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TANAWAT CHAOWASKU[1]

Miliusa pumila (*Annonaceae*), a new species from S Thailand

Abstract

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A new species, *Miliusa pumila* Chaowasku, is described and illustrated. It has been cultivated in Bangkok, Thailand, but was originally from S Thailand. *Miliusa pumila* can be principally distinguished from its most morphologically similar species, *M. filipes* Ridl., by the differences in leaf blade length, pedicel length, and number of stamens per flower. The new species can be mainly distinguished from *M. thailandica* Chaowasku & Kessler, its sister species previously elucidated by means of molecular phylogenetics, by the differences in leaf base, outer petal length, and inner petal size.

Additional key words: *Malmeoideae*, *Miliuseae*, phylogeny, systematics, taxonomy

Introduction

The genus *Miliusa* Lesch. ex A. DC. comprises c. 50 species of shrubs, treelets and trees distributed in (sub)tropical forests of Asia, Australia and New Guinea, including the D'Entrecasteaux Islands and the Louisiade Archipelago (Chaowasku & Keßler 2006, 2013). *Miliusa* belongs to the tribe *Miliuseae* of subfamily *Malmeoideae* (Chatrou & al. 2012; Chaowasku & al. 2014) and is circumscribed by having four diagnostic features: (1) similarly-sized sepals and outer petals, both of which are much smaller than the inner petals; (2) a densely hairy torus; (3) "miliusoid" stamens (sensu Mols & Keßler 2003a), i.e. stamens with minute connective prolongation not covering the thecae or without connective prolongation; and (4) 4-part lamelliform ruminations of the endosperm (Chaowasku & Keßler 2006). Four major clades have been identified in this genus according to a recent molecular phylogenetic study (Chaowasku & al. 2013a), two of which (clades B and D; see Fig. 1) are large clades containing more than 50 % of the species sampled. The morphology of clade B (equivalent to the *M. campanulata* Pierre group sensu Chaowasku & Keßler 2013) is peculiar in that all species sampled usually possess inner petals tightly appressed from the base to more or less the midpoint at anthesis, which is considered a synapomorphy for clade B (Chaowasku & al. 2013a). Other *Miliusa* species exhibiting such morphology are highly likely to belong to clade B as well. In Chaowasku & al. (2013a), there is an unknown species (indicated as *Miliusa* sp. 1; see Fig. 1) of clade B included in the molecular phylogenetic analysis. This unknown species is sister to the recently described *M. thailandica* Chaowasku & Kessler, both of which are so far known to occur in S Thailand only; however, it should be noted that the sister group of this unknown species could change if several other species likely to belong to clade B and occurring in S Myanmar and/or Thailand (*M. filipes* Ridl., *M. hirsuta* Chaowasku & Kessler, *M. longipes* King, *M. saccata* C. E. C. Fisch.) were included in the phylogenetic analysis. Extensive comparisons enable its recognition as a new species, which is described below and can be readily distinguished from its sister, *M. thailandica*, and its most morphologically similar species, *M. filipes*, by several morphological differences.

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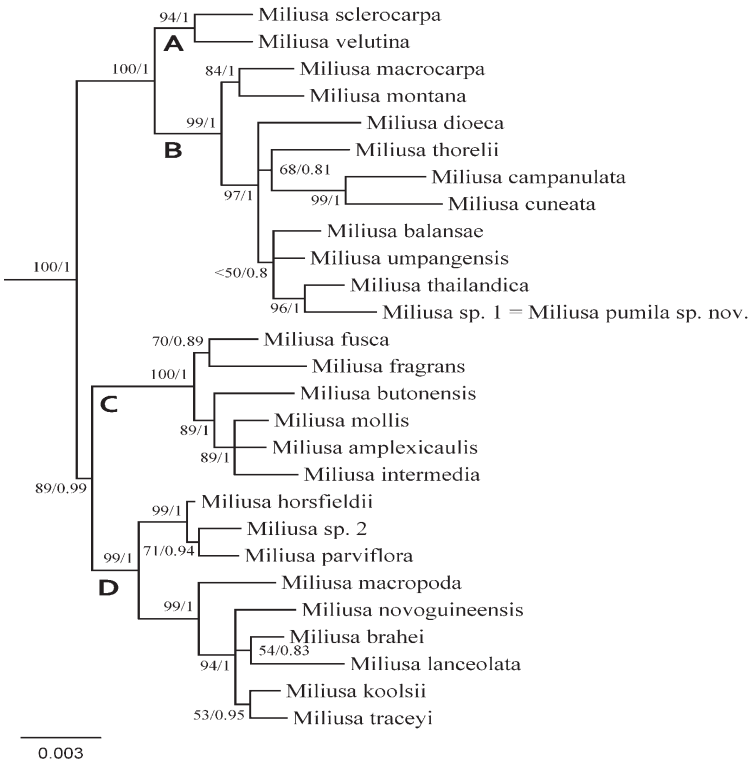


