

## IMPATIENS DARACHUENSIS (BALSAMINACEAE), A NEW SPECIES FROM BHUTAN HIMALAYA

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*Impatiens darachuensis*, a new species from Sarpang district in southern Bhutan, is described and illustrated. Detailed photographs of plants and dissected flowers are provided, as is information on phenology, distribution, habitat and ecology. The new species is assessed as Endangered using IUCN categories and criteria.

**Keywords.** Balsaminaceae, Bhutan, conservation status, endangered, new species, taxonomy  
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### Introduction

The genus *Impatiens* L. in the family Balsaminaceae comprises more than 1000 species, distributed mostly in the tropical, subtropical and northern temperate regions of the world (Fischer, 2004; Chen *et al.*, 2007). Eastern to Central Himalaya is one of the global hotspots for *Impatiens* (Souladeth *et al.*, 2021). Bhutan, a part of eastern Himalaya, is home to 25 species of the genus (Grey-Wilson, 1991; Akiyama *et al.*, 1992), which are mostly distributed in the subtropical broadleaved and temperate forests, with a few species extending to coniferous forests.

Considering the richness of *Impatiens* species in the neighbouring areas (43 in Nepal, Shrestha *et al.*, 2022; 43 in Sikkim and Darjeeling Himalaya, Gogoi *et al.*, 2021; and 58 in Arunachal Pradesh, Gogoi *et al.*, 2018), this current figure is likely to be an underestimate for Bhutan, which provides many suitable habitats, and therefore it is likely that many species await to be reported from the country. However, no studies of *Impatiens* from Bhutan had been conducted for several decades until the recent record of *I. sikkimensis* Govaerts & Chakrab. was published by Wangchuk *et al.* (2020) and *I. pseudolaevigata* Gogoi, B.B.T.Tham & Lidén by Jamtsho *et al.* (forthcoming).

In September 2018, the first author observed an interesting *Impatiens* species from Darachu, Sarpang district, in southern Bhutan. Unfortunately, at the time, all flowers were in bud and field details could not be collected. In October 2020, the same location was revisited and fertile material was collected, photograph were taken and detailed field notes were made. Despite study of this material, a review of relevant literature (Hooker, 1875,

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1904–1906, 1910; Grey-Wilson, 1989, 1991; Akiyama & Ohba, 2000; Chen *et al.*, 2007; Akiyama & Ohba, 2015; Gogoi *et al.*, 2018; Ruchisansakun *et al.*, 2018; Gogoi *et al.*, 2019, 2020), and examination of online images of herbarium specimens at CAL, E, K, NY and THIM (herbarium codes follow Thiers, [continuously updated](#)), it could not be placed in a previously described species.

