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***IMPATIENS SUBFALCATA* (BALSAMINACEAE), A NEW SPECIES FROM LAOS**

P. Souladeth¹, S. Tagane², Y. Suyama³, N. Ishii³, A. Nagahama⁴ & K. Souvannakhoummane⁵

Impatiens subfalcata Soulad. & Tagane, a new species of Balsaminaceae from southern Laos, is described and illustrated. The new species is morphologically similar to *Impatiens attopeuensis* and *I. notoptera* in having succulent stems, serrate leaf margins and pinkish flowers, but distinguished from these two by its falcate lanceolate or oblanceolate leaves, more numerous secondary veins, shorter petioles and smaller dorsal petals.

Keywords. Balsaminaceae, Bolaven Plateau, *Impatiens*, Laos, new species, taxonomy.

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Introduction

Impatiens L. is a genus of Balsaminaceae comprising more than 1000 species. The genus is mainly distributed in tropical and subtropical Africa and Eurasia, with most species found in five hotspots, namely Southeast Asia and southwestern China, eastern to central Himalaya, southern India, tropical Africa, and Madagascar (Grey-Wilson, 1980, 1989; Chen et al., 2007; Cho et al., 2016; Ruchisansakun et al., 2018).

In Laos, thirty-five *Impatiens* species have been enumerated in the *Flora of Laos* (Newman et al., 2017–). The number of species reported is lower than that for neighbouring countries except Cambodia: more than 270 species (> 200 endemic) have been recorded from China (Chen et al., 2007; Lu et al., 2020), approximately 72 species from Vietnam (Tardieu, 1944; Ho, 2003; Shui et al., 2011; Botany Vietnam Group, continuously updated), 65 species from Myanmar (Kress et al., 2003; Ruchisansakun et al., 2018), 69 species from Thailand (Pooma & Suddee, 2014; Ruchisansakun & Suksathan, 2019), and nine species from Cambodia (Hooker, 1911; Tardieu, 1944; Cho et al., 2016, 2017; Kim et al., 2019).

During our recent floristic surveys on the Bolaven Plateau, southern Laos, in 2017–2019, a species of *Impatiens* belonging to section *Uniflorae* Hook.f. & Thomson was collected

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at Tad Seua Waterfall (Figure 1A). It is most similar to *Impatiens attopeuensis* Hook.f. from Attapeu Province of southern Laos, but a comparison with the type specimens and protologue of *I. attopeuensis* as well as those of the other species in Laos and surrounding countries revealed that it differs from any of the previously known species. Therefore, we describe it as a new species, *Impatiens subfalcata* Soulad. & Tagane, the thirty-sixth *Impatiens* species from Laos. The measurements in the following description are based on the herbarium materials we collected.

Taxonomic treatment

Impatiens subfalcata Soulad. & Tagane, sp. nov.

Impatiens subfalcata is easily recognised by its slightly falcate and lanceolate or oblanceolate leaves (length-to-width ratio, 4.6–7.6). In Laos, it is similar to *Impatiens attopeuensis* Hook.f. in its habit, serrate leaf margins and pinkish purple corolla, but distinguished not only by its slightly falcate leaves but also by its more numerous secondary veins (8–10 pairs in *I. subfalcata* versus 5–7 pairs in *I. attopeuensis*), shorter petioles (subsessile to 0.2 cm long versus 0.5–2 cm long), shorter spur (2.1–2.6 cm versus 4–7 cm long), and smaller dorsal petal (6–7 mm versus 12–14 mm). – Type: Laos, Champasak Province, Dong Hua Sao National Protected Area (Bolaven Plateau), 15°04'02.6"N, 106°12'29.9"E, 1147 m elevation, 19 ii 2019, Souladeth P., Tagane S., Sengthong A., Nagahama A., Suyama Y., Ishii N. L2492 (holotype FOF! [FOF0005191]; isotype BKF, HNL, KAG! [KAG128741]). Figure 1.