Fig. 1. Phylogram adapted from Chaowasku & al. (2013a), based on a combination of seven plastid markers (*rbcL* exon, *trnL* intron, *trnL-F* spacer, *matK* exon, *ndhF* exon, *psbA-trnH* spacer, and *ycf1* exon), showing the *Miliusa* clade divided into four major subclades (clades A, B, C, D). – Two kinds of branch support are indicated: parsimony symmetric resampling values left of slash, Bayesian posterior probabilities right of slash. – Scale bar unit: substitution per site.

Material and methods

The collection *Kloss 6968*, the type and only available material of *Miliusa filipes* from the K herbarium, was studied in comparison with material of the new species. Morphological data of *M. thailandica* were obtained from Chaowasku & Keßler (2013). When only a single measurement/observation was made, the word "c." (circa) was added. The indumentum terminology follows Hewson (1988). The term "puberulous" is equivalent to sparsely hairy/with sparse hairs.

Results

Miliusa pumila Chaowasku, **sp. nov.** – Fig. 2–4.
Holotype: Thailand, cultivated in Bangkok [sapling originally taken from Khao Nam Prai Non-hunting Area, Huai Yot District, Trang Province], 23 Aug 2013 [in flower], *Chaowasku 115* (CMUB; isotypes: A, B, L).

Description — *Shrub-like treelets*, c. 1 m tall; *young twigs* puberulous, sometimes with appressed hairs. *Petiole* 1.5–2.5 mm long, grooved on upper surface, puberulous, sometimes with appressed hairs (on both surfaces); *leaf blade* elliptic, 5.4–10.5 × 2–4.1 cm, often somewhat bullate, lower surface puberulous with appressed hairs, upper surface glabrous, base cuneate, sometimes slightly unequal, apex usually (caudate-)acuminate, rarely acute(-acuminate); *midrib* raised and puberulous with appressed hairs on lower surface, (slightly) sunken and puberulous or sparser (only at basal part, c. ⅓ of leaf blade length) on upper surface; *secondary veins* (8 or)9–11 per side, rather prominent on lower surface, usually with inter-secondary veins forming loops, angle with midrib 50°–51° (at middle part of leaf blade). *Flowers* solitary or a pair of solitary flowers in the same axil (small interval observed between the two solitary flowers) or in a 2-flowered inflorescence, bisexual; *peduncle* when present inconspicuous; *bract* not observed; *pedicel* 0.5–1.1 cm long, puberulous or more sparsely so (mostly at basal portion); *bracts* 3 or 4(or 5) per flower, placed at basal portion of pedicel, upper one larger and triangular, others becoming smaller and less triangular/more hemispherical toward basal one. *Sepals* triangular, 1.8–2.1 × 1–1.1 mm, outside (almost) glabrous, inside glabrous, margin puberulous or more sparsely so. *Outer petals* (narrowly) (triangular-)ovate, 2.4–3 × 0.9–1.2 mm, outside (almost) glabrous, inside glabrous, margin puberulous; *inner petals* tightly appressed from base to ± midpoint at anthesis, elliptic, c. 15 × 9 mm, both surfaces glabrous, inner surface at basal portion (c. ⅓ of inner petal length) somewhat rugulose, base slightly (to moderately) saccate, margin shortly puberulous or more sparsely so, apex acute-obtuse. *Torus* subglobose or somewhat more elongated. *Stamens* 38–39 per flower, 1–1.1 mm long, connective prolongation almost absent. *Carpels* 12–13 per flower, 1.5–2 mm long; *stigmas* subglobose to ellipsoid(-obovoid); *ovaries* puberulous or sparser; *ovule* 1 per ovary, sub-basal to sublateral. *Fruits* unknown.

Phenology — Flowering material collected in August (at cultivation site).

Distribution and ecology — Trang Province, S Thailand (Fig. 5), occurring in evergreen forests; on rugged limestone terrain of a small hill.

Field notes — Flowers campanulate, inner petals cream-yellow, with somewhat red venation at base, translucent window-like structures at base present.

