

New Records of two *Impatiens* species (Balsaminaceae) and updated distribution notes on *Impatiens falcifera* in Bhutan

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Abstract: Two species of *Impatiens*, viz., *I. gamblei* Hook.f. and *I. laevigata* Wall. ex Hook.f. & Thomson, are reported here as new additions to the flora of Bhutan. Additionally, the distribution of *I. falcifera* Hook.f. in Bhutan is discussed. *Impatiens falcifera* and *I. gamblei* belong to sect. *Racemosae*, while *I. laevigata* is classified in sect. *Semeiocardium* based on four-carpellate ovary.

Keywords: Bhutan, Eastern Himalaya, section *Racemosae*, section *Semeiocardium*, taxonomy

Introduction

The genus *Impatiens* L. belongs to the family Balsaminaceae. It comprises 1107 accepted species (POWO, 2025), distributed mostly in the tropical, subtropical, and northern temperate regions (Fischer, 2004; Chen *et al.*, 2007; Mabberley, 2017). The Eastern Himalayan region is considered one of the diversity hotspots of the genus *Impatiens* (Yu *et al.*, 2015; Richard *et al.*, 2022), and many species remains undiscovered. Grey-Wilson (1991), recorded 25 species of this genus in Bhutan. Besides, recent studies on the genus have added *I. sikkimensis* Govaerts & Chakrab. (Wangchuk *et al.*, 2020), *I. darachuensis* P.Gyeltshen, W.Adamowski & Phuntsho (Gyeltshen *et al.*, 2023) and *I. pseudolaevigata* Gogoi, B.B.T.Tham & Lidén (Jamtsho *et al.*, 2023) to the flora of Bhutan. In the present study, two species, viz., *I. gamblei* Hook.f. and *I. laevigata* Wall. ex Hook.f. & Thomson, are reported here as new additions to the flora of Bhutan.

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Materials and Methods

Numerous field surveys and trips were conducted between January 2022 and October 2024 with the objectives of assessing and gathering information on the distribution, diversity of native plant species, collecting plant specimens from unexplored areas of the districts, and studying the taxonomy of unreported species for conservation in Bhutan. Field data, including morphological characteristics, geographic information, specimens, and other ecological data were collected. The specimens were deposited in the THIM. The identities of the *Impatiens* species were determined using the Flora of Bhutan (Grey-Wilson, 1991) and other literatures (Hooker, 1903, 1905, 1910; Akiyama & Ohba, 2000, 2015; Gogoi *et al.*, 2013, 2018, 2021; Akiyama, 2021), as well as specimens housed at herbaria CAL, K, PE, and THIM. Detailed descriptions, distribution, habitat and ecology, and notes for all three species along with colour photographs are provided.

Taxonomic Treatment

Impatiens falcifera Hook.f., Bot. Mag. 129: t. 7923. 1903; Hara in Hara & Williams (eds.), Enum. Fl. Pl. Nepal 2: 78. 1979; Akiyama *et al.* in Ohba & Malla (eds.), Himal. Pl. 2: 72. 1991. Grey-Wilson in Grierson & Long (eds.), Fl. Bhutan 2(1): 95. 1991; Chen, Akiyama & Ohba in Wu, P.H.Raven & Hong (eds.), Fl. China 12: 83. 2007; Gogoi, Sherpa & Rai, Wild Balsams Darjeeling

Sikkim Himalaya 118. 2021. *Lectotype* (designated by Akiyama, 2021): INDIA, **Sikkim**, 2438–3048 m, 31.07.1849, *J.D. Hooker s.n.* (K [K000694739 digital image!]).

Fig. 1

Annual herbs, 10–30 cm tall. Stems erect or with procumbent branches, glabrous. Leaves alternate, petioles up to 8 mm long, sometimes with 2 globose extra-floral nectaries; lamina elliptic or ovate, 1–4.5 × 0.5–1.5 cm, ciliate at base, base cuneate to attenuate, margin sharply serrate, apex acute or

acuminate, lateral veins 6–8 pairs. Inflorescences axillary, 1 or 2-flowered; peduncles 1–1.5 cm long, glabrous; pedicels short, up to 1 cm long; bracts narrowly lanceolate, *c.* 3 mm long, small projection below the bract. Flowers spreading, yellow, red-spotted, 1.8–2 cm deep; lateral sepals 2, ovate, apex mucronate, green; lower sepal navicular, constricted into inward spur, *c.* 8 × *c.* 5 mm (excluding spur); spur 1.3–2 cm long; dorsal petal broadly ovate to suborbicular, *c.* 1.0–1.2

