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Tinospora merrilliana (Menispermaceae): an addition to the flora of India

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Abstract: *Tinospora merrilliana* Diels, a little known endemic species of Central Malesia, is reported for the first time as a new record to the flora of India. The species was collected from the Telyababa forest range, Burhanpur district, Madhya Pradesh. A detailed description, distribution, habitat, colour plates, and a key to the species of *Tinospora* Miers in India are provided for easy identification.

Keywords: Central India, Menispermaceae, New record, Telyababa forest range, *Tinospora*.

Introduction

Tinospora Miers is a widespread genus in the family Menispermaceae comprising about 35 species and is distributed throughout tropical Africa, Madagascar, Asia to Australia and the Pacific Islands (Forman, 1981; Kessler, 1993; Pramanik & Gangopadhyay, 1993; Udayan *et al.,* 2009; Mujaffar *et al.,* 2014; Rajendran *et al*., 2016; Wang *et al*., 2017; Mabberley, 2017; Lian *et al*., 2019; Mishra, 2020a,b; Mishra & Mishra, 2020; Mishra *et al*., 2020a,b). The genus is represented by eleven species in India *viz*., *T. baenzigeri* Forman, *T. cordifolia* (Willd.) Miers ex Hook.f. & Thomson, *T. crispa* (L.) Hook.f. & Thomson, *T. formanii* Udayan & Pradeep, *T. glabra* (Burm.f.) Merr., *T. mahajanii* Shakun Mishra, Khristi & Solanki, *T. maqsoodiana* Mujaffar, Moinudd. & Mustakim, *T. neocaledonica* Forman, *T. sinensis* (Lour.) Merr., *T. smilacina* Benth., and *T. subcordata* (Miq.) Diels (Mishra *et al*., 2020a). During our field studies in the period 2016–2018 in the Telyababa forest range in Madhya Pradesh, specimens of *Tinospora* were collected, which on further scrutiny were identified as *T. merrilliana* Diels, a species so far only known from Borneo, Philippines and Sulawesi. Hence, it is reported here as a new addition to the flora of India.

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Materials and Methods

Morphological descriptions and ecological information presented here are based on field observations and material collected during fieldwork in the Telyababa forest range in the period 2016–2018. Detailed examination of the materials was done under an RXLr-5 stereo microscope (Radical Scientific Equipments, Ambala, India) and their identity was confirmed by comparison with the pertinent literature (Forman, 1981; Kessler, 1993; Pramanik & Gangopadhyay, 1993; Xianrui *et al*., 2008; Udayan *et al.,* 2009; Mabberley, 2017). Living plants of *T. merrilliana* were introduced to the botanical garden of the Department of Botany, Shri Neelkantheshwar Government Post Graduate College, Khandwa and voucher specimens were deposited at CAL and BSI.

Taxonomic Treatment

Tinospora merrilliana Diels, Pflanzenr. (Engler) Menispermac. 137. 1910; Elmer, Leaflets. Philipp. Bot. 4: 1164. 1911; Merrill, Enum. Philipp. Fl. P1. 2: 146. 1923. *Fawcettia merrilliana* (Diels) Yamam,

Trans. Nat. Hist. Soc. Formosa 34: 230. 1944. *Type*: Sarawak, *Haviland* 1581 *pro parte quoad inflor. masc* (K [K000644577 digital image!]).

T. negrotica Diels, Pflanzenr. (Engler) Menispermac. 137. 1910. *Type*: PHILIPPINES, **Negros**, *Elmer* 9468 (holo B [B100294281 digital image!]).

