

Impatiens (Balsaminaceae) of Nepal (1): An Identification Key and Taxonomy of the Species of Sections *Uniflorae*, *Fasciculatae* and *Axilliflorae*

Shinobu Akiyama

Department of Botany, National Museum of Nature and Science,
4–1–1 Amakubo, Tsukuba, Ibaraki 305–0005, Japan
E-mail: akiyama@kahaku.go.jp

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Abstract The taxonomy of *Impatiens* (Balsaminaceae) in Nepal is revised based on field research from 1983 to 2008 and a study of herbarium specimens. An identification key to the species is presented. For each species, synonymy, distribution, ecology, flowering time and a list of specimens examined are provided. Of the eight sections of *Impatiens* in Nepal, three of them, sections *Uniflorae*, *Fasciculatae* and *Axilliflorae*, are treated in this paper. Lectotypes for five species, *I. occultans*, *I. exilis*, *I. serrata*, *I. falcifer*, and *I. serratifolia*, are designated.

Keywords: Flora of Nepal, Himalaya, *Impatiens*, Nepal, section *Axilliflorae*, section *Fasciculatae*, section *Uniflorae*.

Taxonomic studies of the Himalayan species of *Impatiens* (Balsaminaceae) were initiated by de Candolle (1824), Roxburgh (1820–24), and Don (1825). Their treatments were mostly based on collections made by Francis Buchanan (later Hamilton) in 1802–03 and Nathaniel Wallich in 1820–21. After Royle (1834) described several species of *Impatiens* from the western Himalaya based on his own collections, *Impatiens* of the western Himalaya was studied by Edgeworth (1846). Hooker studied *Impatiens* over his lifetime, published many new species (Hooker and Thomson, 1859; Hooker, 1874–75, 1903, 1904–05, 1908, 1909, 1910a, 1910b, 1911a, 1911b, 1911c, 1911d) and revised all species in British India and Nepal. He classified them into two groups with several subgroups (Hooker, 1874–75), and later published a synopsis of *Impatiens* from the area (Hooker, 1904–05).

The plants of Nepal have been intensively surveyed by faculty and staff of the University of

Tokyo, Japan, with the cooperation of members of the Department of Plant Resources, Kathmandu, Nepal (Ohba, 1986, 2000; Rajbhandari, 2008). In relation to this survey, I have been studying *Impatiens* in this and adjacent regions, including SW China and Myanmar (Akiyama, 1987, 2017a, 2017b, 2018; Akiyama *et al.*, 1991, 1992a, 1992b, 1995a, 1995b, 1996a, 1996b, 1999, 2009; Akiyama and Ohba, 1993, 2000, 2015a, 2015b, 2016; Akiyama and Wu, 2008; Fujihashi *et al.*, 2002; Sugawara *et al.*, 1994, 1997). The present paper is a revision of the species recorded or newly recognized in Nepal for the Flora of Nepal project (Watson *et al.*, 2010).

The phylogeny of the Balsaminaceae is based on molecular, morphological and chromosomal data (Fujihashi *et al.*, 2002; Yuan *et al.*, 2004) and a recently published infrageneric classification based on phylogenetic research (Yu *et al.*, 2015). The Himalayan species have been insufficiently studied, even in the course of recent molecular studies. Yu *et al.* (2015) treated only 14 of the 43 Nepalese species. One of the reasons

for the dearth of phylogenetic studies of Himalayan species might be due to difficulties in identifying them. Although identification keys are available for areas such as Bhutan (Grey-Wilson, 1991), India (Vivekananthan *et al.*, 1997, Gogoi *et al.*, 2018), Pakistan (Nasir, 1980), and China (Chen, 1986, 2001; Chen *et al.*, 2007; Yu, 2012), and Hara (1979) enumerated the Nepalese species of *Impatiens*, none are available for Nepal, which is located in the center of the Himalaya and is one of the diversification centers for the genus (Grey-Wilson, 1980). In this paper I present a key to identify the Nepalese species based on morphological features. In consideration of the phylogeny, morphologically similar species are classified into sections as in my previous papers (Akiyama and

Ohba, 2015a, 2015b).

In this paper I also present a revision of the species of *Impatiens* recorded from Nepal and designate type specimens for some of the names proposed. This study is based on materials that members of the Society of Himalayan Botany and I have collected and also on herbarium specimens preserved in A, BM, E, G, GH, K, KATH, KUN, L, LIV, NY, PE, RAF, TI, TNS, US, W, and WU. The terminology and measurements of the flowers follow Akiyama *et al.* (1991).

In part 1, a key to the all species known from Nepal and the treatment of each species in the sections *Uniflorae*, *Fasciculatae*, and *Axilliflorae* are given.

Identification key to species of *Impatiens* in Nepal

- 1a Capsule ellipsoid; ovaries inflated 2 [Sect. *Uniflorae*]
 1b Capsule linear or clavate; ovaries slender 8
 2a Flowers spurless, white, shaded reddish purple in center, 6–8 mm long, 1–1.5 mm deep [in alpine individuals] 1) *I. occultans*
 2b Flowers spurred, various color and size [individuals in lowlands and at mid elevations] 3
 3a Lower sepal bucciniform or saccate, then abruptly constricted into a spur 4
 3b Lower sepal navicular, gradually tapering into a spur 6
 4a Peduncles more than 10 mm long; flowers yellow or orange, in axillary racemes; lower sepal bucciniform 2) *I. pulchra*
 4b Peduncles less than 6 mm long; flowers reddish purple, fascicled in leaf axils; lower sepal bucciniform or saccate 5
 5a Lower sepal saccate, spur curved 3) *I. tripetala*
 5b Lower sepal bucciniform, spur spiraled 4) *I. spirifer*
 6a Lower sepal deeply navicular; dorsal petal with a crest [at mid elevations] 5) *I. puberula*
 6b Lower sepal shallowly navicular; dorsal petal slightly crested or not [in lowlands or in cultivation] 7
 7a Dorsal petal without a crest; upper lobe and lower lobe of lateral united petals nearly equal in shape and size [in lowlands] 6) *I. exilis*
 7b Dorsal petal slightly crested; upper lobe of lateral united petals distinctly smaller than lower lobe [cultivated] 7) *I. balsamina*
 8a Pedicels bracteate at middle; inflorescences solitary flowers or flowers few, not in racemes 9 [Sect. *Axilliflorae*]
 8b Pedicels bracteate at base (except *I. glauca*); inflorescences racemose with few to many flowers 17
 9a Flowers pale reddish purple [eastern Nepal] 9) *I. uncipectala*
 9b Flowers white or yellow [throughout Nepal] 10
 10a Lower sepal saccate [western Nepal] 14) *I. bajurensis*