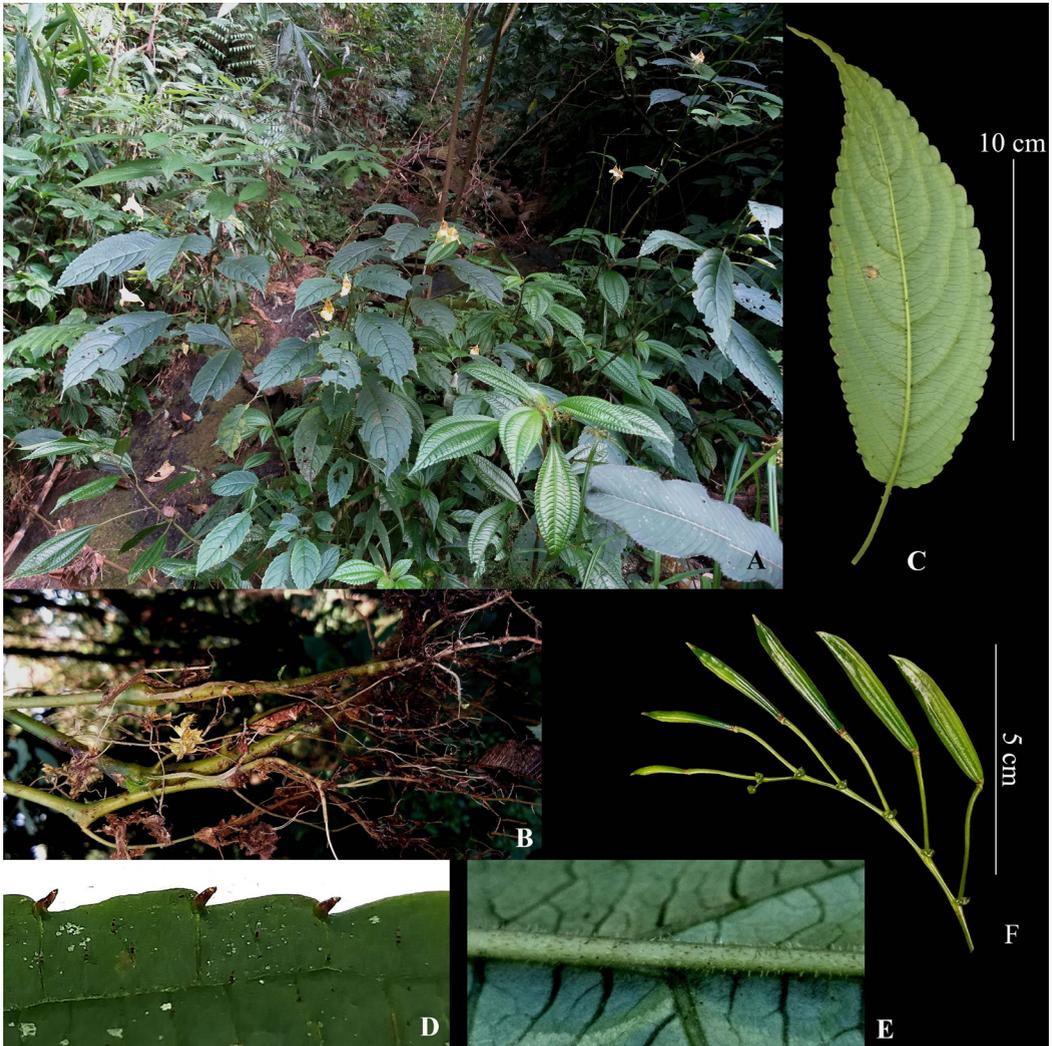
The material is thus here described as representing a species new to science. A full description, information on distribution and ecology, notes highlighting morphological differences from closely related species, and a provisional IUCN conservation status are given. A taxonomic key to all allied species in the region (*Impatiens bakthangensis* Chhetri, Sherpa & Gogoi, *I. cathcartii* Hook.f., *I. discolor* DC., *I. duclouxii* Hook.f., *I. jurpia* Buch.-Ham. ex Hook.f. & Thomson, *I. laevigata* Wall. ex Hook.f. & Thomson and *I. pseudolaevigata*) is also provided, along with colour photographs.

