

## *Garcinia exigua* (Clusiaceae), a new record for Thailand

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### ABSTRACT

*Garcinia exigua* (Clusiaceae), previously known from Borneo [Malaysia (Sarawak) and Brunei], is reported as a new record from dry evergreen forest on limestone hill in Krabi Province, Peninsular Thailand. A detailed morphological description, illustrations and a distribution map of the species are provided, along with information on distribution, specimens examined, habitat, conservation status, phenology, etymology and vernacular name.

KEYWORDS: dioecy, limestone, Peninsular Thailand, taxonomy, Malpighiales, Borneo.

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### INTRODUCTION

*Garcinia* L. (Clusiaceae) is a group of evergreen trees, occasionally shrubs, which are usually dioecious, sometimes polygamo-dioecious; the genus also has some obligately and facultatively agamosperous species. The genus comprises 402 accepted species, and is mostly tropical and subtropical (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 the Malay Peninsula has ca 60 species (King, 1890; Ridley, 1922; Kochummen & Whitmore, 1973; Whitmore, 1973), India 40 species (Maheshwari, 1964; Singh, 1993; Srivastava, 1994; Sabu *et al.*, 2013; Sarma *et al.*, 2016; Shameer *et al.*, 2017, 2021), Indo-China 34 species (Gagnepain, 1943) and China 20 species (Li *et al.*, 2007).

In Thailand, 20 species of the genus *Garcinia* had been enumerated by Craib (1925). More recently,

Gardner listed 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 *et al.* (2022a) published *G. dumosa* King as a new record from Peninsular Thailand, 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.

A revision of the genus *Garcinia* has recently been undertaken by the first author as part of the Flora of Thailand. During fieldwork at Ko Hong (Hong Island), Than Bok Khorani National Park, Krabi Province, we collected specimens of a species of *Garcinia* with staminate flowers in littoral dry evergreen forest on limestone hill in February 2022.

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These specimens match the type and the description in a taxonomic literature of *G. exigua* Nazre, previously known from Borneo (Sarawak and Brunei) (Nazre *et al.*, 2018). Therefore, it is reported here as a new record for Thailand, with a description and illustrations, together with information on distribution, a full list of specimens examined, habitat, IUCN conservation status, phenology, etymology and the vernacular name.

## MATERIALS AND METHODS

The collected specimens were examined by consulting taxonomic literature (e.g., King, 1890; Ridley, 1922; Kochummen & Whitmore, 1973; Whitmore, 1973; Nazre *et al.*, 2018), and by comparing with herbarium specimens deposited in the herbaria AAU, BKF, BM, C, CMUB, K, P, PSU, QBG, SING, and those included in the digital herbarium databases of AAU ([https://www.aubot.dk/search\\_form.php](https://www.aubot.dk/search_form.php)), BM (<https://www.nhm.ac.uk/our-science/collections/botany-collections.html>), E (<https://data.rbge.org.uk/search/herbarium/>), K (<http://www.kew.org/herbcat>), L (<https://biportal.naturalis.nl/>) and P (<https://science.mnhn.fr/institution/mnhn/collection/p/item/search>) were also examined. All acronyms follow Thiers (2022, continuously updated). The morphological characters, distribution, habitat and phenology were described from our field observations during the fieldwork and from label information of the specimens examined. The conservation status of species was assessed 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) based on GeoCAT (<http://www.geocat.kew.org>).

## TAXONOMIC TREATMENT

*Garcinia exigua* Nazre, Phytotaxa 373: 28. figs. 2g, 3i, 10. 2018. Type: Malaysia, Borneo, Sarawak, Bintulu, Buan Forest Reserve, 18 Sept. 1972, *P. Chai S31750* (holotype SAR, isotype L [L2403372, photo seen]). Figs. 1–4.

