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Lagerstroemia ruffordii (Lythraceae), a New Species from Vietnam and Cambodia

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A new species of *Largerstroemia ruffordii* T. T. Pham & Tagane (Lythraceae) from Vietnam and Cambodia is described and illustrated. It is morphologically similar to *L. petiolaris* in having petioles more than 0.9 cm long, but distinguished mainly by its narrower leaves, larger flowers and distinctly 6-ridged calyx tube. DNA barcodes of the two chloroplast regions of *rbcL* and *matK* and one ITS of nuclear ribosomal DNA are also provided.

Key words: DNA barcoding, Indochina, *Lagerstroemia*, Lythraceae, new species

Species of *Lagerstroemia* L. (Lythraceae) are trees or shrubs characterized by paniculate inflorescences, a campanulate or funnel-shaped calyx tube, 6–9 calyx lobes and petals, woody fruits loculicidally dehiscent from the apex, and winged seeds (Furtado & Srisuko 1969, De Wilde & Duyfjes 2014, De wild *et al.* 2014). The genus consists of about 60 species and occurs mainly in lowland tropical and subtropical areas from India to China, and the Malesian region and extending to northern Australia (Furtado & Srisuko 1969, Qin & Graham 2007, De Wilde & Duyfjes 2014).

Recently, De Wilde and Duyfjes (2016) reviewed the species of *Lagerstroemia* of Indochina and enumerated 21 species: 17 species in Vietnam, 14 species in Cambodia and 14 species in Laos, among which *L. densiflora* W. J. de Wilde & Duyfjes, *L. gagnepainii* Furtado & Srisuko, *L. kratiensis* W. J. de Wilde & Duyfjes and *L. micrantha* Merr. are known only from the type specimen or from a few collections.

In 2016, during botanical surveys lead by the first author in Vietnam and the second author in Cambodia, plants of *Lagerstroemia* were found that had flowers and mature fruits that differed from the 21 species recognized by De Wilde and Duyfjes (2016). These plants are here described and illustrated as a new species, *Lagerstroemia ruffordii* T. T. Pham & Tagane. Three DNA barcode regions of the partial genes for the large subunit ribulose-1,5-bisphosphate carboxylase oxygenase (*rbcL*), maturase K (*matK*) (CBOL Plant Working Group 2009) and Internal Transcribed Spacer (ITS) are provided.

Materials and Methods

Unidentifiable plants collected in Vietnam [*Pham T. T. & Nguyen T. T. 16032901* (HN, P,