Lithophytic, perennial herb, 20–40 cm tall, stems upright, usually solitary, succulent, with slightly swollen, caudiform base, 0.4–1 cm in diameter at the base, light green, glabrous. Leaves alternate, spirally arranged, crowded towards apex of stems; petioles subsessile to 2 mm long, pale green, glabrous; lamina lanceolate, oblanceolate, slightly falcate, 1.7–10.5 × 0.2–1.7 cm, length-to-width ratio 4.6–7.6, thinly chartaceous, base cuneate to acute, slightly decurrent, apex acuminate, margin serrate, adaxially light grey-green, abaxially pale green, glabrous except upper adaxial side of secondary veins hairy, midrib prominent at base, flat, or slightly prominent or slightly sunken towards apex on both surfaces, secondary veins 8–10 pairs, clearly sunken abaxially, tertiary veins invisible on both surfaces. Flowers solitary, axillary, 1.3–1.5 × 1.1–1.3 cm, 2.9–3.1 cm deep, purplish pink *in vivo*, pale blue-purple *in sicco*, with white at centre. Bracts narrowly ovate to triangular, c.2 mm long, apex acute, light green, glabrous on both surfaces, persistent. Pedicel 1.2–2 cm long, 0.6–0.9 mm in diameter, light green, glabrous. Lateral sepals 2, ovate, triangular, c.5 × 2.8 mm, apex acute to shortly acuminate, yellowish brown with green tips at apex, glabrous on both surfaces. Lower sepal navicular, 5–6 × 3–4 mm, c.1.5 mm deep, apex acute, white, glabrous, abruptly constricted distally into a straight or incurved spur, spur 2.1–2.6 cm long, white with green tip. Petals 5. Dorsal petal transversely broadly elliptic, 6–7 × 7–9 mm,

