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A taxonomic revision of *Mayodendron* Kurz (Bignoniaceae) in Thailand

Chatchai Ngernsaengsaruay[1,2], Weereesa Boonthasak[1], Voradol Chamchumroon[3]

1 *Department of Botany, Faculty of Science, Kasetsart University, Chatuchak, Bangkok 10900, Thailand*
2 *Biodiversity Center, Kasetsart University (BDCKU), Chatuchak, Bangkok 10900, Thailand*
3 *Forest Herbarium, Department of National Parks, Wildlife and Plant Conservation, Bangkok 10900, Thailand*
Corresponding author: Chatchai Ngernsaengsaruay (fsciccn@ku.ac.th)

Abstract

A taxonomic revision of *Mayodendron* Kurz (Bignoniaceae) in Thailand is presented. One species, *Mayodendron igneum* (Kurz) Kurz, is enumerated with updated morphological description, morphological differences with the related species and illustrations, together with notes on distributions, a distribution map, habitats and ecology, phenology, conservation assessments, etymology, vernacular names, uses and specimens examined. The specimen *Brandis 1357* at HBG [HBG522936] is lectotypified here for *M. igneum*. This species has a conservation status of Least Concern (LC). The leaflet laminas and wood anatomy and pollen morphology of this species are also reported in this study. *M. igneum* has bifacial leaflets, cyclocytic stomata, prismatic crystals in parenchyma around the vascular tissue and epidermal cells on both leaflet surfaces and its wood has diffuse-porous, biseriate, sometimes uniseriate, triseriate, tetraseriate heterocellular rays or uniseriate homocellular rays, with the procumbent cells up to 30 cells long. *M. igneum* has prolate-spheroidal or subprolate pollen shapes, small to medium sized, 19–25 µm in polar axis, 18–23 µm in equatorial axis, heterobrocate exine sculpturing. The pollen aperture patterns are classified as 4 types: typical tricolpate, 3-syncolpate with oblique colpi, 4-syncolpate and 6-pantocolpate.

Key words: anatomy, Lamiales, lectotypification, morphology, palynology, taxonomy, Tecomeae

Introduction

Mayodendron Kurz is a monotypic genus belongs to the tribe Tecomeae Endl. of the family Bignoniaceae Juss. (Zhang & Santisuk 1998), and is sometimes reduced to synonymy of *Radermachera* Zoll. & Moritzi (van Steenis 1976; Santisuk & Vidal 1985; Santisuk 1987; Fischer et al. 2004). The genus consists of one accepted species, *M. igneum* (Kurz) Kurz, and is distributed in India (Assam) to South China, Taiwan and Indo-China (POWO 2023). The generic name *Mayodendron* is derived from compound words, *Mayo-* dedicated to the memory of Lord Mayo, late Governor-General of India, under whose reign the first impulse was given to spreading botanical knowledge amongst the foresters (Kurz 1875), and the Greek word, *-dendron* meaning tree (Stearn 1992; Radclffe-Smith 1998; Gledhill 2002), referring to Lord Mayo's tree.

In 1871, *Spathodea ignea* was named by Kurz (1871), and this name was transferred to the genus *Mayodendron* by Kurz (1875). In 1976, the genus *Mayodendron* was reduced to *Radermachera*; one new combination, *R. ignea* (Kurz) Steenis was made by van Steenis (1976). The reasons which he gave: the halfway slit calyx cannot well be called spathaceous; the

pseudoseptum is absent; the septum is at maturity terete and corky; the fruit valves, septum, and seeds are exactly similar to those in *Radermachera* (van Steenis 1976).

Mayodendron is related to *Radermachera* in its habit, leaf type, and fruit and seed characters, but differs considerably from it in having a short raceme, mostly cauliflorous (vs a terminal or ramiflorous thyrse, never cauliflorous); spathaceous calyx, slit on one side to about the middle (vs campanulate calyx, irregularly lobed, rarely truncate); almost equal fertile stamens (vs didynamous fertile stamens); and not bilabiate corolla (vs bilabiate corolla) (Kurz 1875, 1877; Clarke 1884; Dop 1930; Santisuk 1974, 1987; van Steenis 1976; Santisuk & Vidal 1985; Zhang & Santisuk 1998; Fischer et al. 2004).

Although Santisuk (1974) published accounts of *Mayodendron* in Thailand and only one species, *M. igneum* was recognized, leading up to its treatment in the Flora of Thailand (Santisuk 1987). In this paper, we had extensively examined Thai specimens of *M. igneum* in various local and international herbaria including virtual herbarium repositories and from our observations during field work. As a result, we hereby provide a taxonomic treatment that includes lectotypification, a comprehensive update to species description, morphological differences with the related species, distribution, habitats and ecology and vernacular names, in addition to phenological observations, uses, conservation status, etymology, illustrations, a distribution map in Thailand and specimens examined. Besides that, leaflet laminas and wood anatomical characters and pollen morphology are presented.

Materials and methods

Herbarium specimens deposited in BK, BKF, CMU, CMUB, QBG, and those included in the digital herbarium databases of E (https://data.rbge.org.uk/search/herbarium/), L (https://bioportal.naturalis.nl/), and HBG (http://www.herbariumhamburgense.de/index.php) were examined (all herbaria acronyms follow Thiers 2023, continuously updated). The taxonomic history of *Mayodendron* was compiled using the taxonomic literature Kurz 1871, 1875, 1877; Clarke 1884; Dop 1930; Santisuk 1974, 1987; van Steenis 1976; Santisuk & Vidal 1985; Zhang & Santisuk 1998) and online databases (IPNI 2023; POWO 2023). The morphological characteristics, distributions, habitats and ecology, and phenology were described from historic and newly collected herbarium specimens and the author's observations during field work. The vernacular names were compiled from specimens examined and the literature (Santisuk 1974, 1987; Office of the Forest Herbarium, Forest and Plant Conservation Research Office, Department of National Parks, Wildlife and Plant Conservation 2014). 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 (https://www.kew.org/science/our-science/projects/geocat-geospatial-conservation-assessment-tool).

The leaflet laminas anatomical characters of *Mayodendron igneum* were investigated by transverse sectioning with a sliding microtome at 10–20 µm thickness. For the study of epidermal cells of leaflet laminas, they were peeled and mounted. The wood samples of *M. igneum* were sectioned with a sliding microtome at 15–20 µm thickness along the transverse, tangential and radial planes. The permanent slides of leaflet laminas and wood were made following the standard methods of Johansen (1940) and Kermanee (2008). The anatomical characteristics were

investigated and recorded photographically with an Olympus BX53 microscope and an Olympus DP74 microscope digital camera at the Department of Botany, Faculty of Science, Kasetsart University (KU). The anatomical terminologies follow those in the study by Metcalfe & Chalk (1957).

