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RESEARCH ARTICLE

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A new subspecies and new records of *Trichosanthes* (*Cucurbitaceae*) for India, and notes on *T. khasiana*

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Key words

distribution ranges
India
Trichosanthes dunniana subsp. *clarkei*
Trichosanthes khasiana
Trichosanthes tricuspidata
Trichosanthes wallichiana subsp. *subrosea*

Abstract In India, knowledge of the geographic distribution of *Trichosanthes* species is inadequate, largely due to the lack of revisionary work. Based on field observations, collected specimens and data from herbarium specimens, this paper describes a new taxon – *T. dunniana* subsp. *clarkei* from Sikkim and northern hill districts of West Bengal in northeastern India; and presents the first confirmed records of three southeast Asian taxa, viz., *T. dunniana* subsp. *dunniana* and *T. wallichiana* subsp. *subrosea* from northeastern India, and *T. tricuspidata* from the Andaman & Nicobar Islands. The name *T. khasiana* has been lectotypified, and Indochinese *T. inthanonensis* has been reduced under it. The southern Chinese *Trichosanthes subrosea* is transferred at reduced rank as *T. wallichiana* subsp. *subrosea*, while *T. tridentata* has been reduced to synonymy of this subspecies. Furthermore, we provide an updated distribution map with confirmed occurrences of these taxa in India, critical taxonomic notes and additional taxonomic characters.

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INTRODUCTION

Trichosanthes L., the largest genus in the family *Cucurbitaceae*, is characterised by mostly dioecious perennial climbers, with 2–5-fid tendrils, delicate fimbriate (mostly) white flowers, 3 stamens, solitary pistillate flowers and many seeded fleshy fruits (Schaefer & Renner 2011). This genus has considerable vegetable and medicinal importance, and consists of about 100 species occurring in tropical and subtropical eastern Asia, ranging from India, South China and Japan, east to tropical Australia and Fiji (De Wilde & Duyfjes 2010). The region South China to Malesia is considered as the centre of species diversity in *Trichosanthes* (De Boer et al. 2012). Possible land bridges formed by altered sea levels in the ancient past (De Boer et al. 2012) together with existing landmass connections and seed dispersal by frugivores (Kitamura et al. 2002) could explain the extended distribution of this group of species. However, establishing species distributions is challenging in this large genus, owing to the different taxonomic traditions followed in different countries resulting in over-publication of taxon names, taxonomic misidentifications due to dioecy (necessitating availability of both the sex forms for correct determination), fragile and night-blooming flowers (hence difficult to collect, preserve and study, esp. corolla characters), dissimilar calyx lobe nature of pistillate and staminate flowers (in some species), different juvenile morphology and heterophylly (Rugayah 1999). Specimens maintained in herbaria are often inadequate for identification, as they are too fragmentary or poorly presented to derive specific characters. This necessitates the need for extensive field studies and resultant understanding on the biology and phenology of species in a holistic manner.

Cucurbitaceae in general and *Trichosanthes* in particular, are well studied in southeast Asia and adjoining China, as evidenced from many recent studies (for example, Rugayah 1999, Duyfjes & Pruesapan 2004, Huang & Jeffrey 2011, De Wilde & Duyfjes 2010, 2011), with an exception of Myanmar. Important references pertaining to Indian *Trichosanthes* in the current context include Chakravarty (1959, 1982), Jeffrey (1980, 1982), Renner & Pandey (2013), Pradheep et al. (2015) and Pandey et al. (2016). With the family *Cucurbitaceae* yet to be treated in the on-going Flora of India project of the Botanical Survey of India, there is no obvious revisionary work existing in India since 1982. This has resulted in many plausible taxonomic and nomenclatural confusions, which have been perpetuated since then. Here we report one new taxon, new distribution records of three *Trichosanthes* taxa for India, and provide taxonomic and nomenclatural notes on *T. khasiana* based on field observations, collected specimens and data from herbaria specimens.

MATERIALS AND METHODS

Since 2009, field studies on *Trichosanthes* species were carried out through 23 trips in almost all parts of India, with a special focus on northeastern India. Visits were made to various herbaria: ASSAM, BSD, BSHC, BSIS, BSJO, CAL, CUH, DD, KASH, LWG, MH, NEHU, NHCP, PBL, PCM and RHT (abbreviations as per Thiers continuously updated; accessed 7 June 2020), to study herbarium specimens including the types. This was supplemented with the study of the geographic occurrence data of the species from the Global Biodiversity Information Facility (GBIF) and online herbaria of A, B, BM, BR, E, G, GH, HBG,

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HIFB, FRLHT, IIIM, JCB, K, KFRI, L, LINN, MO, NY, P, PE and RPRC (abbreviations as per Thiers continuously updated; accessed 7 June 2020). All the specimens cited here were either seen as physical specimens or virtually through high quality scans. Images/pictures in social websites Flickr (www.flickr.com/ last accessed 05 December 2019), Flowers of India (http://www.flowersofindia.net/ last accessed 05 December 2019), efloraofindia - google groups (https://groups.google.com/forum/#!forum/indiantreepix last accessed 05 November 2019), Plant Photo Bank of China (http://ppbc.iplant.cn/ last accessed 05 November 2019) and Plant Illustrations (www.plantillustrations.org/ last accessed 05 November 2019) were also consulted (after scrutiny) to understand the range extension and variation in the taxa concerned. Above sources have helped matching collected plant material at a wide geographic level to avoid erroneous description of unwarranted new taxa. While herbarium vouchers collected during field and experimental studies are deposited in the National Herbarium of Cultivated Plants (NHCP) at ICAR-National Bureau of Plant Genetic Resources (ICAR-NBPGR), New Delhi, the germplasm collections are being conserved in the form of (live) seeds in the National Genebank at ICAR-NBPGR, New Delhi. All the morphological evidences, phytogeographic principles and nomenclatural practices were utilised to arrive at the conclusion.

NEW TAXON

Trichosanthes dunniana H.Lév. subsp. ***clarkei*** K.Pradheep, *subsp. nov*. — Fig. 1; Map 1

Similar to *T. dunniana* H.Lév. subsp. *dunniana*, but differs in greenish colour of bracts and calyces (vs red in subsp. *dunniana*), longer pedicels of staminate flowers (4–7 mm vs c. 2 mm in subsp. *dunniana*), shorter calyx lobes (5–6 mm vs c. 9 mm in subsp. *dunniana*), white staminate and pistillate flowers (vs reddish in subsp. *dunniana*). — Type: *K. Pradheep 2741* (holo CAL; iso DD, NHCP), India, Sikkim, East Sikkim District, Radong, near Ranipool, N27.27 E88.58, alt. 750 m, fl. 12 Aug. 2018 (♂ fl).

