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Two new species of *Pittosporum* (Pittosporaceae) for the Flora of Thailand

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ABSTRACT

Two new species of *Pittosporum* (Pittosporaceae) are reported for Thailand. *Pittosporum lacrymasepalum* from Trat Province and *P. maxwellii* from Doi Inthanon, Chiang Mai Province are described and illustrated.

KEYWORDS: Apiales, conservation assessment, Doi Inthanon, taxonomy, Trat.

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INTRODUCTION

Pittosporum Banks ex Gaertn. is the largest genus in the Pittosporaceae with approximately 200 species, distributed from the Pacific, New Zealand through Malesia and extending into Africa and Madagascar (Gowda, 1951; Haas, 1977; Chandler *et al.*, 2007). The genus was revised for Flora Malesiana (Bakker & van Steenis, 1957; for additions see Bakker, 1958, 1962; van Steenis, 1972, 1978; Utteridge, 2000; Hicks & Utteridge, 2002; Cayzer & Chandler, 2018), but has yet to be treated for the Flora of Thailand. Several Thai species were included in Gowda's (1951) revision of the genus in the 'Sino-Indian Region' where 53 species were recognised. However, some of the names and species limits used in Gowda (1951) were rather broad with disjunct distributions, and several taxa have been refined in recent treatments as more specimens and field observations became available; see, for example taxonomic changes in the Flora of China by Zhang *et al.* (2003, and discussed below).

In Thailand, the genus is found throughout the country in nearly all habitat types ranging from *Pittosporum ridleyi* L.W.Cayzer & G.Chandler in Southern Thailand to the new species described here found on Doi Inthanon, Thailand's highest peak. During preliminary studies of the material for the forthcoming Flora account, the following specimens did not match any existing species in Thailand or the surrounding regions and are described here as new; descriptions and a key to all species in Thailand will be presented in the final Flora of Thailand treatment currently in preparation. Both of the new species described here are superficially similar to *P. balansae* A.DC. because of the leaf size and shape as well as the few-flowered terminal inflorescences with 2-valved fruits. Gowda (1951) placed a group of species with similar morphology into a 'Balansae-complex' based on fruit and seed characters. The new species described here differ in several diagnostic characters including indumentum, sepal and petal size and shape and fruit and seed characters. The sepals are especially different – in *P. balansae* they are comparatively long with regard to the petals, lanceolate and ca 6 mm long (± half petal length) becoming reflexed on maturity, whereas both of the new species described here have close-fitting, non-reflexing ovate sepals less than 2 mm long (< ¼ petal length).

Within the genus, the majority of species of *Pittosporum* are now known to be localised endemics (Gowda, 1951; Haas, 1977; Gemmill *et al.*, 2002; Cayzer & Chandler, 2018; Carter *et al.*, 2018), with few wide-ranging species within or between regions. For example, in the Pacific region, most species are endemic to an island, mountain top or a particular substrate (Haas, 1977). The description of the species here allows unique combinations of character variation and distribution patterns to be revealed that can be tested as hypotheses of relationships, rather

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than being lost within a morphologically heterogenous and widespread species. Indeed, genetically distinct and range-restricted populations requiring recognition as new species have been shown to occur throughout Indo-China as a result of the intensive plot work of the Center of Asian Conservation Ecology at Kyushu University (e.g., Souladeth *et al.*, 2019; Tagane *et al.*, 2019; Zhang *et al.*, 2020).

Members of the genus are functionally dioecious and will show sexual dimorphism between staminate and pistillate plants; however, it has been shown that both sexes have inconsistencies and staminate plants can have viable ovules (Cayzer, pers. comm.). In New Guinea, *P. nubigenum* Ridl. was studied by Utteridge (2000) and showed no significant differences between sexes in calyx and pedicel length, but the number of flowers per inflorescence, and petal and filament sizes were greater in staminate plants; some collections of staminate plants had fruit, and the species was concluded to be dioecious with low levels of inconstancy in the sexes (paradioecy, see Sakai & Weller, 1999). Unfortunately, due to the limited number of collections available for study of the two new species described here, only staminate plants in flower have been found, and more collections are needed to allow full descriptions of the different sexes.

