

Garcinia minutiflora (Clusiaceae), a new record from Peninsular Thailand, with lectotypification

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ABSTRACT

Garcinia minutiflora (Clusiaceae), previously known only from Peninsular Malaysia, is reported as a new record from dry evergreen forest on limestone hills in Phangnga and Krabi Provinces, Peninsular Thailand. A detailed morphological description, illustrations and a distribution map of the species are presented, along with information on distribution, specimens examined, habitat, conservation assessment, phenology and vernacular name. In addition, *G. minutiflora* is lectotypified.

KEYWORDS: *Garcinia* sect. *Discostigma*, dioecy, limestone, Malpighiales, Peninsular Malaysia, plant taxonomy.

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INTRODUCTION

Garcinia L. is a group of evergreen trees, occasionally shrubs, which are usually dioecious, sometimes polygamo-dioecious and the largest genus in the Clusiaceae Lindl. (Guttiferae Juss.). The genus consists of 405 accepted species, and is distributed throughout the tropics and subtropics (POWO, 2023) with centres of diversity in South-East Asia and Madagascar (Sweeney & Rogers, 2008). In Asia, *Garcinia* is most diverse in the Malesian region but also spreads north into southern China, west to India and east to the Micronesian islands (Nazre *et al.*, 2018). Previous studies on *Garcinia* revealed that India (including Andaman and Nicobar Islands) has 39 species (Anderson, 1874; King, 1890; Maheshwari, 1964; Singh, 1993; Srivastava, 1994; Sabu *et al.*, 2013; Sarma *et al.*, 2016; Shameer *et al.*, 2017, 2021), Sri Lanka 10 species (Anderson, 1874; Kostermans, 1980; Pathirana & Herat, 2004; Nimanthika & Kaththirarachchi, 2010), Myanmar 19 species (Anderson, 1874; Kurz, 1877; Maheshwari, 1964; Singh, 1993; Nazre *et al.*, 2018; Sweeney *et al.*,

2022), China 20 species (Li *et al.*, 2007), Indo-China (Vietnam, Laos and Cambodia) 30 species (Pitard, 1910; Gagnepain, 1943; Hô, 1991; Toyama *et al.*, 2017; Tagane *et al.*, 2018), the Malesian region 82 species and Peninsular Malaysia 48 species (King, 1890; Ridley, 1922; Backer & Bakhuizen, 1963; Chin, 1973; Kochummen & Whitmore, 1973; Whitmore, 1973; Turner, 1995; Nazre *et al.*, 2018).

In Thailand, the genus *Garcinia* was enumerated by Craib (1925) with 20 species. Gardner recorded six species in Northern (Gardner *et al.*, 2000), and 23 species (including five unidentified species) in Peninsular Thailand (Gardner *et al.*, 2015). More recently, Ngernsaengsaruy & Suddee (2016, 2022) described additional new species: *G. nuntasaenii* Ngerns. & Suddee from North-Eastern and *G. santisukiana* Ngerns. & Suddee from Eastern Thailand, respectively, Ngernsaengsaruy (2022) published three *Garcinia* species in Thailand: *G. atroviridis* Griff. ex T. Anderson, *G. lanceifolia* Roxb. and *G. pedunculata* Roxb. ex Buch.-Ham., Ngernsaengsaruy *et al.* (2022a, 2023) published additional new records from Peninsular Thailand: *G. dumosa* King and *G. exigua* Nazre,

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respectively, and Ngernsaengsaruy *et al.* (2022b) published *Garcinia siripatanadilokii* Ngerns., Meeprom, Boonthasak, Chamch. & Sinbumr. as a new species from Peninsular Thailand. From these publications, the genus as a total of ca 30 accepted species in Thailand.