10b Lower sepal navicular, infundibuliform or bucciniform [throughout Nepal]	11
11a Lower sepal spurless	12
11b Lower sepal spurred	14
12a Flowers 15–18 mm long, pale yellow [in east Nepal]	10) <i>I. kharensis</i>
12b Flowers 3.5–4.5 cm long, white with purple center [throughout Nepal]	13
13a Flowers white, center shaded purple; leaves nearly glabrous	11) <i>I. serrata</i>
13b Flowers yellow, center not shaded purple; leaves pubescent	12) <i>I. williamsii</i>
14a Lower lobe of lateral united petals bilobed, upper lobule falcate	13) <i>I. falcifer</i>
14b Lower lobe of lateral united petals entire, ovate	15
15a Lower sepal bucciniform	15) <i>I. tricornis</i>
15b Lower sepal navicular or infundibuliform	16
16a Lower sepal navicular or infundibuliform, 4–10 mm long, 3–8 mm deep (excluding spur), tapering into upwardly or downwardly curved spur; spur ca. 20 mm long	16) <i>I. scabrida</i>
16b Lower sepal shallowly navicular, 10–14 mm long, 9–12 mm deep (excluding spur), tapering into downwardly curved spur; spur 14–16 mm long	17) <i>I. serratifolia</i>
17a Peduncles usually less than 5 mm long; flowers 1–3, fascicled in leaf axils	8) <i>I. arguta</i> [Sect. <i>Fasciculatae</i>]
17b Peduncles more than 8 mm long; flowers 2–many, in racemes	18
18a Pedicels bracteate at middle; flowers more than 5 per raceme; lower sepal bucciniform; leaves glaucous [western Nepal]	18) <i>I. glauca</i> [sect. <i>Racemosae</i> 1]
18b Pedicels bracteate at base; flowers few to many per raceme; lower sepal navicular, tubular, bucciniform, or saccate; leaves not glaucous [throughout Nepal]	19
19a Lower sepal deeply navicular or tubular	20 [sect. <i>Racemosae</i> 2]
19b Lower sepal bucciniform, saccate, or shallowly navicular	23
20a Flowers reddish purple or nearly white, with or without red dots in center	21
20b Flowers yellow, with red dots in center	22
21a Lateral united petals with appendage elongating into tubular lower sepal; leaf lamina lanceolate to oblong-ovate	19) <i>I. scullyi</i>
21b Lateral united petals without appendage elongating into tubular lower sepal; leaf lamina linear-elliptic	20) <i>I. prainii</i>
22a Apex of lateral sepals acute, straight; lower sepal 12–18 mm deep including spur	21) <i>I. stenantha</i>
22a Apex of lateral sepals sickle-shaped; lower sepal 18–25 mm deep including spur	22) <i>I. drepanophora</i>
23a Flowers in pseudovercils, racemes ascending	24
23b Flowers in regular racemes; racemes ascending or pendulous	32
24a Leaves opposite at middle and base of stem	25 [Sect. <i>Sulcatae</i>]
24b Leaves alternate throughout	27 [Sect. <i>Subumbellatae</i>]
25a Lower sepal shallowly navicular; spur not constricted, horizontal, straight, distally curved	29) <i>I. chungtienensis</i>
25b Lower sepal bucciniform; spur abruptly constricted, bent downward	26
26a Fruit linear, slightly broadened near apex, less than 3 mm broad at maturity [east and central Nepal]	30) <i>I. sulcata</i>
26b Fruit clavate, more than 6 mm broad at maturity [west Nepal]	31) <i>I. glandulifera</i>
27a Lower sepal navicular, tapering gradually into spur	32) <i>I. radiata</i>
27b Lower sepal bucciniform or saccate, abruptly constricted into spur	28

28a Lower sepal saccate	29
28b Lower sepal bucciniform	30
29a Flowers reddish purple with dark reddish purple dots	33) <i>I. bicornuta</i>
29b Flowers yellow with purplish red or brownish dots	34) <i>I. pradhanii</i>
30a Apex of distal lobe of lateral united petals long tailed	35) <i>I. harae</i>
30b Apex of distal lobe of lateral united petals obtuse	31
31a Apex of upper lobe of lateral united petals obtuse	36) <i>I. amphorata</i>
31b Apex of upper lobe of lateral united petals falcate	37) <i>I. edgeworthii</i>
32a Lower sepal shallowly navicular	33 [Sect. <i>Racemosae</i>]
32b Lower sepal bucciniform	37
33a Lower sepal gradually tapering into spur	34
33b Lower sepal abruptly constricted into straight spur	35
34a Flowers yellow, spur curved downward	23) <i>I. racemosa</i>
34b Flowers reddish purple, spur almost straight	24) <i>I. insignis</i>
35a Flowers pink; spur 8–10 mm long	25) <i>I. laxiflora</i>
35b Flowers yellow or creamy white, spur ca. 14–16 mm long	36
36a Spur ca. 14 mm long, apex curved downward	26) <i>I. recticalcarata</i>
36a Spur ca. 16 mm long, almost straight	27) <i>I. leptoceras</i>
37a Dorsal petal with a crest-like appendage	38 [Sect. <i>Jurpia</i>]
37b Dorsal petal without crest-like appendage	39
38a Crest-like appendage of dorsal petal (4–)6–16 mm long; spur slightly curved throughout	38) <i>I. jurpia</i>
38b Crest-like appendage of dorsal petal 3–6 mm long; spur conspicuously incurved near apex	39) <i>I. discolor</i>
39a Spur straight, horizontal	28) <i>I. cymbifera</i> [Sect. <i>Racemosae</i>]
39b Spur incurved forward or curved downward	40 [Sect. <i>Urticifoliae</i>]
40a Lower lobe of lateral united petals loriform, tailed	41
40b Lower lobe of lateral united petals dolabriform	42
41a Flowers yellow with reddish veins; lower sepal with an elongate tip at distal end of mouth; spur incurved forward	40) <i>I. urticifolia</i>
41b Flowers purple; lower sepal without elongate tip at distal end of mouth; spur curved downward or incurved forward	41) <i>I. gamblei</i>
42a Spur curved downward, usually S-shaped; flowers pale yellow with reddish dots	42) <i>I. wallichii</i>
42b Spur incurved forward, flowers pale yellow with reddish dots and veins or reddish purple	43) <i>I. hobsonii</i>

Taxonomic treatment

Impatiens L., Sp. Pl. 1: 937 (1753).

Type species: *I. noli-tangere* L. (Rydberg, 1910).

Part 1

Sections *Uniflorae*, *Fasciculatae*, and *Axilliflo-*

rae are treated. Other sections will be treated in forthcoming parts. Specimens that I collected with members of the Society of Himalayan Botany are marked with an asterisk.

Section *Uniflorae* Hook.f. & Thomson, J. Proc. Linn. Soc. Bot. 4: 113 (1859). Hook. f., Fl. Brit.

India 1: 441 (1874), excl. *I. arguta*. Yu *et al.*, Cladistics 32 (online): 191 (2015, printed in 2016) (DOI10.1111/cla.12119).

Type species: *I. balsamina* L., lecto, designated by S. Z. Yu & Wei Wang (Yu *et al.*, 2015). Species 1–7.

Notes: Yu *et al.* (2015) characterized sect. *Uniflorae* by the short, fusiform capsules, inflorescences fascicles of 2 (or 3) flowers (rarely racemes with 2(–5) flowers), and ellipsoid seeds. Two species, *I. occultans* (Akiyama and Ohba, 2000) and *I. tripetala*, in this section in Nepal have pedunculate inflorescences. Section *Uniflorae* consists of many wide-ranging species (southeast Asia, southwest China, southern India–Sri Lanka, Africa, and Madagascar). The cultivated *Impatiens balsamina* was only species in this section surveyed molecularly by Yu *et al.* (2015). To clarify its phylogenetic relationship in this section, further molecular surveys are needed based on diverse species covering the wide are of distribution.

1) *Impatiens occultans* Hook.f., Rec. Bot. Surv. India 4: 17, 22 (1905). Hara, in Hara and Williams (eds.), Enum. Fl. Pl. Nepal 2: 79 (1979). Akiyama *et al.*, in Ohba and Malla (eds.), Himal. Pl. 2: 76, f. 10, col. pl. 5c (1991). Grey-Wilson, in Grierson and Long (eds.), Fl. Bhutan 2: 96, f. 13 m, n (1991). Press *et al.*, Annotated Checklist Fl. Pl. Nepal: 23 (2000). Chen *et al.*, in Wu and Raven (eds.), Fl. China 12: (2007).

Type: [India], Sikkim, alt. 12000–13000 ft. (Gammie 414, 2 Aug. 1891, K [K000694783], lecto, designated here) (Fig. 1).

Distribution: Nepal (central, east) and E Himalaya.

