

Contributions to the Flora of Myanmar V: a new record of *Mallotus tokiae* (Euphorbiaceae) with the description of flower morphology from Lampi Island

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ABSTRACT

Mallotus tokiae (Euphorbiaceae), a poorly known species, was described based upon a single fruiting specimen from Surat Thani Province, peninsular Thailand. We found this species with staminate and slightly mature pistillate flowers in Lampi Island, Myanmar. A new locality record, description of flowers, preliminary conservation assessment and DNA barcoding of this species are provided.

KEYWORDS: Flora, inventory, ITS, *Mallotus*, *matK*, Mergui Archipelago, *rbcL*.

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INTRODUCTION

The genus *Mallotus* Lour. (Euphorbiaceae) comprises about 110 species of shrubs or trees, seldom climbers, and mainly occurs in (sub-)tropical Asia and the western Pacific, with only two species in tropical Africa and Madagascar (Sierra *et al.*, 2007). Recent phylogenetic work using molecular and morphological data showed that *Mallotus* is monophyletic and sister to monophyletic *Macaranga* Thouars (Kulju *et al.*, 2007; Sierra *et al.*, 2010). The two genera are typically characterized by the presence of glandular hairs with a globose to disc-shaped head and extrafloral nectaries on the upper leaf surface, dioecious reproduction and generally dehiscent fruits that often carry soft spines (Sierra *et al.*, 2007; van Welzen *et al.*, 2009; Sierra *et al.*, 2010), and can be distinguished from each other by the number of

thecae in the anthers: two in *Mallotus*, and three or four in *Macaranga* (Slik *et al.*, 2000; van Welzen *et al.*, 2009). Other differences include the general presence of stellate hairs, generally racemose inflorescences and usually much higher stamen numbers (up to ca 150) in *Mallotus*, in contrast to the general absence of stellate hairs, generally paniculate inflorescences and usually lower stamen numbers (up to ca 30) in *Macaranga*.

Currently, 38 and 24 species of *Mallotus* are recognized in Thailand and Myanmar, respectively (Kress *et al.*, 2003; van Welzen *et al.*, 2007; Kiu & Gilbert, 2008; The Plant List, 2013; van Welzen, 2017), of which six and four species are endemic to each country, and 15 species are known from both countries. However, comprehensive floristic surveys in Myanmar have been limited and much remains to be learned

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of its flora as well as of its floristic relations with neighbouring regions in Asia (Tanaka, 2005).

Recently, *Mallotus tokiae* Welzen, was described as endemic to Thailand based on a single fruiting specimen from Surat Thani Province (van Welzen, 2013). This species is distinct from closely related species by its entire opposite leaves with extrafloral nectaries along the margin on every nerve and spiny fruits. This species was known only from the type locality and lacked the description of flowers. During our floristic inventory in Lampi Island, Myanmar in 2017 (Fig. 1), we found *M. tokiae* with flowers and fruits. Here, we provide a new locality, updated description and preliminary conservation assessment.

The morphological comparisons were based on relevant literature (Kress *et al.*, 2003; Sierra *et al.*, 2007; van Welzen *et al.*, 2007; Kiu & Gilbert, 2008; van Welzen, 2013; van Welzen, 2017) and specimens in the herbaria AAU, BKF, FU, RAF, TNS, and the digitized specimen images on the website of JSTOR Global Plants.

In addition to the morphological examination, DNA sequences were extremely helpful for delimiting species (Hebert & Gregory, 2005; Dick & Webb, 2012). We sequenced three DNA barcode regions, *rbcL*, *matK* and ITS (Kress & Erickson, 2012) according to published protocols (Kress *et al.*, 2009; Rohwer *et al.*, 2009; Dunning & Savolainen, 2010).

