

Research article

Revision of *Tinospora* (Menispermaceae - Chasmantheroideae - Burasaieae) in Singapore

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Abstract. The lianescent genus *Tinospora* Miers in Singapore is revised. Four species are recognised, two of which are newly described. *Tinospora krispura* I.M.Turner sp. nov. is known from Christmas Island and Singapore. *Tinospora singapura* I.M.Turner sp. nov. is known only from Singapore. Two new lectotypifications are included, one at the second step.

Keywords. Christmas Island, climbers, dioecy, lianas, Malesia.

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Introduction

In preparing an account of the Menispermaceae for the *Flora of Singapore*, it was a surprise to find that a considerable number of the specimens collected in Singapore did not fit with any described species in the genus. It was therefore decided to publish a revision of the genus in Singapore, including the description of two new species.

The genus *Tinospora* Miers includes about 30 species of large dioecious climbers found in Africa and Asia to the Pacific. The last complete revision for Asia was by Forman (1981). Recent molecular studies (Wang *et al.* 2017; Lian *et al.* 2019) have supported the removal of three small genera from out of *Tinospora*. *Paratinospora* Wei Wang includes two species from China and Vietnam, *Fawcettia* F.Muell. is represented by a single Australian species and *Hyalosepalum* Troupin by two to maybe five species from Africa and perhaps Madagascar.

Species of *Tinospora* are frequently used medicinally (Chi *et al.* 2016), with much interest particularly in *Tinospora cordifolia* (Willd.) Hook.f. & Thomson (Singh & Chaudhuri 2017), and its potential in the treatment of diabetes.

Material and methods

The study employed classic herbarium taxonomy techniques in order to revise *Tinospora* in Singapore. All the Singapore material of the genus from SING and K was used in the study. Additionally, visits

to BM provided access to a few more specimens. Specimens collected from outside Singapore were used to gather information on morphology for stages absent from the Singapore collections, or when available for the newly described species. Types, when not directly available, were consulted where possible via online resources such as JStor Global Plants and institutional websites.

Results

Class Magnoliopsida Brongn.
Order Ranunculales Juss. ex Bercht. & J.Presl
Family Menispermaceae Juss.
Subfamily Chasmantheroideae Luerrs.
Tribe Burasaieae Endl.
Genus *Tinospora* Miers, nom. cons.

Key to *Tinospora* species in Singapore

1. Old stems densely tuberculate *T. crispa* (L.) Hook.f. & Thomson
– Old stems with tubercles rare or absent 2
2. Leaves with pit domatia in axils of main nerves below; flowers distinctly pedicellate
..... *T. kripura* I.M.Turner sp. nov.
– Leaves with glandular patches or not in axils of main nerves below, pit domatia absent; flowers subsessile 3
3. Leaves with glandular patches in the axils of main nerves below; endocarps with distinct ventral groove and scattered tubercles *T. macrocarpa* Diels
– Leaves not with glandular patches in axils of main nerves below; endocarps with indistinct ventral groove and densely verruculose *T. singapura* I.M.Turner sp. nov.

Note

Tinospora kripura I.M.Turner sp. nov. is only known from male plants, *T. singapura* I.M.Turner sp. nov. only from female plants and female flowers of *T. macrocarpa* remain unknown.

***Tinospora crispa* (L.) Hook.f. & Thomson**
Fig. 1

Flora Indica 1: 183 (Hooker & Thomson 1855). – *Menispermum crispum* L., *Species Plantarum*, ed. 2: 1468 (Linnaeus 1763), basionym. – *Menispermum tuberculatum* Lam., *Encyclopédie méthodique. Botanique* 4: 96 (Lamarck 1797), nom. illegit., superfl. – *Cocculus crispus* (L.) DC., *Regni vegetabilis systema naturale* 1: 521 (De Candolle 1817). – *Chasmanthera crispa* (L.) Baill., *Traité de botanique médicale phanérogamique* 1: 706 (Baillon 1883). – *Tinospora rumphii* Boerl., *Catalogus plantarum phanerogamarum quae in Horto Botanico Bogoriensi coluntur*: 116 (Boerlage 1899), nom. illegit., superfl. – *Tinospora tuberculata* Beumée ex K.Heyne, *De nuttige planten van Nederlandsch-Indie*, ed. 2, 1: 619 (Heyne 1927), nom. illegit., superfl. – **Type:** [published illustration] ‘Funis felleus’, Rumphius, *Herb. Amboin*. 5: t. 44, f. 1 (1747); lectotype designated by Forman (1981).

Menispermum verrucosum Roxb. in Fleming, *Asiatick Researches* 11: 171 (Fleming 1810). – *Cocculus verrucosus* (Roxb.) Wall., *A numerical list of dried specimens* (1831–1832) no. 4988 (Wallich 1831–1832). – *Tinospora verrucosa* (Roxb.) W.Theob., *Burmah*, ed. 4, 2: 656 (Theobald 1883). – **Type:** [unpublished illustration] *Icones Roxburghianae* 1708; lectotype K, designated by Forman (1981).