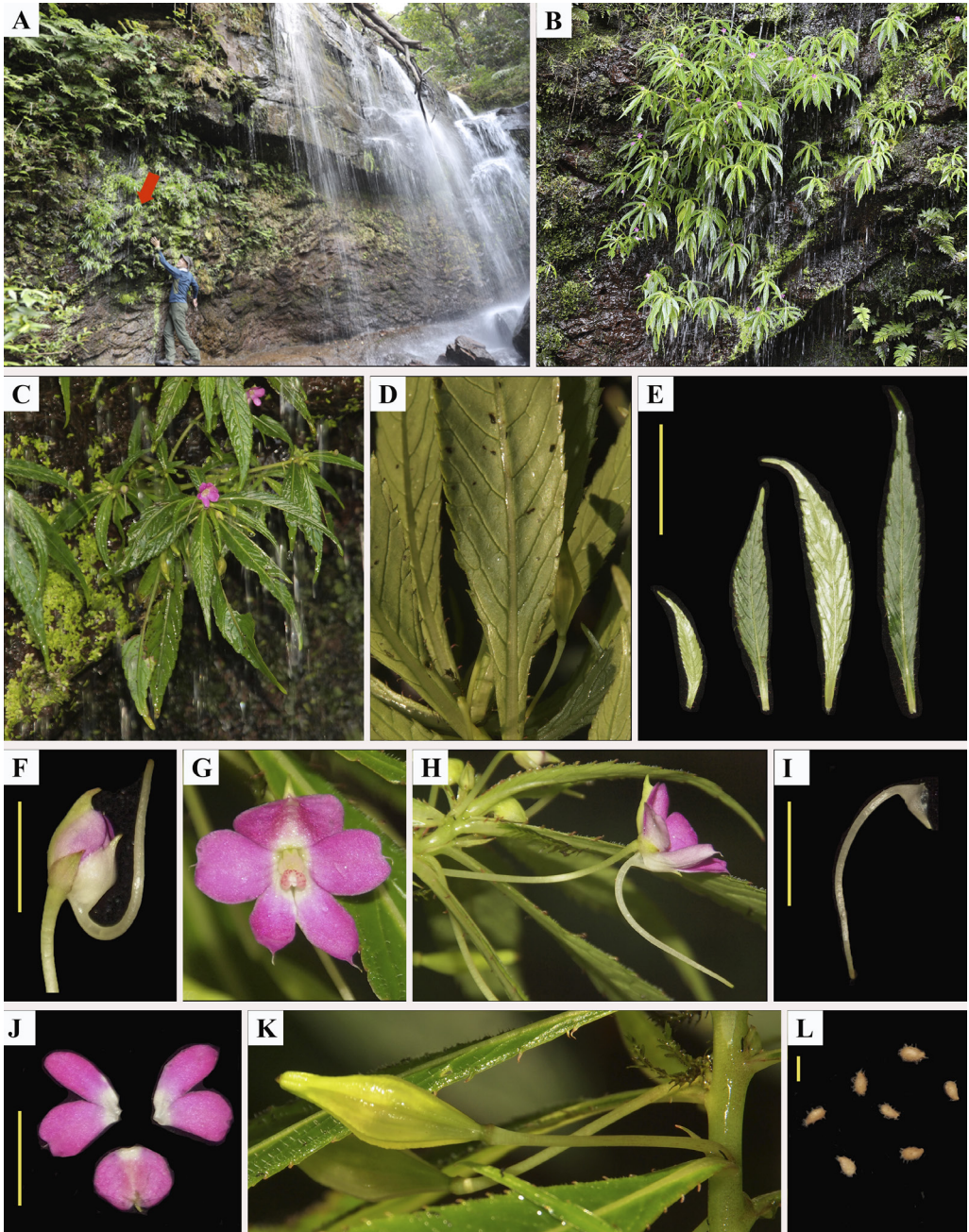


Figure 1. *Impatiens subfalcata* Soulad. & Tagane. A and B, Habitat (individuals indicated by red arrow); C, habit; D, portion of lower leaf surface; E, leaves; F, flower bud; G, flower (front view); H, flower (lateral view); I, spur; J, petals; K, fruit; L, seeds. Scale bars (yellow): E, 5 cm; F, I and J, 1 cm; L, 2 mm. All photographs from Souladeth et al. L2492. Photographs: S. Tagane.

apically slightly recurved, apex obcordate and mucronate stipitate, mucro to 1.2 mm long, base truncate to rounded, purplish pink, except white near base, with green tip, glabrous on both surfaces. *Lateral united petals* broadly obovate, 9.5–12 mm long, free, purplish pink except white near base, glabrous on both surfaces; *upper lobes* obovate-elliptic, 11–12 × 4–4.5 mm, apex round to slightly acuminate emarginate with appendage at apex, appendage 0.5–1.5 mm long, base cuneate; *lower lobes* obovate-elliptic, 9.5–11 × 5.2–6.1 mm, obovate-elliptic, apex slightly obcordate, with appendage at apex, appendage c.1.2 mm long. *Stamens* 5, filaments c.2.5 mm long, flat, pale pink, anthers pale pink. *Ovary* c.2 mm long, c.0.9 mm in diameter, 1 carpel, 4-lobed, green *in vivo*, reddish brown *in sicco*, glabrous. *Fruits* short, fusiform, 1.2–1.8 cm long, 5–6 mm in diameter, green *in vivo*, reddish brown *in sicco*, glabrous. *Seeds* c.20 per capsule, ellipsoid, 2–2.8 mm long, light brown, pilose.

Distribution. Laos, Champasak Province (known only from the type locality).

Habitat and ecology. *Impatiens subfalcata* grows on dripping rocky walls at a waterfall (see [Figure 1A,B](#)).

Etymology. The species epithet, *subfalcata*, is derived from the slightly falcate nature of the leaves of this species.

Vernacular name. ທຶນໄບດາບ (*thien baidab*), suggested here; in Lao, *thien* means *Impatiens* species and *baidab* means ‘falcate leaf’.

