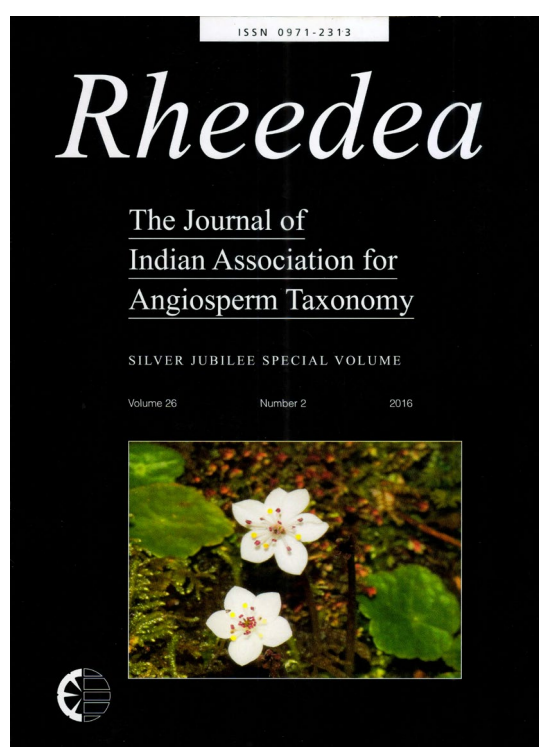




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Revision of the *Trichosanthes tricuspidata* – *bracteata* complex (Cucurbitaceae) in India

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Abstract

The correct identity and occurrence of *Trichosanthes tricuspidata* Lour. and *T. bracteata* (Lam.) Voigt in India have been revisited based on herbarium and field studies. The study concludes that *T. tricuspidata* and *T. bracteata* are two distinct species and the former does not occur in India. All the mainland Indian materials previously identified and reported as *T. tricuspidata* or *T. palmata* Roxb., belong to *T. bracteata*, and earlier reports of *T. tricuspidata* in the Andaman and Nicobar Islands represent *T. quinquangulata* A. Gray. A detailed description with illustrations and photographs of *T. bracteata* is provided for facilitating identification of the taxon.

Keywords: Cucurbitaceae, India, *Trichosanthes bracteata*, *Trichosanthes tricuspidata*

Introduction

Trichosanthes L., the largest genus in Cucurbitaceae, comprises c. 100 species, is distributed in India, Sri Lanka, China, Japan, Southeast Asia, Malesia, New Guinea, Australia, Fiji and Vanuatu (de Wilde & Duyfjes, 2010; de Boer & Thulin, 2012). The genus has been traditionally characterised to include mostly perennial, dioecious, tendrillar climbers with distinctly fringed petals and globose or egg-shaped, fleshy, bright red-coloured fruits. Recent molecular phylogenetic studies by de Boer *et al.* (2012) inferred that the long-fringed petals evolved independently in *Trichosanthes* and *Hodgsonia* Hook.f. & Thomson, and that *Trichosanthes* was monophyletic as long as *Gymnopetalum* was included in it. Therefore, *Trichosanthes* was re-circumscribed by including all the four known species of *Gymnopetalum* (de Boer *et al.*, 2012). In India, *Trichosanthes* s.l. is represented by 22 species, which are distributed in three major centres, namely Peninsula, Northeast, and Eastern Himalaya (Renner & Pandey, 2013).

Among the Indomalaysian species of *Trichosanthes*, two closely resembling species, *T. tricuspidata* Lour. and *T. bracteata* (Lam.) Voigt (based on *Modecca bracteata* Lam.), have long been confused for their true taxonomic identity and geographic distribution. In many Indian floras, the materials referable to this species complex have been treated as a single taxon under three different names: *T. tricuspidata* or *T. bracteata* or *T. palmata*

Roxb. In the present study, the authors revised the *T. tricuspidata* – *bracteata* complex and conclude that *T. tricuspidata* and *T. bracteata* are two distinct species and that the former species does not occur in India, but is restricted to south China, Vietnam, Thailand and the Malesian Islands. This study also concludes that all the Indian materials previously identified as *T. tricuspidata* belong to *T. bracteata*, of which *T. palmata* Roxb. (an illegitimate later homonym) is a heterotypic synonym.

Trichosanthes tricuspidata – *bracteata* complex

Loureiro (1790) described *Trichosanthes tricuspidata* as a new species from Cochinchina, based on his own specimen (Loureiro s.n.) that was later found lost, but now having replaced with a neotype, J. & M.S. Clemens 3267, collected from Quang Nam, Da Nang in Vietnam (Neotype, P02273742, image!; Isoneotypes, BM000884931, image! and K000742683, image!; designated by Keraudren-Aymonin, 1975). Loureiro's original description of *T. tricuspidata* reflected the following diagnostic characters: tricuspidate, multi-veined, glabrous leaves with denticulate margins; axillary inflorescence bearing white flowers; and small ovoid fruits with an acute apex.

Lamarck (1797) described *Modecca bracteata* under the natural order Passiflorae, based on a specimen collected by Pierre Sonnerat in the then "East Indies" (*P. Sonnerat* s.n.; holotype, P00307616, P-LA, image!). The English translation of Lamarck's

diagnosis of the species in French reads as: leaves palmate, serrate; racemes bracteate and axillary.

Roxburgh (1832) described *Trichosanthes palmata* from India to include perennial climbing plants that were native and run wild on forest trees and characterised by having the leaves palmately 3- to 5-lobed with sub lanceolate, acute lobes and serrate margins, the male flowers borne in racemes and the female ones solitary, and the fruits smooth, globose, attaining the size of a small orange and becoming bright red when ripe with seeds embedded in a dark green soft pulp. Two years later, Wight & Arnott (1834) considered *Modecca bracteata* Lam. as identical to Roxburgh's *Trichosanthes palmata*, but they treated *M. bracteata* as a synonym of *T. palmata* Roxb. While accepting Wight & Arnott's (1834) view, Voigt (1845), however, transferred *Modecca bracteata* to *Trichosanthes* as *T. bracteata* (Lam.) Voigt and accepted it as the correct name and reduced *T. palmata* Roxb. to its synonymy.