Evergreen trees, 2.5–20 m tall, 20–100 cm girth, sometimes with buttresses near the base of the

main stem, usually found in large trees; latex yellow, sticky; branches opposite, decussate, horizontal; branchlets 4-angular. *Bark* rather smooth, flaking, leaving roundish or irregularly shaped scars, brown or dark brown, after the peel pale yellow or pale brown; inner bark red. *Terminal bud* concealed between the bases of the uppermost pair of petioles. *Leaves* opposite, decussate; lamina narrowly elliptic, elliptic, broadly elliptic, sometimes obovate, 3–6.3 × 1–3.2 cm, apex narrowly obtuse or obtuse, base cuneate, margin entire and finely revolute, coriaceous, dark green above, paler below, glabrous on both surfaces, midrib raised above and below, secondary veins 10–18 pairs, curving towards the margin connected in distinct loops and united into an intramarginal vein, faint above, inconspicuous below, with intersecondary veins, veinlets reticulate, faint on both surfaces, with a few scattered black gland dots on both surfaces, 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 on both surfaces especially on the lower surface of dry leaves); petiole 0.3–1 cm long, 1–1.5 mm in diam., grooved above, finely transversely rugose, glabrous; young leaves pale green; fresh leaves crispy when crushed; dry leaves pale brown or reddish brown. *Inflorescences* terminal, simple cymes, in fascicles of 3 staminate flowers and usually solitary in pistillate flowers (observations from the fruits). *Flowers* unisexual, plants dioecious, 4-merous; bracteoles caducous; sepals and petals opposite, decussate, glabrous. *Staminate flowers* lightly fragrant, 1.5–2 cm in diam., the middle flowers always largest, with 2 bracteoles, these acting as bract for each lateral flower; bracteoles green or brownish green, conduplicate with a central keel, ovate, 8–10 × 4–5.5 mm, apex acuminate, thinly coriaceous; pedicel pale green, turning pale yellow, 3–4.5 mm long, 1.3–1.7 mm in diam., glabrous; sepals 4, pale yellow, concave, thinly coriaceous, with wavy lines outside, the outer pair broadly ovate, 4.2–5 × 3.5–5 mm, apex acute, the inner pair elliptic or broadly elliptic, 4.2–6 × 3–4.5 mm, apex obtuse; petals 4, pale yellow, elliptic, 6.5–9 × 3.5–8 mm, subequal, apex obtuse, margin revolute, thinly coriaceous, with wavy lines outside; stamens numerous, united in 4-lobed bundles, surrounding a pistillode, opposite petals (antipetalous), 3–3.5 × 3–4 mm each bundle, pale yellow; filaments 0.5–0.7 mm; anthers 2-thealous, 0.9–1.2 × 0.8–1 mm;