Tinospora thorelii Gagnep., *Bulletin de la Société Botanique de France* 55: 46 (Gagnepain 1908). – **Type:** Cochinchine, 1862–1866, *C. Thorel* 350; lectotype P[P00744851] image!, designated at the first step by Diels (1910), and at the second step here; isolectotype P[P00744852] image!.

Tinospora mastersii Diels in Engler, *Das Pflanzenreich* IV, 94(46): 140 (Diels 1910). – **Type:** India, Assam, *Masters s.n.*; holotype CAL [CAL0000004757] image!; isotypes B[B 10 0294284] image!, K[K000644589]!.

Tinospora gibbericaulis Hand.-Mazz., *Anzeiger der Akademie der Wissenschaften in Wien. Mathematische-naturwissenschaftliche Klasse* 60: 95 (Handel-Mazzetti 1924 ‘1923’). – **Type:** China, Yunnan, Manhao prope fines Tonkinenses, 1 Mar. 1915, *H.R.E. von Handel-Mazzetti Iter Sinense 5816*; holotype W†; lectotype WU [sheet. no. 39366] image!, designated here, isolectotype A[A00038940] image!.

Additional material examined

SINGAPORE • Mosque at Jalan Inggu, 26 Oct. 1994, *E. Tang & Sidek* 176; SING[SING0042526] • Singapore Botanic Gardens, 16 ??? 1921, *Deshmukh s.n.*; SING[SING0243589] • Singapore Botanic Gardens, 5 Mar. 2014, *Leong et al. SING 2014-086*; SING[SING0212364] • Pulau Ubin, Chek Jawa, 17 Dec. 2002, *A.T. Gwee GAT112*; SING[SING0042802] • Kent Ridge Park, 16 Sep. 1997, *J. Lai LJ263*; SING[SING0030110].

Description

Large woody climber with many pale, smooth, descending adventitious roots. *Stem* glabrous, succulent, tuberculate, each tubercle conical, topped by a pale lenticel with an outer woody ring, often radially cracked, and a central woody plug, bark thin, drying dark coppery brown, surface smooth and shiny, younger stems drying brown or grey, irregularly longitudinally wrinkled, wrinkles sharp-edged; cut stems producing a milky sap, very bitter to the taste. *Leaves* membranous to chartaceous, glabrous, not peltate, basally 5-nerved with small hollow domatia in axils of nerve bases, main nerves slightly raised



Fig. 1. *Tinospora crispa* (L.) Hook.f. & Thomson growing in Singapore showing the densely tuberculate stems. Photo: Yeoh Yi Shuen.

above in dry leaves, raised beneath and minutely papillate (requires magnification), lamina broadly ovate, 10–15 × 7.5–13 cm, base cordate to almost sagittate, apex acute and acuminate, acumen fine and sharp-pointed, reticulations dense, distinct from below, more obscure from above; petiole 5–10 cm long, drying ca 2 mm wide, glabrous, drying light to dark brown, longitudinally striate, not notably swollen at either end, basally geniculate. *Inflorescences* arising behind leaves, main axis typically unbranched, male inflorescences to 18 cm long, main axis ca 1.5 mm wide near base, drying longitudinally striate, glabrous, bearing widely spaced, 1–3-flowered fascicles each subtended by a small, upcurved, lanceolate bracteole, ca 1 mm long, 0.5 mm wide at base, apex acute; female inflorescences shorter, 2–6 cm long with flowers mostly borne singly, each subtended by a bract as in male. *Male flowers* yellow, pedicel 2–3 mm long, 0.3 mm wide, outer sepals 3, ovate, ca 1.5 mm long, 1 mm wide, inner sepals 3, elliptic, 3 mm long, 2 mm wide, apex obtuse to rounded, margin minutely ciliate, base clawed, petals 3, oblanceolate, 2 mm long; ca 0.4 mm wide, clasping alternate stamens, stamens 6, ca 2 mm long, anthers with thecae slightly oblique. *Female flowers* as in male, staminodes 6, to 1 mm long, carpels 3, ellipsoidal, 2 mm long, stigma shortly lobed. *Fruits* ellipsoidal, to 2 cm long, ripening orange, endocarp white, ellipsoidal, 11–13 × 7–9 mm, surface faintly rugulose, slight longitudinal dorsal ridge, becoming more prominent at base and apex, elliptic ventral aperture ca 2 mm long, 1 mm wide, intrusive condyle.

Female flowers and fruits unknown among Singapore collections. Description of these made with reference to material from Thailand.

Distribution

Probably native in mainland South-East Asia and the Philippines but often cultivated as a medicinal plant (Burkill 1935, sub *T. tuberculata*) and spread anthropogenically across tropical Asia. In Singapore, it occurs as a relict of cultivation.

Notes

Tinospora krispa is only rarely collected in flower in Singapore, and has never been collected in fruit. The densely tuberculate stems readily distinguish it from the other species of *Tinospora* occurring in Singapore.

