate; glands absent; petiole 2–10 cm long. *Male raceme* 9–14(–20) cm long,

hairy, (glabrescent); peduncle 7–15 cm long, 1–2 mm thick; rachis with up to 20 flowers; bracts persistant or caducous, 1–2 mm long, without glands. *Male flowers*: pedicel 3–15 mm long; receptacle tube 15–19 mm long, at throat ca. 3 mm wide; sepals linear, ca. 2 mm long, margin entire; petals ovate-oblong, narrowly elliptic, 5–6(–10) mm long, threads ca. 10 mm long (open corolla ca. 30 mm dia.); synandrium 2(–3) mm long, filaments less than 1 mm long. *Female flowers*: pedicel 5–15(–30) mm long; ovary (narrowly) elliptic, 10(–30) mm long, finely hairy. *Fruits* green, turning orange-red, paler speckled or longitudinally banded, ovoid or narrowly elliptic, narrowed towards apex, 2.5–5 by 1.5–4 cm (up to ca. 100 cm long in var. *anguina*, see note); exocarp thinly leathery, smooth; pulp orange; fruiting pedicel 1–2(–3) cm long. *Seeds* grey or pale or dark brown, compressed, elliptic(-oblong), 6–18 by 4–9 by 2.5–3.5 mm, margin broad but faint, edge undulate.

Thailand.— NORTHERN: Phrae (Mae Yom NP), Chiang Mai (Ban Tin Doi), Phitsanulok; SOUTH-EASTERN: Chon Buri (Thung Prong), Trat (Dan Chumpon); CENTRAL: Ang Thong, Phra Nakhon Si Ayutthaya, Bangkok, Saraburi (Kaeng Khoi).

Distribution.— Widely distributed from India, Sri Lanka, and S China, through Malesia into W, N, and NE Australia. Widespread in cultivation (var. *anguina*).

Ecology.— Open places in alluvial thickets along river banks, in deciduous forest, over shale bedrock, mostly in sandy substrate; 0–500(–1,000) m altitude. Flowering and fruiting in the wet season.

Vernacular.— Nom pichit (นมพิจิตร), mak noi. (หมากนอย).

Note.— *T. cucumerina* is a widespread species, preferring a seasonal climate. The var. *anguina* (L.) Haines (1922) is widely cultivated for its snake-like edible fruits. Only one herbarium collection from Thailand, *Maxwell* 13-7-1969 (BKF), is known.

Field-notes.— Contrary to most *Trichosanthes* species, the flowers of *T. cucumerina* are open during the day light, the corollas falling off in the afternoon.

2. Trichosanthes dolichosperma Duyfjes & Pruesapan, **sp. nov.** Liana robusta. Folia trilobata infra pilis scabridis. Fructus subglobosus ca. 8 cm diam. Semina oblonga vix compressa 12–17 mm long ca. 5 mm lata. Typus: Thailand, Phetchabun, *Shimizu et al*. T 11779 (holotypus BKF; isotypus KYO, L). Fig. 1B.

Stoutish climber; wholly green; cystoliths obvious; stem 4–5 mm diam., glabrous, slightly waxy. *Probract* subovate, ca. 13 by 8 mm, entire, ± scabrous, with glands. *Tendrils* 4- or 5-branched. *Leaves*: blade 3-lobed to ca. ⅓, chartaceous, glabrous above, scabrous with very short stiff hairs below, ovate-orbicular in outline, ca. 24 by 20 cm, base cordate, mid-lobe obovate, ca. 8.5 by 8 cm, apex acute-acuminate, margin with minute yellowish hard teeth; glands few to several, scattered, ca. 0.5 mm diam.; petiole 8–9 cm long. *Male and female flowers* not seen. *Fruits* subglobose, ca. 8 cm diam.; pericarp thin when over ripe; exocarp ca. 0.5 mm thick, smooth; pulp watery, greenish-blackish; fruiting pedicel ca. 2 by 0.5 cm. *Seeds* bright light brown, narrowly oblong, subcylindrical (hardly compressed), 12–16 by 5 by 4 mm, apex and base (narrowly) rounded, the faces smooth, margin obscure, edge rounded, entire.

Thailand.— NORTH-EASTERN: Phetchabun (*Shimizu et al*. T 11779-type).

Distribution.— Endemic to Thailand, known only from the type.

Ecology.— Mountain forest, at ca. 700 m altitude.

3. Trichosanthes dunniana H. Lév., Repert. Spec. Nov. Regni Veg.10: 148. 1911; C. Jeffrey, Cucurbitaceae Eastern Asia, Kew: 41. 1980; S. K. Chen in A. M. Lu & S. K. Chen, Fl. Reip. Pop. Sin. 73, 1: 230, fig. 57: 1–4. 1986; S. K. Chen in C. Y. Wu, C. Chen & S. K. Chen, Fl. Yunnan. 6: 353, pl. 93: 1–4. 1995. Type: China, Guizhou, *Esquirol* 726, (holotype E; isotype K).— *T. rubriflos* auct. non Cayla: C. H. Yueh & C. Y. Cheng, Acta Phytotax. Sin. 12(4): 442, pl. 8. 1974. Fig. 1C.

Medium-sized climber; green, but flowers reddish (inflorescences not seen from Thailand); cystoliths obvious; stem 1–2(–3) mm diam., glabrous. *Probract* broadly ovate, 2–4 by 3–4 mm, subentire, glabrescent, with few glands. *Tendrils* 2-or 3-branched. *Leaves*: blade deeply 3–5-lobed, membranous, glabrous, scabrous, ovate-orbicular in outline, 8–15 by 7–12 cm, base cordate, mid-lobe narrowly ellipic, narrowed at base, up to 12 by 4 cm, apex acute-acuminate, mucronate, margin coarsely serrate-dentate; glands 2–5, large, close to the nerve axils towards the blade base, 1–1.5 mm diam.; petiole 3–5 cm long. *Male raceme* (not known from Thailand, description from *Esquirol* 726, S China) 7–10 cm long, glabrescent or finely hairy; peduncle ca. 4 cm long, 2–3 mm thick; rachis short, with ca. 10 flowers; bracts persistent, broadly obovate, 20–25 by 20 mm, glands few, ca. 1 mm diam., margin shallowly incised, 2–3 mm deep. *Male flowers* finely hairy; pedicel short, ca. 2 mm long; receptacle tube ca. 15 mm long, at throat ca. 8 mm wide; sepals long-triangular, ca. 9 by 3 mm, margin entire; petals ca. 10 by 10 mm, threads not seen; synandrium not seen. *Fruits* ellipsoid, 5–11 by 4.5–8 cm; pericarp 5–10 mm thick; exocarp coarsely wrinkled on drying; pulp greenish-blackish; fruiting pedicel 2–2.5 by ca. 0.4 cm. *Seeds* pale brown, little compressed, ovoid-ellipsoid, 10–12 by 5–7 by 3–5 mm, blunt or rounded at both ends, smooth, without margin absent, the edge rounded, entire.

Thailand.— NORTHERN: Tak (*Chayamarit et al*. 1622), Chiang Mai (*Maxwell* 89-1184).

Distribution.— S. China (type), Myanmar.

Ecology.— Rocky places or forest edges, along roadsides and streams, at 500–600 m altitude (ca. 1,500 m in China). Fruiting in July & October.

Note.— *Henry* 9494 China reportedly has dark red flowers.

Field-note.— Fresh fruit (possibly not fully mature) hard, glossy green with yellowish streaks.

4. Trichosanthes erosa Duyfjes & Pruesapan, **sp. nov.** *Trichosanthi quinquangulatae* similis probractea angusta 2–3 mm longa, sepalis masculis linearibus non lobatis, seminum extremis truncate emarginatis differt. Typus: Thailand, Ratchaburi, *Niyomdham* 4485 (holotypus BKF). Fig. 1D.

Climber to 20 m long; wholly green; cystoliths inconspicuous; stem 2–3 mm diam., glabrous. *Probract* sublinear, 7–10 by 1.5–2 mm, glabrescent, with glands. *Tendrils* 2-or 3-branched. *Leaves*: blade shallowly or deeply 3–5-lobed; (thinly) membranous, glabrous on both surfaces, ovate-orbicular in outline, 11–20 by 9–20 cm, base cordate with wide sinus, the lobes triangular to oblong, the mid-lobe to 16 cm long, apex acute-acuminate, the margin entire or coarsely sinuate; glands numerous, small, including few to several below the lowermost nerves close to the insertion of the petiole; petiole 5–8 cm long. *Male raceme* 15–20 cm long, glabrous, co-axillary with a ca. 10 cm long pedicelled solitary male flower; peduncle ca. 15 cm long, 1–2 mm thick; rachis with 3–5 flowers; bracts persistent, narrowly elliptic, acute at both ends, 15–20 by 10 mm, with numerous small glands, margin entire. *Male flowers* (submature) early glabrescent, hairs minute, grey; pedicel slender, 20(–30) mm long; receptacle tube ca. 25 mm long, at throat 5–6 mm wide; sepals sparsely hairy, linear, 10–15 mm long, ca. 1.5 mm wide at base, with distinct mid-nerve, the margin entire; petals wedge-shaped, ca. 10 mm long; synandrium ca. 6 mm long, filaments ca. 5 mm long, glabrous. *Female flowers* not seen. *Fruits* orange to red, subglobose, ca. 7 cm diam.; pericarp 10–15 m thick; exocarp coarsely wrinkled on drying; pulp blackish; fruiting pedicel straight, ca. 2 by 0.4–0.5 cm. *Seeds* dark reddish-brown, compressed, irregularly elliptic (to quadrangular), 10–12 by 5–7 by ca. 1 mm, the apex and base irregularly retuse, truncate or blunt, faces smooth, the margin broad but obscure, edge square, entire or faintly undulate.

Thailand.— SOUTH-WESTERN: Ratchaburi (in Thailand only known from the type, *Niyomdham* 4485).

Distribution.— North Vietnam, Tonkin (vicinity of Hanoi).

Ecology.— Forest at ca. 900 m altitude. Flowering in August, fruiting in November.

5. Trichosanthes inthanonensis Duyfjes & Pruesapan, **sp. nov.** *Trichosanthi puberae* similis foliis infra glabris, probractea ovata ca, 5 mm longa viridi, seminibus maioribus ca. 15 mm longis 8 mm latis differt. Typus: Thailand, Chiang Mai, Doi Inthanon, *Phonsena, W. J. de Wilde & Duyfjes*. 3930 (holotypus BKF; isotypus L). Fig. 1E.

Trichosanthes lepiniana auct. non Naud.: S. K. Chen in A. M. Lu & S. K. Chen, Fl. Reip. Pop. Sin. 73(1): 226, pl. 56, 5–8. 1986; S. K. Chen in C. Y. Wu, C. Chen & S. K. Chen, Fl. Yunnan. 356, pl. 92, 5–8. 1995.— ?*T. wallichiana* auct. non (Ser.) Wight: Gagnep., Fl. Gén. Indoch. 2: 1048. 1921 (based on a *Kerr* collection, Doi Suthep).

Climber ca. 25 m tall; glabrous (sparse minute hairs on growing apices); purple-red in growing shoots; cystoliths obvious; stem 3–5 mm diam. *Probract* ovate-elliptic, 3–8 by 3–4 mm, entire, green, with glands. *Tendrils* 2–5-branched. *Leaves*: blade shallowly or deeply 3–5-lobed; thinly chartaceous, glabrous or scabrous; orbicular in outline, 12–24 by 11–22 cm, base (deeply) cordate, lobes ovate or oblong, mid-lobe to 12 cm long, the apex acute-acuminate, margin (sparsely) shallowly serrate-dentate; glands large, several or numerous, scattered, 0.5–1.5 mm diam.; petiole 5–9 cm long. *Male and female flowers* unknown; possibly resembling those of *T. rubriflos* subsp. *fissisepala*. *Fruits* red, ovoid, 6–8 by 4.5–6 cm, towards apex narrowed into a short beak ca. 0.3 cm long;pericarp 10(–15) mm thick; exocarp leathery, coarsely wrinkled on drying; pulp greenish-black; fruiting pedice l 3–6.5 by 0.4(–0.5) cm. *Seeds* blackish brown,

compressed, irregularly elliptic, 13–16 by 7–10 by ca. 2.5 mm, the apex subtruncate, base cuneate, the margin distinct or faint, the edge ± rounded, entire.