The genus is characterised by a dioecious habit, with plants sometimes apparently polygamodioecious; yellow, pale yellow, white, cream or clear latex secreted from cut boles, twigs, leaves and fruits; decussate leaves with scattered black or brown gland dots, or interrupted wavy lines of differing lengths; 4- or 5-merous flowers; many to numerous stamens, always united in a bundle at the centre of the flowers: 4 or 5 bundles, distinctly or weakly 4-lobed, 4-angled, a column or a ring; fruits berries, and seeds usually with thick or thin sarcotesta (Ngernsaengsaruy *et al.*, 2022a, 2022b).

A taxonomic revision of the genus *Garcinia* has recently been undertaken by the first author as part of the Flora of Thailand. During fieldwork at Krabi Province, Naiyana Tetsana *et al.* collected specimens of a species of *Garcinia* with fruits and flower buds in March 2021 from littoral dry evergreen forest on limestone hill, Ko Hong (Hong Island), Than Bok Khorani National Park. The first author and Weereesa Boonthasak then collected sterile specimens of same species in March 2022 from dry evergreen forest with bamboo on a limestone hill, Wat Tham Suea. In addition, we found herbarium specimen of the same species collected from Phangnga Province (Shimizu *et al.* T-29205, BKF). These specimens match the type and the description in the taxonomic literature of *G. minutiflora* Ridl., previously known from Peninsular Malaysia (Ridley, 1920, 1922; Chin, 1973; Kochummen & Whitmore, 1973; Whitmore, 1973; Turner, 1995). Therefore, it is reported here as a new record for Thailand, with a detailed morphological description and illustrations, together with information on distribution, a full list of specimens examined, habitat, conservation assessment, phenology and vernacular name.

MATERIALS AND METHODS

The collected specimens were examined by consulting taxonomic literature (Ridley, 1920, 1922; Chin, 1973; Kochummen & Whitmore, 1973; Whitmore, 1973; Turner, 1995), and by comparing

with herbarium specimens deposited in the following herbaria BKF, K, SING, and those included in the digital herbarium databases of K (<http://www.kew.org/herbcat>) and L (<https://bioportal.naturalis.nl/>). All acronyms follow Thiers (2023, continuously updated). The morphological characteristics, distribution, habitat and phenology were described from our observations during fieldwork and from label information of the specimens examined. The assessment of conservation status was performed following the IUCN Red List Categories and Criteria (IUCN Standards and Petitions Committee, 2022) for a preliminary assessment of the conservation category in combination with GeoCAT analysis (Bachman *et al.*, 2011) and field information. The calculation of Extent of Occurrence (EOO) and Area of Occupancy (AOO) are based on GeoCAT (<http://www.geocat.kew.org>).

TAXONOMIC TREATMENT

Garcinia minutiflora Ridl., J. Straits Branch Roy. Asiat. Soc. 82: 169. 1920; Fl. Malay Penins. 1: 176. 1922; Craib, Fl. Siam. 1(1): 117. 1925; S.C.Chin, Limestone Fl. Malaya, M.Sc. Thesis, Univ. Malaya: 287. 1973; Kochummen & Whitmore, Gard. Bull. Singapore 26(2): 272. 1973; Whitmore in Whitmore, Tree Fl. Malaya 2: 216. 1973; I.M.Turner, Gard. Bull. Singapore 47(1): 262. 1995. Type: Peninsular Malaysia, Langkawi Island, Goa Cherita (original publication “Goa Chinta”), with staminate flowers, Mar. 1892, *Curtis 2802* (lectotype selected here **K** [K000677659!]; isolectotypes **SING** [SING0063116!, SING0063117!]). Figs. 1–3.