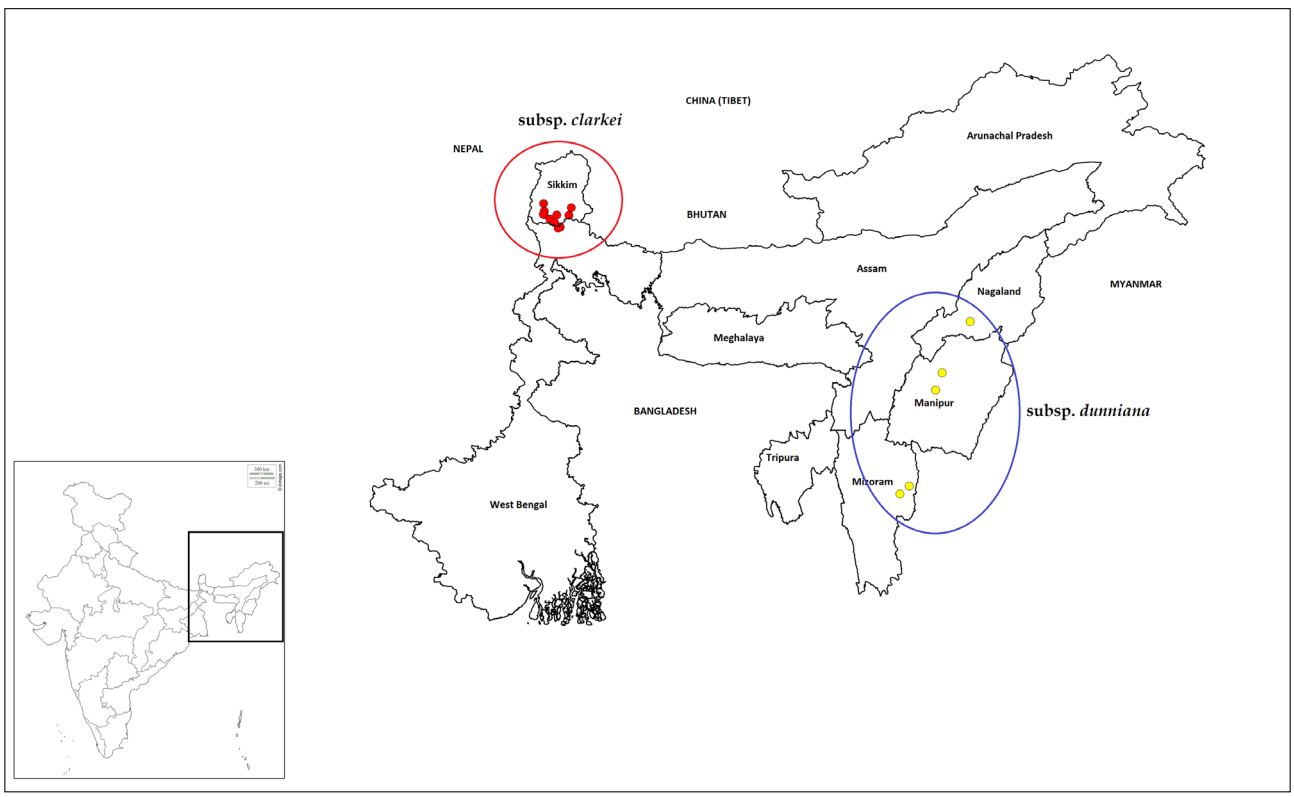
Etymology. The epithet 'clarkei' is in honour of C.B. Clarke, who contributed immensely to the understanding of Indian cucurbits.

Medium-sized perennial dioecious climber, to 10 m long. *Stems* slender, purplish, sulcate-striate, glabrous; probract subentire, broadly ovate, 2–4 by 3–4 mm, punctate; cystoliths obvious; tendrils 2-fid, pinkish tinged. *Leaves*: petiole 4–5 cm long; lamina ovate-orbicular in outline, 5(–7), deeply lobed to 4/5th, 8–15 by 7–12 cm, glabrous, membranous, scabrous, base cordate, central lobe ± elliptic, narrowed at base, margin subentire to remotely serrate, apex acuminate, upper surface dark green, lower whitish, main nerves (3–)5 radiating from petiole, glands 2–5, large, along the main nerves, 1–1.5 mm diam. *Staminate racemes* 12–18 cm long, shorter than or equal to corresponding leaves, 5–8-flowered, peduncle 5–6 cm long, glabrescent; bracts persistent, ovate or obovate, 20–25 by c. 20 mm, green, cucullate, glands many, dark green, c. 1 mm diam, margin serrate-lacerate. *Staminate flowers*: pedicel 4–7 mm long; calyx tube 1.8–2.3 cm long, widening from half-way to throat, there c. 8 mm wide, lobes ovate-triangular, 5–6 by c. 2 mm, green, often purple tinged, margin entire; corolla lobes clavate, c. 10 by 10 mm, white, frills 1.2–2 cm long. *Pistillate flowers*: pedicel 1–1.5 cm long; ovary ovate, more often grooved longitudinally, stigma 3-lobed, conspicuous. *Fruits* ovoid, 5–8.5 by 4–6.5 cm, pericarp 5–10 mm thick, orange-red, pulp greenish black. *Seeds* brownish, tumid, 50–65, slightly compressed, ovoid-ellipsoid, 10–12 by 5–7 by 3–5 mm, rounded at ends.

Distribution — Endemic to North-eastern India (Sikkim, northern West Bengal).

Habitat & Ecology — Common in Sikkim, at 300–1500 m altitude. Staminate plants are dominating in natural populations with an approximate sex ratio of 10–15 : 1. Flowering: July to September; fruiting: October, November.

Additional specimens. India, **Sikkim**, Sikkim Terai, between Goreedora and Kuprail, 30 Apr. 1868, *S. Kurz s.n.* (CAL181081); 4500 ft, 17 June 1874, *G. King 912* (P06393537); East Sikkim District, Tadung, 3000 ft, 19 Sept. 1968, *C. Majumdar 532* (CAL); East Sikkim District, Martham Thanka, 1363 m, 17 Oct. 2012, *K. Pradheep & P.K. Singh 2713* (NHCP); East Sikkim District, Radong, near Ranipool, 750 m, 12 Aug. 2018, *K. Pradheep 2742* (NHCP); East Sikkim District, Kokaley, 14 Aug. 2018, *K. Pradheep 2743* (NHCP); South Sikkim District, Temi, 1479 m, 18 Oct. 2012, *K. Pradheep & P.K. Singh 2716* (NHCP); West Sikkim District, Middle Geyzing, 1070 m, 19



Map 1 Distribution of *Trichosanthes dunniana* H.Lév. subsp. *clarkei* K.Pradheep and *T. dunniana* H.Lév. subsp. *dunniana* in north-east India.

Fig. 1 *Trichosanthes dunniana* H.Lév. subsp. *clarkei* K.Pradheep. a. Pistilalte flowering twig; b. pistillate flower; c. staminate flower; d. staminate flowering twig; e. twig with immature fruit; f. twig with ripe fruit (inset: seeds). — Photos by K. Pradheep.