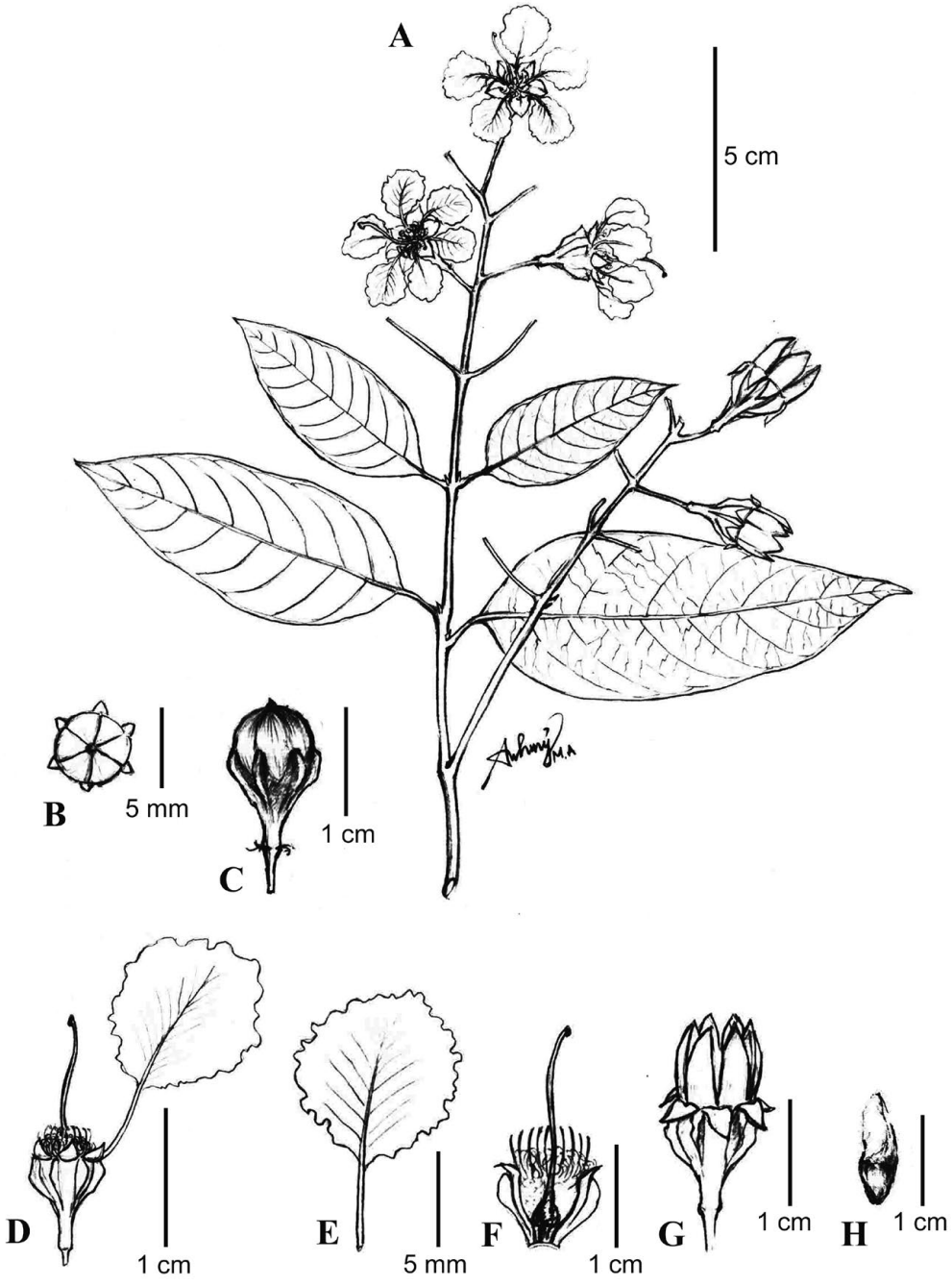

FIG. 1. *Lagerstroemia ruffordii* T. T. Pham & Tagane. A, Flowering and fruiting branch; B, flower bud (top view); C, flower bud (lateral view); D, flower; E, petal; F, longitudinal section of flower in anthesis; G, capsule; H, seed. Materials: A–G, *Pham T. T.* & *Nguyen.T. T. 16032901* (VNF); H, *Tagane et al. 6971* (FU).