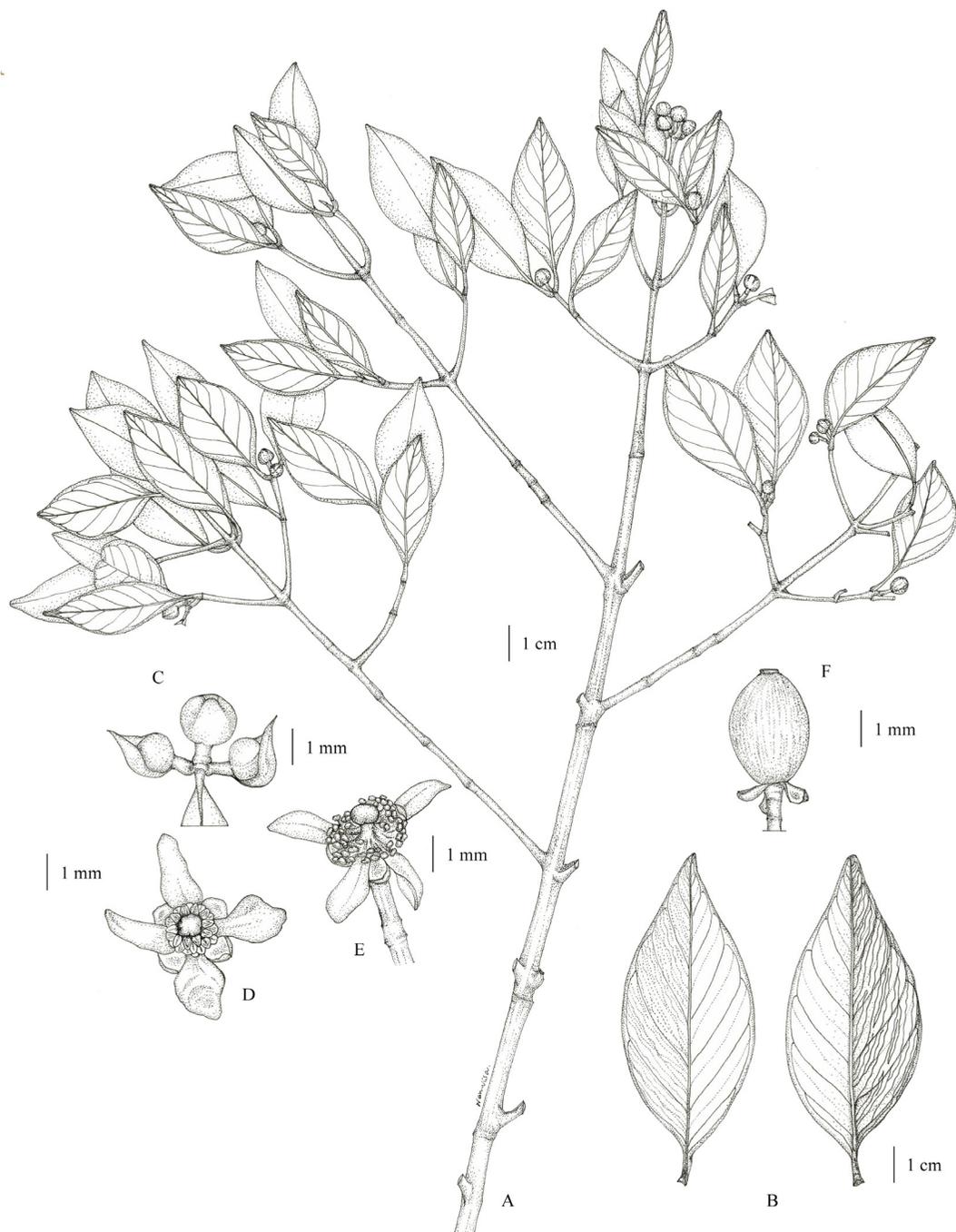


Figure 1. *Garcinia exigua* Nazre: A. branches, leaves and inflorescences with male flower buds; B. upper surface of leaf (left) and lower surface of leaf (right); C. inflorescence and male flower buds with bracteoles; D–E. male flower showing stamen bundles and pistillode; F. fruits with persistent stigma and persistent sepals. Materials from Ngernsaengsaruy et al. G27-13022022, G28-13022022; Pooma et al. 3612 (fruit). Drawn by Wanwisa Bhuchaisri.