Figs. 1 & 2

Slender, woody, dioecious climber with slimy watery sap when cut; bark rough, drying striate. Stems up to 1 cm in diam., young stems 1.5–3 mm in diam., puberulous or glabrous; older stems covered with raised corky lenticels. Leaves with petioles 4–9 cm long, puberulous or glabrous, geniculate and slightly swollen at base; lamina narrowly ovate to ovate or broadly ovate, base truncate to deeply cordate, apex acuminate, 7–22 × 3–16 cm, palmately 5–7-nerved at base, main nerves usually impressed on upper surface and prominent below, both surfaces glabrous, texture stiffly chartaceous, domatia absent. Male inflorescences axillary or arising from older, leafless stems, pseudo-paniculate, 6–16 cm long, solitary or several branches arising together, very slender, puberulous, mostly without flowers in lower half of each branches. Male flowers on 2–5 mm long pedicels; sepals pale green, very thin, glabrous or sparsely puberulous, outer 3 ovate, 1–1.5 mm long, inner 3 obovate to spathulate, 2–3 mm long; petals 6, unguiculate with distinct oblate limb, 1.5–2 mm long, apically fleshy; stamens 6, narrowly clavate, 2–2.5 mm long. Female inflorescences bracteate, pseudo-racemose, solitary, 15–30 cm long, very slender, puberulous. Female flowers on 4–7 mm long pedicles; sepals and petals same as in males; staminodes absent; carpels 3, ellipsoid, 1.5–2 mm long; style terminal; stigma very strongly lobed. Infructescences narrowly pseudo-paniculate, up to 30 cm long, pendent with slender peduncle up to 23 cm long, puberulous. Drupes greenish at immature stage, greenish-white when ripe, radiating from sub-globose carpophore 1–2 mm in diam. on peduncles, 4–6 mm long; pericarp glabrous, drying close to endocarp, mesocarp pulpy, endocarp thinly crustaceous, usually pale, broadly ellipsoidal, 7–8 mm long, dorsally with an obscure medium ridge, surface smooth or obscurely tuberculate, ventrally flattish with elliptic aperture leading to deeply intrusive condyle.

Flowering & fruiting: Flowering from October to December and fruiting from January to May.

Habitat: This species grows in loamy soil along with hedges around cultivated field at an altitude of 318 m. It is rare and sparsely distributed occurring sympatrically with *Tinospora sinensis*. The associated plants in the locality are *Clerodendrum phlomidis* L.f. (Lamiaceae), *Ailanthus excelsus* Roxb. (Simaroubaceae) and *Azadirachta indica* Juss. (Meliaceae).

Distribution: Southeast Asia to South Asia from Borneo, Philippines Sulawesi and now in India.

Specimen examined: INDIA, **Madhya Pradesh**, Burhanpur district, Telyababa forest range, 20.02.2019, *Shakun Mishra* 1019 (BSI, CAL).

Notes: *Tinospora merrilliana* is a little known endemic species of Central Malesia, disjunctly distributed in some parts of Asia-tropical including Borneo, Philippines (Palawan, Luzon, Catanduanes, Panay, Mindanao) and Northeast Sulawesi (Minahassa). It is morphologically closely allied to *Tinospora dissitiflora* (K.Schum & Lauterb.) Diels but differs in many characters: the petioles in *T. merrilliana* are geniculate basally and slightly swollen whereas it is not geniculate in *T. dissitiflora*. In addition, only the latter species has glandular patches in basal nerve axils. Further, the inflorescences of the two species are different. *T. merrilliana* shows bracteate, pseudoracemose, solitary female inflorescence; 15–30 cm long puberulous peduncles; female flowers on 4–7 mm long pedicles; absence of staminodes and, three carpels towards the periphery whereas in *T. dissitiflora* shows male axillary inflorescences or arise from older, leafless stems, pseudopaniculate; female inflorescences pseudopaniculate towards the base; male flowers on very slender pedicels, 5–10 mm long; female flower with 6 staminodes and subulate. Similarly, the drupes of *T. merrilliana* are