Despite being an illegitimate later homonym of *T. palmata* L. (Syst. Nat. 2: 1278. 1759; now treated as *Ceratosanthes palmata* (L.) Urb., Repert. Spec. Nov. Regni Veg. 15: 323. 1918: Bolivia, Guyana and Venezuela), Clarke (1879), Cooke (1903), Gamble (1919), Haines (1922) and several others continued to use *T. palmata* Roxb. as the correct name to designate the Indian materials, with *T. bracteata* as its synonym. Contrarily, Cogniaux (1881) and Chakravarty (1959, 1982) accepted *T. bracteata* as the correct name and maintained *T. palmata* Roxb. as synonymy.

Trichosanthes bracteata and *T. tricuspidata* have been considered as two distinct species distinguishable primarily by the nature of their leaves and fruits (Seringe, 1828; Cogniaux, 1881; Rugayah & Wilde, 1997). *Trichosanthes bracteata* has been diagnosed to have 3–5-lobed leaves with prominent serrate margins, and globose or subglobose fruits with a rounded apex and its surface marked by 10 longitudinal orange streaks, whereas *T. tricuspidata* has shallowly 3-lobed leaves with entire or wavy margins with small dentations, and an ovoid, acute or beaked fruits without any streaks. On the other hand, Keraudren-Aymonin (1975) in Flora of Cambodia, Laos and Vietnam made a drastic change in the concept of *T. tricuspidata* by relegating four other closely related, but distinct species, namely, *T. pubera* Blume, *T. bracteata*, *T. quinqueangulata* A. Gray and *T. lepiniana* (Naud.) Cogn. as its synonyms. Following Keraudren-Aymonin (1975), it was Jeffrey (1980) who first used the name *T. tricuspidata* s.l. to designate the Indian plants, with *T. bracteata*, *T. palmata* and *T. lepiniana*

as its synonyms. Although Jeffrey (1982) later reinstated *T. lepiniana* as a distinct species, several subsequent workers followed Jeffrey's broader concept on *T. tricuspidata* and accepted it as the correct name for this species complex (Saldanha & Rao, 1984; Haridasan & Rao, 1985; Hajra *et al.*, 1996; Philcox, 1997; Pullaiah & Chennaiah, 1997; Luqi *et al.*, 2011).

Rugayah & Wilde (1997) while revisiting the *T. tricuspidata* complex in Java concluded that *T. bracteata* was a distinct species distributed in the continental Southeast Asia, but not in Malesia and Java, and that it was distinct from *T. tricuspidata* and *T. pubera* by its globose fruit and from *T. quinqueangulata* by its incised or deeply dentate male bracts. Pollen exine characters (Pruesapan & van der Ham, 2005) and molecular phylogenetic evidences from nuclear and chloroplast DNA sequence data (de Boer *et al.*, 2012) also supported the distinction of *T. tricuspidata* and *T. bracteata* as separate species. Although recent systematic accounts on *Trichosanthes* in Thailand (Duyfjes & Pruesapan, 2004; Wilde & Duyfjes, 2008), Malesia (Wilde & Duyfjes, 2010) and Indochina (Wilde & Duyfjes, 2012) included *T. tricuspidata* as a distinct species, they did not record the occurrence of *T. bracteata* in these regions. This leads to the assumption that *T. bracteata* is not found in the mainland Southeast Asia, and all earlier reports of *T. bracteata* by Blume (1826), Gangnepain (1921), Ridley (1922), Craib (1931) and Backer (1963) probably represent *T. pubera*, *T. tricuspidata* or *T. quinqueangulata* (cf. Rugayah & Wilde, 1997; Wilde & Duyfjes, 2012). Based on the differences in the male bracts and sepals and the seed morphology, three geographical subspecies are currently recognised under *T. tricuspidata*: i) subsp. *tricuspidata*: south China, Thailand, Cambodia, Laos, Vietnam; ii) subsp. *javanica* Duyfjes & Pruesapan: southwestern Thailand and through Malesia to the Lesser Sunda Islands and the Moluccas; iii) subsp. *rotundata* W.J. de Wilde & Duyfjes: Thailand (excluding peninsular part), Laos, Vietnam (de Wilde & Duyfjes, 2012).

Thus, for more than about two centuries since their original description, *T. tricuspidata* and *T. bracteata* have been implicated with taxonomic and nomenclatural misinterpretations. The authors studied a large number of herbarium specimens of *Trichosanthes* housed in BSD, CAL, CDRI, LWG, MH, and TBGT in India as well as digital images of types and other authentic specimens accessed from the following foreign herbaria: BM, E, K, L and P. Fresh samples of *T. bracteata* were also examined in the field.

Comparative studies on the types and other authentic specimens representing all the taxa involved in the *T. tricuspidata* species complex resulted in the following findings: i) *T. tricuspidata* and *T. bracteata* are two distinct species (**Table 1**; **Figs. 1–3**); ii) All the mainland Indian materials previously identified and reported as *T. tricuspidata* belong to *T. bracteata*, and iii) earlier reports of *T. tricuspidata* in the Andaman and Nicobar Islands represent *T. quinquangulata* A. Gray (cf. Rasingam, 2012). Our results suggest that *T. tricuspidata* does not occur in India and *T. tricuspidata* and *T. bracteata* enjoy different geographical distributional ranges (**Fig. 4**). The correct nomenclature and a detailed description along with illustrations and photographs of *T. bracteata* are provided for easy identification of the species.

Trichosanthes bracteata (Lam.) Voigt, Hort. Suburb. Calcutt.: 58. 1845; Kurz, J. Asiat. Soc. Bengal 2: 99. 1877; Cogn. in A. DC. & C. DC., Monogr. Phan. 3: 375. 1881; Chakrav., Monogr. Indian Cucurbitaceae: 44. 1959 & Fasc. Fl. Ind. 11: 109. 1982; Deb, Fl. Tripura 1: 266. 1981; H.J. Chowdhery & Wadhwa, Fl. Himachal Pradesh: 306. 1984; Khanna & Mudgal, Checklist Dicot. Pl. Uttar Pradesh: 160. 1999; N.K. Sharma, Fl. Rajasthan: 93. 2002. *Modecca bracteata* Lam., Encycl. 4: 210. 1797. Type: East Indies, *P. Sonnerat* s.n. (Holotype, P00307616, P-LA, image!).