Thailand.— NORTHERN: Chiang Mai (Doi Inthanon NP, *Phonsena, De Wilde & Duyfjes* 3930-type; 3933; *De Wilde & Duyfjes* 22143); Nan (Doi Phukha NP, *Phonsena, De Wilde & Duyfjes* 3952; 3958); SOUTH-WESTHERN: Kanchanaburi (*Pruesapan* KP67).

Distribution.— S China?

Ecology.— Scrub on wet soil and in wet places in forest edges; at 1,300–1,700 m altitude. Fruiting August, September.

Vernacular.— Khi ka daeng (ขี้กาแดง).

6. Trichosanthes kerrii Craib, Bull. Misc. Inf. Kew: 7. 1914; Gagnep., Fl. Gén. Indoch. 2: 1047. 1921; Craib, Fl. Siam. Enum. 1: 753. 1931; C. H. Yueh & C. Y. Cheng, Acta Phytotax. Sin. 12(4): 433, fig. 6 & pl. 88: 26. 1974; C. Jeffrey, Cucurbitaceae Eastern Asia, Kew: 44. 1980; S. K. Chen in A. M. Lu & S.K. Chen, Fl. Reip. Pop. Sin. 73(1): 239, pl. 59: 1–4. 1986; S. K. Chen in C. Y. Wu, C. Chen & S. K. Chen, Fl. Yunnan. 6: 365, pl. 95: 1–4. 1995. Type: Thailand, *Kerr* 2454 (holotype K; isotype BM).— *T. tomentosa* Chakrav., J. Bombay Nat. Hist. Soc. 50: 894. 1952.— Type: India, *Watt* 11640 (holotype CAL, fide Jeffrey, l.c., no specimens seen).— *T. villosa* auct. non Blume: Keraudren in Aubrév. & J.-F. Leroy, Fl. Camb., Laos, Viêt-Nam 15: 77, p.p., pl. 13: 1–3. 1975. Figs. 1F, 2 & 6D.

Climber to 10 m; dark brown, yellowish- or reddish-brown hairy, the hairs 1–2 mm long; plant not reddish tinged; cystoliths not obvious; stem 3–4 mm diam., late glabrescent. *Probract* absent. *Tendrils* 2–7-branched, part below point of branching short, 0.5–1 cm long. *Leaves*: blade unlobed (entire); membranous, densely (grey-)rusty short villose; ovate in outline, 12–28 by 9–20 cm, the base cordate, the apex acute-acuminate, 5–10 mm mucronate, the margin entire; glands not obvious; petiole 5–11 cm long. *Male raceme* 10–20 cm long, wholly densely hairy, with co-axillary a densely hairy tail-like appendage, curved at apex, 5–13 cm long; peduncle 8–17 cm long, 2–3 mm thick; rachis with 3–6 flowers; bracts inserted on the pedicel below the middle, (late) caducous, elliptic or rhomboid, 10–20 by 3–8 mm, the glands not obvious, the margin entire or shallowly few-lobed. *Male flowers* hairy; pedicel 2–2.5 cm long; receptacle tube 10–20 mm long, at throat ca. 9 mm wide; sepals linear, 7–9 mm long, 1–2 mm wide at base, the margin entire; petals wedge-shaped, ca. 25 mm long, the threads ca. 5 mm long; synandrium 5–7 mm long, filaments 3–5 mm long, glabrous, inserted towards the base of the tube. *Female flowers*: pedicel ca. 2 cm long; ovary hairy, ellipsoid, 2–3 cm long; receptacle tube ca. 1.5 cm long; sepals hairy, long-triangular, ca. 1.5 cm long, the margin entire. *Fruits* orange(-green), longitudinally paler striped, ellipsoid, 7–10 by 6–7 cm; pericarp not distinct; exocarp ca. 0.5 mm thick, leathery or woody, not wrinkled on drying, with sparse brown hairs, glabrescent; pulp creamy, sweet; fruiting pedicel 2.5–6 by 0.6–0.8 cm. *Seeds* dark brown, compressed, elliptic, 14–16 by 9–11 mm, the base rounded, the apex truncate or notched, margin distinct, ca. 3 mm wide, the edge ± shallowly undulate.

Thailand.— NORTHERN: Chiang Mai: (Doi Ang Khang, *Wongprasert* s.n., 27 May 1998); Nan (Doi Wao, *Kerr* 2454-type; Doi Phukha, *Phonsena, De Wilde & Duyfjes* 3969; 3959).

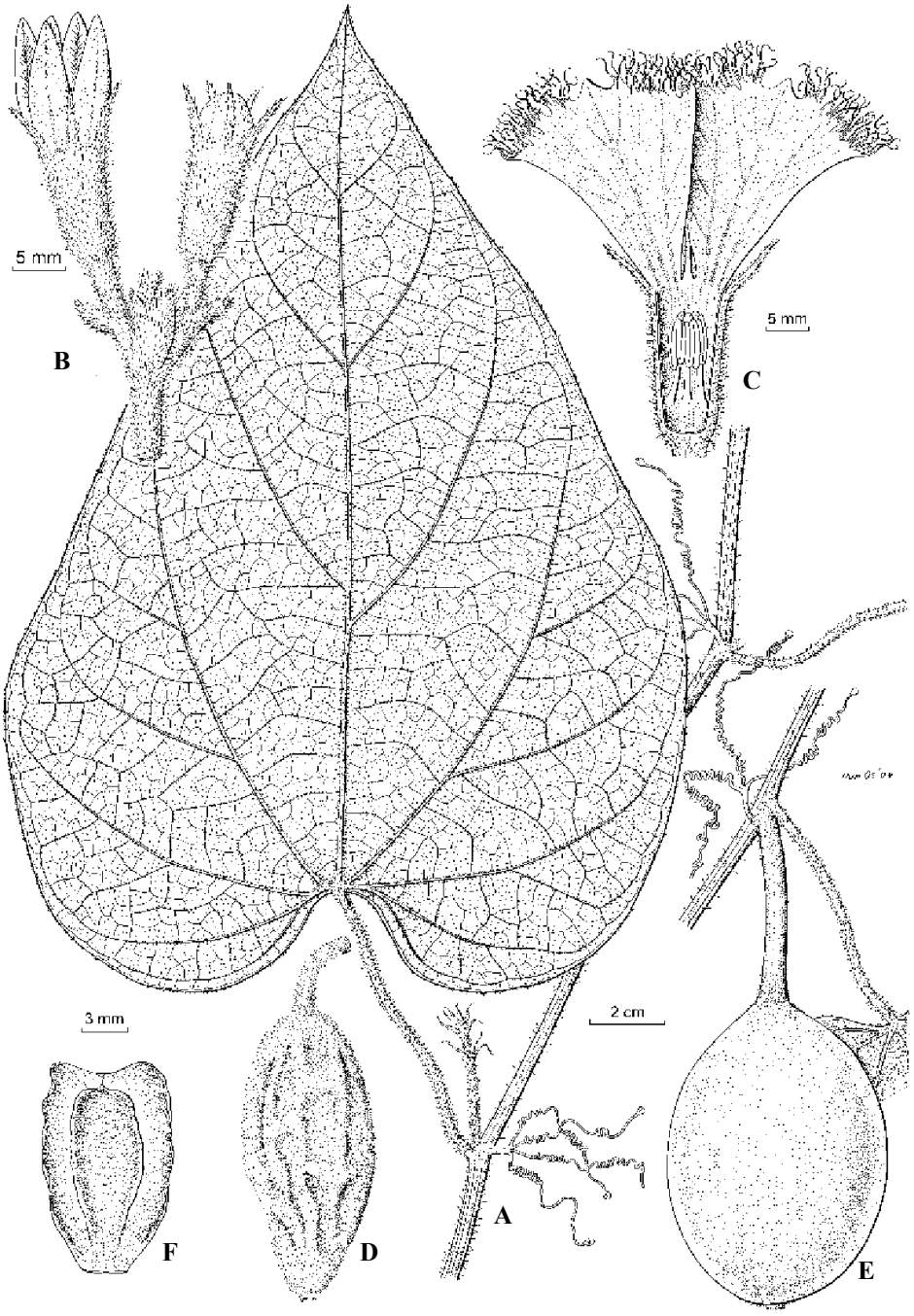

Figure 2. *Trichosanthes kerrii* Craib: A. part of twig with a developing side branch at the node; B. apex of male inflorescence; C. opened male flower; D. immature fruit, note indument; E. mature fruit; F. seed. A, E–F: *Phonsena et al*. 3969; B–C: *Pételot* 8415; D: *Wongprasert* s.n., 27 May 1998. Drawn by Jan van Os.

Distribution.— Yunnan, Guangxi, India?, North Vietnam (Tonkin), Laos.

Ecology.— In (seasonal) mountain forest edges, along streams, at 1,100–1,500 m altitude. Flowering February, April; fruiting May, September.

Vernacular.— Khi ka mo kha (ขี้กาหมอคาร์).

Note.— The tail-like appendage, co-axillary to the male raceme, is apparently derived from a solitary male flower, as frequently found in other *Trichosanthes* species.

7. Trichosanthes kostermansii Duyfjes & Pruesapan, **sp. nov.** *Trichosanthi wallichii* similis bracteis masculis grandis ca. 5 cm longis, sepalis profunde incisis lobis lateralibus angustis differt. Typus: Thailand, Kanchanaburi (Wangka), *Kostermans* 743 (holotypus L; isotypi L, SING).

Climber, ca. 20 m tall, with pendent branches, glabrous; plant somewhat reddish tinged, petals pink; cystoliths obvious; stem 3–4 mm diam. *Probract* elliptic-oblong, 23–26 by 6–8 mm, the margin finely serrate in upper half, the apex acute, with glands. *Tendrils* 2-branched. *Leaves*: blade 3–5-lobed to ca. ⅓; membranous, glabrous; ovate-orbicular in outline, 11–15 by 9–13 cm, the base cordate with broad sinus, mid-lobe subovate, up to 7 by 4.5 cm, apex acute-acuminate, the margin sparsely dentate; glands numerous, scattered, small, less than 0.5 mm diam.; petiole 4–6 cm long. *Male raceme* 8–16 cm long, sparingly hairy, glabrescent, sometimes co-axillary with a ca. 30 mm long pedicelled solitary male flower; peduncle 6–8 cm long, 1.5–3 mm thick; rachis with ca. 10 flowers; bracts (sub)persistent, glabrous, membranous, ovate or elliptic, (15–)40–50 by (10–)30–40 mm, the glands numerous, small, the margin irregularly finely incised ca. 5 mm deep. *Male flowers* glabrous, except petals; pedicel caducous?, 5–10 mm long; receptacle tube ca. 15 mm long, at throat 5–7 mm wide, inside hairy; sepals (narrowly) elliptic, 10–15 by 5–8 mm, deeply finely irregularly incised (lobed), with few minute glands; petals ca. 20 by 10 mm, finely hairy, threads ca. 5 mm long, pink, red-veined; synandrium ca. 10 mm long, the filaments ca. 2 mm long, glabrous, inserted towards the base of the tube. *Female flowers* and *fruits* unknown.

Thailand.— SOUTH-WESTERN: Kanchanaburi (Wangka, *Kostermans* 743-type).

Distribution.— Endemic to Thailand, known only from the type.

Ecology.— Flowering in May.

Note. .— A collection of fruits (Kanchanaburi, *Pruesapan* KP66), from a died-off plant with withered leaves possibly belong here. The red fruit measures ca. 8 by 6 cm, the fruiting pedicel is 4–7 cm long. The seeds, ca. 16 by 8 by 4 mm, have a distinct margin and a retuse apex. Compare also with *T. erosa*.

Etymology.— Named for the late A. J. G. H. Kostermans, former botanist at Bogor, Indonesia.

