

***Munronia assamica* (Meliaceae), a new species from India**

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ABSTRACT. *Munronia assamica* S.Dey & Bhaumik, a new species is described and illustrated from the Kopili River Basin, Dima Hasao District of Assam, India. The new species is morphologically similar to *Munronia lancifolia* Aver. & K.S.Nguyen. A detailed taxonomic description, illustration, field photos and comparison with the nearest species are provided to aid its recognition. A phylogenetic analysis was also carried out to confirm its taxonomic position.

Keywords. Assam, India, Meliaceae, *Munronia*, new species

Introduction

The Southeast Asian genus *Munronia* Wight, first described from India (Wight, 1838), is represented by eight species in tropical and subtropical Asia (POWO, 2024). It is characterised by a suffrutex habit with woody rootstock, indumentum of simple hairs mixed with bifid or stellate hairs, a deeply divided calyx with lobes that are distinctly foliaceous, petals that are free from each other but are fused to halfway or higher with a staminal tube (filaments united). The disc is represented by a cupular or long tubular structure with an entire or toothed margin, often enclosing the ovary and part of the style; the bi-ovulate loculi has unwinged albuminous seeds and the cotyledons are plano-convex or foliaceous (Pennington & Styles, 1975).

As a part of ongoing floristic inventory work at the Kopili River Basin, in the Dima Hasao District of Assam, an interesting Meliaceae species was collected in flower by one of the authors (SD). After careful analysis, it has been found to be an undescribed species of *Munronia* Wight. It appears to be related to *M. lancifolia* Aver. & K.S.Nguyen from Laos but due to the lack of detailed taxonomic description in the protologue, it was difficult to critically compare with material of the undescribed species. After studying the type materials deposited at LE and the protologue, it is found that the new species, here described as *M. assamica* S.Dey & Bhaumik, differs from *M. lancifolia* in several characters.

Phylogenetic studies have been used in the Meliaceae to resolve the taxonomic position of *Munronia breviflora* using ITS and *rbcL* markers (Muellner & Mabberley,

2008). A comprehensive molecular phylogenetic study of Meliaceae was conducted by Muellner et al. (2003), which included representative species from four subfamilies. Here, a phylogenetic reconstruction was undertaken to confirm the taxonomic position of the new species using sequences available in public databases, as well as two newly generated sequences of *M. assamica* from freshly collected samples.

Materials and methods

The genomic DNA was extracted from two accessions of *Munronia assamica* (*S. Dey 160* & *S. Dey 374*) using the DNeasy Plant Pro Kit (QIAGEN). PCR amplification of complete ITS (White et al., 1990) and *rbcL* (Taberlet et al., 1991) regions was done. The contigs were generated from the respective forward and reverse sequences using BioEdit v.7.2 (Hall, 1999). To construct the phylogenetic tree, all the available sequences of *Munronia* and related genera in the family Meliaceae were retrieved from the NCBI GenBank (Table 1). It included sequences of 34 taxa, in which 4 taxa (*Cedrela odorata* L., *Khaya anthotheca* (Welw.) C.DC., *Swietenia macrophylla* King and *Toona* sp.) were considered as outgroups as in Muellner & Mabberley (2008). Multiple sequence alignment of the sequences was done using CLUSTAL W (Thompson et al. 1994) in BioEdit.

The ITS and *rbcL* sequences from two accessions of *Munronia assamica* were 731 bp and 1417 bp in length, respectively. After alignment, the lengths of the ITS and *rbcL* datasets were 771 bp and 1382 bp, respectively. Within the ITS dataset, there were 310 constant sites, 122 parsimony-uninformative sites, and 339 parsimony-informative sites. In comparison, the *rbcL* dataset contained 1195 constant sites, 92 parsimony-uninformative sites, and 95 parsimony-informative sites. The sequences of ITS and *rbcL* markers were concatenated for all the species and used for the analysis. The phylogenetic tree was generated using a maximum likelihood (ML) algorithm in RAxML 2.0.13 with 1000 rapid bootstrap iterations. The substitution model was selected using ModelTest-NG v0.1.7 embedded in the RAxML software. The best-fit model was selected according to the Akaike Information Criterion (AIC) as SYM+I+G4. All other parameters were set to default. The resulting tree file was visualised in FigTree v.1.4.3 (Rambaut, 2016).