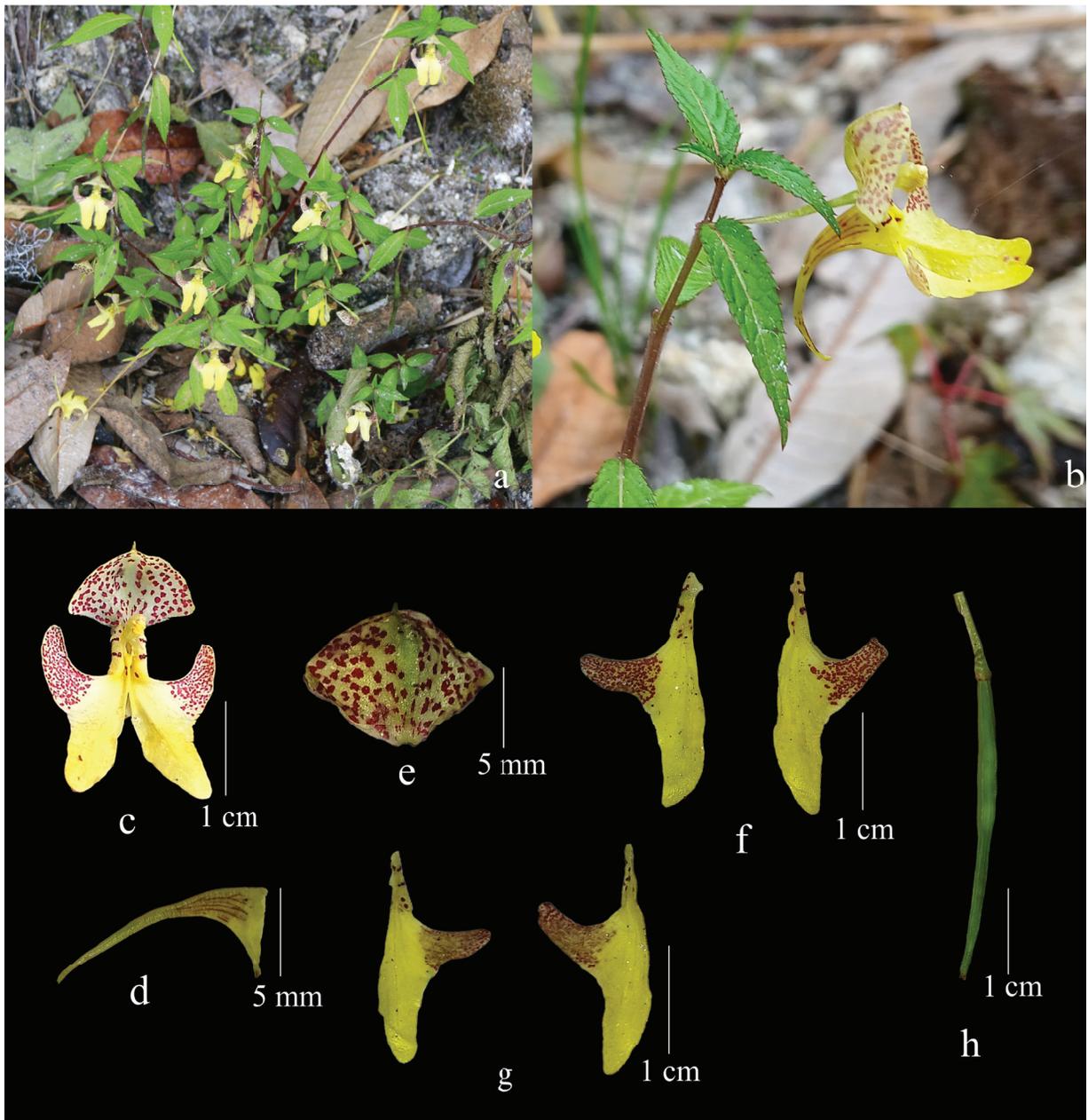


Fig. 1. *Impatiens falcifera* Hook.f.: **a.** Plant in-situ; **b.** Plant with flower; **c.** Flower–front view; **d.** Lower sepal–side view; **e.** Dorsal petal–ventral view; **f.** Lateral united petals–dorsal view; **g.** Lateral united petals–central view; **h.** Capsule (Photos by K. Tobgay).