8. Trichosanthes ovigera Blume, Bijdr. Fl. Ned. Ind.: 934. 1826; Miq., Fl. Ind. Bat.: 674. 1856; Cogn. in A. & C. DC., Monogr. Phan. 3: 380. 1881; Chakrav., Rec. Bot. Surv. India 17: 51. 1959; Backer in Backer & Bakh. f., Fl. Java 1: 303. 1963; Keraudren in Aubrév. & J.-F. Leroy, Fl. Camb., Laos, Viêt-Nam 15: 85, pl. 15. 1975; C. Jeffrey, The Cucurbitaceae of Eastern Asia: 49. 1980; S. K. Chen in A. M. Lu & S. K. Chen, Fl.

Reip. Pop. Sin. 73(1): 255, pl. 63: 6–13. 1986; S. K. Chen in C. Y. Wu, C. Chen & S. K. Chen, Fl. Yunnan. 6: 374, pl. 98: 6–13. 1995; Rugayah & W. J. de Wilde, Blumea 42: 478. 1997. Type: Indonesia, Java (Mt Salak), *Blume* s.n. (holotype L; isotype P).— For synonyms see Jeffrey, l.c. 1980. Figs. 1G & 6A.

Climber 2–7 m long; subperennial; variously short hairy; plant green on drying, the petals white; cystoliths not obvious; stem 2–3 mm diam. *Probract* absent. *Tendrils* 2-or 3-branched. *Leaves*: blade membranous, unlobed or (deeply) 3–5-lobed; hairy below, at least along the (finer) veins, (broadly) ovate or suborbicular in outline, 10–19(–25) by 9–16(–19) cm; the base cordate, with broad or narrow sinus, apex acute-acuminate, short mucronate, the margin entire or sparsely finely or coarsely dentate or undulate; glands absent or few, scattered, ca. 0.5 mm diam.; petiole 3–7 cm long. *Male raceme* 15–20(–25) cm long, densely or sparsely short hairy, sometimes co-axillary with a long-pedicelled male flower; peduncle 8–17 cm long, 1–2 mm thick; rachis with 5–10 flowers; bracts caducous or persistent, membranous, (narrowly) obovate or oblong, 6–20 by 1–5 mm, without glands, the margin few-lobed or dentate. *Male flowers*: pedicel (3–)5–25 mm long (in solitary flower much longer); receptacle tube 15–45 mm long, at apex 3–5 mm diam.; sepals narrowly triangular, 3–15 mm long, 1–2 mm wide at base, the margin entire; petals ovate-oblong or oblong-lanceolate, ca. 10 by 4 mm, subglabrous, the threads 7–17 mm long; synandrium 3–4 mm long, the filaments 1–2 mm long, glabrous. *Female flowers* resembling male, 10 mm long; ovary ellipsoid-oblong, ca. 8 by 2–3 mm, hairy or subglabrous; receptacle; pedicel ca. tube to 55 mm long; sepals to 20 mm long. *Fruits* orange-red, pale flamed, ellipsoid (-oblong), 4–6 by 3–4 cm (larger outside Thailand), the apex acute, 3–5 mm beaked; exocarp leathery, smooth; pulp whitish; fruiting pedicel 1–2 by 0.2 cm. *Seeds* (dark) brown, variously barrel-shaped (tumid) with broad belt, 6–8 by 5–9 by 3–5 mm.

Thailand.— NORTHERN: Chiang Mai (Doi Suthep-summit area, Doi Suthep-Pui NP, Doi Inthanon NP, Doi Chiang Dao, Doi Angka), Chiang Rai (Khun Kon Falls), Lampang (Jae Son NP), Lamphun (Doi Khun Tan NP); CENTRAL: Nakhon Nayok (Khao Yai NP); SOUTH-WESTERN: Kanchanaburi (Thung Yai Naresuan Wildlife Sanctuary); SOUTH-EASTERN: Chanthaburi (Khao Soi Dao Wildlife Sanctuary), Chon Buri (Hup Bon Sriracha forest).

Distribution.— Widespread in SE Asia from NE India and China southeast throughout Malesia (Java, type) to Australia and Solomon Islands.

Ecology.— Half-disturbed and secondary places and road-sides, wet places in evergreen forest, deciduous forest and seasonal hardwood forest; on shale and granite bedrock; up to 1,700 m altitude.

Vernacular.— Khi ka (ขี้กา), khi ka khao (ขี้กาขาว).

9. Trichosanthes pallida Duyfjes & Pruesapan, **sp. nov.** Mediocriter scandens glabrescens, cirrhis simplicibus, foliis trilobatis basi rotundata infra pallescentibus (viridibus) in sicco. Typus: Thailand, Phetchaburi, *Phonsena, W. J. de Wilde & Duyfjes* 3981 (holotypus BKF; isotypus L).

Climber 5–8 m long; minutely hairy, early glabrescent; plant green, corolla white; cystoliths not obvious; stem 1–2 mm diam. *Probract* (narrowly) elliptic, subentire, ca. 3 mm long, with glands, caducous. *Tendrils* simple. *Leaves*: blade 3-lobed to (½–)⅔ (of juvenile shoots entire); membranous, glabrous, drying pale green beneath; orbicular in outline, 8–14 by 10–14 cm, the base rounded, mid-lobe oblong, to 8 by 4 cm, apex (long) acute-acuminate, the margin entire; glands several, scattered, ca. 0.5 mm diam.; petiole 1.5–3 cm long. *Male raceme* ca. 15 cm long, minutely hairy, glabrescent; peduncle ca. 9 cm long, ca. 2.5 mm thick; rachis with 10–12 flowers; bracts, caducous, membranous, (narrowly) elliptic, acute, ca. 40 by 15 mm, with glands, the margin serrate, teeth, narrow, 2–3 mm long. *Male flowers*: pedicel caducous, ca. 15 mm long; receptacle-tube (slightly immature) ca. 10 mm long, ca. 4 mm wide at throat; sepals linear, 12–14 by 1.5 mm, long-acute, sparsely minutely hairy, the margin entire, without glands; petals and androecium not seen. *Female flowers* (immature) in a short 1-flowered raceme ca. 0.5 cm long, the flower axillary to a conspicuous bract resembling male bracts, 15–25 mm long; sepals hairy, linear, entire. *Fruits* green and white, elliptic-oblong, ca. 10 by 4.5 cm, exocarp thickish, smooth; pulp blackish green; fruiting pedicel ca. 1 by 0.3 cm. *Seeds* 6–10, brown, thickish, irregularly ellipsoid, not flat, 15–18 by 10 by 7 mm, base and apex rounded, margin flat.

Thailand.— SOUTH-WESTERN: Phetchaburi (*Phonsena, De Wilde & Duyfjes* 3981-type), Kanchanaburi (*Geesink & Phengklai* 6183).

Distribution.— S Myanmar (*Keenan et al*. 1570, fruit, E).

Ecology.— Forest edge, sandy clay or limestone, at 800–1,000 m altitude. Flowering in July and September; fruiting in September.

10. Trichosanthes phonsenae Duyfjes & Pruesapan, **sp. nov.** *Trichosanthi villosa* et *T. kerrii* similis foliis profunde 5-lobatis, inflorescentia laxa in ligno vetiore, ovario grosse pubescenti, fructu oblongo ca. 15 cm longo 6 cm lata sparse pubescenti differt. Typus: Thailand, Kaeng Krachan NP, *P. Phonsena, W. J. de Wilde & Duyfjes* 4002 (holotypus BKF; isotypus L). Fig. 3.

Climber 7–15 m long; wholly setose-hairy, hairs stiff, grey or brown, 2–4 mm long; plant green (not reddish tinged), the petals white; cystoliths not obvious; stem 3–4 mm diam. *Probract* absent. *Tendrils* 2–5-branched, the portion below point of branching ca. 1.5 cm long. *Leaves*: blade deeply-5-lobed to ca. ⅔; membranous, hairy on both surfaces; suborbicular in outline, 16–31 by 13–28 cm, the base cordate with broad sinus, mid-lobe oblong, to 17 cm long, the apex acute-acuminate, to 15 mm long mucronate, the margin entire; glands several to many, less than 0.5 mm diam.; petiole 8–13 cm long. *Male inflorescences* composed of several male racemes arranged in loose lateral shoots, 50–100 cm long, on the older wood (where stem 10–12 mm thick), each raceme with a reduced leaf or linear bract 10–20 mm long and with or without a reduced tendril at the node. *Male raceme* lax, (6–)10–20 cm long, hairy, mostly co-axillary with a densely hairy pedice l5–13 cm long (without flower); peduncle (3–)12–14 cm long, ca. 2 mm thick; rachis with 3–8 flowers; bracts mostly inserted on the pedicel below the middle, persistent, membranous, ± rhomboid, 15–25 by 5–15 mm, the apex acuminate, mucronate, with minute glands, margin entire. *Male flowers* wholly ± densely brown hairy, the hairs 2–4 mm long; pedicel 0.5–4 cm long; receptacle tube ca. 20 mm long, at

throat ca. 10 mm diam., the base faintly swollen, forming a cup-shaped 'pseudo-ovary'; sepals narrowly triangular or linear, 15–20 mm long, 2–3 mm wide at base, the margin entire; petals finely hairy, wedge-shaped, 15–20 mm long, threads ca. 10 mm long; synandrium ca. 10 mm long, with anthers closely appressed but free, the filaments ca. 3 mm long, hairy at the base, inserted towards the base in the tube, at apex of 'pseudo ovary'. *Female flowers*: pedicel 50–80 mm long; ovary narrowly ellipsoid, ca. 35 by 10 mm, densely hairy; corolla as in male. *Fruits* (slightly immature) green, white striped, narrowly ellipsoid, ca. 15 by 6–8 cm; pericarp fleshy; exocarp thin, leathery, sparsely hairy, glabrescent; pulp whitish; fruiting pedicel ca. 11 by 0.3 cm. *Seeds* (immature) compressed, elliptic, ca. 1 cm long, margin entire.

Thailand.— SOUTH-WESTERN: Phetchaburi (Kaeng Krachan NP).

Distribution.— Endemic to Thailand, known from three collections: *Phonsena, De Wilde & Duyfjes* 3980, 4001, 4002-type, all Kaeng Krachan NP.

Ecology.— Evergreen lower montane forest; on shales. Roadside and forest edges; at 700–900 m altitude. Flowering & fruiting in September.

Etymology.— Named in of Phongsak Phonsena, Thai botanist.

Notes.— 1. Male inflorescences are formed on almost leafless lateral shoots up to 1 m long on the older wood. The inflorescences are lax, and like the flowers, pale green, the corollas in fallen-off flowers are white. Female flowers and fruits are formed on the leafy nodes, shaded among the dense foliage.

2. Having white fruit pulp and a similar construction of the male flowers, with the stamens inserted low in the receptacle tube, and a 'pseudo-ovary' (the thick-walled basal part of the receptacle tube, without staminodes), the three species *T. kerrii, T. phonsenae* and *T. villosa* form a coherent, distinct group within *Trichosanthes*. The pollen of *T. phonsenae* much resembles that of *T. postari* from Borneo (Pruesapan & Van der Ham, in press). As long as the mature seeds of *T. phonsenae* are unknown we refrain from any formal grouping within *Trichosanthes*.

3. Yueh & Cheng (1974) accomodated *T. kerrii* and *T. villosa* into different sections: *T. kerrii* into section *Truncatae* C. Y. Cheng & C. H. Yueh, and *T. villosa* into section *Folio bracteola* C. Y. Cheng & C. H. Yueh.

11. Trichosanthes pubera Blume, Bijdr. Fl. Ned. Ind.: 936. 1826; Miq., Fl. Ind. Bat. 1, 1: 975. 1856; Rugayah & W. J. de Wilde, Blumea, 42, 2: 479, fig. 1c & c', 2c, 3c. 1997.— *T. bracteata* (Lam.) Voigt var. *pubera* (Blume) Cogn. in A. & C. DC., Monogr. Phan. Prodr. 3: 377. 1881. Type: Indonesia, Java, *Blume* s.n. (holotype L; isotype P).

A variable and widespread species with two subspecies. Subsp. *rubriflos* occurs in Thailand and is variable, particularly in the hairiness of young stems and lower leaf surfaces, the mode of incision of the margin of the male bracts and sepals (small or large, entire or with side-lobes). The variation in these characters is not unequivocal, but the differences in the male sepals are most striking. This subspecies is divided into two, more or less geographically separated, varieties. Female flowering and fruiting specimens can be placed only arbitrarily.

