**Toona calcicola**, a new species and *Reinwardtiodendron humile*, a new record to Thailand

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ABSTRACT. Two species of Meliaceae, *Toona calcicola* and *Reinwardtiodendron humile* are newly added for flora of Thailand. *Toona calcicola*, a new species from Suan Hin Pha Ngam Forest Park, Loei Province, is described and illustrated. This species is endemic to ridge of limestone hill and characterized by *O*. Since this is the first account of the genus *Reinwardtiodendron* to the flora of Thailand, the key to the genera of Meliaceae (based on flowers) in Thailand is revised.


**INTRODUCTION**

Meliaceae is a large family containing 49–50 genera and ca 620 species and distributed in pantropical area expanding to temperate zone (Mabberley et al., 2007). In Southeast Asia, species of Meliaceae are widely found from lowlands to higher elevation highlands, and are one of important components in tropical and subtropical evergreen forests. In Thailand, 18 genera, 84 species, 3 subspecies and 4 varieties were recognized (Wongprasert et al., 2011; Pooma & Suddee, 2014).

During our botanical surveys in Kaeng Krachan National Park, Phetchaburi Province and Suan Hin Pha Ngam Forest Park, Loei Province, we found two species of Meliaceae which are undocumented in Thailand. To contribute to the Flora of Thailand, we here provide the new records of them based on our materials and herbarium specimens with their descriptions and photographs.

**DESCRIPTION**

*Toona calcicola* Rueangr., Tagane & Suddee, sp. nov.

Erect inflorescences and subsessile to short petiolules up to 2 mm long are characteristic of this species, differing from all the other species of *Toona*. Phenotypically similar to *Toona ciliata* M. Roem. but differs in having puberulent leaf blades on both surfaces, cordate leaf base (vs. rounded and mostly oblique), short petiolules (vs. 0.2–10(–14) mm long), calyx lobes valvate (vs. imbricate), glabrous disc and ovary (vs. puberulent) and 8–10 ovules (vs. 5–8 ovules). It is also similar to *T. sinensis* (A. Juss.) M. Roem., but differing in its ciliate margins of petals (vs. not ciliate), more ovules (vs. 6 ovules) and absence of staminodes (vs. always presence). Type. Thailand. Loei, Suan Hin Pha Ngam Park, Suan Sawan Nature Trail, limestone area, 17°03’31.50”N, 101°45’45.45”E, alt. 547 m, 8

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Trees, 8 m tall; bark grayish white to brown, fissured and flaking; young twigs 1–1.3 cm in diam, puberulent, lenticellate. Leaf scar obcordate, 0.8–1.4 × 0.7–1.1 cm. Leaves spiral, paripinnate, occasionally abort one leaflet on top (looks imparipinnate), 32–55 cm long; petiole 6.5–13.5 cm long, puberulent, lenticellate, rachis puberulent, lenticellate; leaflets opposite, (6–)8–14 pairs; petiololes subsessile to 2 mm long, puberulent; leaflets blades ovate-lanceolate to oblong-lanceolate, 3–12 × 1.4–4.7 cm, apex acuminate, margin entire, revolute, base cordate, tertiary veins scalariiform-reticulate, inconspicuous on upper surface, prominent on lower surface. Inflorescences terminal, erect, panicle, 59–79.5 cm long, rachis puberulent, reddish brown. Flowers ca 5 mm in diam. Pedicle 0.5–1.6 mm long, densely puberulent. Calyx 5(–6), ca 1.5 mm long, outside hairy, inside glabrous, 5-lobed, free; sepals broadly triangular, ca 1–1.2 × 1.3–1.6 mm, margins shortly ciliate. Petals 5(–6), cream in vivo, elliptic-oblong 5 × 2.5–3 mm, raised on the mid-part near base inside and inserted on the androgyphonophore (disk), apex acute to obtuse, both surfaces puberulent, denser near margin on the outside, both surfaces ciliate, denser at the middle on the inside. Male flowers: anthers 5(–6), 1.2 × 0.6–0.8 mm, filaments ca 1.8 mm long, glabrous; disk 1.8–2 mm in diam., yellowish to reddish orange; ovary 5-locular, ca 2.5 × 2.0 mm, glabrous; style ca 2.5 mm long, glabrous, stigma capitate, ca 1 mm in diam. Female flowers: antherodes (non-functional anthers) 5(–6), ca 0.8 × 0.4 mm, filaments 1.1–1.3 mm long, glabrous; staminodes absent; disk 1.8–2 mm in diam., reddish orange, glabrous; ovary 5-locular, 3 × 2.3 mm, glabrous, lenticellate; ovules 8–10 per locule; style ca 1.1 mm long, glabrous, stigma capitate, ca 1.2 mm in diam. Mature capsule, ovoid, 2–2.5 × 2.5–3 cm, with scattered lenticels, opening from apex with 5 valves; columella softly woody, 5-angled to shallowly 5-winged, extending to apex of capsule. Seed, winged at one end, flat, 1.2–2 × 0.4–0.8 cm, body 0.5 × 1 × 0.2–0.5 cm, brown when dry, attached by seed-end to proximal part of the columella.