Oct. 2012 (living collection IC597012 at NBPGR), *K. Pradheep & P.K. Singh 2717* (NHCP). – **West Bengal**, Darjeeling District, Punkabari, 5000 ft, 4 Sept. 1870, *C.B. Clarke 13329* (CAL); Darjeeling District, Rungbee, 5000 ft, 23 July 1870, *C.B. Clarke 12233* (CAL); Darjeeling District, 12th mile to Kalimpong from Bagdogra, 1238 m, 12 Oct. 2012 (living collection IC614479 at NBPGR), *K. Pradheep & P.K. Singh 2715* (NHCP); Darjeeling District, Lohapool, 11 Oct. 2012, *K. Pradheep & P.K. Singh 2718* (NHCP); Darjeeling District, near Kalimpong, 11 Oct. 2012, *K. Pradheep & P.K. Singh 2719* (NHCP).

Note — The differences between the two subspecies of *T. dunniana* have been summarised in Table 1. Earlier collections of this taxon were invariably misidentified as either *T. bracteata* (Lam.) Voigt or *T. wallichiana* (Ser.) Wight. Prominence of the stigmatic lobes, bifid tendrils, claw-like corolla lobes, long pedicels of staminate flowers, and longitudinally-grooved ovaries are some field identification characters for this new taxon.

Table 1 Distinguishing features between *T. dunniana* subsp. *clarkei* and *T. dunniana* subsp. *dunniana*.

Sl. No.	Character	*Trichosanthes dunniana* subsp. *clarkei*	*Trichosanthes dunniana* subsp. *dunniana*
1	(Young) stem colour	Purplish	Greenish
2	Bract colour	Greenish	Deep-red
3	Flower: calyx lobe	Green, often purple-tinged, 5–6 mm long; tip much below the level of about-to-open bud	Pale-red, c. 9 mm long; clasp about-to-open bud
4	Flower: corolla colour (both sexes)	White	Reddish
5	Staminate flower: pedicel	4–7 mm long	c. 2 mm long

Fig. 2 *Trichosanthes dunniana* H.Lév. subsp. *dunniana* from a. Manipur and b. Mizoram (inset: seed). — c–g. *Trichosanthes khasiana* Kundu. c. Pistillate flowering twig; d. staminate flowering twig (inset: distal part of staminate flower showing dissected calyx lobes); e. pistillate flower (note the probract); f. longitudinal section of pistillate flower exposing style and stigma; g. fruits and seeds. — Photos by K. Pradheep.

NEW RECORDS

For specimens studied see Identification list-I and for germplasm collections conserved see Identification list-II

1. *Trichosanthes dunniana* H.Lév. subsp. ***dunniana*** — Fig. 2a, b; Map 1

Trichosanthes dunniana H.Lév. (1911) 148; S.K.Chen (1995) 358; Duyfjes & Pruesapan (2004) 85; W.J.de Wilde & Duyfjes (2008) 518; Lu Q.Huang & C.Jeffrey (2011) 42. — Type: *J. Esquirol 726* (holo E; iso K), China, Guizhou, Tchen-Fong, 18 July 1905.
Trichosanthes prazeri Kundu (1943) 378. — Type: *J.C. Prazer s.n.* (holo CAL0000015110), Upper Myanmar, Khoni, May 1888.

Medium-sized dioecious climber. *Stems* sulcate-striate, glabrous; probract subentire, broadly ovate, 2–4 by 3–4 mm, punctate; cystoliths obvious; tendrils 2- or 3-fid. *Leaves*: petiole 4–5 cm long; lamina ovate-orbicular in outline, 5(–7)-deeply lobed, 8–15 by 7–12 cm, glabrous, membranous, scabrous, base cordate, central lobe elliptic-obovate, narrowed at base, margin coarsely serrate-dentate, apex cuspidate-acuminate, glands 2–5, large, close to the nerve axils towards the blade base, 1–1.5 mm diam. *Staminate racemes* small, about 10-flowered, glabrescent; bracts persistent, obovate, 20–25 by c. 20 mm, glands few, c. 1 mm diam, margin serrate-laciniate. *Staminate* and *pistillate flowers* not seen. *Fruits*: pedicel 1–2 cm long; ovoid-ellipsoid, 5–9 by 4–7 cm, pericarp 5–10 mm thick, orange-red, pulp greenish black. *Seeds* brownish, slightly compressed, ovoid-ellipsoid, 10–12 by 5–7 by 3–5 mm, rounded at lateral sides.

Distribution — India (Manipur, Mizoram, Nagaland), China, Myanmar, Thailand and Vietnam.

Habitat & Ecology — Rocky places, forest openings, along roadsides, thickets and stream banks at 600–1700 m altitude. Flowering: July to September; fruiting: October, November.

Note — Jeffrey (1982) synonymised an altogether different species *T. majuscula* (C.B.Clarke) Kundu (described from Khasi Hills of Meghalaya), under this species, therefore reported its occurrence from India. However, *T. majuscula* is easily distinguished from *T. dunniana* by the 3–5-lobed larger leaves (15–20 by 15–20 cm) with lobes measuring not more than 2/3rd depth towards base, ovate-elongate fruits and compressed flat seeds which are belted at the middle. Earlier collections of *T. dunniana* from India were invariably misidentified as either *T. bracteata* or *T. wallichiana*.

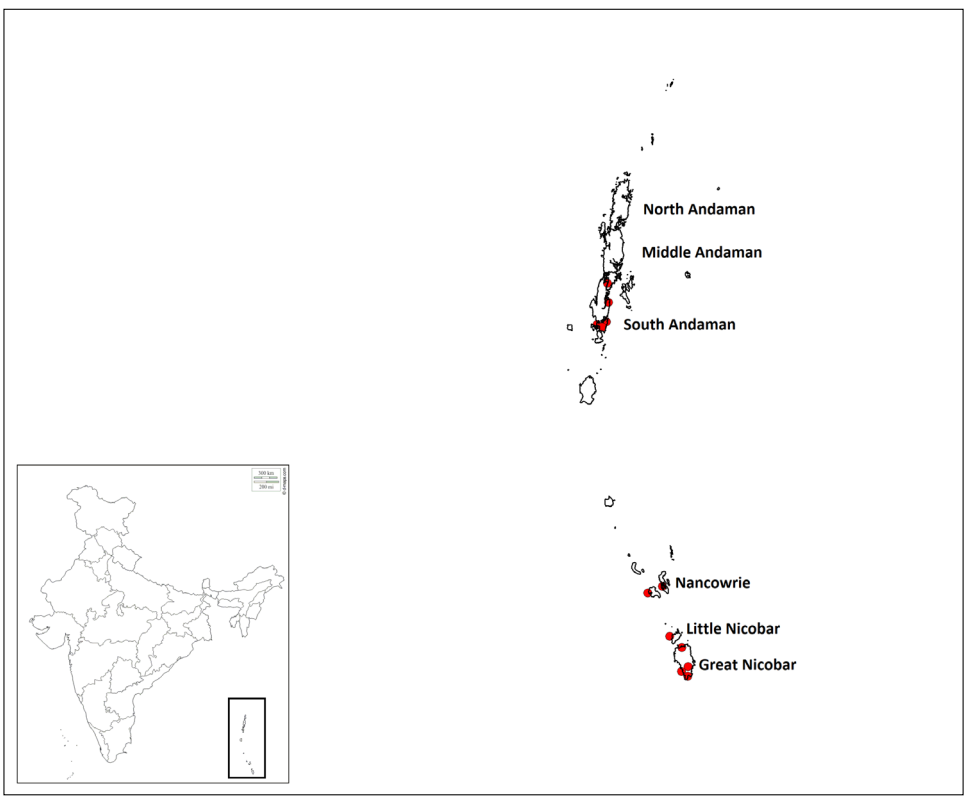
2. *Trichosanthes tricuspidata* Lour. — Fig. 3f–h; Map 2