Preliminary conservation assessment. *Impatiens subfalcata* is currently known only from a single population with c.30 individuals at its type locality on the Bolaven Plateau ([Figure 2](#)) and may be restricted to dripping-wet, rocky walls. Therefore, the most appropriate initial assessment of the IUCN conservation status for this species is Critically Endangered (CR) under criteria D (IUCN, [2012](#)).

Note 1. The possibility that *Impatiens subfalcata* is simply an extreme variation of *I. attopeuensis* has been considered. *Impatiens attopeuensis* is a variable species, and two species, *I. longecalcarata* Tardieu and *I. monotricha* Hook.f., both described from Bolaven, are now treated as synonyms of *I. attopeuensis* in the checklist of Laos (Newman et al., [2017–](#)). However, *Impatiens subfalcata* is different from these species not only in morphology (as shown in the diagnosis above and the [Table](#)) but also in its habitat and elevation range. Whereas *Impatiens subfalcata* grows on dripping rocky walls in wet evergreen forest at an elevation of 1147 m, *I. attopeuensis*, including the two synonymised species, grows on rocks or soils near streams or waterfalls at lower elevations, 199–900 m. The types of *Impatiens attopeuensis* (a drawing in Hooker’s Icon. Pl. 29: t. 2853; based on Harmand s.n., P), *I. longecalcarata* (Poilane 15955, P) and *I. monotricha* (Harmand 1137, P) were collected in Attapeu Province (at 600–900 m for *I. longecalcarata* and 200–300 m for *I. monotricha*).

We collected *Impatiens attopeuensis* at Tad Tayicseua Waterfall (Souladeth et al. L2573) at an elevation of 634 m ([Figure 3](#)) and at Tad Xe Ponglai Waterfall (Souladeth et al. L3222