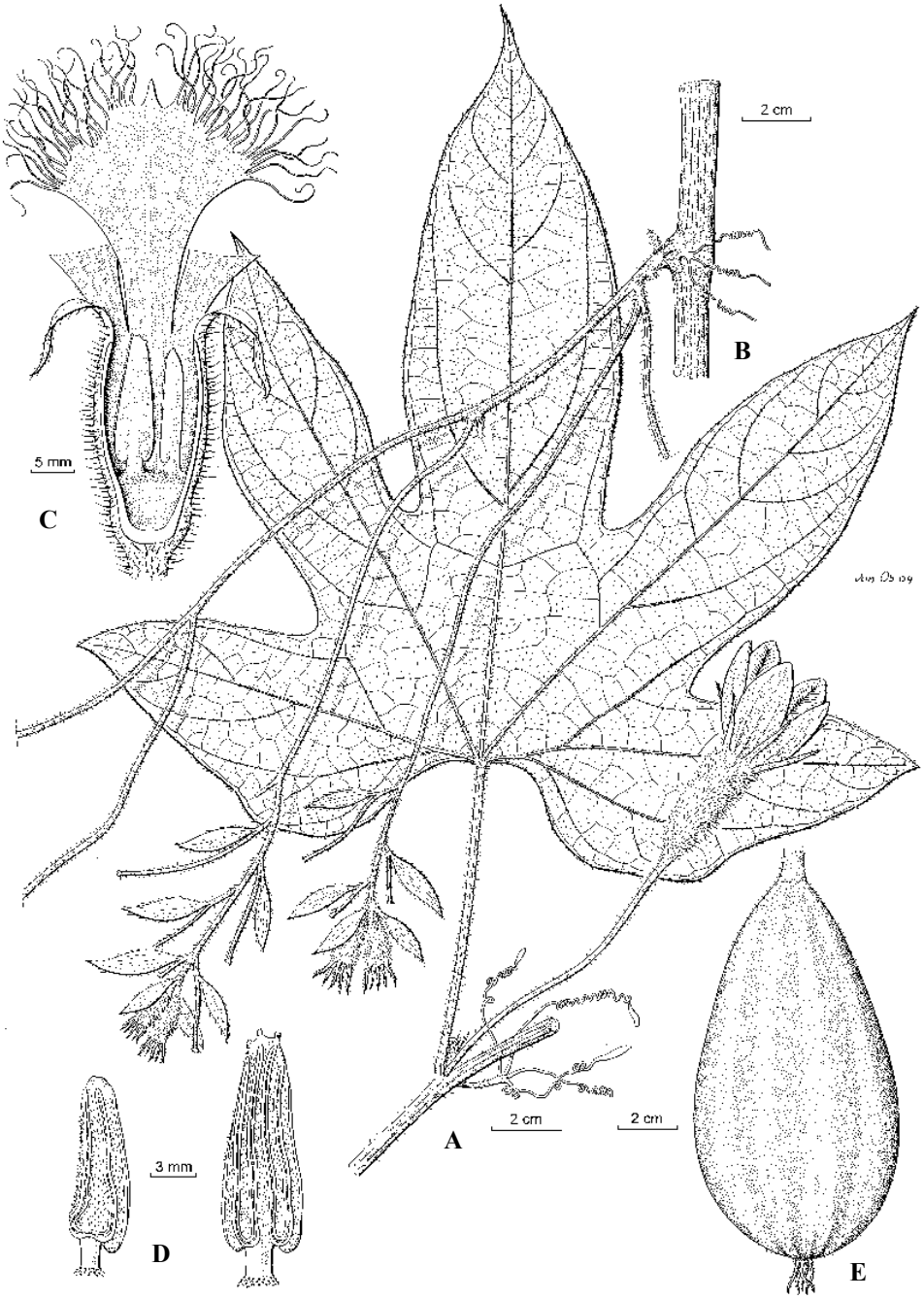

Figure 3. *Trichosanthes phonsenae* Duyfjes & Pruesapan: A. part of twig with a single female flower, petals not yet expanded; B. part of twig with compound male inflorescence, showing two partial inflorescences, note inflorescence on the older wood; C. opened male flower; D. two stamens, the left hand 1-thecous, the right hand 2-thecous; E. submature fruit. A, E: *Phonsena et al*. 4001; B–D: *Phonsena et al*. 4002. Drawn by Jan van Os.

KEY TO THE SUBSPECIES

1. Male bracts and flowers green, reddish tinged, but petals white, the threads pinkish at apex. (West Malesia, not in Thailand) **subsp. pubera**
1. Male bracts and flowers deep purple red, but petals white or pink, red veined, threads red **subsp. rubriflos**

Trichosanthes pubera Blume subsp. **rubriflos** (Cayla) Duyfjes & Pruesapan, **comb. et stat. nov.** Figs. 5A–B.

Trichosanthes rubriflos Cayla, Bull. Mus. Hist. Nat. Par., 14: 170. 1908; Gagnep., Fl. Gén. Indoch. 2: 1043. 1921; Craib, Fl. Siam. Enum. 1: 753. 1931; Keraudren in Aubrév. & J.-F. Leroy, Fl. Camb., Laos, Viêt-Nam 15: 80. 1975; C. Jeffrey, Cucurbitaceae Eastern Asia, Kew: 41. 1980; S. K. Chen in A. M. Lu & S. K. Chen, Fl. Reip. Pop. Sin. 73(1): 232, pl. 57: 5–8. 1986; S. K. Chen in C. Y. Wu, C. Chen & S. K. Chen, Fl. Yunnan. 6: 358, pl. 93: 5–8. 1995. Lectotype (Keraudren 1975): Cambodia, Stung-streng, *Thorel* 2126 (lectotype P; isolectotypes P, K). Fig. 1H.

Climber 5–20 m long; hairy, partly glabrescent, the hairs 0.5–2 mm long, grey or pale rusty; growing shoots and bracts reddish, (reddish-) brown on drying, the petals pink or pink-veined rarely white; cystoliths obvious; stem 2–4 mm diam. *Probract* narrowly elliptic or linear, (10–)15–40(–50) mm long, entire, finely rusty hairy, without glands. *Tendrils* 2- or 3-branched. *Leaves*: blade unlobed or shallowly or deeply 3–5-lobed to $^{5}/_{6}$, membranous or chartaceous, scabrous above, short hairy below, broadly ovate in outline, 5–17 by 3–15 cm, the base shallowly or deeply cordate with broad or narrow sinus, the mid-lobe triangular to narrowly elliptic, up to 15 cm long, the apex acute-acuminate; margin finely or coarsely serrate; glands few or several, scattered, 0.5–1 mm diam.; petiole (sometimes conspicuously hairy when young) 5–11 cm long. *Male raceme* (4–)10–22 cm long, hairy; peduncle (3–)7–14 cm long, 2–3 mm thick; rachis with 5–15 flowers; bracts (sub)persistent, purple-red, membranous, obovate-rhomboid, 25–45 mm long, with glands, the margin coarsely or finely incised; flowers purple-red, except petals. *Male flowers*: pedicel 2–6 mm long; receptacle tube 20–55 mm long, at throat 5–7 mm diam.; sepals linear or ovate-elliptic, 7–23 mm long, the margin entire or with side-lobes; petals whitish or pale pink with reddish veins, ± wedge-shaped, 20–30 mm long, threads ca. 10 mm long, (white or) reddish; synandrium ca. 10 mm long, the filaments 1–2 mm long, glabrous or hairy. *Female flowers*: pedicel ca. 10 mm long; ovary (narrowly) ellipsoid, 5–9 by 3–4 mm, sparsely or densely hairy; receptacle tube 25–35 mm long, at apex ca. 5 mm diam.; sepals long-triangular or narrowly elliptic, the apex acute-acuminate, 5–10 mm long, the margin entire. *Fruits* (orange-)red, subglobose or ovoid, 5–7(–8) by 4.5–5.5 cm, the apex short-rostrate; dry pericarp 5–10 mm thick; exocarp leathery, usually coarsely wrinkled on drying; pulp green-black; fruiting pedicel 1–5 by 0.3–0.4 cm. *Seeds* blackish-brown, compressed, variable in size and shape, elliptic-oblong to obliquely obovate, 9–12 by 4–5 by 1–2 mm, broadly rounded at base, (narrowly) rounded at apex, margin indistinct, edge faintly square or rounded, entire.

Distribution.— S China, NE India, Myanmar, Thailand, Laos, Cambodia & Vietnam (type).

Ecology.— In primary evergreen forest, mixed forest; in swamps, forest edges and roadsides; up to 1,700 m altitude.

Note.— subsp. *rubriflos* appears closely related to *T. wallichiana* (Ser.) Wight, a pink-flowered species of S China, India, Nepals and Bhutan (type). The latter has slender, entire male sepals as in var. *rubriflos*, but the probracts are broader, not linear.

KEY TO THE VARIETIES

1. Male sepals undivided or occasionally with a short side-lobe. Male bracts with coarsely incised margin. (C, N & E Thailand and S China & Indochina) **a. var. rubriflos**
1. Male sepals with side-lobes or deeply incised. Male bracts densely and finely incised, 5–10 mm deep. (N & W Thailand) **b. var. fissisepala**

var. **rubriflos**

Hairs on stem 0.5–1 mm long. *Leaf blade* below, along veinlets, with hairs ca. 0.5 mm long. *Male bracts* in upper half with coarsely incised margin, ca. 5 mm deep. *Male sepals* long-triangular or linear, (5–)10 mm long, entire or with an odd small side-lobe. Fig. 6C.

Thailand.— NORTHERN: Chiang Mai, Chiang Rai, Nan, Lampang, Phitsanulok; NORTH-EASTERN: Nong Khai; EASTERN: Nakhon Ratchasima; CENTRAL: Saraburi; SOUTH-EASTERN: Sa Kaeo, Chanchoengsao, Chon Buri, Chanthaburi.

Distribution.— Indochina; possibly also S China, but no collections seen.

Ecology.— Forest clearings and roadsides; at 100–1,600 m altitude.

Vernacular.— Khi ka daeng (ขี้กาแดง).

var. **fissisepala** Duyfjes & Pruesapan, **var. nov.** a varietate *rubriflos* sepalis masculis latis, lobis lateralibus longis distincta. Typus: Thailand, Chiang Mai, *Van Beusekom & Phengklai* 1250 (holotypus L; isotypus AAH, BKF, C, E, K, KYO, P).

Hairs on stem short or long, 1–2 mm long. *Leaf blade* below, especially along the veinlets, with hairs sparse or dense, short or long, ca. 0.5 or 1 mm long. *Male bracts* irregularly, densely, finely incised, 5–10 mm deep. *Male sepals* (broadly) ovate-oblong, 10–23 mm long, 3–5 mm wide, in lower half with several slender side-lobes, to 5 mm long.

Thailand.— NORTHERN: Mae Hong Son, Chiang Mai (*Van Beusekom et al*. 1250-type), Chiang Rai, Lamphun, Phrae, Tak; SOUTH-EASTERN: Kanchanaburi, Prachuap Khiri Khan.

Distribution.— Probably also in Laos, Cambodia and Vietnam, and S China, but no material seen.

Ecology.— Forest edges and roadsides; at 50–1,700 m altitude.

Vernacular.— Lee-are-tee (ลี-อา-ตี) (Karen), khi ka daeng (ขี้กาแดง).

Note.— The collection *Maxwell* 93-906 (immature fruit) is doubtful because it has glabrous leaves, and is annotated as wholly green, not reddish, but it has conspicuous long-linear probracts.