The samples of pollen grains of *M. igneum* were examined and recorded photographically with an Olympus BX53 microscope and an Olympus DP74 microscope digital camera. Materials were prepared for scanning electron microscopy (SEM) at the Scientific Equipment Centre, Faculty of Science, KU by mounting pollen grains on stubs using double-sided sellotape, sputter-coating them with gold and examining them using an FEI Quanta 450 SEM (Hillsboro, OR, USA) at 15.00 KV. The characteristics of pollen grains were examined and measured, following Erdtman (1945, 1952) and Simpson (2010). The pollen morphology terminologies follow those of Punt et al. (2007).

Results and discussion

Taxonomic treatment

***Mayodendron* Kurz, Prelim. Rep. Forest Pegu, App. D. t. 1. 1875**; Kurz, Forest Fl. Burma 2: 232. 1877; C. B. Clarke in Hook. f., Fl. Brit. India 4: 381. 1884; Dop in Lecomte et al., Fl. Indo-Chine 4: 597. 1930; Z.-Y. Zhang & Santisuk in C. Y. Wu & P. H. Raven, Fl. China 18: 224. 1998.

Description. Trees evergreen. ***Leaves*** 2–4-pinnately compound, decussate; leaflets opposite, entire and repand, with a few scattered glands below. ***Inflorescences*** cauliflorous or ramiflorous, short corymb-like raceme. ***Flowers***: bracteolate; calyx tubular, spathaceous, one side lobed up to the middle; corolla tubular-funnel-shaped, the basal tube shorter and narrower than the upper tube, 4–5-lobed, lobes short, equal or subequal, revolute; fertile stamens 4, equally or subequally long (scarcely didynamous), filaments adnate at insertion up to the middle of corolla tube, anthers divaricate, longitudinal dehiscent; staminodes present; disc annular, surrounding the base of ovary; pistil: ovary superior, narrowly cylindrical, 2-locular, ovule numerous, axile placenta, stigma flattened 2-lobed. ***Fruits*** loculicidal capsule, narrowly cylindrical, slightly twisted, septum terete and corky. ***Seeds*** numerous, flattened, rectangular, with a lateral hyaline-membranous wing.

Type species. *Spathodea ignea* Kurz = *Mayodendron igneum* (Kurz) Kurz

***Mayodendron igneum* (Kurz) Kurz, Prelim. Rep. Forest Pegu, App. D. t. 1. 1875**; Kurz, Forest Fl. Burma 2: 233. 1877; C. B. Clarke in Hook. f., Fl. Brit. India 4: 382. 1884; Dop in Lecomte et al., Fl. Indo-Chine 4: 597. fig. 65, 5–6. 1930; Santisuk, Thai Forest Bull., Bot. 8: 8. fig. 4. 1974; Z.-Y. Zhang & Santisuk in C. Y. Wu & P. H. Raven, Fl. China 18: 225. 1998.
Figs 1–3

≡ *Spathodea ignea* Kurz, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 40(1): 77. 1871.
≡ *Radermachera ignea* (Kurz) Steenis, Blumea 23(1): 127. 1976; Santisuk & J. E. Vidal in J.-F. Leroy, Fl. Cambodge Laos Vietnam 22: 24. t. 3, fig. 10. 1985; Santisuk in Smitinand & K. Larsen, Fl. Thailand 5(1): 41. 1987.

Type. Myanmar, without locality, s.d., *Brandis 1357* (Herb. D. Brandis) (lectotype designated here HBG [HBG522936, photo seen]; isolectotypes CAL [without barcode, n. v.], K [without barcode, n. v.].

Description. Trees evergreen, 3–12(–15) m tall, 30–100 cm girth; bark slightly fissured, brown to greyish brown. ***Leaves*** 3–4-pinnate, sometimes 2-pinnate; petioles 15.5–18.5 cm long; primary rachises 38–55 cm long; primary leaflets 5–6 pairs; petiolules 1–7 cm long, secondary rachises 5–23 cm long; secondary leaflets 1–7 pairs; petiolules 0.5–2.7 cm long; tertiary rachises 1.5–5 cm long; tertiary leaflets 1–2 pairs; quaternary leaflets 1 pair (if present); petioles, rachises and petiolules glabrous; leaflets numerous, laminas elliptic, broadly elliptic, obovate, ovate or lanceolate, 4–12 × 2–5.6 cm, usually unequal-sided, apex acute, acuminate, caudate or obtuse, base cuneate or obliquely cuneate, margin entire and repand, subcoriaceous, slightly bullate, glabrous and with a few peltate glandular trichomes on both surfaces, glossy above, midrib raised below, lateral veins 3–5 pairs, curving and connected in loops near the margin, veinlets reticulate; petiolules 1–5 mm long or leaflets sessile; petioles, rachises and petiolules greenish purple and green. ***Inflorescences*** short corymb-like raceme, 6–40-flowered; peduncles 0.5–2.5 cm long; rachises 2.5–11.5 cm long; peduncles and rachises pubescent. ***Flowers*****:** bracteoles lanceolate, 0.7–1.7 × 0.2–0.7 mm, pubescent on both sides; pedicels 0.8–1.7 cm long, pubescent; calyx reddish purple, tubular, spathe-like, 1.5–2.5 × 0.6–0.8 cm, one side lobed up to the middle, veins convergent to the apex, pubescent and usually with yellow glands outside, glabrous inside; corolla orange or orangish yellow, tubular-funnel-shaped, 6–7 cm long, straight, basal tube narrowly cylindrical, 1–1.5 cm long, 3–4 mm in diam., upper tube funnel-shaped, 5–5.5 cm long, 1.5–2.5 cm in diam., longer and broader than basal tube, 5-lobed, sometimes 4-lobed, lobes suborbicular, 0.9–1.1 cm in diam., equal or subequal, revolute, corolla tube and lobes glabrous on both sides; fertile stamens 4, 4.8–5.2 cm long, equal or subequal, filament orange, straight, adnate at insertion up to the middle of corolla tube, lower part pubescent, anthers 4–4.5 mm long, divaricate; staminodes 1, needle-like, 2–3 mm long; disc annular, yellowish green, surrounding the base of ovary; pistil 5–7 cm long, ovary reddish purple, narrowly cylindrical, 0.8–1 cm long, 1.5–2 mm in diam., with dense transparent glands, style purplish green, 4.5–6 cm long, slender, stigma flattened 2-lobed. ***Fruits*** narrowly cylindrical, 37–80 cm long, 5–7 mm, in diam., greenish purple turning green when mature and brown when dry, septum terete, 2–3 mm in diam., corky. ***Seeds*** flattened, rectangular with a lateral hyaline-membranous wing, 1–2.2 × 0.2–0.4 cm.

Recognition. *Mayodendron igneum* is similar to *Radermachera hainanensis* Merr. in its habit, leaf type, leaflet shape, size, apex and base, corolla color, fruit and seed characters. Differences between these two related species are shown in Table 1.

Distribution. India (Assam), Bangladesh, Myanmar, China (Guangdong, Guangxi, Yunnan), Taiwan, Vietnam (Tonkin, Annam), Laos, Thailand.