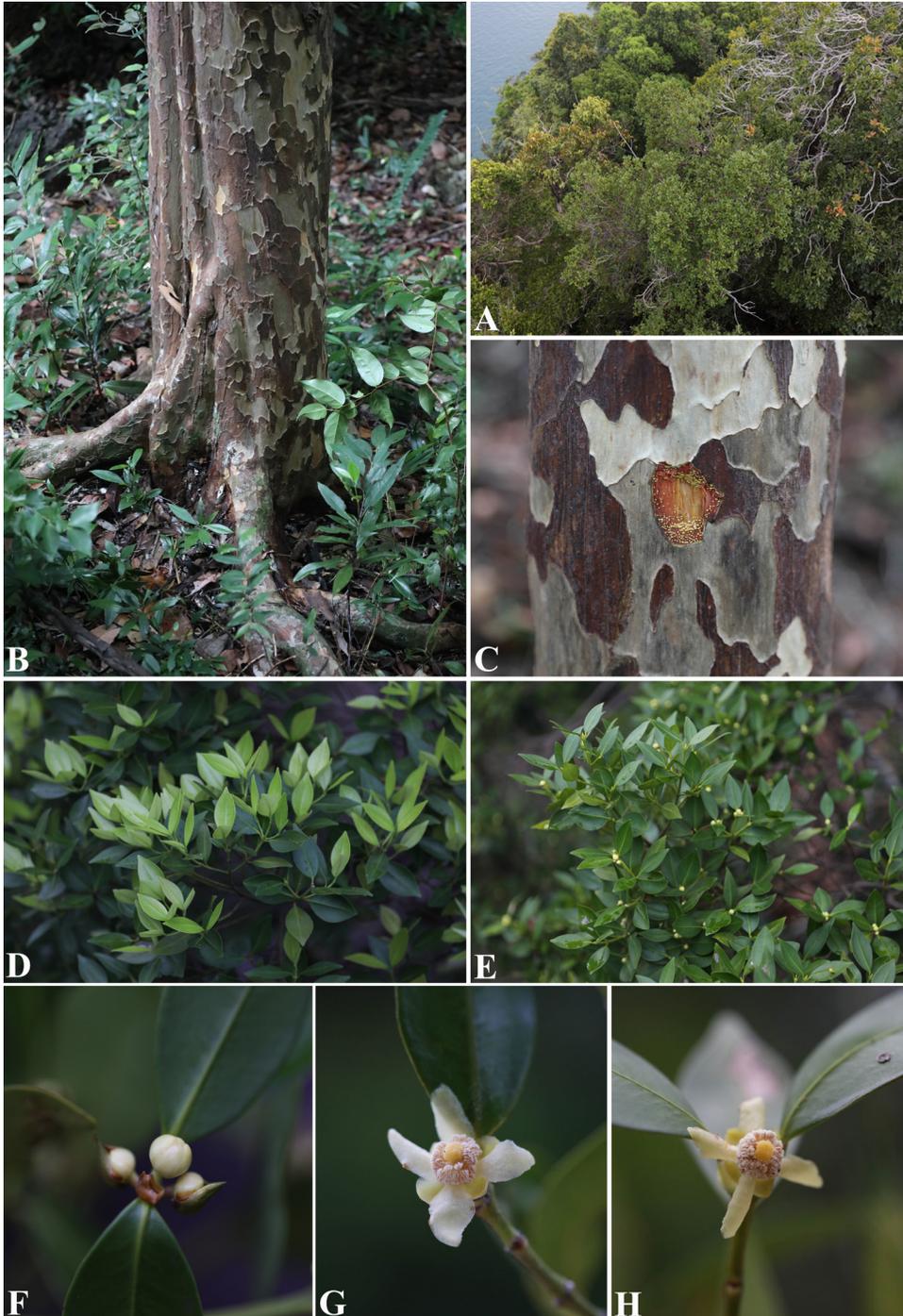


Figure 2. *Garcinia exigua* Nazre: A. habitat and canopy (top view); B. buttresses near the base of the stem; C. outer bark and inner bark with yellow latex; D. branches, young and mature leaves; E. branches, leaves and inflorescences with male flower buds; F. inflorescence and male flower buds with bracteoles; G–H. male flower. Photos: Chatchai Ngernsaengsaruy.

pistillode mushroom-shaped (fungiform), 3–3.5 mm long; stigma yellow, sessile, convex, 2.5–3 mm in diam., weakly 4-lobed. *Pistillate flowers* not seen. *Fruit* a berry, subglobose, globose or broadly ellipsoid, 1–1.3 × 0.8–1.1 cm, green, smooth with fine longitudinal striate, glabrous, pericarp coriaceous; persistent stigma dark brown, flattened, 2–3 mm in diam., weakly 4-lobed; sepals persistent and becoming a little larger than at flowering; fruiting stalk 1–2 mm long, 1–1.8 mm in diam. *Seeds* 1, brown, convex on both surfaces, ellipsoid, ca 6 mm × ca 3.5 mm, ca 1.8 mm thick, obtuse at both ends, enveloped by a fleshy lacerate pulp.

Thailand.— PENINSULAR: Krabi [Wat Tham Suea (originally “Tham Sue” on the label), Mueang

Krabi District, in evergreen forest, partly open-rugged limestone hill, ca 50–100 m alt., shrubby tree 5–7 m tall, fruits light green, 8 May 2002 (as *Garcinia* sp.), *Pooma et al.* 3612 (BKF, QBG); Ko Hong, trail up to view point, Than Bok Khorani National Park, Mueang Krabi District, in littoral dry evergreen forest on limestone hill, 90 m alt., tree 3 m tall, 13 Feb. 2022, *Ngernsaengsaruy et al.* G27-13022022 (BKF, K, QBG); *ibid.*, 96 m alt., tree 4 m tall, 13 Feb. 2022, *Ngernsaengsaruy et al.* G28-13022022 (BKF, K, QBG)]. (Fig. 5).

Distribution.— Malaysia [Borneo, Sarawak (Bintulu, Buan Forest Reserve; Mulu National Park: Matong Ubong, Ulu Matong, Sungai Ubong)]; Brunei [Temburong (Ulu Belalong)].