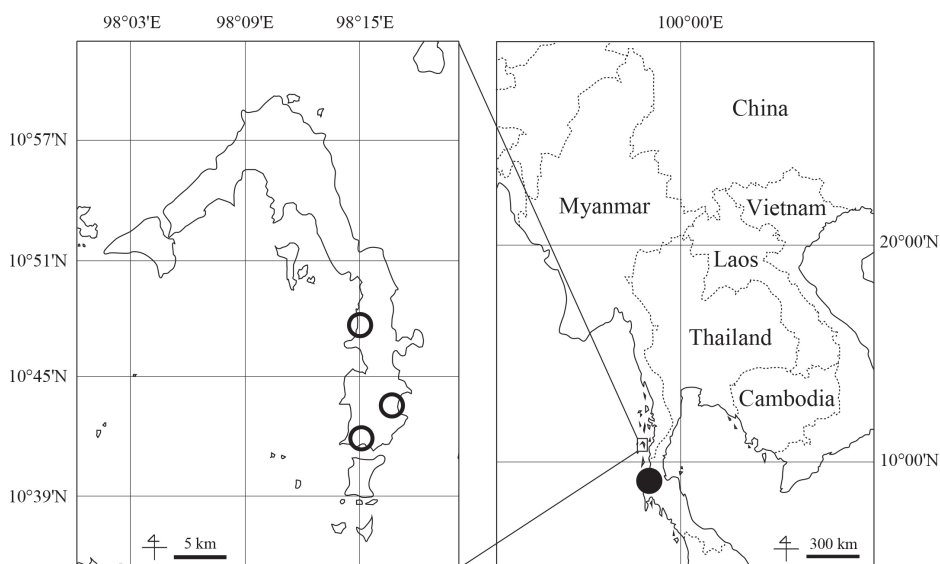


Figure 1. Distribution of *Mallotus tokiae* Welzen. Filled circle represents type locality in Thailand, and opened circles represent newly discovered localities in Myanmar.

UPDATED DESCRIPTION

Mallotus tokiae Welzen, Thai Forest Bull., Bot. 41: 86. 2013. – Figs. 2 & 3.

Type: Thailand, Peninsular, Surat Thani, trail behind Khao Sok Ranger Station, Ratchaprapha Dam, 09°00'N, 98°25'15"E, 20 Feb. 2001 (fr., Chayamarit, Pooma, Chamchumroon, Phattarahirankanok & Middleton 2580 (holotype BKF [SN193513!]; isotype BKF [SN193514!]).

Shrub, ca 1.5 m tall, monoecious with dichogamy (see note). *Indumentum* of stellate to almost lepidote

hairs, glandular scale hairs lacking. *Stipules* triangular, 2–6 × 0.8–2.1 mm, outside almost glabrous to hairy and inside glabrous, late caducous. *Leaves* opposite; petiole 0.5–1.7 cm long, densely hairy, completely pulvinate; blade elliptic, 11.5–34 × 4.3–12 cm, length/width ratio 1.7–3, drying greenish brown, coriaceous, base cuneate to narrowly emarginate, margin entire, apex bluntly acute, upper surface glabrous, with extra floral nectaries, these elliptic, ca 0.8 × 0.4 mm, on every major nerve, 0.5–1 cm from the margin, present above the nerves with a few exceptions, becoming smaller and disappearing

towards the apex, lower surface subglabrous with few stellate hairs, lacking peltate scales; venation penninerved, clearly visible from above and beneath, nerves 6–14 pairs, looped and closed near the margin, somewhat bullate within the arches. *Inflorescences* axillary, single, unbranched, sessile; glomerules of flowers either/both with 3–8 staminate flowers or/and with single pistillate flowers. *Young staminate flowers* 4.5–8 mm in diam., whitish brown; pedicel 1–1.5 mm long, densely covered with brown stellate hairs; sepals 3, ovate to elliptic, 4–6 × 1.5–2.5 mm, densely covered with brown stellate hairs on the outer surface, glabrous on the inner surface except at the apex with stellate hairs, margin entire, apex acute; stamens 21–36, filaments 2.5–5.5 mm long, adnate in the lower half, anthers 0.2–0.3 × 0.5–0.8 mm; pistillode oblate, 0.5–0.8 × 0.8–1.2 mm, very shortly stalked, stalk ca 0.2 mm long. *Slightly fruiting pistillate flowers* ca 7 mm in diam., yellowish green; pedicel ca 2 mm long, densely covered with brown stellate hairs; sepals 2 or 3, ovate, 7.5–8.5 × 3–3.5 mm, densely covered with brown stellate hairs on the outer surface, sparsely covered with brown stellate hairs on the inner surface, margin entire, apex acuminate; ovary 3-locular, ca 6 × 6 mm, covered with up to ca 3 mm long spines; style not distinct; stigmas 3, recurved, ca 5 × 1 mm. *Fruits* axillary, single, capsules surrounded by bracts, 3-locular, ca 2 × 1 cm, opening loculicidally, valves outside greenish to blackish, covered with very slender, up to 5 mm long spines with an acute, bent apex; pedicel ca 2 mm long, densely covered with brown stellate hairs; disc absent; wall thin, woody when dry; columella up to 8 mm long, sturdy, apically broadened. *Seeds* subellipsoid, 9.5–10 × ca 8.5 × 8–8.2 mm, without ariloid.