Trichosanthes tricuspidata Lour. (1790) 723; Duyfjes & Pruesapan (2004) 98; W.J.de Wilde & Duyfjes (2008) 535; (2010) 308; Lu Q.Huang & C.Jeffrey (2011) 43. — Neotype (designated by Keraudren-Aymonin 1975): *J. & M.S. Clemens 3267* (neo P; isoneo BM), Vietnam, Quang Nam, Da Nang, May–July 1927.

Dioecious perennial climber, 5–15 m long. *Stems* glabrescent at early stage, 2–4 mm diam; young shoots reddish or green, striate; probracts (broadly) obovate, 5–7 by 3–5 mm, margin entire, with green glands; tendrils 2- or 3-branched. *Leaves*: petiole 4–6 cm long; blade broadly ovate or orbicular in outline, 7–10 by 5.5–9.5 cm, usually 3-cusped, cusps divaricate/divergent, membranous, (sub)glabrous adaxially, glabrous abaxially, the central cusp ± triangular, to 7 cm long, the apex of all cusps acuminate(-caudate), the margin (sub)entire or wavy with small dentations, glands few, very small. *Staminate inflorescence* 8–12(–15) cm long, peduncle 4–6 cm long, c. 2 mm thick; rachis with 5–10 flowers; bracts obovate-elliptic, 2–3.2 by 1.5–2 cm, with conspicuous glands, obscurely dentate, 3–5 mm deep. *Staminate* and *pistillate flowers* not seen. *Fruits* ± ovoid, 5–5.5 by c. 4 cm; pedicel 1–2 cm long; exocarp bright red, smooth; mesocarp yellow, 8–9 mm thick; pulp greenish black. *Seeds* dark brown, compressed, obovate-elliptic or oblong, c. 8 by 4.5–5 by c. 2 mm, often with inconspicuous longitudinal midline, edge almost rounded, entire.

Distribution — Bangladesh, China, India (Andaman & Nicobar Islands), Myanmar, Thailand, Vietnam, West Malesia.

Habitat & Ecology — Roadside thickets, along forest openings; over rocks; at 0–350 m altitude. Flowering: May to September; fruiting: October to January.



Map 2 Distribution of *Trichosanthes tricuspidata* Lour. in Andaman & Nicobar Islands, India.

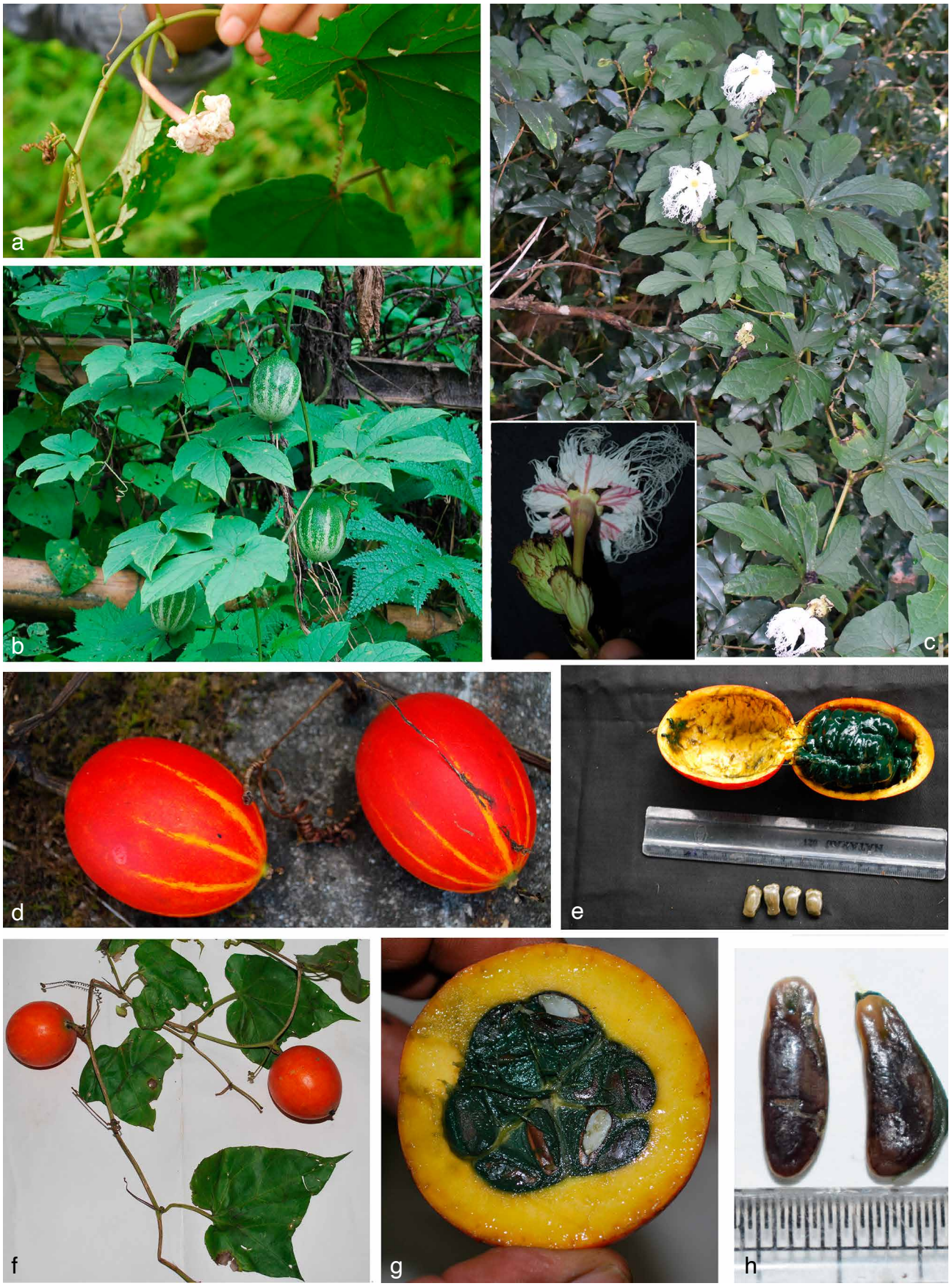


Fig. 3 *Trichosanthes wallichiana* (Ser.) Wight subsp. *subrosea* (C.Y.Cheng & C.H.Yueh) K.Pradheep & K.J.John. a. Pistillate flowering twig (note long probract); b. twig with immature fruit; c. staminate flowering twig (inset: distal part of staminate inflorescence showing fully-opened staminate flower); d. ripe fruit; e. longitudinal section of ripe fruit and seeds. — f–h. *Trichosanthes tricuspidata* Lour. f. Twig with ripe fruit; g. cross section of fruit; h. seeds. — Photos by K. Pradheep.