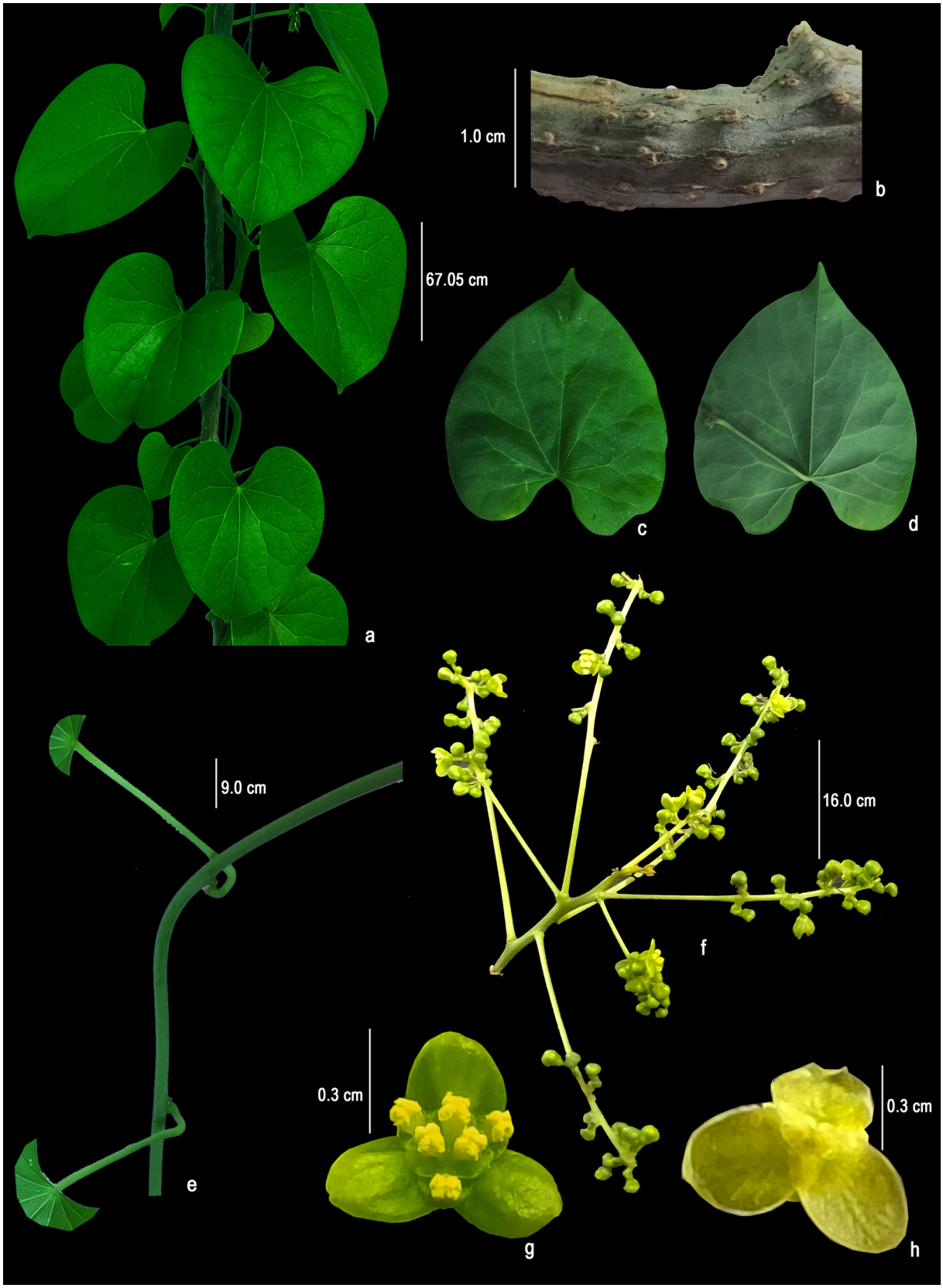

Fig. 1. *Tinospora merrilliana* Diels: **a.** Twig; **b.** Woody stem with raised corky lenticels; **c.** Adaxial view of leaf; **d.** Abaxial view of leaf; **e.** Part showing geniculate and slightly swollen petiole base; **f.** Male inflorescence; **g.** Male flower-front view; **h.** Male flower-back view (from *Mishra* 1019; photos by D. Mishra).