### Taxonomic treatment

***Impatiens darachuensis*** P.Gyeltshen, W.Adamowski & Phuntsho, *sp. nov.*

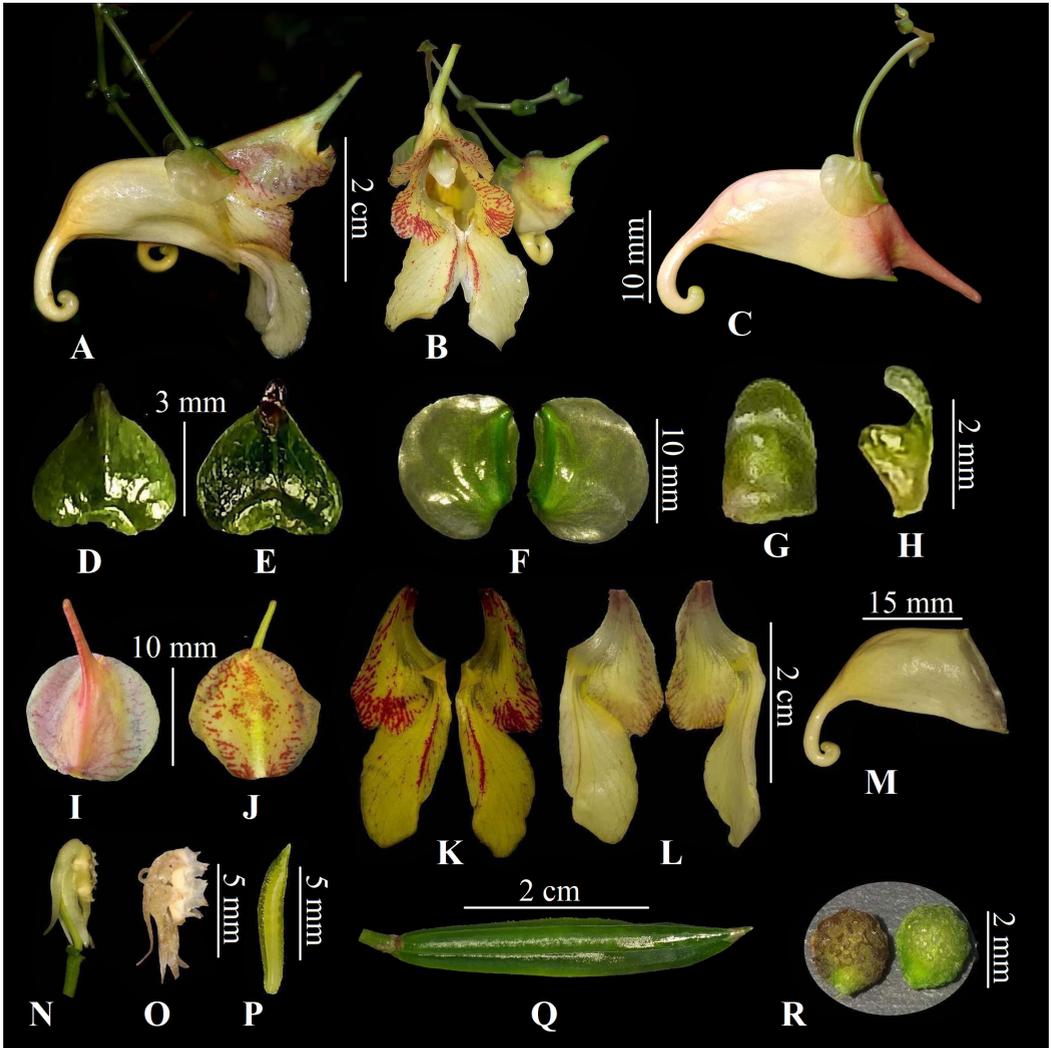
*Impatiens darachuensis* is most similar to *I. duclouxii* and *I. cathcartii* in having scorpioid cyme, but it is distinguished from *I. duclouxii* by its larger habit, longer peduncle (30–50 mm vs 25 mm), 3–9 flowers per inflorescence (vs 3–6), crenate leaf margins (vs coarsely serrate), longer capsule (30–36 mm vs 15–25 mm), 4 lateral sepals (vs 2 lateral sepals), and inner lateral sepals oblong (vs absent) with a prominent crest on the basal part. It differs from *Impatiens cathcartii* in its hairy leaf surface especially on veins (vs glabrous), 4 lateral sepals (vs 2), shorter peduncle (30–50 mm vs 40–60(–100) mm), and subfusiform capsule (vs cylindrical). It is also similar to *Impatiens jurpia* and *I. discolor* in having a bucciniform lower sepal but differs from those species by its subscorpioid cyme, 4 lateral sepals, subfusiform capsule, and oblong inner lateral sepals. – Type: Bhutan, Sarpang, Darachu area, 1700–1950 m elevation, 20 ii 2020, P. Gyeltshen 35 (holotype THIM!, isotype THIM!). Figures 1, 2, 3.

Terrestrial, erect perennial herbs, 30–200 cm tall. Roots densely puberulent, pale green to pale greenish white. Underground stems pale green, glabrous, nodes swollen. Aerial stems single, branched at base to halfway up the stem, terete, woody at base, not winged, green, pale green or pale purplish at distal portions, glabrous, nodes swollen. Leaves alternate, laxly arranged on the upper half of the stem; petioles slender, 1.5–7 cm long, sometimes with a pair of glands just below the lamina, pale green, glabrous; lamina ovate-lanceolate to ovate-elliptic, 8–19 × 3.5–7.5 cm, base oblique, obtuse or rounded, apex acuminate or caudate-acuminate, margin crenate with thick setae, abaxially pale green, glabrous with sparse hairs on midrib and lateral veins, adaxially dark green sparsely hairy, midvein and lateral veins prominent ventrally, dorsally depressed, with 8–10 veins on each side of the midvein. Inflorescence subscorpioid cyme, terminal or axillary, 3- to 9-flowered; peduncle