Taxonomic treatment

Munronia assamica S.Dey & Bhaumik, **sp. nov.**

This new species differs from the morphologically similar species *Munronia lancifolia* Aver. & K.S.Nguyen and *Munronia unifoliolata* Oliv. by its unequal calyx lobes (vs equal calyx lobes), longer corolla lobes 2.8–3.5 cm long (vs 1.5–2.5 cm long), glabrous (vs puberulous) ovary, and longer anther 2–2.5 mm long (vs 1.6–2 mm long). – TYPE: India, Assam, West Panimur, Dima Hasao District, Kopili River Bed, 25°43'46.12"N 92°49'23.43"E, 145 m, 9 April 2024, *S. Dey 160* (holotype CAL; isotypes BSIS, CAL). (Figs 1, 2)

Perennial, subshrub, 15–25 cm tall. **Stem** simple, occasionally branched near base, scabrous, with prominent leaf scars, pubescent. **Leaves** alternate, throughout from lower half, clustered near stem apices, simple, blade narrowly elliptic to elliptic-lanceolate, $3\text{--}7.5 \times 0.7\text{--}1.5$ cm, base attenuate, margin entire, apex obtuse, with a short mucro, abaxially pale green, sparsely pubescent, densely along midvein and secondary veins, adaxially deep green, glabrous, secondary veins 4–7(–8) on each side of midvein; petiole 0.7–1.5 cm long, densely pubescent. **Inflorescence** axillary with one or two flowers. **Flowers** white, bracteate, bracteolate. **Peduncle** 4–7 mm long, pubescent. **Pedicel** slender, 5–8(–12) mm long, sparsely pubescent. **Bracts** 2, lanceolate, c. 2.5 mm long, pubescent. **Bracteoles** 2, lanceolate, c. 1.1 mm long, pubescent. **Calyx** widely campanulate, sub-equally 5-lobed almost to base, pubescent; lobes lanceolate, $2\text{--}3 \times 1\text{--}1.2$ mm, apex obtuse, outer side pubescent. **Corolla** tubular-funnelform, equally 5-lobed; tube slender, 1.6–2 cm long, pubescent externally; lobes oblanceolate, oblong-elliptic, or elliptic, $10\text{--}15 \times 6\text{--}8$ mm, apex shortly cuspidate to obtuse, margin slightly wavy. **Stamens** 10, forming staminal tube; staminal tube exerted, glabrous outside, pubescent within, forming 10 lobes towards apex; lobes alternate to stamens, linear to lanceolate, 1–1.5 mm long, glabrous; anthers lanceolate, $2\text{--}2.5 \times 0.8\text{--}1$ mm, apex slightly mucronate, pubescent. **Disc** tubular, enclosing ovary and basal part of style. **Ovary** globose or sub-globose, c. $1 \times 0.8\text{--}1$ mm, glabrous; style slender, 2–2.5 cm long, slightly exerted from filament tube, whitish, hairy; stigma capitate, globose. **Fruit** (not fully mature) 5-loculed, obovoid-spherical, $7.5\text{--}9 \times 9\text{--}12$ mm, truncate at apex, narrowed at base, puberulous (hairs not exactly stellate, but with 1–3 simple hairs from common base). **Seeds** 2 in each locule, ovoid, $3\text{--}5 \times 4\text{--}5$ mm, light green when young.

Phenology. Flowering in April; fruiting in June.

Ecology. *Munronia assamica* generally grows in rock crevices along the riverbed, usually in shady places. The species is adapted to the rheophytic environment and usually grows near fast-flowing water. The other associated species occurring in the type locality were *Syzygium polypetalum* (Wall.) Merr. & L.M.Perry, *Jasminum* sp., *Tarenna pumila* (Hook.f.) Merr., *Thysanolaena latifolia* (Roxb. ex Hornem.) Honda, *Eriobotrya angustissima* Hook.f., *Millettia* sp. and *Melastoma malabathricum* L.