IUCN conservation status — Data Deficient (DD) (IUCN 2012) because this species was discovered recently and only once, and since then no attempts have been made to revisit it or locate it in other areas, espe-

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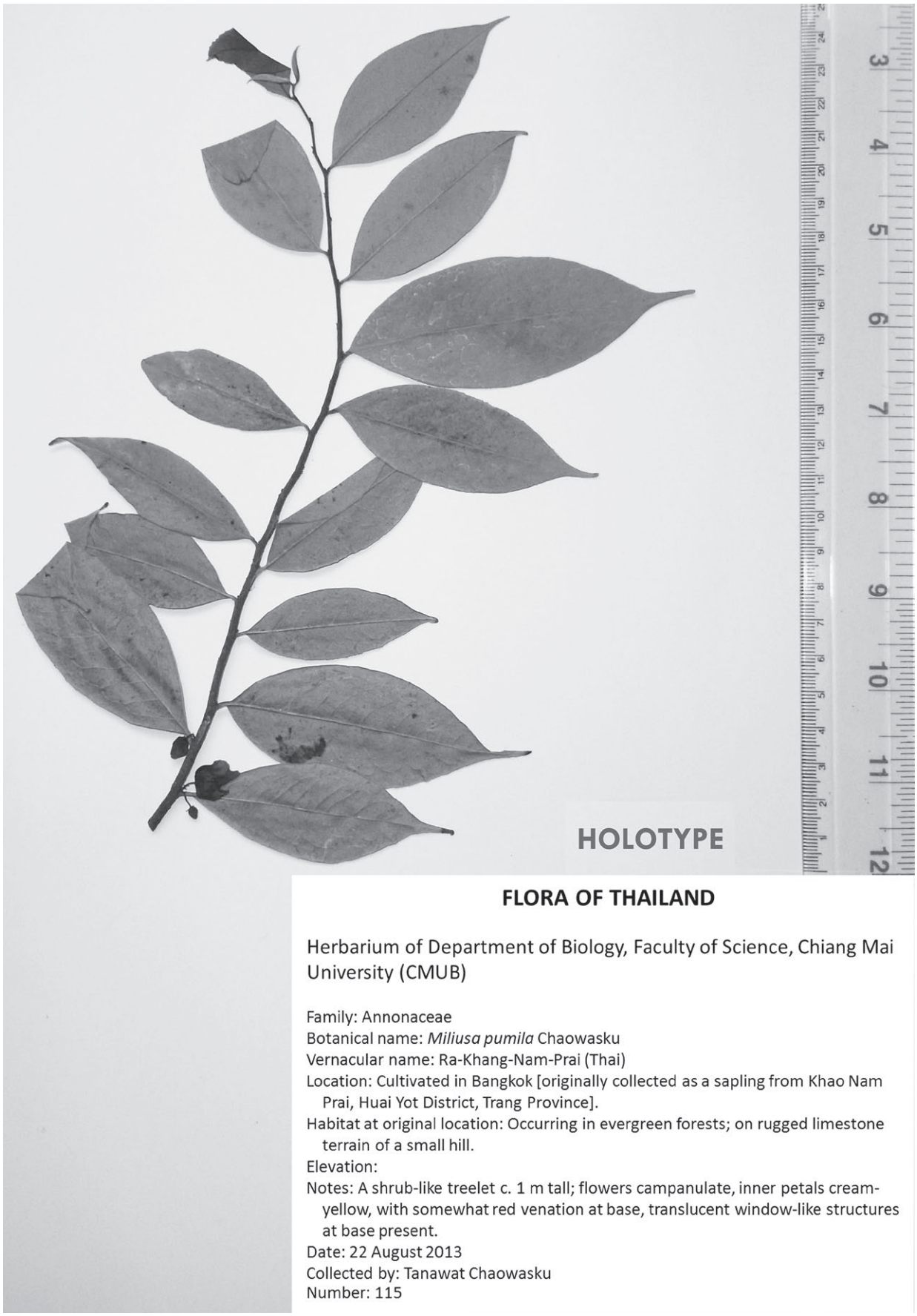


Fig. 2. Holotype of *Miliusa pumila*, *Chaowasku 115* (CMUB).

