

A taxonomic revision of *Trichosanthes* L. (Cucurbitaceae) in Australia, including one new species from the Northern Territory

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Summary

Cooper, W.E. & de Boer, H.J. (2011). A taxonomic revision of *Trichosanthes* L. (Cucurbitaceae) in Australia, including one new species from the Northern Territory. *Austrobaileya* 8(3): 364–386. *Trichosanthes* is represented by six species in Australia: *T. cucumerina* L. var. *cucumerina*, *T. morrisii* W.E.Cooper sp. nov., *T. odontosperma* W.E.Cooper & A.J.Ford, *T. pentaphylla* F.Muell. ex Benth., *T. pilosa* Lour. and *T. subvelutina* F.Muell. ex Cogn. *Trichosanthes ovigera* Blume has recently been synonymised with *T. pilosa* and we now include *T. holtzei* F.Muell. within this synonymy. All taxa are illustrated (with the exception of *T. odontosperma* previously illustrated in 2010), and distinguished from other Australian species. Notes on habitat and distribution are included together with distribution maps. Three identification keys are presented, two to the sections of *Trichosanthes* and one to the species of *Trichosanthes* in Australia.

Key Words: Cucurbitaceae, *Trichosanthes*, *Trichosanthes cucumerina*, *Trichosanthes ovigera*, *Trichosanthes pilosa*, *Trichosanthes odontosperma*, *Trichosanthes subvelutina*, *Trichosanthes pentaphylla*, *Trichosanthes morrisii*, Australia flora, Northern Territory flora, Queensland flora, taxonomy, identification keys, new species, new combination, probracts

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Introduction

Trichosanthes L. is a genus of approximately 100 species distributed from India, Sri Lanka, China, Japan, SE Asia to Malesia (including New Guinea), Australia, and the eastern Pacific (Rugayah & de Wilde 1999). *Trichosanthes* is broadly represented in Australia with one or two species from five of the six sections: *Trichosanthes* L., *Cucumeroides* (Gaertn.) Kitam., *Edulis* Rugayah, *Asterosperma* W.J.de Wilde & Duyfjes (not in Australia), *Foliobracteola* C.Y.Cheng & C.H.Yueh and *Involucraria* (Ser.) Wight. Sections are distinguished using (1) seed shape and structure, (2) colour of fruit pulp, (3) presence or absence of probracts, (4) size of male bracts. However, leaf shape is variable within all species, and shape of male bracts can vary greatly in *Trichosanthes cucumerina* L., *T. pentaphylla* F.Muell. ex Benth. and *T. subvelutina* F.Muell. ex Cogn.

The last comprehensive treatment of *Trichosanthes* in Australia (Telford 1982)

described six species in which *T. holtzei* F.Muell. was thought to be closely allied to *T. ovigera* Blume; however, *T. holtzei* is no longer maintained here with the present authors synonymising it with the widespread and variable *T. pilosa* Lour. Examination of a greater number of herbarium specimens collected in Australia during recent years, as well as molecular analysis (de Boer & Cooper unpublished), have confirmed this finding. *Trichosanthes ovigera* has been previously referred to this synonymy through priority of *T. pilosa* (de Wilde & Duyfjes 2008).

Telford(1982)suggested that *Trichosanthes pentaphylla* (Fig. 1, 6) is probably conspecific with *T. trifolia* (L.) Merr. and the latter has now been synonymized with *T. wawrae* Cogn. (Rugayah & de Wilde 1997). However, the two species differ sufficiently to maintain *Trichosanthes pentaphylla* as distinct from *T. wawrae*.

Taxa in the genus *Trichosanthes* can be extremely variable throughout their distribution with regard to leaf (Fig. 3,4),



Fig. 1. *Trichosanthes pentaphylla* from the Mowbray River, showing silvery leaves with dark green veins, typical juvenile growth of plants in the section *Involucraria*. Photograph: W.T. Cooper



Fig. 2. *Trichosanthes subvelutina*. male flowers, Terania Creek NSW. Photograph: H. Nicholson

bract and fruit morphology, as well as seed surface in *T. pilosa*. The extremes of habitat preferences within one species can often be associated with morphological variation. *Trichosanthes* sp. Fine Leaf (L.A. Craven 7930) had been recognised as a different taxon by the Northern Territory Herbarium (DNA); however, the present authors see it as part of the widespread and variable *T. cucumerina* L. var. *cucumerina*.

In this revision, six species of *Trichosanthes* are recognised for Australia and of those, *T. odontosperma* W.E.Cooper & A.J.Ford, *T. pentaphylla*, *T. subvelutina* and *T. morrisii* W.E.Cooper are endemic. Five species are mostly tropical with one species (*Trichosanthes subvelutina*) mainly subtropical.

Materials and methods

We examined 363 specimens from BR, BRI, CANB, CNS, DNA, K, L, MEL, P, PERTH and NSW. All species were observed in the field by the first author.

Flowers of *Trichosanthes* are fragile and difficult to preserve as good quality dried specimens. They are therefore not easy to analyze (Duyfjes & Pruespan 2004), and have not been used as key species characters. Even with fresh flowers, plants are mostly not identifiable to species; however, plants having flowers with fimbriate petal margins belong to sections *Trichosanthes* or *Cucumeroides*, and those having petals with fimbriate apices belong to sections *Foliobracteola*, *Involucrarina* or *Edulis*. Leaf, probract and seed features provide good characters (Duyfjes & Pruespan 2004) and along with male bract size and sepals, have been predominantly used here as key features for dichotomous determination keys.

Measurements of all parts were done on dried material and specimens preserved in 70% ethanol, as well as on fresh material in the field. Common abbreviations in the text include N.P. (National Park) and S.F./S.F.R. (State Forest/State Forest Reserve).

The extensive bibliographic taxonomic history of *Trichosanthes* sections and the species that also occur outside of Australia has

been repeated several times in recent years (e.g. Rugayah & de Wilde 1997, 1999; Duyfjes & Pruespan 2004; de Wilde & Duyfjes 2010) and is largely omitted from this account.

Taxonomy

Trichosanthes L., *Sp. Pl.* 2: 1008 (1753).
Type species: *Trichosanthes anguina* L., *fide* M.L.Green, *Prop. Brit. Bot.* 190 (1929) [= *T. cucumerina* subsp. *anguina* (L.) Greb.]

Cucumeroides Gaertn., *Fruct. Sem. Pl.* 2: 485, t. 4 (1791). **Type species:** not designated.

Involucrarina Ser., *Mém. Soc. Phys. Genève.* 3(1): 25, t. 5. (1825). **Type species:** *Involucrarina wallichiana* Ser.

Trichosanthes in Australia: Monoecious or mostly dioecious, trailing or climbing **vines or lianas**, annual or mostly perennial, partially or completely seasonally senescent; bark corky, warty, flaky, fissured or lenticellate; stems either weak and slender or robust and somewhat woody; glabrous, pubescent or scabrous; roots tuberous. **Indumentum** of translucent multicellular trichomes, glandular or eglandular; cystoliths often present, discoid or rosette-shaped, drying to white or black in herbarium specimens. **Probracts** present at the nodes in many species, caducous or persistent, may be pubescent, glands often present. **Tendrils** unbranched or 2-, 3- or 4-branched (up to 9-branched in Asia), positioned at the node (not truly axillary). **Leaves** simple or compound (digitate), alternate, petiolate, unlobed or 3–7 (rarely 10)-lobed, margin entire or toothed with a soft mucro or callus terminating main veins, membranous or leathery, scabrous, velvety or glabrous, glands often present on the underside, pedately veined with 3–5 main veins, intralateral veins reticulate. **Inflorescence** beside petiole at the node (not truly axillary). **Flowers** unisexual, mostly nocturnal excepting *T. cucumerina*, epigynous, petals 5 (rarely 4); corolla white, cream or yellowish, actinomorphic; sepals 5 (rarely 4), free, subulate or triangular; petals hairy, margin fimbriate; receptacle tube elongate. **Male flowers** either solitary, paired, or in racemose or rarely paniculate inflorescences; bracts present on racemes at pedicel base and sometimes at peduncle

base, persistent or caducous, glands may be present; stamens 3, inserted near receptacle tube orifice, included, free until anthesis then becoming fused; filaments free; anthers oblong, s-shaped, two are 2-theous, one is 1-theous, basifixed. **Female flowers** mostly solitary or paired (one is usually much older), sometimes in a racemose inflorescence in *T. pilosa*, solitary and usually co-axillary with male raceme in *T. cucumerina*; perianth similar to males; style long, narrow; stigma 3–5-lobed; staminodes absent; ovary inferior, pubescent or glabrous, elliptic, ovoid, globose or fusiform; ovules numerous, horizontal. **Fruit** a pepo or berry, ellipsoid, ovoid, globose or fusiform, beaked at apex, 30–140 mm

long, mostly solitary; epicarp green with or without longitudinal white stripes, orange or red, glabrous or pubescent; epicarp leathery, chartaceous or woody; mesocarp fleshy or firm, orange, yellow or whitish, smooth or fibrous; pulp white, yellow, orange, red or dark green; seeds few–numerous, horizontal, 1-locular or 3-locular with the two lateral locules empty, compressed or turgid, smooth or sculptured, brown, cream, grey or black. Germination is hypogeal, semi-hypogeal or epigeal.

Etymology: The generic epithet *Trichosanthes* is derived from the Greek *tricho-* (hairy) and *-anthus* (flowered); referring to the petals, which have fimbriate margins.

Key to sections of *Trichosanthes* in Australia using mostly seed and fruit features

- 1 Seeds 3-locular Section **Cucumeroides**
1. Seeds 1-locular 2
- 2 Seeds surrounded by dark green pulp, adult leaves compound or simple;
juvenile leaves silvery with dark green veins Section **Involucraria**
2. Seeds surrounded by white, greenish-white, yellow, orange or red pulp, all
leaves simple; juvenile leaves green only. 3
- 3 Seeds surrounded by white or greenish-white pulp Section **Foliobracteola**
3. Seeds surrounded by yellow, orange or red pulp 4
- 4 Seeds toothed; probract present on new growth; plants dioecious Section **Edulis**
4. Seeds with an undulate margin; probract absent; plants monoecious
. Section **Trichosanthes**

Key to sections of *Trichosanthes* in Australia using leaf, probract and male bract

- 1 Leaves compound Section **Involucraria**
1. Leaves simple 2
- 2 Probracts present (at least on new growth) 3
2. Probracts absent 5
- 3 Probracts caducous Section **Edulis**
3. Probracts persistent 4
- 4 Leaf upperside with numerous cystoliths Section **Involucraria**
4. Leaf upperside without cystoliths Section **Foliobracteola**
- 5 Plants monoecious; male inflorescence bracts up to 3 mm long. Section **Trichosanthes**
5. Plants dioecious; male inflorescence bracts 4–8 mm long Section **Cucumeroides**

Key to species of *Trichosanthes* in Australia

- 1 Leaves compound (Qld only) **T. pentaphylla**
1. Leaves simple **2**
- 2 Leaf upperside glabrous or glabrescent. **3**
2. Leaf upperside hairy **4**
- 3 Probract linear or narrowly ovate, caducous; seeds toothed, surrounded in orange or red pulp (Qld only) **T. odontosperma**
3. Probract obovate, elliptical or oblong, persistent; seeds entire, surrounded in dark green pulp, (NT only). **T. morrisii**
- 4 Plants monoecious; male inflorescence bracts up to 3 mm long; seeds with an undulate margin (NT, Qld, WA) **T. cucumerina** var. **cucumerina**
4. Plants dioecious; male inflorescence bracts 4–33 mm long; seed margin not undulate **5**
- 5 Male inflorescence bracts 4–8 × 0.5–3 mm; seeds tumid, t-shaped, surrounded by yellow-orange pulp (NT, Qld, WA). **T. pilosa**
5. Male inflorescence bracts 15–33 × 7–23 mm; seeds flat, round and entire, surrounded by greenish-white pulp (NSW, Qld) **T. subvelutina**

Trichosanthes L. section *Trichosanthes*

Type species: *Trichosanthes anguina* L. [= *T. cucumerina* var. *anguina* (L.) Haines]

Monoecious trailing vines. Probracts absent. Male bracts persistent (caducous in Asia). Flowers diurnal, petals fimbriate with thread-like extensions along the margins. Fruit yellow or orange; seeds 1-locular, flat, margins broad and undulate.