12. Trichosanthes quinquangulata A. Gray, Bot. U.S. Expl. Exped. 1: 645. 1854; Cogn. in A. & C. DC., Monogr. Phan. 3: 378. 1881; Craib, Fl. Siam. Enum. 1: 753. 1931; C. H. Yueh & C. Y. Cheng, Acta Phytotax. Sin. 12(4): 443. 1974; C. Jeffrey, Cucurbitaceae of Eastern Asia: 41. 1980; S. K. Chen in A. M. Lu & S. K. Chen, Fl. Reip. Pop. Sin. 73(1): 223, pl. 56: 1–4. 1986; S. K. Chen in C. Y. Wu, C. Chen & S. K. Chen, Fl. Yunnan. 6: 353, pl. 92: 1–4. 1995; Rugayah & W. J. de Wilde, Blumea 42: 479, fig. 1a, 2a, 3a. 1997; Rugayah, *Trichosanthes* (Cucurbitaceae) in Malesia: 130. 1999. Type: Philippines, Mangsi Island (Sulu Sea), *Wilkes* s.n. (holotype GH-A).— *T. bracteata* auct. non (Lam.) Voigt: Chakrav., Rec. Bot. Surv. India 17: 44, p.p. 1959.— *T. tricuspidata* auct. non Lour.: Keraudren in Aubrév. & J.-F. Leroy, Fl. Camb., Laos, Viêt-Nam. 15: 81, p.p. 1975. Fig. 1I.

Climber 5–20 m; rarely monoecious; (sub)glabrous, hairs minute; plant green, blackish on drying, the petals white; cystoliths usually not obvious; stem 3–5 mm diam. *Probract* obovate-oblong, 8–12(–15) mm long, with glands. *Tendrils* (2–)3–5-branched. *Leaves*: blade 3–5-angular or lobed to ca. ¼; membranous, ± scabrous above, suborbicular in outline, 8–21 by 7–16 cm, the base deeply cordate, lobes triangular, the apex acute-acuminate, the margin entire; glands several or numerous, close to the nerve axils, especially several in the axils of the main nerves at very base of the blade, 0.5–1 mm diam.; petiole 2.5–8(–10) cm long. *Male raceme* 10–25(–30) cm long, glabrescent; peduncle 7–14 cm long, 2–3 mm thick; rachis with 5–20 flowers; bracts late-caducous, membranous, (ob)ovate-elliptic or ± rhomboid, 15–25 mm long, with glands near mid-nerve, the margin (sub)entire. *Male flowers*: pedicel (sub)caducous, 2–5(–10) mm long; receptacle tube 30–50 mm long, at apex ca. 7 mm wide; sepals long-triangular, 10–15 mm long, 2–3 mm wide at base, the margin with few slender side-lobes in basal part; petals very finely hairy, obovate or broadly cuneate, ca. 20 mm long, threads 10–15 mm long; synandrium 6–8 mm long, filaments 1–3 mm long, glabrous. *Female flowers*: pedicel 5–8(–20) mm long; ovary (ovoid-)ellipsiod, ca. 8 by 4 mm, glabrous; receptacle tube (25–)40–60 mm long; sepals smaller and narrower than in male, ca. 10 by 1 mm, entire. *Fruits* bright red, (depressed) globose, 5–6(–7) cm diam., the apex not beaked; dry pericarp 10–15 mm thick; exocarp leathery, smooth, coarsely wrinkled on drying or not; pulp green-black; fruiting pedicel 1–3 by 0.4–0.5 cm, usually curved. *Seeds* pale brown, compressed, elliptic-oblong, 8–10 by 4–5 by 1(–2) mm, pointed at one end, margin absent, edge square in section, entire.

Thailand.— NORTHERN: Lamphun (Doi Khun Tan NP), Chon Buri (Thung Brong); NORTH-EASTERN: Phetchabun (Phu Miang); SOUTH-WESTERN: Phetchaburi (Kaeng Krachan NP), Prachuap Khiri Khan; CENTRAL: Saraburi (Sam Lan forest); SOUTH-EASTERN: Sa Kaeo (Ang Rue Nai Wildlife Sanctuary), Nakhon Ratchasima (Korat, Pak Chong Nah Kate, near Sriracha), Chon Buri (Thung Brong); PENINSULAR: Songkhla (Hat Yai, Klong Hoi Kong), Narathiwat (Waeng), Surat Thani, Satun (Tarutao Island).

Distribution.— S China, Myanmar, Indochina, Malaysia, Indonesia, east to Philippines (type), and New Guinea.

Ecology.— A widespread species, in thickets of secondary growth, forest fringes, in bamboo and deciduous forest along streams, in evergreen forest; at 25–1,000 m altitude.

Vernacular.— Tum ka (ตูมกา), khi ka yai (ขี้กาใหญ่), khi ka khorn (ขี้กาขอน), kra dueng chang (กระดึงช้าง), luk khi ka (ลูกขี้กา), buap liam (บวบเหลี่ยม) (Geranal).

13. Trichosanthes siamensis Duyfjes & Pruesapan, **sp. nov.** *Trichosanthi ovigera* folii margine minute dentato fructu longitudinaliter pallide lineato similis, foliis infra glabris, seminibus crassis laevibus nec cupiformibus cingulo lato distincta. Typus: Thailand, Kanchanaburi, Thung Yai Naresuan Wildlife Sanctuary, *Maxwell* 94-546 (holotypus L; isotypus L).

Climber, several metres long; monoecious (see note); subglabrous, hairs shaggy, 0.5 mm long, largely early glabrescent; plant green, blackish on drying, the petals white; cystoliths not obvious; stem 2(–3) mm diam. *Probracts* absent. *Tendrils* simple. *Leaves*: blade unlobed or deeply 3–5-lobed to ¾, the lower lobes straight and downwards directed, membranous, (sub)glabrous; ovate or suborbicular in outline, 7–15 by 5–12 cm, base deeply cordate with narrow or broad sinus, or (sub)hastate, mid-lobe to 13 by 2.5 cm, the apex acute-acuminate, the margin entire or finely serrate-dentate; glands absent; petiole 1.5–4.5 cm long. *Male raceme* 12–14 cm long, (densely) minutely brown hairy, sometimes co-axillary with a solitary flower; peduncle 3–4 cm long, 1.5–2 mm thick; rachis with 15–20 flowers; bracts late caducous, chartaceous, subovate, 9–10 by 4–5 mm, with glands, the margin serrate-lobed. *Male flowers*: greyish hairy, glabrescent; pedicel caducous, ca. 5 mm long (10–20 mm long in solitary flower); perianth immature, presumably as in female flowers; synandrium ca. 6 mm long, the filaments ca. 3 mm long, subglabrous *Female flowers*: pedicel ca. 15 mm long; ovary narrowly ellipsoid, much narrowed towards apex, ca. 10 by 2.5 mm, glabrous; receptacle tube 15–25 mm long, at apex ca. 4 mm wide; sepals long-triangular or linear, ca. 10 mm long, 1–1.5 mm wide, with glands, margin entire; petals ca. 12 mm long, threads ca. 6 mm long. *Fruits* green with whitish longitudinal streaks, ovoid, (narrowly) ellipsoid, narrowed at both ends, especially at apex, 7.5–9 by 3.5–4 cm; exocarp leathery, smooth; pulp unknown; fruiting pedicel 1.5–2.5 by 0.3 cm. *Seeds* (from detached material) pale brown, slightly compressed, ovoid-ellipsoid, 11–13 by 7–8 by 5 mm, the apex narrowly, the base broadly obtuse, smooth, the margin absent, edge entire.

Thailand.— SOUTH-WESTERN: Kanchanaburi (Sangkhla Buri, Thung Yai Naresuan Wildlife Sanctuary, *Maxwell* 94-546-type).

Distribution.— Endemic to Thailand and known only from the type.

Ecology.— Open or partly shaded, degraded, deciduous forest with much bamboo on rugged limestone area, at 400 m altitude.

Vernacular.— Bai khai tha (ใบไข่ทา) (Karen).

Note.— The two duplicate specimens seen of *Maxwell* 94-546, represent male flowering and fruiting material, either mounted on the same sheet, or female flowers and fruits on another sheet, but male and female are not connected. However, the plant is likely monoecious.

Field-notes.— Fruit light green with whitish-greyish vertical streaks. Leaves polymorphic, entire or lobed.

14. Trichosanthes tricuspidata Lour., Fl. Cochinch. 1: 589. 1790; 2: 723. 1793. Type: Vietnam, *Loureiro* s.n., lost; neotype (Keraudren 1975): Vietnam, Quang Nam, Da Nang, *J. & M. S. Clemens* 3267 (neotype P; isoneotype BM, selected by Keraudren, 1975).

Climber 5–20 m long; occasionally monoecious; minutely hairy, early glabrescent; plant green, brown on drying, the petals white; cystoliths obvious; stem 2–4 mm diam. *Probract* (broadly) elliptic or obovate, 2–11 by 2–5 mm, entire, with glands. *Tendrils* 2-or 3-branched. *Leave*s: blade shallowly (or deeply) 3–5-lobed, to ⅓(–¾) deep (leaves of juvenile plants deeply compoundly lobed); membranous or chartaceous, (sub) scabrous above, glabrous beneath; broadly ovate or orbicular in outline, (4–)7–15 by (3–)5–14 cm, the base cordate, the mid-lobe triangular or ellipsoid(-oblong), to 12 cm long, the apex acute(-acuminate), the apex of side-lobes frequently somewhat down-curved, the margin (sub)entire or ± coarsely dentate, the glands few to several, scattered, 0.5–1 mm diam.; petiole 3–7.5 cm long. *Male raceme* 7–16 cm long, hairy (partly glabrescent); peduncle (2–)5–11 cm long, ca. 0.2 cm thick; rachis with 3–20 flowers; bracts persistent or late-caducous, membranous or chartaceous, (broadly) obovate-elliptic or rhomboid, 15–30(–40) by 14–20 mm, with conspicuous glands, the margin at apical portion irregularly lobed or incised, 2–7 mm deep. *Male flowers* short hairy; pedicel caducous, 3–5 mm long; receptacle tube 30(–50) mm long, at apex 4–7 mm wide; sepals (narrowly) ovate-triangular or oblong, 10–16 mm long, 3–5 mm wide at base, margin entire or ± lobed at base, or serrate, without or with glands; petals obovate-rhomboid, ca. 15 mm long, the threads ca. 20 mm long, white or yellow; synandrium 6–10 mm long, the filaments ca. 3 mm long, (sub)glabrous. *Female flowers* (not known from Thailand): pedicel 5–10 mm long, ovary ovoid, ca. 10 mm long, glabrous (glabrescent); perianth as in male. *Fruits* bright red, (ellipsoid-)ovoid, 6–7 by ca. 4.5 cm; exocarp leathery, smooth, coarsely wrinkled on drying; pulp green-black; fruiting pedicel 1–2 by 0.3–0.4 cm. *Seeds* dark brown, compressed, obovate-elliptic or oblong, 9–10 by 5–6 by 1.5–2(–3) mm, the margin absent, edge square or rounded, entire.

Distribution.— Widespread; Myanmar (?), Thailand, and Indochina (Vietnam, type), West Malesia, east to the Moluccas. Not in the Philippines, possibly not in India and Bangladesh.

A fairly homogenous species which can be split into two very similar subspecies, largely defined geographically and according to the shape of the male sepals.

KEY TO THE SUBSPECIES

1. Male bracts with finely, densely, deeply serrate-laciniate margin. Male sepals with serrate margin or with side-lobes (female sepals entire). (Thailand, Indochina; rare in Malesia) **subsp. tricuspidata**
1. Male bracts with shallowly coarsely dentate margin. Male sepals (almost) entire (female sepals entire). (West Malesia and locally in S Thailand) **subsp. javanica**

subsp. **tricuspidata**

Trichosanthes tricuspidata Lour., Fl. Cochinch. 1: 589. 1790; 2: 723. 1793; Gagnep., Fl. Gén. Indoch. 2: 1042. 1921; Craib, Fl. Siam. Enum. 1: 754, for *Kerr* 6873 only. 1931; Keraudren in Aubrév. & J.-F. Leroy, Fl. Camb., Laos, Viêt-Nam. 15: 81, p.p., pl. 14: 1 & 4–7. 1975; C. Jeffrey, Cucurbitaceae of Eastern Asia: 39. 1980. Figs. 1J–K & 5C.

Leaves of adult plants shallowly or deeply 3-or 5-lobed, up to $^{4}/_{5}$ deep. *Male bracts* deeply and finely incised, up to ca. ⅓ deep. *Male sepals* with margin serrate or margin with side-lobes.