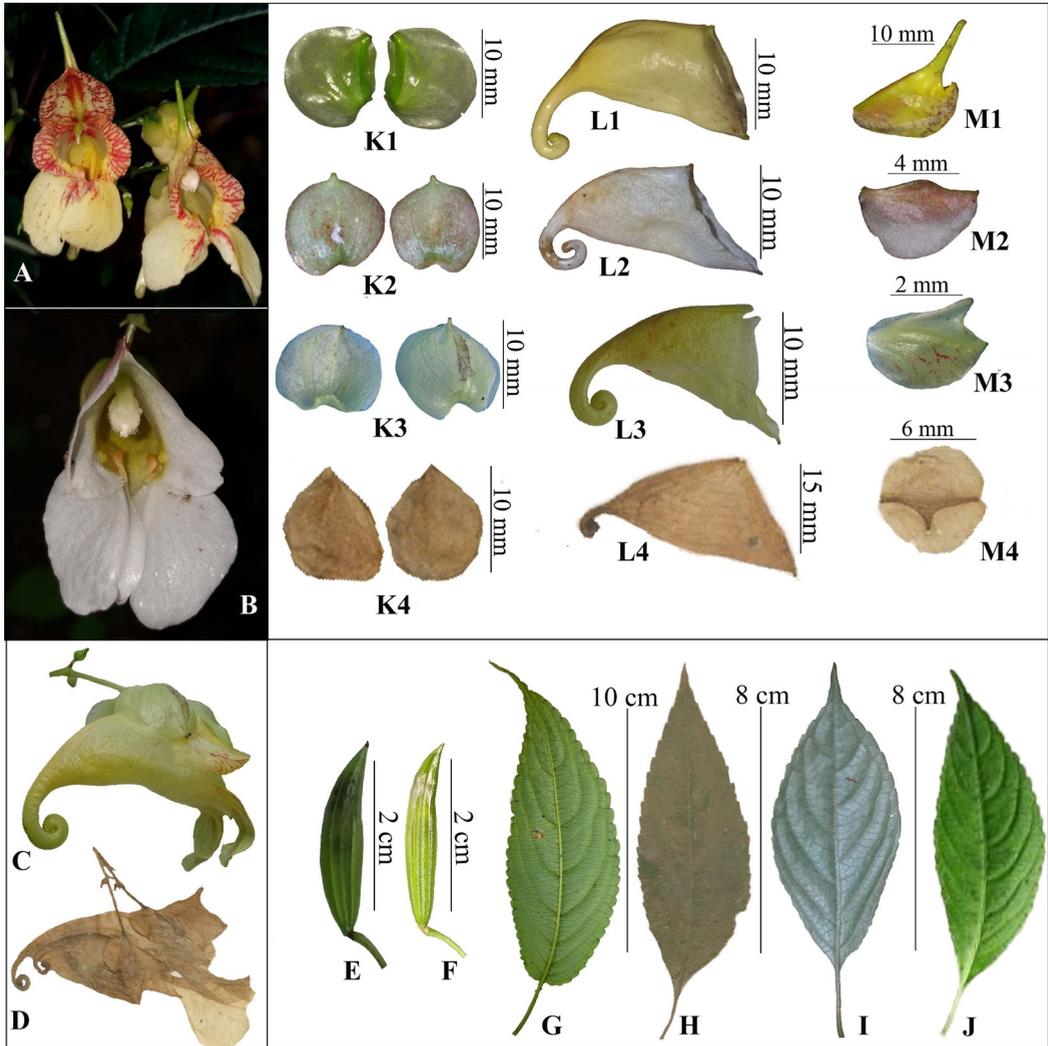


**Figure 1.** *Impatiens darachuensis* P.Gyeltshen, W.Adamowski & Phuntsho, sp. nov. A, Habit; B, underground stems with roots; C, abaxial surface of leaf blade; D, close-up of adaxial surface of leaf blade, showing margin, setae and hairs; E, close-up of middle section of abaxial surface of leaf blade, showing midrib with hairs; F, infructescence with capsules. Photographs: P. Gyeltshen.