Altitudinal range in Nepal: 3400–4000 m.

Ecology in Nepal: Alpine.

Flowering in Nepal: July to August

Nepalese specimens examined (in addition to those cited in Akiyama *et al.*, 1991): Annapurna Himal, Seti Khola, 12500 ft. (Stainton, Sykes & Williams 6609, 3 Aug. 1954, BM-44301; E). Arun Valley, Popti La, N. of Hatiar, 13000 ft. (J. D. A. Staiton 1420, 22 Aug. 1956, BM-44258;

A). Arun Valley, Popti La, N. of Hatiar, 3900m (H. Kanai & T.B. Shrestha 1420, 22 Aug. 1965, TI). Megu, 14000 ft. (Ribu & Rhomoo 6456, in 1913, E). Chilime Khola, 13500 ft. (O. Polunin 1138, July 1949, BM-44168). Near Cow-huts of Bhuanjang Garka, 3200m (da Haas J. H. 2136, 9 Aug. 1944, BM-43972). South of Gurjakhani, 11500 ft. (Stainton, Sykes & Williams 3875, 17 Aug. 1954, BM-44282). Above Sauwala Khola, 12500 ft. (Stainton, Sykes & Williams 3573, 22 July 1954, BM-44275). **Rasuwa Dist.**, Singum Gompa–Gosainkund, 3900m (H. Hara *et al.* 721860, 23 Aug. 1972, TI); Tinbu Kharka–Sano Bhera Kharka–Tulo Bhera Kharka, 3910m (F. Miyamoto *et al.* 9420074*, 28 July 1994, TI); a Kharka–Pati Kharka, 3880m (F. Miyamoto *et al.* 9420165*, 4 Aug. 1994, TI); Ganesh Base Camp–cross a river–a Kharka, 3600m (F. Miyamoto *et al.* 9410244*, 10 Aug. 1994, TI; TNS); Seto Kund–a pass–Chyauche Kharka, 3900m (F. Miyamoto *et al.* 9420233*, 11 Aug. 1994, TI); Laurebinayak–Sing Gompa (T. Hoshino *et al.* 9539203, 30 July 1995, TI). **Sankhuwasawa Dist.**, around Cha Ding Kharka and Shipton Pass, 4000m (M. Minaki *et al.* 9020826, 11 Aug. 1990); Singoa Kharka–Pahakhola, 4000m (H. Ohba *et al.* 9120397*, 11 Aug. 1991, TI). **Solukhumbu Dist.**, Gnaula–Pike, 3290m (F. Miyamoto *et al.* 9584036, 22 July 1995, TI); Thasing Dingma–Sanu Khola–Saure Kharka, 3470m (F. Miyamoto *et al.* 9584111, 4 Aug. 1995, TI); Dudh Kund–Bhedi Kharka–Mosom Kharka, 3760m (M. Wakabayashi *et al.* 9720276, 25 Aug. 1997, TI); Mosom Kharka–Rangdu Kharka–Hinku Khola–Tashing Dingma, 3370m (M. Wakabayashi *et al.* 9715241, 26 Aug. 1997, TI); Kurki–Pangkongma La–Pangkongma–Kharikhola, 3400m (M. Wakabayashi *et al.* 9710403, 29 Aug. 1997, TI). **Taplejung Dist.**, around Topke Gola–Chaun Kharka (H. Ohba *et al.* 9120311*, 8 Aug. 1991, TI; TNS); Topke Gola, 12200 ft. (T. B. Shrestha & D. Joshi 436, 2 Aug. 1971, BM-44330).

Notes: The most remarkable feature of *I. occultans* is the fusiform capsule, which places it in sect. *Uniflorae*. *Impatiens occultans* is unique



Fig. 1. Lectotype of *Impatiens occultans* Hook. f. (Gammie 414, 2 Aug. 1891, K000694783).

in growing in the alpine zone. It is 3–20 cm tall, has a leaf blades 5–25 mm long, white (shaded reddish purple in center) flowers 6–8 mm long. a spurless lower sepal and fusiform capsules. It is

similar to *I. serrata* and *I. kharensis*, also in the alpine zone. They have white (shaded reddish purple in center) or pale yellow flowers with a spurless lower sepal, but the margin of their

leaves is crenate, not serrate, as in *I. puberula* and *I. spirifer*.

2) *Impatiens pulchra* Hook.f. & Thomson, Proc. J. Linn. Soc. Bot. 4: 139 (1860). Hook. f., Fl. Brit. India 1: 459 (1874); Rec. Bot. Surv. India 4: 12, 18 (1905). Hara, in Hara and Williams, Enum. Fl. Pl. Nepal 2: 79 (1979). Grey-Wilson, in Grierson and Long (eds.), Fl. Bhutan 2: 90, f. 11 l, m (1991). Press *et al.*, Annotated Checklist Fl. Pl. Nepal: 23 (2000).

Type: [India] Umbrosis montibus Khasia regione teperata et subtropica alt. 4000–5000 ped. (fl. Sept.–Nov.) [Pomrang, 5000 ped.] (J. D. Hooker & T. Thomson 2281, 16 Sept. 1850, K000694754, lecto; K000694753, isolecto) (Ruchisansakun *et al.*, 2018); [5000 ped. (J. D. Hooker & T. Thomson, s.n., K000694755, syn). *Nepalia maxime orientali*, alt. 4000–5000 ped., as var. *β*. (fl. Sept.–Nov.) [E Nepal, Moyong valley] (J. D. Hooker, 31 Oct., K000694757, syn; K000694758, syn).

Distribution: Nepal (east) and E Himalaya and Assam-Burma.

Altitudinal range in Nepal: 2400–2700 m.

Ecology in Nepal: Hills at mid elevations; open places in forests.

Flowering in Nepal: September to November.

Nepalese specimens examined: Types only.

3) *Impatiens tripetala* Roxb. [Hort. Beng.: 18 (1814), nom. nud.] ex DC., Prodr. 1: 687 (Jan. 1824). Hara, in Hara and Williams (eds.), Enum. Fl. Pl. Nepal 2: 79 (1979). Grey-Wilson, in Grierson and Long (eds.), Fl. Bhutan 2: 91, f. 11q–s (1991). Press *et al.*, Annotated Checklist Fl. Pl. Nepal: 24 (2000). Ruchisansakun *et al.*, Blumea 63: 247 (2018).

Type: [India], Silhet, Indiae or. (ex hort. calc) (B. G. C. July 1818, G00218033, lecto) (Karthigeayan and Gogoi, 2016).

I. multiflora Wall. [Numer. List: 168, n. 4742 (1831), nom. nud.] ex Hook. f. & Thomson, J. Proc. Linn. Soc. Bot. 4: 126 (1860). Type: Bangladesh, Pundua [mont.] De Silva (N. Wallich Cat. no. 4742, K001039802, lecto) (Ruchisan-

sakun *et al.*, 2018).

Distribution: Nepal (east), E Himalaya and Assam-Burma.

Altitudinal range in Nepal: 1400–1800 m.

Ecology in Nepal: Hills at mid elevations; open places in forests.

Flowering in Nepal: July to October.

Nepalese specimens examined: **Taplejung Distr.**, Linkhim–Tuwa (H. Hara *et al.*, 4 Nov. 1963, TI); Papung–Bir Gaon–Sangrati Pati, 1300 m (H. Ohashi *et al.* 771074, 772756, 774013, 774018, 775362, 26 Aug. 1977, TI); Saju Khola, 1400 m (H. Kanai *et al.* 720981, 1 July, 1972, TI); Tamur Valley, Phembu, N. of Taplejung, 1350 m (J.D.A. Stainton 1226, 3 Aug. 1956, BM-44256, TI); Tamur River between Tawa and Chirwa (KEKE 153, 2 Sept. 1989, E, K); Taplethok (H. Hara *et al.* 6300496, 5 Nov. 1963, TI).