Distribution: One species (two varieties) occurring in China, India, Sri Lanka, SE Asia, Malesia and Australia (one variety).

1. *Trichosanthes cucumerina* L., *Sp. Pl.* 2: 1008 (1753). **Type: habitat in India, “Padavalam” in Rheede, *Hort. Malab.* 8: 39, t. 15 (1688) (lecto: *fide* Keraudren-Aymonin [1975: 91]).**

The species comprises two varieties as accepted here with *T. cucumerina* var. *cucumerina* occurring in Australia. The second variety (*T. cucumerina* var. *anguina* (L.) Haines) is the common snake gourd of horticulture. Data from molecular sequencing support the placement of the cultivated snake gourd as a cultivated variant of *T. cucumerina* (Ali & Al-Hermaid 2010).

***Trichosanthes cucumerina* var. *cucumerina*; Haines, *Bot. Bihar Orissa* 3: 388 (1922).**

Trichosanthes pedatifolia Miq., *Fl. Ind. Bat.* 1: 677 (1856). **Type:** Indonesia: Java, *s.dat.*, *T.Horsfield s.n.* (holo: BM28187; iso: U).

Trichosanthes reniformis Miq., *Fl. Ind. Bat.* 1: 675 (1856). **Type:** Indonesia: Java, *s.dat.*, *T.Horsfield s.n.* (holo: BM28189, 28188).

Trichosanthes ambrozii Domin, *Biblioth. Bot.* 89: 631 (1929). **Type:** Australia: Western Australia. between Ashburton and De Gray Rivers, *s.dat.*, *E.Clement s.n.* (syn: B, K, PR *n.v.*).

Trichosanthes brevibracteata Kundu, *J. Bot.* 77: 10 (1939). **Type:** India. Punjab, Karnal, in 1885–1888, *J.R.Drummond 25031* (syn: K); India. Ahmedabad, July 1920, *L.J.Sedgwick s.n.* (syn: K).

Trichosanthes pachyrrhachis Kundu, *J. Bot.* 77: 9 (1939). **Type:** Northwest India, in 1844, *M.P.Edgeworth 63* (holo: K).

Trichosanthes sp. Nitmiluk. (C.R.Mitchell 3293); Australian Plant Census (CHAH 2005); Australian Plant Name Index, <http://www.anbg.gov.au/cgi-bin/apni>. Accessed February 2010.

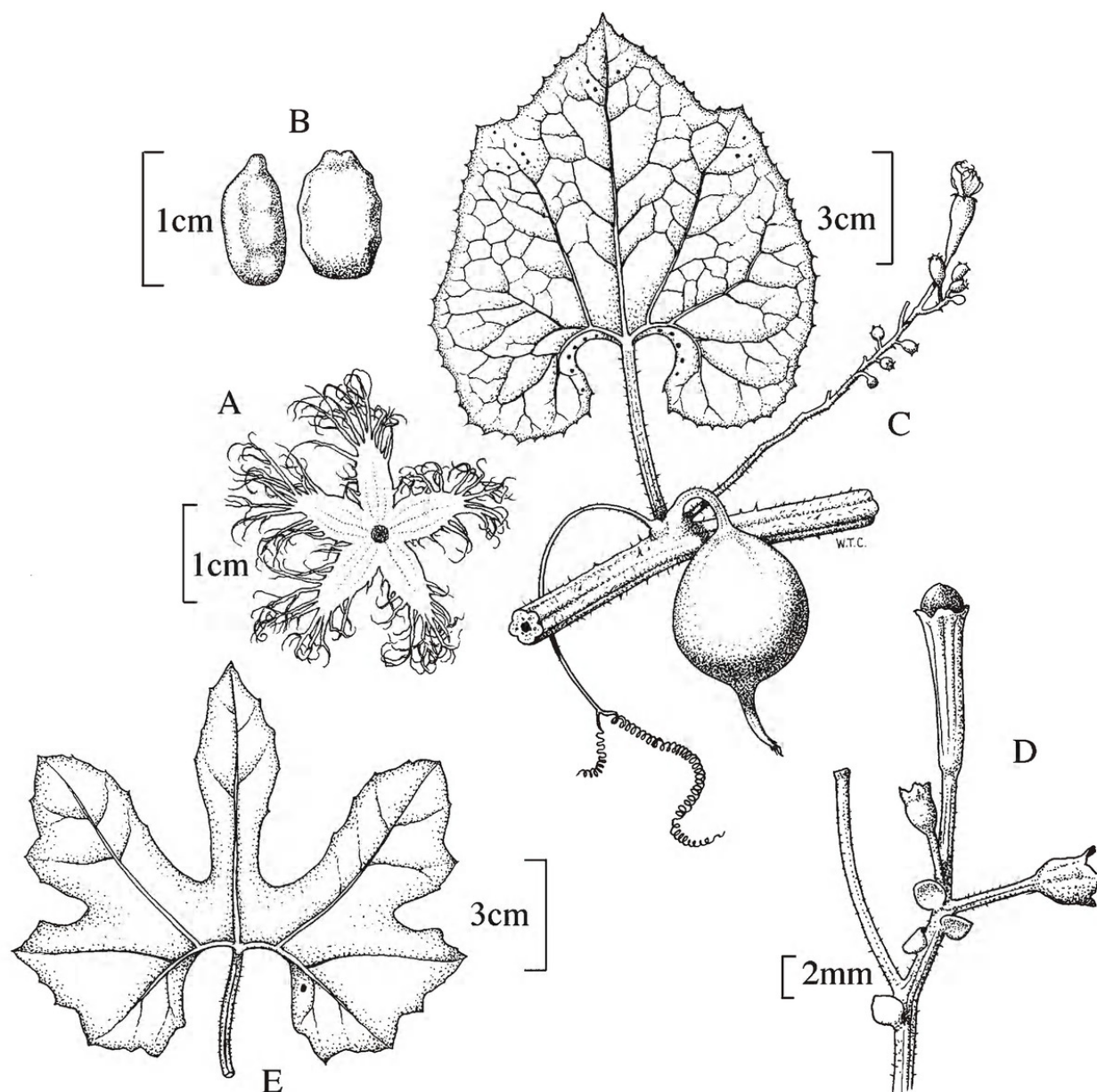


Fig. 3. *Trichosanthes cucumerina* var. *cucumerina*. A. male flower. B. seeds. C. unlobed leaf underside showing glands, male inflorescence with bracts, fruit and tendrils. D. male inflorescence, buds and broadly ovate and orbicular cupular bracts. E. leaf underside with deeply lobed margin and solitary gland. A–C from *Cooper 2119* (CNS); D–E from *Fox 2513* (DNA) (scales as indicated). Del. W.T. Cooper.

Trichosanthes sp. Fine Leaf (L.A. Craven 7930), Australian Plant Census (CHAH 2005); Kerrigan & Albrecht (2007); Australian Plant Name Index, <http://www.anbg.gov.au/cgi-bin/apni>. Accessed February 2010.

Illustrations: Yueh & Cheng (1974: pl.82); Telford (1982: 197); Wheeler (1992: 254); Rugayah & de Wilde (1999: 231); Hyland *et al.* (2003); Duyfjes & Pruesapan (2004: 81).

Monoecious slender trailing vine to 2 m. **Stem** diameter 1–2 mm, 5-ribbed, pubescent

(trichomes may be sparse); trichomes short glandular and eglandular and mostly interspersed with scattered long eglandular trichomes, denser at nodes or sometimes only at nodes; cystoliths rarely present. **Probracts** absent. **Tendrils** 2 or 3-branched, sparse glandular or eglandular trichomes towards base. **Leaves** simple, discolorous, membranous; petioles 8–57 mm long, sparse to dense short glandular and eglandular trichomes, mostly with scattered longer trichomes, rarely with a few discoid cystoliths; lamina cordate, ovate,

broad-ovate or reniform, 23–145 mm long, 25–135 mm wide; unlobed, or shallowly to deeply 3–7-lobed, rarely 10-lobed, lobe divisions up to *c.* 95% of lamina length; central lobes oblong, elliptical, obovate or spatulate; lateral lobes ovate, triangular, oblong, asymmetrical, spatulate; base cordate and shortly cuneate or truncate, sinus often shallow and wide; apex acute, acuminate or obtuse, with a soft mucro; margin undulate, denticulate, dentate or serrate, 4–40 teeth or soft mucros along each side; membranous; upperside pubescent, hirsute or scabrous, trichomes short eglandular and/or glandular, sometimes restricted to main veins, and mostly with scattered long eglandular trichomes often restricted to near the margin, rarely with a few scattered discoid cystoliths; underside pubescent, hirsute or scabrous, trichomes short glandular and/or eglandular, often with longer scattered eglandular trichomes usually on veins or close to margin; glands at leaf base 1–8 per side, some scattered glands may be present, gland diameter 0.2–0.3 mm; rarely with a few scattered discoid cystoliths.

Male inflorescences racemose or solitary (rarely a panicle), usually arising well after co-axillary female; raceme 70–240 mm long, 4–21-flowered, rachis with sparse to dense, short glandular and eglandular trichomes as well as long eglandular trichomes, peduncle 25–180 mm long; bracts persistent at base of pedicels and often at base of peduncle, ovate, broadly ovate, orbicular, triangular, narrowly triangular, reniform, obovate, oblong, elliptical, rhombic or linear, often cupular, 0.25–3 mm long, 0.25–2.5 mm wide, base truncate or cuneate, apex obtuse, acute or rarely obcordate, entire, crenate, unlobed or with 3–5 shallow lobes, mostly orange-brown or pinkish-brown in herbarium specimens (linear bracts remain green), glabrous or trichomes sparse to dense and usually much sparser than those on the adjoining rachis, glands absent; venation absent, obscure or 3-veined with a midrib and intramarginal veins. **Male flowers:** pedicels 5–45 mm long; receptacle tube slender-funnelform, 7–35 mm long; trichomes glandular and eglandular, sparse to moderately dense; sepals triangular, entire, 0.5–2.5 mm long, 0.25–1 mm wide, green, trichomes sparse to dense; corolla

diameter 8–20 mm (not including fimbriae); petals elliptic-ovate, 9–10 mm long (not including numerous fimbriae), *c.* 4 mm wide, white, pubescent abaxially and adaxially; anthers *c.* 2 mm long; filaments *c.* 0.8 mm long. **Female flowers:** solitary or paired, co-axillary with male racemes (usually emerging before male inflorescence is fully expanded); pedicels 3–50 mm long, trichomes glandular; receptacle tube, slender-funnelform, 12–50 mm long, trichomes glandular and eglandular, pubescent; sepals triangular or subulate, entire, 1–3 mm long, 0.5–1.5 mm wide, green, pubescent abaxially and adaxially; corolla diameter 9–25 mm (not including fimbriae), petals ovate, 5–10 mm long, 2–3 mm wide, white, trichomes glandular and sparse; ovary 4–25 mm long, glabrous or trichomes sparse. **Fruit** elongated-globular, fusiform or globose with a beaked apex, 21–50 mm long, 18–25 mm wide, orange or red (unripe fruit is longitudinally streaked dark and pale green), glabrous or glabrescent; pulp meagre, translucent orange or reddish; mesocarp 2–2.5 mm wide; pedicel 3–9 mm long, trichomes sparse, bract from base of male raceme usually persistent at base; exocarp *c.* 0.3 mm wide; seeds 3–12, elliptical or obovoid, 1-locular, margin undulate with 3–5 shallow lobes on each side, 6–10 mm long, 4–7 wide, 3–5 mm thick, testa brown or grey. Germination type unknown. **Fig. 3.**

Additional selected specimens (from 166 examined):

Australia: Western Australia. Edge of small bay W of Cape Ruthiers, Mar 1993, *Mitchell 2989* (DNA); *c.* 2 km E of Mitchell Falls, Mar 1994, *Mitchell 3368* (CANB); Lacrosse Island at head of Cambridge Gulf, NE Kimberley, Jun 1992, *Kenneally 11327* (CANB); The Dag, Mornington Wildlife Sanctuary, Apr 2005, *Legge 521 et al.* (BRI); West Kimberley, Oscar Range, Brooking Gorge, May 1988, *Sands 4732* (CANB); Dampier Archipelago, Enderby Island, Jul 1980, *Wilson 7268* (CANB); *c.* 135 km S of Port Hedland on Great Northern Highway, Apr 1995, *Mitchell PRP280* (CANB). **Northern Territory.** *c.* 30 km NNE of Jabiru, Mar 1981, *Craven 7930 & Whitebread* (CANB); Kakadu N.P., Mt Brockman, Mar 1995, *Egan 4575* (DNA); 6 km S Mt Gilruth, Arnhem Land, March 1984, *Wightman 1345* (DNA); Deaf Adder Gorge, Feb 1977, *Fox 2513* (DNA); Nitmiluk gully of Nitmiluk Gorge, Apr 2004, *Crane 1311 & Dixon* (DNA); Katherine Gorge, Apr 1972, *Must 973* (DNA); 6 km NE Cape Crawford Hotel, Abner Range, Jan 1989, *Brock 484* (DNA). **Queensland.** COOK DISTRICT: Lankelly Creek, McIlwraith Range, May 1995, *Hyland 15339* (CNS); Mt White, Coen, Apr 1993, *Hyland 14776* (CNS); Jane Table Hill, Lakefield N.P., Mar 1993,

Fell 2903 & *Stanton* (BRI); Metal Hills, 4 km NNE of Chillagoe, May 2006, *Wannan 4372* (NSW); Royal Arch N.P., Chillagoe, Feb 1996, *Forster PIF18614* & *Ryan* (BRI); Royal Arch Tower, Chillagoe N.P., Apr 2010, *Cooper 2119* & *Ford* (CNS).