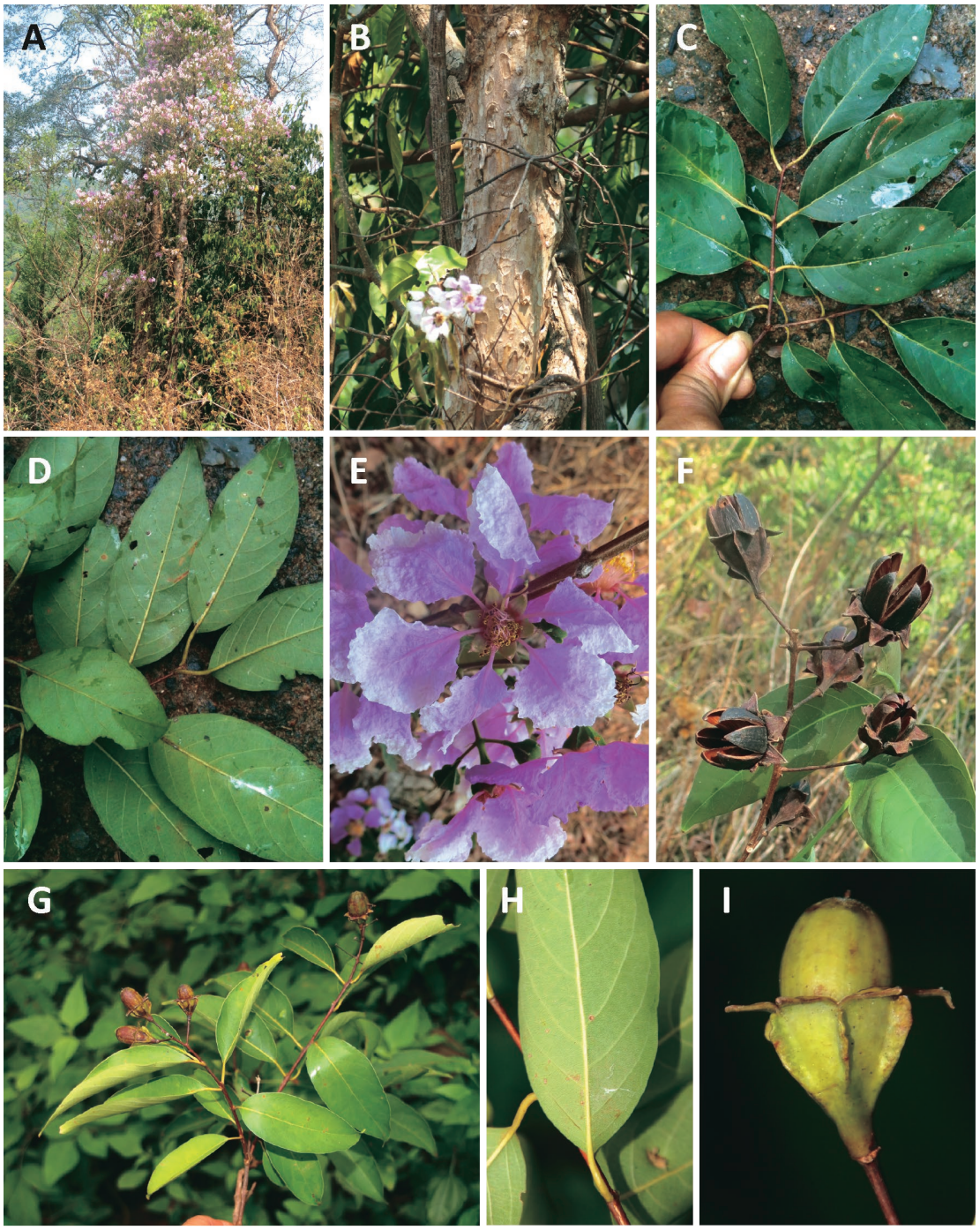

FIG. 2. *Lagerstroemia ruffordii* T. T. Pham & Tagane from Vietnam (A–F) and Cambodia (G–I). A, Habit; B, trunk; C, Leafy twig (adaxial side); D, leafy twig (abaxial side); E, flower; F. fruits; G. fruiting branch: H, abaxial leaf surface; I, fruits. [Photographs by Pham T. T. on 29 March 2016 for *Pham T. T. & Nguyen T. T. 16032901* (A–F) and by S. Tagane on 1 November 2016 for *Tagane et al. 6971* (G–I)].

VNF, VNMN)] and Cambodia [*Tagane S.*, *Zhang M.*, *Chhang P.*, *Hatake K.*, *Ota T.* & *Mase K. 6971* (BKF, FU, KYO, L, RUPP, VNM, herbarium of the Forest Administration of Cambodia)] were compared with specimens of *Lagerstroemia* in FOF, HN, HNU, VNF and VNMN and with digital images of type specimens on the website of JSTOR Global Plants (https://plants.jstor.org/). Literature relevant to *Lagerstroemia* in Cambodia and Vietnam (Furtado & Srisuko 1969, Gagnepain 1921, Huang 1993, Hô 2003, Qin & Graham 2007, De Wilde & Duyfjes 2014a, b, 2016) was also consulted.

DNA amplification and sequencing were performed according to published protocols: *rbcL* and *matK* (Kress *et al.* 2009, Dunning & Savolainen 2010) as in Toyama *et al.* (2015), and ITS (Rohwer *et al.* 2009).

Taxonomic treatment

Lagerstroemia ruffordii T. T. Pham & Tagane, **sp. nov.**—Figs. 1 & 2.