TAXONOMY

Pittosporum lacrymasepalum Utteridge, **sp. nov.**

Differs from other *Pittosporum* species in Thailand and surrounding countries in the combination of the ferrugineous hairs on the young vegetative parts, terminal, few-flowered inflorescences, sepals 1–1.4 mm long (less than ⅕ petal length) with an acute apex, the ovary sparsely hairy at the base, and the 2-valved capsules with only 4 or 5 relatively small seeds each 4–5 mm long. Type: Thailand. Krat [=Trat], Kao Kuap [12°23'N 102°47'E], 1,700 m, 26 Dec. 1929 (fl.), *Kerr 17781* (holotype **BK** [digital image!]; isotypes **K!**, **L** [digital image!]). Fig. 1.

Shrubs to 2 m tall. Young parts, especially bud scales, ferrugineous hairy, very soon glabrous. *Leaves* clustered at branchlet apex; petiole 0.5–1.5 cm long, ferrugineous hairy on the adaxial surface when young, soon glabrous; lamina elliptic to oblanceolate, 5–11.5 × 1.5–3.5 cm, chartaceous, glabrous ad- and abaxially, drying dark olive-green adaxially, pale olive-brown abaxially; secondary veins 5–9-paired, secondary and lower order venation distinct abaxially, indistinct to distinct adaxially; base cuneate, margins entire, flat and smooth after drying, apex acute to attenuate or very slightly acuminate. *Inflorescences* terminal, laxly cymose, with <5 flowers (staminate plants), or flowers solitary (pistillate plants, only seen in fruit), glabrous; peduncle up to 3 mm long; bracts ovate, apex acute, up to 0.5 mm long, margins entire. *Staminate flowers*: pedicel 2.5–4.5 mm long; sepals free, ovate, apex acute, 1–1.4 mm long, glabrous; petals free, 5.5–6.5 mm long; stamens slightly shorter than petals, filaments ca 4 mm long, anthers 1.4–1.6 mm long; ovary long ovoid, sparsely hairy at the base, placentas at base of ovary, ovules 4–6(–9) per placenta. *Pistillate flowers* not seen. *Fruits* dehiscent, 2-valved capsules, wider than long, globose to oblongoid and somewhat laterally compressed, valves 0.9–1.1 × 0.8–1.4 cm; pericarp thinly woody, with numerous horizontal striations internally. *Seeds* 4–5, subreniform, 4–5 mm along the longest axis, not cohering.

Thailand.— SOUTH-EASTERN: Trat [Kao Kuap [12°23'N 102°47'E], 1,700 m, 26 Dec. 1929 (fl.), *Kerr 17781* (**BK** [digital image BK208009], **K**, **L** [digital image, L1886256]); ibid., 22 May 1930 (fr.), *Put 2951* (**BK** [digital image, BK202974], **K**, **L** [digital image, L1886313]); ibid., 25 May 1930 (fr.), *Put 3023* (**BK**-2 sheets [digital images, BK202972, BK202973], **K**)].

Distribution.— Endemic to Thailand (so far known only from Kao Kuap).

Ecology.— "Common in light evergreen forest" fide *Kerr 17781*; Trat, like peninsular Thailand, has rains throughout the year; this species was collected at 1,700 m alt. which would be a lower montane evergreen forest type.

Etymology.— Named after the tear-shaped sepals (*lachryma* or *lacryma*, Latin, a tear, see Jackson 1905: 142).

Provisional conservation assessment.— DD (Data Deficient). The species is only known from three collections from the same locality from 1929 and 1930. The area lies along the border with Cambodia and appears to be forested on satellite imagery (Google Earth data from 2020); further field observations on the species and the quality of habitat are needed.

