



Taxonomic identity and occurrence of *Garcinia spicata* and *G. talbotii* (Clusiaceae) in peninsular India

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Abstract

Garcinia talbotii Raizada ex Santapau is often misidentified as *G. spicata* (Wight & Arn.) Hook.f. in the regional Floras of northern Western Ghats. This paper clearly delimits these two species with unambiguous morphological and anatomical characters to facilitate authentic identification.

Keywords: Distribution, *Garcinia spicata*, *Garcinia talbotii*, Misidentification, Northern Western Ghats

Introduction

Garcinia L. (Clusiaceae) is one of the medicinally and economically important genera due to the presence of two major bioactive compounds namely hydroxycitric acid and garcinol. The genus consists of c. 260 species, and distributed predominantly in tropical regions, especially Asia (Mabberley, 2017). In India, the genus is represented by 39 species and 7 varieties, of which 18 species and 5 varieties are endemic (Maheshwari, 1965; Singh, 1993; Sabu *et al.*, 2013; Nayar *et al.*, 2014; Sarma *et al.*, 2016; Shameer *et al.*, 2017). *Garcinia talbotii* Raizada ex Santapau is one of the species endemic to Western Ghats that produces edible fruits which can be used in culinary preparations. Quantitative HPLC-PDA analysis of benzophenones and biflavonoids in eight species of *Garcinia* showed highest amount of xanthochymol in *G. spicata* (Wight & Arn.) Hook.f. (Acuna *et al.*, 2012). It also yields timber, used in construction and yellow-coloured pigment from bark and young fruits as a dye.

A critical examination of herbarium specimens of *G. spicata* housed at BSI, FRLH, CALI, MH, SUK and TBGT revealed that most of them were misidentification of *G. talbotii*. Similarly, scrutiny of descriptions of *G. spicata* in the earlier published Floras (Santapau, 1967; Almeida, 1990; Naithani *et al.*, 1997; Godbole & Das Das, 2000; Yadav & Sardesai, 2002; Ganeshaiyah *et al.*, 2012) that recorded the occurrence of this species in the northern Western Ghats revealed that the diagnostic features provided for *G. spicata* fall well within the circumscription of *G. talbotii*. Inclusion of northern Western Ghats, especially Goa and

Maharashtra under the distribution range of *G. spicata* by other workers (Singh, 1993; Nayar *et al.*, 2014) is also based on the above mentioned earlier works. Further, an examination of fresh field collections corroborates that *G. spicata* does not occur in northern Western Ghats. The present communication provides detailed description, differentiating characters (**Table 1**), photographs depicting morphological and anatomical features and images of type specimens to facilitate the accurate identification of both these species.

Garcinia spicata (Wight & Arn.) Hook.f., J. Linn. Soc., Bot. 14: 486. 1875; Brandis, Indian Trees: 49. 1906; Gamble, Fl. Madras: 53. 1915; Maheshw., Bull. Bot. Surv. India 6: 112. 1965; N.P. Singh in B.D. Sharma & Sanjappa, Fl. India 3: 125. 1993. *Xanthochymus spicatus* Wight & Arn., Prodr. Fl. Ind. Orient. 1: 102. 1834. Type: *s.loc., s.die*, R. Wight 346A (Syn, E, image!). **Figs. 1,3,5**

Tree, dioecious, 5–20 m high; trunk straight; bark smooth, olive green to brown; latex white; branchlets 4-angled, angles flat. Leaves broadly elliptic-oblong or ovate, 9–22 × 4–8 cm, base rounded or obtuse, margins entire, apex retuse, obtuse or acute-acuminate, thick-coriaceous, smooth, dark green; midrib prominent, raised; lateral veins 15–18 pairs, prominent on both surfaces, slightly curved, parallel, clearly visible in dry specimens; petioles to 2 cm long with stem-clasping ligule [anatomy: incurved open vascular strand with large gap]. Flowers in male plant on both spicate and fasciculate inflorescence; spicate inflorescence 2–11-flowered, 1.4–9.5 cm long; fasciculate inflorescence with 5–15 short pedicellate flowers arising directly from the stem. Female



Fig. 1. Syntype of *Garcinia spicata* (Wight & Arn.) Hook.f. (\equiv *Xanthochymus spicatus* Wight & Arn. [R. Wight 346A, E00179065] @Royal Botanic Garden, Edinburgh.