4) *Impatiens spirifer* Hook.f. & Thomson, Proc. J. Linn. Soc. Bot. 4: 135 (1859). Hara, in Hara and Williams, Enum. Fl. Pl. Nepal 2: 80 (1979). Chen, in Wu (ed.), Fl. Xizang. 3: 189 (1986). Grey-Wilson, in Grierson and Long (eds.), Fl. Bhutan 2: 94, f. 12o–q (1991). Press *et al.*, Annotated Checklist Fl. Pl. Nepal: 23 (2000).

Type: [India], Sylvis temperatis subtropicisque Himalayæ orientalis Sikkim, alt. 4000–7000 ped. (fl. Oct.–Dec.) [Sikkim. Regio. temp. & trop., alt. 4–5000 ped. Choongtam] (J. D. Hooker, 27 Oct. 1849, K000694933, lecto) (Gogoi *et al.*, 2017). [Sikkim. Regio. temp. & trop., alt. 4–7000 ped. Lachoong 6000 p.] (J. D. Hooker, 2 Oct. 1849, K000694931, syn); [Sikkim. Regio. temp. & trop., alt. 4–7000 ped.] (J. D. Hooker s.n., K000694932, syn). [Leuhen Lachong, K. Sikkim. Regio. temp. & trop., alt. 4–7000 ped.] (J. D. Hooker s.n., BM, syn?; GH, syn?).

Distribution: Nepal (east), E Himalaya and Tibetan Plateau.

Altitudinal range in Nepal: 1400–2100 m.

Ecology in Nepal: Hills at mid elevations; open places in forests.

Flowering in Nepal: June to October.

Nepalese specimens examined: Tamur River

between Chirwa and Hellok. 27°29'N, 87°46'E, 1400 m (KEKE 200, 4 Sept. 1989, E, K). **Panchthar Distr.**, Gairi Kharka–Phaleke–Lasune Kharka–deurali–Rabi Khola–Beteni, 2000 m (S. Noshiro *et al.* 9240987*, 21 June 1992, TI); between Chayngtharpa & Memeng, N. of the pass, 2050 m (N. P. Taylor 13 in Grey Wilson 4698, 13 Oct. 1981, E, K).

5) *Impatiens puberula* DC., Prodr. 1: 687 (Jan. 1824). Wall., Pl. Asiat. Rar. 2: 83, t. 193 (1831). Hara, in Hara and Williams (eds.), Enum. Fl. Pl. Nepal 2: 79 (1979). Akiyama *et al.*, in Ohba and Malla (eds.), Himal. Pl. 2: 78, f. 18, col. pl. 7a, b (1991). Grey-Wilson, in Grierson & Long (eds.), Fl. Bhutan 2: 94, f. 12i–k (1991). Press *et al.*, Annotated Checklist Fl. Pl. Nepal: 23 (2000). Chen *et al.*, in Wu and Raven (eds.), Fl. China 12: 80 (2007). S.-X. Yu, Balsaminaceae China: 197 (2012).

Type: [Nepal] In Napauliã. (N. Wallich, G00218032, holo).

I. mollis Wall., in Roxb., Fl. Ind., Carey ed. 2: 461 (March–June 1824). Type: Nipal [Nepal] Sheopore (N. Wallich s.n., not seen)

I. hispidula Benth. in Wall., Numer. List: 168, n. 4340 (1831), nom. nud.

Distribution: Nepal (west, central, east), E Himalaya and Tibetan Plateau.

Altitudinal range in Nepal: 1500–2700 m.

Ecology in Nepal: Hills at mid elevations; in forests.

Flowering in Nepal: June to November.

Nepalese specimens examined (in addition to those cited in Akiyama *et al.*, 1991): (N. Wallich s.n., BM-44362). Arun Valley, Chhoyang Khola, W. of Num, 2550 m (J. D. A. Stainton 699, 19560618, A, BM-44251, TI). Charikot, 7000 ft. (Banerjee, Shrestha & Upadhuy 2764, 15 Sept. 1964, NA). Chulti, 2000 m (Alain Maire AMA02, 9 July 1972, BM-44151). Kakani, 8 miles north west of Katmandu (Kenneth de B. Codrington 289, in 1956, BM-43933). Godavari, north of Katmandu (Kenneth de B. Codrington 182, in 1956, BM-43932). Kaure/Shallyan, 5500 ft. (H. Flatt 135, 2 Nov. 1969, BM-44028). Lan-

jung Himal, 9000 ft. (Stainton, Sykes & Williams 6420, BM-44297). Mangning, 5000 ft. (Colow, F.M. Bailey's Collectors 243, 13 Aug. 1935, BM-43863). Milke Danda, 8000 ft. (L. W. Beer 10118, 1 Oct. 1971, BM-43876). Hills round Nepal Valley, 5000 ft. (Proud 275, in June, BM-44239). Phaplos, 8–9000 ft. (Lall Dhwoj 67, in 1930, BM-43994, E). Phulchoke, SW. of Kathmandu, 1800 m (A. D. Shilling, 618, 27 Aug. 1965, TI). Phulchoki, Dhungri Khola, 6000 ft. (Unknown coll. 7049, BM). Pulyan, 27°38'86°44', 2500 m (J. F. Dobremez 328, 5 July 1970, BM-44005). Sedua, 1740 m (M. Ohsawa & P. R. Shakya 1799, 15 Sept. 1971, TI). Between Sundarijal and Pati Banjang ($\pm 27^{\circ}48' 85^{\circ}26'$), 2500 m (J. H. de Haas 2628, 4 Sept. 1974, BM-43979). Taksindhu., 2400 m (D. McCosh 261, 20 June 1964, BM-44157, TI). Thade, 2130 m (P. R. Shakya & Dr. Adhikari 594, 18 July 1971, TI). S. of Tharke Gyang on W. exposed valley side of Malemchi Khola, 27°59' 85°34', 2600 m (J. H. de Haas 2685, 7 Sept. 1974, BM-43981). Yamphodin, 2100 m (L. H. J. Williams 941, 25 June 1969, BM-44377, TI). Kanchenjunga, Phidim, 3 km south of Yamphudin, 1640 m (R. J. D. McBeath 2482, 1 June 1991, E). **Dhankuta Distr.**, Shidua–Tute (H. Ohba *et al.* 9120044*, 13 July 1991, TI); Tute–Tinjure Phedi (H. Ohba *et al.* 9120057*, 14 July 1991, TI); Tinjure Danda, 27°10'N 87°29'E 7500 ft. (Williams & Stainton 8378, 6 Sept. 1967, A, BM-44382, TI). **Dolakha Distr.**, Jiri–Ratomate–Back Col–Chefae–a pass–Mali–Sibalaya, 2250 m (F. Miyamoto *et al.* 9596013, 8 July 1995, TI); 1860 m (F. Miyamoto *et al.* 9584007, 18 July 1995, TI). **Kaski Distr.**, Banthanti–Deurali–Ghodepani Deurali (Ghorapani), 2720 m (M. Suzuki *et al.* 8842103, 24 Aug. 1988, TI); 2620 m (M. Suzuki *et al.* 8881274, 24 Aug. 1988, TI); Bhainsi Kharka–Misal Kharka–Tadapani–Chupru Khola–Mato Bisaune–Banthanti (M. Suzuki *et al.* 8812593, 23 Aug. 1988, TI); 1550 m (M. Suzuki *et al.* 8881260, 19880823, TI); Ghandruk (Ghandrung)–Bhainsi Kharka 2160 m (M. Suzuki *et al.* 8860585, 22 Aug. 1988, TI); 2470 m (M. Suzuki *et al.* 8860620, 22 Aug.