Trichosanthes palmata Roxb., Fl. Ind. 3: 704. 1832, nom. illeg., non L., Syst. Nat. 2: 1278. 1759; J. Graham, Cat. Pl. Bombay: 79. 1839; Dalzell, Cat. Indig. Pl. Bombay Pres.: 26. 1858; Dalzell & A. Gibson, Bombay Fl.:

103. 1861; C.B. Clarke in Hook.f., Fl. Brit. India 2: 606. 1879, p.p. excl. var. *scotanthus* C.B. Clarke & var. *tomentosa* B. Heyne ex C.B. Clarke; Trimen, Handb. Fl. Ceylon: 244. 1893; Collett, Fl. Siml.: 199. 1902; Duthie, Fl. Gangetic Plains 1: 363. 1903; T. Cooke, Fl. Bombay: 527. 1903; Haines, Forest Fl. Chota Nagpur: 166. 1910; Bamber, Pl. Punjab: 616. 1916; Gamble, Fl. Madras: 529. 1919; Strachey, Cat. Pl. Kumaon: 70. 1918; Haines, Bot. Bihar Orissa: 387. 1922; Osmaston, Forest Fl. Kumaon: 255. 1927; Fyson, Fl. S. Indian Hill Stat. 1: 242. 1932; Kanjilal et al., Fl. Assam 2: 327. 1938. *T. tricuspidata* Lour. var. *strigosa* Sunit Mitra & S. Bandyop., J. Bombay. Nat. Hist. Soc. 95: 374. 1998. *T. tricuspidata* auct. non Lour. 1790: C.J. Saldanha & M.S.E. Rao in C.J. Saldanha, Fl. Karnataka 1: 305. 1984; Harid. & R.S. Rao, Forest Fl. Meghalaya 1: 422. 1985; Hajra et al., Mat. Fl. Arunachal Pradesh 1: 523. 1996; Pull. & Chennaiah, Fl. Andhra Pradesh 1: 417. 1997.

Climber, perennial. Stems angular, glabrous. Tendrils 2- or 3-fid, slender, glabrous. Leaves simple, broadly ovate, 3–5-lobed, lobes 1/2–4/5 deep (occasionally unlobed), 3–20 × 2–18 cm, cordate at base, prominently dentate at margins, acute-acuminate at apex, sparsely scabrous due to cystoliths on upper surface, glabrous with 3–9 scattered glands on lower surface; petioles 2–5 cm long, slender, sparsely pubescent. Male flowers: in racemes; peduncles 4–10 cm long, sparsely pubescent; bracts obovate, 2–4 × 1.8–3.5 cm, deeply lacinate and pubescent, glandular, greenish; pedicels 2–5 mm long; receptacle tube cupular, c. 3.5 × 1.5 cm, pubescent, narrowing towards base, broad at throat, inner surface more hairy than outer surface. Sepals 5, narrowly triangular or oblong-lanceolate, c. 10 ×

Table 1. Comparison of distinguishing characters between *T. tricuspidata*, *T. bracteata* and *T. quinquangulata*

Character	<i>T. tricuspidata</i>	<i>T. bracteata</i>	<i>T. quinquangulata</i>
Leaf margins	Entire or wavy with small dentations	Prominently dentate, never entire	Entire or coarsely remotely dentate
Male sepals	With serrate margin or with side lobes	With entire margin or occasionally with 2 or 3 side lobes	Laterally with some remote slender lobes
Female sepals	Entire along margins	Margins with side lobes	Entire along margins
Male bracts	With finely densely deeply serrate-lacinate margins	With sparsely lacinate margins	Entire
Fruits	Ovoid, acute, beaked at apex, without streaks	Subglobose, ellipsoid, rounded at apex with 10 longitudinal paler streaks	Globose, rounded at apex, without streaks
Seeds	Seed coat not marginate	Seed coat marginate	Seed coat not marginate