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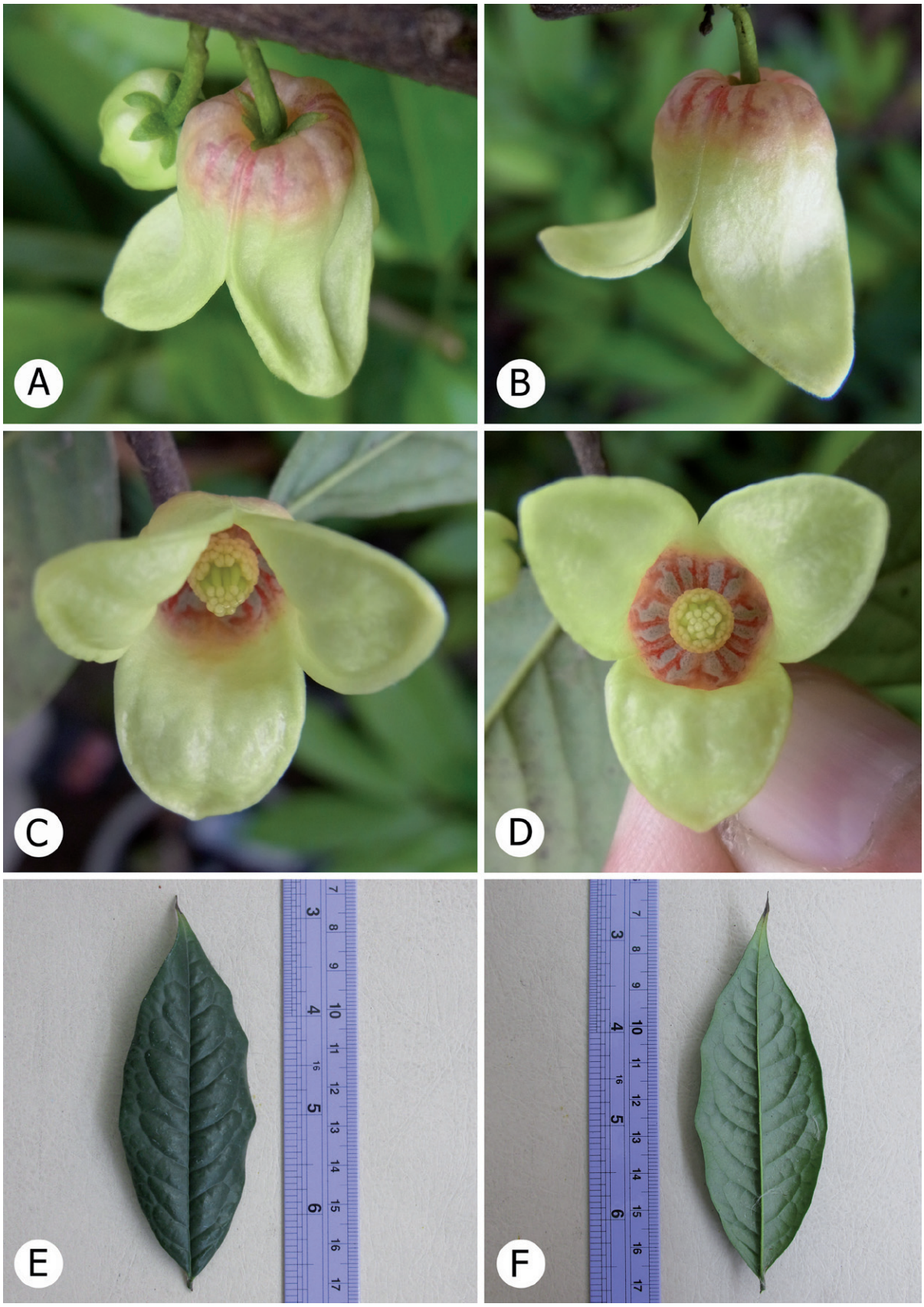


Fig. 3. *Miliusa pumila*, various positions of flowers and a leaf – A: flower, oblique view, particularly showing sepals and outer petals; B: flower, side view; C: flower, oblique view, showing stamens and carpels exposed; D: flower, bottom view, showing stamens and carpels exposed and translucent window-like structures; E: leaf, upper surface; F: leaf, lower surface. – A–D from *Chaowasku 115* (CMUB – spirit material); E & F from cultivated material.