In accordance with ICN (Turland *et al.* 2018) Art. 9.17, a second-stage lectotypification is presented here, as Diels (1910) failed to distinguish between the two specimens of *Thorel 350* in the Paris Herbarium when referring to the type of *Tinospora thorelii*.

Tinospora krispa I.M.Turner sp. nov.

urn:lsid:ipni.org:names:77329782-1

Figs 2–3

Diagnosis

The pit domatia in the axils of the main nerves on the leaf lamina adaxial surface, the general form of the male inflorescence and the turbinate male flower buds are all similar to *Tinospora baenzigeri* Forman, but the male inflorescences are typically longer, the male flower pedicels much longer (10–15 mm vs 1.5–4 mm), and the stamen filaments dry dark rather than pale.

Etymology

The specific epithet represents a contraction of the Malay names for the two islands from which the species is known, Pulau Krismas (Christmas Island) and Pulau Singapura (Singapore Island). The epithet is effectively a noun in apposition.

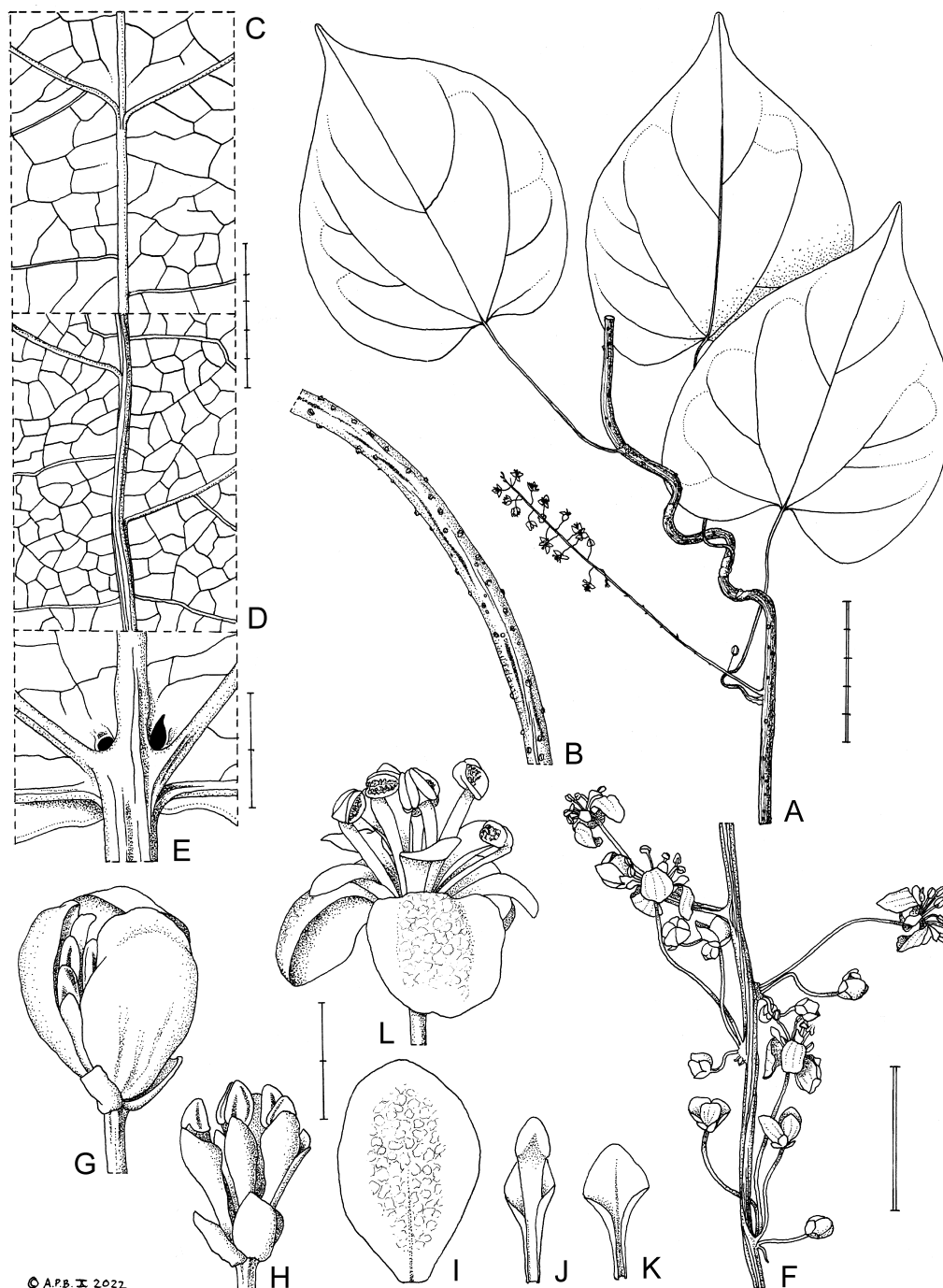


Fig. 2. *Tinospora kripura* I.M.Turner sp. nov. **A.** Habit of male plant bearing inflorescence. **B.** Old stem showing prominent lenticels. **C.** Leaf lamina adaxial surface. **D.** Leaf lamina abaxial surface. **E.** Domatia in nerve axils on leaf abaxial surface. **F.** Part of male inflorescence. **G.** Male flower bud beginning to open. **H.** G after removal of inner sepals to reveal petals clasping filaments of stamens. **I.** Inner sepal abaxial view. **J.** Petal and stamen adaxial view. **K.** Petal with stamen removed, adaxial view. **L.** Open male flower (pedicel incomplete) with anthers post dehiscence. Drawn by Andrew Brown. Graduated single bar = 2 mm and 5 mm, double bar = 1 cm, graduated double bar = 5 cm. Material used: *Powell & H'ng 263C* (K) (A, F–L); *Powell 439* (K) (B); *Lua SING 2015-080* (SING) (C, D); *Powell & H'ng 263A* (K) (E).

Material examined

Type

CHRISTMAS ISLAND • 3 Aug. 1981, *D.A. Powell & H'ng Kim Chey 263E*; holotype K[K001129962, K001129963, one specimen mounted on two sheets]!.

Paratypes

CHRISTMAS ISLAND • Jun. 1981, *D.A. Powell & H'ng Kim Chey 263C*; K! • Isabel Beach, Feb. 1981; *D.A. Powell & H'ng Kim Chey 263B*; K! • Isabel Beach, Dec. 1980, *D.A. Powell & H'ng Kim Chey 263A*; K! • Between waterfall and Ethel Beach, Mar. 1993, *D.A. Powell 1217*; K! • Isabel Beach, 28 Sep. 1981, *D.A. Powell & H'ng Kim Chey 408*; K! • Smith's Point, 28 Sep. 1981, *D.A. Powell & H'ng Kim Chey 407B*; K! • 11 Nov. 1981, *D.A. Powell 439*; K!.



Fig. 3. Photograph of *Tinospora krispura* I.M.Turner sp. nov. on Christmas Island showing male inflorescences. Reproduced with the permission of the Board of Trustees of the Royal Botanic Gardens, Kew.