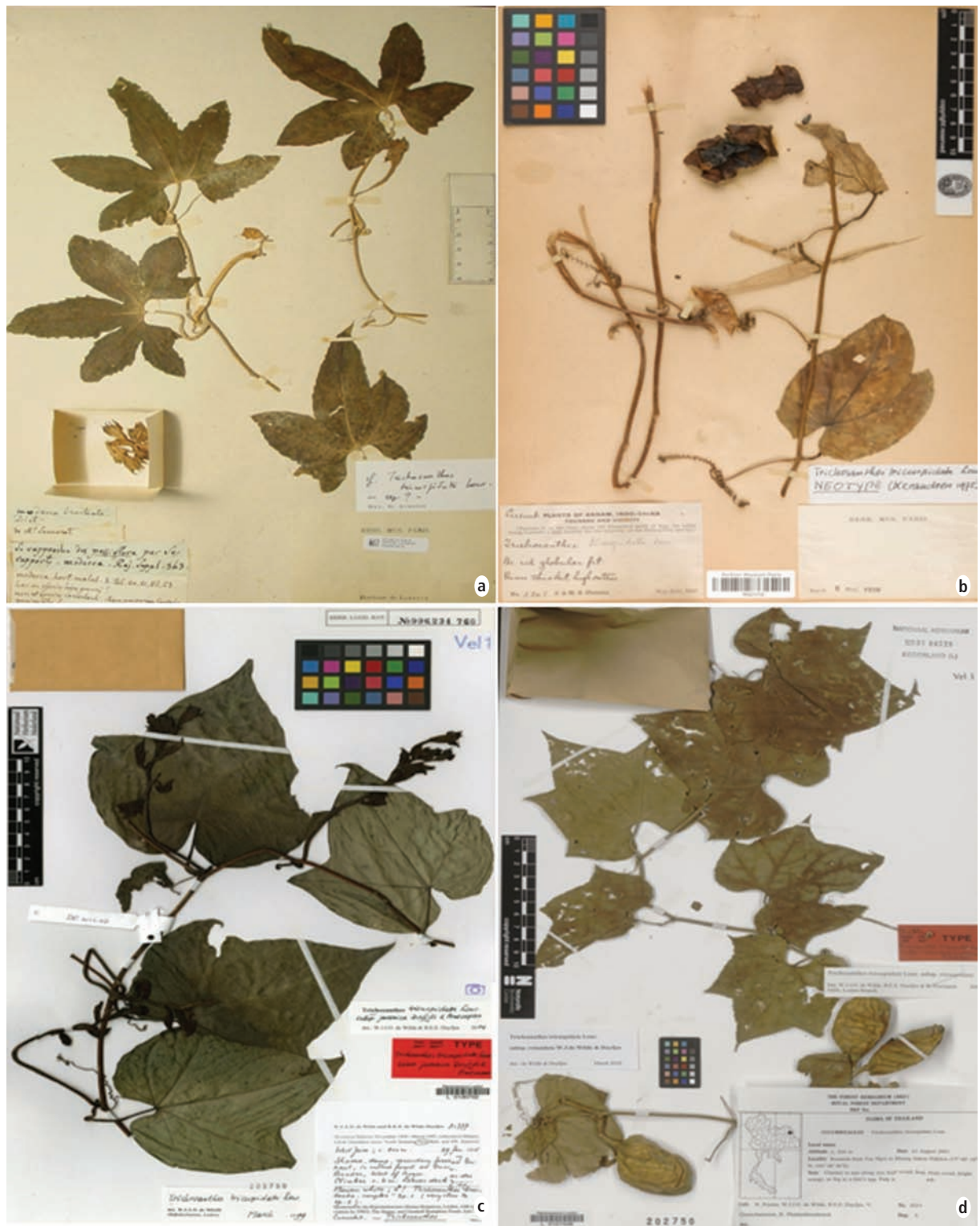


Fig. 1. Type images: a. *Trichosanthes bracteata* (Lam.) Voigt (= *Modecca bracteata* Lam.) – Holotype: P. Sonnerat s.n. (P00307616, P-LA, image!); b. *T. tricuspidata* Lour. subsp. *tricuspidata* – Neotype: J. & M.S. Clemens 3267 (P02273742); c. *T. tricuspidata* Lour. subsp. *javanica* Dufjies & Pruesapan – Holotype: de Wilde & Dufjies 21777 (L0130752); d. *T. tricuspidata* Lour. subsp. *rotundata* W.J. de Wilde & Dufjies – Holotype: R. Pooma et al. 2574 (L0127425). [All reproduced with permission]

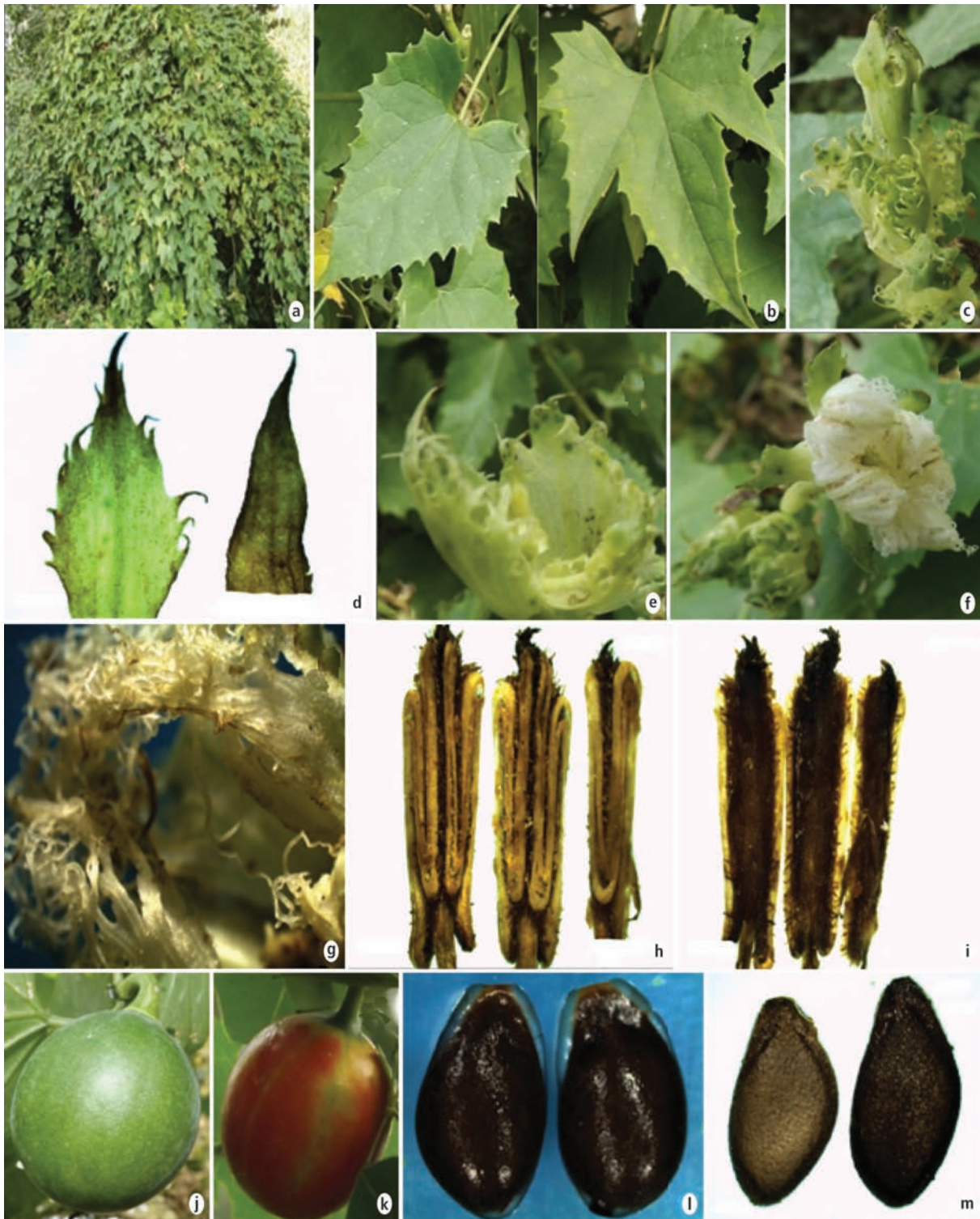


Fig. 2. *Trichosanthes bracteata* (Lam.) Voigt: a. Habit; b. Unlobed and lobed leaves on same plant; c. Male flower bud; d. Male sepals; e. Male bract; f. Male flower – Close-up view; g. Petals showing fimbriate margins; h. & i. Stamens: Dithecous (two), Monothealous (one); h. Dorsal view; i. Ventral view; j. & k. Fruits: j. young; k. mature; l. Seeds showing prominent white transparent margins; m. Seeds after drying.