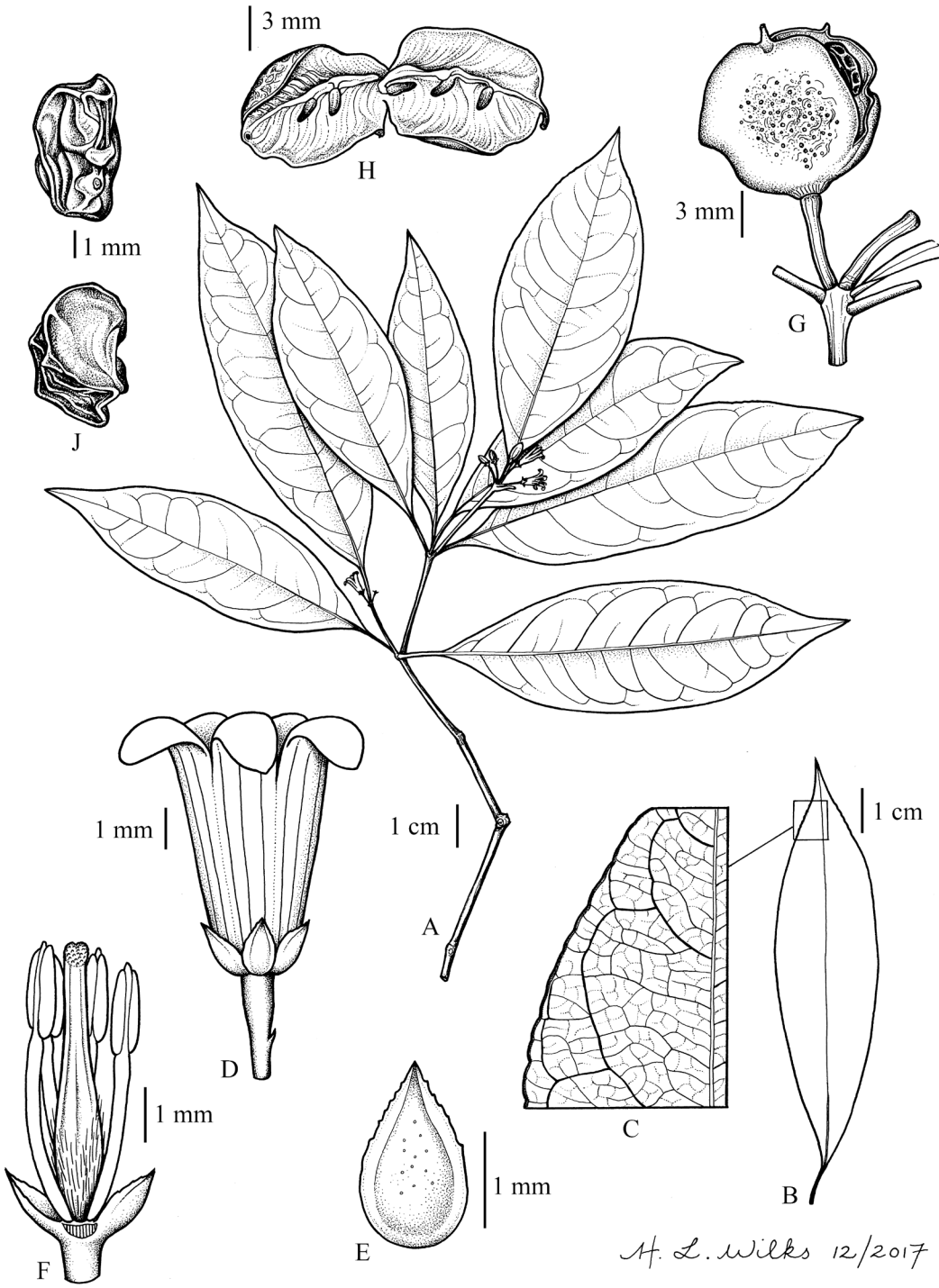

Figure 1. *Pittosporum lacrymasepalum* Utteridge. A. habit; B. leaf outline; C. leaf venation and margin detail; D. flower; E. individual sepal; F. flower with petals removed showing stamens, ovary and style; G. fruit and pedicels; H. dehisced fruit; J. seeds. A–F. *Kerr 17781* (**K**); G–J. *Put 2951* (**K**). All drawn by Hazel Wilks.