Other specimens examined. Myanmar.—Tanintharyi [Lampi Island, 10°43'16.1"N, 98°16'44.8"E, alt. 64 m, 21 May 2017 (fl.), *Tagane et al. MY2409* (**FU!**, **RAF!**, **TNS!**); *ibid.*, 10°47'37.0"N, 98°15'5.8"E, alt. 33 m, 22 May 2017 (fr.), *Tagane et al. MY2533* (**RAF!**); *ibid.*, 10°41'38.0"N, 98°14'55.1"E, alt. 55 m, 23 May 2017 (fl.), *Tagane et al. MY2570* (**FU!**, **RAF!**, **TNS!**)].

Preliminary conservation status.—*Mallotus tokiae* is commonly found in evergreen forest at Lampi Island; there are many reproductively mature individuals and the forest is well protected. Therefore, this species would be assessed as Least Concern (LC) according to IUCN Red List Categories (IUCN

Standards and Petitions Subcommittee, 2017).

Notes.—Van Welzen (2013) noted that this species is probably dioecious, but our samples preserved in ethanol to examine the morphology of the inflorescence showed that 14% (2/14) of inflorescence per node were composed of both staminate and pistillate flowers, and 72% (10/14) and 14% (2/14) were composed only of staminate flowers or pistillate flower, respectively. Therefore, *Mallotus tokiae* could be considered as monoecious with dichogamy: staminate and pistillate flowers are on the same plant, but separated by time.

In the fruits, van Welzen (2013) described “sepals persistent, 5”, but the type (*Chayamarit et al. 2580*) and our specimens (*Tagane et al. MY2570*) have 2 or 3 persistent sepals. Here, the description was partially amended according to our present morphological studies.

The BLAST similarity search based on the *rbcL*, *matK* and ITS sequence of *Mallotus tokiae* resulted in homology as high as 565/567 bp with *M. japonicus* (L.) Müll.Arg. (GeneBank accession no. AB267923), 776/782 bp with *M. pierrei* (Gagnep.) Airy Shaw (EF582675), and 687/734 bp with *M. subulatus* Müll.Arg. (DQ866622) in the DNA database, respectively. The *matK* sequences between *M. tokiae* and *M. calocarpus* Airy Shaw, the morphologically most similar species (van Welzen, 2013) differ in 2 bases of the 500 total (EF582635) with removing ambiguous sequences (nucleotide code “N”).

GenBank accession number (entry ID).—*Tagane et al. MY2409*: LC498617 (*rbcL*), LC498618 (*matK*), LC498619 (ITS).