SINGAPORE • Bukit Tinggi, Kampong Chantek, 16 Sep. 2016, *H.K. Lua SING 2016-153*; SING [SING0253453, SING0251967]! • Evans Road, 8 Oct. 2015, *H.K. Lua SING 2015-260*; SING[SING0225269]! • Turf Club Road, 30 Mar. 2015, *H.K. Lua SING 2015-080*; SING[SING0232261, SING0232260]! • Balestier Road, 1899, *H.N. Ridley s.n.*; SING[SING0042527]! • Government House Domain, 15 Jul. 1931, *R.E. Holttum s.n.*; SING[SING0042531]!.

Description

Large woody climber with young shoots twining, abundant long descending aerial roots. *Old stems* with a smooth shiny uniformly coloured yellow-brown to red-brown thin outer layer, peeling in places, drying coarsely wrinkled with scattered raised pale lenticels, in cross section with vascular bundles divided radially, younger stems drying pale brown or grey, finely longitudinally wrinkled with abundant raised pale lenticels, young twigs drying uniformly longitudinally finely striate, glabrous. *Leaves* membranous to subcoriaceous, glabrous, drying pale grey-green to grey-brown, generally slightly paler below, not peltate, main nerves more or less flush above, raised below, lamina ovate, 9–17 × 6.5–12 cm, base cordate, apex acuminate, main nerves palmately arranged, 5–7, with pit domatia in nerve axils below, tertiary venation reticulate and clearly visible from both surfaces in dry leaves; petioles 3–11 cm long, 0.5–1.5 mm wide midlength, glabrous, not notably swollen at either end when dry, base often geniculate with long straight central portion, drying pale brown, finely and uniformly longitudinally striate. *Male inflorescences* solitary, arising from axils of fallen leaves or on old stems, main axis very slender, to 30 cm long, ca 1 mm wide near base when dry, glabrous, drying brown, finely longitudinally striate, laxly bearing, more or less uniformly spaced fascicles of 3–4 flowers in a close-packed row on a very short, laterally compressed protruberance of the main axis, subtended by an ovate, incurved bracteole, ca 1 mm long, 0.5 mm wide, apex acute, glabrous, flowers developing in order from uppermost. *Male flowers* mostly green in vivo, obovoid in bud, pedicel filiform, 10–15 mm long at anthesis, drying ca 0.2 mm wide, glabrous, drying brown, faintly longitudinally striate, sepals glabrous, outer sepals 3, elliptic 1–1.5 × 0.7–0.8 mm, drying minutely verruculose outside, inner sepals 3, elliptic to obovate, 4 × 2 mm, apex rounded, base cuneate, in bud 1 inner sepal each with 2, 1 or 0 margins overlapped, reflexing at anthesis, drying brown, sometimes with ca 5 longitudinal veins visible, minutely verruculose outside, petals 6, basally connate, yellow in vivo, narrowly rhomboidal, ca 2 × 1 mm, long basal portion with margins inrolled to form tube clasping filament of opposed stamen, apical portion ca 1 × 1 mm, spreading, stamens 6, 3–4 mm long, filament filiform or winged, wings widening distally, connective triangular with oblique thecae meeting apically. *Female inflorescences, flowers and fruits* unknown.