Notes.— This species differs from its close relatives in its distribution and its unique combination of characters: the low shrub habit to 2 m height, ferrugineous hairs on the young vegetative parts, relatively small, elliptic to oblanceolate leaves with distinct petioles, few-flowered terminal inflorescences, the relatively short, ovate sepals with an acute apex, the ovary sparsely hairy at the base only, and the 2-valved capsules with only 4 or 5 relatively small seeds.

Whilst there is no contemporary phylogenetic taxonomic framework of *Pittosporum*, or recent revision of the group in Indo-China and Thailand, Gowda's (1951) revision of the genus in the region can be used as an identification tool. This species would key to the informal 'Bivalvae' group of Gowda (1951) on account of the 2-valved capsule, even though the number of fruit valves is not always consistent with species. Gowda's (1951) complexes within the 'Bivalvae' are less clear-cut to key out, and relying on overlapping fruit and seed characters without the dimensions and size range clearly defined in his key, the species would be best placed within the 'Balansae-complex' based on the fruit and seed size, but also keys out somewhat to the 'Floribundum-complex' in having short sepals and small capsules (but that group often has relatively large, terminal, many-flowered panicles).

Although superficially similar to *P. balansae* on account of the elliptic leaves and the terminal inflorescence with few flowers, *P. lacrymasepalum*, as well as the other new species described herein, *P. maxwellii* Utteridge **sp. nov.**, is quite different in the floral structure, especially in the key diagnostic characters of sepal size and shape. *Pittosporum balansae*, as represented by the populations in Thailand, has lanceolate sepals, 5–6 mm long (about half petal length), whereas the two new species here have very short ovate sepals not longer than 2 mm long (less than ⅕ petal length).

In Thailand, the only other species likely to be confused with this new species is the other species described here, *P. maxwellii* Utteridge **sp. nov.**, on account of the habit and the short sepals less than 2 mm long. However, *P. lacrymasepalum* differs in the shorter petioles, the indumentum of the floral parts (*P. lacrymasepalum*: pedicels, sepals and corolla entirely glabrous; *P. maxwellii*: pedicels and sepals hairy, petal margins ciliate) and the smaller fruit (*P. lachrymasepalum* fruit valves 0.9–1.1 × 0.8–1.4 cm; *P. maxwellii* fruit valves 1.6–2 × 1.5–1.8 cm). Finally, both taxa are range restricted endemics with *P. lacrymasepalum* in the southern-eastern Trat Province bordering Cambodia, whilst *P. maxwellii* is endemic to Doi Inthanon in Chiang Mai Province in the north of the country.

Put 3023 is noted (in Thai) to be a small tree on the BK specimen, and was determined as *P. ferrugineum* W.T.Aiton at Kew. Specimen labels of collections made by Put Phraisurind, a Thai assistant of Kerr, usually have his name stamped in the centre of the label and not next to the printed 'Collector' field, thus leaving it seemingly blank – unfortunately, some mischievous person has put 'A. Hitler' in the blank Collector field on *Put 2951*, no doubt after the specimen was received at Kew.

Tagane *et al.* (2019: 137) report the newly described Cambodian species, *Dichapetalum cambodianum* Tagane & Nagam., as a new record to Thailand from a Put collection from Kao Kuap, and *Dendropanax siamensis* Craib (Araliaceae) was described from Kao Kuap (Esser & Jebb, 2019). Although the latter species is now synonymized with *D. maingayi* King now, this is still the only Thai record for this taxon (Esser & Jebb, 2019), and this disjunct distribution between Malacca and Kao Kuap suggests a link between the two regions; the only species of Malaysian *Pittosporum* similar to *P. lacrymasepalum* is *P. reticosum* Ridl. (which just extends into southern Thailand at Yala), on account of the similar sized leaves, but that species has relatively long sepals compared to the petal length and long, fine pedicels up to 2 cm long. Clearly, the area of Kao Kuap would merit further study, such as the compilation of a critical checklist from the literature and, especially, more fieldwork; however, there have been no recent visits to this area because of the many landmines throughout this border area (Pooma, pers. comm.).