Evergreen trees, 3–15 m tall, 20–60 cm girth; latex yellow, sticky; branches decussate, horizontal; branchlets 4-angular. *Bark* smooth, rough or scaly, dark greyish brown to dark brown. *Terminal bud* concealed between the bases of the uppermost pair of petioles. *Leaves* decussate; lamina obovate or elliptic, 3.8–6 × 1.7–3.7 cm, apex obtuse or retuse, base cuneate or obtuse, margin entire and finely revolute, coriaceous, dark green above, paler below, glabrous on both surfaces, midrib slightly raised above, raised below, secondary veins 5–9 pairs, curving towards the margin connected in distinct loops and united into an intramarginal vein, conspicuous on both surfaces, with intersecondary veins, veinlets reticulate, conspicuous on both surfaces,

with many scattered black gland dots below, interrupted long wavy lines (glandular wavy lines) of differing lengths, nearly parallel to the midrib, running across the secondary veins to the apex or the margin, visible below; petiole 0.3–1 cm long, 1–2 mm in diam., grooved above, glabrous; young leaves pale green and petiole red or reddish green; fresh leaves crispy when crushed; dry leaves brown or brownish green. *Inflorescences* axillary or on branches at leafless nodes. *Flowers* unisexual, plants dioecious, 4-merous; bracts 4, decussate; sepals and petals decussate, glabrous; flower buds globose or subglobose, pale green. *Staminate flowers* in a short thyse, 0.8–2 cm long, many-flowered, very small, 1.8–2 mm in diam.; bracts semiorbicular, 0.7–1.1 × 0.9–1 mm, apex obtuse; pedicel pale green, 1.4–1.5 mm long, 1.7–1.8 mm in diam., glabrous; sepals 4, pale green, concave, the outer pair slightly larger than the inner pair, the outer pair suborbicular or broadly ovate, 1.6–2 × 1.6–2 mm, apex obtuse, the

inner pair ovate or suborbicular, 1–1.5 × 1–1.5 mm, apex obtuse; petals 4, creamy white or pale yellow, obovate, 1–1.5 × 0.8–1.1 mm, subequal, apex obtuse or rounded, slightly smaller than the sepals; stamens numerous, filaments completely united in 4 bundles, antipetalous (opposite the petals), 0.4–0.5 × 0.3–0.5 mm each bundle; anthers 2-theous, globose or subglobose, 0.1–0.2 × ca 0.1 mm; pistillode mushroom-shaped (fungiform), 0.5–0.7 mm long; stigma sessile, slightly convex, ca 0.3 mm in diam., weakly 4–5-lobed. *Pistillate flowers* not seen. *Fruit* a berry, subglobose, globose or broadly ellipsoid, 1.4–1.7 × 1.3–1.5 cm, green, smooth with fine longitudinal striate, glabrous, pericarp coriaceous, ca 0.6 mm thick, cut fruits with sticky, yellow latex; persistent stigma dark brown, convex, 2–3 mm in diam., weakly 4–5-lobed; with small persistent sepals; fruiting stalk 2–3 mm long, 1.5–3 mm in diam. *Seeds* 1–2, black when dry, depressed subglobose, ca 1.1 × 1.2 cm, ca 7.8 mm thick, with sarcotesta.

