

***Mallotus glomerulatus* (Euphorbiaceae sensu stricto), a new species:
description, pollen and phylogenetic position**

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INTRODUCTION

A field trip by several staff members of the Forest Herbarium in Bangkok (BKF) to Phu Langka National Park in Nakhon Phanom Province resulted in the discovery of an unusual undershrub up to 1.5 m high and with the typical ‘explosively’ dehiscent fruits of Euphorbiaceae. The two plants showed a unique combination of characters: opposite leaves, stellate hairs, two apical, axillary ‘fruiting columns’ (no real inflorescences), smooth carpels, and a single ovule per locule (typical for the Euphorbiaceae s.s.: subfamilies Acalyphoideae, Crotonoideae, and Euphorbioideae). A year later, other staff members of BKF collected the staminate flowers, which were present in shortly peduncled glomerules. This inflorescence type is quite common in subfamily Phyllanthoideae (now often referred to at the family level as Phyllanthaceae), but all representatives of this (sub)family have two ovules per locule. Thus, the presence of glomerules makes the set of characters unique and we consider the unidentified plant to be a new species.

The new species resembles the genus *Mallotus* in having extrafloral nectaries in the form of round or oval glands on the upper leaf surface, stellate hairs and short, terminal pistillate inflorescences reduced to a single flower. In Thailand the latter character is present in *M. calocarpus* Airy Shaw. The new species also resembles *M. calocarpus* in the smooth, unarmed fruits, the penninerved (not triplinerved) leaf blade, short staminate inflorescences (though no glomerules in *M. calocarpus*) and a lack of glandular scales.

There are also differences between the new species and *M. calocarpus*. *M. calocarpus* has branches with much longer hairs. The leaf blade has small marginal teeth such that from every loop between two nerves a vein originates, which ends in a very short marginal tooth or a group of hairs in older leaves. The leaf margin is entire in the new species except for a subapical tooth on either side. The staminate inflorescence is longer in *M. calocarpus*, not glomerulate as in the new species, and the fruits are larger, ca. 21 by 15 mm compared to ca. 14 by 10 mm in the new species.

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In order to investigate the relationship of the new species to *Mallotus* a leaf clearing was made to identify the type of laticifers (articulate or inarticulate), its pollen was described and, even though the specimens were dried slowly and perhaps treated with alcohol, DNA samples were taken. The laticifers are numerous and inarticulate; these are characteristic of Euphorbiaceae s.s. The pollen and DNA, discussed below point to *Mallotus*. Therefore, the new species is described here in *Mallotus*. The name refers to the glomerulate staminate inflorescences.

DESCRIPTION

Mallotus glomerulatus Welzen, sp. nov.

Frutices 1–1.5 m alti. Indumentum pilis simplicibus et stellatis. Folia opposita plerumque aequalia elliptica ad 25.5 cm longa venatione pinnata. Inflorescentiae masculini breviter pedunculatae, floribus glomerulatis, sepalis 3, staminibus 26. Inflorescentiae pistillatae floribus singularibus ad paucis, calyce 4-lobato, stigmatibus integris, supra papillis longis ramosis. Fructus laeves.— Typus: Thailand, Nakhon Phanom Prov., Ban Phaeng District, Phu Langka National Park, Tat Pho waterfall, 17° 59'00" N, 104°08'37" E., *Koonkhunthod*, *Supuntee* & *Thetsna* 524 (holotypus L; isotypus BKF). Fig. 1.