Pittosporum maxwellii Utteridge, **sp. nov.**

Similar to *Pittosporum balansae* in the shrubby habit, relatively small leaves, the terminal inflorescences and the 2-valved fruit capsules, but differs in having more numerous secondary veins with 7–9-pairs (*P. balansae*: 6–7 pairs), only 2–5 flowers per inflorescence (*P. balansae*: 3–9 flowers), the

triangular to ovate sepals less than ⅓ petal length (*P. balansae*: lanceolate, > half petal length) and the 8–11 mm long petals (*P. balansae* ca 8 mm long). Type: Thailand. Chiang Mai Province, Doi Inthanon National Forest, east side, north of km 38, Huai Hoi area, 1,700 m, 30 Jan. 1993 (fl.), Maxwell 93-115 (holotype **BKF!**, isotypes **CMUB** [digital image!], **L** [digital image!]). Fig. 2.

Shrubs or treelets 1.5–3 m tall. Young parts, especially bud scales, densely ferrugineous hairy, soon sparsely hairy then glabrescent. *Leaves* clustered at branchlet apex, pseudowhorled; petiole 0.5–0.9 cm long, sparsely hairy abaxially; lamina narrowly elliptic to narrowly oblanceolate, (5–)8–13 × 1.4–3.1 cm (sometimes with a reduced leaf up to 2.3 cm long at the base of the pseudowhorl), chartaceous, ferrugineously hairy on the abaxial surface only when young, soon glabrous ad- and abaxially when mature, drying olive-green adaxially, pale olive-brown abaxially; secondary veins 7–9-paired, secondary and lower order venation distinct abaxially, indistinct to distinct adaxially; base cuneate, margins entire, flat and smooth after drying, apex acute to attenuate. *Inflorescences* terminal, umbellate with 2–5 flowers or aggregated single flowers, hairy; subsessile or with a short peduncle up to 5 mm long; bracts narrowly ovate to lanceolate, apex acute, up to 0.5 mm long, margins ciliate. *Staminate flowers*: pedicel 6.8–10.3 mm long, hairy; sepals free, triangular to ovate, apex acute-rounded, tiny, 1.25–2 mm long (< 1/5 petal length), sparsely hairy, margins ciliate; petals free but adhering for ¾ of their length in mature flowers, 8–11 mm long (at maturity), margins very shortly ciliate; stamens slightly shorter than petals, filaments ca 6 mm long, anthers ca 2 mm long; ovary long ovoid, sparsely hairy, ovules 3–5 per placenta. *Pistillate flowers* not seen. Fruits globose, dehiscing by 2 valves, valves 1.6–2 × 1.5–1.8 cm; pericarp leathery, eventually thinly woody. *Seeds* 3–5, subreniform, 6–7 mm along the longest axis.

Thailand.— NORTHERN: Chiang Mai [Doi Inthanon National Forest, Siri Phum Waterfall, 1,100 m, 26 Feb. 1979 (fl.), *Koyama et al. T-15563* (**BKF**-2 sheets); Doi Inthanon, east side, north of km 38, Huai Hoi area, 1,700 m, 30 Jan. 1993 (fl.), *Maxwell 93-115* (**BKF**, **CMUB** [digital image, CMUB 01256], **L** [digital image, L4176908]); Doi Inthanon, 1,900 m, 22 Jan. 1969 (fl.), *Nooteboom et al. 822* (**BKF**, **L** [digital image, L1657130]); Doi Inthanon, 1,500 m, 22 Mar. 1967 (fl.), *Smitinand et al. 10268* (**BKF**); Doi Inthanon, 2,000 m, 23 Mar. 1967 (fl.), *Smitinand et al. 10298* (**BKF**); Doi Inthanon, Kanzaki plot, transect line 2, 1,688 m, 7 Nov. 2011 (st.), *Tagane et al. T348* (**BKF**); Doi Inthanon, 15 Apr. 1970 (fr.) *Weraweat 85* (**BKF**)].

Distribution.— Endemic to Doi Inthanon.

Ecology and phenology.— Collected from evergreen forest and tropical lower montane forest, 1,100–2,000 m alt. Flowering & fruiting: January–April.