Etymology. The species epithet is derived from its place of origin, Assam.

Provisional IUCN conservation assessment. Approximately 23 mature individuals were seen in three different patches in the habitats as outlined in ecology above. As per the IUCN Standards and Petitions Committee (2024), the species is therefore provisionally assessed under criteria D as Critically Endangered (CR) until more information on its population and distribution range becomes available.

Notes. In addition to the characters listed in the diagnosis, *Munronia assamica* is most similar to *M. lancifolia* but differs in the obtuse leaf apex, oblanceolate petal lobes, and staminal tube with ten lanceolate apical lobes whereas *M. lancifolia* has acute leaf apex,

petal lobes oblong-elliptic, and staminal tube with ten subulate lobes; these characters are compared with morphologically similar species to aid recognition (Table 2).

The present phylogenetic reconstruction based on the combined ITS and *rbcL* sequences showed that the genus *Munronia* formed a monophyletic group in which *M. assamica* was placed along with other *Munronia* spp. such as *M. pinnata*, *M. humilis*, and *M. breviflora* (Fig. 3), confirming its generic circumscription and phylogenetic affinity with related species. While the overall topology of our phylogenetic tree differs in some respects from that reported by Muellner & Mabberley (2008), the placement of the genus *Munronia* remains consistent across both studies. Currently, the sequence data for the closely related species *M. lancifolia* from Laos is unavailable. Including these data in the future would provide a clearer understanding of its phylogenetic position within the genus.

Key to the species of *Munronia*

- 1a. Leaves pinnately compound 2
- 1b. Leaves simple 3

- 2a. Petiole up to 4 cm long; corolla lobes more than 1 cm long *M. pinnata*
- 2b. Petiole more than 4 cm long; corolla lobes less than 1 cm long ... *M. yinggelingsensis*

- 3a. Leaf margins variously serrate, crenate or undulate 4
- 3b. Leaf margins entire, not undulate 5

- 4a. Leaf blade ovate-lanceolate, more than 3 cm long; anthers glandular hairy
..... *M. humilis*
- 4b. Leaf blade obovate, up to 4 cm long; anthers not glandular hairy ... *M. unifoliolata*

- 5a. Leaves evenly distributed along stem, stellate hairy *M. breviflora*
- 5b. Leaves congested towards apical part of the stem not stellate hairy 6

- 6a. Calyx lobe subequal; ovary glabrous *M. assamica*
- 6b. Calyx lobe equal; ovary puberulous 7

- 7a. Leaf blade up to 2 cm wide, base rounded; inflorescence 3–5-flowered
..... *M. unifoliolata*
- 7b. Leaf blade more than 2 cm wide, base cuneate, rarely narrowly rounded; thyse
1–3-flowered 8

- 8a. Branches stellate hairy to glabrescent; petiole 2.5–4.5 cm, stellate hairy; lateral
nerves 6–12 *M. petiolata*
- 8b. Branches not stellate hairy; petiole 1–3.5 cm, not stellate hairy; lateral nerves 4–7
..... *M. lancifolia*

Table 1. Details of samples used for the phylogenetic reconstruction retrieved from the NCBI.