Shrub, 1–1.5 m high, according to labels monoecious, but sexes at least on separate branches; young branches shortly hairy, glabrescent. *Indumentum* mainly of white stellate hairs and a few simple ones; glandular scales absent. *Stipules* triangular, 3–4 by 1–2 mm, early caducous, pilose outside. *Leaves* simple, opposite, distichous; petiole 6–15 mm long, completely pulvinate, reniform in transverse section, pilose; blades of each pair usually equal, elliptic, 9.3–25.5 by 2.5–8.2 cm; length/width ratio 3–3.8, symmetric, subcoriaceous, drying greenish, base attenuate, margin entire except for a single subapical tooth at each side, apex acuminate, glabrous, upper surface with round (small ones) to elliptic (larger ones) extra-floral nectaries, light brown when dry, basal ones twice as large as the smaller ones in the loops of the nerves along the margin; venation distinct on both sides, penninerved, 8–12 nerves per leaf side, looped and joined near the margin, veins ± scalariform, veinlets reticulate. *Inflorescences* ramiflorous to terminal, shortly peduncled, peduncle ca. 7 mm long; with glomerules of flowers, either with many staminate flowers or 1–4 pistillate flowers; bract 1 per flower, triangular, ca. 2 by 1–2 mm, hairy outside. *Flowers* actinomorphic, petals and disc absent. *Staminate flowers* ca. 3.7 mm in diam., white-green; pedicel ca. 4 mm long; sepals 3, free, valvate, ovate, 3.3–3.5 by 1–1.2 mm, pilose outside; stamens 26, glabrous, filaments strap-like, ca. 1 mm long, anthers convex, ca. 1.2 by 0.4 mm, 2-celled, anther cells parallel, opening extrorse-latrorse with lengthwise slits; pistillode short, ca. 0.3 mm long, with a few hairs on top. *Pistillate flowers* ca. 4 mm in diam., (sub)sessile when young, white; calyx 4-lobed, the lobes ca. 3 by 1.7 mm, hairy outside, few simple hairs basally inside; ovary 3(–4)-locular, ca. 2 by 1.8 mm, villous, style ca. 2.3 mm long, hairy, stigmas ca. 4 mm long, not split apically, with long, branching papillae above, hairy beneath. *Fruit* a lobed capsule, on a short (3–4 mm long) pedicel, ca. 14 by 10 mm, dehiscent septically and (partly) loculicidally, with few hairs outside, glabrescent, fruit wall thin, rather woody; column broadly T-shaped, 7.5–8 mm long. *Seeds* obovoid, ± trigonous in transverse section, 7.7–8 by 6.2–7 by 5.5–6 mm, covered by a thin sarcotesta (when young?).