3–5 cm long, green, glabrous, with 2–5 superfluous bracts below the lowest flower; bracts flat, deltoid, 2.5–4 × 3.5–4 mm, glabrous, green, margins entire, apex mucronate, swollen. *Flowers* 4–4.2 cm deep, 5.4–5.6 cm long, yellow or creamy, bud tinged with reddish striations; pedicel 10–23 mm long, green, glabrous. *Lateral sepals* 4, outer lateral sepals obliquely suborbicular, 10–11 × 9–10 mm, apex swollen mucronate, margin entire, semitransparent, pale greenish white, glabrous, midrib at extreme inner position, prominent,



**Figure 2.** *Impatiens darachuensis* P.Gyeltshen, W.Adamowski & Phuntsho, sp. nov. A and B, Inflorescences with flowers (lateral and front views, respectively); C, flower bud (lateral view); D and E, bracts (abaxial and adaxial surface views, respectively); F, outer lateral sepals (abaxial surface view); G and H, inner lateral sepal (abaxial surface and lateral views, respectively); I and J, dorsal petal (abaxial and adaxial surface views, respectively); K and L, lateral united petals (adaxial and abaxial surface views, respectively); M, lower sepal with spur (lateral view); N, androecium surrounding gynoecium (lateral view); O, androecium (lateral view); P, pistil; Q, capsule; R, seeds. All photographs of P. Gyeltshen 35, taken by P. Gyeltshen.



**Figure 3.** *Impatiens darachuensis* P.Gyeltshen, W.Adamowski & Phuntsho, sp. nov.: A, flowers (front view); F, capsule; G, leaf (abaxial surface); K1, outer lateral sepals (ventral view); L1, lower sepal (lateral view); M1, dorsal petal (lateral view). *Impatiens discolor*: B, flower (front view); I, leaf (abaxial surface); K2, outer lateral sepals (ventral view); L2, lower sepal (lateral view); M2, dorsal petal (lateral view). *Impatiens bakthangensis*: C, flower (lateral view); E, capsule; J, leaf (adaxial surface); K3, outer lateral sepals (ventral view); L3, lower sepal (lateral view); M3, dorsal petal (lateral view). *Impatiens duclouxii*: D, flower (lateral view); H, leaf (adaxial surface); K4, outer lateral sepals (ventral view); L4, lower sepal (lateral view); M4, dorsal petal (ventral view); dorsal petal (lateral view). Photographs: A, B, F, G, I, K1, K2, L1, L2, M1 and M2: P. Gyeltshen; C, E, J, K3, L3 and M3: R. Gogoi; D and K4, NY00387525 © The New York Botanical Garden; H, L4 and M4, K000694006 and K000694008, respectively, © The Board of Trustees of the Royal Botanic Gardens, Kew.

thick; inner lateral sepals minute, oblong, with prominent crest in basal part, pale greenish yellow, glabrous,  $1.8\text{--}2 \times 0.8\text{--}1$  mm, apex rounded. *Lower sepal* bucciniform, 22–25 mm long, tube 12–15 mm wide (excluding spur), abruptly constricted into short deep incurved spur, yellow with or without red nerves inside, spur deeply incurved at apex, 13–17 mm long, apex obtuse, pale yellow, glabrous. *Dorsal petal* slightly cucullate, suborbicular,  $12\text{--}15 \times 15\text{--}16$  mm when flattened, base rounded, apex retuse, margins entire, yellow with reddish nerves ventrally, glabrous horn-like keel on adaxial side, 12–13 mm long, apex acute. *Lateral united petals* 30–36 mm long, 2-lobed; basal lobe obovate or suborbicular,  $17\text{--}18 \times 17\text{--}18$  mm, apex emarginate to obtuse, yellow with reddish streaks, glabrous; distal lobe dolabriform,  $19\text{--}21 \times 9\text{--}10$  mm, apex obtuse to abruptly lobed, yellow with reddish nerves; dorsal auricle triangular,  $3.5 \times 3$  mm, apex broadly acute, yellow. *Androecium*  $c.5\text{--}10 \times 2.5\text{--}3$  mm, curved towards the apex, stamens 5, connate, surrounding the gynoecium, filaments  $c.5\text{--}10$  mm long, narrow at the base and broader at the apex, free in the middle, anthers  $c.3.8\text{--}5$  mm long, apex cuspidate, white. *Pistil*  $c.1$  cm long. *Capsule* long, subfusiform,  $30\text{--}36 \times 4.5\text{--}5$  mm, slightly curved, green, glabrous, seeds numerous, spherical,  $c.2 \times 1.5$  mm, surface warted, brown.

*Distribution.* Darachu, Sarpang district, Bhutan (known only from the type locality).