Distribution.—Endemic (so far known only from the type locality).

Vernacular.—Yom hin pun (ยมหินปุน).

Ecology.—In ridge of limestone hill; alt. ca 550 m.

Phenology.—Flowering: November–December. Fruiting: December–March.

Etymology.—The specific epithet refers to the limestone habitat.

Genbank accession No.—Tagane et al. T3673: LC052213 (rbcL), LC052214 (matK).

Note.—It is noteworthy that Toona calcicola has erect inflorescences (Fig. 1A, Fig. 2B & K), while all the previously known species of this genus, T. ciliata Merr. & Rolfe, T. ciliata M.Roem, T. fargesii A.Chev., T. sinensis (A.Juss.) M.Roem. and T. surenii (Blume) Merr., show pendulous ones. The closely related genus Cedrela, distributed in tropical America and widely introduced to tropical regions including SE Asia for timber plantations, has erect inflorescence and species of the genus are seemingly similar, but differ in having larger petals, cylindrical androgyphonophore (disk) and one-winged seeds attached to distal end of columella (Chung et al., 1995; Mabberley 2011). The matK sequence of T. calcicola resulted in homology as high as 781/785 bp with the sequence of T. ciliata (Phu Kradueng, Thailand, Tagane et al. T4759, FU), T. sinensis (Genbank accession no. JN680341), T. surenii (Blume) Merr. (Mt. Bokor, Cambodia, Tagane et al. JQ4299, FU) and 764/772 bp with that of C. odorata (JQ588333) in the DNA database.
TOONA CALCICOLA, A NEW SPECIES AND REINWARDTIODENDRON HUMILE, A NEW RECORD TO THAILAND
(S. RUEANGRUEA, S. TAGANE, S. SUDEE, N. TETSANA, M. POOPATH, H. NAGAMASU & A. NAIRK)

Figure 1. Toona calcicola Rueang., Tagane & Suddee, A. leaves and inflorescences; B. female flower with sepals and petals removed; C. longitudinal section of male flower; D. young fruit, whole and cross-section showing ovules; E. capsules; F. seeds. A–D from Tagane et al. T3673 (BKF); E–F from Tetsana et al. NT919 (BKF). All drawn by O. Kerdkaew.
Figure 2. *Toona calcicola* Rueangr., Tagane & Suddee. A. habitat; B. flowering branch; C. abaxial surface of leaflet; D. bark; E. leaf scar; F. flowers; G. male flower with some petals removed; H. female flower with some petals removed; I. young fruits; J. cross section of young fruit; K. infructescence; L–M. capsules; N. capsules and seeds showing seeds attached by seed-end to proximal part of the columella; O. seeds. Photos: A & M. by Sukid Rueangruea; B–J. by Shuichiro Tagane; K & L. by Naiyana Tetsana. N & O. from Tetsana et al. NT919 (BKF).
Conservation status.— DD (Data Deficient). A few similar trees have been observed on limestone areas in Loei Province but flowers and fruits have not been seen. More exploration in nearby limestone areas is needed in order to gain more information for a robust conservation assessment.


