

Rediscovery of *Madhuca diplostemon* (Sapotaceae) - a threatened species of the Western Ghats, India, after a hiatus of 184 years

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Abstract: *Madhuca diplostemon* (C.B.Clarke) P.Royen, a threatened endemic species of the Western Ghats, is rediscovered in a sacred grove in Kollam district in Kerala, after a hiatus of 184 years since its first collection. A detailed description, photographs and relevant notes are provided.

Keywords: Endemic species, Kerala, Kollam district, *Madhuca*, Sacred Grove, Sapotoideae.

Introduction

The genus *Madhuca* Buch.-Ham. ex J.F.Gmel. (subfamily Sapotoideae), has about 100 species distributed in Bangladesh, Borneo, China, Hainan, India, Java, Laos, Malaya, Maluku, Myanmar, Nepal, New Guinea, Philippines, Sri Lanka, Sulawesi, Sumatra, Thailand and Vietnam (Mabberley 2017; POWO, 2020). In India seven species are reported viz. *Madhuca bourdillonii* (Gamble) H.J.Lam, *M. diplostemon* (C.B.Clarke) P.Royen, *M. fulva* (Thwaites) Macbr., *M. indica* J.F.Gmel., *M. insignis* (Radlk.) H.J.Lam, *M. longifolia* (Koenig) Macbr. and *M. neriifolia* (Moon) H.J.Lam, of which *M. bourdillonii*, *M. diplostemon*, and *M. insignis* are endemic to the Western Ghats (Nayar & Sastry, 1990; Nayar *et al.*, 2014; IUCN, 2020).

During floristic studies in the sacred groves of Kollam district in Kerala, samples assigned to *Madhuca* were collected from a sacred grove near

Paravur in Kollam district. On critical study with authentic literature and type specimen housed at K and E (herbaria codes according to Thiers, 2020 continuously updated), it has been identified as *M. diplostemon*, an endemic and endangered species of the Western Ghats.

Wight (1848) first described this species in his *Icones Plantarum Indiae Orientalis* as *Diospyros obovata* Wight, based on his collection from Kollam ('Quilon') in 1835 which comprises of three specimens with immature flower buds. Later, Clarke (1882) examined Wight's specimens and found that it neither belonged to *Diospyros* nor to Ebenaceae, but was a close match with *Isonandra* of Sapotaceae. *Diospyros obovata* Wight is a later homonym of *D. obovata* Jacq. (1798), hence he described it as *Isonandra diplostemon* C.B.Clarke with a scanty description. However, owing to its immature floral details, he safely placed it under an anomalous species section that was also followed by Gamble (1921) in his *Flora of the Presidency of Madras*. Royen (1960) during his revisionary investigation of the genus *Madhuca* for South East Asia transferred *Isonandra diplostemon* to *Madhuca* and made a combination viz. *M. diplostemon* (C.B.Clarke) P.Royen. The type specimens are housed at K (K000777740, lectotype) and E (E00179201, E00277959, isolectotypes). Sadly, out of the three specimens collected by Wight, only the duplicate sheets housed at E have the annotation about its type locality as 'Quilon', whereas the type specimen at K is lacking it. Many of the later

botanists might have consulted the type specimen housed at K thought that the specimen was collected from an imprecise locality somewhere on the Deccan Peninsula (Oldfield *et al.*, 1998). Kollam (Quilon) was a quite large area with several luxuriant vegetations in the past. Now, most of these forests have been cleared for several development activities, and currently the original vegetation prevailed in the lowland and midland is confined to the sacred groves. Since its original collection, individuals of *M. diplostemon* were never collected again, neither from its locality nor elsewhere, and botanical explorations in Eastern and Western Ghats have failed to find the species (Nayar & Sastry, 1990; Rakesh, 1993; Oldfield *et al.*, 1998). Moreover, it has not been enlisted in any of the recent treatises of southern India (Nayar *et al.*, 2006, 2014). The present collection hence forms a rediscovery of this species after a hiatus of 184 years since its first collection. A detailed description, photographs, IUCN status and relevant notes are provided in this paper.

Taxonomic treatment

Madhuca diplostemon (C.B. Clarke) P. Royen, *Blumea* 10: 78. 1960. *Isonandra diplostemon* C.B. Clarke, *Fl. Brit. India* 3(9): 540. 1882. *Diospyros obovata* Wight, *Icon. Pl. Ind. Orient.* 4: t. 1226. 1848, *nom. illeg., non* Jacquin 1798. *Lectotype* (designated by Jeuken, 1952): INDIA, Kerala, Kollam district, Kollam (Quilon), December 1835, Robert Wight 583 (K [K000777740 digital image!]; *isolecto* E [E00179201, E00277959 digital images!])