Table 2 Distinguishing features between *T. tricuspidata* and *T. bracteata*.

Sl. No.	Character	*Trichosanthes tricuspidata*	*Trichosanthes bracteata*
1	Leaf-lobing	Usually 3 cusps; cusps divaricate/divergent; basal lobes insignificant	3–5(–7) lobes; basal lobes prominent
2	Leaf upper surface	(Sub)glabrous	Scabrid
3	Leaf margin	Entire or wavy with small dentations	Prominently dentate, never entire
4	Staminate inflorescence length (cm)	8–12(–15)	(10–)12–23(–28)
5	Male bracts	Obscurely dentate	Serrate-laciniate
6	Pistillate calyx lobes	Often lacerate (based on herbarium specimens)	Entire

Notes — 1. Most of the Indian literature from 1980s onwards follows Jeffrey (1980), who treated *T. bracteata* as synonym of *T. tricuspidata*, therefore the name *T. tricuspidata* was invariably used in place of *T. bracteata*. On the other hand, we consider them as distinct species in accordance with King (1898: 29), Rugayah & De Wilde (1997) and Pandey et al. (2016). However, we disagree with Pandey et al. (2016), who stated that India (incl. Andaman & Nicobar islands) has only *T. bracteata*, while *T. tricuspidata* occurs in Indochina and Malesia. Our study revealed that *T. tricuspidata* occurs in the Andaman & Nicobar islands. Renner & Pandey (2013) mentioned a doubtful distribution status of this species for West Bengal, based on *T. tricuspidata* var. *strigosa* Sunit Mitra & S.Bandyop. While the holotype of the latter (*S. Bandyopadhyay 2904*) was untraceable at CAL, its reported distribution as 'throughout India' revealed that this taxon corresponds to *T. bracteata* only.

2. The distinguishing features between *T. bracteata* and *T. tricuspidata* are given in Table 2. Pandey et al. (2016) distinguished *T. bracteata* from *T. tricuspidata* by using six characters. The characters, margin of pistillate calyx lobes with side lobes, (often) ellipsoid-shaped fruits, fruits with 10-longitudinal paler streaks and marginate seeds mentioned for *T. bracteata* are found to be untenable in our study. Ellipsoid fruits and streaks over the fruits were never met with *T. bracteata*, which is always (sub)globose, while converse of other characters are also found in the highly variable *T. bracteata*.

3. At juvenile stage, *T. tricuspidata* usually possesses 5–7-deeply lobed leaves, later on, gradually 3-lobed towards mature stage of plant growth.

4. After observing parallel variation in the contemporary polymorphic species *T. bracteata*, we refrain from further classifying the variability within *T. tricuspidata*; as the two subsp. (subsp. *tricuspidata* and subsp. *rotundata* W.J.de Wilde & Duyfjes) have overlapping distribution patterns and no good characters to distinguish them. Nevertheless, our collections match more towards subsp. *rotundata* owing to the round-edged seeds.

3. *Trichosanthes wallichiana* (Ser.) Wight subsp. ***subrosea*** (C.Y.Cheng & C.H.Yueh) K.Pradheep & K.J.John, *comb. nov.* — Fig. 3a–e; Map 3

Trichosanthes subrosea C.Y.Cheng & C.H.Yueh in C.H.Yueh & C.Y.Cheng (1980) 349. — Type: *T.T. Yu 19429* (holo PE; iso A, E, PE), China, Yunnan, Kiukiang Valley, Chiengen, 1700 m, 26 July 1938

Trichosanthes grandibracteata Kurz (1877) 98, 99. — Type: not indicated, untraceable. See note 2.

Trichosanthes tridentata C.Y.Cheng & C.H.Yueh in C.H.Yueh & C.Y.Cheng (1980) 349, syn. nov. — Type: *C.Y. Cheng 73-04* (holo Paking Med. Col. conserv.; iso: K), China, Yunnan, Luxi Xian.

Trichosanthes wallichiana auct. non (Ser.) Wight: Grierson & D.G.Long (1991) 266; S.K.Chen (1995) 357; Lu Q.Huang & C.Jeffrey (2011) 41.

Medium, perennial, dioecious climber. *Stems* glabrous, sulcate-striate, 4-angled; shoot pinkish or green with a ring of pink hispid hairs around the node; probract caducous, rarely absent, broad lanceolate or spathulate, 2–3 cm long, margin pinkish bordered, laxly serrate, venation reticulate; tendrils 3-fid. *Leaves*: petiole 6–10 cm long, striate, often with short white or pink hispid hairs; blade cordate or suborbicular in outline, 15–20 cm long, thinly papery, 5–7-lobed to 4/5th, each lobe irregularly partite or sinuate; central lobe subrhombic or elliptic, to 18 cm long, abaxially pale green, adaxially deep green, both surfaces hispidose, margin dentate; glands small, mostly in leaf base. *Staminate inflorescences* occasionally in pairs, one early, single flowered, and the other bearing a raceme; raceme (20–)25–35(–38) cm long, striate, 4-angled, 10–15-flowered, peduncle 15–25 cm long, flower bud pinkish, clasped by calyx lobes, flowers fragrant; bract obovate, 2.5–3 cm long, pale green, cucullate, glabrous, apex obtuse, basal half subentire, distal half irregularly lacerate, glands few. *Staminate flowers*: calyx segments narrowly lanceolate, (1.2–)1.5–2 by c. 0.5 cm, entire; calyx tube 7–8 cm long, striate, widens at 2/3rd towards the throat, hairs short, pink, glandular; corolla inner core yellowish, velvety; corolla lobes c. 2 by 1.5 cm, apex truncate, deep pink outside and pale pink inside or rarely snow-white, frills up to 4 cm long, thread-like, branching; stamens short of corolla rim, connate, c. 1 cm long, filament c. 0.5 cm long. *Pistillate flowers*: pedicel 1.5–2 cm long, often covered with pink glandular hairs; calyx tube c. 4 by 0.2–0.3 cm, gradually widening towards the throat, calyx and corolla as in staminate flower; ovary ovate-clavate, 1–1.2 by 0.35–0.4 cm, pink glandular hairy; style c. 2.5 cm long, stigma 3-lobed. *Fruits*: pedicel stout, 2–3(–4.5) cm long; exocarp orange-red, subglobose, rarely base slightly rostrate, 6–8.5 by 5.5–7.5 cm; pulp greenish black. *Seeds* greenish brown, 4-angled, 11–15 by 7–10 by 2.4–3 mm, lateral sides angular, prominently tridentate at the distal end.