Distribution and habitat: *Trichosanthes cucumerina* var. *cucumerina* is widely distributed from India, Southern China and Southeast Asia through Malesia to Australia. Within Australia it is widespread in Western Australia from the northern Kimberley south to the Port Hedland area, also in the Northern Territory from Arnhem Land to the Abner Range near McArthur, and in Queensland from Cape York to Chillagoe (**Map 1**). In Queensland it is more restricted with a few isolated collections from Cape York Peninsula and Chillagoe-Mungana Caves N.P., and one collection from Black Mountain near Cooktown within the Wet Tropics bioregion. It has a strong association with sandstone habitats but it also occurs in areas of granite and limestone. It is a climber on rocks, shrubs and trees in open forest, woodland, shrubland (often on sandstone escarpments), monsoon forest, vine thickets, *Allosyncarpia* forest, herblands and grasslands.

Phenology: Flowers have been recorded in January, February, March, April, May, June, July and October; fruit has been recorded in January, February, March, April, May, June, August and October.

Notes: *Trichosanthes cucumerina* var. *cucumerina* is a highly variable species with leaves varying from unlobed to deeply lobed. However, all plants have male bracts up to 3 mm long, flowers that are open during the day, and seeds with undulate margins. It differs from all other Australian *Trichosanthes* by having flowers that open during daylight, and very small male bracts. Male inflorescence bracts are usually persistent through to ripe fruit in Australian populations, whereas in Malesia and China the bracts are absent, subpersistent or caducous (Backer & Bakhuizen van den Brink 1963; Rugayah & de Wilde 1997; de Wilde & Duyfjes 2004, 2010; Duyfjes & Pruesapan 2004; Lu *et al.* 2011). Leaf glands are usually present in Australian populations whereas in Malesia leaf glands are absent or few (de Wilde & Duyfjes 2010). The leaves

have a pungent smell like those of *Momordica charantia* L. mixed with peanut butter.

Etymology: After its similarity to the related genus *Cucumis*.

Trichosanthes section **Cucumeroides** (Gaertn.) Kitam., *J. Jap. Bot.* 19: 35 (1943); *Cucumeroides* Gaertn., *Fruct. Sem. Pl.* 2: 485, t. 4, f. 4. (1791). **Type species:** *T. cucumeroides* (Ser.) Maxim. [= *T. pilosa* Lour.]

Dioecious (sometimes monoecious) vines; probract absent; male bracts persistent (caducous or persistent in Thailand, Duyfjes & Pruesapan 2004), relatively short and mostly narrow; flowers nocturnal, petals fimbriate with thread-like margins; fruit pulp yellow or orange (also whitish or pinkish in Asia, de Wilde & Duyfjes 2004); seeds 3-locular, t-shaped, quadrangular and tumid.

Distribution: Approximately 14 species in China, India, SE Asia, Malesia and Australia (one species).

2. *Trichosanthes pilosa* Lour., *Fl. Cochinch.* 1: 588 (1790). **Type:** Vietnam (holo: lost); Vietnam. Tu Phap, *s.dat.*, *Bon 4019* (neo: P, *fide* de Wilde & Duyfjes [2008: 270]).

Trichosanthes ovigera Blume, *Bijdr. Fl. Ned. Ind.* 15: 934 (1826). **Type:** Indonesia: Java. Mt Salak, *s.dat.*, *C. Blume s.n.* (holo: L130442; iso: L130439).

Trichosanthes chinensis Ser. in DC., *Prodr.* 3: 308 (1828). **Type:** tab. 13 in Cattle, *l.c. Pl. Chinâ* (1821).

Bryonia cucumeroides Ser. in DC., *Prodr.* 3: 308 (1828); *Trichosanthes cucumeroides* (Ser.) Maxim. in Franch. & Sav., *Enum. Pl. Jap.* 1: 172 (1873). **Type:** Japan, *Cucumeroides* Thunb. ex. Gaertn., *Fruct.* 2: 485 (1791).

Trichosanthes horsfieldii Miq., *Fl. Ned. Ind.* 1: 677 (1856). **Type:** Indonesia: Java. Priangan, *s.dat.*, *T. Horsfield s.n.* (holo: BM; iso: K, U).

Trichosanthes hearnii F. Muell. ex Benth., *Fl. Austral.* 3: 315 (1867). **Type:** Australia: Queensland. Rockingham Bay, *s.dat.*, *J. Dallachy s.n.* (syn: K; isosyn: MEL100085).

Trichosanthes himalensis C.B. Clarke in Hook.f., *Fl. Brit. India* 2: 608. (1879). **Type:**

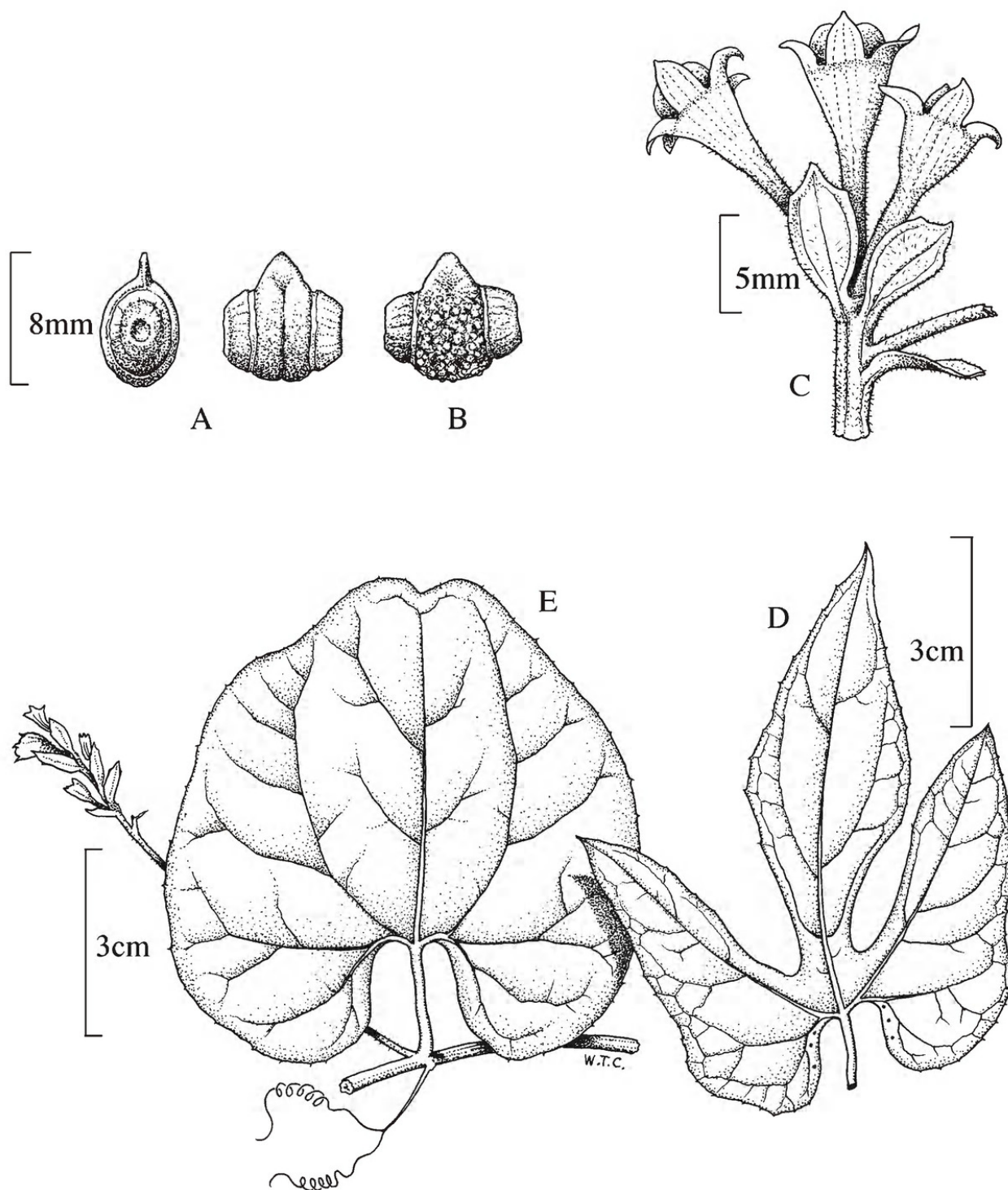


Fig. 4. *Trichosanthes pilosa*. A. seed: lateral and adaxial view. B. seed: adaxial view. C. male inflorescence with bracts and buds. D. lobed leaf underside showing glands near base. E. unlobed leaf upperside, male inflorescence and tendril. A & E from Gray 7477 (CNS); B from Cooper 2120 (CNS); C from McDonald 8839 & Dennis (CNS); D from Cooper 2064 (CNS) (scales as indicated). Del. W.T. Cooper.

India: Sikkim. Yoksun to the plains, *ann. coll. ign.*, J.D. Hooker s.n. (syn: K); India. Sikkim, *s.dat.*, Clarke s.n. (syn: K).

Trichosanthes dicoelospermum C.B.Clarke in Hook.f., *Fl. Brit. Ind.* 2: 609 (1879); *T. cucumeroides*

var. *dicoelosperma* (C.B.Clarke) S.K.Chen, *Bull. Bot. Res.* 5: 118 (1985). **Type:** India: Sikkim. Khasia, *s.dat.*, J.D.Hooker s.n. (syn: K); *loc. cit.*, *s.dat.*, J.D.Hooker & T. Thomson s.n. (syn: K, UPS).

Trichosanthes holtzei F.Muell. *Aust. J. Pharm.* 1: 447 (1886). **Type:** Australia: Northern Territory. near Port Darwin, *s.dat.*, *M.Holtze* 432 (holo: MEL100084), **syn. nov.**

Trichosanthes cavaleriei Lév., *Fl. Kouy-Tcheou* 123 (1914). **Type:** China: GUIZHOU PROVINCE: near Guiyang, *Bodinier* 2306, *Cavalerie* 1032, 1816 (syn: all E).

Trichosanthes vanoverberghii Merr., *Philipp. J. Sci.*, C 9: 458 (1915). **Type:** Philippines. LUZON PROVINCE: Bontoc subprovince, Bauco, *s.dat.*, *M.Vanoverbergh* 3662 *bis* (iso: K).

Trichosanthes baviensis Gagnep., *Bull. Mus. Hist. Nat. Paris* 24: 379 (1918). **Type:** Vietnam. Tu Phap, *s.dat.*, *Bon* [as *Balansa*] 4016 (holo: P).

Trichosanthes pierreii Gagnep., *Bull. Mus. Hist. Nat. Paris* 28: 380 (1918). **Type:** Vietnam. Baria, Mt Lu Dinh, *s.dat.*, *Pierre* 4491 (holo: P).