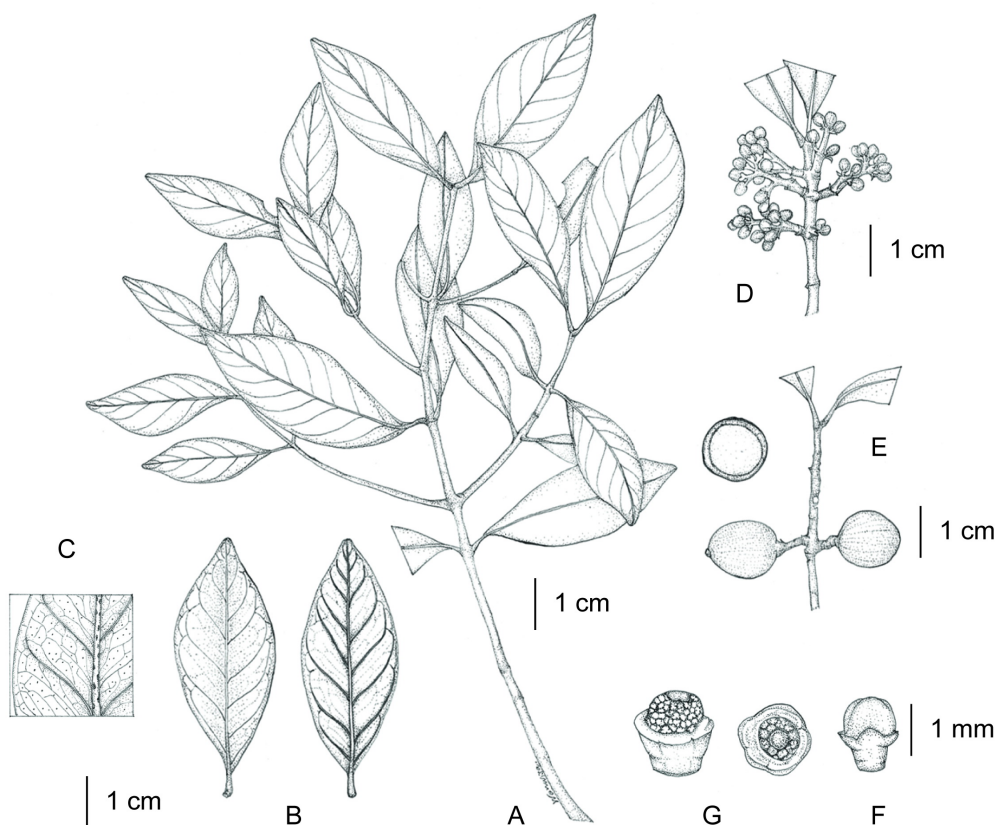


Figure 1. *Garcinia minutiflora* Ridl.: A. branches and leaves; B. upper surface of leaf (left) and lower surface of leaf (right); C. lower surface of leaf with many scattered black gland dots; D. branch and inflorescences with staminate flower buds; E. fruiting branch and transverse section of fruit; F. staminate flower bud; G. staminate flower bud showing stamens and pistillode (sepals and petals removed). Materials from Tetsana et al. 2087 and Tetsana et al. 2088. Drawn by Wanwisa Bhuchaisri.



Figure 2. *Garcinia minutiflora* Ridl.: A. habitat and habit; B. outer bark; C. branches, leaves and fruits. Photos: A. by Chatchai Ngernsaengsaruary; B–C. by Naiyana Tetsana.

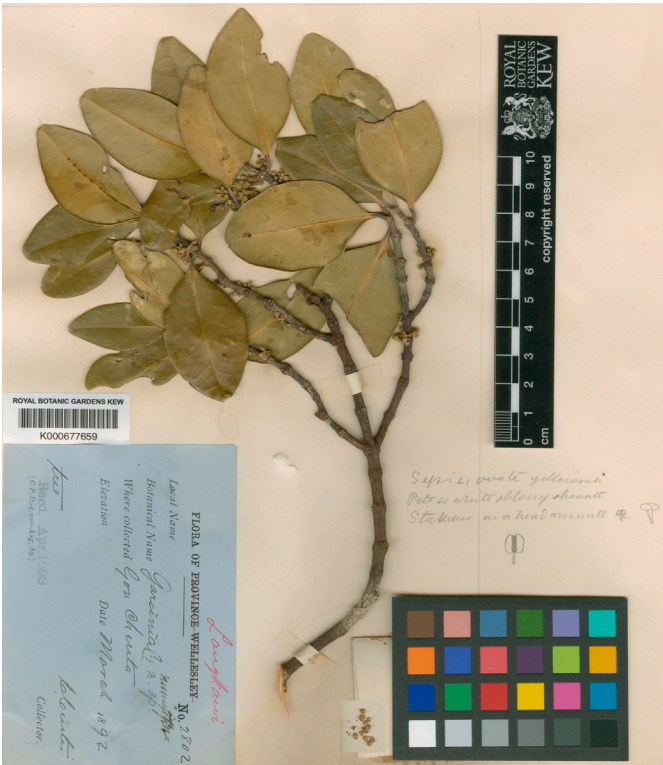


Figure 3. Lectotype of *Garcinia minutiflora* Ridl., Curtis 2802 (K [K000677659] from Peninsular Malaysia, Langkawi Island, Goa Cherita (<http://specimens.kew.org/herbarium/K000677659>).