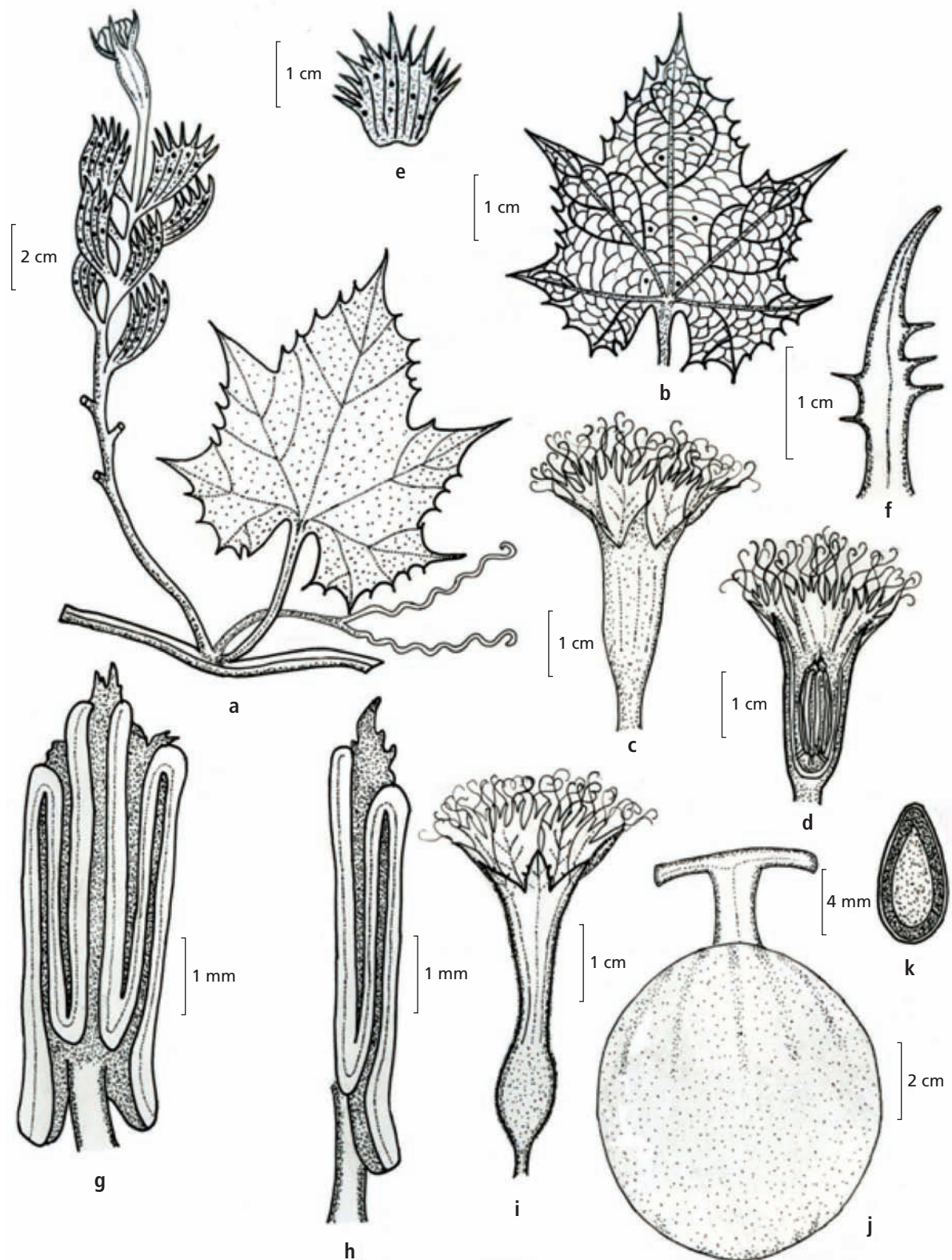


Fig. 3. *Trichosanthes bracteata* (Lam.) Voigt: a. Portion of branch with male inflorescence; b. Lower surface of leaf showing glands; c & d. Male flower from outside and opened; e. Male bract; f. Female sepal; g & h. Stamens: g. dithecous; h. monothealous; i. Female flower; j. Fruit; k. Seed in face view; (a & b: K.N. Nair & Savita Pandey 259404 (LWG); c, d, e, g, h, & j: K.N. Nair & Savita Pandey 259494 (LWG); f & i: K.N. Nair & B. Datt 223121 (LWG); k: K.N. Nair & Savita Pandey 259468 (LWG).