Trichosanthes hainanensis Hayata, *Icon. Pl. Formosan.* 10: 8 (1921); *T. cucumeroides* var. *hainanensis* (Hayata) S.K.Chen, *Bull. Bot. Res.* 5: 117 (1985). **Type:** China. HAINAN PROVINCE: *s.loc.*, *s.dat.*, *Katsumada* *s.n.* (holo: TI).

Trichosanthes formosana Hayata, *Icon. Pl. Formosan.* 10: 7 (1921). **Type:** Taiwan. Taipei, Urai, *s.dat.*, *Matsuda* 267 (holo: TI).

Trichosanthes matsudai Hayata, *Icon. Pl. Formosan.* 10: 10 (1921). **Type:** Taiwan. Qishan, Kosenpo, *s.dat.*, *Matsuda* *s.n.* (holo: TI).

Trichosanthes boninensis Nakai ex Tuyama, *Bot. Mag. Tokyo* 50: 133 (1930). **Type:** Japan. Bonin Island, Titizima, *s.dat.*, *Nakai* *s.n.* (holo: TI).

Trichosanthes chingiana Hand.-Mazz., *Sinensia* 7: 621 (1936). **Type:** China: GUANGXI PROVINCE: Yema Shan, *s.dat.*, *R.C.Ching* 7113 (holo: W).

Trichosanthes rostrata Kitam., *Acta Phytotax. Geobot.* 5: 210 (1936). **Type:** Japan. Ryukyu Islands. Miyagi Island, *s.dat.*, *Koidzumi* *s.n.* (holo: KYO *n.v.*; iso: US36699).

Trichosanthes cucumeroides var. *stenocarpa* Honda, *Bot. Mag. Tokyo* 54: 223 (1941). **Type:** Japan. Musasi, Urawa, *s.dat.*, *K.Emori* *s.n.* (holo: TI).

Trichosanthes okamotoi Kitam., *J. Jap. Bot.* 19: 40 (1943). **Type:** Taiwan. Gaoxiong, 'Benchi, Chushinron', *s.dat.*, *Okamoto* *s.n.* (holo: KYO).

Trichosanthes mafuluensis Merr. & L.M.Perry, *J. Arnold Arbor.* 30: 58 (1949). **Type:** Papua New Guinea: CENTRAL PROVINCE. Mafulu, 1933, *L.J.Brass* 5257 (holo: A; iso: BO, BRI).

Trichosanthes ascendens C.Y.Cheng & C.H.Yueh, *Act. Phytotax. Sin.* 18: 340 (1980). **Type:** China: GUANGXI PROVINCE: He Xian, *s.dat.*, *C.T. Li* 604120 (holo: IBX).

Trichosanthes trichocarpa C.Y.Wu ex C.Y.Cheng & C.H.Yueh, *Acta Phytotax. Sin.* 18: 340 (1980). **Type:** China. YUNNAN PROVINCE: Baoshan Xian, *s.dat.*, *T.T. Yu* 17861 (holo: KUN; iso: A).

Illustrations: Keraudren-Aymonin (1975: 87) as *T. ovigera*; Telford (1982: 197) as *T. ovigera*; Brennan (1986: 26) as *T. cucumerina*; Jones & Gray (1988: 354) as *T. holtzei*; Wheeler (1992: 254) as *T. ovigera*; Rugayah & De Wilde (1999: 231) as *T. ovigera*; Hyland *et al.* (2003) as *T. ovigera*; Duyfjes & Pruesapan (2004: 81) as *T. ovigera*; Cooper & Cooper (2004: 144) as *T. ovigera*; Cooper & Cooper (2004: 144) as *T. holtzei*.

Dioecious or monoecious trailing vine to 6 m, perennial, partly or completely seasonally senescent. **Stem** diameter 1–3 mm, 5-ribbed, glabrous or glabrescent, trichomes glandular and/or eglandular, scattered longer eglandular trichomes may be present; nodes usually slightly swollen, discoid cystoliths may be present at nodes. **Probracts** absent. **Tendrils** unbranched or 2- or 3-branched. **Leaves** simple, discolorous, membranous or chartaceous; petioles 17–85 mm long, eglandular trichomes present, interspersed with sparse glandular trichomes, rarely with a few longer trichomes, discoid cystoliths may be present; lamina cordate, unlobed or shallowly to deeply 3-lobed, 70–200 mm long, 50–155 mm wide, base cordate, usually shortly cuneate, sinus deep and narrow (rarely wide),

apex acute, acuminate, obtuse or retuse, with a soft mucro, margin remotely denticulate, undulate or crenate (mostly almost entire except for a small mucro terminating each vein), 16–28 mucros on each side; upperside pubescent, hirsute or scabrous, sparsely to densely clothed in short eglandular trichomes, rarely with some glandular trichomes near base, sometimes interspersed with longer trichomes which are often only present near margin; underside pubescent, hirsute or scabrous, sparsely to densely covered in short eglandular or glandular trichomes (usually denser on underside), often with a few longer trichomes on main veins especially towards margin; 1–5 glands at leaf base on each side, rarely with scattered glands, gland diameter 0.2–0.9 mm; discoid cystoliths may be present on main veins. **Male inflorescence** racemose or sometimes co-axillary with a solitary flower; raceme up to 200 mm long and up to 11-flowered, rachis densely covered in glandular trichomes, peduncle 15–75 mm long; bracts persistent, lanceolate, ovate, rhomboid, linear, elliptical or obovate, 4–8 mm long, 0.5–3 mm wide, base truncate or cuneate, apex acute or rarely obtuse, margin entire or 3–7-toothed, glabrous or glabrescent, trichomes glandular and eglandular, glands absent, discoid cystoliths may be present, venation pinnate and reticulate. **Male flower:** pedicels 5–35 mm long; receptacle tube salverform or slender-funnelform, 23–24 mm long, clothed in glandular and eglandular trichomes; sepals triangular, subulate or lanceolate, entire or 3-toothed, 4–7 mm long, 1–2 mm wide, green, clothed in glandular and eglandular trichomes; corolla diameter 12–20 mm; petals ovate, 6–8 mm long (not including fimbriellae), white, cream, yellow or greenish-yellow, pubescent. **Female flowers** in racemose inflorescence or solitary (rarely intermixed on a male raceme) on a pedicel 10–30 mm long; racemes 30–70 mm long, 5–10 flowered; bracts present on racemes and similar to those on male inflorescences, trichomes glandular and eglandular. **Female flower:** pedicels 12–16 mm long for solitary flowers, *c.* 5 mm long for flowers in racemose inflorescence, trichomes glandular and eglandular; receptacle tube salverform or slender-funnelform, 18–50 mm

long (including ovary), trichomes glandular and eglandular; sepals triangular or subulate, often recurved, 2–9 mm long, 0.5–3.5 mm wide, green, trichomes glandular and eglandular; corolla diameter (not including fimbriellae) 15–17 mm; petals ovate, 8–18 mm long, 4–9 mm wide (not including fimbriellae), white or cream, clothed in glandular and eglandular trichomes; fimbriellae white, yellow or greenish-yellow; ovary 10–16 mm long, trichomes glandular and eglandular. **Fruit** obovoid or oblong-globose, apex acute or obtuse with a short beak, 10-ribbed (ribs sometimes subtle), 31–62 mm long, 31–35 mm wide, orange or red, glabrous or a few glandular trichomes near base; mesocarp 2–2.5 mm wide, orange; pedicel 7–10 mm long; seeds 10–21, t-shaped, subquadrangular, tumid, 3-locular, central cell warty to smooth and containing the embryo, lateral cells cone-shaped and empty, 5–10 mm long, testa brown or blackish, suspended in yellow-orange pulp. Germination is hypogeal or semi-hypogeal, cotyledons straight. **Fig. 4.**

Additional selected specimens (from 85 examined):

Western Australia. Mitchell Plateau, N Kimberley, Feb 1979, *Beard 8436* (PERTH). **Northern Territory.** Gurig N.P., Apr 2006, *Brennan 6919* (DNA); Murgarella, Wunyu Beach, Mar 1987, *Russell-Smith 1967 & Lucas* (DNA); 5 km E mouth of Peter John River, NE Arnhem Land, Feb 1988, *Russell-Smith 4768 & Lucas* (DNA); Rocky Bay, Yirrkala, Mar 1988, *Russell-Smith 5168 & Lucas* (BRI); 1 km SE of Angurugu, Groote Eylandt, Mar 1988, *Russell-Smith 5135 & Lucas* (CANB); 5 km SW Cutta Cutta Caves, Feb 1989, *Russell-Smith 7157 & Lucas* (DNA); Van Dieman Gulf at base of Cape Hotham Peninsula, Mar 1993, *Cowie 3291* (DNA); Gunn Point, Apr 1984, *Dunlop & Wightman 6678* (DNA); Wangi Falls, Litchfield N.P., Dec 2009, *Cooper 2100 & Morris* (CNS). **Queensland.** COOK DISTRICT: Old Mapoon Road, Jun 2000, *Hyland 16381* (CNS); Iron Range N.P., Mar 1994, *Fell 4118 & Stanton* (BRI); Lake Patricia, Weipa, Mar 1989, *O'Reilly 262* (BRI); Turrell Hill, Macrossan Range, Silver Plains, Jun 1998, *Forster PIF23085 et al.* (BRI); Brooklyn, May 2010, *Cooper 2120 & Russell* (CNS); Barron Gorge, Aug 2001, *Cooper 1569 & Cooper* (CNS); Eight Mile Mt, Mar 1999, *Gray 7477* (CNS); Burke Developmental Road, Royal Arch Tower, Chillagoe N.P., Feb 2010, *Cooper 2102 & Ford* (CNS); Barron Gorge N.P., Apr 2009, *Cooper 2064* (CNS); Kennedy Highway, 300 m N of Herberton turnoff, May 2004, *Cooper 1840 & Cooper* (BRI); N.P.R. 16, Forty Mile Scrub, old road, Mar 1999, *Ford 2193* (CNS); Wind Tunnel Lava Tubes, Undara N.P., Mar 2010, *McDonald 8839 & Dennis* (CNS). SOUTH KENNEDY DISTRICT: Carlisle Island, Sep 1986, *Batianoff 5038* (BRI).

Distribution and habitat: *Trichosanthes pilosa* is widely distributed from India through Southern China to Japan, Southeast Asia through Malesia to Australia and the eastern Pacific. Within Australia it is widespread in the Northern Territory and in Queensland it occurs from Cape York south to Carlisle Island (northeast of Mackay) and west to Chillagoe (**Map 2**). There is one specimen from the Mitchell Plateau in the northern Kimberly area of Western Australia. It occurs in a variety of habitats from wet tropical rainforest, monsoon forest and littoral rainforest to deciduous vine thickets at an altitudinal range from near sea level to 1000 m.

Phenology: Flowers have been recorded in February, March, April and June; fruit has been recorded in February, March, April, May, June and August.

Notes: *Trichosanthes holtzei* F.Muell. was described as being reminiscent of *T. anguina* (synonym of *T. cucumerina* var. *anguina*) by Mueller (1886). His description is of a specimen with staminate and pistillate flowers. However, pistillate flowers are not evident on the type specimen today, and even though pistillate flowers may have been present, this feature is not sufficient to distinguish it, as *Trichosanthes pilosa* can at times be monoecious. The inflorescence bracts and leaves on the type specimen are a good match for *Trichosanthes pilosa*, and *T. holtzei* is here synonymised with *T. pilosa*.

A second variety of *Trichosanthes pilosa* was described by de Wilde & Duyfjes (2008) restricted to Thailand. Molecular analyses to date do not support the recognition of varieties in this species (de Boer, unpublished). Only the nominative variety occurs in Australia.

Etymology: The specific epithet *pilosa* is derived from the Greek *pilos* (anything made of felt), presumably referring to the indumentum.

Trichosanthes section **Edulis** Rugayah, *Reinwardtia* 11: 232 (1999). **Type species:** *T. edulis* Rugayah

Dioecious trailing vines or lianas; probract present, caducous; flowers nocturnal, petal margin fimbriate in upper half; fruit pulp

red; seeds numerous, 1-locular, flat or quadrangular, toothed or notched.

Distribution: Nine species (New Guinea eight endemic, Australia one endemic).

3. *Trichosanthes odontosperma* W.E.Cooper & A.J.Ford, *Austrobaileya* 8: 126 (2010). **Type:** Australia: Queensland. COOK DISTRICT: Topaz, Westcott Road, 15 April 2009, *W.Cooper 2065* (holo: CNS; iso: BRI, CANB, DNA, L, MO, NSW, UPS).