Taxon	GenBank ID (<i>rbcL</i>)	GenBank ID (ITS)
<i>Anthocarapa nitidula</i> (Benth.) T.D.Penn. ex Mabb.	DQ238056	DQ861616
<i>Aphanamixis polystachya</i> (Wall.) R.Parker	AY128213	AY695584
<i>Azadirachta indica</i> A.Juss.	AY128215	AY695594
<i>Cabralea canjerana</i> (Vell.) Mart.	DQ238055	DQ861617
<i>Calodecaryia crassifolia</i> J.-F.Leroy	AY128216	DQ861631
<i>Cedrela odorata</i> L.	AY128220	DQ861606
<i>Chisocheton macrophyllus</i> King	AY128221	DQ861613
<i>Cipadessa baccifera</i> (Roth) Miq.	AY128224	DQ861627
<i>Dysoxylum gaudichaudianum</i> (A.Juss.) Miq.	AY128227	DQ861619
<i>Ekebergia capensis</i> Sparrm.	AY128228	DQ861623
<i>Guarea glabra</i> Vahl	AY128229	AY695591
<i>Heckeldora staudtii</i> (Harms) Staner	AY128230	AY695592
<i>Khaya anthotheca</i> C.DC.	AY128231	DQ861608
<i>Lansium domesticum</i> Corrêa	AY128232	AY695586
<i>Lepidotrichilia volkensis</i> (Gürke) J.-F.Leroy ex Styles & F.White	DQ238061	DQ861620
<i>Malleastrum mandenense</i> J.-F.Leroy	DQ238062	DQ861626
<i>Melia azedarach</i> L.	AY128234	AY695595
<i>Munronia humilis</i> (Blanco) Harms	EU621669	FJ194496
<i>Munronia pinnata</i> (Wall.) W.Theob.	AY128236	DQ861604
<i>Naregamia alata</i> Wight & Arn.	DQ238059	DQ861629
<i>Nymanina capensis</i> (Thunb.) Lindb.	AY128238	DQ861633
<i>Owenia vernicosa</i> F.Muell.	DQ238063	DQ861622
<i>Pseudoclausena chrysogyne</i> (Miq.) T.P.Clark	DQ238065	DQ861602
<i>Quivisianthe papinae</i> Baill.	AY128239	DQ861605
<i>Reinwardtiendendron kinabaluense</i> (Kosterm.) Mabb.	DQ238054	AY695589
<i>Ruarea pubescens</i> H.Karst.	DQ238057	AY695593

Table 1 (continued).

Taxon	GenBank ID (<i>rbcL</i>)	GenBank ID (ITS)
<i>Sandoricum koetjape</i> (Burm.f.) Merr.	DQ238068	DQ861600
<i>Swietenia macrophylla</i> King	AY128241	DQ861609
<i>Toona</i> sp.	AY128243	DQ861607
<i>Trichilia emetica</i> Vahl	AY128244	EF136577
<i>Turraea breviflora</i> Ridl.	EU621670	FJ194497
<i>Turraea sericea</i> Sm.	AY128245	DQ861630
<i>Vavaea amicorum</i> Benth.	AH015483	DQ861610
<i>Walsura tubulata</i> Hiern	AY128246	DQ861625

Table 2. Comparative analysis of characters among closely related species.

	<i>Munronia assamica</i>	<i>Munronia lancifolia</i>	<i>Munronia unifoliolata</i>
Inflorescence	With 1–2 flowers	With 1–3 flowers	With 1–3 flowers
Calyx	Sub-equally 5-lobed; lobes lanceolate, obtuse	Equally 5-lobed; lobes oblong lanceolate, obtuse	Equally 5-lobed, linear to lanceolate, obtuse to slightly acuminate
Corolla	2.8–3.5 cm, tube shorter than corolla lobes	2–2.5 cm, tube longer than corolla lobes	1.5–2.5 cm, tube as long or longer than corolla lobes
Staminal tube	Lobes linear to lanceolate, simple	Lobes subulate, simple	Lobes linear to lanceolate, sometimes apically 2-cleft
Ovary	Glabrous	Puberulent	Puberulent