Distribution in Thailand. Northern: Mae Hong Son, Chiang Mai, Chiang Rai, Phayao, Lampang, Phrae; North-Eastern: Phetchabun, Loei; Eastern: Nakhon Ratchasima; South-Western: Uthai Thani, Phetchaburi; Central: Bangkok (cultivated). (Fig. 4)

Habitats and Ecology. It is frequently found on limestone hills and also in dry evergreen forests and lower montane rain forests, at elevations of 300–1200 m a.m.s.l.

Phenology. Flowering nearly all year round, with a peak in March to May; fruiting February to July.

Conservation status. *Mayodendron igneum* is widely distributed from Assam eastward to Taiwan, downward to Thailand, it has a relatively large extent of occurrence (EOO of 75,584.90

km^2) and small area of occupancy (AOO of 56 km^2) and does not face any major threats. It is assessed as Least Concern (LC).

Etymology. The specific epithet of *Mayodendron igneum* is a Latin word meaning fire-red, flame-color, fiery-red-and-yellow (Stearn 1992; Radclffe-Smith 1998; Gledhill 2002) and refers to flower color.

Table 1. Morphological differences between *Mayodendron igneum* and the related species, *Radermachera hainanensis*

Characteristics	*Mayodendron igneum*	*Radermachera hainanensis*
Leaf type	3–4-pinnate, sometimes 2-pinnate	2–3-pinnate
Leaflet lamina texture	subcoriaceous	chartaceous
Leaflet lamina margin	entire and repand	undulate
Petiole, rachis and petiolule color	greenish purple and green	green
Inflorescences	short corymb-like raceme, 6–40-flowered, cauliflorous or ramiflorous, pubescent (peduncles, rachises and pedicels)	short thyrse (raceme-like), 2–6-flowered, terminal or ramiflorous, glabrous (peduncles, rachises and pedicels)
Bracteoles	bracteolate	ebracteolate
Calyx	reddish purple or greenish red-purple, tubular, spathe-like, 1.5–2.5 × 0.6–0.8 cm, one side lobed up to the middle, pubescent and usually with yellow glands outside	green, campanulate, 0.8–1.7 × 0.5–0.8 cm, 2–3-lobed, glabrous, sometimes with tiny lepidote outside
Corolla	tubular-funnel-shaped, basal tube 3–4 mm in diam., upper tube funnel-shaped, 5–5.5 cm long, 1.5–2.5 cm in diam., straight, not bilabiate, 5-lobed, sometimes 4-lobed, lobes suborbicular, 0.9–1.1 cm in diam., revolute, corolla tube and lobes glabrous on both sides	tubular-campanulate, basal tube 5–7 mm in diam., upper tube campanulate, 2.5–3.5 cm long, 2.5–3.5 cm in diam., widened towards the mouth, bilabiate, 5-lobed, upper lobes 2 and lower lobes 3, lobes suborbicular or broadly obovate, 1.5–2.5 × 1.5–2.2 cm, not revolute, corolla tube and lobes with glandular hairs outside, glabrous inside
Fertile stamens	4, equal or subequal (scarcely didynamous), filament straight, adnate at insertion up to the middle of corolla tube	4, didynamous, filament curved, adnate at insertion of corolla tube
Ovary color	reddish purple	green
Young fruit color	greenish purple	green

Vernacular names. Kaki (กากี) (Surat Thani); **Kasalong kham** (กาสะลองคำ) (Chiang Rai); Khae po (แคเป๊าะ) (Lampang), Chang chuet (จางจืด) (Chiang Mai); Saphao (สะเภา) (Northern); Samphao lamton (สำเภาหลามต้น) (Lampang); Oi chang (อ้อยช้าง) (Northern); Lord Mayo's tree (English).

Uses. Cultivated as ornamental trees.

Lectotyoification. *Spathodea ignea* was named and described by Kurz (1871: 77), who cited the specimen *Brandis 1357* (Herb. Dr. Brandis) collected from Myanmar (originally published "Burma"), without locality but he did not mention the herbaria in which they were present. This species was transferred to the genus *Mayodendron* by Kurz (1875: App. D. t. 1) and *Radermachera* by van Steenis (1976: 127), respectively. However, the correct name is *Mayodendron igneum*.

The specimen *Brandis 1357* at CAL (without barcode) and K (without barcode) was mentioned by van Steenis (1976: 127) as the type. We located only one sheet of this specimen at HBG [HBG522936]. Following Art. 9.6 of the ICN (Turland et al. 2018), they constitute syntypes; We therefore selected the HBG specimen as the lectotype, following Art. 9.3 and 9.12 of the ICN (Turland et al. 2018).

Notes. Santisuk (1987) reported the leaf type of *Mayodendron igneum* is 2-pinnate; however, from our observations, we found the leaf type of this species can be 3–4-pinnate, sometimes 2-pinnate.

According to Santisuk (1987), the shape, apex and base of leaflets of this species are elliptic-lanceolate, ovate-lanceolate and oblong-lanceolate in shape, acuminate and caudate at apex, and acute at base. Furthermore, from our examinations, we found the leaflets of this species are more in shape, apex and base: elliptic, broadly elliptic, obovate, ovate and lanceolate in shape, acute and obtuse at apex, and cuneate and oblique at base.

In addition to Santisuk (1987), the distribution in Mae Hong Son, Phayao, Phetchabun, Loei, Nakhon Ratchasima and Phetchaburi Provinces are newly recorded in this study.

Additional specimens examined. THAILAND. Northern: Mae Hong Son [Mueang, Ban Sanga, 14 Apr 1977, *Nimanong & Phusomsaeng 1827* (BKF); Mae Sariang, Mae Kong, Salawin National Park, east side, west end of Mae Sam Laep Reservoir, 25 May 2005, *Maxwell 05-346* (CMUB, L [L3730655, L3730656]); without locality, 21 Jun 1973, *Geesink et al. 6005* (BKF, L [L2815437])]; Chiang Mai [Chiang Dao, 19 Feb 1957, *Bunchuai 335* (BKF, K); Chiang Dao, s.d., *Bunchuai 961* (BKF); Chiang Dao, above Ban Yang Pong Luang, 21 Mar 1989, *Maxwell 89-363* (BKF, CMU, L [L2815393, L2815394]); Chiang Dao, Ban Tham, Wat Tham Chiang Dao, 19 Mar 2005, *Pooma et al. 4925* (BKF); Chiang Dao, Chiang Dao Wildlife Research Station, 4 Nov 2018, *Boonthasak et al. 36* (BK); Fang, 3 Jul 1978, *Phengklai et al. 4239* (BKF); Mae On, Huai Kaeo, Doi Lan, above Mae Kampong Village, 6 Apr 1997, *Maxwell 97-311* (BKF, CMUB, L [L3730487]); Mae On, Doi Lan, Mae Li Village, 4 Mar 2005, *Maxwell 05-180* (CMUB, L [L3730580]); ibid., 10 Apr 2005, *Maxwell 05-255* (CMUB, L [L3730660, L3730661, L3730662]); Huai Pu, 17 Mar 1998, *Sirithumrong 1* (QBG); Doi Suthep, *Kerr 2546* (BM, E, K, reported by Santisuk 1974); Chiang Mai University, Central Library, cultivated, 24 Jan 1979, *Surinrat 209* (CMUB); Chiang Mai University, Sala Dham, cultivated, 23 Apr 1988, *Maxwell 88-500* (BKF, CMU, L [L3730544]); Mueang Chiang Mai, Huai Kaeo Arboretum, cultivated, 14 Feb 1992, *Pooma 635* (BKF)]; Chiang Rai [Doi Tham Yup, Mae Kok, 9 Mar 1924, *Garrett 157* (BKF, L [L2815400]); Chiang Saen, *Kerr 5134* (BK, K, reported by Santisuk 1974); Mae Sai, Pong Pha, Ban Nam Cham School, cultivated, 8 Apr 2018, *Boonthasak et al. 27* (BKF), *28* (BK)]; Phayao [Mueang Phayao, Doi Luang National Park, Champa Thong Waterfall, 24 May 1997, *Gardner & Sidisunthon 2133* (CMU, L [L3730702])]; Lampang [Wang Nuea, Wang Thong, Doi Luang