Fig. 2. Holotype of *Garcinia talbotii* Raizada ex Santapau (*G. ovalifolia* var. *macrantha* Vesque) [W.A. Talbot 3713, BSI0000000003] @Botanical Survey of India, Western Regional Centre, Pune.

flowers solitary or in pairs. Flowers pale green or whitish yellow; sepals 4 or 5, suborbicular, 2.5–3 mm long, less than half the length of petal, margins ciliate, membranous, pubescent outside; petals 5, obovate, 6–7 mm long, concave, membranous, pale green or whitish yellow. Male flowers: Pedicels 1–5 mm long; stamens in 5 spatulate bundles, each bundle with 8–10 stamens, long-clawed, opposite petals; filaments very short, free. Rudimentary pistil absent. Female flowers: Pedicels 1.2–3.5 cm long; staminodes 5, small with weak anthers; ovary oblong, 2–4 locular; style short, c. 1 mm long; stigma 3–5-lobed, peltate, spreading, 2–3 mm in diameter, persistent, thick at peltate region, black. Fruits broadly globose, subglobose or depressed-globose, shallowly angular, to 4 cm in diameter; immature fruits with mild ridges and furrows, pale green; ripened fruits smooth, yellow, with mild unpleasant odour; pulp acidic, bitter taste; seeds 1–3, broadly oblongoid, 1.5–2.5 × 1–1.3 cm, dark brown, black when dried.

Flowering & fruiting: January–August.

Distribution: India (Andhra Pradesh, Karnataka, Kerala and Tamil Nadu) and Sri Lanka.

Specimens examined: INDIA, **Andhra Pradesh**: Nellore district, Sriharikota forest, May 1904, *s.coll.* 3034, 3035 (MH). **Karnataka**: Agumbe district, Barakana, Balehalli, 19.5.1960, R. Sundara Raghavan 62720 (BSI). **Kerala**: Kasargod district, Cherpady, Uduma, 12.3.1993, A. Nazarudeen 16408 (TBGT); Kollam district, Karingalodathodu area, Tenmalai range, 7.12.1961, K.N. Subramanian 77529 (BSI); Kottayam district, Koruthode, 200 m, 12.11.1995, Jomy Augustine 16906 (CALI); Puthupalli, *s.die*, G.S. Puri 36572 (BSI); Palakkad district, Mukkali forest, 7.3.1975, E. Vajravelu 46240 (MH); Pathanamthitta district, Pamba, 200 m, 12.2.1994, Jomy Augustine 13370 (CALI); Pamba, 18.3.1994, A. Nazarudeen 19587 (TBGT). **Tamil Nadu**: Cuddalore district, Puthupet, 12°03' N, 79°52' E, 5 m, 18.5.2017, R.S. Palkar & S. Krishnan 5177 (Goa University Herbarium); Pudukkottai district, Pudukkottai, November 1909, C.A. Barber 8498 (MH); Villupuram district, Marakkanam, 3.6.1907, C.A. Barber 8321 (MH); Marakkanam, Kurumbaram Reserve Forest, 12°12' N, 79°56' E, 10 m, 5.5.1995, J.D.H., P.B. & W.F.G. 02757 (FRLH). SRI LANKA, **Ceylon Southern Province**: Hambantota district, Yala, Talgasmankade, 26.4.1973, L.H. Cramer 4124 (MH).