Distribution — China (Xizang, Yunnan, ?Guangxi), India (Arunachal Pradesh, Assam, Meghalaya, Nagaland and Manipur), Bhutan, Myanmar.

Habitat — Common amidst grasses on roadsides, bamboo forests and thickets at 900–1700 m altitude. Flowering: July, August; fruiting: September to November.

Notes — 1. The two subspecies of *T. wallichiana* differ mainly in seed characters, which have been summarised in Table 3. The importance of seed characters in distinguishing taxa in *Trichosanthes* is also stressed by Rugayah (1999) and Duyfjes & Pruesapan (2004). Since the type locality of *T. wallichiana* is from Nepal, collections from Nepal and adjoining Sikkim, Darjeeling and Kalimpong areas (of India), all exhibiting a distinct seed morphology, form the typical subspecies. While other areas, engrossing vast areas of northeast India, Myanmar, Bhutan and southwest China represent subsp. *subrosea*. Earlier reports of *T. wallichiana* subsp. *wallichiana* occurring in areas of India other than the northeast (Chakravarty 1959, 1982, Renner & Pandey 2013), are based on misidentification of the variable *T. bracteata*.

2. In the protologue of *T. grandibracteata* (Kurz 1877: 98, 99), Kurz did not cite any specific specimen or gathering but only the locality: "Ava, along the Irrawadi northwards from Mandalay; also Khakyen-hills east of Bhamo". As there are no *Trichosanthes* collections from these areas, either collected by Kurz or

Table 3 Distinguishing features between *T. wallichiana* subsp. *subrosea* and *T. wallichiana* subsp. *wallichiana.*

Sl. No.	Character	*Trichosanthes wallichiana* subsp. *subrosea*	*Trichosanthes wallichiana* subsp. *wallichiana*
1	Indumentum of pitillate flowers	Often covered with pink glandular hairs, especially on ovary	Strictly glabrous
2	Indumentum of petiole	Often covered with pink or white hispid hairs	Strictly glabrous
3	Seed size (mm)	11–15 by 7–10 by 2.4–3	15–18 by 9–11 by 3–3.8
4	Seed colour	Greenish brown	Chocolate-brown
5	Nature of seed edge	Angled with prominent 3-dents at the distal end	Rounded

earlier botanists, available in any of the herbaria, the name is difficult to interpret. Huang & Jeffrey (2011) synonymised *T. tridentata* with *T. rubriflos* Thorel ex Cayla. However, the isotype of *T. tridentata* (at K) has greenish brown angular seeds with 3 dents at the distal end, and these characters are typical of subsp. *subrosea*.

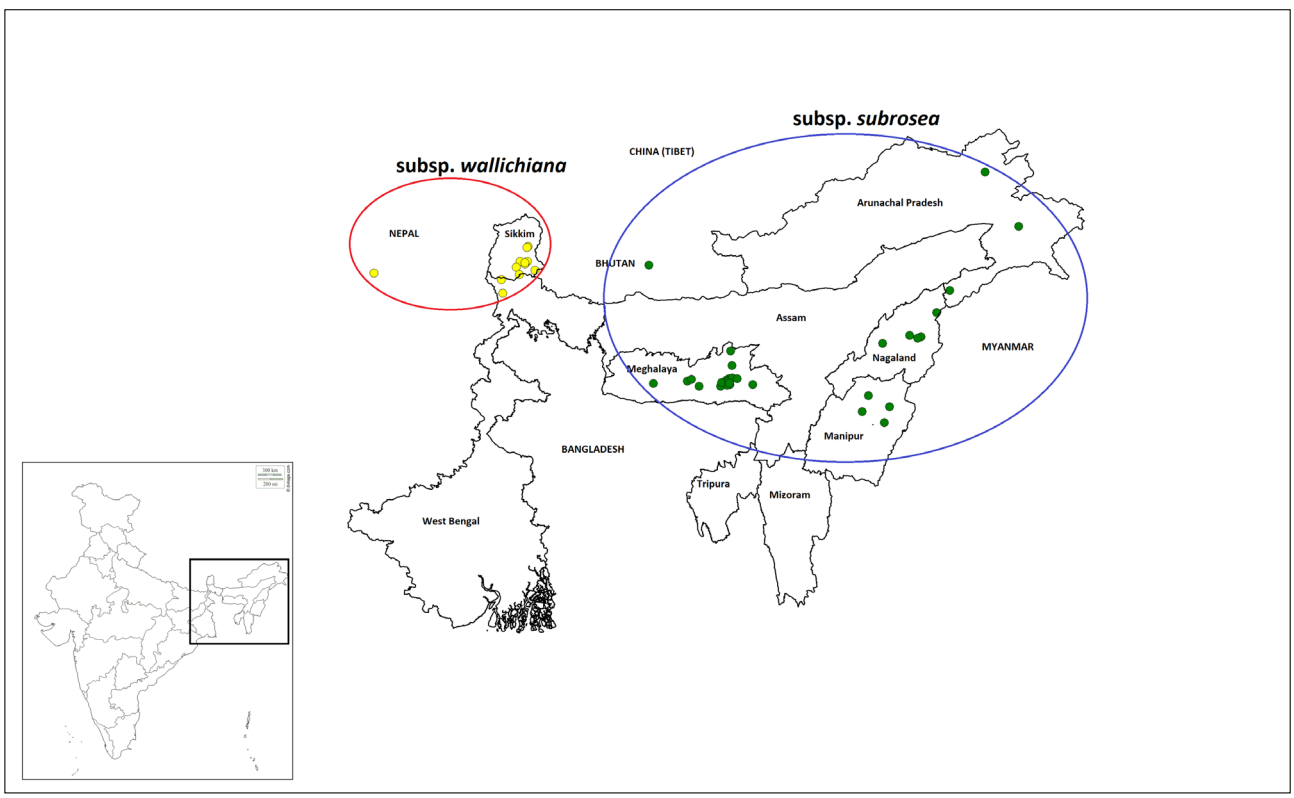
3. In Myanmar, *T. wallichiana* subsp. *subrosea* was collected from Seinghku Valley by F. Kingdon-Ward (http://bioportal.naturalis.nl/multimedia/L.4288886_0379698312/term=trichosanthes+subrosea&from=0 last accessed 08 December 2019), which adjoins the Indian state of Arunachal Pradesh. Presence of this taxon in Bhutan is established by the herbarium specimen housed at CAL (CAL0000060567) and on the authority of Grierson & Long (1991), who described the seeds of *T. wallichiana* as 'squarish, 15–17 mm, 7 mm thick'. In the absence of any obvious dissimilarity in mountain landscapes between Sikkim and Bhutan, occurrence of subsp. *wallichiana* further in the western part of Bhutan and the midway areas of Tibet (China) is in expected lines. Charles Jeffrey annotated the specimen GH00031967 (https://s3.amazonaws.com/huhwebimages/7DAD1626178C4C0/type/full/31967.jpg last accessed 09 September 2019) as an isotype of *T. khasiana*; however, its deeply lobed leaves with sinuate margin, staminate inflorescence with very long peduncle, flowers crowding at the top, and obovate bracts with subentire basal part at once identify it as subsp. *subrosea*. Pistillate flower characters of this taxon have been described for the first time.