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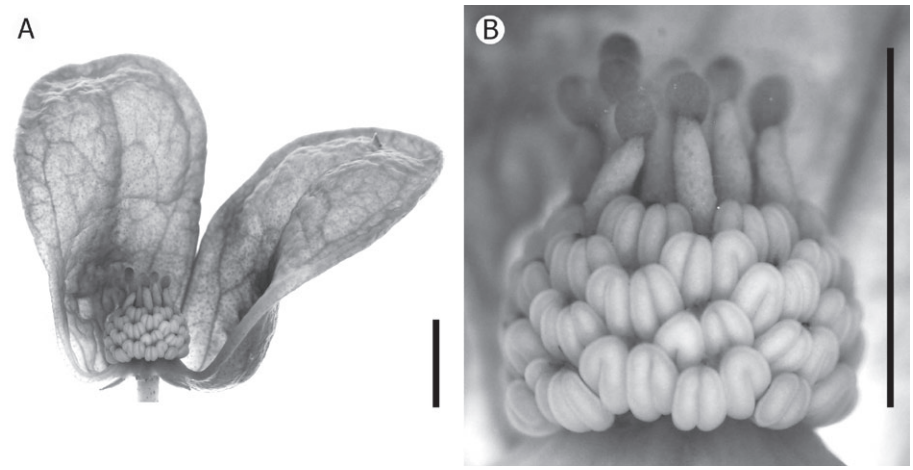


Fig. 4. *Miliusa pumila* – A: flower with one inner petal removed, side view; B: detail of A, showing stamens and carpels enlarged. – Scale bars = c. 3.5 mm. – From *Chaowasku 115* (CMUB – spirit material).

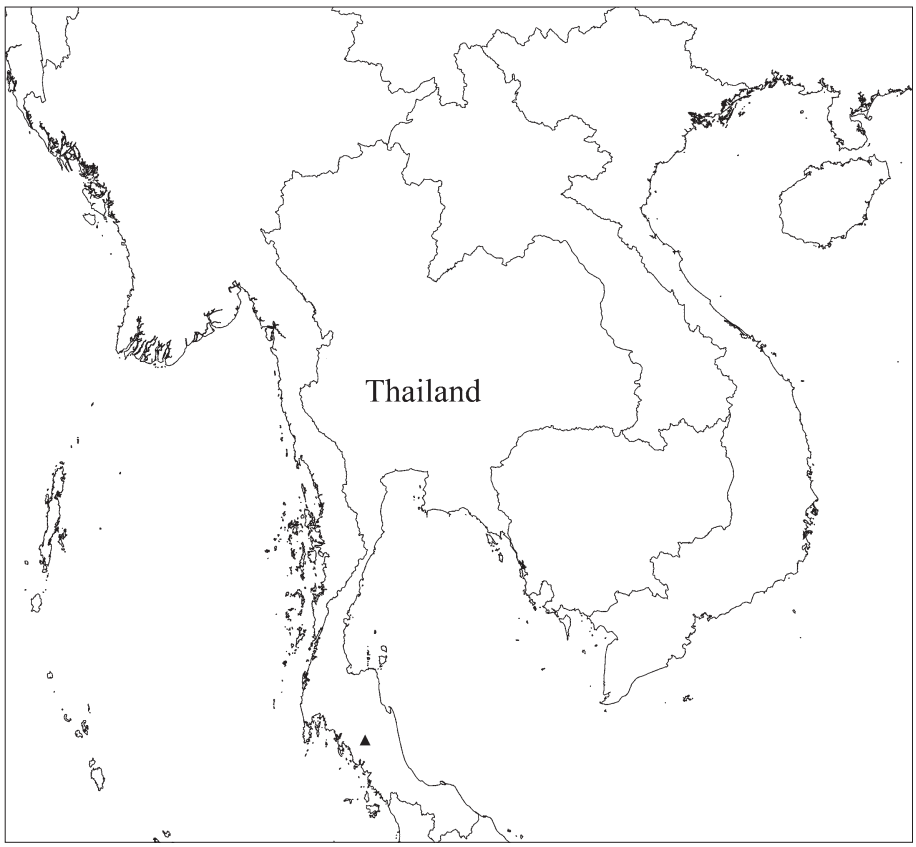


Fig. 5. Distribution of *Miliusa pumila* (triangle).

cially the nearby Khao Pu Khao Ya National Park and Khao Banthat Wildlife Sanctuary.

Etymology — The epithet refers to the habit of this species, a shrub-like treelet c. 1 m tall.

Additional specimen examined (paratype) — Chaowasku 110 (L; voucher for molecular phylogenetic study in Chaowasku & al. 2013a; collected from the same individual as the type collection).