Garcinia talbotii Raizada ex Santapau, Rec. Bot. Surv. India 16(1): 14. 1960; Maheshw., Bull. Bot. Surv. India 6: 113. 1965; N.P. Singh in B.D. Sharma & Sanjappa, Fl. India 3: 127. 1993; M.R. Almeida, Fl. Maharashtra 1: 88. 1996; Godbole & Das Das in

N.P. Singh & Karthik., Fl. Maharashtra 1: 277. 2000. *G. ovalifolius* (Roxb.) Hook.f. ex T. Anderson var. *macrantha* T. Anderson in Hook.f., Fl. Brit. India 1: 269. 1874. *G. spicata* (Wight & Arn.) Hook.f. var. *macrantha* Vesque in A. DC., Monogr. Phan. 8: 311. 1893; T. Cooke, Fl. Bombay 1: 79. 1901. *G. malabarica* Talbot, J. Bombay Nat. Hist. Soc. 11: 234, 1897, non Desr. 1792. *Xanthochymus ovalifolius* J. Graham, Cat. Pl. Bombay: 26. 1839, non Roxb. 1832.

Garcinia spicata auct. non (Wight & Arn.) Hook.f. 1875: T. Cooke, Fl. Bombay 1: 78. 1901; Santapau, Rec. Bot. Surv. India 16(1): 14. 1967, incl. spec. *Blatter* 624; S.M. Almeida, Fl. Savantwadi 1: 54. 1990, incl. spec. G.A. Gammie 15025; H.B. Naithan *et al.*, Forest Fl. Goa: 65. 1997; Godbole & Das Das in N.P. Singh & Karthik., Fl. Maharashtra 1: 276. 2000.

Type: INDIA, **Karnataka**: North Kanara district, Garrsoppah Ghat, 20.1.18??, W.A. Talbot 3713 (holo, BSI0000000003, image!). **Figs. 2,4,5**

Tree, dioecious, 6–18 m high; trunk straight; bark smooth, olive green; latex sticky, turning into brownish; branches angular, slender, twiggy; branchlets 6-angled, angles concave. Leaves elliptic-oblong or ovate, 5–18 × 4–9 cm, base rounded, margins entire, apex obtuse, retuse or acute-acuminate, coriaceous, shiny, dark green; midrib prominent; lateral veins 16–18 or more pairs, distinct, parallel; petioles to 1.8 cm long [anatomy: curved open vascular strand with no gap or minute gap]. Spikes in male plant on old wood, numerous, 5–8 mm long; spikes absent in female plant. Flowers 3–12, on fasciculate inflorescence in both male and female plant. Flowers creamy-white, white to greenish-yellow; sepals 5, orbicular, concave, green, 3–5 mm across; petals 5, orbicular or suborbicular, concave, c. 10 × 8 mm, pale green or whitish yellow. Male flowers: Pedicels 5–8 mm long; stamens in 5 spatulate bundles, thick, 8–12 anthers on each phalange, reddish, opposite petals; filaments very short, free. Rudimentary pistil absent. Female flowers: Pedicels 0.4–1 cm long; staminodes 5, thin, flattened bundles, 4 or 5 anthers on each phalange, similar to male flower; ovary globose, 2 or 3-locular; stigma 3-lobed, 1–3 mm in diameter, narrow at base, persistent, thick, black. Fruits globular, 4–6 cm; immature fruits smooth, without any ridges and furrows, dark green; ripened fruits smooth, yellow, with bad odour; pulp acidic, bitter; seeds 1 or 2, narrowly oblongoid, 2.5–3 × 1.2–1.5 cm, brown.

Flowering & fruiting: January–June.

Distribution: India (Goa, Karnataka, Kerala and Maharashtra). **Endemic**.