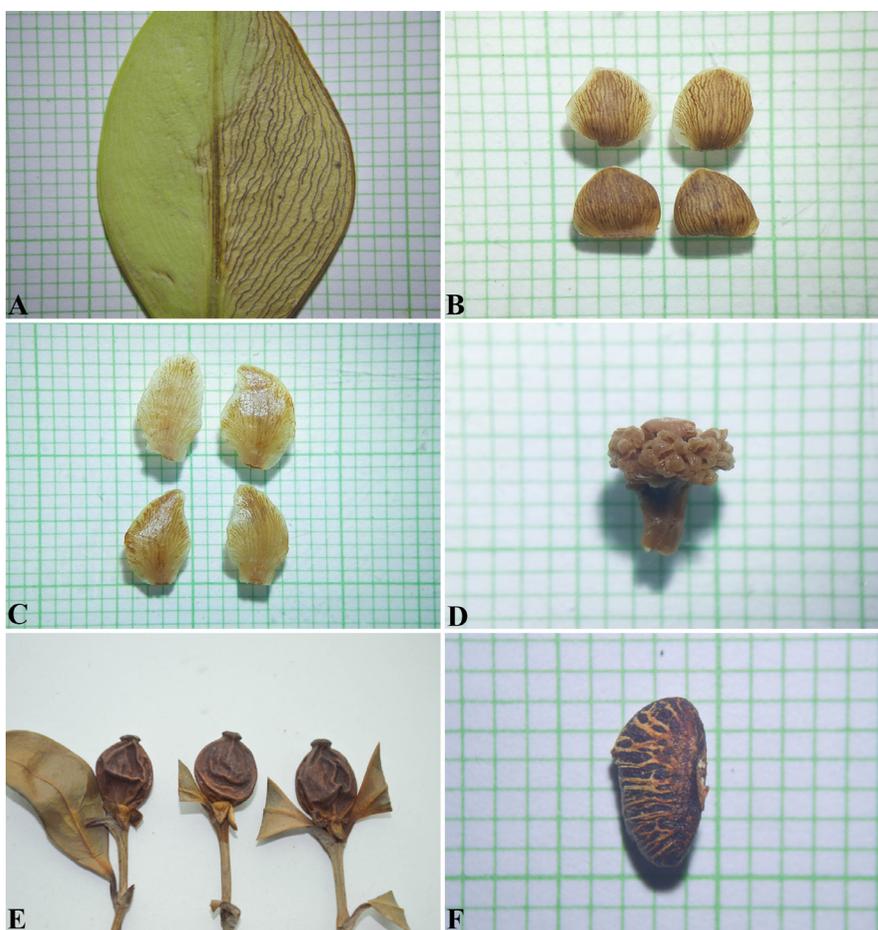


Figure 3. *Garcinia exigua* Nazre: A. lower surface of leaf showing interrupted long wavy lines; B. outer pair of sepals (lower) and inner pair of sepals (upper); C. outer pair of petals (lower) and inner pair of petals (upper); D. male flower showing stamen bundles and pistillode (sepals and petals removed); E. fruits with persistent stigma and persistent sepals; F. seed. Photos: Weereesa Boonthasak. A–D. from *Ngernsaengsaruy et al.* G27-13022022; E–F. from *Pooma et al.* 3612.