Lagerstroemia ruffordii is similar to *L. petiolaris* Pierre ex Laness. in having petioles more than 0.9 cm long and adaxially glabrous leaves, but differs in having narrower leaves (length/width ratio 2.3–3 in *L. ruffordii* vs. 1.3–2 in *L. petiolaris*), smaller petals (1.5–1.8 cm long including claw in *L. ruffordii* vs. ca. 3 cm long in *L. petiolaris*) and conspicuously 6-ridged calyx tube (vs. slightly 6-ridged in *L. petiolaris*). The fruits are similar to *L. ovalifolia* Teijsm. & Binn in having a calyx distinctly ridged, but *L. ruffordii* differs from *L. ovalifolia* in its longer petiole (0.9–1.4 cm long vs. 0.3–0.5 cm long in *L. ovalifolia*) and 6 calyx lobes [vs. (6 or)7–9 calyx lobes]. It is also similar to *L. lecomtei* Gagnep. in having an ovate leaf blade and 6-ridged calyx (sometimes 5-ridged in *L. lecomtei*), but distinguished from *L. lecomtei* by its longer petiole (0.3–0.5 cm long in *L. lecomtei*), more secondary veins (8 or 9 pairs vs. 7 pairs) and sparsely hairy calyx lobes (vs. densely tomentose). A more detailed morphological comparison of the four species is provided in Table 1.

Typus. VIETNAM. Dak Nong Province, Tuy Duc district, Quang Truc community 12°17'31.7"N, 109°59'21.5"E, alt. 533 m, 29 Mar. 2016, with flowers and fruits, *Pham T. T.* & *Nguyen T. T. 16032901* (holo- VNF!, iso- HN!, P!, VNMN!).

Description. **Trees** 16 m tall; bark pale brown, rather smooth and peeling or flaking. Young twigs reddish brown, sparsely hairy, old twigs grayish brown, glabrous. **Leaves** simple, opposite; ***petiole*** 0.9–1.4 cm long, glabrous; ***lamina*** ovate or elliptic, (4.5–)5.7–10.5(–15) × (1.9–)2.7–3.9(–5.2) cm, base cuneate, margin entire, apex acuminate or acute, chartaceous, upper surface glabrous, lower surface glabrous except sparsely hairy on midvein when young; midrib prominent on both surfaces, lateral veins 8 or 9 on each side of midrib, prominent on both surfaces; intercostal venation reticulate, slightly prominent on both surfaces. **Inflorescences** paniculate, terminal, 6.5–8 cm long; peduncle 0.7–2.5 cm long, sparsely hairy. **Flowers** buds obovoid, ca. 1 cm long, 0.5 cm in diam., apex with a 0.5 mm long nipple, minutely hairy; pseudopedicel 3–4 mm long; ***calyx tube*** campanulate, 7–8 mm long, 3–5 mm in diam., sparsely hairy, 6-ridged, ridges conspicuously winged along both ridges and calyx lobe-sutures, without auricles between calyx lobes; ***calyx lobes*** 6 (or 7), deltate, 4–5 mm long, apex caudate, sparsely hairy adaxially; ***petals*** 6 (or 7), showy, pinkish or violet, obovate, 1.5–1.8 cm long including 3.5–4.5 mm long claw, margin undulate, apex rounded. ***Stamens*** ca. 100, dimorphic, longer stamens 9, 8–11 mm long, shorter and thinner stamens 4–7 mm long; anther ca. 1 mm long, yellow *in vivo*. ***Ovary*** narrowly ellipsoid, 2.5 mm long, 6-loculed, hairy; style long-exserted, 1.6 cm long; stigma capitate. **Capsules** smooth, glabrous, ellipsoid, 2–2.1 cm long, 0.9–1.2 cm in diam., apex rounded, with minute style-remnant, dark reddish brown or blackish when dry, loculicidally dehiscent from apex, 6-valved; fruiting pseudopedicel 3–4 mm long. **Seeds** numerous, winged at one end, flat, 9–12 × 4 mm, body 5–6 × 3–4 mm, light brown or reddish brown, glabrous.

Additional specimen examined. Cambodia, Mondulkiri Province, Sen Monorom, in community forest near Pulung Village, in mixed deciduous forest, alt. 630 m, 12°30'40.7"N, 104°12'57.2"E, 1 Nov. 2016, with fruits, *Tagane S., Zhang M., Chhang P., Hatake K., Ota T. & Mase K. 6971* (BKF, FU, KYO, L, RUPP, VNM, the herbarium of Forest Administration of Cambodia).