*Habitat and ecology.* *Impatiens darachuensis* grows in semi-moist areas along the roadside at elevations ranging from 1700 to 1920 m in the warm broadleaved forest. Flowering and fruiting from October to November. The associated species are *Aster verticillatus* (Reinw.) Brouillet, Semple & Y.L.Chen, *Begonia annulata* K.Koch, *Craniotome furcate* (Link) Kuntze, *Diplazium javanicum* Makino, *Girardinia diversifolia* (Link) Friis, *Gonostegia triandra* (Blume) Miq., *Hydrangea febrifuga* (Lour.) Y.De Smet & C.Granados, *Hydrocotyle himalaica* P.K.Mukh., *Impatiens stenantha* Hook.f., *Koenigia mollis* (D.Don) T.M.Schust. & Reveal, *Lobelia montana* Reinw. ex Blume, *Melissa axillaris* (Benth.) Bakh.f., *Persicaria chinensis* (L.) H.Gross, *Ranunculus cantoniensis* DC., *Rubus acuminatus* Sm., *Rubus paniculatus* Sm., *Strobilanthes helicta* T.Anderson, *Carex* sp., *Dennstaedtia* sp., *Elatostema* spp. *Microlepia* sp. and *Pilea* spp. (see [Figure 1A](#)).

*Etymology.* The specific epithet, *darachuensis*, refers the type locality in Darachu forest, Sarpang.

*Proposed IUCN conservation category.* *Impatiens darachuensis* is known only from Darachu in the Sarpang district of Bhutan. We observed fewer than 60 mature individuals at two locations, and the area of occupancy is approximately less than 10 km<sup>2</sup>. It is expected that this species may occur in intermediate areas, but so far, no more populations have been observed. The species is under serious threat of extinction due to road maintenance and clearing of plants within the road buffers. The widening of the roads in the near future may lead to loss of its natural habitat. Following IUCN guidelines (IUCN Standards and Petitions Committee, 2022), we assess *Impatiens darachuensis* as Endangered [EN B2ab(iii,iv,v); C2a(i); D].

Notes. The key morphological differences between the new species, *Impatiens darachuensis*, and *I. cathcartii*, *I. discolor*, *I. duclouxii* and *I. jurpia* are summarised in the [Table](#). The terminology followed in the species description follows Ruchisansakun *et al.* (2018).

Based on the results of molecular and morphological analyses of the genus, Yu *et al.* (2015) recognised a subclade 'F' (sect. *Scorpioidae*) characterised by subscorpioid cymes, concave bracts, long and bent (sub)fusiform capsules, and a minutely warted seed coat ornamentation. *Impatiens darachuensis* shares the majority of these features (Figures 1F, 2Q; [Table](#)). The other known species in sect. *Scorpioidae* are *Impatiens conchibracteata* Y.L.Chen & Y.Q.Lu, *I. duclouxii*, *I. hunanensis* Y.L.Chen and *I. rubro-striata* Hook.f., which occur further to the east in Northeast India, Myanmar, southern China and Thailand (Chen *et al.*, 2007; Gogoi *et al.*, 2018; Ruchisansakun *et al.*, 2018).

**Table.** Diagnostic morphological differences between *Impatiens darachuensis* P.Gyeltshen, W.Adamowski & Phuntsho, sp. nov., and *I. cathcartii*, *I. discolor*, *I. duclouxii* and *I. jurpia*