Fig. 1

Small trees, up to 4 m high, bark fissured, blaze yellowish-white, latex thick, sticky, white; branchlets angular, 2–6 mm in diam., glabrous; terminal buds 2.5–3.5 mm long, sparsely ferruginous hairy, stipules minute, lanceolate, *c.* 1 × 0.5 mm, apex acute, glabrous inside, puberulous outside, caducous. Leaves more or less spirally arranged, crowded towards the branch tips, obovate, suborbicular-obovate or narrowly obovate, 3–14 × 1.5–8 cm, base rounded, abruptly narrowed to oblique, margins entire, apex rounded,

retuse to obtusely acuminate, coriaceous, glabrous, dark green on the upper surface, pale on the lower surface, midrib prominent and crested on the upper surface, rounded on the lower surface; venation brochidodromous, secondary veins 10–18 pairs, prominent on both surfaces, ascendant with an angle of 65°, tertiary veins laxly reticulate, distinct on either side but more prominent beneath; petioles 7–14 mm long, flat-convex beneath, glabrous. Fascicles axillary, 3–8-flowered. Flowers pedicellate; pedicels 1–1.5 cm long, gradually thickened towards the apex, ferruginous tomentose when young, later glabrescent. Sepals 4, ovate or ovate-suborbicular, 8–10 × 6–8 mm, apex obtusely acuminate, outer sepals sparsely ferruginous hairy outside, glabrous inside, inner sepals glabrous, hyaline, margins fimbriate. Corolla campanulate, 7–8-lobed, 1.5–1.8 cm long, glabrous; lobes oblong-obovate, apex rounded. Stamens 15–19 in 2 whorls; filaments subulate, short, glabrous; anthers sagittate, apex with *c.* 1 mm long appendix. Ovary oblongoid, *c.* 0.5 cm long, superior, glabrous, 6–8; ovules 1 in each; style slender, 2–2.5 cm long, glabrous; stigma pointed. Berries ellipsoid, 2–3 × 0.8–1 cm, beaked, glabrous. Seed one, narrowly ellipsoid, laterally compressed, 2–2.5 × 0.6–0.8 cm, pale brown, slightly regulate and shining.

Flowering & fruiting: Flowering and fruiting from January to March.

Habitat: Found in a sacred grove at 40 m altitude. There was only one mature tree observed in front of a temple and currently protected by a retaining wall around the tree. There is no associated species in the vicinity of the tree owing to the paved tiles made by the temple authority.

Distribution: Endemic to Kerala.

Specimen examined: INDIA, Kerala, Kollam district, Koonayil Ayiravilli Siva Temple Tavu, Paravur, 22.01.2019, Shailajakumari 9909 (TBGT).

Conservation status: *Madhuca diplostemon* is listed as an endangered species in the IUCN Red List (IUCN, 2020). So far, only one mature individual is known. The senior author could not locate a