1988, TI); Naudanda Phedi (Naudhara Phedi)–Dhampus Jhaure–Dhampus Lakhane–Dhampus Deurali–Pothana, 1930m (M. Suzuki *et al.* 8881041, 19 Aug. 1988, TI). **Kathmandu Distr.**, Forest Office–Chhap–Shiwapuri Summit (M. Suzuki *et al.* 8881944, 13 Sept. 1988, TI); 2400m (M. Suzuki *et al.* 8881829, 13 Sept. 1988, TI); Katmandu, Shepuri, 6500 ft. (Stainton, Sykes & Williams 6936, 19 Aug. 1954, E; 6937, BM-44304). **Lalitpur Distr.**, Phulchoki (H. Kanai 673348, 9 Aug. 1969, TI). **Myagdi Distr.**, Chitre, 2150m (M. Mikage *et al.* 9485557, 27 Aug. 1994, TI); Ghar Khola 3000m (Stainton, Sykes & Williams 5777, 15 June 1954, BM-44296, E, TI); near Lumsum, 7000 ft. (Stainton, Sykes & Williams 4280, 7 Sept. 1954, BM-44287, E, TI). **Panchthar Distr.**, Prangbung–Namle Phedi–Namle–Goruwale Bhanjang (Bhanduke) (S. Noshiro *et al.* 9241085*, 25 June 1992, TI); 2300m (S. Noshiro *et al.* 9241087*, 25 June 1992, TI). **Rasuwa Distr.**, Mane Gaon–Thale (H. Kanai & P. R. Shakya 24 June 1970, TI). **Sindhupalchok Distr.**, Thale–Thale Bisauna, 2500m (H. Kanai, Ch. Chuma & T. Nagano s.n., 10 Sept. 1970, TI); Tingoang–Khosori Khabre (H. Kanai, Ch. Chuma & T. Nagano s.n., 12 Sept. 1970, TI). **Solukhumbu Distr.**, Fera–Pangoma–Takisindu–Nunthara, 2740m (F. Miyamoto *et al.* 9584062, 26 July 1995, TI); Nunthala–Taksindu La–Ringmo–Junbesi, 2620m (M. Wakabayashi *et al.* 9710412, 31 Aug. 1997, TI); 2600m (M. Wakabayashi *et al.* 9715298, 31 Aug. 1997, TI); 2330m (M. Wakabayashi *et al.* 9720338, 31 Aug. 1997, TI); Nunthara–Phuleli–Dudh Kosi–Juving–Kharikhola, 1670m (F. Miyamoto *et al.* 9596158, 27 July 1995, TI); Ringmo–Taksindu La–Nunthala–Dudh Koshi–Jubing, 2670m (M. Wakabayashi *et al.* 9720079, 1 Aug. 1997, TI). **Taplejung Distr.**, Shewaden–Mewa Khola, 2300m (H. Kanai *et al.* 720947, 720947, 29 June 1972, TI).

6) *Impatiens exilis* Hook.f., Rec. Bot. Surv. India 4: 13, 19 (1905). Hara, in Hara and Williams (eds.), Enum. Fl. Pl. Nepal 2: 78 (1979). Akiyama *et al.*, in Ohba and Malla (eds.), Himal. Pl.

2: 71, f. 6 (1991). Grey-Wilson, in Grierson and Long (eds.), Fl. Bhutan 2: 88, f. 11e, f (1991). Press *et al.*, Annotated Checklist Fl. Pl. Nepal: 22 (2000).

Type: Darjeeling (Pantling in 1901, no. 1244 Cat. Hb. Griffith, K000694676, lecto) (designated here) (Fig. 2). Darjeelong [Darjiling]. Mungpo [Pomong] (Clarke 879b, 23 Aug. 1869, K000694677, syn).

I. filicornu C.B. Clarke ex Hook.f., Rec. Bot. Surv. India 4: 19 (1905), nom. nud., pro syn.

Distribution: Nepal (central, east) and E Himalaya.

Altitudinal range in Nepal: 600–1200m.

Ecology in Nepal: Lowlands and hills at mid elevations; open places.

Flowering in Nepal: July to October.

Nepalese specimens examined (addition to Akiyama *et al.*, 1991): North of Chula Chuli. 26°45'N. 87°37'E., 3500 ft. (Williams & Stainton 8519, 15 Sept. 1967, BM-44389). Dharan, 600m (Williams & Stainton 8338, 3 Sept. 1967, BM-44381, TI); 26°49' 87°18', 600m (J. F. Dobremez 1439, 13 Aug. 1972, BM-44008). Near Gangdua, Wabak Khola, 70000 ft. (L. W. Beer 9507, 29 July 1971, BM-43873). Pohlara, 1050m (Stainton, Sykes & Williams 7135, 7 Sept. 1954, BM-44307, E, TI). Sanguri Bhanjang–Dhara (H. Hara *et al.* 6300493, 16 Oct. 1963, TI). Yanguri Lekt, 4000 ft. (L. H. J. Williams 1180, 7 July 1969, BM-44380). **Sankhuwasawa Distr.**, Baidep–Arun River–Num (H. Ohba *et al.* 9120411*, 13 Aug. 1991, TI); Pahakhola–Baidep (H. Ohba *et al.* 9120406*, 12 Aug. 1991, TI). **Sunsari Distr.**, Dhara Pani, 1000m (H. Kanai *et al.* 721226, 10 July 1972, TI); Dhara Pani–Sanguri Bhanjyang–Dharan (H. Kanai *et al.* 721226, 10 July 1972, TI).

7) *Impatiens balsamina* L., Sp. Pl.: 938 (1753). Hara, in Hara and Williams (eds.), Enum. Fl. Pl. Nepal 2: 78 (1979). Grey-Wilson, in Grierson and Long (eds.), Fl. Bhutan 2: 103, f. 13zc–ze (1991). Press *et al.*, Annotated Checklist Fl. Pl. Nepal: 22 (2000). Chen *et al.*, in Wu and Raven (eds.), Fl. China 12: 58 (2007). Yu, Balsamina-