Thailand.— NORTHERN: Mae Hong Son, Chiang Mai, Lampang; NORTH-EASTERN: Sakon Nakhon, Nong Khai; CENTRAL: Lob Buri; EASTERN: Chaiyaphum; SOUTH-EASTERN: Chanthaburi (Bo Rai, E of Makham).

Distribution.— S China (?), Laos, Cambodia, Vietnam (type), one collection from Peninsular Malaysia.

Ecology.— Secondary roadside thickets, in mixed deciduous forest edges; on limestone and granitic bedrock; at 100–1,200 m altitude.

Vernacular.— Khuea mak khi ka (เขือหมากขี้กา) (Champasak, Laos), khi ka daeng. (ขี้กาแดง).

Note.— *Trichosanthes tricuspidata* subsp. *tricuspidata* as here defined appears quite homogeneous, except for the seeds. Mature seeds are known from Thailand from a comparatively large number of collections, and show a rather problematic variation in seed size and shape, comprising compressed forms with a square edge (e.g. *Pooma et al*. 2672), or more less-compressed forms with a rounded edge. Possible taxonomic implications of this variation are as yet unclear.

subsp. **javanica** Duyfjes & Pruesapan, **subsp. nov.** a subspecies typica bracteis masculis vadose grosse dentatis, sepalis masculis integris differt. Typus: Indonesia, Java, *W. J. de Wilde & Duyfjes* 21777 (holotypus L; isotypus BO, K, L). Fig. 6B.

Trichosanthes tricuspidata auct. non Lour.: Blume, Bijdr. Fl. Ned. Ind.: 935, excl. type. 1826; Cogn. in A. & C. DC., Monogr. Phan. 3: 374. 1881; Rugayah & W. J. de Wilde, Blumea 42(2): 481, fig.1b, 2b & 2c. 1997; Rugayah, *Trichosanthes* (Cucurbitaceae) in Malesia: 120, pl. 10. 1999.— *T. bracteata* auct. non. (Lam.) Voigt: Backer in Backer & Bakh. f., Fl. Java 1: 304. 1963.— *T. tricuspis* Miq., Fl. Ind. Bat. 1 (1): 679. 1856.

Leaves of adult plants 3-lobed, to ⅓–½. *Male bracts* shallowly and coarsely dentate. *Male sepals* (almost) entire.

Thailand.— SOUTH-WESTERN: Phetchaburi (*Phonsena, De Wilde & Duyfjes* 3982); SOUTH-EASTERN: Chanthaburi (*Larsen et al*. 32315; *Seidenfaden* 2878).

Distribution.— West Malesia (Java, type) to the Moluccas and Lesser Sunda Islands (not in Philippines).

Vernacular.— Khi ka daeng (ขี้กาแดง).

Note.— Collections from Kaeng Krachan NP have conspicuously bright yellow petal fringes, not white as in the specimens from the type locality (Java).

15. Trichosanthes truncata C. B. Clarke in Hook. f., Fl. Brit. Ind. 2: 608. 1879; Cogn. in A. & C. DC., Monogr. Phan. 3: 364. 1881; Chakrav., Ind. J. Agric. Sc. 16(1): 22. 1946; Monogr. Ind. Cucurbitaceae, 17(1): 39. 1959; S. K. Chen & C. H. Yueh, Acta Phytotax.

Sin. 12(4): 434. 1974; C. Jeffrey, Cucurbitaceae Eastern Asia, Kew: 43. 1980; Kew Bull. 34: 797. 1980; S. K. Chen in A. M. Lu & S. K. Chen, Fl. Reip. Pop. Sin. 73(1): 238. 1986; S. K. Chen in C. Y. Wu, C. Chen & S. K. Chen, Fl. Yunnan. 6: 364. 1995. Type: India, Khasia, Cherra Coal-pit, *Hooker & Thomson* 1188 (lectotype K, select here).— *T. ovata* Cogn. in A. & C. DC., Monogr. Phan. 3: 365. 1881; C. H. Yueh & C. Y. Cheng, Acta Phytotax. Sin. 12(4): 435. 1974; S. K. Chen in A. M. Lu & S. K. Chen, Fl. Reip. Pop. Sin. 73(1): 237. 1986; S. K. Chen in Y. Wu, C. Chen & S. K. Chen, Fl. Yunnan. 6: 364, pl. 94: 7–10. 1995. Type: India, Sikkim, *Thomson* 148 (holotype L; isotype LE).

Climber, 4–10 m long; glabrous or very minutely hairy, glabrescent; plant green, not reddish tinged, the petals white; cystoliths not obvious; stem 2–4 mm diam. *Probract* absent. *Tendrils* simple (Annam) or 2- or 3-branched. *Leaves*: blade unlobed or rarely (deeply) 3-lobed; chartaceous, glabrous; ovate(-oblong), 8–16 by 7–14 cm, the base cuneate or rounded or shallowly cordate (sometimes slightly peltate), the apex acute-acuminate, the margin subentire or sparsely sharply dentate, with apical teeth 1–1.5 mm long; nerves prominent beneath; glands absent; petiole 3–6 cm long. *Male raceme* solitary or sometimes panicle-like branching from the older wood, (4–) 10–20 cm long, glabrous or glabrescent, sometimes with a long-pedicelled flower co-axillary, or male inflorescence existing of one solitary flower at the node only; peduncle 3–7 cm long, 1–1.5 mm thick; rachis with 4–24 flowers; bracts sessile or 1(–2) mm stiped, persistent, chartaceous, suborbicular or (narrowly) elliptic, 7–16(–20) by 2–12 mm, at base usually narrow, without or with several glands, the margin entire or sharply 3–5-toothed or shallowly lobed. *Male flowers* minutely hairy; pedicel 2–6 mm long; receptacle tube 20 mm long, at apex ca. 7 mm wide; sepals linear, reflexed, 5–8 mm long, less than 1 mm wide, margin entire; petals finely hairy, long-cuneate, ca. 20 mm long, threads ca. 10 mm long; synandrium not seen, filaments glabrous. *Female flowers* (not known from Thailand): pedicel 3–4 cm long; ovary ellipsoid, ca. 20 by 8 mm, brown hairy; sepals slightly shorter than in male; petals like in male. *Fruits* (not known from Thailand, description from literature) orange, ellipsoid (or oblong), 12–18 by 5–10 cm, glabrous; fruiting pedicel (1?–)4–5 cm long. *Seeds* (pale) brown, oblong-obovate, 18–30 by 12–20 by 4–6 mm, the apex subrounded, the base obtuse to oblique, sometimes slightly emarginate, the margin present, edge entire.

Thailand.— NORTHERN: Chiang Mai (Doi Suthep-Pui NP; Ban Pa Deng, Mae Dang District; Mae Soi Ridge-Awp Luang NP near Ban Bah Gluay; Mong village, Jawm Thong District), Nan (Doi Phukha NP).

Distribution.— China (Yunnan), India (Assam, Sikkim, type), Bangladesh, Vietnam (Annam).

Ecology.— (Degraded) deciduous or evergreen forest, forest with bamboo; rugged limestone terrain or on granite bedrock; at 900–1,450 m altitude.

Notes.— 1. The description in the present treatment is drawn largely from the restricted Thai material available, supplemented with data (especially for fruit and seed) from the literature. The male flowers seen from Thai material are full grown buds and one open flower. According to Clarke (1879) the receptacle tube at anthesis is ‘0.75–1.5 inch long’.

2. Yueh & Cheng (1974), Chen (1986) and Chen (1995) accept both *T. ovata* and *T. truncata* for China, besides *T. smilacifolia* C. Y. Wu. Differences mentioned are in the male bracts (in *T. ovata* chartaceous, without stipe, in *T. truncata* coriaceous with stipe), in the sepals (in *T. ovata* longer than in *T. truncata*) and in the seed size (in *T. ovata* smaller than in *T. truncata*). Tentatively, we do not follow this for Thailand because the above mentioned differences are not distinct there, and also because the types of both names concerned are from India, and both are without fruits and seeds.

3. According to Yueh & Cheng (1974, 1980) and Chen (1995) *T. truncata* and *T. smilacifolia*, from China, have the same habit and male flowers, but different seeds. In *T. smilacifolia* the edge of the seeds is crenate, that of *T. truncata* entire (see also Chen, 1995, pl. 94, 5).

4. *Maxwell* 93-862, a male plant, contains one (immature) solitary female flower.

Field-notes.— Calyx tube pale light yellow-greenish, lobes green, corolla lobes whitish with light green veins; anthers cream.

16. Trichosanthes villosa Blume, Bijdr. Fl. Ned. Ind.: 934. 1826; Cogn. in A. & C. DC., Monogr. Phan. 3: 366. 1881; Gagnep., Fl. Gén. Indoch. 2: 1047, p.p. 1921; Craib, Fl. Siam. Enum. 1: 754, ?p.p. (see notes). 1931; Backer in Backer & Bakh. f., Fl. Java 1: 304. 1963; C. H. Yueh & C. Y. Cheng, Acta Phytotax. Sin. 12(4): 443, pl. 87: 2. 1974; Keraudren in Aubrév. & J.-F. Leroy, Fl. Camb., Laos, Viêt-Nam 15: 77. p.p., pl. 13: 4. 1975; S. K. Chen in A. M. Lu & S. K. Chen, Fl. Reip. Pop. Sin. 73(1): 224. 1986; S. K. Chen in C. Y. Wu, C. Chen & S. K. Chen, Fl. Yunnan. 6: 354. 1995; Rugayah & W. J. de Wilde, Blumea 42(2): 481. 1997; Rugayah, *Trichosanthes* (Cucurbitaceae) in Malesia: 152. 1999. Type: Indonesia, West Java, *Blume* s.n. (holotype L; isotype P). Figs. 1M, 4 & 5D.

Climber 8–25 m long; brown or grey-white villose, the hairs ca. 1 mm long, to 3 mm long in sterile running shoots; plant green, the petals white; cystoliths not obvious; stem 3–4 mm diam. *Probract* absent. *Tendrils* 4–7(–9)-branched, portion below point of branching 1–3 cm long, late glabrescent. *Leaves*: blade unlobed or shallowly 3–5-lobed or angular; membranous, minutely whitish (rough-)hairy above, villose below; broadly ovate or suborbicular in outline, (8–)10–18 by (4.5–)6–14 cm, the base cordate, the apex acute-acuminate, to 12 mm long mucronate, the margin entire; glands few to many, scattered, ca. 0.5 mm diam.; petiole 5–9 cm long. *Male raceme* 10–20(–30) cm long, hairy; peduncle 5–13 cm long, 2–3 mm thick; rachis with 10–20 flowers; most bracts inserted on the pedicel below the middle, subpersistent, ± obovate, 20–40(–60) by 20–30(–40) mm, mostly with small glands, the margin subentire or shallowly lobed-dentate. *Male flowers* shaggy hairy; pedicel ca. 30 mm long; receptacle tube 25–30 mm long, at throat 8–12 mm diam., the base ± swollen, forming a 'pseudo-ovary'; sepals linear or narrowly triangular, 13–20 mm long, 1–2 mm wide at base, the margin entire; petals finely hairy, wedge-shaped, 15–20 mm long, the threads ca. 10 mm long; synandrium 10–12 mm long, the filaments 2–3 mm long, glabrous, inserted about halfway the tube. *Female flowers* (not seen from Thailand): pedicel 30(–50) mm long; ovary ellipsoid, ca. 10 mm long, hairy; otherwise like in male. *Fruits* green, longitudinally whitish banded, broadly ellipsoid, ca. 14 by 11.5 cm, glabrous (glabrescent); pericarp hard-fleshy, ca. 15 mm thick; exocarp thin, woody-leathery, not wrinkled on drying; pulp white, finely fibrous; fruiting pedicel ca. 5 by 0.6 cm. *Seeds* bright brown, compressed, ovate-oblong, (23–)25–27 by 11–12 by 5–6 mm, the base narrowly rounded, apex truncate, notched, and laterally ± bulging, the margin 2–3 mm broad, edge rounded, entire.