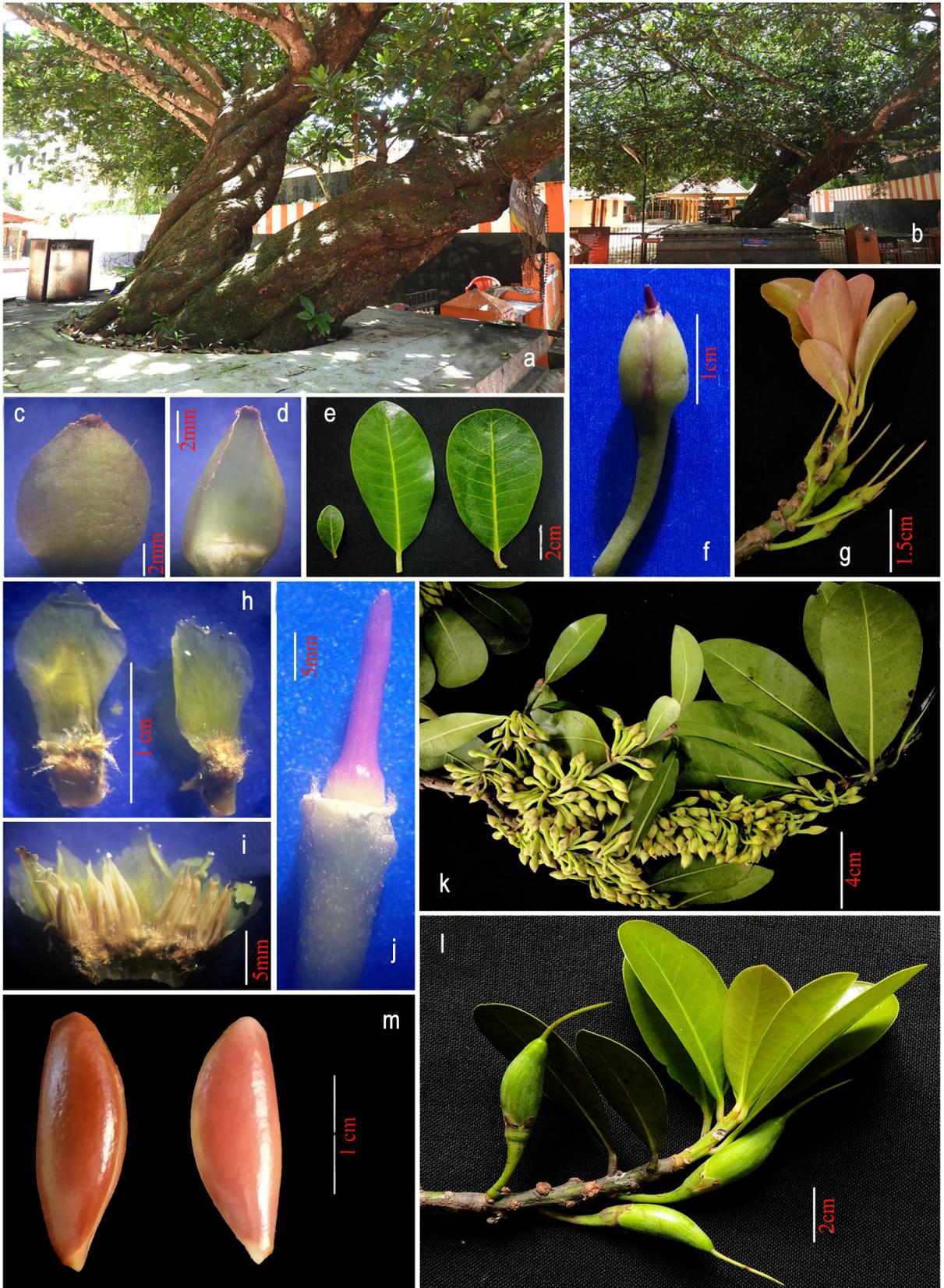


Fig. 1. *Madhuca diplostemon* (C.B. Clarke) P. Royen: **a & b.** Habit; **c.** Outer sepal-lower surface; **d.** Outer sepal-upper surface; **e.** Leaves; **f.** Flower bud; **g.** Young shoot with flowers; **h.** Portion of corolla showing lobes (left-outer corolla lobe, right-inner corolla lobe); **i.** Stamens attached to corolla; **j.** Pistil with part of style removed; **k.** Flowering twig with buds; **l.** Twig with fruits; **m.** Seeds showing both surfaces (photos by E.S. Santhosh Kumar).

second locality of this species despite thorough surveys in more than 1100 sacred groves spread across Kollam district. It is believed that the species was a highly local endemic with a few individuals in the past, which were inadvertently removed for temple expansion in recent years. We have observed a name board on this tree denoted as *Madhuca neriifolia* during our initial surveys. This indicated that the temple authorities might have overlooked this endangered species as a common *Attilippa* (*M. neriifolia*) and cleared the rest of the individuals for temple expansion. Since the species is represented by a single mature individual in a single locality, it is assessed here as Critically Endangered, as per IUCN criteria B2ab(iii) and D (IUCN, 2019).

Notes: Based on morphological and molecular data, Swenson and Anderberg (2005) recognized three subfamilies for Sapotaceae viz. Sarcospermatoidae, Sapotoideae and Chrysophylloideae. The subfamily Sapotoideae has two recognized tribes: Sapoteae and Sideroxyloae, of which Sapoteae includes the formerly recognized subtribes Manilkarinae and Mimusopinae but excludes Glueminae (Mimusopeae) and one part of the tribe Isonandreae. Since Isonandreae is polyphyletic, certain genera previously belonging to this tribe, such as *Madhuca*, *Palaquium* Blanco, *Payena* A.DC., are now included in Sapoteae because of their strong morphological and cladistic support. Now, tribe Sapoteae has eleven genera, of which *Madhuca*, *Manilkara* Adans., *Mimusops* L. and *Palaquium* occur in India.

Madhuca diplostemon is morphologically similar to *M. insignis*, another endangered species of the Western Ghats, but differs from it by having glabrous young shoots (rusty sericeous), lanceolate stipules (lanceolate-subulate), branchlets with coriaceous leaves sub-conferted towards the tip (sub-coriaceous leaves scattered throughout the branchlets), obovate, sub-orbicular-obovate to narrowly obovate lamina (obovate to oblanceolate-oblong), ovate or ovate to sub-orbicular sepals with sparsely ferruginous hairs (ovate sepals with rusty sericeous hairy) and the oblongoid ovary (ovoid

ovary). Since the present description of *M. diplostemon* derived from a single tree located in a sacred grove, we admit that the ranges of variations in morphological characters are quite limited. This can be addressed when more individuals are raised from seeds or located elsewhere. Jawaharlal Nehru Tropical Botanic Garden and Research Institute (JNTBGRI) is planning to undertake *ex situ* conservation activities for this species through its species recovery programme.

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