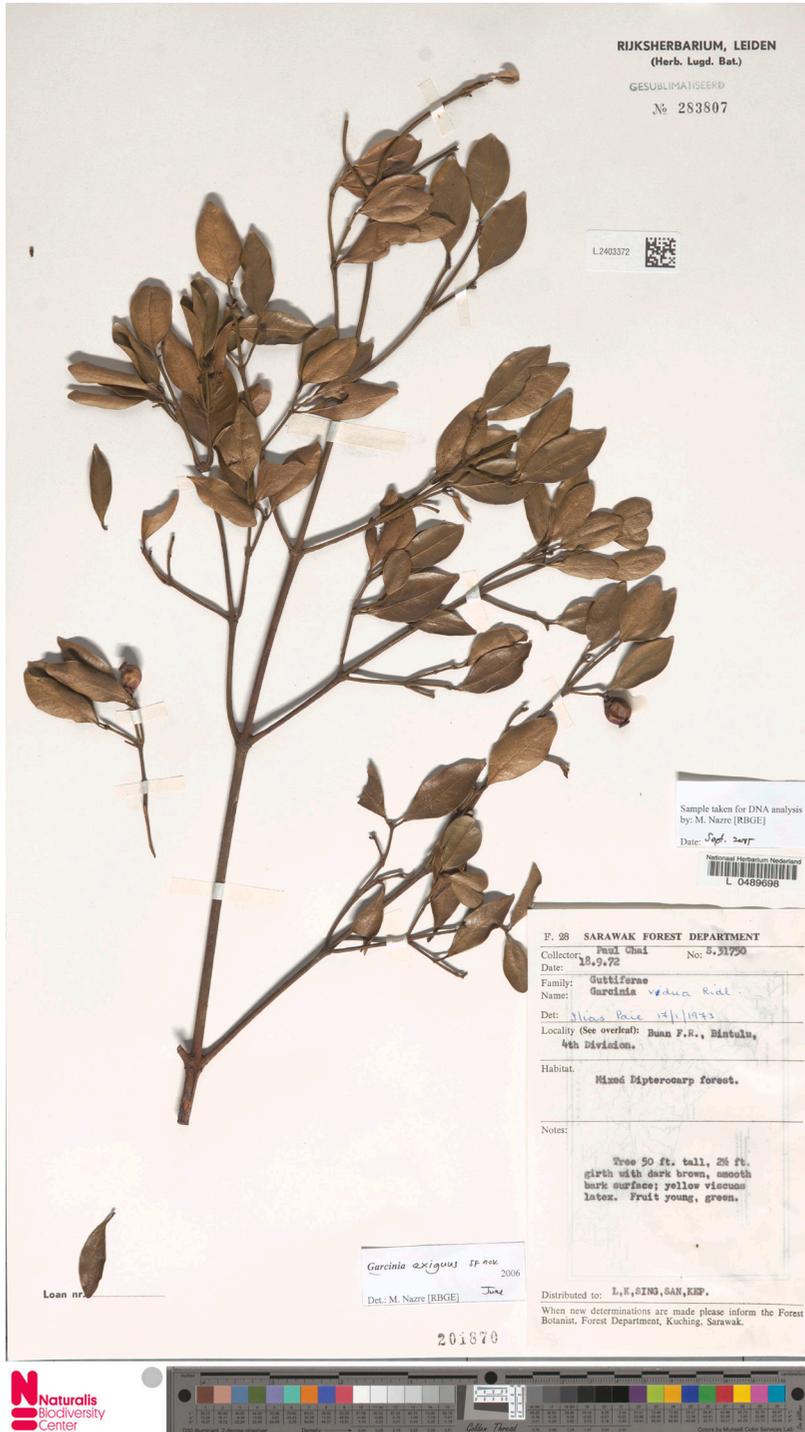


Figure 4. Isotype of *Garcinia exigua* Nazre, P. Chai S31750 (L [L2403372] from Malaysia, Borneo, Sarawak, Bintulu, Buan Forest Reserve (<https://medialib.naturalis.nl/file/id/L.2403372/format/large>).

Habitat.— In dry evergreen forest on limestone hill and littoral dry evergreen forest on limestone hill, 50–100 m alt.

Phenology.— Flowering January to March; fruiting April to June.

Vernacular.— Phawa bai lek krabi (พะวาใบเล็ก กระบี่) (suggested here); Kandis (Sarawak) (from *Runi & Yii S61132*).

Etymology.— The specific epithet *exigua* is a Latin word, referring to the small size of all parts in the specimens (Nazre *et al.*, 2018).

IUCN Conservation status.— Rare in Borneo, only represented from three localities in lowland and hill forest in Sarawak and Brunei (Nazre *et al.*, 2018). *Garcinia exigua* is known only from Borneo to Thailand, and has a small Extent of Occurrence (EOO of 51,767.17 km<sup>2</sup>) and a small Area of Occupancy (AOO of 16 km<sup>2</sup>). In Thailand, the species is known only from two localities (see habitat) in Krabi Province, but to be expected in other limestone hills. It is appropriate to consider its status here as Vulnerable [VU B2ab(ii, iv)].

Notes.— *Garcinia exigua* belongs to section *Garcinia*, which is defined by having terminal inflorescences in clusters of 2–14 flowers, male flowers with 4-lobed or 4-angled stamen bundles

bearing 2-theous anthers, and fruits that are usually solitary, terminal berries with smooth and thick or thin wall (when dry) containing 1–8 seeds covered with a soft, edible translucent or white aril. Stamen bundles can be divided into three types based on shaped: (1) distinctly 4-lobed, stamens usually open when mature (e.g., *G. celebica* L.), (2) weakly 4-lobed, stamens hardly open when mature (e.g., *G. nitida* Pierre) and (3) 4-angled, (e.g., *G. mangostana* L.) (Nazre, 2006; Nazre *et al.*, 2018).