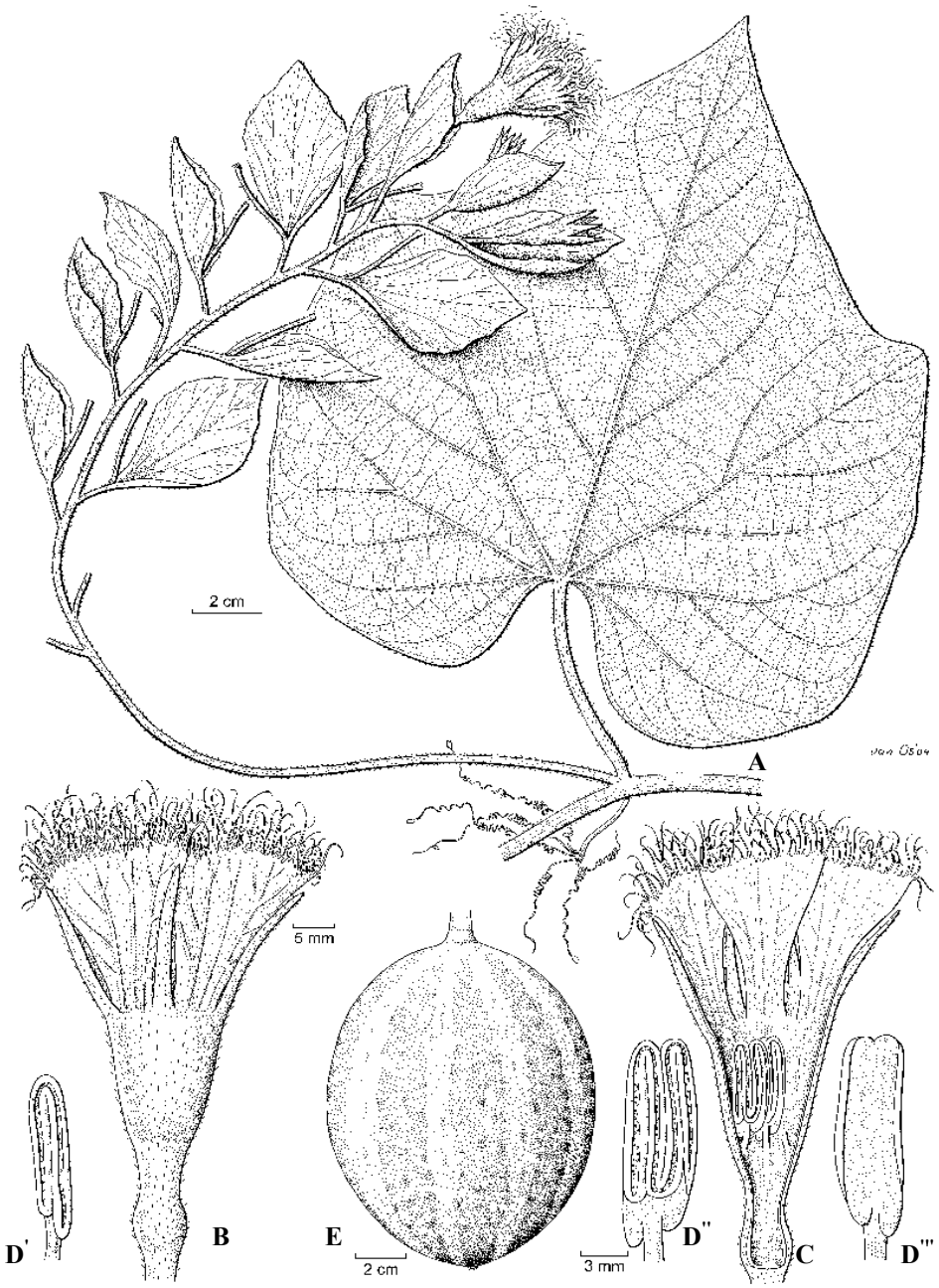

Figure 4. *Trichosanthes villosa* Blume: A. part of twig with male inflorescence; B male flower; C. opened male flower; D'. stamen, 1- thecous; D''—D'''. stamens, 2-thecous, showing ab-and adaxial side respectively; E. fruit. A–D: *Phonsena et al*. 4000; E: *Phonsena et al*. 3518. Drawn by Jan van Os.

Thailand.— NORTHERN: Chiang Mai (Doi Inthanon NP); NORTH-EASTERN: Nong Khai (Singhanat Ban Phot Temple); SOUTH-WESTERN: Kanchanaburi (Erawan NP), Phetchaburi (Kaeng Krachan NP); SOUTH-EASTERN: Chantaburi (Khao Soi Dao).

Distribution.— Yunnan (no material seen), Indo-china (no material seen), Java (type), Borneo (Sabah), Philippines, Lesser Sunda Islands east to Flores. Not known from Peninsular Malesia and Sumatra.

Ecology.— In mixed evergreen (deciduous) forest, and bamboo forest, near streams; at 150–550 m altitude.

Vernacular.— Taeng soi dao (แตงสอยดาว).

Notes.— 1. Female flowers are not known from Thailand, while fruits are known only from one collection.

2. The records of *T. villosa* by Craib (1931): 754, pertain largely to specimens of *Thladiantha cordifolia* Blume, a species with the leaves similarly densely villose below. Only the collection *Kerr* s.n., 22 Oct. 1922, Mae Taeng, Chiang Mai (BM), may belong to *T. villosa*.

3. Whether the Thai and Chinese collections of *T. villosa* are similar to those from Malesia needs further study; possibly in Thailand the seeds are bigger, and the sepals of the male flowers narrower.

17. Trichosanthes wawrae Cogn. in A. & C. DC., Monogr. Phan. 3: 384. 1881 ('wawraei'); Ridl., Fl. Malay Penin. 1: 845. 1922; Craib, Fl. Siam. Enum. 1: 754. 1931; Rugayah & W. J. de Wilde, Blumea 42: 481. 1997; Rugayah, Trichosanthes (Cucurbitaceae) in Malesia: 108. 1999. Type: Singapore, *Wawra* 241 (holotype W).— *T. trifolia* auct. non (L.) Blume: Blume, Bijdr. Fl. Ned. Ind.: 936. 1826 ("trifoliata"); Backer in Backer & Bakh. f., Fl. Java 1: 303. 1963. Fig. 1L.

Climber, 3–8 m long; glabrous or partly short hairy; plant green, the petals white; cystoliths obvious or not; stem ca. 2 mm thick. *Probract* obovate ca. 4 by 2 mm, with glands (always?). *Tendrils* 2-branched. *Leaves*: blade: 3-foliolate, in juvenile plants partly simple, lobed or unlobed; membranous, ± glabrous; suborbicular in outline, the middle leaflet obovate-lanceolate, 4.5–9 by 2–4 cm, base long-cuneate, apex acute-acuminate, the lateral leaflets unequal-sided (sometimes deeply 2-lobed), ovate-oblong, of about the same size as the middle one, the margin entire or minutely sparsely dentate; glands absent to several, scattered, ca. 0.5 mm diam.; petiolules ca. 0.5 cm long; petiole 2–3.5(–5) cm long. *Male raceme* 9–20 cm long, thinly hairy; peduncle 2–6 cm long, 2(–3) mm thick; rachis with 10(–20) flowers; bracts (sub)persistent, membranous, obovate or oblong, 7–13 by 2–7 mm, with glands, the margin (entire or) shallowly or deeply dentate-laciniate. *Male flowers*: pedicel ca. 3 mm long; receptacle tube 20(–40) mm long, narrow in lower half, at apex (3–)5 mm wide; sepals narrowly triangular, 5–7 mm long, ca. 2 mm wide at base, entire; expanded petals not seen; synandrium ca. 11 mm long, the filaments ca. 1 mm long, glabrous. *Female flowers* (not seen in Thai material): pedicel 5–15 mm long, ovary ovoid, ca. 10 by 5 mm, glabrous; perianth as in male. *Fruits* (orange-)red with yellowish lengthwise streaks, ovoid, ca. 7 by 5 cm; pericarp ca. 5 mm thick when dry, with age leaving the exocarp leathery; pulp greenish-blackish; fruiting pedicel 0.5–2 by ca. 0.3 cm. *Seeds* dark brown, compressed, ovate or elliptic (-oblong), 15–17 by 10–11 by 2 mm, the base subtruncate, the apex obtuse or subacute, the margin broad but obscure, the edge entire.

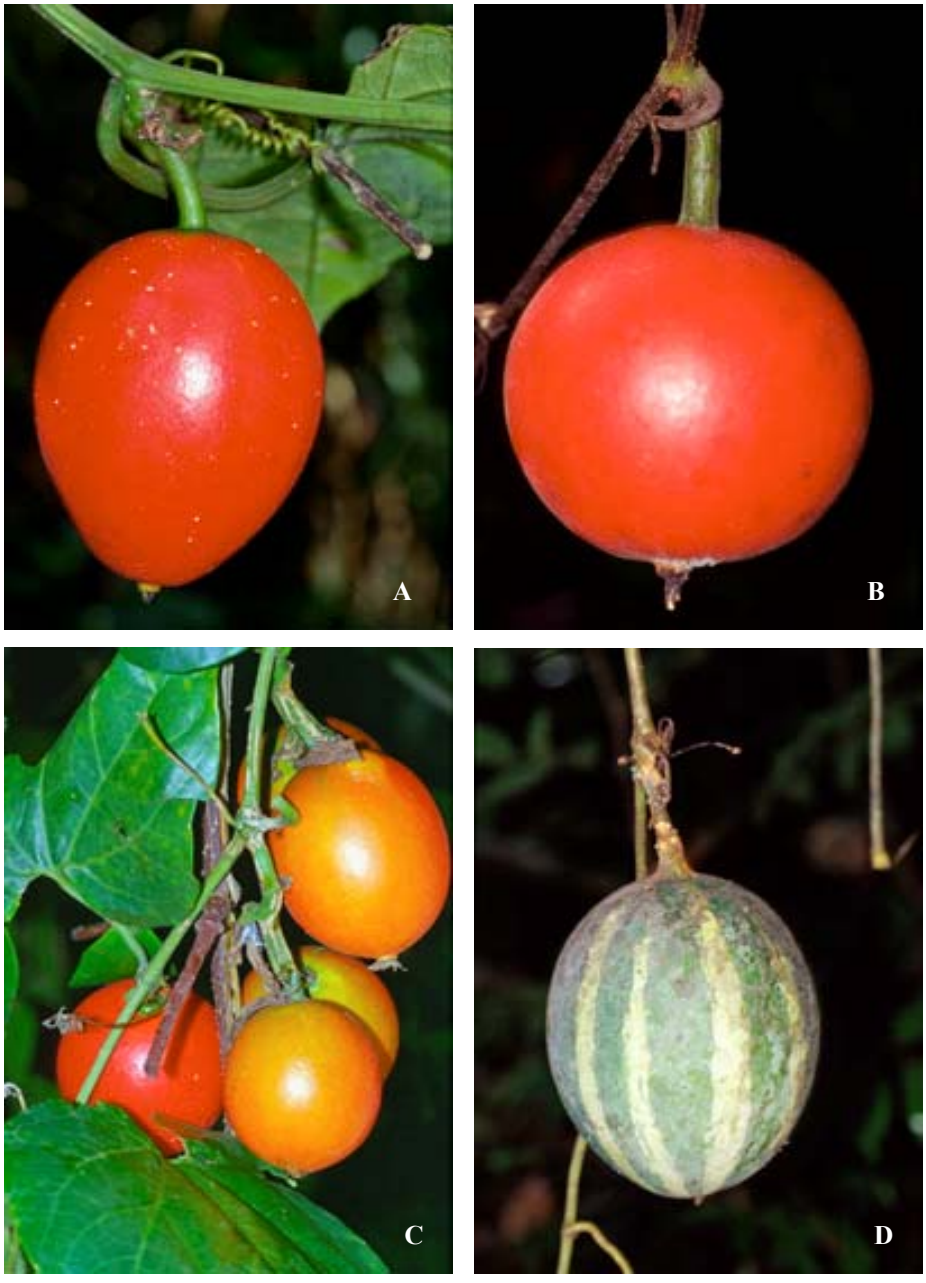

Figure 5. *Trichosanthes pubera* Blume subsp. *rubriflos* (Cayla) Duyfjes & Pruesapan: A. ovoid fruit (Doi Inthanon NP); B. globose fruit (Doi Suthep-Pui); C. *Trichosanthes tricuspidata* Lour. subsp. *tricuspidata* (Central Thailand, roadside); D. *Trichosanthes villosa* Blume, mature fruit (Chanthaburi, Khao Soi Dao WS). Photographed by W.J.J.O. de Wilde.