4. Some of the field characters include the medium-sized (*not* robust) climbing nature, presence of a ring of pink hairs surrounding the nodes, staminate flowers and bracts congested at the top of the inflorescences, green-yellow bracts that never open wide, and the plant drying up very quickly at the time of cessation of fruiting. The tridentate nature of the seeds becomes increasingly strong towards the east longitude.

5. Jeffrey (1980) mentioned the fruits as ellipsoid, however, they are actually (sub)globose, sometimes with a slightly rostrate end. In the Flora of China, Huang & Jeffrey (2011) wrongly reported the flower colour of *T. wallichiana* as white, whereas it is actually pink.

NOTE ON *TRICHOSANTHES KHASIANA*

Renner & Pandey (2013) placed *T. khasiana* Kundu as an accepted species based on Jeffrey (1982) and De Boer & Thulin (2012) and cited its type as a staminate specimen (http://www.kew.org/herbcatimg/505009.jpg) without attributing a reason. In fact, there are two syntypes, a staminate (*J.D. Hooker & T. Thomson s.n.*) and a pistillate specimen (*J.D. Hooker & T. Thomson 617*) housed at K (annotated by Kundu), which represent two different taxa. The type that most closely matches



Map 3 Distribution of *Trichosanthes wallichiana* (Ser.) Wight subsp. *wallichiana* and *T. wallichiana* (Ser.) Wight subsp. *subrosea* (C.Y.Cheng & C.H.Yueh) K.Pradheep & K.J.John in South Asia.

Fig. 4 Designated lectotype of *T. khasiana* Kundu (http://specimens.kew.org/herbarium/K000102019) (Reproduced with the kind permission of authorities of Royal Botanic Gardens (K), Kew).

the original description or diagnosis is the pistillate one (Fig. 4), hence the name *T. khasiana* is lectotypified here (ICN Art. 9.3 and 9.14, Turland et al. 2018). The staminate specimen is a yet-to-be described taxon of *Trichosanthes*.

Trichosanthes khasiana Kundu — Fig. 2c–g; Map 4

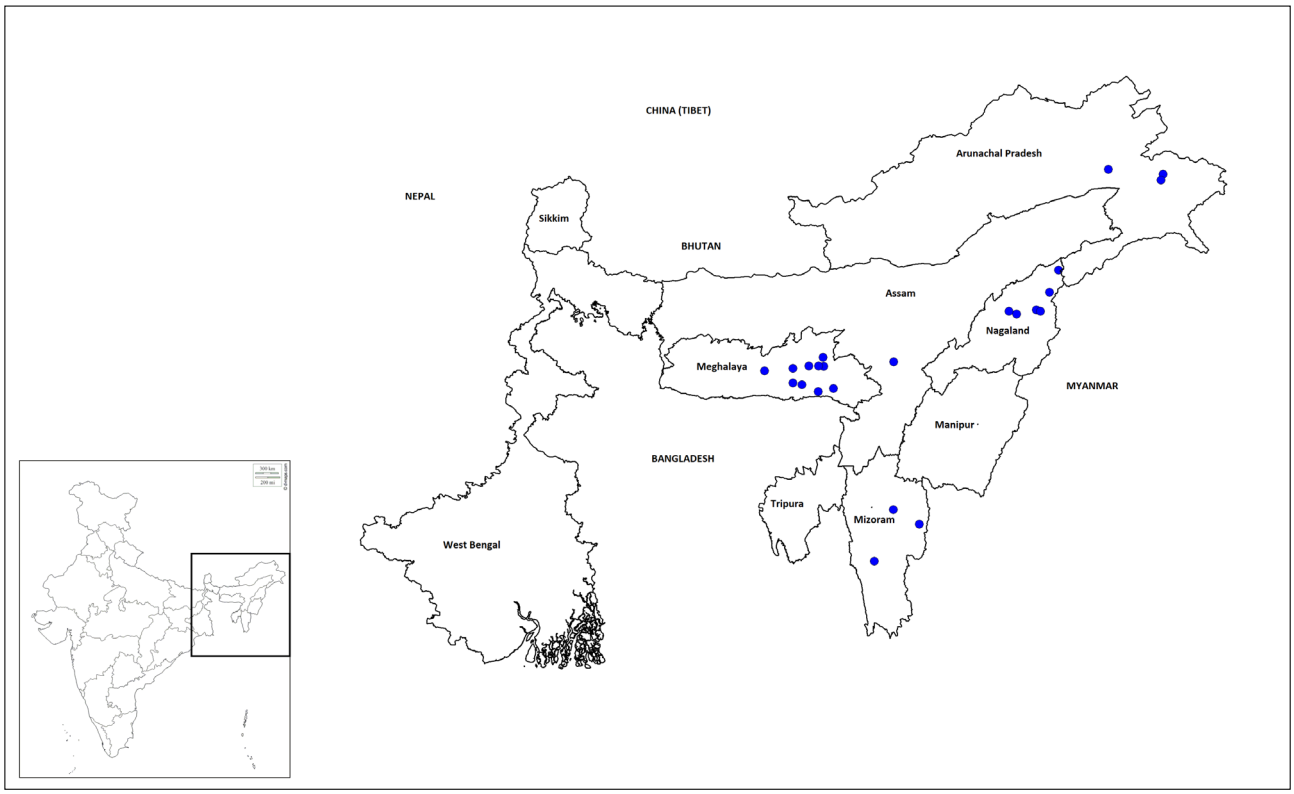
Trichosanthes khasiana Kundu (1939) 11. — Lectotype (designated here): *J.D. Hooker & T. Thomson 617* (lecto K000102019, http://www.kew.org/herbcatimg/505008.jpg), India, Meghalaya, Khasia Hills. — Fig. 4.

Trichosanthes inthanonensis Duyfjes & Pruesapan (2004) 86; W.J. deWilde & Duyfjes (2008) 520; (2011) 271. — Type: *P. Phonsena et al. 3930* (holo BKF; iso L), Thailand, Chiang Mai, Doi Inthanon NP, 1330 m, 16 Sept. 2003.

Trichosanthes lepiniana auct. non (Naudin) Cogn.: Kundu p.p. (1943) 380 (only Naga Hills); S.K.Chen (1986) 226; (1995) 356; Lu Q.Huang & C.Jeffrey (2011) 41.