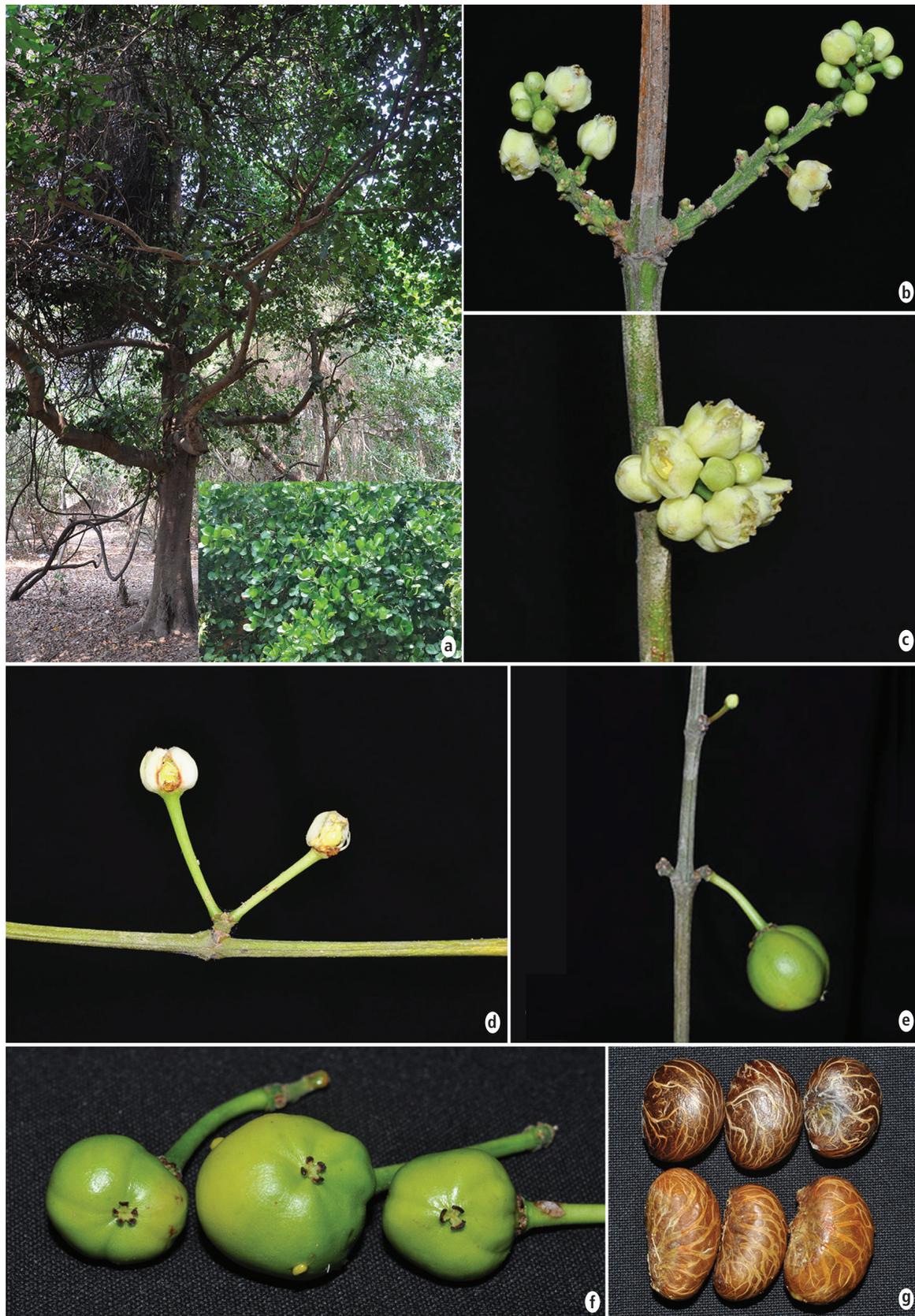


Fig. 3. *Garcinia spicata* Hook.f.: a. Habit (Insert: close-up of branch); b. Spicate inflorescence (male); c. Fasciculate inflorescence (male); d. Female flower; e. Immature fruit with ridges and furrows; f. Fruits with 3–5 stigmatic lobes; g. Matured and dried seeds: upper row – *G. spicata*, lower row – *G. talbotii*.