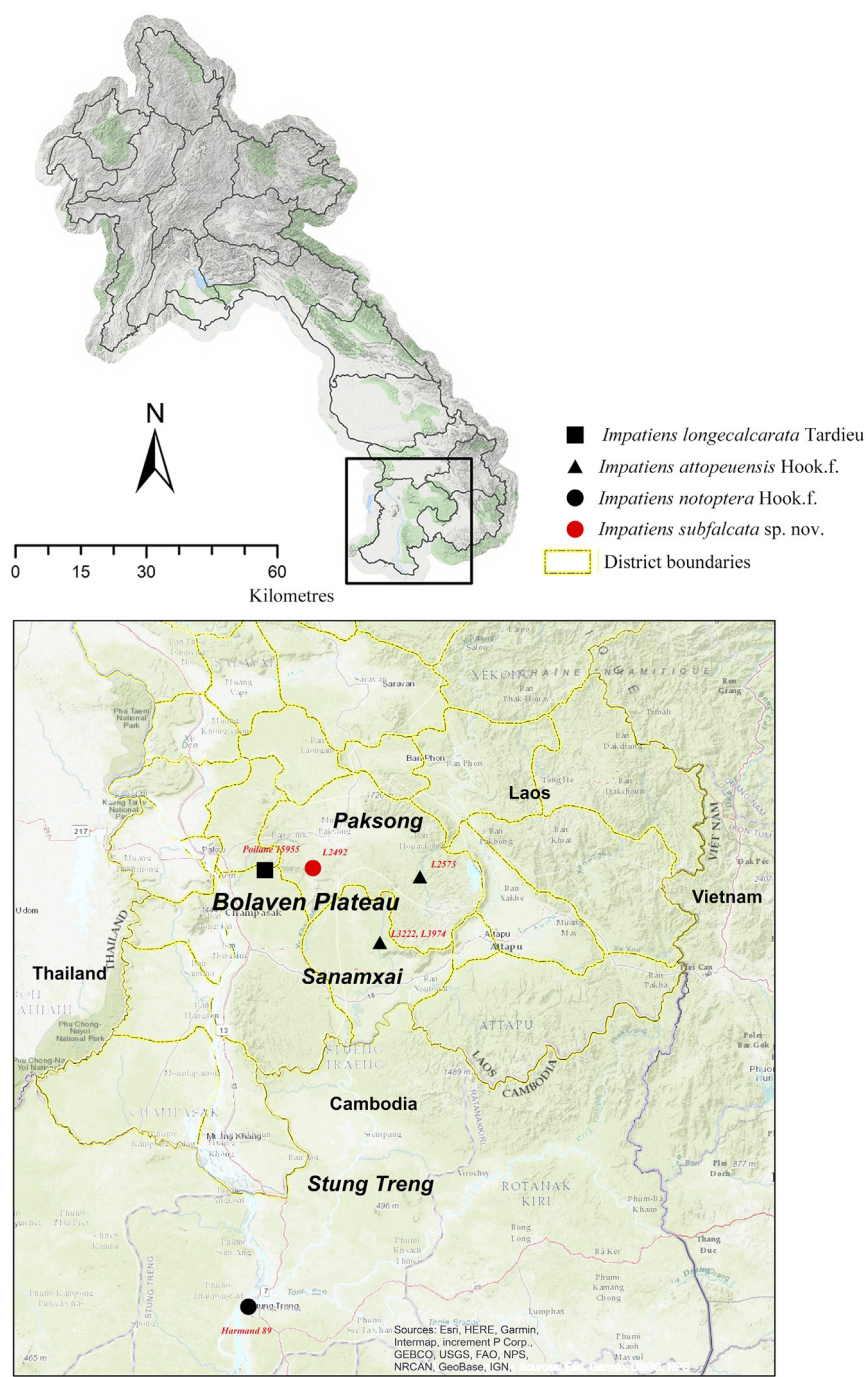


Figure 2. Distribution of *Impatiens subfalcata* and *I. attopeuensis* (including the type locality of *I. longecalcarata* and *I. notoptera*, both synonyms of *I. attopeuensis*) in Laos and Cambodia.



Figure 3. *Impatiens attopeuensis* at Tad Tayicseua Waterfall, at elevation 634 m, Champasak Province. A, Habit; B, lower leaf surface; C, flower (front view); D, flower (lateral view). All photographs from Souladeth et al. L2573. Photographs: S. Tagane.

and Souladeth et al. L3974) at 199 m (Figure 4). These collections are deposited in FOF and KAG. We conducted wide-ranging surveys in the four provinces of Attapeu, Champasak, Salavan and Sekong on the Bolaven Plateau in December 2018, February, July and December 2019, and September 2020, and never encountered *Impatiens attopeuensis* above 1000 m elevation or observed any morphological intermediates between the two species. Given this, we consider that *Impatiens subfalcata* is a distinct species. Because *Impatiens subfalcata*