*Garcinia exigua* is characterized by its bark rather smooth, flaking, leaving roundish or irregularly shaped scars similar to the bark of some species of *Lagerstroemia* L. in the Lythraceae, e.g., *L. duperreana* Pierre ex Gagnep., *L. floribunda* Jack and some species of *Terminalia* L. in the Combretaceae, e.g., *T. corticosa* Pierre ex Laness.

The stamens of the male flowers are united into 4-lobed bundles. The leaves and fruits are small. *Garcinia exigua* is related to *G. nitida*, but differs in having its lamina narrowly to broadly elliptic, sometimes obovate, 3–6.3 × 0.8–3.2 cm (vs broadly elliptic, elliptic or suborbicular, 5–8.5 × 2.9–3.8 cm); fruits subglobose, globose or broadly ellipsoid, 1–1.3 × 0.8–1.1 cm (vs ovoid or flask-shaped to globose, 2–2.5 × 2.3–4 cm); leaves with a few scattered black gland dots on both surfaces, interrupted long wavy

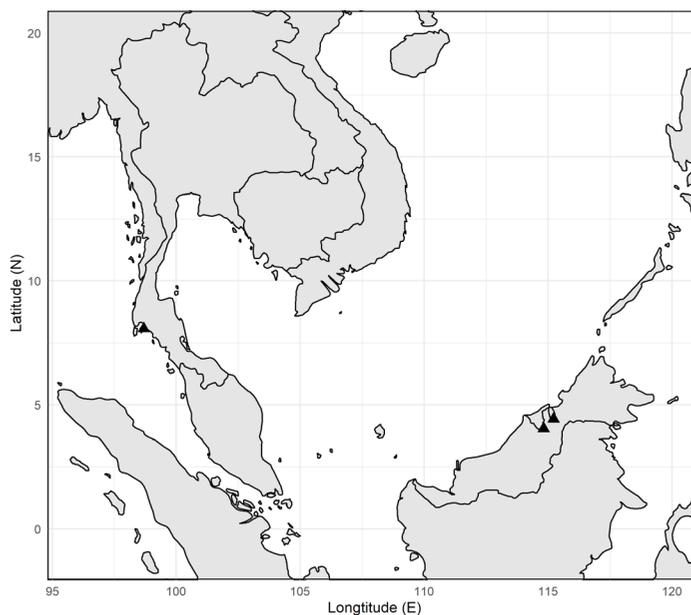


Figure 5. Distribution of *Garcinia exigua* Nazre

lines of differing lengths, nearly parallel to the midrib, running across the secondary veins to the apex or the margins (vs in interrupted wavy lines with a mixture of short and long lines and dots, running at ca 70° to the midrib across the secondary veins from midrib towards the margins); distinctly 4-lobed stamens, anthers usually open when mature (vs weakly 4-lobed stamens, anthers hardly open when mature) [The characters of *G. nitida* were taken from Nazre *et al.* (2018)].

According to Nazre *et al.* (2018), the shape and size of leaves are elliptic and 0.8–2.1 × 0.3–1 cm; however, from our observations, we found the leaves can be narrowly elliptic to broadly elliptic, sometimes obovate, and larger, 3–6.3 × 1–3.2 cm.

Additional specimens examined.—Malaysia. Borneo, Sarawak [Mulu National Park, Sg. Matong Ubong, in lower submontane forest, 400 m alt., tree 16 m tall, fruits green, 11 Nov. 1990, *Yii & Runi S57293* (L [L3810871], as *Garcinia sarawhensis* Pierre); Mulu National Park, Ulu Matong, in lower montane forest, 1,050 m alt., tree 6 m tall, fruits green, 13 Nov. 1990, *Yii & Runi S60529* (BKF, L [L3811190], as *G. sarawhensis*); Mulu National Park, Sungai Ubong, in mixed dipterocarp forest, tree 17 m tall, 19 Nov. 1990, *Runi & Yii S61132* (K, L [L3811193], as *G. sarawhensis*).

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