National Park, Pha Doop Cave, 14 Mar 1991, *Maxwell 91-277* (CMU, L [L3731028]); Mueang Pan, Chae Son National Park, along Mae Mon Stream, at Park Headquaters, 27 Mar 1996, *Maxwell 96-423* (BKF, CMU, L [L2815392]); Mae Ta, *Winit 692* (BKF, K, reported by Santisuk 1974)]; Phrae [Sung Men, Huai Rai, 27 Apr 1943, *Chandsap 23* (BKF)]; **North-Eastern:** Phetchabun [without locality, 2 Apr 1976, *Sangkhachand 3103* (L [L2815391])]; Loei [Na Haeo, Nam Hueang, 21 Mar 1997, *BGO. Staff 13* (QBG), Wang Saphung, Pakpuan Arboretum, cultivated, 25 Feb 2007, *Suddee et al. 3011* (BKF)]; **Eastern:** Nakhon Ratchasima [Wang Nam Khiao, Sakaerat Silvicultural Research Station, cultivated, 4 Mar 2018, *Ngernsaengsaruay* & *Meeprom 89, 90* (BKF)]; **South-Western:** Uthai Thani [Ban Rai, Huai Kha Khaeng Wildlife Sanctuary, 21 Feb 1970, *Beusekom & Santisuk 2898* (L [L2815439, L2815440, L2815441])]; Phetchaburi [Kaeng Krachan, Kaeng Krachan National Park, Ban Krang Camp, 23 Jan 2005, *Williams et al. 1044* (BKF, E [E00375423, E00396538])]; **Central:** Bangkok [Kasetsart University, cultivated, 19 Mar 1971, *Maxwell 71-413* (L [L2815404, L2815405]); Kasetsart University, Faculty of Science, cultivated, 21 Feb 2018, *Boonthasak 17* (BK)].

Anatomical study

Leaflets and wood anatomy of *Mayodendron igneum*

The cuticular ornamentation is deposited on the outer wall of the epidermal cells. The epidermal cells are arranged in a single layer on both surfaces, and are larger on the upper surface (adaxial surface) than on the lower surface (abaxial surface). The epidermal cells are irregular in shape with undulate (wavy) anticlinal walls on both surfaces. The stomata are cyclocytic, confined only to the lower surface. Peltate glandular trichomes that are sunken into epidermal cells on both surfaces. The mesophyll composed of palisade parenchyma (also called palisade mesophyll) underlying the upper epidermis and spongy parenchyma (also called spongy mesophyll) underlying the lower epidermis (bifacial leaf). The palisade parenchyma exhibits one layer, less than half in height, tightly packed cells and the spongy parenchyma comprised of loosely packed, irregularly shaped cells, interspaced with larger air space. The vascular bundles in the midrib consist of xylem inside and phloem outside, and these bundles are surrounded by the sclerenchyma layer. The sclerenchymatous sheath of stele is made both by phloem fibres and lignified rays. Stele interpreted as two crescents, arched both sides. The presence of sclerenchyma cells in the midrib is to provide support and protection for the leaf structure. Prismatic crystals can be found in parenchyma around the vascular tissue and epidermal cells on both leaflet surfaces. (Fig. 5)

In the leaflet laminas, we found prismatic crystals in parenchyma around the vascular tissue and epidermal cells on both leaflet surfaces. In contrast, Poomsripanon et al. (2019) reported the type of inclusions in epidermal cells of *Mayodendron igneum* are raphide crystals.

According to Santisuk (1987), the leaflets of this species have a few scattered glands below. However, from our study, we found a few scattered peltate glandular trichomes on both leaflet surfaces.

Mayodendron igneum has diffuse-porous wood and growth rings are distinct. Vessels (pores) are solitary and form in groups of 2–5 cells, 30–85 µm in diam. and 150–340 µm length. Axial parenchyma patterns are confluent. Rays are heterocellular, biseriate, sometimes uniseriate, triseriate or tetraseriate (1–4 rows of cells), with the procumbent cells 1–30 cells long, and with 1–4 rows of the upright cells at both ends, and are sometimes uniseriate homocellular with only the

upright cells 2–8 cells long. Prismatic crystals are found in ray parenchyma. Fibres are non-septate. (Fig. 6)

According to Gasson & Dobbins (1991), the wood of *Mayodendron igneum* has diffuse porous and growth rings are indistinct. Axial parenchyma patterns are confluent and scanty. Rays are homocellular, uniseriate or biseriate (1–2 rows of cells), with the procumbent cells up to 20 cells long. Fibres are thin to thick wall and non-septate.

A comparison of leaflet and wood anatomical characters of *Mayodendron igneum* with the previous studies of other three genera: *Dolichandrone* (Fenzl) Seem (Boonthasak & Ngernsaengsaruay 2021), *Santisukia* Brummitt (Meeprom et al. 2022) and *Fernandoa* Welw. ex Seem. (*Fernandoa adenophylla*) (Ngernsaengsaruay et al. accepted, in press in PhytoKeys) in the tribe Tecomeae of the family Bignoniaceae in Thailand is shown in Table 2.

Table 2. A comparison of leaflet and wood anatomical characters of *Mayodendron* with other three genera, *Fernandoa*, *Dolichandrone* and *Santisukia* in the tribe Tecomeae of the family Bignoniaceae in Thailand.