Illustrations: Cooper & Cooper (1994: 291), as *Trichosanthes* sp. (Mt Lewis); Cooper & Cooper (2004: 145), as *Trichosanthes* sp. (Mt Lewis); Hyland *et al.* (2003), as *Trichosanthes* sp. (Mt Lewis BG 167); Jones & Gray (1988: 354 & back cover), as *Trichosanthes* sp.; Williams (1987: 307), as *Trichosanthes* sp.; Cooper & Ford (2010: 128–129).

Dioecious trailing vine or liana to mid-canopy, perennial, partly or completely seasonally senescent. **Stem** diameter to 3 cm, young branchlets 5-angular, glabrescent with minute trichomes clustered at nodes; bark fissured and corky on older growth; nodes often markedly swollen. **Probracts** caducous, linear or narrowly ovate, minutely lobed or with a few teeth, 3–13 mm long, 1–3 mm wide, glandular, glabrous or glabrescent. **Tendrils** unbranched or 2- or 3-branched. **Leaves** simple, discolorous, coriaceous; petioles 20–95 mm long; lamina ovate, cordate or triangular, unlobed or rarely 3-lobed, 50–190 mm long, 41–160 mm wide, base cordate or rarely hastate, sinus mostly narrow and deep, apex acuminate to acute, with or without a soft mucro; margin denticulate with 13–27 teeth per side; upperside smooth, glabrous or with sparse minute translucent trichomes on main veins; numerous small translucent and sunken multicellular (rosette-shaped) cystoliths, which in most dried specimens become black; underside with sparse translucent minute trichomes on main veins, 1–16 circular and flat glands on each side of the leaf base. **Male inflorescences** with flowers mostly solitary, rarely in a fascicle of two flowers or a raceme beside a solitary flower, peduncle 35–110 mm long; bracts at the base of racemose flowers narrowly ovate, glabrous, 5–17 mm long, 1–3 mm wide. **Male flowers:** 45–90 mm

diameter, pedicel 43–83 mm long; receptacle tube salverform, 45–90 mm long, green or creamy-green with a narrow bright yellow centre, glabrous or glabrescent abaxially; sepals usually 5 (rarely 4), triangular, entire or with 1–3 teeth, 8–20 mm long, 2–4 mm wide, green, glabrous or glabrescent; petals 5 (rarely 4), obdeltoid, length including fimbriae 27–40 mm, 24–40 mm wide, white, both surfaces villous becoming glabrescent towards apex. **Female inflorescences** a solitary flower on pedicels 31–50 mm long, bracts absent. **Female flowers:** 60–73 mm long, 55–65 mm diameter; receptacle tube salverform, 39–55 mm long, green or creamy-green with a narrow bright yellow centre, adaxial surface of tube yellow, glabrous or glabrescent abaxially; sepals 5, triangular, entire, glabrous or glabrescent, 5–12 mm long, 1–2 mm wide, green; petals 5, obdeltoid, 28–31 mm long, white, both surfaces villous; ovary 14–24 mm long, glabrous and 10-ribbed externally. **Fruit** ovoid or ellipsoid, apex beaked, 90–140 mm long, 60–90 mm diameter, glabrous, longitudinally 10-ribbed, orange to red; mesocarp firm, 10–13 mm thick, yellow-orange; pedicel 25–40 mm long (or more, based upon flowering specimens), 4–10 mm wide; seeds numerous, quadrangular, 1-celled, 2-horned at one end, 4-lobed at the other end, both sides with 2 rows of 2–10 teeth, 12–18 mm long, 6.3–7.7 mm wide, 3–4 mm thick, testa brown to blackish, suspended in orange or red pulp. Germination epigeal.

Distribution and habitat: *Trichosanthes odontosperma* is endemic to the rainforests of the Wet Tropics bioregion in north-east Queensland. It occurs from the Windsor Tableland area, west of Cape Tribulation, to the Cardwell Range, west of Tully (detailed notes were given previously in Cooper & Ford [2010]).

Phenology: Flowers have been recorded in all months; fruits have been recorded in January, March, April, June, July, August, October and November.

Etymology: The specific epithet is derived from the Greek, *odonto* (tooth) and *-sperma* (seed) and refers to the toothed seeds, distinguishing it from all other Australian *Trichosanthes*.

Trichosanthes section **Foliobracteola** C.H.Yueh & C.Y.Cheng, *Act. Phytotax. Sin.* 12: 427 (1974). **Type species:** *T. kirilowii* Maxim.

Dioecious vines or lianas; probracts present; male bracts large; flowers nocturnal, petal margin fimbriate in upper half; fruit pulp whitish, cream or greenish-white; seeds 1-locular, flat, margined.

Distribution: 12 species in China, India, SE Asia, Malesia and Australia (one species).

4. Trichosanthes subvelutina F.Muell. ex Cogn., *Monogr. Phan. [A.DC. & C.DC.]* 3: 366 (1881). **Type:** Australia: Queensland. MORETON DISTRICT: Moreton Bay, Archers Brush, [November 1843], *L. Leichhardt* 4 (lecto [here designated]: P731577, photo!); isolecto: P731576, photo!; MEL100124, photo!; MEL100125, photo!).

Illustrations: Telford (1982: 197); Harden (1990: 448); Nicholson & Nicholson (2004: 65); Harden *et al.* (2007: cover, 95, 96).

Dioecious trailing vines or lianas to 8 m, sometimes extending into the canopy, perennial, seasonally senescent. **Stem** diameter to 15 mm, ribbed with vertical lenticels, bark shallowly corky on older stems; young stems glabrous and 5-angular, diameter *c.* 3 mm, clothed in rusty trichomes, discoid cystoliths may be present, nodes swollen. **Probracts** persistent, ovate, quadrate or triangular, entire or apex 3-toothed, 1–5 mm long, 1–4 mm wide, sparsely to densely pubescent, often glandular. **Tendrils** 2–7-branched. **Leaves** simple, discolorous, membranous; petioles 22–110 mm long; trichomes translucent white, fawn or pale rusty eglandular; discoid cystoliths may be present; lamina cordate or broadly ovate, 3–5-lobed (rarely 7-lobed), lobes shallow to deep, 85–260 mm long, 60–220 mm wide; base cordate, shortly cuneate or truncate, sinus deep and narrow or wide and shallow; apex acute, acuminate or obtuse, usually with a soft mucro; margin denticulate, undulate or almost entire except for a short soft mucro terminating each vein, 22–37 mucros per side; upperside pubescent (sometimes scabrous) with translucent white or fawn eglandular trichomes, may be interspersed

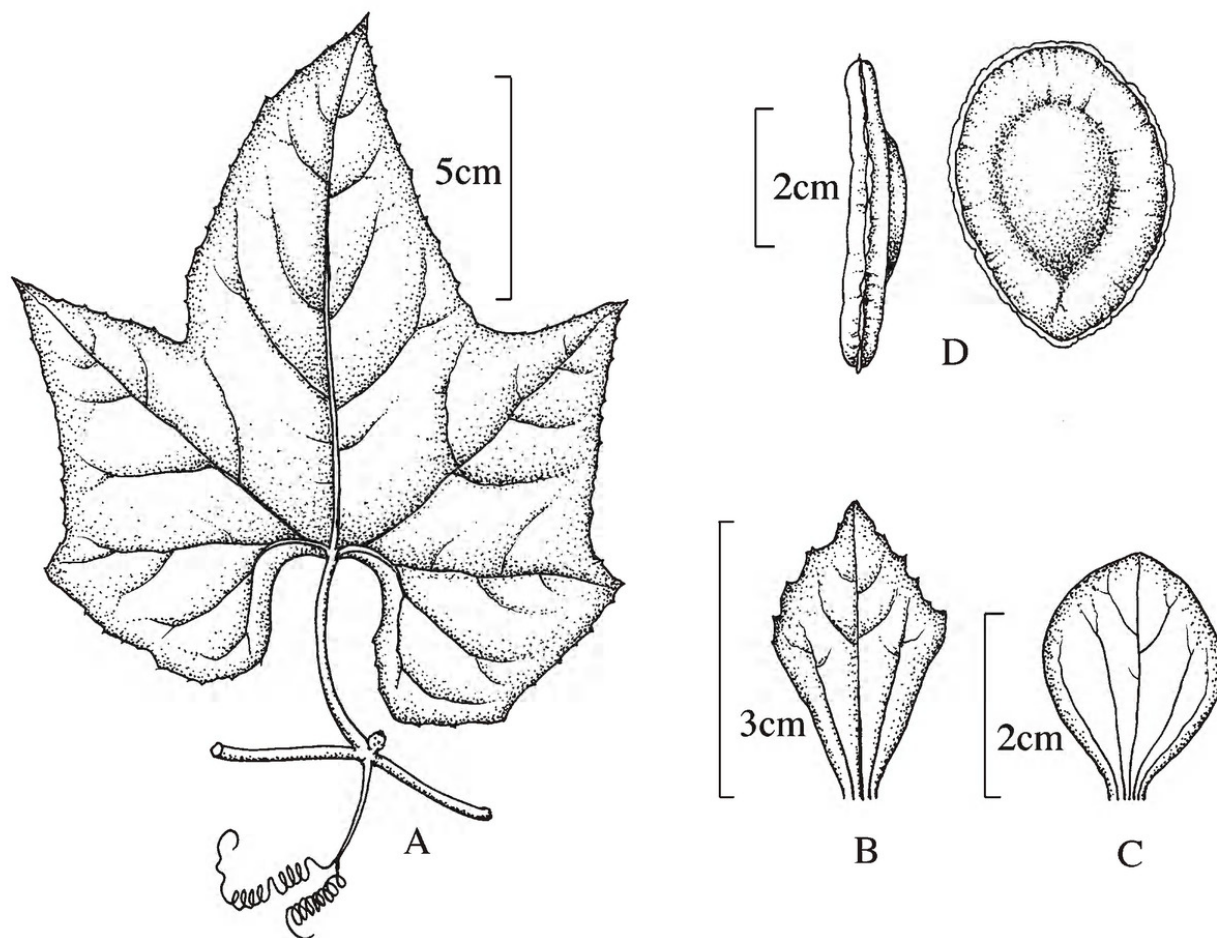


Fig. 5. *Trichosanthes subvelutina*. A. leaf, probract and tendril. B. rhomboid bract. C. broad-elliptic bract. D. seeds: left, lateral view; right, adaxial view. A & D from *Nicholson 3110* (BRI); B from *Boorman s.n.* (NSW146961); C from *Telford 9723* (CANB) (scales as indicated). Del. W.T. Cooper.

with longer trichomes; underside pubescent with translucent white or fawn glandular and eglandular trichomes, glands at leaf base up to 4 per side or absent, gland diameter 0.4–0.5 mm; cystoliths absent. **Male inflorescences** racemose, paired, solitary or a solitary flower co-axillary with a raceme, racemes *c.* 250 mm long with up to 12 flowers; peduncle 75–165 mm long, pubescent; bracts persistent, broad-elliptic, rhomboid or obovate, 15–33 mm long, 7–23 mm wide, apex acute or obtuse, base truncate or cuneate, densely pubescent, some trichomes glandular, margin denticulate or almost entire except for soft mucros, palmately veined, reticulate, glands sparse or absent, gland diameter 0.3–0.5 mm. **Male flowers:** pedicels 35–155 mm long; receptacle tube funnellform or slightly urceolate, 31–45 mm long, green with fawn pubescence abaxially; sepals triangular, entire, 8–11

mm long, 2–3 mm wide, green, pubescent; corolla diameter 30–70 mm; petals obovate or obdeltoid, 18–21 mm long (not including fimbriae), white, pubescent on both sides. **Female inflorescences** with flowers solitary or paired (one usually much older) on pedicels 18–50 mm long, pubescent. **Female flowers:** receptacle tube tubular, 22–51 mm long, pubescent, trichomes fawn or rusty; sepals triangular, entire, 5–11 mm long, 1–3 mm wide, green, pubescent; corolla diameter (not including fimbriae) 40–67 mm; petals obovate, *c.* 22 mm long, white, trichomes mostly on veins adaxially, glabrous abaxially; ovary 18–20 mm long, pubescent. **Fruit** ellipsoid, apex beaked, 75–160 mm long, 60–100 mm wide, green with paler irregular stripes, sparsely pubescent; mesocarp firm, *c.* 5 mm wide, whitish; pedicel 40–92 mm long, diameter 3.5–6 mm; seeds numerous