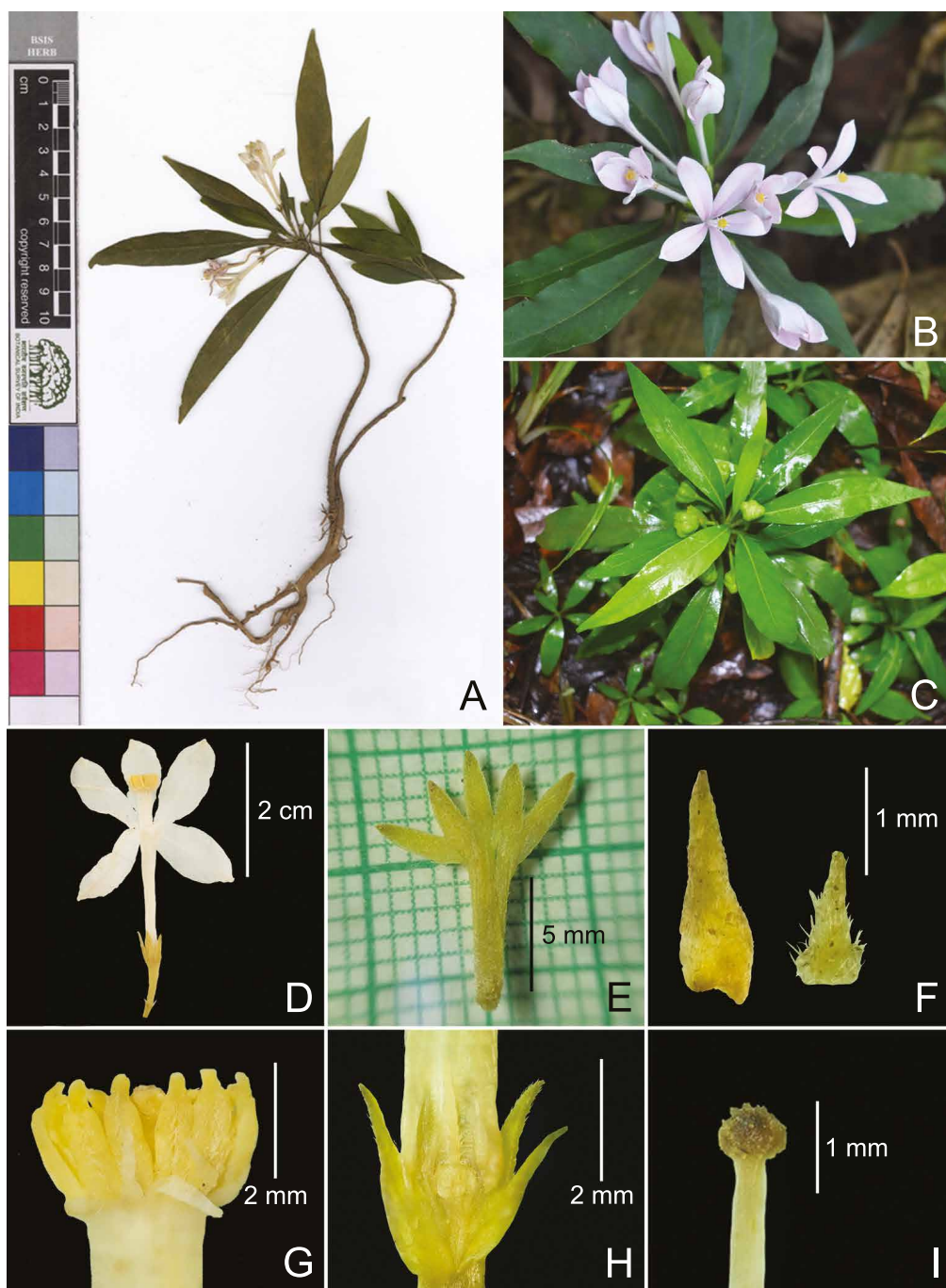


Fig. 1. *Munronia assamica* S.Dey & Bhaumik. **A.** Habit. **B.** Flowering twig. **C.** Fruiting twig. **D.** Flower. **E.** Calyx spread out. **F.** Bract and bracteole. **G.** Apical part of staminal tube showing anthers. **H.** Calyx split open to show ovary and style base. **I.** Part of style and stigma. (Photos: S. Dey)