Distribution

Currently only known from Christmas Island and Singapore.

Notes

Forman (1986, 1993) referred the Christmas Island specimens to his *Tinospora baenzigeri*, a species otherwise known from the strongly seasonal parts of Central and Northern Thailand, with drought-deciduous vegetation. The occurrence of the Christmas Island plant on aseasonal Singapore, with collections dating back to the 19th Century, must raise questions as to whether there is only one species involved. Forman (1986) noted that there were many similarities between the Thailand and the Christmas Island collections, but that the male flower pedicels were considerably longer on Christmas Island. The Singapore specimens are very similar to the Christmas Island ones. Given the consistent and considerable differences in the length of the pedicel in the male flowers, I feel justified in describing a new species for the Christmas Island and Singapore plant. Forman suggested that the plants on Christmas Island could be escapes from cultivation of imported plants. Given the distance between Christmas Island and Thailand, this seems unlikely, when considering *Tinospora baenzigeri* as the species in question. But cultivating plants from Singapore on Christmas Island seems more likely given the closer proximity

and former political and cultural ties between the two islands (Christmas Island was administered from Singapore in the period 1949–1958).

Tinospora macrocarpa Diels

Fig. 4

in Engler, *Das Pflanzenreich* IV, 94(46): 141 (Diels 1910). – **Type:** PENINSULAR MALAYSIA – • Malacca, 7 Jun. 1868, *A.C. Maingay* 3133 [Kew Distrib. 111]; holotype K [K000644584]!; possible isotype K [K000644583]!.

Additional material examined

SINGAPORE • Cluny Road, 1899, *H.N. Ridley s.n.* [Talka leg.]; SING[SING0042528] • Western Catchment, 15 Jun. 2010, *Hassan et al.* SING 2010-769; SING[SING0146684] • Mandai Track 7, 27 Feb. 2012, *Ang & Yeo s.n.*; SING[SING0168703] • Nee Soon Firing Range, 12 May 2019, *Ng & Yeo* SING 2019-483; SING[SING0315293, SING0315294, SING0310265] • Singapore Botanic Gardens, 6 Apr. 1921, *Deshmukh s.n.*; SING[SING0243590] • Balestier, 1898, *H.N. Ridley s.n.*; SING[SING0042532] • Yo Chu Kang, 1902, *H.N. Ridley s.n.*; SING[SING0042525] • cultivated in Pasir Panjang Nursery, 9 Feb. 2022, *R.C.J. Lim & X.Y. Ng* SING 2022-242; SING[SING0359031] • 1867–1868, *A.C. Maingay* 2594 [Kew distrib. no. 112]; K • Tanah Runto, 14 Feb. 1890, *J.S. Goodenough s.n.*; BM.

Description

Large woody climber with twining young shoots; descending aerial roots present. *Old stems* drying red-brown, irregularly longitudinally wrinkled, bark thin, smooth, shiny with scattered pale raised lenticels,



Fig. 4. Specimen of *Tinospora macrocarpa* Diels from Singapore with unripe fruits. Photo: Paul Leong.

young stems paler brown, more consistently longitudinally striate, glabrous. *Leaves* membranous to chartaceous, glabrous, not peltate, basally 5-nerved, generally with minutely papillate glandular patches on lower lamina surface between bases of main nerves, nerves flush to slightly raised above in dry leaves, raised below, lamina ovate, 7.5–18 × 5–13 cm, base truncate to strongly cordate, apex acute and acuminate, acumen may be fine and sharply pointed, reticulations visible on both surfaces; petiole 4.5–13 cm long, drying 1–2 mm wide, longitudinally striate, not notably swollen at either end, but usually geniculate at base. *Male inflorescences* borne in groups on the old stems, unbranched, slender, sometime slightly zigzag, 7–20 cm long; flowers borne about 3 together subtended by bracteole 0.5–1 mm long. *Male flowers* subsessile, outer sepals 3, triangular-ovate 0.8 mm long, inner sepals 3, broadly elliptic, concave 1.5–2 mm long; petals 6, oblong with lateral edges incurved; stamens 6, 0.8 mm long. *Female inflorescences* and *female flowers* unknown. *Infructescences* to 25 cm long, fruiting pedicel 5–13 mm long, 2–3 mm thick, drupes 1–3 per flower, mostly 1, ovoid, 4 × 1.5–2 cm, green with pale spots when immature, ripening orange, drying dull black, longitudinally wrinkled with a short beak and short stipe, glabrous, pericarp thick, mesocarp white and mucilaginous, endocarp ovoid, 3–3.5 × 1.3–1.5 cm, drying almost white, ventrally with a pronounced groove, dorsally with a slight narrow ridge that becomes a more prominent keel basally, scattered irregularly tubercles laterally. *Seed* ± cylindrical, ca 2 × 1 cm, with a marked ventral groove.