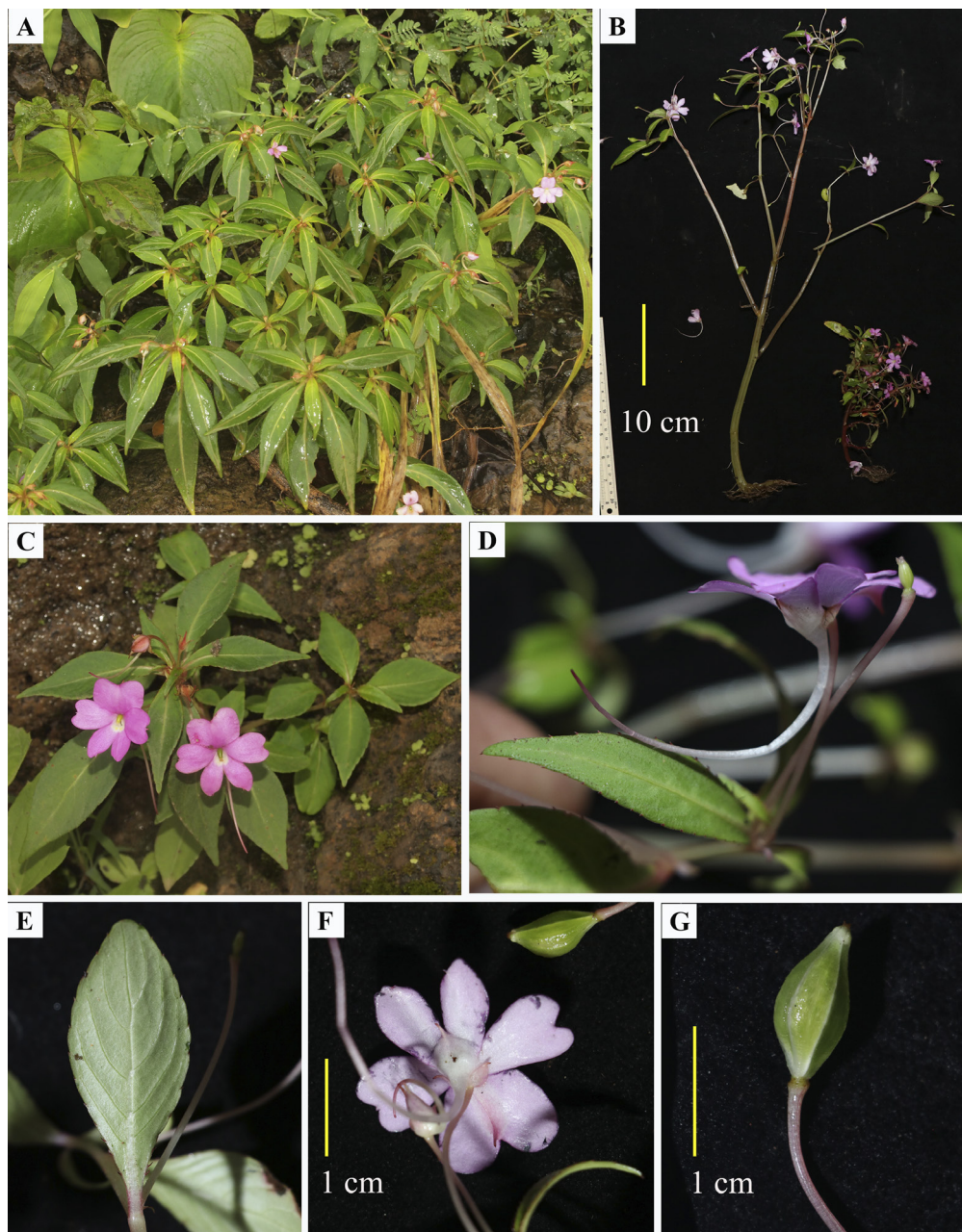


Figure 4. *Impatiens attopeuensis* (form corresponding to *I. longecalcarata*) at Tad Xe Ponglai Waterfall, at elevation 199 m, Attapeu Province. A and B, Habit; C, individual and flowers (front view); D, flower and leaf (lateral views); E, lower leaf surface; F, flower (back view); G, fruit. A and C from Souladeth et al. L3222; B and D–G from Souladeth et al. L3974. Photographs: A and C, S. Tagane; B and D–G, K. Souvannakhoummane.

is morphologically most similar to *I. attopeuensis*, it may have recently originated from it. Further phylogenetic analysis will help to clarify the relationship between these two species.

Note 2. *Impatiens subfalcata* is also similar to *I. notoptera* Hook.f. (sometimes treated as a synonym of *I. semounensis* Hook.f.), known from Stung Treng, Cambodia, but can be distinguished by its narrower leaf blades (length-to-width ratio 4.6–7.6 in *I. subfalcata* versus 1.8–2.4 in *I. notoptera*), shorter petiole (subsessile to 0.2 cm long versus 2–4 cm long), and larger lateral petals (10–12 mm long versus c.6 mm long).