× 1 cm, apex mucronate, crest oblong; lateral united petals clawed, 1.5–2 cm long, 2-lobed; upper lobule ovate to ovate-oblong, c. 10 × c. 5 mm, falcate, apex rounded; lower lobule, bilobed, oblong, c. 8 × 5 mm, apex rounded, auricle absent. Staminal filaments linear, c. 5 mm long; anthers small. Capsule linear, 2–4 cm long, glabrous; seeds ovoid, c. 2 × c. 1 mm, glabrous.

Flowering & fruiting: Flowering and fruiting in June to November.

Habitat & ecology: *Impatiens falcifera* grows in the hills at mid-elevations to sub-alpine regions between 2500–3400 m (Akiyama, 2021) in Nepal, and between 2007–3600 m elevations in China (Chen *et al.*, 2023). It is found in the temperate to sub-alpine zones, among *Rhododendron* scrub, on mossy rocks, and in disturbed and moist roadside areas in Darjeeling and Sikkim regions of India, at elevations between 2500–3400 m (Gogoi *et al.*, 2021). In Bhutan, the plant is found along the stream bank on sandy soil in conifer forest at 2968 m elevation.

Distribution: China (Sichuan & Tibet), India (Darjeeling & Sikkim), Nepal and Bhutan (Trashigang district; reported here).

Specimens examined: BHUTAN. **Trashigang District**, Sakteng Block, Takthri, 2968 m elev., 27° 24' 55.44" N, 91° 54' 28.44" E, 20.09.2024, P. Gyeltshen & K. Tobgay 365 (THIM20059!) *ibid.*, 20.09.2024, P. Gyeltshen & K. Tobgay 365 (THIM20060!).

Notes: Grey-Wilson (1991) included this species in the flora of Bhutan based on its occurrence in other eastern Himalayan regions, such as Darjeeling and Sikkim in India. Although, the species has been cited in subsequent literature and regional floras (Chen *et al.*, 2007; Akiyama, 2021; Gogoi *et al.*, 2021), no concrete evidence has confirmed the presence of *I. falcifera* in Bhutan. Our recent collection from Samdrup Jongkhar district represents the first authentic record of *I. falcifera* from the country.

Impatiens falcifera can be distinguished from other known species in Bhutan by a bilobed lower lobe of lateral united petals with a falcate upper lobule (Grey-Wilson, 1991; Akiyama, 2021). This species is classified under *Impatiens* sect. *Racemosae* Hook.f. et Thomson (Yu *et al.*, 2015) due to its racemose inflorescence, two lateral sepals, linear capsules, and ovoid seeds. Other studies have suggested that the position of the bract in the inflorescence as an important characteristic for distinguishing the species (Akiyama & Ohba, 2000; Chen *et al.*, 2007). A bract at the base of the pedicel and a small hair-like projection below the bract have been observed in *I. falcifera*.

Impatiens gamblei Hook.f., Rec. Bot. Surv. India 4: 15. 1905; Gogoi, Sherpa & Rai, Wild Balsams Darjeeling Sikkim Himalaya 118. 2021. *Lectotype* (designated by Akiyama & Ohba, 2015): INDIA, **Sikkim**, Sandukpho, 3505 m, September 1880, J.S. Gamble 8423 (K [K000694669 digital image!]). **Fig. 2**

Perennial herbs, 9–22 cm tall. Stems terete, 1 to 2 branched, glabrous. Leaves alternate, crowded at the apex of stem; petiole 2–5 mm long, glabrous; blade elliptic, 2–3 × 1–1.5 cm, base attenuate or cuneate, margins crenate with teeth shortly appendaged, apex acute, dark green above, pale green below, secondary veins 3–6 paired. Inflorescence 1–2 flowered; peduncle slender, up to 4 cm long. Bracts ovate, 3–4 × 1.8–2 mm, apex acute, green or purple. Flowers purple, c. 3.5 cm long, c. 2.5 cm deep; pedicels 4–7 mm long. Lateral sepals 4 (in 2 pairs), outer pair ovate, 9–10 × 4–5 mm, apex acuminate, green with purple tinge; inner sepals narrowly lanceolate, c. 2 × c. 1 mm, minute, white; lower sepal bucciniform c. 2.5 cm deep, gradually constricted into incurved spur, c. 1.3 cm wide, apex beaked; spur c. 8 mm long, apex bilobed. Dorsal petal sub-orbicular, 1.3–1.5 × 1.7–2.0 cm, apex rounded, crest oblong; lateral united petals purple with white base, 2-lobed; upper lobes oblong or obovate, 12–13 × 7–9 mm; lower lobes oblong-dolabriform, 24–27 × 7–9 mm, apex acuminate. Stamens white surrounding

the gynoecium, and anthers without appendage. Ovary c. 5 mm long. Capsules not observed.