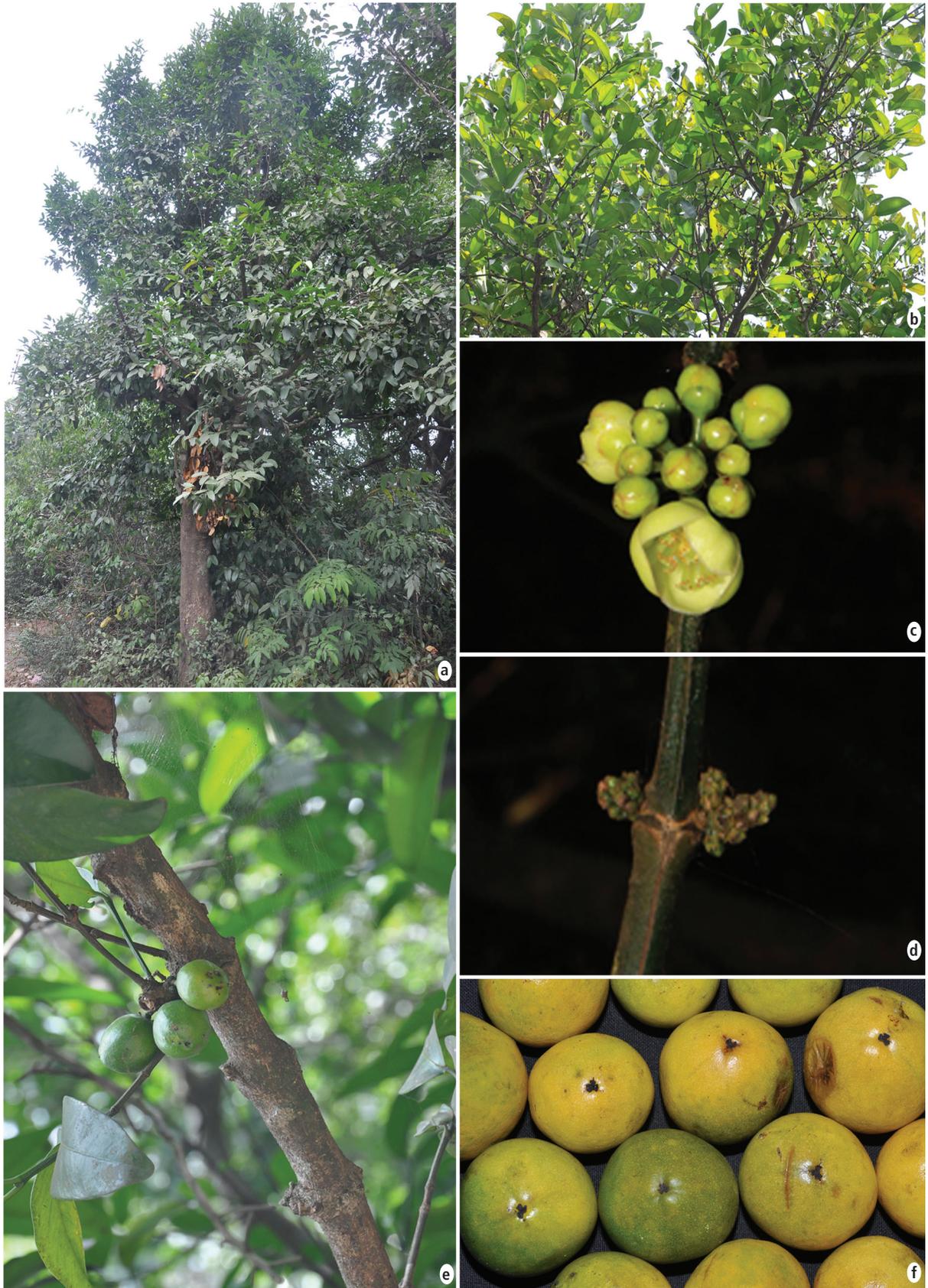


Fig. 4. *Garcinia talbotii* Raizada ex Santapau: a. Habit; b. Branch showing numerous spikes in male plant; c. Fasciculate inflorescence (male); d. Close-up of spike; e. Immature fruit with smooth surface; f. Mature fruits showing 3-lobed stigma.