Thailand.— PENINSULAR: Phangnga [Takua Thung, Khao Phing Kan Islands, 0–5 m alt., 8 Sept. 1982, *Shimizu et al.* T-29205 (BKF)]; Krabi [Ao Luek, Than Bok Khorani NP, Hong Islands, 80 m alt., 15 Mar. 2021, *Tetsana et al.* 2087 (BKF); *ibid.*, *Tetsana et al.* 2088 (BKF)].

Additional specimens examined.— Peninsular Malaysia: Kedah [Langkawi, Pulau Dayang Bunting, with fruits, 13 Nov. 1941, *Corner* SF37855 (L [L2416845]); *ibid.*, 14 Dec. 1969, *Whitmore* *Kep. FRI* 15054 (L [L2416842]); *ibid.*, 15 Dec. 1969, *Whitmore* *Kep. FRI* 15086 (L [L2416841]); *ibid.*, Pulau Chupah, 19 Nov. 1941, *Corner* SF37818 (L [L2416844]); *ibid.*, 2 Nov. 1971, *Chin* 1722 (L [L2416839]); *ibid.*, 9 Dec. 1969, *Whitmore* *Kep. FRI* 12966 (L [L2416843]); *ibid.*, 1 Feb. 1975, *Jaman* 127 (L [L2416840])].

Distribution.— Peninsular Thailand and Peninsular Malaysia: Perlis (Kaki Bukit), Kedah (Langkawi Island), Penang, Kelantan (Gua Musang). Fig. 4.

Ecology.— In littoral dry evergreen forest on limestone hill (Ko Khao Phing Kan and Ko Hong, 0–100 m alt.) and dry evergreen forest on limestone hill (Wat Tham Suea, 130–250 m alt.), 0–250 m alt. Flowering and fruiting more than once a year, August–March.

Vernacular.— Nuan dok lek khao hin pun (นวลดอกเล็กเขาหินปูน)(suggested here).

Preliminary conservation assessment.— *Garcinia minutiflora* is known from Peninsular Malaysia and Peninsular Thailand, and has a relatively small Extent of Occurrence of 6,774.65 km² and a small Area of Occupancy of 28 km². In Thailand, the species is known only from three locations (see habitat) in Phangnga and Krabi Provinces, but to be expected in other limestone hills. We therefore consider the conservation assessment as Vulnerable [VU B1B2a,b(ii,iv)].

Lectotypification.— *Garcinia minutiflora* was described by Ridley (1920: 169–170) based on *Curtis* 2802 from Peninsular Malaysia, Langkawi Island, Goa Cherita (originally published “Goa Chinta”) but did not mention the herbaria in which the specimen(s) were present. We located three sheets of the specimen *Curtis* 2802: one sheet at K [K000677659] and two sheets at SING [SING0063116,

SING0063117] collected from the same locality, and following Art. 9.6 of the ICN (Turland *et al.*, 2018), they constitute syntypes. Ridley was a director of Botanic Gardens Singapore (1888–1912) then after his retirement from SING so he was based at K (Stafleu & Cowan, 1983). Therefore, the specimen *Curtis* 2802 at K [K000677659] is selected here as the lectotype, following Art. 9.3 and 9.12 of the ICN (Turland *et al.*, 2018).