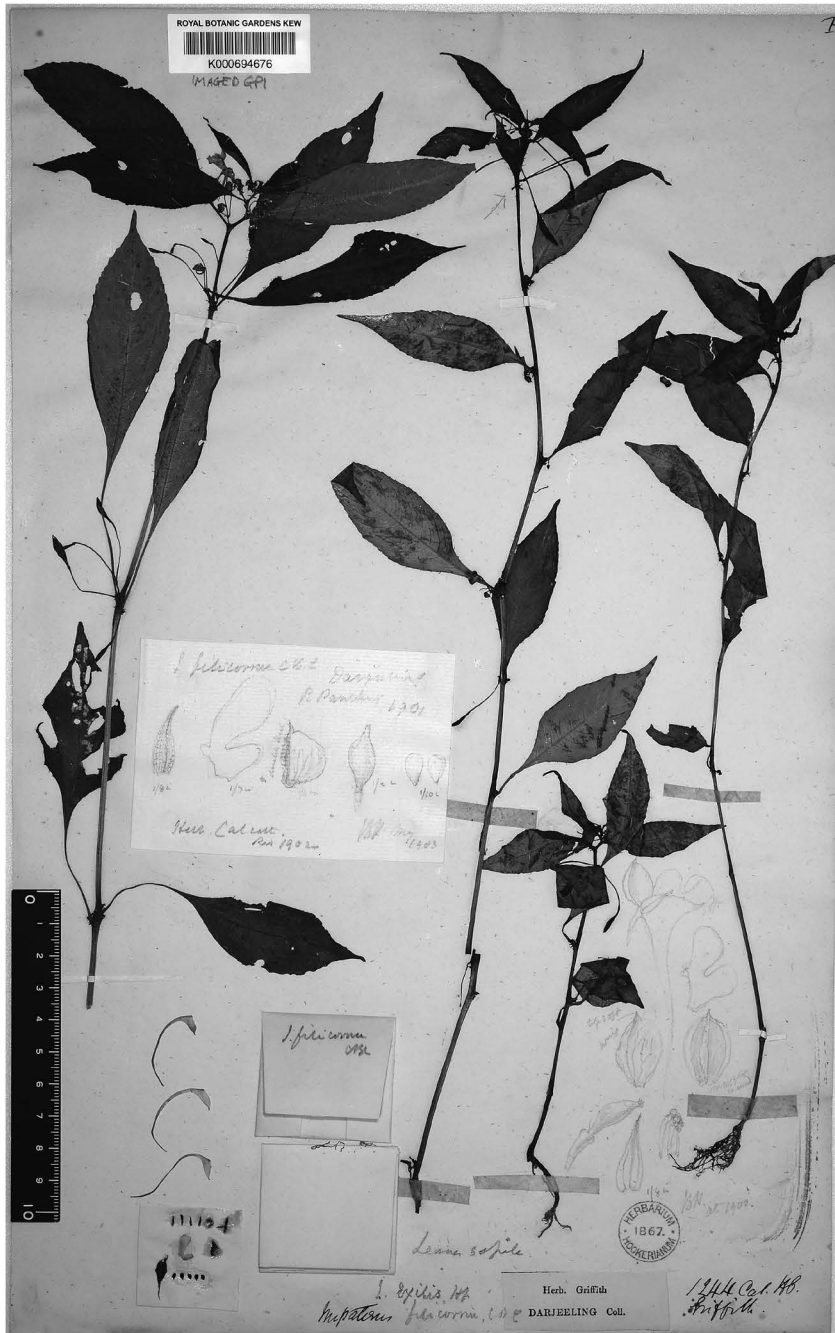


Fig. 2. Lectotype of *Impatiens exilis* Hook. f. (Pantling in 1901, no. 1244 Cat. Hb. Griffith, K000694676).

ceae China: 96, col. pl. (2012). Ruchisansakun *et al.*, *Blumea* 63: 37 (2018).

Type: Anonymous s.n. (LINN-HL1053.5, lecto) (Christenhusz and Jarvis, 2010).

I. cornuta L., *Sp. Pl.*: 937 (1753).—*Balsamina*

cornuta (L.) DC., *Prodr.* 1: 686 (1824). Type: Sri Lanka. Paul Hermann 3: 9, n. 316 (BM000621820, lecto) (Singh, 2017).—*I. balsamina* L. var. *sylvestris* Wight & Arn., *Prodr.* 1: 136 (1834).

I. coccinea Sims, *Bot. Mag.* 31: t. 1256

(1810). Type: Sims (1810) t. 1256, illustration of specimen cultivated in Sloane street by Mr. Salisbury, seeds received from Mr. Roxburgh, east India (lecto) (Ruchisansakun *et al.*, 2018).

I. balsamina L. var. *longifolia* Wight & Arn., Prodr. 1: 136 (1834). Type: Wall. Numer. List. n. 4734 (K001039792).—*I. longifolia* (Wight & Arn.) Benth. ex Wall., Numer. List. n. 4734 (1831), nom. nud.

I. arcuata Wight & Arn., Prodr. 1: 136 (1834). Type: India. Wall. Numer. List. n. 4735 (K001039793).—*I. balsamina* L. var. *arcuata* (Wight & Arn.) Hook.f., Fl. Brit. India 1: 454 (1875).

Distribution: Widely cultivated, native of SE Asia.

Altitudinal range in Nepal: 1200–1900 m.

Ecology in Nepal: Cultivated in gardens and escaped on roadsides.

Section *Fasciculatae* S.X.Yu & Wei Wang in Yu *et al.*, Cladistics 32 (online): 191 (2015, printed in 2016).

Type species: *I. arguta* Hook.f. & Thomson. Species 8.

Notes: Although sect. *Fasciculatae* was reported to be characterized by long, fusiform capsules, fascicled inflorescences (of 2 or 3 flowers), 4 lateral sepals, and ellipsoid seeds (Yu *et al.*, 2015), the capsule of *I. arguta*, the only species of this section, is linear, as described by Hooker and Thomson (1859) and as seen in the type specimen (Fig. 3). The position of sect. *Fasciculatae* between sect. *Impatiens* and sect. *Racemosae* (both sections characterized by linear, clavate or cylindrical capsules) (Yu *et al.*, 2015) is reasonable because *I. arguta* has linear capsules.

The phylogenetic distinctness of *Impatiens arguta* was already shown by Fujihashi *et al.* (2002). They reported that *I. arguta* (chromosome number $2n=20$, in monophyletic group B2), together with *I. puberula* and *I. discolor* (chromosome number $2n=20$, in monophyletic group B3), apart from other Nepalese species (chromosome number $2n=18$, monophyletic group A). Section *Impatiens* includes *I. noli-tan-*

gere, *I. nubigena*, and *I. textorii*, which all have $2n=20$ chromosomes, was placed in monophyletic group B1 by Fujihashi *et al.* (2002). Sections *Racemosae*, *Subumbellatae*, *Sulcatae* and *Urticifoliae* include the Nepalese *I. bicornuta*, *I. racemosa*, *I. radiata*, *I. sulcata* and *I. urticifolia* (all $2n=18$) were in monophyletic groups A1 and 2 in Fujihashi *et al.* (2002). The relationships of *I. arguta* with other species in the Sino-Himalaya region is phylogenetically interesting.

8) *Impatiens arguta* Hook.f. & Thomson, J. Proc. Linn. Soc. Bot. 4: 137 (1860). Hara, in Hara & Williams (eds.), Enum. Fl. Pl. Nepal 2: 78 (1979). Photo Pl. E. Himal.: t. 87 (1968). Grey-Wilson, in Grierson & Long, Fl. Bhutan 2: 92 (1991). Chen *et al.*, Fl. China (2007). S.-X. Yu, Balsaminaceae China: 154 (2012).

Type: Umbrosis Himalayæ orientalis temperatæ et tropicæ; Sikkim, alt. 5000–7000 ped. [Sikkim Himalayah, Darjeeling, 7500 ft.] (Hooker [J. D. H.] s.n., K000694618, lecto) (Ruchisansaku *et al.*, 2018) (Fig. 3); [Darjeeling. Sept.] (Hooker [J. D. H.] s.n., K000694619, syn); [Sikkim Himalayas. Ex ***[illegible], abundant at 7000 ft. Fl. blue-purple] (Hooker [J. D. H.] s.n. K000694620, syn); Mont. Khasiæ, alt. 3000–6000 ped. (Lobb, & c, fl. Jun.–Oct., syn not seen).

I. gagei Hook.f., Hooker's Icon. Pl. 30: t. 2951 (1911). Type: Eastern Himalaya: Darjeeling; Tonglo slopes, below Simana, alt. 6000–8000 ft. (Burkill 27744, K000694617, lecto) (Ruchisansaku, *et al.* 2018), loc. cit. (Burkill 27743, syn, not seen), loc. cit. (Burkill 27745, syn, not seen).

Distribution: Nepal (east), E Himalaya (E Nepal to Bhutan), Tibetan Plateau and Assam-Myanmar.

Altitudinal range in Nepal: 2100–2900 m.

Ecology in Nepal: Hills at mid elevations; open places in forests.