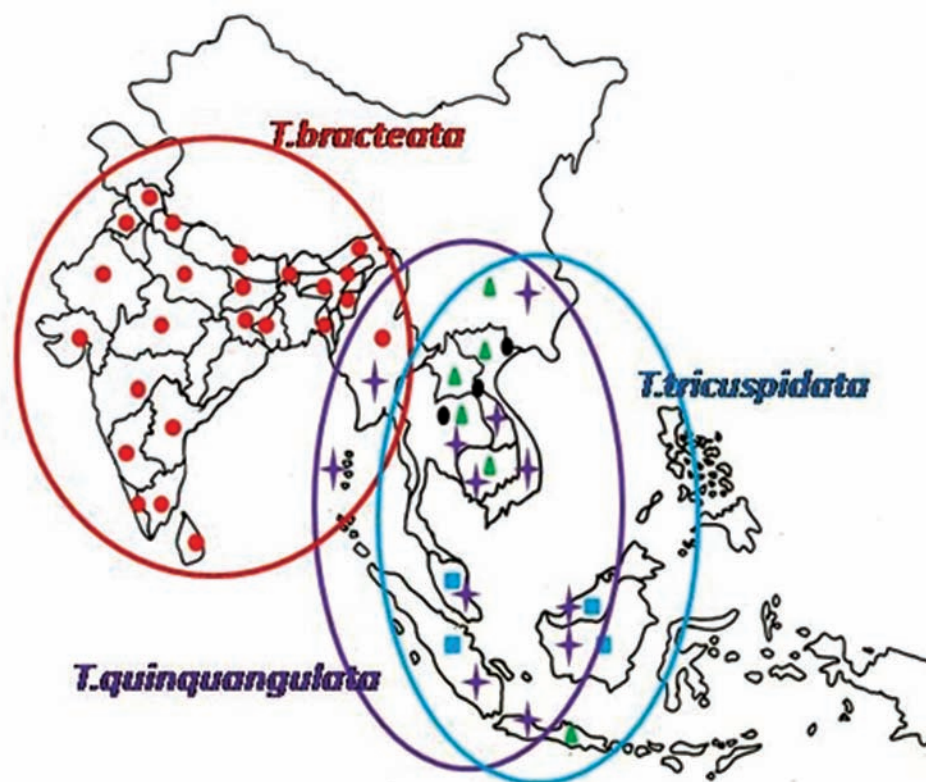


Fig. 4. Map showing distributional range of: *Trichosanthes bracteata* (Lam.) Voigt (●); *T. tricuspidata* Lour. subsp. *tricuspidata* (▲); *T. tricuspidata* subsp. *javanica* Duijjes & Pruespan (■); *T. tricuspidata* subsp. *rotundata* W.J. de Wilde & Duijjes (●); *T. quinquangulata* A. Gray (✦).

3 mm, truncate at base, entire or lobed at margins, acuminate at apex, with or without glands, green. Petals 5, broadly obovate, c. 10×7 mm, fimbriate at margins, truncate at apex, incurved, inserted near apex of receptacle tube, inner surface more hairy than outer surface, white. Stamens 3; 2 ditheous, 1 monotheous, inserted near the base of receptacle tube, glabrous; anther cells conduplicate, hairy, yellow; connectives narrowly produced beyond the anther lobes. Female flowers: solitary, ebracteate. Sepals and petals as in male flower. Ovary oblongoid-ellipsoid, c. 15×5 mm, glabrescent, green. Berries subglobose to ellipsoid, $3.5\text{--}8 \times 3\text{--}7$ cm, glabrous with 10 longitudinal paler streaks, red when ripe; pericarp pale yellow on inner side enclosing dark greenish black soft pulp; fruiting pedicels c. 2 cm long, glabrous. Seeds obovate, $5\text{--}8 \times 3\text{--}6$ mm, truncate at base, with or without smooth white transparent margins, rounded at apex, dark brown.

Flowering & fruiting: June–November.

Habitat: Semi-evergreen or mixed deciduous forests, mostly on forest fringes and along

roadsides or in abandoned places from sea level to 2000 m or above in the Himalayas.

Distribution: Bangladesh, India (throughout), Myanmar, Nepal and Sri Lanka.

Note: Renner & Pandey (2013) reported the occurrence of *T. tricuspidata* in India based on the type locality (Jamalda, Coochbehar in West Bengal) of *T. tricuspidata* var. *strigosa* Sunit Mitra & S. Bandyop. (1998). Renner & Pandey (2013) treated *T. tricuspidata* var. *strigosa* and *T. palmata* Roxb. (1832, nom. illeg.) as synonyms of *T. tricuspidata*. The holotype specimen of *T. tricuspidata* var. *strigosa* is missing in CAL. However, a close examination of the paratypes revealed that they do not represent a true variety under *T. tricuspidata*, but comprised probable admixtures of *T. bracteata*, *T. lepiniana* and *T. rubriflos* Thorel ex Cayla.

Uses: Different parts of *T. bracteata* are used for various diseases can be treated with different parts of this plant. Fruits are a cure for Asthma, earache and ozoena (Duvey et al., 2012). The aerial parts of this plant showed anthelmintic activity

(Duvey, 2013), whereas the roots are shown to have antioxidant, antibacterial and antifungal properties (Saboo *et al.*, 2013). Root paste is applied to cure gonorrhoea (Devi Prasad, 2014).