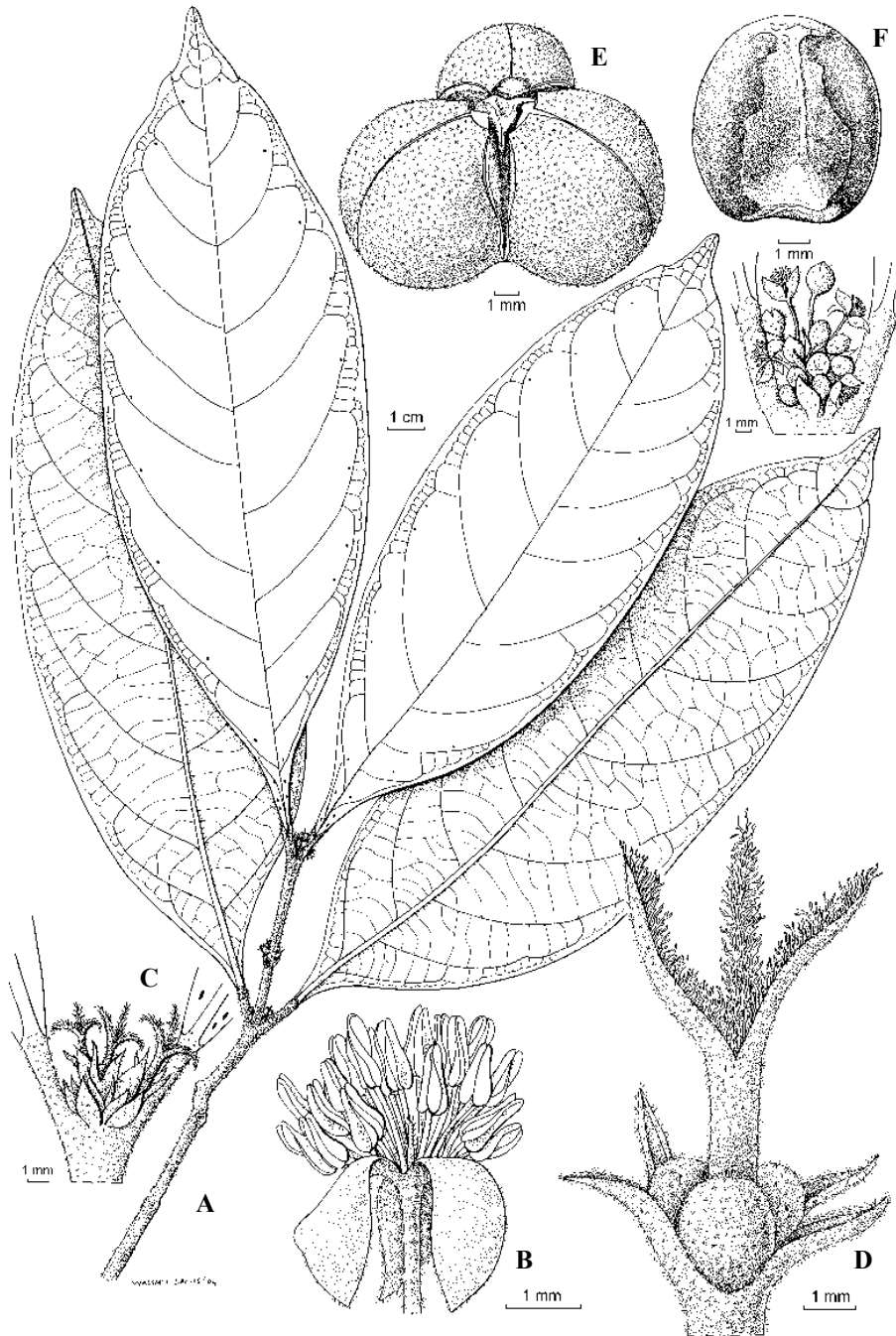


Figure 1. *Mallotus glomerulatus* Welzen: A. habit with staminate inflorescence; B. staminate flower; C. habit with pistillate flowers; D. pistillate flower; E. fruit; F. seed. Drawn by Anita Walsmit Sachs.

Thailand.— NORTH-EASTERN: Nakhon Phanom [Phu Langka National Park, *Koonkhunthod*, *Supuntee*, *Thetsna* 517 (BKF, L) & 524 (holotype L; isotype BKF); Phu Langka National Park, *Pooma et al.* 2636 (BKF, L) & 2662 (BKF, L)].

Distribution.— Endemic to north-eastern Thailand.

Ecology.— Scattered in dry evergreen forest; shaded. Altitude: 150–200 m. Flowering: May; fruiting: August.

Vernacular.— Mak lium (หมากเหลี่ยม).

POLLEN MORPHOLOGY

Material studied: *Koonkhunthod*, *Supuntee*, *Thetsna* 517 (BKF, L), with light microscopy and scanning electron microscopy. Fig. 2A–B.

Pollen grains medium-sized (Polar axis x Equatorial diameter = 28.5 x 28.5 μm), more or less obtusely triangular (3-aperturate grains) or elliptic (2-aperturate grains) in polar view, spheroidal in equatorial view (Polar axis / Equatorial diameter = 1.00).

Apertural system 2- or 3-colporate (ca. 20 / 80%). Colpi narrow, ca. 15 x 2 μm , without margos, without operculum, without costae ectocolpi; colpus membrane covered with irregular, microechinate scabrae up to 0.6 μm in diameter. Endoapertures large, lalongate, 6–8 x 10–15 μm , with indistinct lateral sides and thick, clearly delimited (shield-like) polar sides (costae endocolpi).

Exine ca. 1 μm thick, indistinctly stratified, with thin nexine, thin columellate layer and thick tectum. Ornamentation perforate/microreticulate with minute echinae. Perforations < 0.1–0.3 μm in diam.; microechinae 0.1–0.2 μm in diam.

The pollen of *Mallotus glomerulatus* is indistinguishable from that of a few genera of the subtribe Rottlerinae of the tribe Acalypheae: *Mallotus*, *Neotrewia* and *Trewia* (compare with Nowicke & Takahashi, 2002: 258–269, plates XIII–XVIII).