Flowering in Nepal: July to September

Nepalese specimens examined: Arun Valley, Maghang Khola, E. of Num, 2550 m (J. D. A. Stainton 817, 1 July 1956, A, BM-44254, TI). Chauki. 27°11', 37°29', 2500 m (J. F. Dobremez

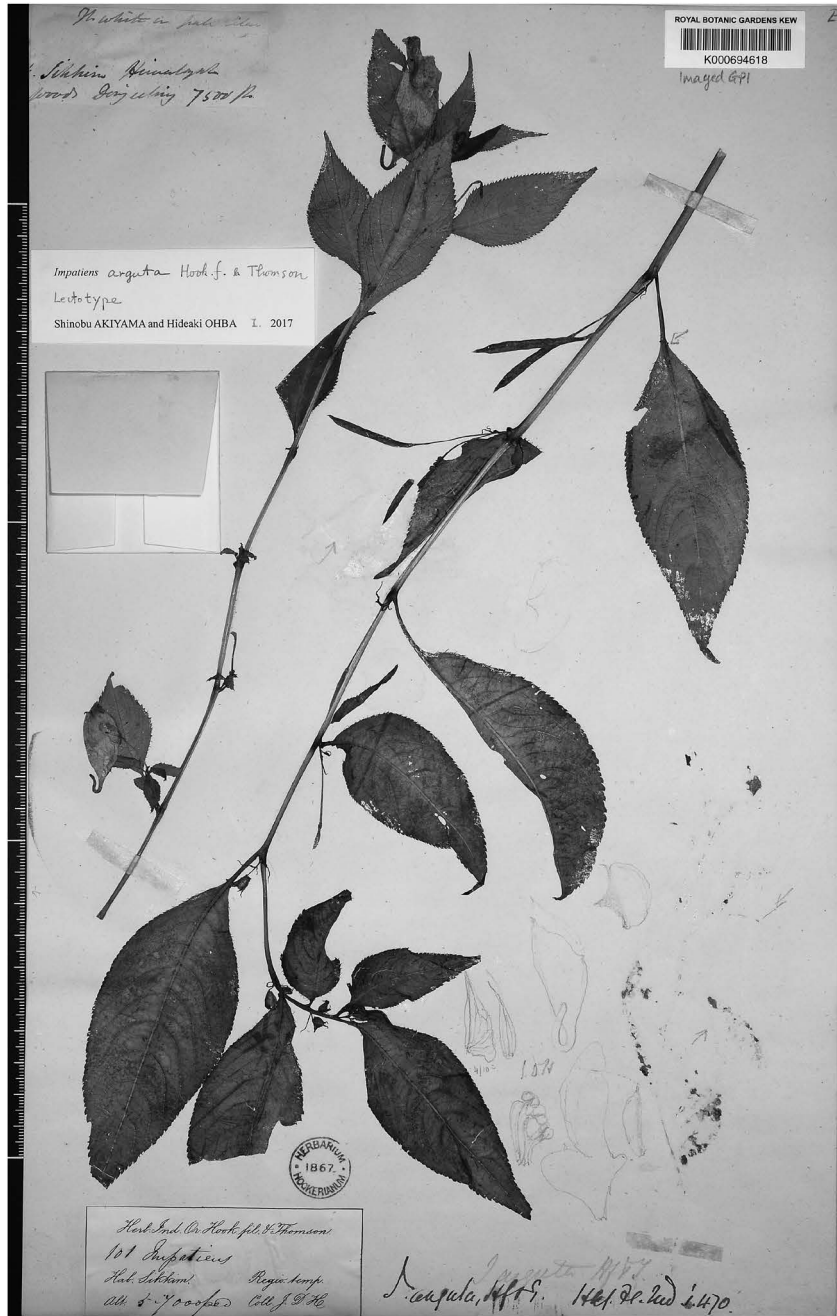


Fig. 3. Lectotype of *Impatiens arguta* Hook. f. & Thomson (J. D. Hooker s.n., K000694618).

1516, 17 Aug. 1972, BM-44009). Nigale, 5500 ft. (Banerjee, Shrestha & Upadhyaya 2633, 11 Sept. 1964, US). Phaplos, 8–9000 ft. (Lall Dhwoj 79, in 1930, BM-43995, E). Tinjure Danda, 2400 m (Williams & Stainton 8402, 6 Sept. 1967,

BM-44388, TI). **Dhankuta Distr.**, Bilbatay Bhanjang, 2200 m (H. Hara *et al.* 25 Oct. 1963, TI); Chitre, 2400 m (H. Kanai *et al.* 721162, 7 July 1972, TI); Murhay (H. Hara *et al.* s.n., 23 Oct. 1963, TI); Shidua–Chitre–Basantapur–Tute (H.

Ohba *et al.* 9120030*, 13 July 1991, TI); Shidua–Tute (H. Ohba *et al.* 9120029*, 9120045*, 13 July 1991, TI); Tute–Sindua (H. Ohashi *et al.* 771288, 2 Sept. 1977, TI); Goruwale Bhanjang (Bhanduke)–Maimajuwa–Pemeglu–Deurali Illam–Mai Pokhari, 2300 m (S. Noshiro *et al.* 9241103*, 26 June 1992, TI); **Panchthar Distr.**, Prangbung–Namle Phedi–Namle–Goruwale Bhanjang (Bhanduke), 2300 m (S. Noshiro *et al.* 9241070*, 25 June 1992, TI). **Ramechhap Distr.**, Bhandar–Kenja–Sete, 1880 m (M. Wakabayashi *et al.* 9710032, 29 July 1997, TI). **Rasuwa Distr.**, Syabru–Gonpagaon–Barbal–Bhargu–Dhunche, 2300 m (H. Takayama *et al.* 9241088, 25 July 1992, TI). **Solukhumbu Distr.**, Bandar–Goranda–Thadokhora–Linkhu Khola–Chamla Kharka–Chamare–Namkhli (F. Miyamoto *et al.* 9584017, 9596061, 20 July 1995, TI); Fera–Ringmu–Pangoma–Takisindu–Thoghe Boeg–Nunthara, 2780 m (F. Miyamoto *et al.* 9596393, 26 July 1995, TI); Kharikhola–Copra–Pangonba, 2110 m (F. Miyamoto *et al.* 9584068, 28 July 1995, TI); Kurki–Pangkongma La–Pangkongma–Kharikhola, 2270 m (M. Wakabayashi *et al.* 9720321, 29 Aug. 1997, TI); Namikhil–Chamare–Likhu (a bridge)–Bhandar (H. Ohba *et al.* 8572574, 10 Sept. 1985, TI); 1900 m (H. Ohba *et al.* 8520416, 10 Sept. 1985, TI); Namkhli–Gori–Gnuala, 2300 m (F. Miyamoto *et al.* 9592060, 21 July 1995, TI).

Notes: Ruchisansakun *et al.* (2018) designated Hooker 101 (K000694618) as the lectotype of *I. arguta*. The number '101' of 'Hooker 101' is not Hooker's collection number, but the number used by Hooker to organize the specimens *Impatiens*, as in the case of *I. serratifolia* mentioned below. It is not certain that all of specimens cited by Ruchisansakun *et al.* (2018) as isolectotypes are duplicates of the specimen chosen as the lectotype.

Section *Axilliflorae* Hook.f., Fl. Brit. India 1: 441 (1874).

Type species: *I. scabrida* DC., lecto, designated by S. X. Yu & Wei Wang (Yu *et al.*, 2015). Species 9–17.

Impatiens sect. *Lateriflorae* Hook.f. & Thomson, J. Proc. Linn. Soc. Bot. 4: 113 (1859), pro parte.

Impatiens sect. *Racemosae* Hook.f. & Thomson: S. X. Yu *et al.*, Cladistics 32 (online): 191 (2015, printed in 2016), pro parte.