Specimens examined: INDIA, **Andhra Pradesh**, East Godavari district, Rampa Chodavaram, 3.10.1920, V. Narayanswami 418 (CAL); Rampa, near Gunjugudem, 5.10.1920, V. Narayanswami 434 (CAL); Barangi (between Devipatnam and Rampa Chodavaram), 175 m, 19.9.1980, G.V. Subba Rao 67578 (CAL); Krishna district, Machilipatnam, Fort near Port Office, 19.9.1970, R.S. Rao & A.R.K. Sastry 7443 (CAL); Visakhapatnam district, Kothuru, 250 m, 28.9.1961, N.P. Balakrishnan 852 (CAL). **Arunachal Pradesh**, Changlang district, 510 m, D.B. Deb 25821 (CAL). **Assam**, Nagaon district, Kaziranga R.F., 21.9.1957, R.S. Rao 9702 (CAL); Doboka R.F., 3.50 miles south of Kaphitoli, 400 m, 28.4.1964, N.P. Balakrishnan 39538 (CAL); North Cachar district, Mongsemd, May 1895, G. Watt 11809 (CAL); Haflang, 2500 ft, 11.8.1908, W.G. Craib 214 (CAL); Udalguri district, Tangla, 24.4.1958, B.A. Nath 13403 (CAL). **Gujarat**, Rajkot district, Saurashtra, Sasan, Girnagar Forest, 4.9.1954, S.L. Kapoor 14637 (LWG); Valsad district, Wilson Hill, 15.8.2010, A.K. Srivastava & K.N. Nair 252965 (LWG). **Himachal Pradesh**, Mandi district, Jogindar Nagar, near P.W.D. Rest House, 1387 m, 20.8.1977, S.K. Murti & R. Prasad 61894 (BSD); Rewalsar, 23.8.1977, S.K. Murti & R. Prasad 62038 (BSD); Shimla district, Baluganj Hill, 28.5.1954, Ram Singh 127796 (LWG!); between Veor and Sarahan, 1560 m, 25.5.1962, N.C. Nair 21835 (BSD); Bareilly forest, Ghanahati, 31.5.1986, P.C. Pant 80858 (BSD). **Jharkhand**, Singhbhum district, 9.1.1903, H.H. Haines 587 (CAL). **Karnataka**, Chamarajanagar district, Bandipur, 950 m, 23.4.1965, B.D. Naithani 23886 (MH); Chickmagalur district, Chickmagalur, 19.10.1965, R.K. Arora 5120 (CAL); bottom of Bababudan Hills, 1100 m, 27.7.1979, C.J. Saldanha KFP 0507 (CAL); Hassan district, near Harihalli, in partial shade on bushes along roadside hedges, 800 m, 10.9.1970, F.M. Jarrett & C. Saldanha HFP 735 (CAL); Kodagu district, Kibbetta, 1.5 miles N. of Somwarpet, 15.10.1963, s. coll. 94615 (CAL); Shimoga district, Sagara, 600–900 m, October 1908, A. Meebold 9787 (CAL); Agumbe, Cattle shed road, 15.5.1960, R. Sundara Raghavan 62521 (CAL); Uttara Kannada district, Bailur, 380 m, 22.8.1905, C.E.C. Fischer 267 (CAL). **Kerala**, Ernakulam district, Cochin, Parambicolam, 1200 m, November 1910, A. Meebold 12468 (CAL); Kottayam district, Pambar, 1000 m, 24.5.1965, K. Vivekananthan 24302 (MH); Kozhikode district, Kannothe, 11.12.1913, s.coll.

9564 (MH); Pambara estate, 900 m, 18.8.1964, J.L. Ellis 20474 (MH); Palakkad district, Panthanthode, Karivana slopes, 725 m, 2.5.1980, V.J. Nair 67445 (MH); Thiruvananthapuram district, Veli, 4.4.2009, Usha 72707 (TBGT); Vanchiyoore, 10 m, 18.2.2016, K.N. Nair 302486 (LWG); Thrissur district, Vellilapara, 1.8.1996, A.G. Pandurangan & G. Rajkumar 30750 (TBGT); Wayanad district, without precise locality, 12.9.2014, Usha & Deepthi 82224 (TBGT). **Maharashtra**, Pune, on road side, from Ambavne–Lonavala, 24.7.1964, B. Venkata Reddi 99209 (CAL); Mula river bed, near Kotri Ambavne–Lonavla, 28.7.1964, B. Venkata Reddi 99349 (CAL); Pimpri Jungle, 22.8.1965, R.D. Pataskar 165902 (CAL); Markandey top, 16.9.1966, R.D. Pataskar 168874 (CAL); Pune district, Lingmala forest, Mahabaleshwar, 20.6.1968, M.Y. Ansari 105088 (CAL). **Meghalaya**, East Khasi hills district, Nongthymai, 30.8.1956, G. Panigrahi 3198 (CAL); Shillong district, Jowai Badarpur Road, 70 miles from Shillong, 22.7.1957, G.K. Dea 10128 (CAL). **Rajasthan**, Alwar district, Kankwani forest block, 400 m, 23.10.1984, P.J. Parmar 9437 (CAL); Banswara district, Loharia forest Block, 122 m, 23.8.1976, V. Singh 3016 (CAL); Chittorgarh district, Gangaji ka Ghara, 350 m, 14.8.1979, V. Singh & R.P. Pandey 6936 (CAL). **Sikkim**, Rungbi, 10.6.1902, Prain's s.n. (CAL). **Tamil Nadu**, Coimbatore district, Vellingiri hills, 23.2.1932, S.R. Raju & Ratnavelu 258 (MH); Maruthamalai, 633 m, 21.9.1956, K.M. Sebastine 814 (CAL, MH); Velliangiri hills, 667 m, 12.4.1957, K.M. Sebastine 2739 (CAL, MH); near Mylon's Bungalow, Siruvani, 850 m, 25.9.1960, A.N. Henry 636 (MH); Sholayar submergible area, 1075 m, 28.7.1963, K. M. Sebastine 17250 (MH); Anakkatti, 600 m, 8.9.1970, M.V. Viswanathan 752 (MH); Singanallur, 300 m, 10.2.2007, C. Murugan s.n. (MH); Cuddalore district, South Arcot, without precise locality, 200 m, 6.1.1927, S.R. Raju & Maparathan 17944 (MH); Dharmapuri district, Theerthamalai R.F., 400 m, 29.7.1978, E. Vajravelu 58008 (MH); Dindigul district, Kodai to Machur, Pulneys, 24.7.1920, s. coll. 16645 (MH); Erode district, Dhimbam, 945 m, 23.12.1910, C.A. Barber 8625 (MH); Nilgiris district, Thattapallam–Kotagiri, 1600 m, 24.10.1956, K. Subramanyam s.n. (MH); Chermbadi–Brumadu, 800 m, 27.7.1972, E. Vajravelu 41838 (MH); Theppakadu, 850 m, 27.10.1972, K. Vivekananthan 43098 (MH); Altikadu forest (near Chermambadi), 850 m, 21.6.1974, E. Vajravelu 44898 (MH); Ramanathapuram district, Esani forest, 100 m, 14.8.1964, K. Ramamurthy 20933 (MH); Salem district, Vasampadi estate – forest Sevaroy hills, 30.8.1983, E. Vajravelu 77748 (MH); Sivaganga district, Thirukoshtiyur, Thirupathur, 100 m, 20.12.1964, K. Ramamurthy 22795 (MH); Thanjavur