Flowering & fruiting: Flowering from July to September; fruiting not observed.

Habitat & ecology: *Impatiens gamblei* grows in open moist areas along the roadside in temperate and coniferous forest margins. In Nepal, it is found between 2640–4360 m elevations (Akiyama & Ohba, 2015; Raskoti & Ale, 2022), in Sikkim and Darjeeling (India) between 2200–3970 m

(Akiyama & Ohba, 2015, Gogoi *et al.*, 2018) and 2400–3600 m in Tibet (Chen *et al.*, 2023). In Bhutan, it is found alongside the road clearing in the cool broadleaved forest at 2470 m elevation.

Distribution: China (Tibet), India (Darjeeling & Sikkim), Nepal and Bhutan (Haa district; reported here).

Specimens examined: BHUTAN, **Haa District**, Below Tergola, 2470 m, 27° 9' 21.6" N, 89° 11' 29.76" E, 09.10.2024, P. Gyeltshen, Phuentsho & K. Tobgay 330 (THIM, [THIM23386!]).



Fig. 2. *Impatiens gamblei* Hook.f.: **a.** Plant in-situ; **b.** Leaf–dorsal view; **c.** Flower bud–lateral view; **d.** Flower–front view; **e.** Flower–lateral view; **f&g.** Lateral sepals–ventral view; **h.** Lower sepal; **i.** Dorsal petal–ventral view; **j.** Dorsal petal–dorsal view; **k&l.** Lateral united petals–dorsal view (Photos by P. Gyeltshen).

Notes. Akiyama and Ohba (2015) recognized type 2b pendulous racemose inflorescence in *Impatiens gamblei* with bracts at the base of pedicels. However, specimens from Bhutan bears solitary flower accompanied by a minute projection at the opposite side of the bract (Fig. 2e). They distinguished *I. gamblei* from other species in *Impatiens* section *Urticifoliae* S.Akiyama & H.Ohba in Nepal based on its lower sepal, which lacks beak at the oblique mouth, and its spur, which is curved downward or incurved forward. However, *I. gamblei* from India (Plate 12.1g in Gogoi *et al.*, 2021) and Bhutan (Fig. 2h) shows a beak on the lower sepal, makes difficult to separate from other species in the section based on the presence or absence of a beak. Recent molecular studies have placed *I. urticifolia* Wall., the type of the sect. *Urticifoliae*, sensu Akiyama and Ohba (2015) into *Impatiens* sect. *Racemosae* (Yu *et al.*, 2015). Therefore, *I. gamblei* can be assigned under sect. *Racemosae* due to the presence of racemose inflorescence (rarely solitary), two lateral sepals (rarely four), linear capsules, and ovoid seeds.

Impatiens laevigata Wall. ex Hook.f. & Thomson, J. Proc. Linn. Soc., Bot. 4(15): 146. 1859; Hook.f., Fl. Brit. India 1: 473. 1875; Hook.f., Rec. Bot. Surv. India 4(2): 30. 1905; Hook.f., Bull. Misc. Inform. Kew 1910: 299. 1910. *Lectotype* (designated by Ruchisansakun *et al.*, 2018): BANGLADESH, Sylhet (Sillet), October 1820, *F.D. Silva* 326 (Wall. Cat. no. 4753) (K [K000694815 digital image!]) **Fig. 3**

Perennial herbs, up to 70 cm tall. Stems terete, rough, succulent, lower portion woody, green, glabrous. Leaves alternate, crowded together at the apex of stem; petiole 1.5–3 cm long; lamina elliptic or oblanceolate, 6.5–14 × 4–8.5 cm, base attenuate or cuneate, margins crenate with teeth shortly appendaged, apex acute to acuminate, dark green above, pale green below, secondary veins 5–7 pairs, raised on lower side. Inflorescence axillary, subumbellate, 1–3-flowered; peduncles slender, 0.7–1.5 cm long. Bracts ovate, 3–4 × 2–3 mm, apex acute, green. Flower yellowish white,