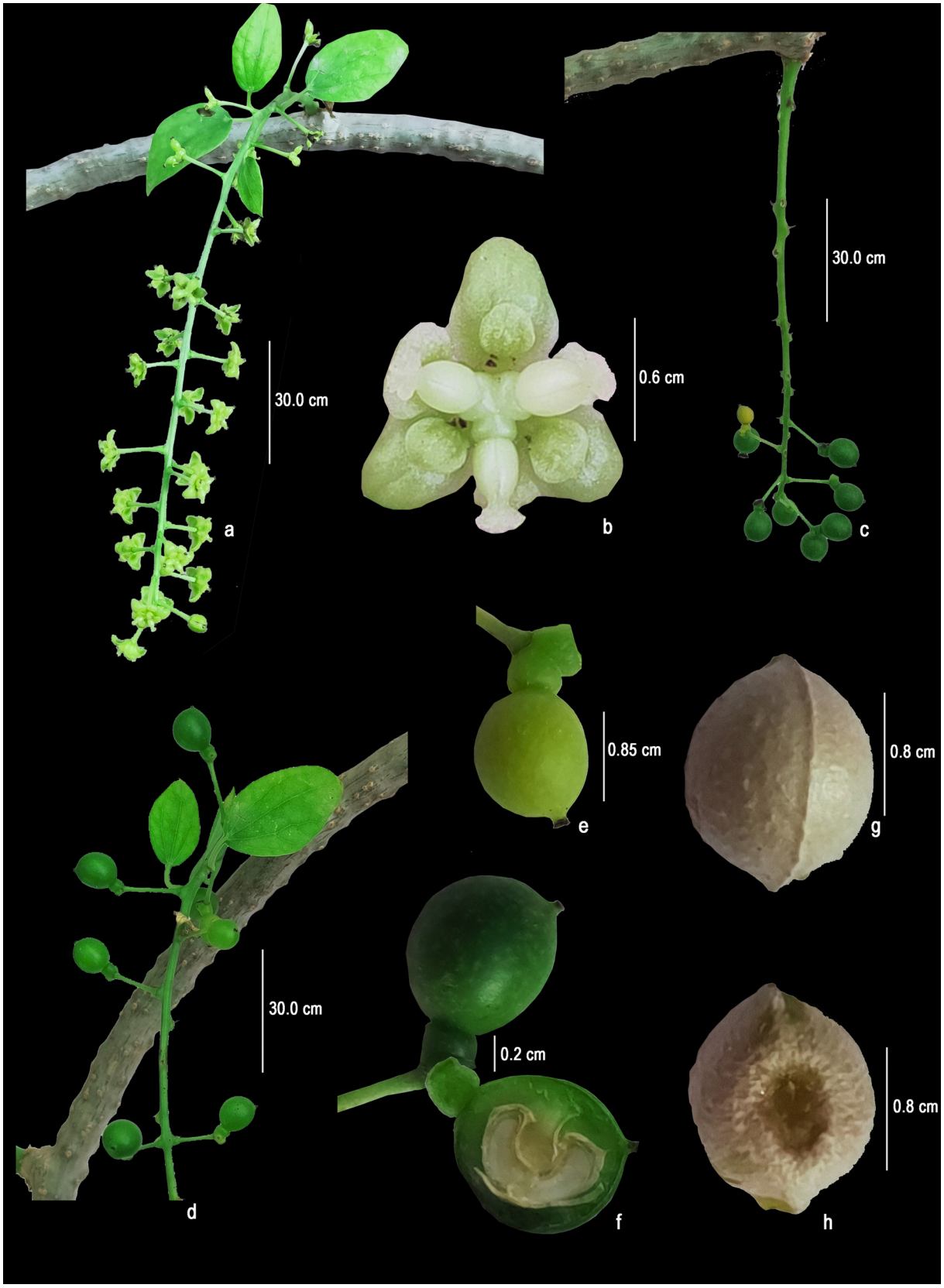

Fig. 2. *Tinospora merrilliana* Diels: **a.** Female inflorescence; **b.** Female flower-front view; **c.** Infructescence; **d.** Infructescence with leafy bracts; **e.** Mature drupe; **f.** Immature drupe with carpophore and longitudinal section of drupe; **g.** Endocarp-dorsal view; h. Endocarp-ventral view (from *Mishra* 1019; photos by D. Mishra).

greenish when young and or later become greenish white, but in *T. dissitiflora* they are red. Moreover, the endocarp of *T. merrilliana* is broadly ellipsoidal in outline, 7–8 mm long, dorsally with an obscure medium ridge, smoother surface obscurely tuberculate. Whereas in *T. dissitiflora* the endocarp is bony, strongly and irregularly tuberculate, rather oblong in outline with squarish corners, 10–12 × 7–8 mm. Forman (1981) in his revision of the genus in Asia to Australia and the Pacific has not given details of the female inflorescence, which are provided here.

Key to the species of *Tinospora* in India

1. Climbers with very long filiform aerial roots 2
1. Climbers without or with short aerial roots 6
2. Leaves broadly sinuate ..... *T. sinensis*
2. Leaves triangular 3
3. Stems strongly tuberculate; petals usually 3 ..... *T. crispa*
3. Stems not tuberculate; petals usually 6 4
4. Leaves with a pair of hollow domatia in abaxial axils of basal veins ..... *T. baenzigeri*
4. Leaves with glandular-papillose patches in abaxial axils of basal veins 5
5. Leaves with petioles 2–7 cm long ..... *T. cordifolia*
5. Leaves with petioles 7–11 cm long ..... *T. maqsoodiana*
6. Inflorescences branched 7
6. Inflorescences unbranched 8
7. Infructescences up to 14 cm long ..... *T. mahajanii*
7. Infructescences 15–30 cm long ..... *T. merrilliana*
8. Outer and inner sepals equal ..... *T. formanii*
8. Outer sepals much smaller than inner sepals ..9
9. Leaves with domatia present on abaxial side in axils of basal nerve ..... *T. glabra*
9. Leaves with glandular patches present on abaxial side in basal nerve axils 10
10. Leaves ± ovate with sides convexly curved ..... *T. neocaledonica*
10. Leaves ± triangular to broadly triangular with sides straight or sometimes concave 11
11. Drupes borne on columnar carpophore, 4–5 mm long ..... *T. subcordata*
11. Drupes borne on sub-globose carpophore, 1.5–2 mm long ..... *T. smilacina*

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