Character	<i>I. darachuensis</i>	<i>I. cathcartii</i>	<i>I. discolor</i>	<i>I. duclouxii</i>	<i>I. jurpia</i>
Habit	Erect, 30–200 cm tall	Erect, 30–180 cm tall	Suberect or decumbent, 15–60 cm tall	Erect, 20–100 cm tall	Erect, up to 60 cm tall
Petiole length	15–70 mm	15–55 mm	8–35 mm	24–55 mm	15–90 mm
Leaf margin	Crenate	Crenate	Shallowly crenate	Coarsely serrate	shallowly crenate
Leaf surface	Sparse hairs on veins	Glabrous	Scabrid on veins or nearly glabrous	Abaxially glabrous, adaxially sparsely strigose	Scabrid on veins or nearly glabrous
Inflorescence	Subscorpioid cyme, terminal or axillary, 3- to 9-flowered	Subscorpioid cyme, axillary, 2- to 7-flowered	Racemose, axillary, 1- to 5-flowered	Subscorpioid cyme, axillary, 3- to 6-flowered	Racemose, 3- to 10-flowered
Peduncle length	30–50 mm	40–60(–100) mm	4–15 mm	Up to 25 mm	25–65(–110) mm
Lateral sepals	4, inner one oblong, with a prominent crest on the basal part	2, inner one absent	2, inner ones absent	2, inner one absent	2, inner one absent
Keel length and apex	12–13 mm, acute	3–5 mm, obtuse	3–6 mm, obtuse	4–8 mm, acute	7–11 mm acute
Lower sepal	Bucciniform, abruptly constricted into short incurved spur	Bucciniform, abruptly constricted into a long incurved spur	Bucciniform, abruptly constricted into short into involute, spiraled spur	Bucciniform, abruptly constricted into long involute or coiled spur	Bucciniform, abruptly constricted into long incurved spur
Capsule	Long subfusiform, 30–36 mm long	Cylindrical, 34–40 cm long	Clavate, 19–21 mm long	Subfusiform, 15–25 mm long	Cylindrical-clavate, 25 mm long

*Impatiens cathcartii* is similar to *I. darachuensis* in being a glabrous plant, but it has a much thinner, not involute spur, as well as a short and obtuse crest on the dorsal petal (Gogoi & Sherpa, 2020; Gogoi et al., 2021). In the original description (Hooker, 1875), the inflorescence is given as a raceme; however, the images in Gogoi & Sherpa (2020, figure 1E) and Gogoi et al. (2021, p. 85–87) clearly show a subscorpioid inflorescence. In Gogoi et al. (2022, p. 86), a subfusiform capsule is also shown for this species.

The recently described species *Impatiens bakthangensis* (Gogoi et al., 2020) shares a subfusiform capsule with *I. darachuensis* and other members of sect. *Scorpioidae sensu* Yu et al. (2015) but has, however, a racemose inflorescence. *Impatiens cyclosepala* Hook.f. ex W.W.Sm. has similar shape of lower sepal and spur as *I. darachuensis* but differs by its inflorescence subscorpioid cyme, four lateral sepals, and outer sepals obliquely suborbicular with prominent thick green midrib at the inner position. *Impatiens bakthangensis* is also similar to *I. laevigata* and *I. pseudolaevigata* (Gogoi et al., 2013, 2017) in having four lateral sepals but differs by its larger habit, much longer peduncle, inner lateral oblong sepals with a prominent crest in the basal part, and larger size subfusiform capsule.

*Impatiens jurpia* has a long and pointed appendage on the dorsal petal that is similar to that of the new species (Grey-Wilson, 1989, 1991; Akiyama & Ohba, 2015; Gogoi et al., 2018), but it has a racemose inflorescence (Figure 4) and is described as pubescent and has a curved, not involute, spur.

A more detailed study of the inflorescence types, seed-coat micromorphology, and molecular genetics of the species mentioned above is clearly required to reveal their relationship with other species from sect. *Scorpioidae*.

*Additional specimen examined.* BHUTAN. Sarpang district: Darachu area, 1700–1920 m, 20 xi 2020, P. Gyeltshen & T. Phuntsho 36 (THIM).

### Key to *Impatiens darachuensis* and closely allied species

- |     |   |                      |
|-----|---|----------------------|
| 1a. | Lateral sepals 2 _____  | 2                    |
| 1b. | Lateral sepals 4 _____  | 5                    |
| 2a. | Inflorescence raceme _____  | 3                    |
| 2b. | Inflorescence subscorpioid cyme _____                                     | 4                    |
| 3a. | Peduncle 25–65(–110) mm long, appendage on dorsal petal 4–16 mm long ____ | <i>I. jurpia</i>     |
| 3b. | Peduncle 4–15 mm long, appendage on dorsal petal 3–6 mm long _____        | <i>I. discolor</i>   |
| 4a. | Leaf margin crenate, capsule cylindrical _____                            | <i>I. cathcartii</i> |
| 4b. | Leaf margin coarsely serrate, capsule subfusiform _____                   | <i>I. duclouxii</i>  |
| 5a. | Capsule linear _____  | 6                    |
| 5b. | Capsule fusiform to subfusiform _____                                     | 7                    |