Tree, 27 m tall. Twigs greyish brown, lenticellate, subglabrous except densely pubescent apices. Leaves odd-pinnate, 12–25 cm long; petiole 2.5–4.1 cm long, petiole and rachis flat above, rounded below; leaflets 3 or 5, subopposite to opposite; petiolules 2–4 mm long, blades elliptic to oblanceolate, 4.7–19 × 2.2–6 cm, base cuneate, channelled, margin entire, apex acuminate, acumen to 1.8 cm long, subcoriaceous, glossy on both surfaces, glabrous except with very sparse hairs on abaxial surface of midrib; midrib sunken above, prominent below, secondary veins 13–19 pairs, at an angle of ca 60° from midrib, connected to the above ones near margin, prominent on both surfaces, tertiary veins finely reticulated, prominent on both surfaces. Inflorescence spike or panicles, 2–7.2 cm long, peduncles and rachis very sparsely hairy, lenticellate; bract ovate, ca 1.8 mm long, sparsely pubescent. Flower buds globose, ca 2 mm in diam., sessile. Calyx lobes 5, orbicular, ca 1.5 mm in diam., imbricate, glabrescent, margin ciliate; petals 5, obovate, 3.5–4.5 × ca 2 mm, yellow, very sparsely pubescent outside, glabrous inside; staminal tube subglobose, ca 3.2 mm in diam., glabrous outside, pubescent inside, anthers 10, 2 whorls of 5, ca 1 mm long. Ovary 5-locular, one ovule per locule, style ca 0.5 mm long, Fr. not seen.


Distribution.— China (Hainan), Laos, Cambodia, Vietnam, Peninsular Malaysia, Sumatra, Borneo (Kalimantan, Sabah, Sarawak), Java, Philippines, Sulawesi.

Vernacular.— Mang kha (ติ้มก้า)(Phangnga).


Phenology.— Flowering: October, November, February.
Figure 3. Photographs of Reinwardtiodendron humile (Hassk.) Mabb. A. branchlet with flower buds; B. abaxial surface of leaflet; C. inflorescence; D. voucher specimen: Tagane et al. T2305 (FU). E. close up specimen image showing prominent reticulated venation on both upper and lower surfaces. Photographs: A–C. 27 Oct. 2013, Kaeng Krachan National Park.
KEY TO THE GENERA OF MELIACEAE IN THAILAND
(based on flowering specimens, modified from Wongprasert et al. (2011) in order to add Cedrela and Reinwardtidendron).

1. Flower buds ovoid, obovoid or obconical; petals not exceeding 5 mm long
2. Leaves paripinnate
3. Leaves all paripinnate in adult (leaves of young trees mostly bipinnate with incised or lobed leaflet), usually with juvenile leaflet hairy
4. Apical leaflets expand later than the proximal, but the leaf is not indeterminate
5. Pistil hairy
6. Leaf indeterminate, with bud of undeveloped leaflets
7. Leaves trifoliolate, 2–(3-)imparipinnate; leaflet margin serrate
13. Sandoricum
12. Leaves imparipinnate or simply imparipinnate
13. Leaves paripinnate in adult (leaves of young trees mostly bipinnate with incised or lobed leaflet), usually with juvenile leaflet hairy
14. Stems connate, staminal tube cylindric
15. Toona
16. Leaf indeterminate, with bud of undeveloped leaflets
17. Munronia
18. Turraea
19. Aphanamixis
20. Cedrela (C. odorata)
21. Reinwardtidendron
22. Xylocarpia
23. Aphanamixis
24. Azadirachta
25. Chukrasia
26. Dysoxylum
27. Cipadessa
28. Heynea
29. Rhus
30. Doryanthes
31. Lantana
32. Melia
33. Toona
34. Xylocarpia
35. Reinwardtidendron
36. Aphanamixis
37. Azadirachta
38. Chukrasia
39. Dysoxylum
40. Cipadessa
41. Heynea
42. Rhus
43. Doryanthes
44. Lantana
45. Melia
46. Toona
47. Xylocarpia
48. Reinwardtidendron
49. Aphanamixis
50. Azadirachta
51. Chukrasia
52. Dysoxylum
53. Cipadessa
54. Heynea
55. Rhus
56. Doryanthes
57. Lantana
58. Melia
59. Toona
60. Xylocarpia

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