MOLECULAR ANALYSIS

Material studied: *Koonkhunthod*, *Supuntee*, *Thetsna* 517 (BKF, L).

DNA was extracted from the herbarium specimen using the DNeasy Kit (Qiagen, Leusden, Netherlands). Plastid *trnL* intron and *trnL-F* intergenic spacer regions were amplified using primer pairs c/d and e/f, respectively (Taberlet et al., 1991). Sequence reactions and electrophoresis were conducted with standard methods using BigDye chemistry and an ABI 377 automatic sequencer (Applied Biosystems, Nieuwekerk a/d Ijssel, Netherlands).

The obtained sequences were phylogenetically analysed with a dataset consisting of all the genera of subtribe Rottlerinae, including samples from different *Mallotus* sections. The closely related genus *Macaranga* (currently placed in a different subtribe; Webster, 1994) was also included in the study. Details of the methods and results will be available in a separate paper (Kulju et al., in prep.). Although *Mallotus* was not monophyletic, the results of both maximum parsimony (PAUP* 4.0b10; unweighted Fitch

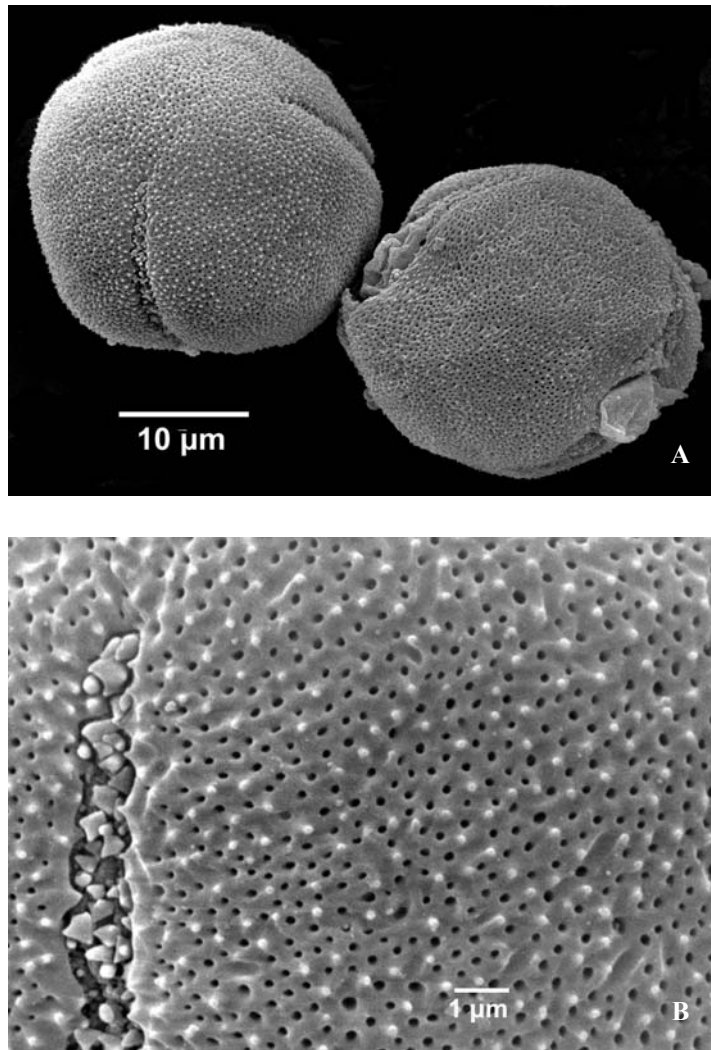


Figure 2. Pollen of *Mallotus glomerulatus* (SEM): A. almost polar view (left) and equatorial view (right) of 3-aperturate pollen grains. Scale bar = 10 µm.; B. detail, showing part of colpus and ornamentation. Scale bar = 1 µm.

parsimony with TBR branch swapping) and Bayesian analyses (MrBayes 3.0b4; GTR+G model) placed *M. glomeratus* indisputably in a highly supported clade containing specimens from most of the *Mallotus* sections, including the type species *M. paniculatus*. Thus, the molecular study clearly supports the inclusion of the new species in the genus *Mallotus*.

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