Etymology.— This species is named in honour of James F. Maxwell (1945–2015), botanist and prolific collector with an unparalleled knowledge of the flora of Thailand, as well as a champion for fieldwork and plant taxonomy: "no aspect of computer or molecular technology can be used as a substitute for dedicated field work, diligent herbarium research, and competent production of keys, descriptions, and other observations" (from Maxwell's Preface to the 'Vascular Flora of Ko Hong Hill, Songkla Province, Thailand' quoted in Webb *et al.*, 2016).

Provisional conservation assessment.— The Extent of Occurrence is 965 km^2 and the Area of Occupancy 20 km^2 (AOO based on user defined cell width of 2 km), both metrics fulfilling the geographic range criterion of the Endangered category of the IUCN Red List (IUCN 2012). However, the subcriteria are not fulfilled, for example, the exact locations of the collections are problematic to determine and Doi Inthanon is a National Park with protected status. The species is provisionally evaluated as Near Threatened (NT) here requiring more data to confirm the exact status of the species.

Notes.— *Pittosporum maxwellii* is unique in having the following combination of characters: shortly petiolate, narrowly elliptic to narrowly oblanceolate leaves, few-flowered terminal inflorescences, flowers with tiny sepals and petals adhering for ¾ of their length in mature flowers, and the 2-valved fruits with 3–5 seeds. The shortly ciliate petal margins allow the petals to adhere for ¾ of their length, i.e. the hairs act somewhat like 'velcro'. From field notes, the corolla is recorded as being yellow (*Koyama et al. T-15563*), yellow-green (*Maxwell 93-115*; *Nooteboom et al. 822*) or greenish (*Smitinand et al. 10268*).