tinged with red, c. 2 cm long, c. 3.8 cm deep; pedicels 1.6–2 cm long. Sepals 4, outer two ovate, 9–10 × 6–7 mm, pale yellow, margin entire, apex acuminate; inner two linear-oblong, 1.6–2 × 0.2–0.3 cm, falcate, pale yellow at apex and white towards base. Dorsal petal obovate, 1.5–1.6 × 1.8–2.0 cm, base truncate, apex cuspidate, yellowish-white, crest triangular, small; lateral united petal pinkish yellow, 2-lobed; basal lobe oblong or suborbicular, 1.2–1.3 × 0.5–0.6 cm; distal lobes obovate 1.1–1.2 × 0.5–0.6 cm, apex slightly emarginate or 2-lobed, streaked with red lines, auricle reflexed; lower sepal bucciniform c. 3.3 cm long (including spur), c. 1.7 cm wide, constricted into incurved spur, yellow with or without red nerves inside; spur, c. 2 cm long, apex swollen, rounded, yellow, glabrous. Stamens 5; connate, surrounding the gynoecium; filaments 6–8 mm long, narrow at the base and broader at the apex, free in the middle; anthers 3–4.5 mm long, white, apex without appendage. Ovary 6–8 mm long, 4-locular. Capsules not observed.

Flowering & fruiting: Flowering from November to January; fruiting not observed.

Habitat & ecology: *Impatiens laevigata* grows in the subtropical forest at an elevation range of 1000–1500 m (Raskoti & Ale, 2022) and shady areas in evergreen forest between 400–1600 m (Ruchisansakun *et al.*, 2018). It grows between 197–1440 m elevations in India (Gogoi *et al.*, 2013; Pandey *et al.*, 2020), and in shady and wet areas near water bodies in Bangladesh (Sultana *et al.*, 2022). In Bhutan, it is found at around 390 m elevation in the subtropical forest in Samdrup Jongkhar district. The associated species are *Achyrospermum densiflorum* Blume, *Amorphophallus bulbifer* (Schott) Blume, *I. tripetala* Roxb. ex DC., *Strobilanthes hamiltoniana* (Steud.) Bosser & Heine and *Begonia* sp.

Distribution: Bangladesh, India (Arunachal Pradesh, Assam, Manipur, Meghalaya), Nepal, Myanmar, and Bhutan (Samdrup Jongkhar district; reported here).

Specimen examined: BHUTAN, Samdrup Jongkhar District, Chummey Block, Jampani area, 394 m elev., 11.11.2023, P. Gyeltshen & P. Tobgay 97 (THIM, [THIM22520!]).

Notes: *Impatiens laevigata* Wall. ex Hook.f. & Thomson var. *grandifolia* Hook.f. is characterized by oblong bracts (Gogoi *et al.*, 2013; Pandey *et al.*, 2020), whereas *I. laevigata* Wall. ex Hook.f. & Thomson var. *laevigata* possesses ovate bracts or ovate to ovate-lanceolate bracts (Gogoi *et al.*, 2013,

2017; Ruchisansakun *et al.*, 2018). Interestingly, *I. laevigata* from Bhutan displays both oblong and ovate bracts (Fig. 3d–f). Besides, the inner sepals of the specimens of *I. laevigata* from Bhutan are similar to the species found in India and Thailand (Gogoi *et al.*, 2013; Ruchisansakun *et al.*, 2018), but differ in having ovate outer sepals (vs sub-ovate to orbicular in India (Gogoi *et al.*, 2013)). The dorsal petal of *I. laevigata* var. *grandifolia* is reniform (Gogoi *et al.*, 2013, figs. 2i & 2j), consistent with the type description, but not obovate (Gogoi *et al.*, 2017). In



Fig. 2. *Impatiens laevigata* Wall. ex Hook.f. & Thomson: **a.** Plant in-situ; **b.** Flower–front view; **c.** Flower–lateral view; **d–f.** bracts–ventral view; **g.** Outer lateral sepal–ventral view; **h.** Inner lateral sepals–ventral view; **i.** Lower sepal–lateral view; **j.** Dorsal petal–dorsal view; **k.** Lateral united petals–ventral view; **l.** Lateral united petals–dorsal view; **m.** Stamens covering ovary (Photos by P. Tobgay).

contrast, specimens from Bhutan exhibit a flabellate dorsal petal (Fig. 1e). For *I. laevigata* var. *laevigata*, the dorsal petal is broadly elliptic to broadly obovate (Ruchisansakun *et al.*, 2018, fig. 7g) but not reniform (Gogoi *et al.*, 2013, fig. 1k). Additionally, the crest on the dorsal petal is highly variable for *I. laevigata*. Given these overlapping morphological traits, we refrain from assigning the present species to an infraspecific rank. Further studies are needed to clarify the ecological distinctions between the two infraspecific taxa. Based on the presence of a 4-carpellate ovary, this species is classified under *Impatiens* sect. *Semeiocardium* (Zoll.) S.X. Yu & Wei Wang (Yu *et al.*, 2015; Ruchisansakun *et al.*, 2018).

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