Distribution

Endemic to the Malay Peninsula. Forman (1986) included some fruiting specimens from Sabah in *T. macrocarpa*, but these appear to me to represent a separate species and are hence excluded here.

Notes

Tinospora macrocarpa has glandular patches on the lower lamina surface between the main nerves. These readily distinguish the species from the others found in Singapore. The scattered tubercles on the endocarps contrast with the densely verruculate endocarps of *T. singapura* I.M.Turner sp. nov.

Tinospora singapura I.M.Turner sp. nov.

urn:lsid:ipni.org:names:77329783-1

Figs 5–7

Diagnosis

Similar to *T. sumatrana* Becc. and *T. macrocarpa*, but differs in having leaves with the base rounded to cuneate, rather than cordate, and 3-nerved, rather than 5-nerved, with no glandular patches in the axils of those main nerves adaxially, and the fruit endocarp being densely verruculose rather than with scattered warts.

Etymology

The specific epithet consists of the Malay name for Singapore, the type locality of the species. The epithet should be treated as a noun in apposition.

Material examined

Type

SINGAPORE • Jalan Kampong Chantek to Bukit Tinggi Road, 15 Sep. 2016, H.K. Lua & R. Lim SING 2016-152; holotype SING[SING0253451, SING0253452, one specimen mounted on two sheets]!

Paratype

SINGAPORE • Jalan Kampong Chantek to Bukit Tinggi Road, 15 Sep. 2016, H.K. Lua & R. Lim SING 2016-154; SING[SING0251968]!