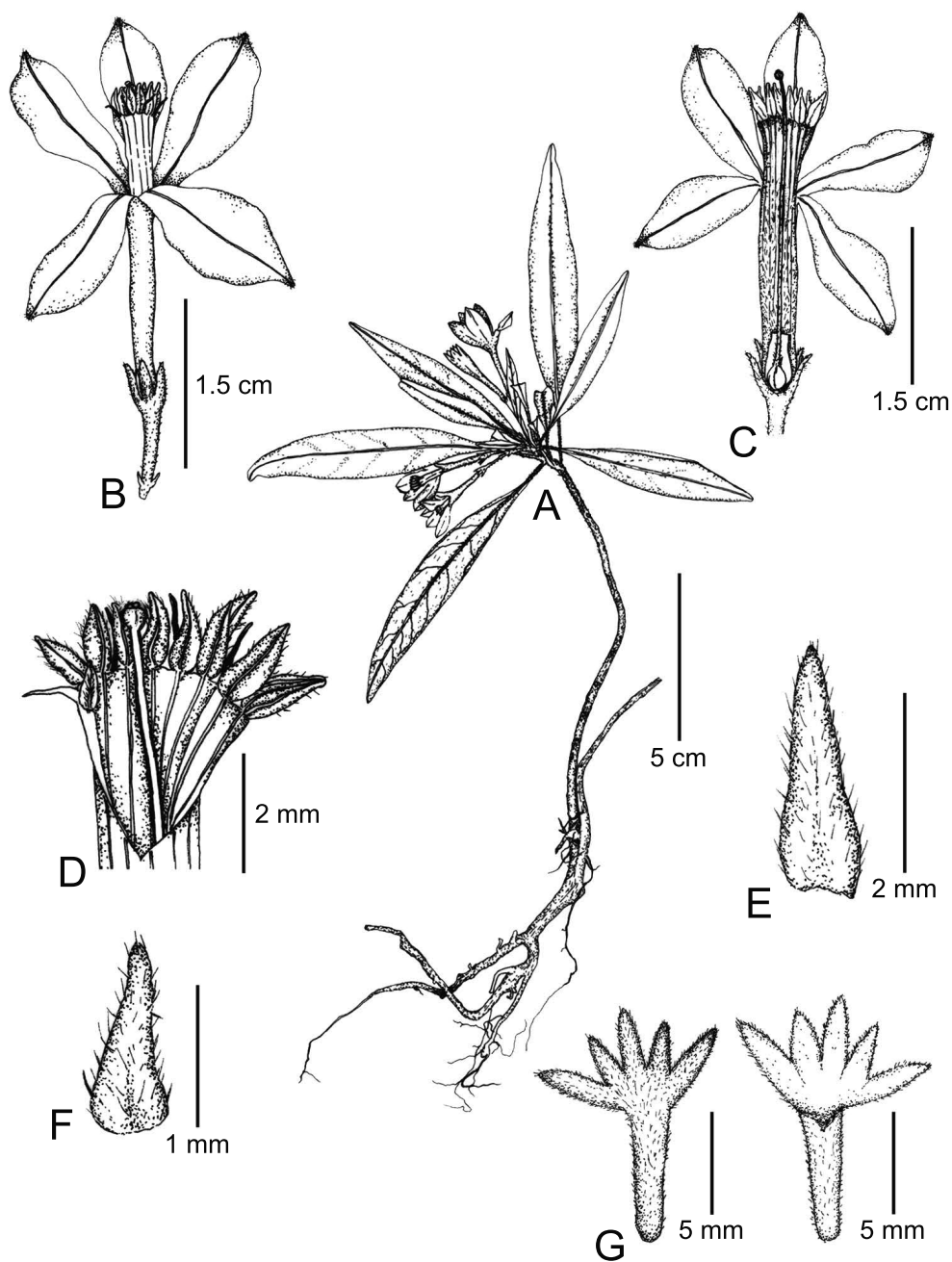


Fig. 2. *Munronia assamica* S.Dey & Bhaumik. **A.** Habit. **B.** Flower. **C.** Flower split open. **D.** Stamens. **E.** Bract. **F.** Bracteole. **G.** Calyx with upper part split open. Drawn by S. Roy from type materials.