Medium-sized perennial, dioecious climber. *Stems* glabrous, purple-red-tinged, deeply striate, slightly zigzag; young twigs purplish red; probract ovate-elliptic, 5–8 by 3–4 mm, margin subentire, glands 2 or 3, pink or green, variable in size; tendrils pinkish, glabrous, 3-fid. *Leaves*: petiole (5–)7–8 cm, furrowed, striate; lamina suborbicular, 13–17(–20) by 12–17(–19) cm, chartaceous, glabrescent, minutely hairy on both sides, strongly 3-lobed up to 1/3 to middle, with small subtle side basal lobes, each lobe apically acuminate, nerve-tipped, ± dentate-serrate, upper surface green to dark green, white-hairy along nerves, lower surface pale green, nerves pinkish, glands small, green or pinkish, 8 or 9, mostly at base. *Staminate inflorescence* 15–20 cm long, rarely occurring with a co-axillary flower; peduncle (5–)7–10(–12) cm long, glabrous, robust, striate, sometimes twisted; rachis slightly zigzag; bracts cucullate, suborbicular, 3–3.5(–3.8) by 3–3.5 cm, laciniate, glands 2 or 3; opening buds (dark) greenish. *Staminate flowers*: pedicels c. 5 mm long; calyx lobes laciniate, irregularly broader at base, c. 1.2 by 0.3 cm; corolla lobes whitish, anthers 9–10 mm long. *Pistillate flowers*: pedicel 3–3.5 cm long, c. 2 mm wide; calyx lobe entire, triangular, 0.8–0.9 cm long, c. 0.25 cm wide at base; calyx tube brownish red, 3.5–4 cm long, slightly crooked, with two projections; ovary ovate, 2–2.3 cm long, glabrous, style 3–3.5 cm long; stigmas 3, lobes completely free, greenish. *Fruits*: pedicel 3–6 cm long; exocarp turbinate-ovate, 5–8(–10) by 4–7(–8) cm, red, with acuminate tip, distal umbo 4–6 mm long, pericarp 10(–12) mm thick, pulp greenish black. *Seeds* 30–50, brownish, compressed, irregularly elliptic, 12–15 by 7–10 by c. 2.5 mm, apex subtruncate, base cuneate, the edge ± angular, marginate.

Distribution — China, India (Arunachal Pradesh, Assam, Meghalaya, Mizoram, Nagaland), Laos and Thailand; most probably in Myanmar also.



Map 4 Distribution of *Trichosanthes khasiana* Kundu in north-east India.

Habitat & Ecology — Wet places in forest openings; at 900–1700 m altitude. Flowering: May to July; fruiting: August to November.

Note — Earlier collections from NE India were mostly misidentified as *T. lepiniana*. A closer look at the syntypes of *T. lepiniana* (at BM, P) indicated that it is not convincingly distinguishable from the highly variable *T. bracteata*. Clarke (1879) did not mention *T. lepiniana* (originally described as *Involucraria lepiniana* Naudin in 1868 from Pondicherry, South India) for India, though Cogniaux (1881) reported it from the Eastern Himalayas. Thereafter, *T. lepiniana* was reported from Naga Hills (now Nagaland) (Kundu 1943). All the Chinese specimens/material kept under the name *T. lepiniana* by Huang & Jeffrey (2011), and later by De Wilde & Duyfjes (2011) as *T. inthanonensis*, belong to this species. Critical study of protologue and all the virtual herbarium specimens (including the isotype) of *T. inthanonensis* at L, indicates that its distinction from *T. khasiana* is untenable. *Trichosanthes khasiana* is distinguished from *T. bracteata* by pinkish leaf nerves (at base), less lacerate bracts, long slender pistillate flowers, ovoid fruits with narrow short beak, and broad obovate seeds. Its field identification characters include glabrous lower leaf surface, long pedicel of pistillate flower, fruits with typical apical umbo, and uniformly flat, broad obovate seeds. Also, often 3-lobed tender leaves and pigmented nerves in lower leaf surface were noticed.

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IDENTIFICATION LIST - I
(herbarium specimens)

1 = *T. dunniana* H.Lév. subsp. *dunniana*
2 = *T. khasiana* Kundu
3 = *T. tricuspidata* Lour.
4 = *T. wallichiana* (Ser.) Wight subsp. *subrosea* (C.Y.Cheng & C.H.Yueh) K.Pradheep & K.J.John

SL Abbas 102745 (ASSAM): 1.
SN Bal 174 (CAL): 4 – NP Balakrishnan 42650: 2; 42935: 4; 42938: 4; 46907: 4 (all at ASSAM) – GH Bhaumik 60529 (ASSAM): 2 – NL Bor 6393: 4; 18122: 4 (both at DD).
CY Cheng 73-04 (K): 4 – J Clemens & MS Clemens 3267 (BM, P): 3 – WG Craib 214: 2; 517: 2 (both at CAL).
DB Deb 29247: 4; 29276: 4 (both at ASSAM) – GK Deka 10128 (CAL): 2 – H Deka 34638 (ASSAM): 4.
J Esquirol 726 (E, K): 1
Gustavmann 232 (DD): 4.
K Haridasan 9870 (NEHU): 4 – MA Hock 133 (CAL): 1 – JD Hooker & T Thomson 617 (K): 2 – D Hooper 34686 (CAL): 2 – AM Huq 10209 (US): 3.
PC Kanjilal 9143 (ASSAM): 4 – F Kingdon-Ward 17740: 4; 18025: 4; 18035: 4; 18704: 4 (all at NY) – Herb. S Kurz 232 (CAL): 4.
Mukherjee 3169 (CAL): 1 – SK Mukherjee 2885 (CAL): 4.
NG Nair 4841 (PBL): 3.
K Pradheep 2714: 1; 2720: 1; 2734: 2; 2735: 2; 2749: 4; 2750: 4; 2753: 2; 2754: 4 (all at NHCP) – K Pradheep & K Joseph John 2475: 3; 2730: 3; 2731: 3; 2732: 3 (all at NHCP) – K Pradheep & PK Singh 2722: 4; 2728: 4; 2729: 4; 2736: 2; 2737: 2; 2738: 2; 2747: 2 (all at NHCP) – Pradheep & Soyimchitten 2724: 4; 2725: 4; 2726: 4; 2727: 4; 2739: 2; 2740: 2 (all at NHCP) – K Pradheep, K Joseph John & I Jaisankar 2755 (NHCP): 3 – K Pradheep, RS Rathi & GD Harish 2721 (NHCP): 4 – P Phonsena et al. 3930 (BKF, L): 2.
AS Rao 42541 (ASSAM): 2 – L Rasingam 17583 (PBL): 3.
G Saran et al. 68140 (LWG): 3 – SR Sharma 10234 (ASSAM): 4.
G Watt 5831 (CAL): 4.
TT Yu 19429 (A, E, PE): 2.

IDENTIFICATION LIST - II
(germplasm collections at ICAR-NBPGR, New Delhi)

1 = *T. dunniana* H.Lév. subsp. *dunniana*
2 = *T. khasiana* Kundu

JB/11-133A: 1; JB/11-144: 1; JB/11-151: 2; JB/11-153: 2.
KP/18-1 (IC628855): 2; KP/18-3 (IC628857): 2 – KP/SC-1589 (IC614467): 2; KP/SC-1614 (IC614468): 2; KP/SC-1664 (IC614470): 2.
RPH-24 (IC626251): 2.