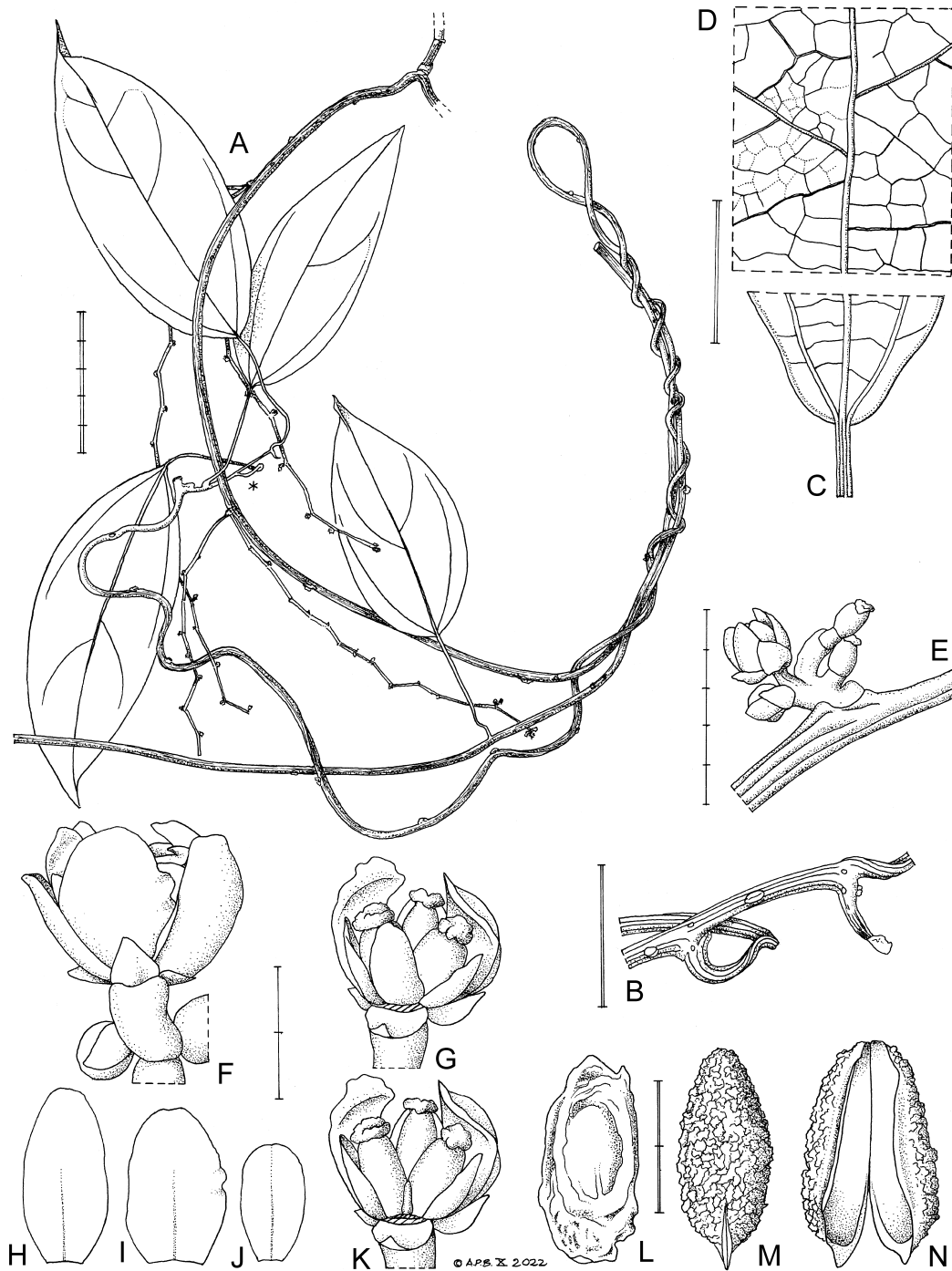


Fig. 5. *Tinospora singapura* I.M.Turner sp. nov. **A.** Habit of female plant. **B.** Detail of stem and petiole surface at * in A. **C.** Leaf base abaxial view, note absence of domatia. **D.** Abaxial leaf surface centrally. **E.** Detail of fascicle of flowers on female inflorescence. **F.** Open flower, side view, with developing flower bud to left. **G.** Flower in F after removal of two inner sepals to reveal petals and the three carpels. **H, I.** Inner sepals, abaxial view. **J.** Petal, abaxial view. **K.** Flower in G after removal of petal to reveal staminode. **L.** Drupe in dry state. **M.** Endocarp. **N.** Endocarp after splitting with seed removed. Drawn by Andrew Brown. Graduated single bar = 2 mm and 5 mm; double bar = 1 cm; graduated double bar = 2 cm and 5 cm. Material used: *Lua et al. SING 2016-152* (SING) (A–E); *Lua et al. SING 2016-154* (SING) (F–N).



Fig. 6. Plant of *Tinospora singapura* I.M.Turner sp. nov. in Singapore showing stems and abundant aerial roots. Photo: Reuben Lim.



Fig. 7. Fallen fruits and endocarps of *Tinospora singapura* I.M.Turner sp. nov., with the seed germinating in one case. Photo: Reuben Lim.

Description

Woody climber with abundant descending aerial roots. *Twigs* drying red-brown or brown, glabrous, shiny, irregularly longitudinally wrinkled, wrinkles narrow and quite sharp-edged with scattered raised pale lenticels, and leaf scars as raised, slightly concave, discs. *Leaves* chartaceous, glabrous, drying pale grey-brown, not peltate, 3-nerved at base, domatia absent, main nerves more or less flush above in dry leaves, raised beneath; lamina ovate to narrowly elliptic, 5–13 × 2.5–5.5 cm, base rounded to cuneate, apex acuminate, reticulations visible from both surfaces; petiole 2–4.5 cm, ca 1 mm wide at midlength, drying yellow-brown, finely and uniformly longitudinally striate, not notably swollen at ends when dry. *Male inflorescences* and *flowers* unknown. *Female inflorescences* from axils of fallen leaves, mostly solitary, main axis 10–16 cm long, ca 1 mm wide at base, glabrous, drying brown, finely longitudinally striate, slightly zig-zag, bearing on short lateral protruberences regularly spaced fascicles of 3–4 subsessile flowers or very reduced branches bearing 2–3 flowers. *Female flowers* sessile to subsessile, sepals 3 + 3, outer sepals ovate, ca 0.5 × 0.5 mm, drying brown, glabrous, minutely verruculose-papillate outside, inner sepals ovate, ca 1.5 × 1 mm, drying dark brown, minutely verruculose-papillate outside, apical margin minutely ciliate, carpels 3, clavate, ca 1 mm long, 0.5 mm wide distally, drying yellow, stigma sessile. *Fruits* ovoid, 4.5 × 3 cm smooth, ripening orange-yellow, fleshy, drying brown and coarsely wrinkled with surface shiny and minutely rugulose, pericarp ca 4 mm thick, yellow in vivo, mesocarp thin and translucent; endocarp white, 3–3.5 × 1.5 cm, prominent narrow basal keel, very slight ventral groove, dorsal and lateral surfaces with a dense and more or less uniform covering of small, short conical warts, endocarp wall thin but quite stiff, splitting longitudinally from ventral groove and along middle of basal keel.

Distribution

The species is only known from Singapore.

Notes

The leaves and endocarps of the Singapore specimens are very distinctive and not readily confusable with any other known species of *Tinospora*. The stems and female flowers are typical for the genus, so there is no doubt about its placement.

Why a species in a much-collected locality as Singapore should escape detection until now is a matter for speculation. A possibility is that the plant or population at the Kampong Chantek site represents a relict of cultivation of a species brought from some distant place, perhaps Sumatra or Borneo.

Discussion

The Menispermaceae, despite often being economically and culturally important as medicinal plants, remain a challenge taxonomically. That a location which has been intensively botanised for over a century, such as Singapore, can have half of the species in a genus as undescribed is remarkable and surely reflective of the difficulties associated with research on large, dioecious climbers. High-climbing lianas are difficult to collect properly and when the flowers are small and the fallen fruits unexceptional they often escape detection by field botanists. Many species are still unknown in terms of one of the sexes. More and better collections remain a prerequisite to a fuller understanding of the family.