Characters	*Mayodendron igneum*	*Fernandoa adenophylla*	*Dolichandrone*	*Santisukia*
Leaflet types	bifacial	bifacial	bifacial or unifacial	bifacial or unifacial
Stomatal types	cyclocytic	anomocytic	anomocytic	anomocytic
Crystal types in leaflets	prismatic crystals	absent	druse crystals	absent
Vessel arrangement	diffuse-porous	diffuse-porous	diffuse-porous	diffuse-porous
Vessel diameter (μm)	30–85	20–100	30–90	c. 100
Axial parenchyma patterns	confluent	confluent	banded or confluent	aliform or confluent
Ray parenchyma patterns	biseriate, sometimes uniseriate, triseriate, tetraseriate heterocellular or uniseriate homocellular	biseriate, sometimes uniseriate heterocellular or uniseriate homocellular	uniseriate, sometimes biseriate heterocellular	biseriate, triseriate or tetraseriate heterocellular
Ray height (cells)	1–30	3–12	2–45(–60)	5–40
Ray width (rows of cells)	(1–)2(–4)	(1–)2	1(–2)	2–4
Fibres	non-septate	septate	septate	septate

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Palynological study

The pollen grains of *Mayodendron igneum* are monads, isopolar, prolate-spheroidal or subprolate in shape. The size of the pollen grains is small to medium, the polar axis ranges between 19–25 µm, and the equatorial axis ranges between 18–23 µm. The exine sculpturing is heterobrochate, a reticulate with lumina of different sizes: microreticulate (lumina smaller than 1 µm) and fine reticulate (lumina between 1–2 µm) (Fig. 7). The pollen aperture is classified as 4 types:

Type 1: typical tricolpate; pollen grains with three colpi, perpendicular to the equatorial axis, apices of colpi free. (Fig. 7A, B)

Type 2: 3-syncolpate with oblique colpi; pollen grains with three colpi, the ends of which fused at one or both poles, with one or more oblique colpi. (Fig. 7G, H)

Type 3: 4-syncolpate; pollen grains with four colpi, adjacent pairs of colpi fused, delimiting a tennis ball-like. (Fig. 7C, D)

Type 4: 6-pantocolpate; pollen grains with six colpi, three colpi perpendicular to the equatorial axis and three remaining perpendicular to the polar axis, the ends of which are fused and form a triangular area. (Fig. 7E, F)

The result of pollen morphology from this study is consistent with Santanachote (1981) in pollen shape and size, aperture and exine sculpture. However, the pollen aperture patterns of this are highly variable among species. In addition to the basic type (tricolpate) also has 3-syncolpate, 4-syncolpate and 6-pantocolpate as well as in the family Gentianaceae, Fabaceae, Clusiaceae, and other eudicots (Pire & Dematteis, 2007)

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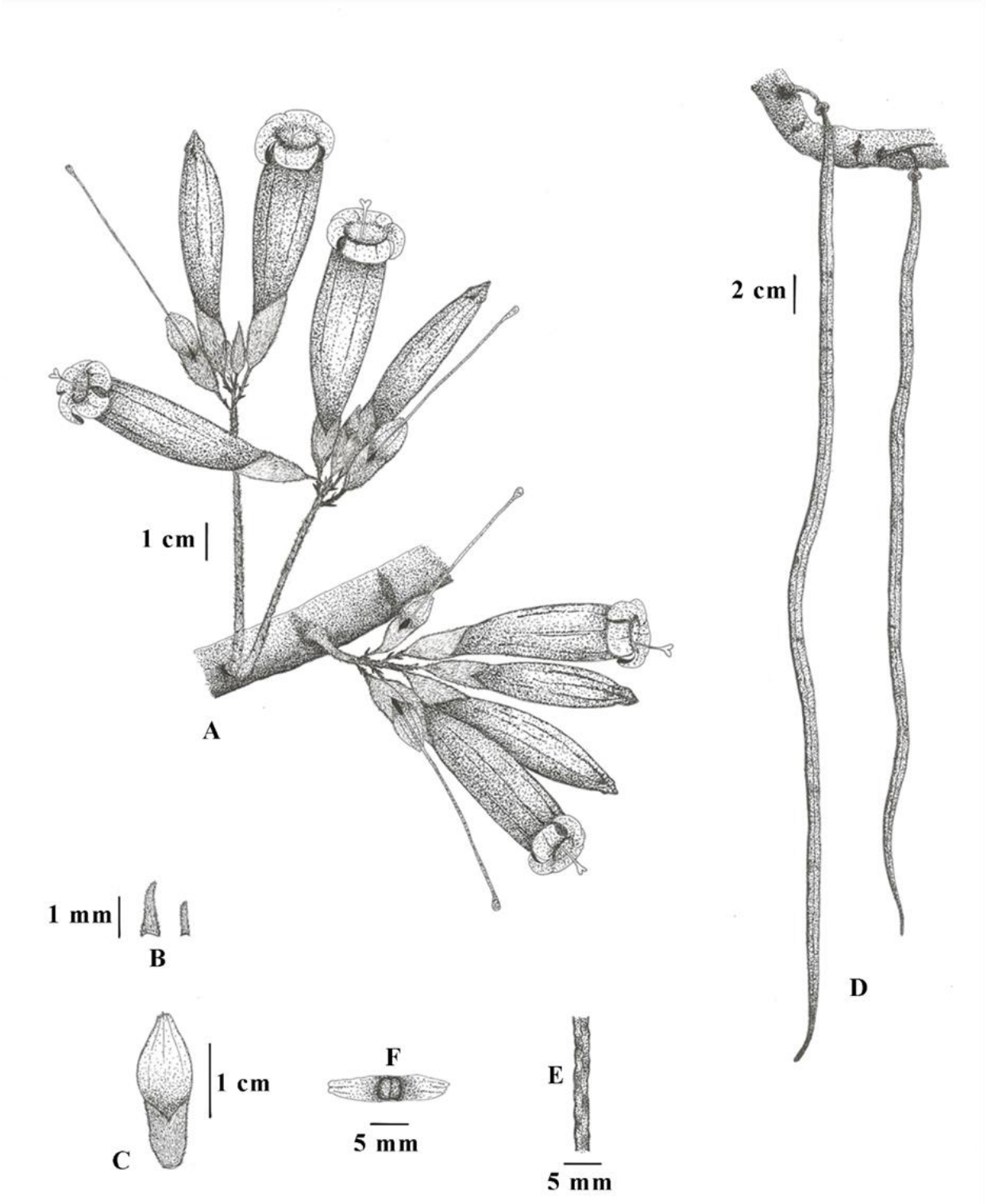

Figure 1. *Mayodendron igneum*. **A** branch and inflorescences; **B** bracteoles; **C** spathaceous calyx; **D** branch and fruits; **E** septum; **F** winged seed. Drawn by Weereesa Boonthasak.