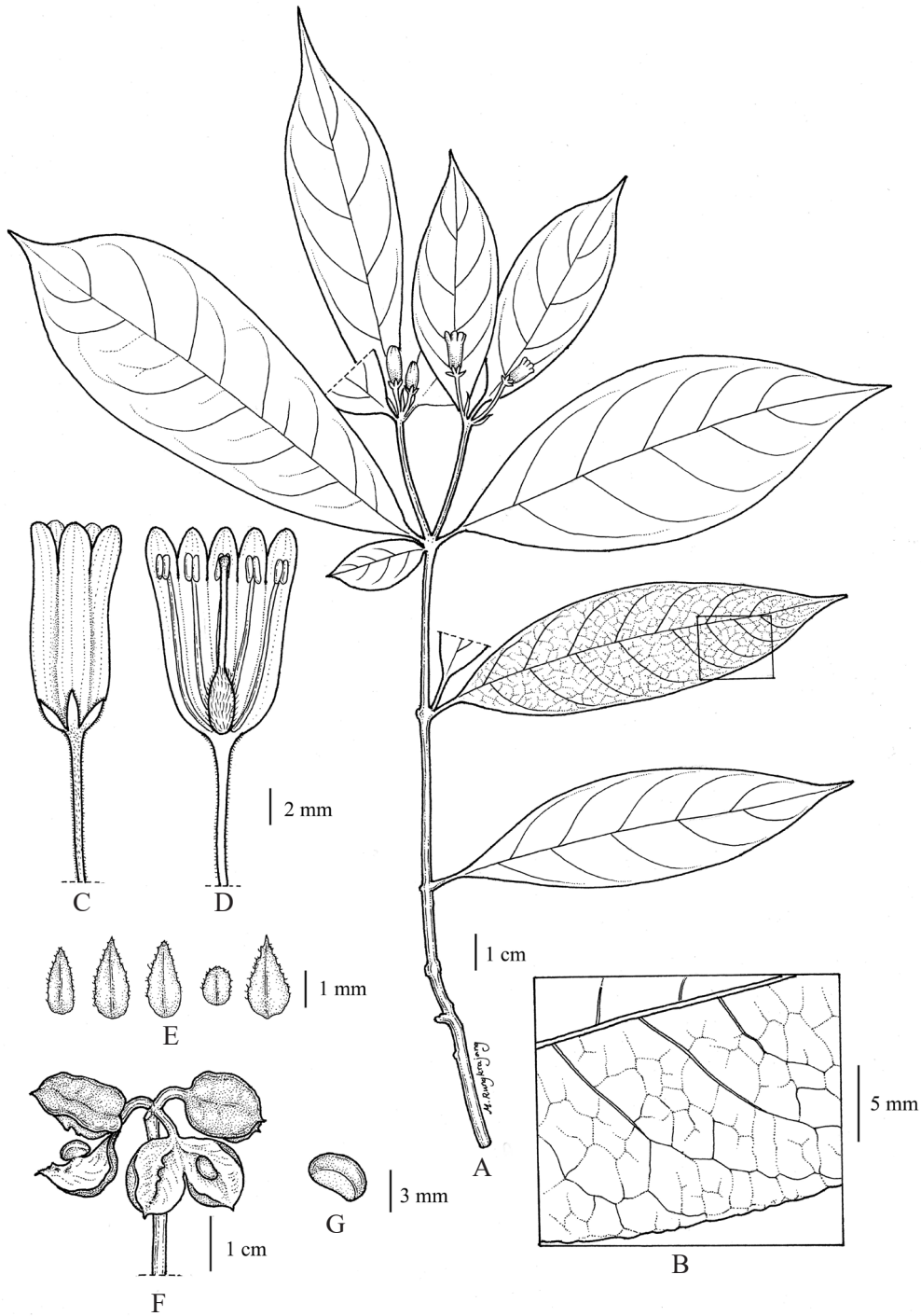

Figure 2. *Pittosporum maxwellii* Utteridge. A. habit; B. leaf venation and margin detail; C. flower; D. flower opened to show stamens and ovary; E. sepal lobes; F. dehisced fruit; G. seed. A–E from *Maxwell 93-115* (**BKF** & **L**); F & G from *Weraweat 85* (**BKF**). All drawn by Mahsarahka Rungkrajang.

Like *P. lacrymasepalum*, this new species differs from *P. balansae* in several characters including the number of flowers (*P. maxwellii*: 2–5 flowers per inflorescence; *P. balansae*: 3–9 flowers), and the sepal size and shape (*P. maxwellii*: triangular to ovate, 1.25–2 mm long; *P. balansae*: lanceolate, 5–6 mm long); in addition, the petals of *P. maxwellii* are slightly longer than *P. balansae* which are usually ca 8 mm long. The species is also similar to *P. baileyanum* Gowda in the few seeds (less than 8), the narrow leaves (ca 4 times as long as broad) and the pedicellate flowers. However, *Pittosporum baileyanum* was described by Gowda based on *Pittosporum balansae* A.DC. var. *angustifolium* Gagnep., and Zhang *et al.* (2003) recognised Gagnepain's variety rather than Gowda's species and placed *Pittosporum baileyanum* within a broader *Pittosporum balansae*. *Pittosporum balansae* var. *angustifolium* is distributed in China (Guangdong, Guangxi, Hainan) and Vietnam (northern and central areas including Quảng Ninh and Thừa Thiên-Huế Provinces).

On Doi Inthanon, the only other recorded species of *Pittosporum* is *P. napaulense* (DC.) Rehder & E.H.Wilson, collected from the mid-altitudes at ca 1,200 m (though usually recorded between 700 and 1,000 m), and so does overlap with the habitat range although *P. maxwellii* is usually found at higher altitudes above 1,600 m. *Pittosporum napaulense* is unlikely to be confused with *P. maxwellii* being a tree to 20 m and with inflorescences with several to many flowers with a distinct central axis and larger oblanceolate to obovate-lanceolate or elliptic leaves, 6–19 × 3.5–8 cm.

Specimens of *P. maxwellii* were determined as *P.* aff. *tetraspermum* Wight. & Arn. by Maxwell, but this species is now known to be restricted to southern India and Sri Lanka, and has 2 placentas each with only 2 basal ovules as the name suggests.

Specimens of *P. maxwellii* have been determined as *Schoepfia* Schreb. (Olacaceae) on several occasions, as well as Thymelaeaceae. This species was not recorded or mentioned in Gardner *et al.* (2000).

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