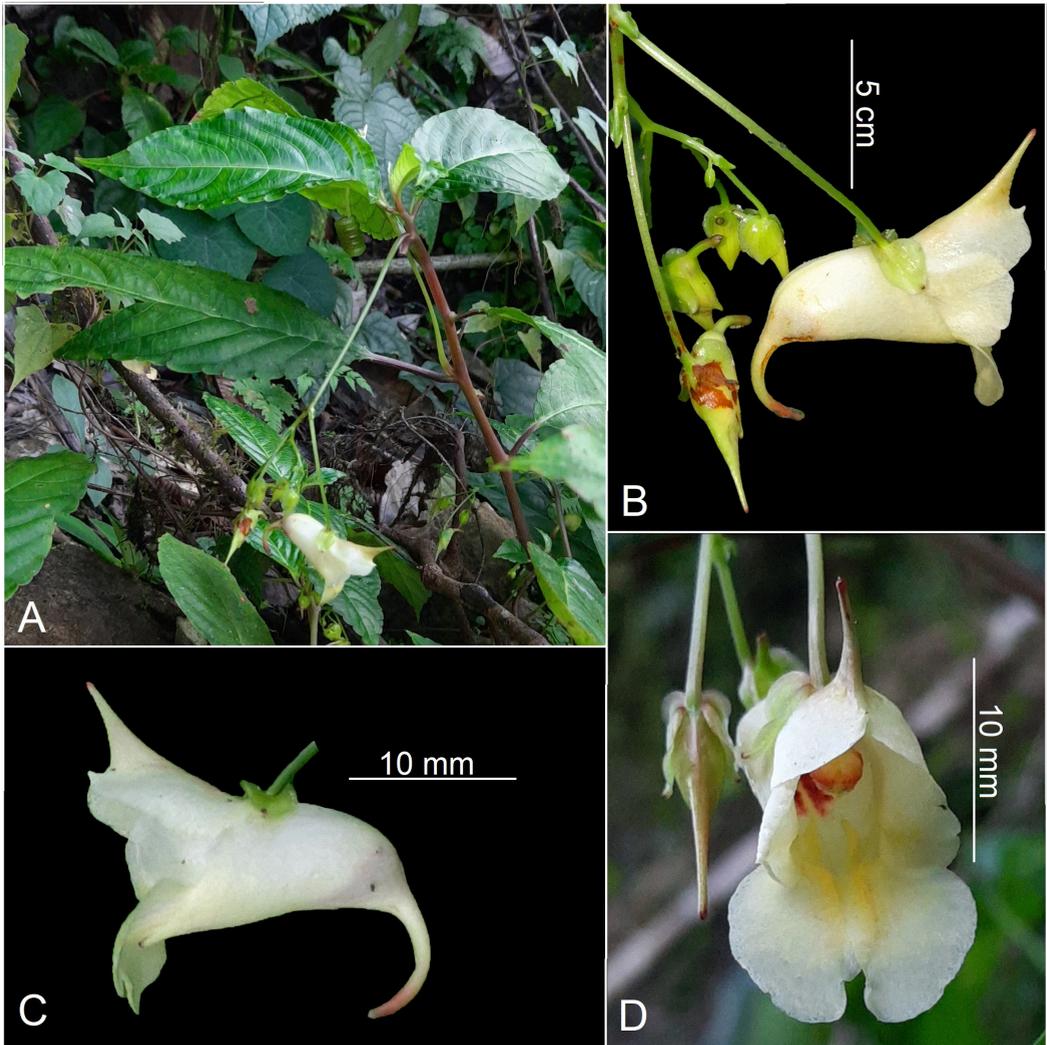


Figure 4. *Impatiens jurpia*. A, Habit; B, inflorescence with flowers; C, flower (lateral view); D, flower (front view). Photographs: P. Zangpo.

- 6a. Dorsal petal keeled, floral bracts ovate to lanceolate \_\_\_\_\_ *I. laevigata*  
 6b. Dorsal petal not keeled, floral bracts orbicular \_\_\_\_\_ *I. pseudolaevigata*  
 7a. Leaf base rounded or obtuse; lower sepal bucciniform abruptly constricted into short deep incurved spur, inner lateral sepals oblong \_\_\_\_\_ *I. darachuensis*  
 7b. Leaf base cuneate; lower sepal narrowly bucciniform, gradually constricted into long coiled or circinate spur, inner lateral sepals triangular \_\_\_\_\_ *I. bakthangensis*

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