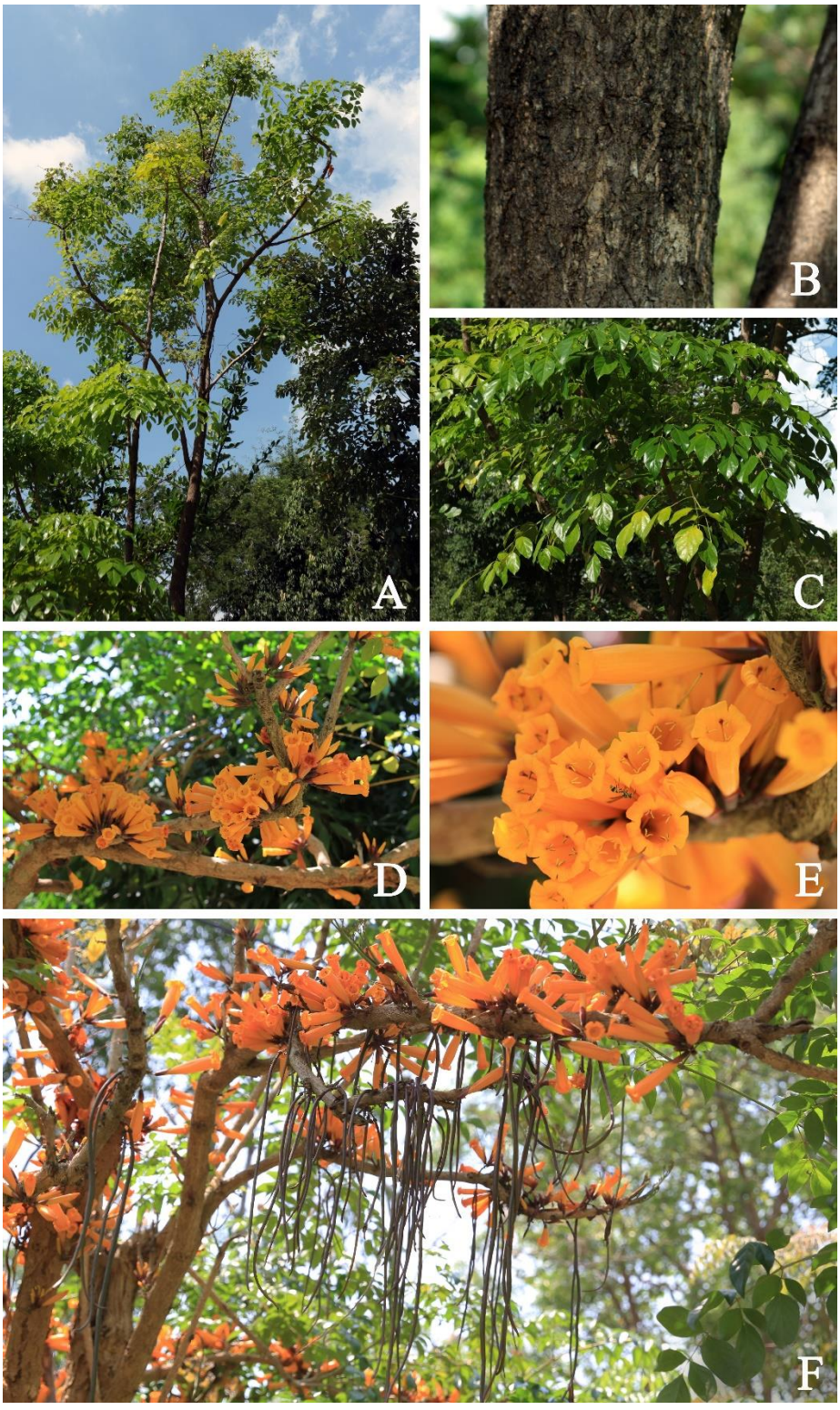

Figure 2. *Mayodendron igneum.* **A** habit; **B** bark; **C** branches and leaves; **D** branches and inflorescences; **E** inflorescence; **F** branches, inflorescences and fruits. Photos: Pichet Chanton (**A**–**C**); Chatchai Ngernsaengsaruay (**D**–**F**).

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Figure 3. Lectotype of *Mayodendron igneum*, *Brandis 1357* (HBG [HBG522936]) from Myanmar, designated here. Photo: University of Hamburg, Hamburg, Germany. http://www.herbariumhamburgense.de/index.php

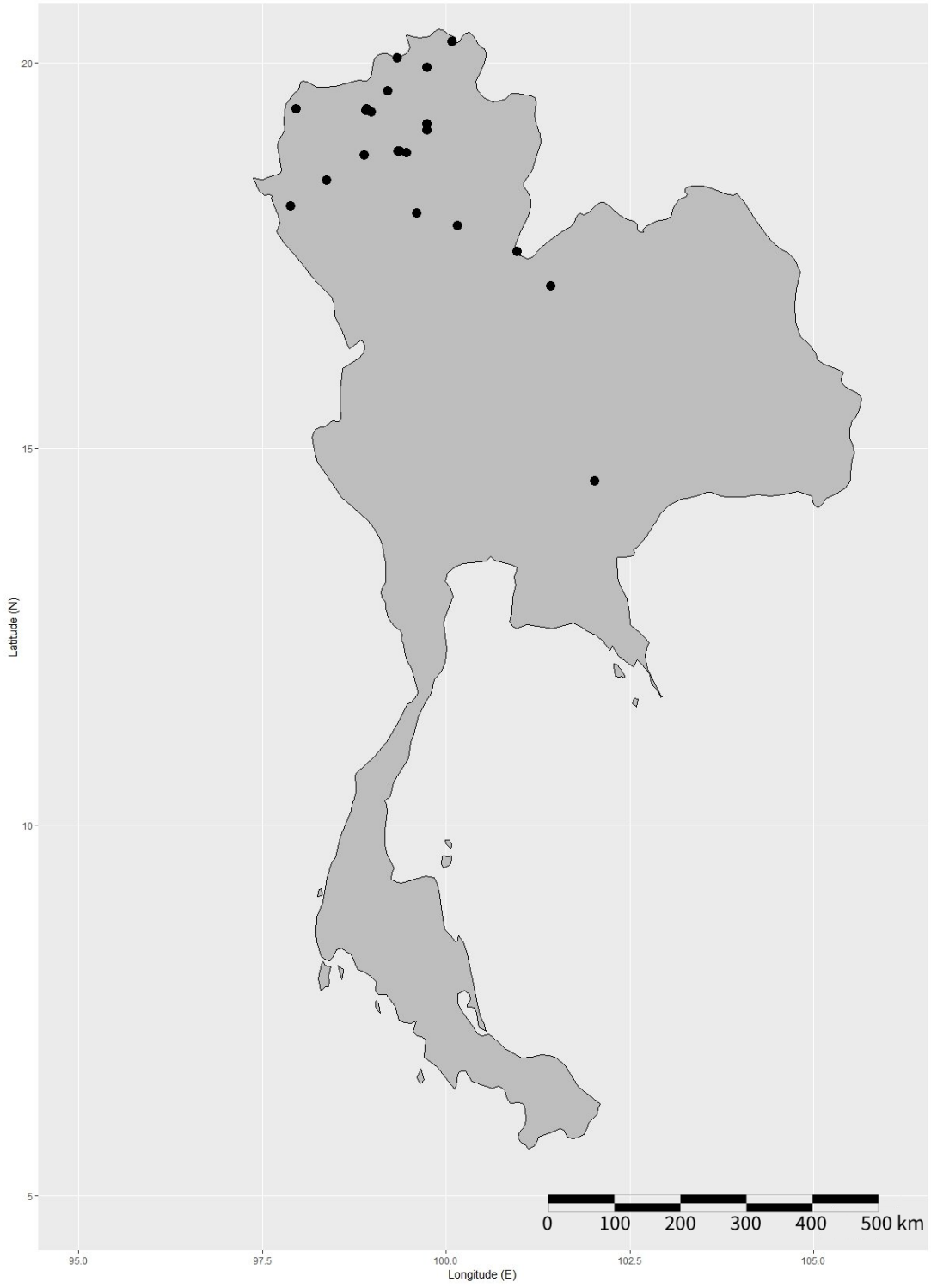

Figure 4. Distribution of *Mayodendron igneum* in Thailand, known from Northern, North-Eastern, Eastern and South-Western floristic regions [Thailand floristic regions follow Flora of Thailand Volume 16 Part 1 (The Forest Herbarium, Department of National Parks, Wildlife and Plant Conservation 2022)]. Map: Pichet Chanton & Chatchai Ngernsaengsaruay.