- district, Kumbakonam to Valangaiman, 50 m, 19.9.1977, *K. Ramamurthy* 51319 (CAL); Tirunelveli district, Courtallum, 3.12.1913, *M. Rama Rao* 2030 (CAL); Namakkal district, Kollimalai, 27.10.1914, *s. coll.* 11266 (MH); Vellore district, Javadi hills, Komattiyeri, 701 m, 28.9.1916, *C.E.C. Fischer* 4009 (CAL); Yelagiri hills, on road side, 1220 m, 20.10.1919, *s. coll.* 526 (MH). **Tripura**, Agartala district, 152–183 m, 2.1.1915, *P.M. Debbarman* 1177 (CAL); North Radha, Kishorepore Reserve Forest, 28.8.1957, *Rolla Seshagiri Rao* 8933 (CAL). **Uttar Pradesh**, Bahraich district, Kakardari, 7.7.1954, *V. Chandra & Party* 12084 (LWG); Murtiha Forest Rest House, 14.11.2002, *S.D. Maliya* 224673 (LWG); Girijapuri Forest, 19.7.2004, *S.D. Maliya* 225980 (LWG); behind Bicchiya Railway Station, 28.12.2004, *S.D. Maliya* 225577 (LWG); near Murtiha Rest house roadside, 9.9.2005, *S.D. Maliya* 227171 (LWG); Banda district, 15.8.1983, *J.P. Singh* 1842 (LWG); Kheri district, Golagokarn Nath, *s.d.*, *K.K. Singh* s.n. (CDRI); 11 km before Palia Kalan, 16.8.2013, *K.N. Nair & Savita Pandey* 259404 (LWG); Palia Kalan, 28.10.2014, *K.N. Nair & Savita Pandey* 259494 (LWG); Lucknow district, Dilkhusa Garden, 19.11.1961, *Ram Singh Badya* 97747 (LWG); Sitapur district, Mission Church, 26.4.1956, *G. Saran & Party* 26886 (LWG). **Uttarakhand**, Chamoli district, *s.loc., s.d.*, *S.K. Palni & Party* (CDRI); Mondal, 1600 m, 1.10.1970, *B.D. Naithani* 41978 (BSD); Mondal area, 1650 m, 22.5.1971, *B.D. Naithani* 43984 (BSD); Phata-Rampur Chattu road, 22.8.1978, *G. Panigrahi & B.M. Wadhwa* 65340 (BSD); Champhawat district, Maitte- Baruu 1800 m, 16.09.1971, *C.M. Arora* 45772 (BSD); Mayawati, September 2002, *O.S. Karla* 98639 (BSD); Dehra Dun district, Binehi-Cashna, 1300 m, 8.06.1959, *M.A. Rao* 10032 (CAL); FRI, 14.7.1952, *Hiralal* s.n. (LWG); Rispana, 15.6.1964, *C.R. Babu* 32228 (BSD); Nainital district, Doglas Dale, 12.8.1913, *N. Gill* 683 (LWG); Corbett NP, Gairal, Molliasot, 21.11.1972, *K.P. Janardhanan* 51152 (BSD); Pauri Garwahl district, Gohra, 2000 m, 8.6.1955, *M.A. Rao* 10032 (BSD); Pipal Koti, 4000 ft, 24.6.1957, *Y.K. Saran & M.A. Rao* 2737 (BSD); Khirsa Experimental Garden, 1825 m, 29.5.1975, *B.S. Asaral* 55317 (BSD); Pithoragarh district, Rathi Bogdwar, 610–914 m, 13.6.1958, *T.A. Rao* 6715 (BSD); Tavaghat, 1500 m, 9.6.1960, *T.A. Rao* 11696 (BSD); Pithoragarh, 1680 m, 11.5.1961, *U.C. Bhattacharya* 15126 (BSD); Dafia Dhunn, 2200 m, 3.1.1972, *C.M. Arora* 49578 (BSD); Pithoragarh, near Daronte village on road, 17.9.1983, *Bipin Balodi* 75290 (BSD); Pithoragarh, on way to Lilam, May 1985, *Bipin Balodi* 77504 (BSD); Rudra Prayag district, Ukhimath 1300 m, 17.8.1915, *M.A. Rao* 38784 (BSD, L0128205, image!); Tehri Garhwal district, Gangrami, Jamuna Valley, 4500 ft, 18.6.1951, *D.D. Awasthi* 2417 (LWG); Sahanchalti Gangram, 1800 m, 18.6.1961, *M.A. Rao* 15824 (BSD, CAL); 26.7.1964, *U.C. Bhattacharya* 33700 (BSD); Nag Tibba, 3200 m, 3.6.1978, *A.K. Goel* 64025 (BSD); Mussoorie to Kempty Fall, 25.7.2002, *K.N. Nair & B. Datt* 223121 (LWG); Uttarkashi district, Natwar, 24.9.1993, *Surendra Singh* 90132 (BSD); Natwar, 17.9.1995, *Bipin Balodi* 88614 (BSD); Dugada, 16.10.1998, *M.S. Pundir* 55714 (BSD). **West Bengal**, Darjeeling district, 19.1.1942, *J.N. Naskar* s.n. (LWG); Howrah district, Chengail, 22.6.1964, *S.S.R. Bennet* 786 (CAL); Jalpaiguri district, Burma Bhutan Border, 1829–1981 m, 20.5.1949, *V. Narayanswami & Party* 2770 (CAL); Malda district, Saja dishi, 23.8.1966, *R.M. Dutta* 350 (CAL). **Peninsula Indiae Orientalis**, *s.loc.*, *Wight* 1136, 1137 (P06395567, P06395561, images); *Wight* 1136 (E00179488–91, images); *s.loc.*, 1859, *J.D. Hooker & T. Thomson* s.n. (P06395563, image). **BANGLADESH**, Gangachara, EICH No. 6688 A (K001124534/35, images). **MYANMAR**, Sagain, Wallich 6688 G (K001124541, image); Plangyu, September 1902, *Shaik Mokim* 92 (CAL). **NEPAL**, Kabre, Kali Gendaki Valley, 6500 ft, 31.5.1954, *Stainton, Sykes & Williams* 5481 (CAL). **SRI LANKA**, *s.loc., s.d.*, *M. Thwaites* 185 (P06395562, image).

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