Notes.— *Garcinia minutiflora* is related to *G. santisukiana* Ngerns. & Suddee in having 4-merous flowers, decussate sepals and petals, stamens united in 4 bundles, staminate flowers with a pistillode, fruits with small persistent sepals and coriaceous pericarp, but differs in having its lamina apex obtuse or retuse, with 5–9 pairs of secondary veins, with many scattered black gland dots below (vs lamina apex acute, sometimes retuse, with 9–14 pairs of secondary veins, with a few scattered black gland dots on both surfaces); staminate flowers in a short thyrses, 0.8–2 cm long, many-flowered, very small, 1.8–2 mm in diam. (vs staminate flowers mostly in fascicles of 3–5 flowers, small, 4–7 mm in diam.);

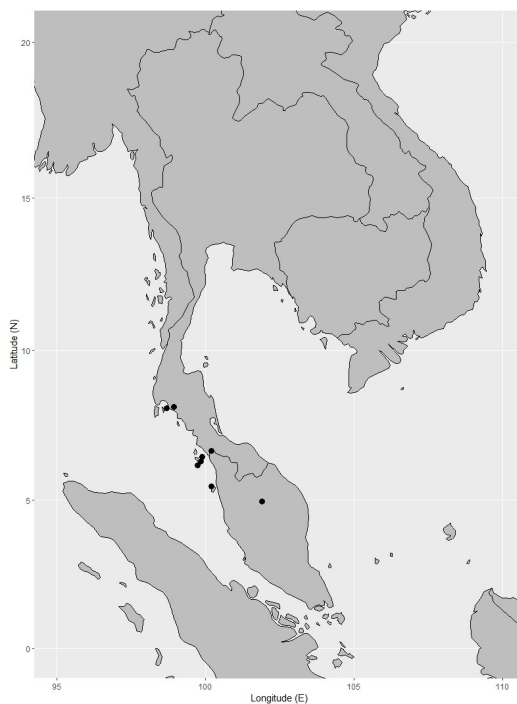


Figure 4. Distribution of *Garcinia minutiflora* Ridl., known from Peninsular Thailand and Peninsular Malaysia.

fruits with fine longitudinal striate, with convex persistent stigma (vs fruits without fine longitudinal striate, with flattened persistent stigma); distribution and habitat (see below) [vs Ubon Ratchathani Province, Eastern Thailand, in dry evergreen forest (Dong Na Tham Forest) and in deciduous dipterocarp forest on sandstone crevices (Pha Chana Dai), 400–420 m alt. (The characters, distribution and habitat of *G. santisukiana* were taken from Ngernsaengsaruy & Suddee, 2022).

According to Ridley (1920, 1922), Kochummen & Whitmore (1973) and Whitmore (1973), the staminate flowers of *Garcinia minutiflora* have numerous stamens in a central globose mass, without a pistillode; however, from our observations, we found the stamens are numerous, the filaments are completely united in 4 bundles, the pistillode is present with prominent stigma, and the fruits with coriaceous pericarp. These characteristics belong to *Garcinia* section *Dicostigma* in agreement with Jones (1980), some species in the section are found in Thailand (e.g. *G. merguensis* Wight, *G. santisukiana*).

According to Chin (1973), the shape and size of leaves are ovate, ovate-elliptic to obovate and $4.5\text{--}8 \times 2.5\text{--}4.5$ cm; the shape and size of fruits are ellipsoid and 1.2–2.3 cm long, with one seed; however, from our observations, we found the leaves can be obovate or elliptic, and sometimes smaller, $3.8\text{--}6 \times 1.7\text{--}3.7$ cm; the fruits can be subglobose, globose or broadly ellipsoid, and sometimes smaller, $1.4\text{--}1.7 \times 1.3\text{--}1.5$ cm, with one to two seeds.

Chin (1973) reported the pistillate flowers of the species are solitary or paired (simple cyme, in fascicles of 2 flowers), but from our study, we did not find pistillate flowers.

Craib (1925) reported *Garcinia minutiflora* found in the former Phuket [then consisting of present-day Ranong, Phangnga, Phuket, Krabi, Trang and Satun Provinces]. He cited only the type *Curtis 2802*, but did not mention any specimens from Thailand. Langkawi Island (Ko Langkawi) is an administrative district of Kedah located about 30 km off the coast of northwestern Peninsular Malaysia and a few kilometres south of Ko Tarutao (Tarutao Island), Satun Province, adjacent to the Thai border.

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