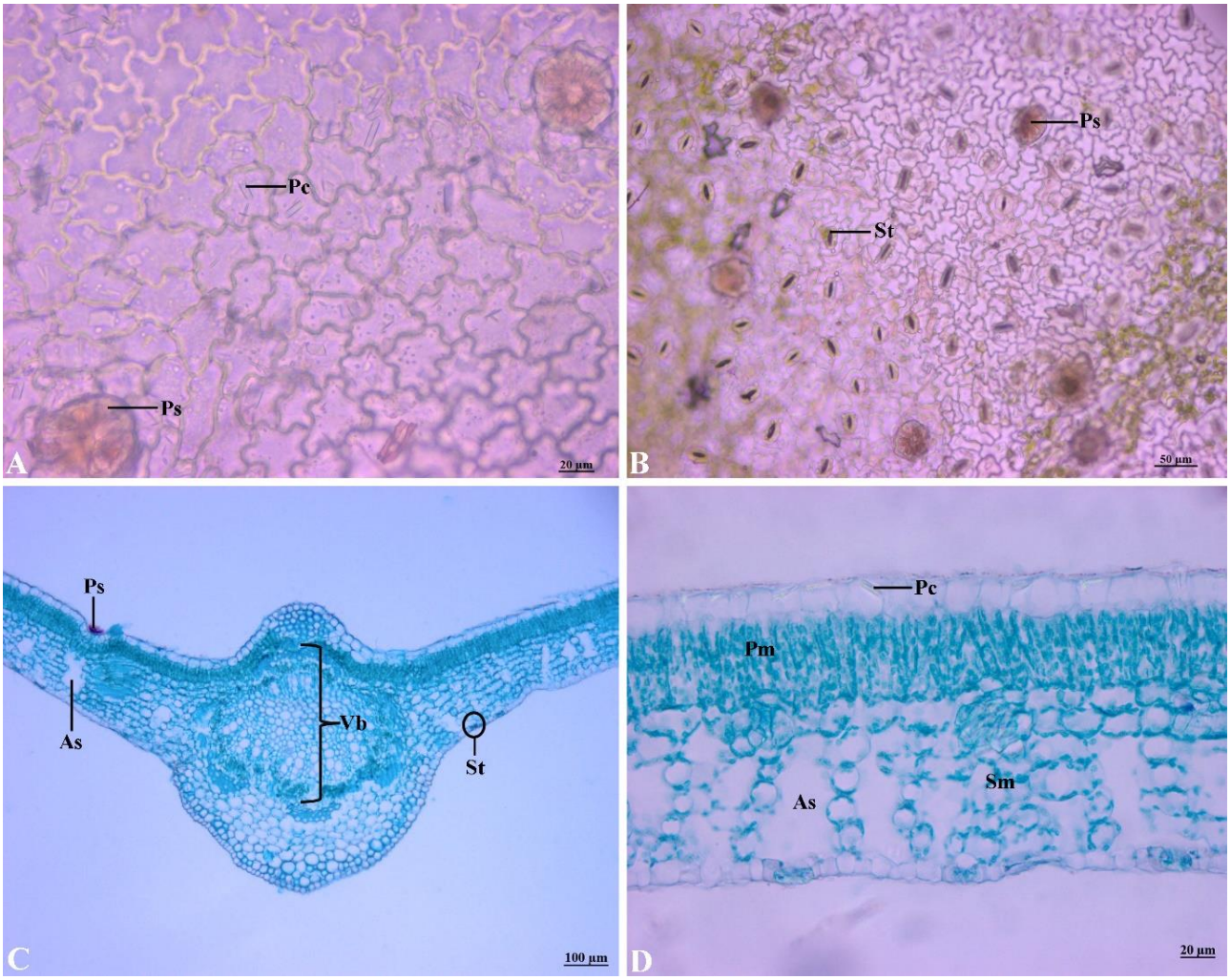

Figure 5. Leaflet lamina anatomy of *Mayodendron igneum*. **A** upper epidermis; **B** lower epidermis; **C**, **D** transverse section [As = air space, LowEp = lower epidermis, Pc = prismatic crystal, Pm = palisade mesophyll, Ps = peltate scale (peltate glandular trichome), Sm = spongy mesophyll, St = stoma, UpEp = upper epidermis, Vb = vascular bundle].