(about 100), broad-ovate or broad-elliptical, 9–12 mm long, 6–9 mm wide, testa cream-coloured, marginate, flesh around seeds white or greenish-white. Germination type unknown. *Silky Cucumber*. **Figs. 2 & 5.**

Additional selected specimens (from 35 examined):
Queensland. NORTH KENNEDY DISTRICT: Gloucester Island, Apr 1994, *Batianoff 9404129 & Figg* (BRI). WIDE BAY DISTRICT: Veteran S.F. [now Gympie N.P.], c. 9 km NNE of Gympie, May 1999, *Bean 14829* (BRI); Booloumba Creek area, Feb 2001, *Wright s.n.* (BRI [AQ552068]); Upper Kadanga S.F., 9 km NE of Gallangowan, Oct 2008, *Forster PIF34404 et al.* (BRI); Western Road, Montville, Apr 1959, *Gowlett s.n.* (BRI [AQ310073]). MORETON DISTRICT: Dunumbar Reserve, London Creek, off McDonalds Road, 2 km NNE of Peachester, Jul 2006, *Forster PIF31757 & Smyrell* (BRI); Geebung, Brisbane, Jan 1977, *Gray s.n.* (BRI [AQ310082]); Daisy Hill S.F., Logan City, Dec 1992, *Thompson LOG75* (BRI); O'Possum Creek, Springfield near Ipswich, Apr 1994, *Bird s.n.* (BRI [AQ627235]); Springbrook Plateau, Purlingbrook Falls, Apr 1984, *Telford 9723* (CANB); Currumbin Creek Road to Tomewin Gap, Jan 1984, *Telford 9103* (CANB); Mt Nathan, Mudgeeraba, May 1963, *Morgan s.n.* (BRI [AQ310080]); Lyrebird Ridge Road, Springbrook, Feb 2004, *Edginton & Halford s.n.* (BRI [AQ763103]); Binna Burra, Feb 2004, *Fechner et al. s.n.* (BRI [AQ578156]).
New South Wales. Billynudgel, Feb 1913, *Boorman s.n.* (NSW146961); Whian Whian S.F., N of Lismore, Apr 1939, *Joubert s.n.* (NSW146959); 10.2 km along Terania Creek Road from The Channon, Apr 2009, *Nicholson 3110* (BRI); Victoria Park near Rous, S of Alstonville, Nov 1964, *Williams K22* (NSW).

Distribution and habitat: *Trichosanthes subvelutina* is endemic to eastern Australia. Apart from a highly disjunct population on Gloucester Island east of Bowen, it is restricted to southeast Queensland (extant northern limit at Gympie N.P.) south to Rous near Alstonville in northern New South Wales (**Map 2**). It inhabits open or closed canopy *Eucalyptus* forest, disturbed rainforest, rainforest margins and Araucarian vineforest at altitudes from near sea level to 600 m.

Phenology: Flowers have been recorded in January, February, March, April, June, October and November; fruit has been recorded in January, February, March, April and May.

Typification: A diverse range of specimens were cited in the original description of this species. These were widely distributed by Mueller to herbaria in Europe with some (but not all) having what are presumably

duplicates retained at MEL. We have selected as lectotype of this name, a fertile collection that is labelled as being from “Archers Brush” and collected by Leichhardt.

Other residual syntypes are as follows – Australia: Queensland. MORETON DISTRICT: Three Mile Scrub [Ashgrove Avenue, Ashgrove], Burrigan, Moreton Bay, July 1843, *F. Mueller s.n.* (BR6606213, photo!; MEL100126, photo!); Moreton Bay, *s.dat.*, *L. Leichhardt 8* (P731578, photo!); Moreton Bay, Archers Brush, November [?1843], *L. Leichhardt 26* (P731579, photo!); Moreton Bay, Archers Brush, November–December [?1843], *L. Leichhardt s.n.* (P731580, photo!); Moreton Bay, *s.dat.*, *F. Mueller s.n.* (P731573, photo!); Brisbane River, Moreton Bay, *s.dat.*, *F. Mueller s.n.* (P731575, photo!; MEL100128, photo!); New South Wales. Clarence River, 1861, *C. Moore s.n.*, (P731574, photo!).

Etymology: The specific epithet is derived from the Latin *sub-* (almost or somewhat) and *velutinus* (velvety), probably referring to the indumentum.

Trichosanthes section **Involucraria** (Ser.) Wight, *Madras J. Lit. Sci.* 12: 52 (1840); *Involucraria* Ser., *Mém. Soc. Phys. Genève* 3: 27, t. 5 (1827). **Type species:** *Involucraria wallichiana* Ser. [= *Trichosanthes wallichiana* (Ser.) Wight]

Dioecious vines or lianas; probracts persistent; leaves simple or compound; juvenile leaves silvery with dark green veins; male bracts medium or large, glandular; petal margin fimbriate in upper half; fruit red, pulp dark green; seeds 1-locular, flat or slightly swollen, with a narrow margin or not margined.

Distribution: Approximately 50 species in China, India, SE Asia, Malesia (including New Guinea) and Australia (two species).

5. *Trichosanthes pentaphylla* F.Muell. ex Benth., *Fl. Austral.* 3: 314 (1867). **Type:** Australia: Queensland. NORTH KENNEDY DISTRICT: "Mt Grame" [Mt Graham, west of Rockingham Bay], June 1864, [probably *J.Dallachy s.n.* for F.Mueller] (lecto [here designated]: MEL100120, photo!).

Illustrations: McCubbin (1971: cover, 58–59); Jones & Gray (1988: 354); Cooper & Cooper (1994: cover, 290); Hyland *et al.* (2003); Cooper & Cooper (2004: 145).

Dioecious vine or liana to canopy, perennial, seasonally senescent. **Stem** diameter to 40 mm, bark on older stems slightly flaky, fissured, lenticellate, not ribbed, adventitious roots at nodes when trailing; young branchlets 7-ribbed, diameter 4–6 mm, glabrescent or some trichomes clustered at nodes; nodes slightly swollen; discoid cystoliths present, usually denser at nodes. **Probracts** persistent, ovate, rotund, oblong, rhomboid or broadly elliptic, often cupular, base truncate, apex acute or acuminate; margin entire, crenate or serrate with 1–6 teeth, 2–14 mm long, 1.5–7 mm wide, glands 2–8, glabrous or sparse minute trichomes on both sides; discoid cystoliths may be present. **Tendrils** unbranched or 2- or 3-branched. **Leaves** compound, digitate with 3–5 leaflets (juveniles simple or 3-foliolate, cordate, ovate or elliptical, lobed or unlobed), coriaceous; petioles 15–60 mm long, trichomes sparse and minute, discoid cystoliths may be present; central leaflets sessile or petiolules up to 13 mm long; lamina elliptic, obovate, elliptic-obovate or ovate-elliptic, 45–160 mm long, 18–95 mm wide, base cuneate, rounded or decurrent, apex acute or acuminate with a soft mucro; margin serrate, remotely serrate or undulate; 3–7 teeth, mucros or calluses per side; lateral leaflets sessile or petiolules up to 12 mm long, ovate or oblique-cordate, 50–170 mm long, 22–110 mm wide, lobed or unlobed, base oblique, rounded, cuneate, attenuate or cordate, apex acute or acuminate with a soft mucro; margin serrate, remotely serrate or undulate with 3–13 teeth, mucros or callouses per side; upperside coarsely scabrous, glabrous or with a few minute trichomes along main veins especially near base, numerous small translucent rosette-

shaped cystoliths; underside scabrous or smooth, glabrous or with a few translucent trichomes near base, discoid cystoliths on main veins; glands at base absent or up to 3, a few scattered usually present, diameter 0.6–1 mm. **Male inflorescences** with flowers racemose or coaxillary with a solitary flower, racemes 92–180 mm long with 3–14 flowers, rachis thickened and 6-ribbed and with sparse minute trichomes; peduncle 10–85 mm long, 3–5.25 mm wide, 6-ribbed; bracts obovate or rhomboid, 25–40 mm long, 23–33 mm wide, base truncate, apex obtuse or broadly obtuse, margin fimbriate in upper half, venation parallel, reticulation sparse, both sides pubescent, glands scattered, gland diameter 0.5–1 mm. **Male flowers:** pedicels 3–5 mm long; receptacle tube slender-funnelform, 10-angled or 10-ribbed, 38–46 mm long, sparse minute trichomes; sepals subulate or triangular, entire or 5-toothed, 22–38 mm long, 6–8 mm wide, green, 5-veined, trichomes sparse and minute; corolla diameter c. 50 mm (not including fimbriallae); petals obdeltoid, 14–25 mm long, 15–20 mm wide, white, pubescent. **Female inflorescences** with flowers solitary or paired (one much older). **Female flowers:** pedicel 10–19 mm long; receptacle tube, salverform, 10-angled or 10-ribbed, 40–47 mm long, glabrous or glabrescent; sepals narrow-triangular, entire, 5-veined, 11–15 mm long, green or yellowish-green, clothed in minute trichomes; corolla diameter 34–40 mm (not including fimbriallae); petals obdeltoid, 14–18 mm long, c. 9 mm wide, white, trichomes dense and minute on both sides; stigma green; ovary 13–16 mm long, trichomes sparse and minute; ovules several, in vertical rows, c. 1 mm long. **Fruit** globose, ellipsoid, apex beaked, 10-ribbed, 40–75 mm long, 50–65 mm wide, red, glabrous or with a few trichomes at base; mesocarp 11–14 mm wide, orange; pedicel 6–36 mm long, 3–7 mm thick, trichomes sparse, cystoliths absent or few to numerous; seeds several, oblong or elliptical, flat or slightly swollen, base rounded and may be flattened, apex obtuse or acute, seeds 7–15 mm long, 5–8 mm wide, 2–4 mm thick, testa brown, pulp dark green. Germination is hypogeal, cotyledons straight. **Figs. 1 & 6.**