Discussion

Miliusa pumila is morphologically most similar to *M. filipes*, which is known only from the holotype collected from Tasan, Chumphon Province, S Thailand. The new species differs primarily by having: (1) shorter leaf blades (5.4–10.5 cm long vs 10.9–13.8 cm long in *M. filipes*); (2) shorter pedicels (0.5–1.1 cm long vs c. 2 cm long in *M. filipes*); and (3) more stamens per flower (38–39 vs c. 22 in *M. filipes*). *Miliusa pumila* chiefly differs from its sister species, *M. thailandica* (see Fig. 1), by having (1) a cuneate leaf blade base, sometimes only slightly unequal (vs slightly subcordate to cordate, always slightly to moderately unequal in *M. thailandica*); (2) shorter outer petals (2.4–3 mm long vs c. 6 mm long in *M. thailandica*); and (3) smaller inner petals (c. 15 × 9 mm vs 18–26 × 11–15 mm in *M. thailandica*). Table 1 shows important morphological traits differentiating the new species from *M. filipes* and *M. thailandica*.

The new species is so far endemic to Khao Nam Prai Non-hunting Area, which is situated adjacent to the Banthat mountain range. The latter is one of the most important mountain ranges in S Thailand because it consists of large evergreen forests where Khao Pu Khao Ya National Park (c. 694 km^2) and Khao Banthat Wildlife Sanctuary (c. 1267 km^2) are situated. Several years ago, when the sapling was collected, I found 10–20 individuals (each c. 20 cm tall) restricted only to rugged limestone terrain. Besides *Miliusa pumila*, the recently described *Pseuduvaria gardneri* Y. C. F. Su, Chaowasku & R. M. K. Saunders is also known only from the calcareous Khao Nam Prai Non-hunting Area (Su & al. 2010). In addition, two other rare and narrowly distributed *Annonaceae* species, *Neo-uvaria sparsistellata*

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Chaowasku (Chaowasku & al. 2011) and *Winitia expansa* Chaowasku (Chaowasku & al. 2013b), have so far been found to be endemic to the Banthat mountain range and also associated with limestone habitat. These discoveries, including the present one, highlight the importance of the Banthat mountain range and the adjacent Khao Nam Prai Non-hunting Area as a reservoir of endemic species.

Table 1. Important morphological features distinguishing *Miliusa pumila* from its most morphologically similar species (*M. filipes*) and its sister species (*M. thailandica*).

Character	*Miliusa pumila*	*Miliusa filipes*	*Miliusa thailandica*
Leaf blade length [cm]	5.4–10.5	10.9–13.8	5–20
Leaf blade base shape	cuneate, sometimes slightly unequal	cuneate, equal	slightly subcordate to cordate, always slightly to moderately unequal
Pedicels length [cm]	0.5–1.1	c. 2	1.6–5
Outer petals length [mm]	2.4–3	2.5–3	c. 6
Inner petals size [mm]	c. 15 × 9	c. 10 × 7	18–26 × 11–15
Number of stamens per flower	38–39	c. 22	27–28

Phytochemically, it is noteworthy that in *Annonaceae* a class of secondary metabolites called "miliusanes" has been found to occur only in two species of *Miliusa*, *M. balansae* Finet & Gagnep. (including *M. sinensis* Finet & Gagnep., which was synonymized with *M. balansae* in Chaowasku & Keßler 2014) (Kamperdick & al. 2002; Huong & al. 2004; Zhang & al. 2006) and the recently described *M. umpangensis* Chaowasku & Kessler (Sawasdee & al. 2014), belonging to a weakly supported subclade of clade B (see Fig. 1). This subclade also comprises the sister species *M. pumila* and *M. thailandica*. Further research is required to determine whether the "miliusanes" could be of chemosystematic significance for this subclade or even the more inclusive clade B.

The genus *Miliusa* has not been entirely revised. Only regional taxonomic studies are available (e.g. Mols & Keßler 2003b; Chaowasku & Keßler 2013, 2014). A number of new species have been described during the past ten years (e.g. Chaowasku & Keßler 2006, 2013, 2014; Narayanan & al. 2010, 2012; Chaowasku 2013; Chaowasku & al. 2013a). Most of these species as well as *M. pumila* occur only in limited areas, and several of them are known only from the type specimens. Although the threat category Data Deficient (DD) is applied here to *M. pumila*, the IUCN (2012) stated: "Listing of taxa in this category indicates that more information is required and acknowledges the possibility that future research will show that threatened classification is appropriate", implying that the categories below Vulnerable (VU) are unlikely. This raises concerns about extinction, and therefore conservation efforts should be initiated.

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