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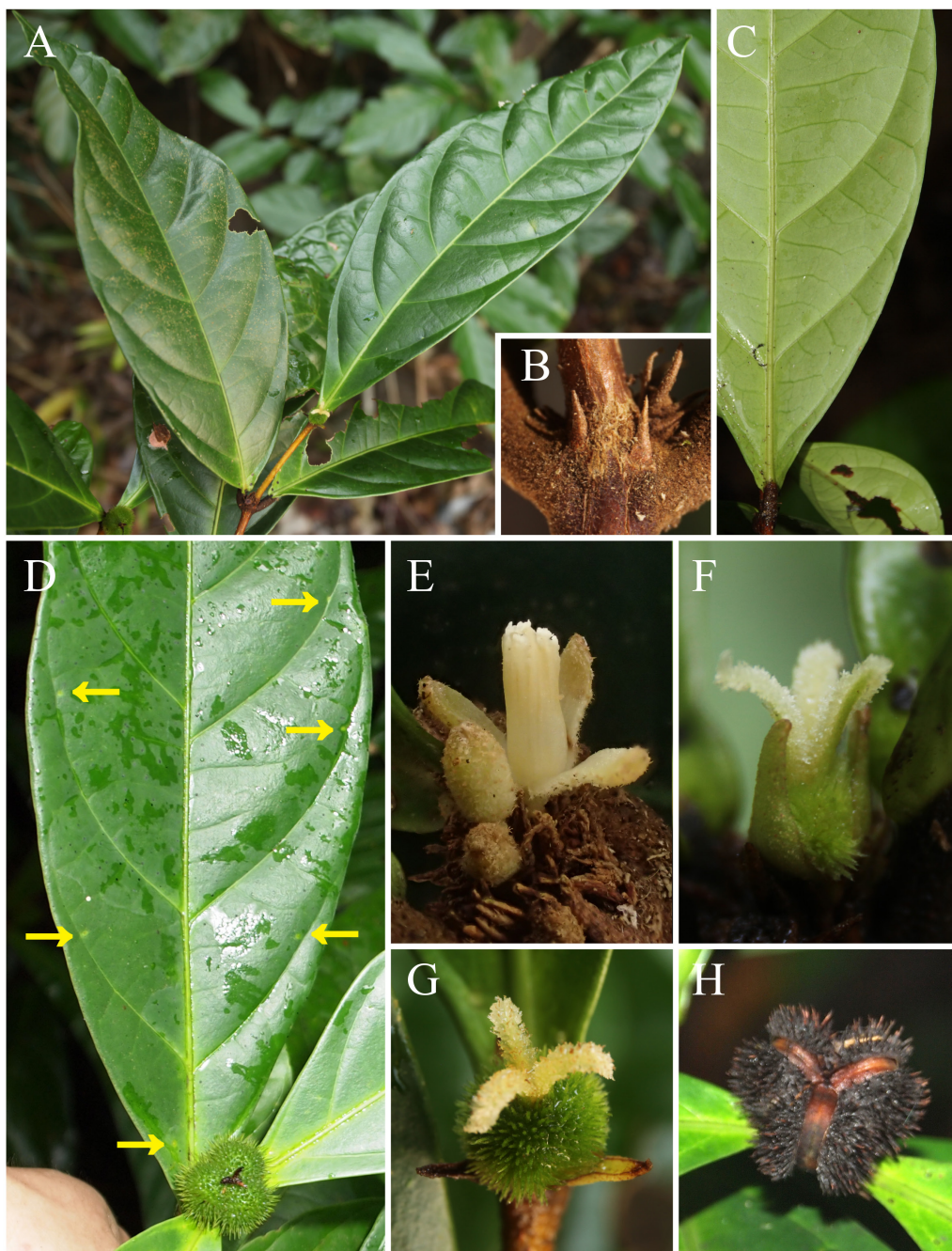


Figure 2. *Mallotus tokiae* Welzen: A. fruiting branch; B. node showing stipules; C. portion of abaxial leaf surface; D. portion of adaxial leaf surface with a fruit. The arrows show extrafloral nectaries; E. young staminate flowers; F. pistillate flower; G. young fruit; H. mature fruit. Photographs of A, B, F and G were taken on 23 May 2017 (Tagane et al. MY2570). Photographs of C, D and H were taken on 22 May 2017 (Tagane et al. MY2533). Photograph of E was taken on 21 May 2017 (Tagane et al. MY2409).