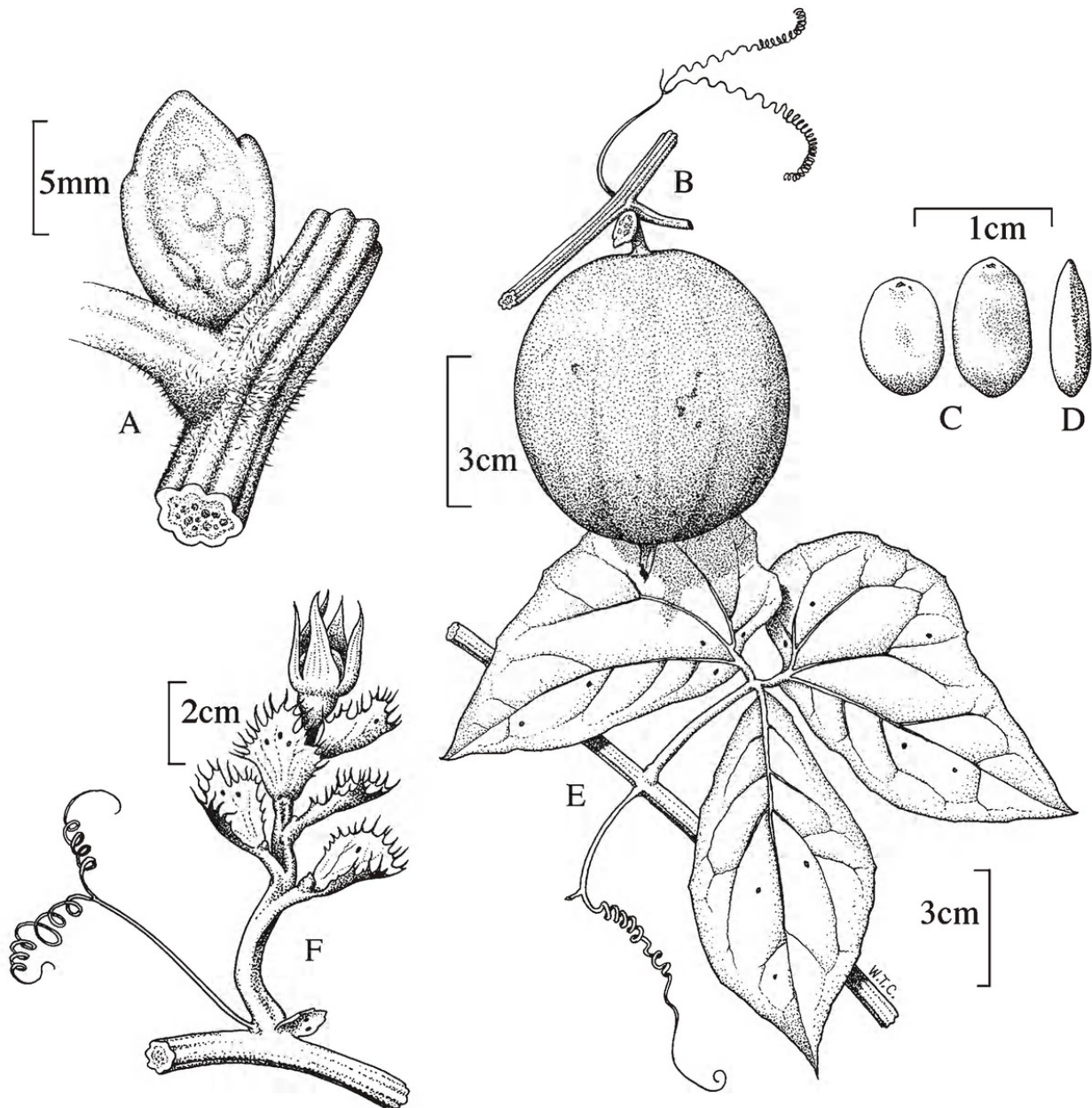


Fig. 6. *Trichosanthes pentaphylla*. A. glandular probract at node. B. fruit, probract and tendril. C. adaxial view of seeds. D. lateral view of seed. E. underside of leaf showing veins and glands. F. male inflorescence with glandular bracts and bud. A–D from *Cooper 2124 & Ford* (CNS); E & F from *Cooper 2134 & Jensen* (CNS) (scales as indicated). Del. W.T. Cooper.

Additional selected specimens (from 59 examined):
Queensland. COOK DISTRICT: 22 km NE of Bamaga, Feb 1994, *Fell 4040 & Stanton* (BRI); Lockerbie Scrub, Feb 1994, *Cooper 814* (CNS); Bamaga, May 1981, *Hyland 21136V* (CNS); Merluna, Oct 1999, *Hyland 16278* (CNS); Mowbray River Road, 3.5 km from highway, Jan 2000, *Gray 7762* (CNS); Oak Beach, May 1974, *Foley 431* (CNS); Kuranda, May 1993, *Cooper 535* (CNS); Kuranda Range Road, May 1976, *Gray 163* (CNS); Bank of Freshwater Creek, Freshwater, Nov 1936, *Hunter s.n.* (CNS [NQNC2541]); Alooomba, edge of Mulgrave River, May 1998, *Kitchener 73* (CNS); SFR 310, Mar 1979, *Gray 20088V* (CNS); Royal Arch Tower, Chillagoe NP, Jun

2010, *Cooper 2124 & Ford* (CNS); Royal Arch Tower, Chillagoe NP, Feb 2011, *Cooper 2134 & Jensen* (CNS); Bank of North Johnstone River, Goondi near Innisfail, Mar 1973, *Colman s.n.* (BRI [AQ9203]). NORTH KENNEDY: Ingham, Jun 1997, *Waterhouse 4431* (BRI); Townsville, Jun 1936, *Rowse s.n.* (BRI [AQ310052]); Herbert River, Euramo Station, *Dansie s.n.* (CNS [QRS119011]); Ayr, Jan 1980, *McGuire s.n.* (BRI [AQ319650]); Home Hill district, 1964, *Wyatt s.n.* (BRI [AQ310049]).

Distribution and habitat: *Trichosanthes pentaphylla* is known from northeast Queensland between Cape York and Home Hill south of Townsville (**Map 3**). It mostly occurs on riverbanks where it climbs into the canopy and hangs along the forest edge in wet lowland rainforest. It also occurs in the Chillagoe–Mungana Caves N.P. at Chillagoe where the habitat is deciduous vine thicket on limestone.

Phenology: Flowers have been recorded in January, February, March, April and May; fruit has been recorded in January, February, March, April, May, June and December.

Typification: A diverse range of specimens were cited in the original description of this species. These were widely distributed by Mueller to herbaria in Europe with some (but not all) having what are presumably duplicates retained at MEL. We have selected as lectotype of this name, a fertile collection that is labelled as being from “Mt Grame” and collected in June 1864, presumably by Dallachy.

Other residual syntypes are as follows – Australia: Queensland. NORTH KENNEDY DISTRICT: Rockingham Bay, *s.dat.*, [probably *J.Dallachy s.n.* for F.Mueller] (BR6605889, photo!; K, photo!); Burdekin River, *s.dat.*, [probably *J.Dallachy s.n.* for F.Mueller] (MEL100121; K742661, photo!); Burdekin, *s.dat.*, [probably *J.Dallachy s.n.* for F. Mueller] (K, photo!).

Notes: *Trichosanthes pentaphylla* specimens from the Chillagoe area are rather variable and could represent a new subspecies. However, DNA analysis has not confirmed this (de Boer & Cooper, unpublished). One collection with male inflorescences is typical of specimens from the lowland rainforests, with a thickened rachis; bracts obovate or rhomboid, margin fimbriate in upper half and sparse reticulation. A second specimen (*Cooper 2101 & Ford*) from the same vicinity has a slender rachis, bracts broadly ovate or reniform, with an acute or acuminate apex, margin denticulate not fimbriate, reticulate venation and female receptacle tube deeply ribbed. The morphology of this particular specimen has not been included in the general description.

Affinities: Telford (1982) suggested that *Trichosanthes pentaphylla* may be conspecific with *T. trifolia* (L.) Merr. (syn. *T. wawrae*). However, *Trichosanthes wawrae* has narrowly ovate probracts, 3–5 × 1.5–3 mm; suborbicular juvenile leaves; adult leaves finely scabrous above, margin entire or minutely sparsely dentate, central leaflet base long-cuneate; male raceme not thickened; bracts obovate or oblong, 7–25 × 4–12 mm; sepals 4–6 mm long; fruit pedicel 2–3 mm thick. *T. pentaphylla* has probracts ovate, rotund, oblong, rhomboid or broadly elliptical, 2–14 mm long, 1.5–7 mm wide; juvenile leaves cordate, ovate or elliptical; adult leaves coarsely scabrous above, margin serrate, remotely serrate or undulate; central leaflet base cuneate, rounded or decurrent; male raceme thickened; bracts obovate or rhomboid, 25–40 mm long, 23–33 mm wide; sepals 22–38 mm long; fruit pedicel 3–7 mm thick.

Etymology: The specific epithet is derived from the Greek *penta-* (five) and *-phyllus* (-leaved) referring to the digitate compound leaves, which often have 5 leaflets.

6. *Trichosanthes morrisii* W.E.Cooper **species nova** a *Trichosanthes pentaphyllae* similis, foliis simplicibus et sepalis margine laciniato differt. **Type:** Australia: Northern Territory. Kakadu National Park, near Gubara Saddle, 28 December 2010, *W.E.Cooper 2128*, *I.Morris & R.Dempster* (holo: CNS [2 sheets + spirit], iso: 8 sheets to be distributed to BR, BRI, CANB, DNA, L, MO, P, UPS).

Trichosanthes sp. (D55403); Liddle *et al.* (1994).

Trichosanthes sp. Kakadu (C.R. Dunlop 6639), Australian Plant Census (CHAH 2005); Australian Plant Names Index, <http://www.anbg.gov.au/cgi-bin/apni> Accessed February 2010.

Dioecious trailing vine or liana to about c. 6 m, perennial, seasonally senescent. **Stem diameter** to 20 mm, cream with numerous black warts; young branchlets 7-ribbed with cystoliths near nodes. **Probracts** persistent, broadly elliptical, obovate or oblong; apex acute or acuminate; margin denticulate, crenate or serrate with 5–7 teeth, base

truncate or cuneate, 5–10 mm long, 2–4 mm wide, adaxial surface with 4–7 glands, sparse trichomes on both sides, cystoliths may be present abaxially. **Tendrils** 2–4-branched. **Leaves** simple, discolorous, membranous; petioles 22–60 mm long, sparsely hairy, discoid cystoliths present, sparse minute trichomes may be present; lamina cordate, 3–5-lobed (juveniles cordate-deltoid, unlobed or remotely 3-lobed), 80–170 mm long, 68–160 mm wide, base truncate, cuneate or cordate, sinus deep and narrow or wide (juveniles with shallow and wide sinuses), apex acute or acuminate, usually with a soft mucro; margin remotely denticulate with 17–24 mucros or teeth per side; upperside scabrous, trichomes may be present on midrib and main lateral veins; cystoliths numerous, multicellular, rosette-shaped, diameter 0.3–1 mm; underside glabrous or a few trichomes may be present near base; glands sparse near base and towards apex, gland diameter 0.5–1.25 mm; cystoliths discoid, sparse, scattered

along main veins. **Male inflorescences** with flowers (from mature buds) racemose, usually beside a solitary flower, racemes 140–240 mm long, up to 11-flowered, peduncle 95–105 mm long, rachis slender, trichomes sparse, discoid cystoliths present; bracts persistent, rhomboid or ovate, unlobed or shallowly lobed, 27–34 mm long, 17–24 mm wide, base attenuate, cuneate or decurrent, apex acuminate; margin denticulate, lacinate or fimbriate in upper half only (entire in lower half); venation palmate-pinnate, reticulation dense, both sides with sparse minute trichomes denser near margin towards apex, rarely with glands, gland diameter *c.* 0.5 mm; aberrant leaf-like bracts may be present towards base of inflorescence, ovate-cordate, 3-lobed, 26–57 mm long, 18–63 mm wide, base short cuneate or decurrent, apex acute or acuminate, margin denticulate, venation palmate-pinnate, 3–5-veined (venation similar to leaves), reticulate, trichomes as in main bracts. **Male flowers:** pedicel on solitary flowers *c.* 40 mm long,

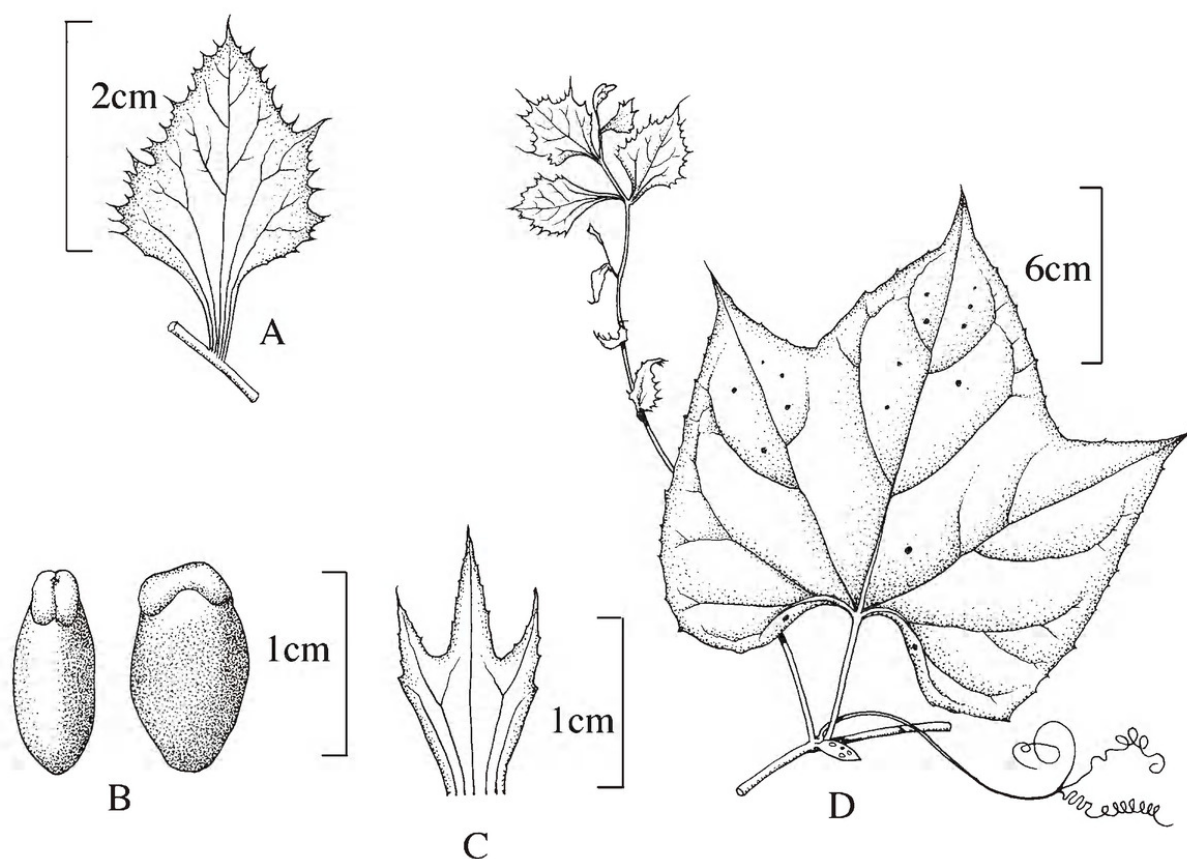


Fig. 7. *Trichosanthes morrisii*. A. male bract. B. seeds: left, lateral view; right, adaxial view. C. male sepal. D. leaf underside with glands, tendril & male inflorescence. A, C, D from Cooper 2128, Morris & Dempster (CNS); B from Dunlop 6626 (DNA) (scales as indicated). Del. W.T. Cooper.