TABLE 1. Morphological comparison of *Lagerstroemia ruffordii, L. ovalifolia, L. petiolaris* and *L. lecomtei.*

Characteristics	*L. ruffordii,* sp. nov.	*L. petiolaris*[1)]	*L. ovalifolia*[2)]	*L. lecomtei*[3)]
Leaf blade size	(4.5–)5.7–10.5(–15) × (1.9–)2.7–3.9(–5.2) cm	6–13 × 3–7 cm	6–11 × 4–5.6 cm	2.5–5.5 × 2–3 cm
Length/width ratio of leaf blade	2.3–3	1.3–2	1.9–2.7	1.25–1.9
Hairiness of leaves	glabrous	glabrous	glabrous	glabrous
Leaf apex	acute or acuminate	acute	obtuse, acute (to acuminate)	acute
Petiole length	0.9–1.4 cm	1.3–1.5 cm	0.2–0.5 cm	0.3–0.5 cm
No. of lateral veins	8–9 pairs	7–8 pairs	7–8 pairs	7 pairs
No. of petals	6 (or 7)	6	(6–)7–9	5 or 6
Petal size including claw	1.5–1.8 cm long	ca. 3 cm long	1.5–3 cm long	1.2–1.4 cm long
Calyx tube	campanulate, 0.7–0.8 cm long, 6-ridged, ridge distinctly winged	campanulate, 1.0–1.2 cm long, slightly 6-ridged	campanulate, 1.0–1.3 cm long, distinctly 6–9- ridged	5–6 mm long, distinctly 5- or 6-ridged
Calyx lobes	6 (or 7), sparsely hairy adaxially	6, glabrous adaxially	(6 or)7–9, minutely hairy in upper part adaxially	5 or 6, tomentose in upper part adaxially
Fruit	ellipsoid, 2–2.1 cm long, 0.9–1.2 cm in diam.	subglobose or globose, 1.2 cm long, 1–1.2 cm in diam.	ellipsoid or subglobose, 1.4–2.5 cm long, 1.3–1.6 cm in diam.	obovoid or ellipsoid, 1.5 cm long.

[1)] from the description in Furtado & Srisuko (1969).
[2)] from the description in Furtado & Srisuko (1969) and De Wilde *et al.* (2014), and based on digital image on the web [*Cheng et al. CL618*. Barcode: P00633190 (P)]. for length/width ratio of leaf blade.
[3)] from the description in Gagnepain (1921) and Furtado & Srisuko (1969) and based on digital image on the web [*Lecomte & Finet 1406*. Barcode: P01902039 (P)].

Distribution. Cambodia (Mondulkiri Province) and Vietnam (Dak Nong Province).

Habitat and Ecology. In mixed deciduous forests, 533–630 m altitude.

In Mondulkiri, Cambodia, *Lagerstroemia ruffordii* is one of the dominant species, growing with *Cratoxylum formosum* (Jacq.) Benth. & Hook. f. ex Dyer, *Dalbergia nigrescens* Kurz, *Irvingia malayana* Oliv. ex A.W.Benn., *Strychnos nux-blanda* A. W. Hill, *Terminalia nigrovenulosa* Pierre, and *Vitex peduncularis* Wall. ex Schauer. A flowering and fruiting specimen was collected in March and a fruiting specimen in November.

Vernacular name in Cambodia. Kval Yang (in Sen Monorom), Sralao Chu (in Khmer).

Etymology. The specific epithet '*rufford*' is derived from the Rufford Small Grants Foundation that supported this research.

DNA barcodes. GenBank accession no. LC258573 (*rbcL*), LC258573 (*matK*), LC258575 (ITS): we have sequenced *Tagane et al. 6971* (FU).

Preliminary conservation status. At present, *Lagerstroemia ruffordii* occurs widely and commonly in mixed deciduous forests, as well as in secondary forests, in both Dak Nong Province, Vietnam and Mondulukiri Province, Cambodia. We observed many reproductive trees and therefore propose the status of this species to be Least Concern (LC) according to IUCN Red List Categories (IUCN 2012).

Note on phenology. Among the species of Cambodia and Vietnam, *Lagerstroemia ruffordii* is distinct in that it blooms in March when new leaves are flushing, while most other species bloom after leaf flush.

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