Acknowledgements

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References

- Baillon H. 1883. *Traité de botanique médicale phanérogamique. Fasc. I.* Librairie Hachette et Cie, Paris.
- Boerlage J.C. 1899. *Catalogus plantarum phanerogamarum quae in Horto Botanico Bogoriensi coluntur. Fasc. I.* Typis Officinae Publicae, Bataviae.
- Burkill I.H. 1935. *A Dictionary of the Economic Products of the Malay Peninsula. Vol. II.* Crown Agents for the Colonies, London.
- Chi S., She G., Han D., Wang W., Liu Z. & Liu B. 2016. Genus *Tinospora*: ethnopharmacology, phytochemistry, and pharmacology. *Evidence-based Complementary and Alternative Medicine* 2016(9322593): 1–32. <https://doi.org/10.1155/2016/9232593>
- De Candolle A.P. 1817. *Regni vegetabilis systema naturale. Vol. I.* Treuttel & Würtz, Paris.
- Diels L. 1910. Menispermaceae. In: Engler A. (ed.) *Das Pflanzenreich* IV, 94 (46): 1–345.
- Fleming J. 1810. A catalogue of Indian medicinal plants and drugs, with their names in the Hindustani and Sanscrit languages. *Asiatick Researches* 11: 153–196.
- Forman L.L. 1981. A revision of *Tinospora* (Menispermaceae) in Asia to Australia and the Pacific: the Menispermaceae of Malesia and adjacent areas: X. *Kew Bulletin* 36: 375–421. <https://doi.org/10.2307/4113613>
- Forman L.L. 1986. Menispermaceae. In: Van Steenis C.G.G.J. (ed.) *Flora Malesiana*, ser. I, 10(2): 157–253. <https://repository.naturalis.nl/pub/532690>
- Forman L.L. 1993. Menispermaceae. In: *Flora of Australia* 50 (Oceanic Islands 2): 79–83.
- Gagnepain F. 1908. Nouveautés asiatiques de l’herbier du Muséum (I. Hydrocharitacées, II. Ménispermacées, III. Lardizabelées). *Bulletin de la Société botanique de France* 55: 43–48.
- Handel-Mazzetti H. 1924 ‘1923’. Plantae novae Sinenses, diagnosis brevibus descriptae. *Anzeiger der Akademie der Wissenschaften in Wien. Mathematische-naturwissenschaftliche Klasse* 60: 95–101.
- Heyne K. 1927. *De nuttige planten van Nederlandsch-Indië. Vol. 1, ed. 2.* Departement van Landbouw, Nijverheid en Handel in Nederlandsch-Indië, Buitenzorg.
- Hooker J.D. & Thomson T. 1855. *Flora Indica. Vol. 1.* W. Pamplin, London.
- Lamarck [J.B.A.P.M.] 1797. *Encyclopédie méthodique. Botanique. Vol. 4, part 1.* Chez H. Agasse, Paris.
- Lian L., Ortiz R.del C., Jabbour F., Chen Z.-D. & Wang W. 2019. Re-delimitation of *Tinospora* (Menispermaceae) implications for character evolution and historical biogeography. *Taxon* 68(5): 905–917. <https://doi.org/10.1002/tax.12126>
- Linnaeus C. 1763. *Species plantarum. Vol. 2, ed. 2.* Impensis Direct. Laurentii Salvii, Holmiae.
- Singh D. & Chaudhuri P.K. 2017. Chemistry and pharmacology of *Tinospora cordifolia*. *Natural Product Communications* 12: 299–308. <https://doi.org/10.1177/1934578X1701200240>
- Theobald W. 1883. *Burmah. Vol. 2, ed. 4.* Stephen Austin & Sons, Hertford.
- Turland N.J., Wiersema J.H., Barrie F.R., Greuter W., Hawksworth D.L., Herendeen P.S., Knapp S., Kusber W.-H., Li D.-Z., Marhold K., May T.W., McNeill J., Monro A.M., Prado J., Price M.J. & Smith G.F. 2018. *International Code of Nomenclature for algae, fungi, and plants (Shenzhen Code) adopted by the Nineteenth International Botanical Congress Shenzhen, China, July 2017. Regnum Vegetabile* 159. Koeltz Botanical Books, Glashütten. <https://doi.org/10.12705/Code.2018>

Wallich N. 1831–1832. *A Numerical List of Dried Specimens*. Nos. 4876–6224. London.

Wang W., Ortiz R.del C., Jacques F.M.B., Chung S.-W., Liu Y., Xiang X.-G. & Chen Z.-D. 2017. New insights into the phylogeny of Burasaieae (Menispermaceae) with the recognition of a new genus and emphasis on the southern Taiwanese and mainland Chinese disjunction. *Molecular Phylogenetics and Evolution* 109: 11–20. <https://doi.org/10.1016/j.ympev.2016.12.038>

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