Note 3. The recent infrageneric classification of *Impatiens* by Yu *et al.* (2016) divided the genus into two subgenera (subg. *Clavicarpa* S.X.Yu ex S.X.Yu & Wei Wang and subg. *Impatiens*), and further divided subgenus *Impatiens* into seven sections (sect. *Fasciculatae* X.S.Yu & Wei Wang, sect. *Impatiens*, sect. *Racemosae* Hook.f. et Thomson, sect. *Scorpioidae* S.X.Yu & Wei Wang, sect. *Semeiocardium* (Zoll.) S.X.Yu & Wei Wang, sect. *Tuberosae* S.X.Yu & Wei Wang and sect. *Uniflorae* Hook.f. & Thomson). *Impatiens subfalcata* belongs to section *Uniflorae* by its fusiform capsule, conspicuously turgid at the middle, many ovules per locule, and ellipsoid seeds.

The [Table](#) summarizes the morphological differences between *Impatiens subfalcata*, *I. attopeuensis* and *I. notoptera*.

Table. Morphological comparison between *Impatiens subfalcata*, *I. attopeuensis* and *I. notoptera*

Character	<i>I. subfalcata</i>	<i>I. attopeuensis</i> ^a	<i>I. notoptera</i> ^a
Lamina shape	Lanceolate, oblanceolate, slightly falcate	Ovate to ovate-lanceolate, symmetrical	Ovate, symmetrical
Lamina length	1.7–10.5 cm	3–5 cm	4–6 cm
Length-to-width ratio of lamina	4.6–7.6	2.1–2.8	1.8–2.4
No. of secondary veins	8–10 pairs	5–6(–7) pairs	6–8 pairs
Petiole length	Subsessile to 0.2 cm	0.5–2 cm	2–4 cm
Lateral sepals	2, ovate-triangular, 5 × 2.8 mm, acute to shortly acuminate at apex	2, ovate-circular, 7 × 7 mm, acute at apex	2, ovate-circular, c.5 × 3 mm, cuspidate at apex
Lower sepal	Navicular, 5–5.5 mm long	Navicular, 12 mm long	Navicular, 4 mm long
Spur length	2.1–2.6 cm	4–7 cm	2–2.5 cm
Dorsal petal	Transversely broadly elliptic, 6–7 mm long	Broadly obovate, 12–14 mm long	Broadly obovate-circular, c.8 mm long
Lateral petals	United, broadly obovate, 10–12 mm long	United, broadly obovate, 5 mm long	United, broadly obovate, c.6 mm long
Seeds	Ellipsoid, 2–2.8 mm long, pilose	Ellipsoid, c.2.2 mm long, short hairy	Oblong to obovoid, c.3 mm, glabrous, granulate

^a The measurements of *Impatiens attopeuensis* and *I. notoptera* are based on the published protologues (Hooker, 1908 and 1909, respectively), digitised herbarium specimens available on the web (e.g. JSTOR Global Plants, [continuously updated](#)), and our specimens of *I. attopeuensis* (i.e. Souladeth *et al.* L2573, L3222 and L3974 [FOF, KAG]).