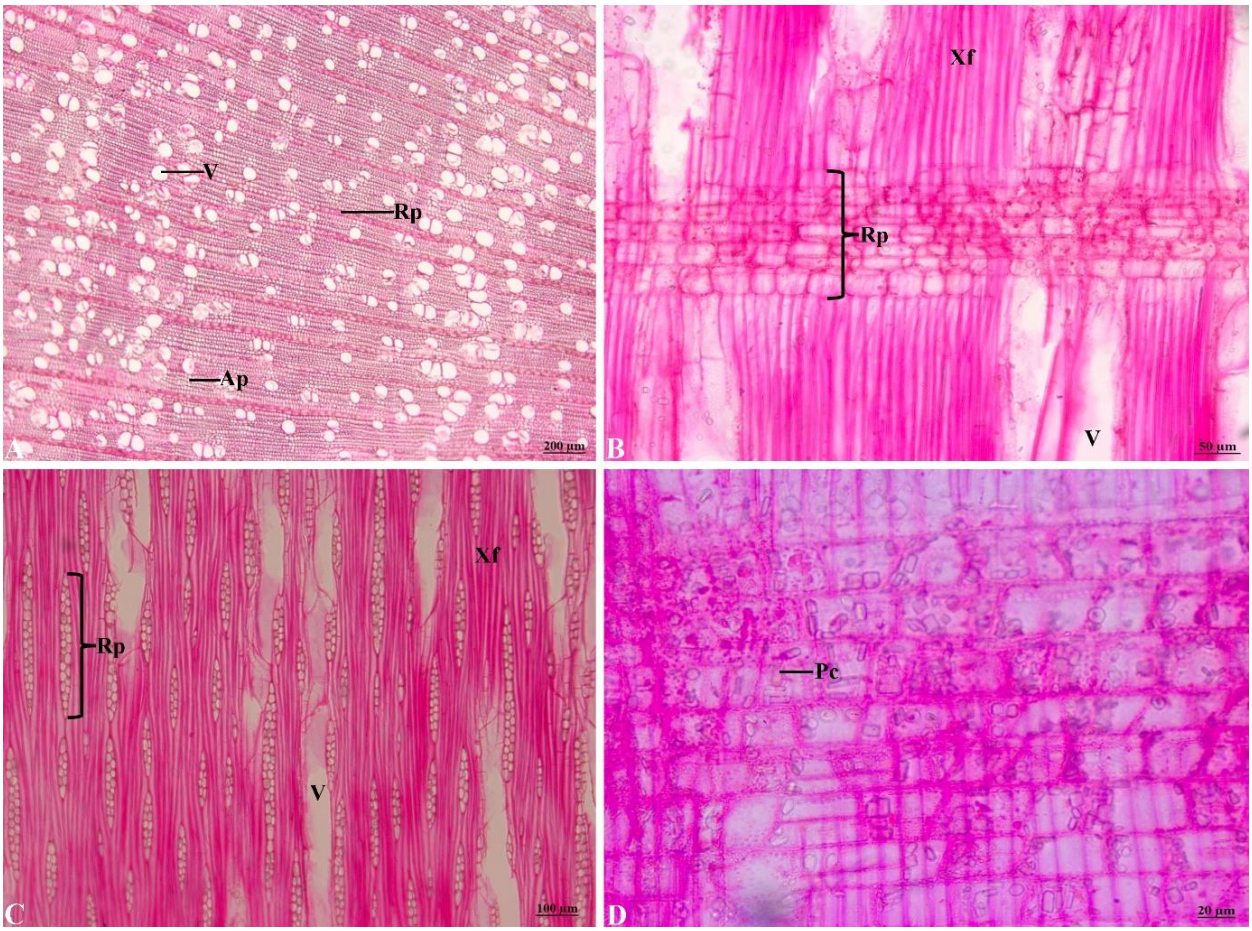

Figure 6. Wood anatomy of *Mayodendron igneum*. **A** transverse section; **B** radial longitudinal section; **C** tangential longitudinal section; **D** prismatic crystal in xylem ray [Ap = axial parenchyma, Pc = prismatic crystal, Rp = ray parenchyma, V = vessel, Xf = xylem fibre].

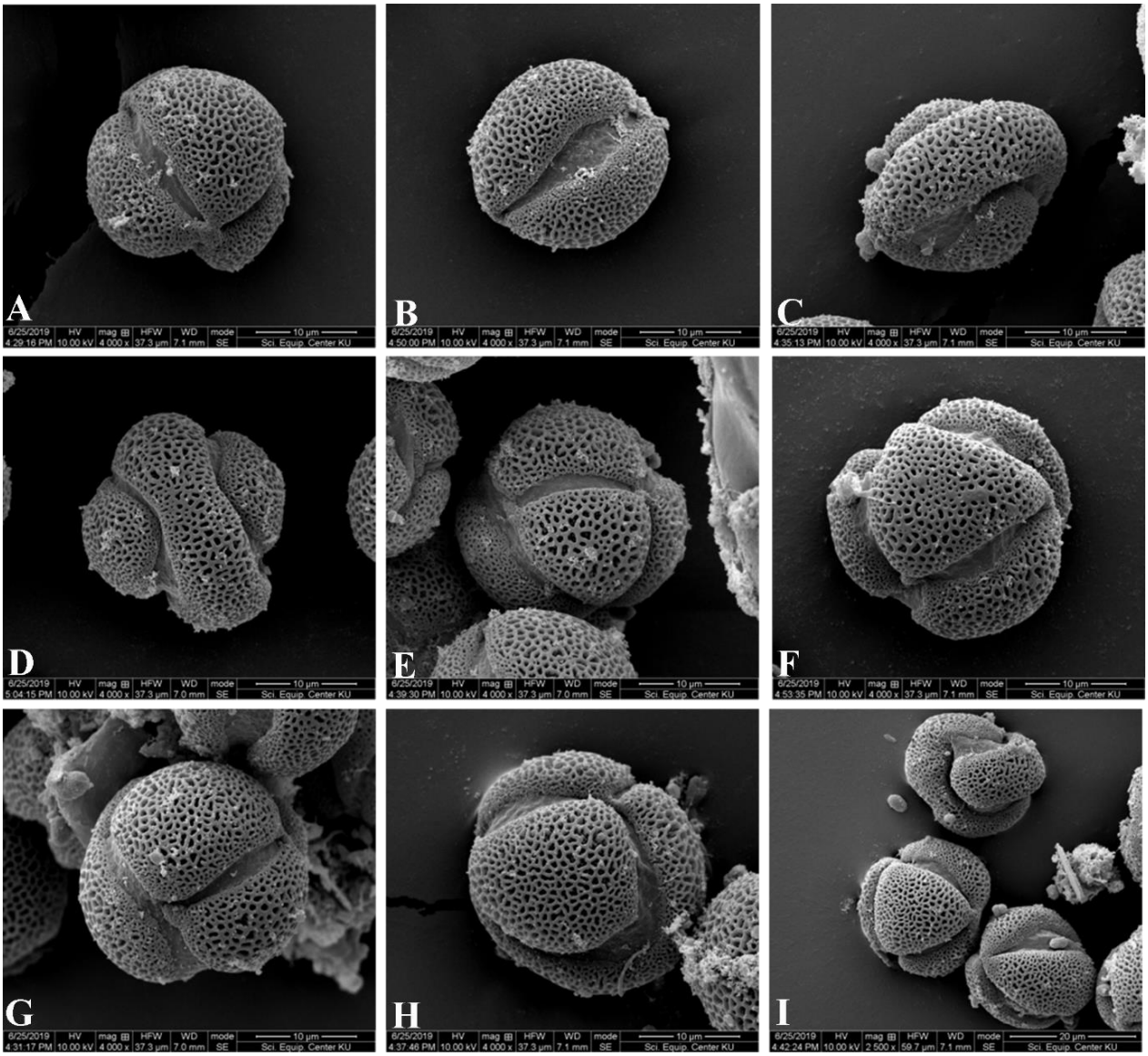

Figure 7. SEM micrographs of pollen grains of *Mayodendron igneum*. **A**, **B** typical tricolpate pollens; **C**, **D** 4-syncolpate pollens; **E**, **F** 6-pantocolpate pollens; **G**, **H** 3-syncolpate pollens; **I** variable of pollen aperture patterns.

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Additional information

Conflict of interest
The authors have declared that no competing interests exist.

Ethical statement
No ethical statement was reported.

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Author contributions
Conceptualization: CN. Data curation: CN, WB. Formal analysis: CN, WB. Funding acquisition: CN. Investigation: CN, WB. Methodology: CN, WB, VC. Project administration: CN. Resources: CN, WB. Supervision: CN, VC. Writing – original draft: CN, WB. Writing – review and editing: CN, VC.

Author ORCIDs
Chatchai Ngernsaengsaruay https://orcid.org/0000-0002-7131-976X

Data availability
All of the data that support the findings of this study are available in the main text.

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