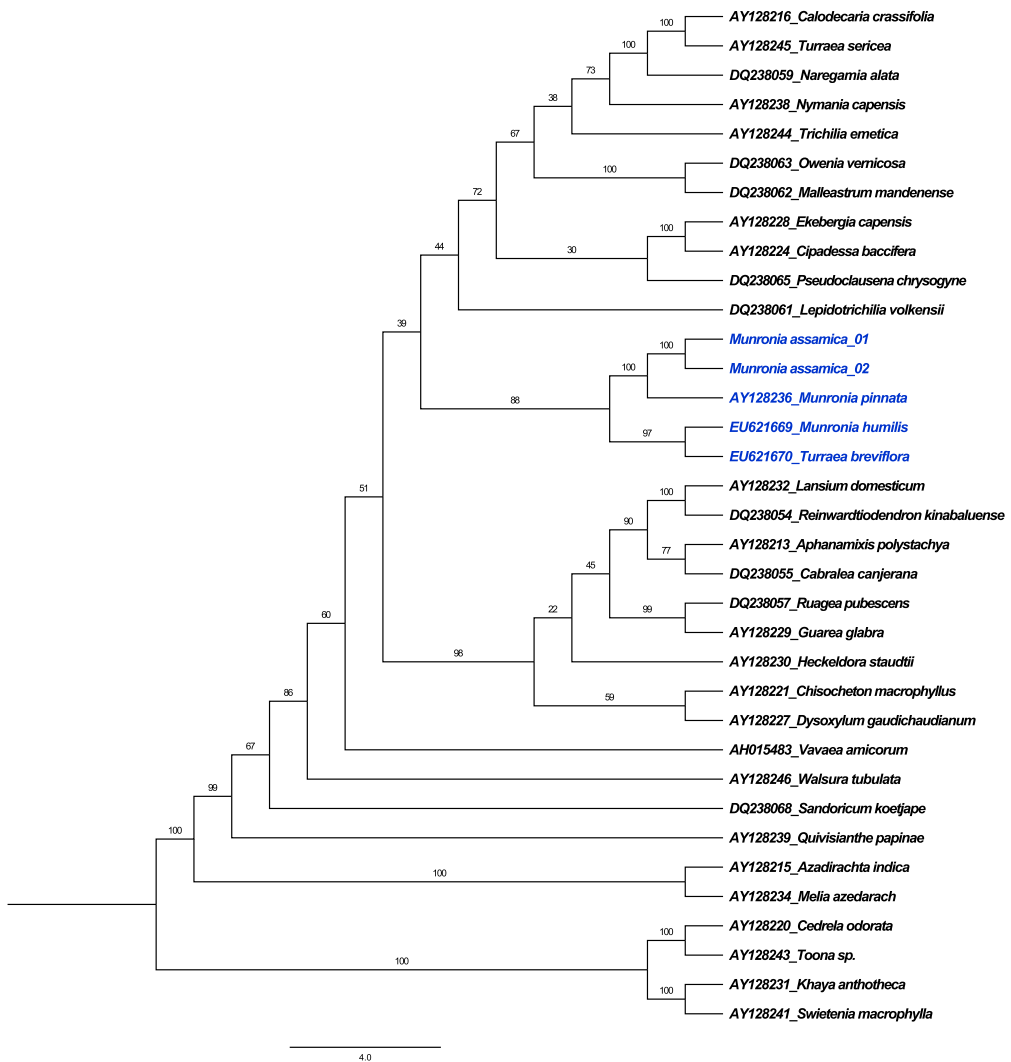


Fig. 3. Maximum likelihood tree showing the phylogenetic position of *Munronia assamica* S.Dey & Bhaumik in the family Meliaceae. Bootstrap values are provided in the respective branches. The members of the genera *Cedrela*, *Toona*, *Khaya*, and *Swietenia* were used as outgroups.

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