sepals rhomboid, 3-veined, margin laciniate, hairy, reticulate; petals not seen. **Female flowers:** not seen. **Fruit** globose, apex beaked, 36–55 mm long, 35–60 mm wide, orange to red, probract persistent at base; mesocarp firm, 7–9 mm wide; pedicel up to 18 mm long and 5 mm wide, cystoliths present; seeds several, flat, oblong, both ends obtuse, base slightly bulbous, 11.2–12 mm long, 6.8–7.4 mm wide, 3.7–4.2 mm deep, testa brown, suspended in greenish-black pulp. Germination type unknown. **Fig. 7.**

Additional selected specimens (from 8 examined): **Australia: Northern Territory.** Arnhem Land, SE Mt Howship, Feb 1984, *Dunlop 6626* (DNA); Arnhem Land, SE Mt Howship, Feb 1984, *Dunlop 6639* (DNA); Groote Eylandt, Umbakumba, Mar 1988, *Russell-Smith 5099 & Lucas* (DNA); Groote Eylandt, 8 km SW Umbakumba, Jul 1987, *Russell-Smith 2750 & Lucas* (DNA); Groote Eylandt, Jul 1987, *Russell-Smith 2798 & Lucas* (DNA); Mt Brockman Outlier, Apr 1989, *Russell-Smith 8056* (DNA); 1 km east of the Gubara Saddle, Kakadu N.P., Dec 2009, *Cooper 2098 & Morris* (CNS).

Distribution and habitat: *Trichosanthes morrisii* is endemic to the Northern Territory where it is currently known to occur in Kakadu N.P., Arnhem Land and on Groote Eylandt (**Map 3**). It inhabits *Allosyncarpia*-dominated forest in gorges on sandstone escarpments and in riparian evergreen vineforest on coastal dunes. It appears to favour areas with perennial water, which retain some moisture through the drier seasons. Other species it co-occurs with are *Remusatia vivipara* (Roxb.) Schott, *Drynaria quercifolia* (L.) J.Sm., *Calophyllum sil* Lauterb., *Myristica insipida* R.Br., *Tylophora benthamii* Tsiang and *Desmos wardianus* (F.M.Bailey) Jessup.

Phenology: Male inflorescences without fully expanded flowers were collected in December, and flowering probably occurs between December and February; fruit has been collected in February and April.

Affinities: *Trichosanthes morrisii* is closely related to *T. pentaphylla* with similar juvenile leaves and fruit. The former has simple leaves, male bracts which are reticulate with an acuminate apex, attenuate or cuneate base, and lacinate sepals, whereas, *T. pentaphylla* has compound leaves, male bracts are not reticulate and have an obtuse apex, a truncate base and entire sepals (excepting one aberrant

collection [*Cooper 2101 & Ford*] in which the bracts are ovate, reticulate and acute).

Etymology: Named for Northern Territory naturalist, Ian Morris (1951–), in honour of his extensive contribution to natural history knowledge.

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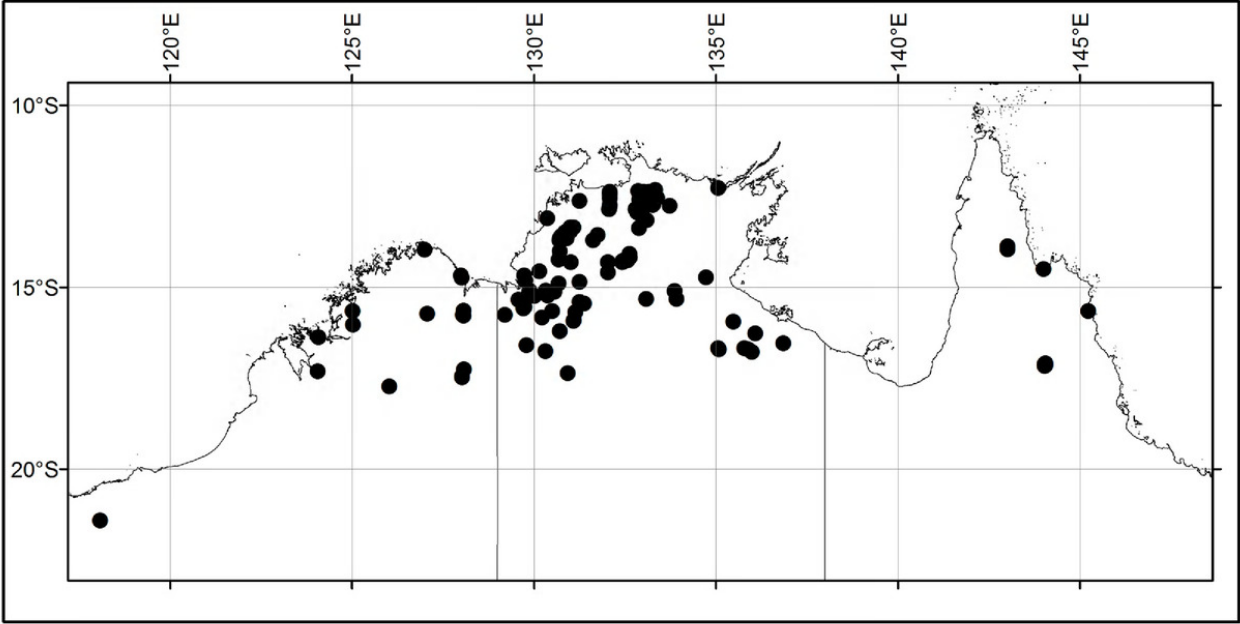
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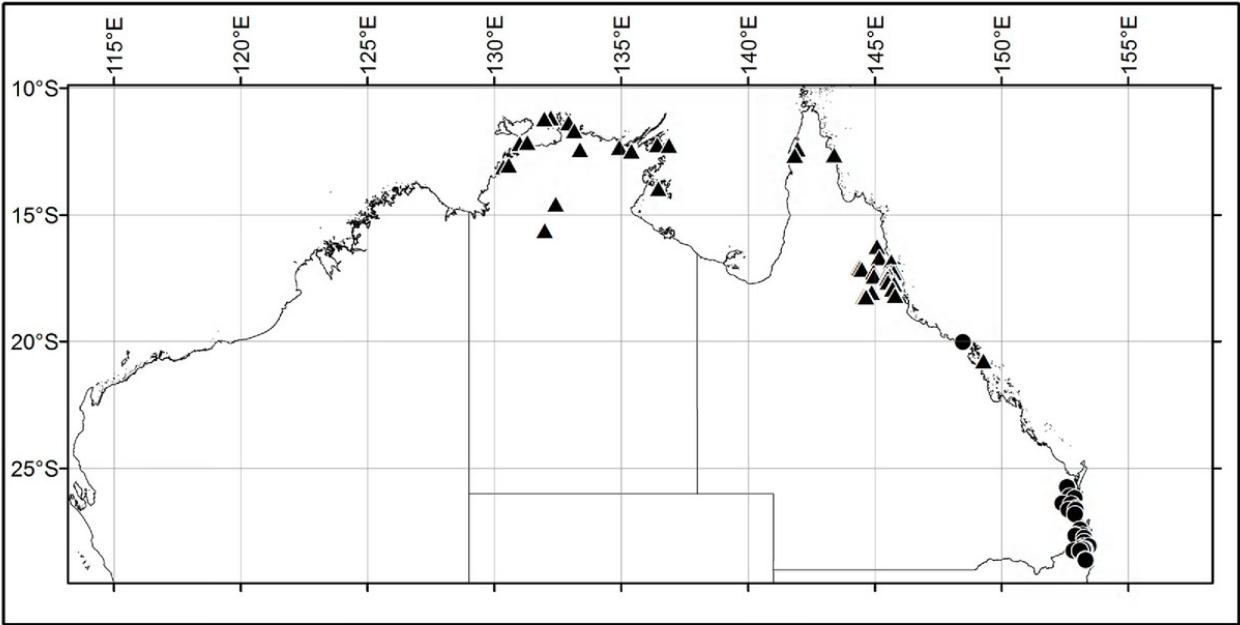
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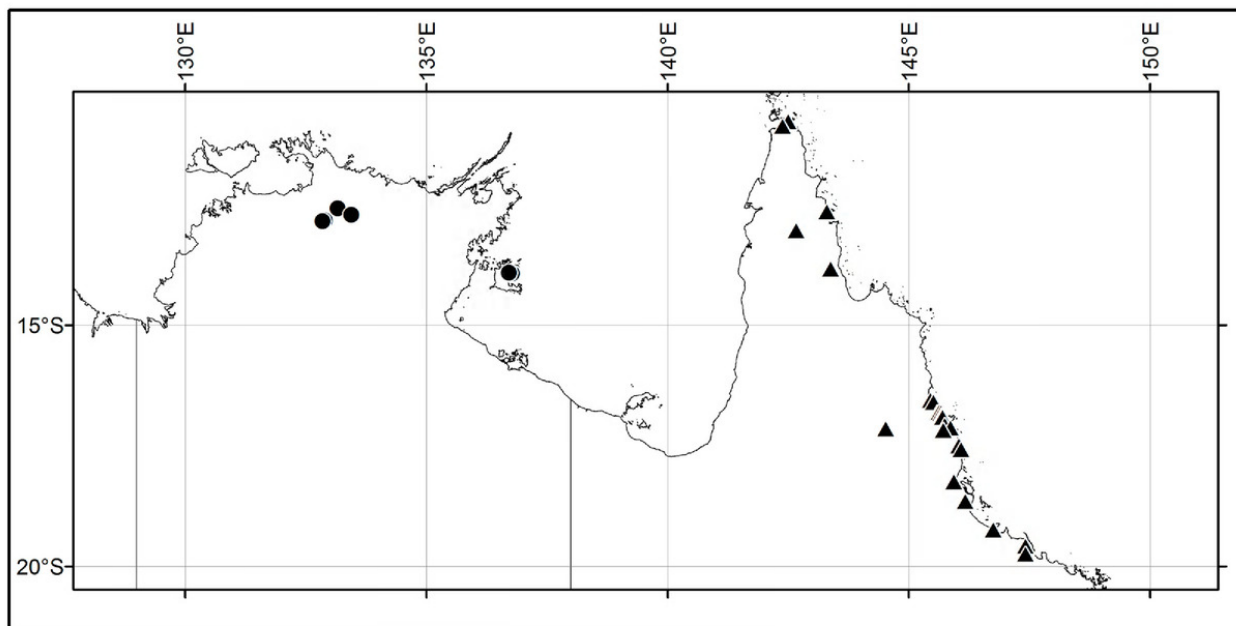
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Map 1. Distribution of *Trichosanthes cucumerina* var. *cucumerina* (●) in Australia.



Map 2. Distribution of *Trichosanthes pilosa* (▲) and *T. subvelutina* (●) in Australia.



Map 3. Distribution of *Trichosanthes pentaphylla* (▲) and *T. morrisii* (●).



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