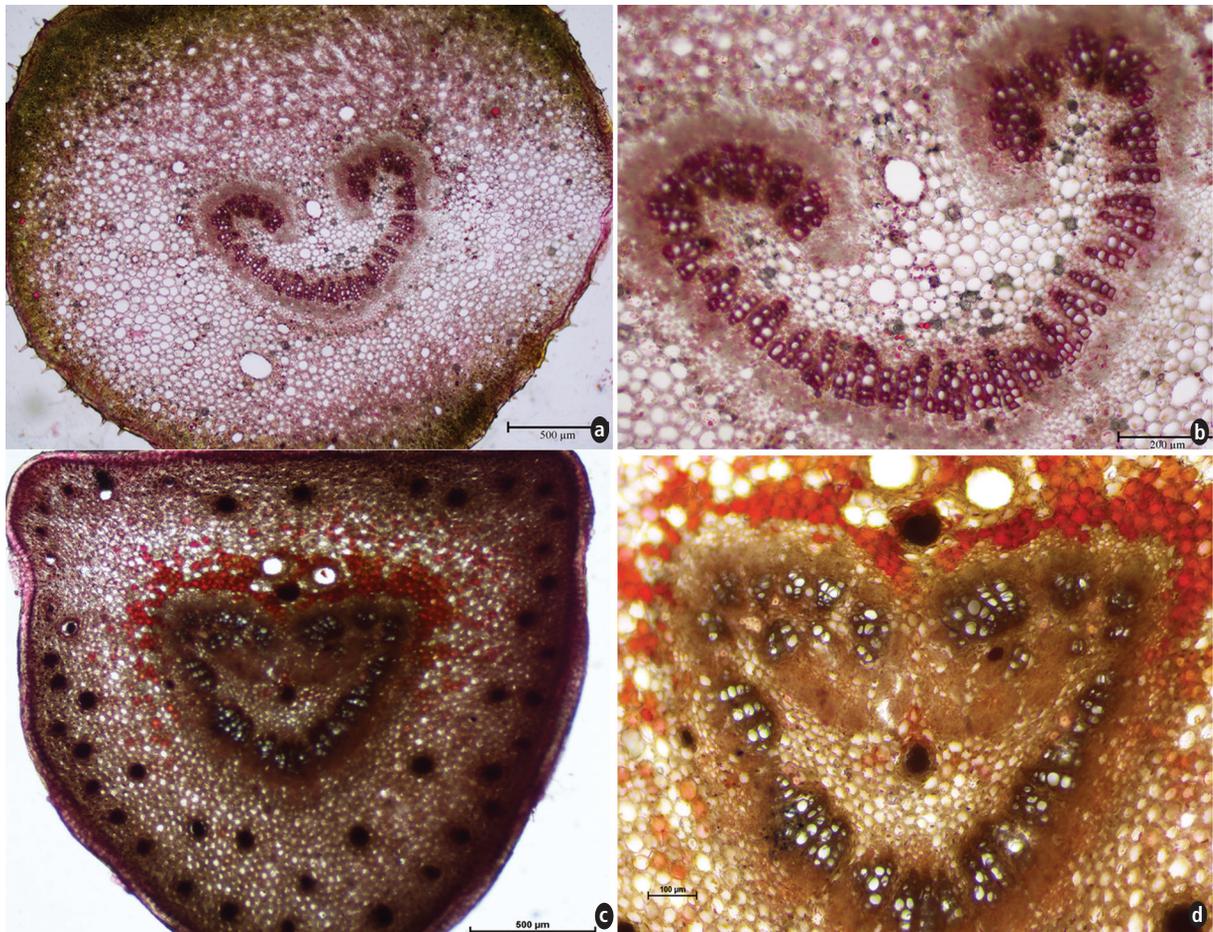


Fig. 5. T.S. of petioles stained with safranin: a,b. *Garcinia spicata* showing incurved open vascular strand with large distinct gap; c,d. *Garcinia talbotii* with curved vascular strand with very minute gap.