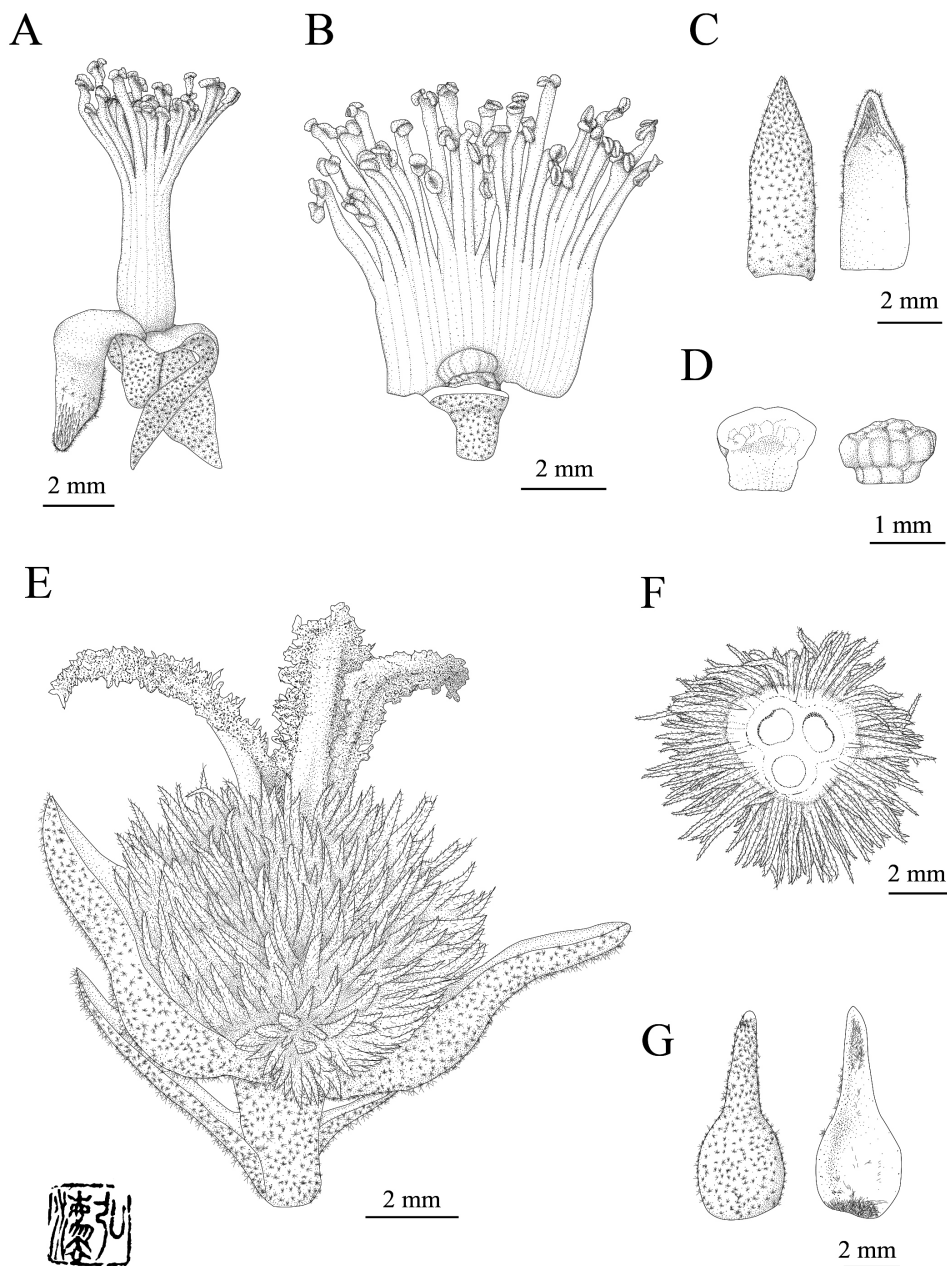


Figure 3. Flower morphology of *Mallotus tokiae* Welzen: A. young staminate flower; B. inside of opened young staminate flower; C. outer (left) and inner (right) surface of sepal of staminate flower; D. longitudinal section (left) of pistillode of staminate flower and its outer surface (right); E. slightly matured pistillate flower; F. transverse section of young fruit; G. outer (left) and inner (right) surface of sepal of pistillate flower. A–D from Tagane et al. MY2409 (FU). E–G from Tagane et al. MY2570 (FU). Drawn by H. Toyama.

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