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References

- Botany Vietnam Group. Continuously updated. Vietnam Plant Data Center. Online database. <http://www.botanyvn.com/> [Accessed 8 June 2020.]
- Chen Y-L, Akiyama S, Ohba H. 2007. Balsaminaceae. In: Wu ZY, Raven PH, Hong D-Y, editors. *Flora of China*, Volume 12 (Hippocastanaceae through Theaceae). Beijing: Science Press, and St Louis: Missouri Botanical Garden Press. pp. 43–113.
- Cho SH, Chhang P, Kim Y-D. 2016. A Checklist for the Seed Plants of Cambodia. Incheon: National Institution of Biological Resources, Ministry of Environment. 272 pp.
- Cho S-H, Kim B-Y, Park H-S, Chhang P, Kim Y-D. 2017. *Impatiens bokorensis* (Balsaminaceae), a new species from Cambodia. *PhytoKeys*. 77:33–39.
- Grey-Wilson C. 1980. *Impatiens* of Africa: Morphology, Pollination and Pollinators, Ecology, Phytogeography, Hybridisation, Keys and a Systematic Treatment of All African Species with a Note on Collecting and Cultivation. Rotterdam: Balkema.
- Grey-Wilson C. 1989. A revision of Sumatran *Impatiens*: Studies in Balsaminaceae: VIII. *Kew Bulletin*. 44(1):67–106.
- Ho PH. 2003. Balsaminaceae. In: *An Illustrated Flora of Vietnam*, vol. 2. Ho Chi Minh City: published by author. 951 pp.
- Hooker JD. 1908. *Impatiens attopuensis* Hook.f. *Hooker's Icones Plantarum*, vol. 29: t. 2853.
- Hooker JD. 1909. *Impatiens* d'Indo-Chine. In: Lecomte H, editor. *Notulae Systematicae*. Paris: Masson. pp. 10–14.
- Hooker JD. 1911. Balsaminaceae. In: Lecomte H, Gagnepain F, editors. *Flore Générale de l'Indo-Chine*, vol. 1. Paris: Masson. pp. 611–629.
- IUCN. 2012. IUCN Red List Categories and Criteria, version 3.1. IUCN Species Survival Commission. Gland, Switzerland, and Cambridge: International Union for Conservation of Nature.
- JSTOR Global Plants. Continuously updated. Electronic database. <https://plants.jstor.org/>
- Kim B-Y, Won H, Chhang P, Lim C-K, Shin J-S, Kim Y-S, Cho S-H. 2019. *Impatiens cardamomensis* (Balsaminaceae), a new species from Cambodia. *Korean Journal of Plant Taxonomy*. 49(4):319–323.
- Kress WJ, DeFilipps RA, Farr E, Kyi DYY. 2003. A Checklist of the Trees, Shrubs, Herbs, and Climbers of Myanmar (Revised from the Original Works by J. H. Lace, R. Rodger, H. G. Hundley, and U Chit Ko Ko on the "List of Trees, Shrubs, Herbs and Principal Climbers, etc. Recorded from Burma". *Contributions from the United States National Herbarium*. 45:1–590.

-
- Lu Z-C, Pan B, Huang F-Z, Liu Y. 2020. *Impatiens gongchengensis* (Balsaminaceae), a new species from Guangxi, Southern China. *Taiwania*. 65(1):1–4.
- Newman MF, Pullan M, Ketphanh S, Svengsuksa B, Thomas P, Sengdala K, Lamxay V, Armstrong K. 2017–. A Checklist of the Vascular Plants of Lao PDR. Online database. <https://padme.rbge.org.uk/laos/> [Accessed 8 June 2020.]
- Pooma R, Suddee S, editors. 2014. Tem Smitinand's Thai Plant Names, revised edition. Bangkok: The Office of the Forest Herbarium, Department of National Parks, Wildlife and Plant Conservation.
- Ruchisansakun S, Suksathan P. 2019. *Impatiens jenjittikuliae* (Balsaminaceae), a new species from Thailand. *PhytoKeys*. 124:139–147.
- Ruchisansakun S, Suksathan P, Van der Niet T, Smets EF, Lwin S, Janssens SB. 2018. *Balsaminaceae* of Myanmar. *Blumea*. 63(3):199–267.
- Shui Y-M, Janssens S, Huang S-H, Chen W-H, Yang Z-G. 2011. Three new species of *Impatiens* L. from China and Vietnam: preparation of flowers and morphology of pollen and seeds. *Systematic Botany*. 36(2):428–439.
- Tardieu BM. 1944. Les *Impatiens* d'indochine, répartition, affinités et description d'espèces nouvelles. *Notulae Systematicae, Herbarium du Muséum de Paris*. 11:169–185.
- Yu S-X, Janssens SB, Zhu X-Y, Lidén M, Gao T-G, Wang W. 2014. Phylogeny of *Impatiens* (Balsaminaceae): integrating molecular and morphological evidence into a new classification. *Cladistics*. 32(2):179–197.