Table 1. Comparative key characteristics of *Garcinia spicata* and *G. talbotii*

| Characters | <i>G. spicata</i> | <i>G. talbotii</i> |
|---|--|--|
| Branchlets | 4-angled; angles flat | 6-angled; angles concave |
| Flowers in male plant | Spicate and fasciculate. Spikes 1.4–9.5 cm long | Fasciculate. Also arranged in numerous pseudospikes of 0.5–0.8 cm long |
| Flowers in female plant | Solitary or in pairs | Fasciculate |
| Length of pedicels in female flowers | 1.2–3.5 cm | 0.4–1 cm |
| Ovary | 2–4-locular | 2 or 3-locular |
| Stigmatic lobes | 3–5 | 3 |
| Fruits | Shallowly angular | Smooth |
| Seeds | Broadly oblongoid, 1.5–2.5 × 1–1.3 cm, dark brown, black when dry | Narrowly oblongoid, 2.5–3 × 1.2–1.5 cm, brown |
| Vascular strand in petiole | Incurved open with large gap | Curved open with no gap or minute gap |

Specimens examined: INDIA, **Goa**: North Goa district, Vagheri hills, 19.12.1997, *Vaishali C. Joshi* 1296 (Goa University Herbarium). **Karnataka**: Belgaum district, Hemadga, *s.die*, *Nilesh V. Malpure* NVM 3766 (SUK); Sada plateau, 15°40.18' N, 74°7.10' E, 806 m, 8.5.2016, *R.S. Palkar* 5172 (Goa University Herbarium). **Kerala**: Palakkad district, Nelliampathy ghat, 29.6.1914, *S.T. Dunn* s.n. (MH Acc. No. 3018). **Maharashtra**: Kolhapur district, Amba, *s.die*, *Priti Mahekar* SUK-392 (SUK); Gajapur, *s.die*, *Milind Sardesai* 831 (SUK); Manoli, Amba, 11.5.1904, *R.K. Bhide* s.n. (BSI); Palghar district, Shirgaon, 21.4.1957, *L.A. Vasavada* 17031 (BSI); Pune district, Auhpe forest, 23.3.1907, *G.M. Ryan* 1751* (BSI); Bhimashankar, 25.10.1956, *L.A. Vasavade* 8575* (BSI); Bhimashankar, 13.6.1961, *K.P. Janardhanan* 72256 (BSI); Bhimashankar, 7.6.1962, *K.P. Janardhanan* 76642 (BSI); Bhimashankar, *s.die*, *J.A.V.* 9314* (BSI); Choura hill, Bhimashankar, 24.2.1961, *K.P. Janardhanan* 69201 (BSI); Choura hill, Bhimashankar, 22.4.1961, *K.P. Janardhanan* 72108 (BSI); Choura hill, Bhimashankar, 4.4.1962, *K.P. Janardhanan* 76581 (BSI); Bhimashankar, 2.2.1999, *S.R. Yadav* 5845 (SUK); Raigad district, Matheran, 2.11.1907, *H.P. Paranjpe* s.n.* (BSI Acc. No. 6751); Matheran, 9.11.2006, *S.C. Majumdar & S.K. Das* 192443 (BSI); Sudagarh Fort, Pali, 9.3.1979, *M.J. Kothari* 156423 (BSI); Satara district, Khandala, 21.3.1903, *G.A. Gammie* 16163* (BSI); Koyna, 23.11.1978, *R.K. Kochhar* 157811 (BSI); Jaigad, Koyna, 11.2.1979, *R.K. Kochhar* 158332* (BSI); Kusavade, May 1995, *M.P. Bachulkar Cholekar* 20040* (SUK); Vasota, April 1993, *M.P. Bachulkar Cholekar* 5550 (SUK); Sindhudurg district, Amboli, 28.4.1902, *G.A. Gammie* 15025* (BSI); Amboli, 15°56.28' N, 73°59.99' E, 821 m, 27.5.2015, *R.S. Palkar* 5173 (Goa University Herbarium); Chaukul, Amboli, 9.11.1965, *B.G. Kulkarni* 107936 (BSI). (*Specimens of *G. talbotii* wrongly identified as *G. spicata*).

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