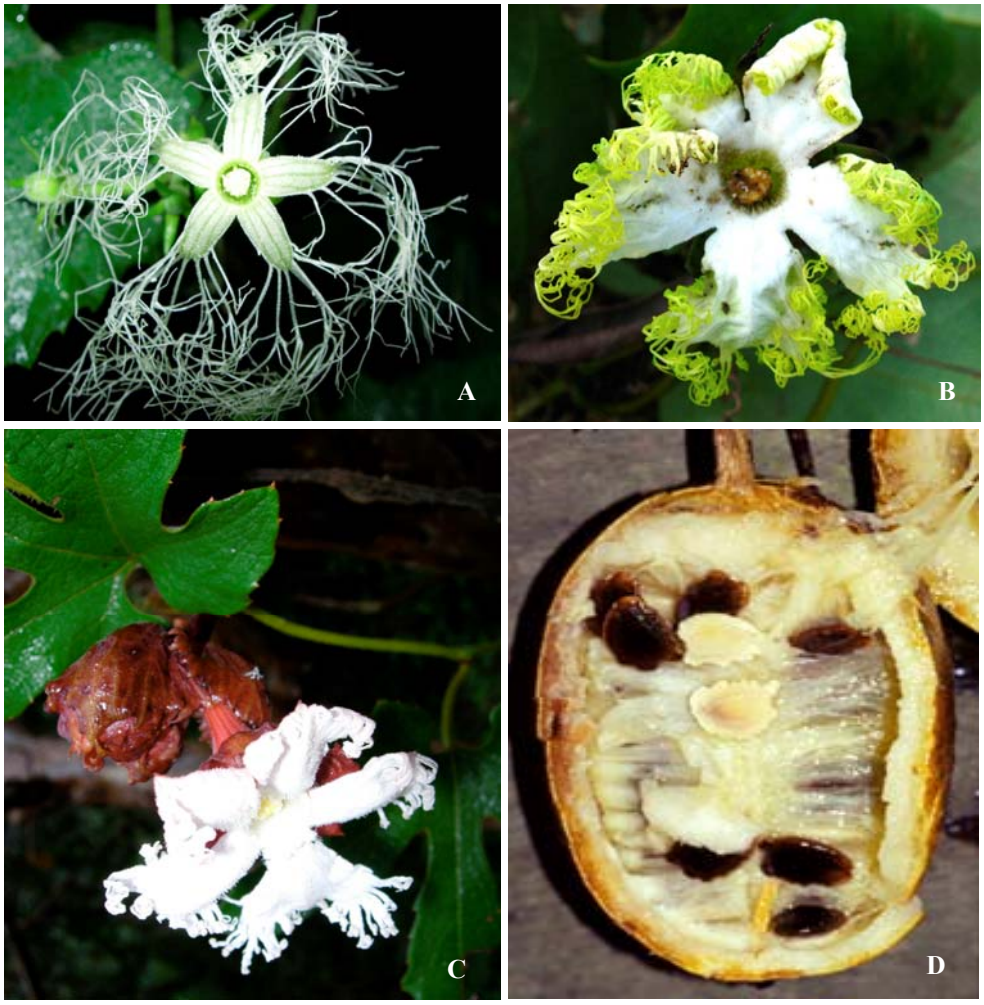

Figure 6. A. *Trichosanthes ovigera* Blume, male flower (Doi Inthanon NP); B. *Trichosanthes tricuspidata* Lour. subsp. *javanica* Duyfjes & Pruesapan, male flower (Kaeng Krachan NP); C. *Trichosanthes pubera* Blume subsp. *rubriflos* (Cayla) Duyfjes & Pruesapan var. *rubriflos*, male flower, a specimen with completely white flowers (Doi Inthanon NP); D. *Trichosanthes kerrii* Craib, showing crenate seed margin (Doi Phukha NP). Photographed by W.J.J.O de Wilde.

Thailand.— SOUTH-EASTERN: Chonburi; PENINSULAR: Pattani, Satun.

Distribution.— West Malesia: Peninsular Malaysia, Singapore (type), Sumatra, Java, Borneo (Sarawak).

Ecology.— Open areas, forest edges, in evergreen forest, at 200–900 m altitude. Flowering April & June; fruiting March.

Vernacular.— Khi ka din (ขี้กาดิน).

18. Trichosanthes species aff. *laceribractea* Hayata

Three collections from Indochina (*Pételot* 1084, Tonkin; *Poilane* 11304, Annam; *Poilane* 16778, Laos), treated in Flora of Laos, Cambodia & Vietnam (Keraudren, 1975) under the widely conceived *T. tricuspidata* Lour., actually represent a separate species. The collection *Pételot* 1084 was mentioned by Jeffrey (1980) as representing the SE Chinese species *T. laceribractea*. However, comparison of the original description (Hayata, 1911) with the treatments in Flora of China (S. K. Chen, 1986) and Flora of Yunnan (S. K. Chen, 1995) reveals some substantial differences, viz. plants obviously not red-tinged, bracts long and slender, male sepals narrower with long and slender side-lobes, leaves glabrous below, glands copious, 2–3 mm diam., all characters not mentioned for *T. laceribractea*. The provenance of the three above mentioned collections makes the discovery of this possibly yet undescribed species in Thailand probable.

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IDENTIFICATION LIST

1a = *T. cucumerina* var. *cucumerina*
1b = *T. cucumerina* var. *anguina*
2 = *T. dolichosperma*
3 = *T. dunniana*
4 = *T. erosa*

5 = *T. inthanonensis*
6 = *T. kerrii*
7 = *T. kostermansii*
8 = *T. ovigera*
9 = *T. pallida*
10 = *T. phonsenae*
11 = *T. pubera* subsp. *rubriflos*
11a = *T. pubera* subsp. *rubriflos* var. *rubriflos*
11b = *T. pubera* subsp. *rubriflos* var. *fissisepala*
12 = *T. quinquangulata*
13 = *T. siamensis*
14 = *T. tricuspidata*
14a = *T. tricuspidata* subsp. *tricuspidata*
14b = *T. tricuspidata* subsp *javanica*
15 = *T. truncata*
16 = *T. villosa*
17 = *T. wawrae*

Balick et al. 3409: 11.— *Boonnak* 655: 11.

Chayamarit et al. 1539: 11; 1622: 3; 1966: 11.— *Chiramongkolgarn* UC 384: 11b.— *Collins* 901: 11; 1494: 12; 1648: 12; 1649: 8.— *Congdon* 261: 12.

De Wilde et al. 22128: 11a; 22130: 11a; 22131: 12; 22138: 8; 22140: 8; 22141: 11b; 22142: 11; 22143: 5; 22146: 11a; 22150: 14a; 22164: 11; 22167: 14a; 22267: 16; 22295: 11a; 22296: 11a.

Garrett 442: 8; 818: 11b; 1486: 1a.— *Geesink et al*. 6183: 9.

Henderson SF 25225: 14.

Iwatsuki et al. T-10364: 11; T-10372: 11b; T-10865: 11b; T-11079: 8; T-13269: 11.

Kasin 361: 11b.— *Kerr* 1-08-1924: 1a; 10880: 12; 1266: 14; 12715: 12; 14585: 17; 14965: 17; 17327: 12; 17631: 1a; 2454: 6; 27-8-1921: 14; 372: 1a; 4414: 11; 4414A: 11a; 5660: 14; 653: 14a; 6873: 14; 714: 1a; 8203: 12; 8203A: 12; 9711: 12.— *Kocyan* AK189: 15.— *Konta et al*. 4020: 11; 4022: 8.— *Koonkhunthod et al*. 326: 12; 334: 16.— *Kostermans* 1078: 11b; 743: 7.

Lace 6228: 11b.— *Ladell* 228: 12.— *Lakshnakara* 244: 1a; 767: 12; 926: 11.— *Larsen et al*. 2277: 11b; 2956: 15; 32315: 14b; 46198: 11a; 46381: 11a.

Marcan 1504: 12; 1808: 1a; 420: 11a; 998: 1a.— *Maxwell* 13–7–1969: 1b; 71-641: 11; 71-770: 12; 71-778: 1a; 72-387: 11; 72-603: 12; 72-719: 11; 73-601: 12; 74-926: 8; 75-1077: 11a; 75-693: 12; 75-719: 11a; 76-381: 17; 86-389: 12; 87-1145: 8; 87-1224: 14a; 87-1318: 11; 87-1523: 8; 88-1036: 8; 88-1091: 11; 88-799: 11a; 88-803: 11b; 89-1184: 3; 89-1369: 8; 89-1462: 8; 89-553: 11b; 90-1105: 8; 90-669: 15; 90-852: 11b; 90-853: 11; 91-628: 11b; 91-698: 11b; 91-911: 1a; 91-927: 11b; 93-1084: 8; 93-1222: 8; 93-438: 11b; 93-862: 15; 93-906: cf. 11b; 93-946: 15; 94-546: 13; 94-854: 11b; 94-934: 12; 96-1240: 8; 96-854: 14a; 97-645: 11b; 97-868: 11; 98-1140: 8; 98-910: 14a; 02-345: 8; 03-197: 11b.— *Middleton* 165: 8; 196: 11a.— *Middleton et al*. 1068: 11b; 2168: 11.— *Mitsuta et al*. T-50463: 11.— *Murata* T-17222: 1a; *Murata et al*. T-16568: 14a; T-16718: 11b; T-17171: 14; T-51642: 11; T-51644: 8.

Niyomdham 4485: 4.— *Niyomdham et al*. 1531: 12.— *Nooteboom et al*. 783: 11.— *Nui Noe* 265: 14.

Paisooksantivatana y1619-86:14.— *Palee* 269: 12; 385: 14a; 458: 11a.— *Phengklai et al*. 1164: 12; 6225: 11b; 7016: 5.— *Phonsena et al*. 3907: 11a; 3914: 11; 3916: 11; 3921: 11; 3926: 11; 3951: 11a; 3970: 11a: 3518: 16; 3521: 8; 3905: 16; 3913: 8; 3915: 11b; 3917: 15; 3925: 11b; 3927: 8; 3930: 5; 3933: 5;. 3938: 11b; 3944: 15; 3952: 5; 3958: 5; 3959: 6; 3967: 15; 3969: 6; 3977: 14a; 3980: 10; 3981: 9; 3982: 14b; 4000: 16; 4001: 10; 4002: 10; 4007: 14a; 4414: 14b; 4415: 14b; 4417: 14b; 4419: 10; 4449: 16.— *Pooma et al*. 500: 14; 1656: 14; 2671: 11a; 1656: 14; 2574: 14a; 2585: 14a; 2672: 14a; 2690: 16; 2900: 14a; 2943: 14a; 2963: 14a; 3103: 11b; 3106: 11b; 500: 14.— *Pradit* 226: 14; 346: 11; 527: 11.— *Prayad* 367: 11; 423: 12; 450: 11.— *Pruesapan* KP66: 7; KP67: 5.— *Put* 124: 11a; 2540: 1a.

Sai Jai 45: 15.— *Santisuk* 1420: 11.— *Seidenfaden* 2879: 14b.— *Shimizu* T-11764: 12; T-11779: 2.— *Shimizu et al*. T-10799: 8; T-19165: 11.— *Smitinand* 3520: 14.— *Smitinand et al*. 1334: 11a.— *Sørensen et al*. 7627: 11b.— *Suradej* 49: 11.— *Sutheesorn* 2443: 11; 2732: 12; 3425: 12.

Tagawa et al. T-10629: 11a; T-11245: 11a.— *Takahashi* T-62576: 14a.— *Tamura* T-60124: 11.

Van Beusekom et al. 1250: 11b; 1905l: 11a; 3464: 11b.— *Vidal et al*. 6307: 11b.

Wongprasert 009-25: 11; 012-21: 12; 27-05-1998: 6; 997-35: 11.