Notes: Section *Axilliflorae*, sensu Yu *et al.* (2015), consists of species distributed in the Himalaya, Southeast Asia, and southwest China. They are characterized by linear capsules, many-flowered racemose inflorescences and ovoid seeds. The following Nepalese species in section *Axilliflorae* are characterized by the middle bracts in the inflorescence. The position of the bract in the inflorescence is an important character in distinguishing the species (Hooker and Thomson, 1859; Hooker, 1874–75; Chen, 1978; Akiyama and Ohba, 2000; Chen *et al.*, 2007). Inflorescences are not racemose but unusual (Akiyama and Ohba, 2000). Only two Nepalese species of section *Axilliflorae*, *I. scabrida* and *I. falcifer*, were surveyed molecularly; they are remote from other species of the section (Yu *et al.*, 2015).

9) *Impatiens uncipectala* C.B. Clarke ex Hook., Rec. Bot. Surv. India 4: 18, 22 (1905). Hara, in Hara and Williams (eds.), Enum. Fl. Pl. Nepal 2: 80 (1979). Grey-Wilson, in Grierson and Long (eds.), Fl. Bhutan 2: 92, f. 11t–v (1991). Press *et al.*, Annotated Checklist Fl. Pl. Nepal: 24 (2000). Chen, Akiyama and Ohba, in Wu and Raven (eds.), Fl. China 12: (2007). Gogoi *et al.*, Phytotaxa 273: 207 (2016). Ruchisansakun *et al.*, Blumea 63: (2018).

Type: India. Darjeeling, Rungyroong, 6500 ft. (Clarke 9121, 6 Sept. 1869, K000694903, lecto) (Gogoi *et al.*, 2016). Sikkim. alt. 6500–8500 ft. [Darjeeling, Sinchul 8500] ([Clarke 8846, 27 Aug. 1869], K000694902, syn).

I. yui S.H. Huan, Acta Bot. Yunnan 25: 266 (2003). Type: China. Yunnan, Gongshan, Dulongjiang mixed forest, 1800 m (T. T. Yü 19964, KUN, holo).

I. scabrida auct. non Wall.: Hook. f., Fl. Brit. India 1: 472 (1875), p.p.

I. cristata auct. non Wall.: Hara, Fl. E. Himal.: 195 (1966).

Distribution: Nepal (east) and E Himalaya.

Altitudinal range in Nepal: 2200–2400 m.

Ecology in Nepal: Hills at mid elevations; in forests.

Flowering in Nepal: June to October.

Nepalese specimens examined: **Dhankuta Distr.**, Shidua–Tute (H. Ohba *et al.* 9120043*, 13 July 1991, TI); Sinduwa, 2100 m (H. Hara *et al.* 6306721, 24 Oct. 1963, TI); Sinduwa–Chitray (H. Hara *et al.* 6306722, 24 Oct. 1963, TI). **Panchthar Distr.**, Chyangthapu–Chamlin Danda–Perunge–Dabale Deurali, 2500 m (S. Noshiro *et al.* 9241023*, 23 June 1992, TI); Dabale Deurali–bridge–Memeng–Prangbung (S. Noshiro *et al.* 9241051*, 24 June 1992, TI). **Sankhuwasawa Distr.**, Tinjure Phedi–Mangal Bare (H. Ohba *et al.* 9120059*, 15 July 1991, TI). **Taplejung Distr.**, Surke Pati–Gupha Pokhari (H. Ohashi *et al.* 771180, 772940, 774134, 775444, 30 Aug. 1977, TI).

10) *Impatiens kharensis* S.Akiyama, H.Ohba & M.Wakabayashi in Ohba and Malla (eds.), Himal. Pl. 2: 75, f. 9, col. pl. 5e (1991). Press *et al.*, Annotated Checklist Fl. Pl. Nepal: 23 (2000).

Type: C Nepal. Khare Khola: Bitta Kharka (4100 m)–a valley (3300 m)–Patale Pokhari (4000 m) (H. Ohba *et al.* 8320702, 12 Sept. 1983, TI, holo; KATH, iso).

Distribution: Endemic to Nepal (East).

Altitudinal range in Nepal: 3300–4000 m.

Ecology in Nepal: Alpine.

Flowering: September.

Nepalese specimen examined: Type only.

11) *Impatiens serrata* Benth. [ex Wall., Numer. List: 168, n. 4771 (1831), nom. nud.] ex Hook.f. & Thomson, J. Proc. Linn. Soc. Bot. 4: 136 (1859). Hara, in Hara and Williams (eds.), Enum. Fl. Pl. Nepal 2: 80 (1979). Akiyama *et al.*, in Ohba and Malla (eds.), Himal. Pl. 2: 74, f. 8, col. pl. 5d (1991). Grey-Wilson, in Grierson and Long (eds.), Fl. Bhutan 2: 96, f. 13 m, n (1991). Press *et al.*, Annotated Checklist Fl. Pl. Nepal: 23

(2000). Chen *et al.*, in Wu and Raven (eds.), Fl. China 12: 83 (2007). S.-X. Yu, Balsaminaceae China: 201 (2012).

Type: Umbrosis Himalayæ temperatæ centralis et orientalis, Nepal [Napalia] ([Wallich Cat. no. 4771, in 1821], K001039866, lecto, designated here) (Fig. 4). Sikkim, 8000–10000 ped. (J. D. H. s.n., syn) (not found).

I. serrulata Hook.f., Rec. Bot. Surv. India 4: 7, 10 (1904). Type: Kumaon, Ralam valley, at Saba Udiyar (not found).

Distribution: Nepal (west, central, east), W Himalaya and E Himalaya.

Altitudinal range in Nepal: 2000–3600 m.

Ecology in Nepal: Hills at mid elevations to alpine.

Flowering in Nepal: July to October.

Nepalese specimens examined (addition to Akiyama *et al.*, 1991): (N. Wallich, Cat. no. 4771, BM-44361). (Clive Wigram s.n., in 1927, E). Central (J. Scully s.n., Sept. 1880, K). Bheding, 12–13000 ft. (Lall Dhwoj 331, in 1930, BM-44000, E). Between boulders along trail near Dobato (28°03' 85°28'), 2500 m (J. H. de Haas 2333, 8 Aug. 1978, BM-43974). Gangja La–Palchock Danda (O. Polunin 1962, 10–17 Sept. 1949, BM-44179). Near Gorjigoth, Don Sehl, N. W. of Jumla, 11000 ft. (O. Polunin, W. R. Sykes & L. H. Williams 5060, 9 Aug. 1952, BM-44212, E). Nr. Gurjakhani, 8500 ft. (Stainton, Sykes & Williams 3682, 31 July 1954, BM-44277, E). South of Gurjakhani, 11000 ft. (Stainton, Sykes & Williams 3867, BM-44281, E). Between Jumla and Gorjigoth, 12000 ft. (O. Polunin, W. R. Sykes & L. H. Williams 5066, 9 Aug. 1952, BM-44213, E). Lang Dang, 7000 ft. (F. M. Bailey's collectors 31 Aug. 1935, BM-43862). Laurivingyak, 10–11000 ft. (S. B. Malla 9226, 27 July 19677, BM-44154). Maney Dara, 13–14000 ft. (L. Dhwoj 505, in 1930, BM-44002, E). Sattewati, 6500 ft. (Stainton, Sykes & Williams 8912, 12 Oct. 19541 BM-44324, E). E. of Tarke–Ghyang, 28°00'–85°33', 31–3400 m (J. H. de Haas 2714, 8 Sept. 1975, BM-43984). Tsedang Pokhari, 3100 m (H. Kanai & S.B. Malla 674682, 23 Aug. 1969, TI).



Fig. 4. Lectotype of *Impatiens serrata* Benth. ex Hook. f. & Thomson (N. Wallich Cat. no. 4771, in 1821, K001039866).

Bajhang Distr., Jimkot–Sonargaon–Daruhaon–Meltadi–Khaptad National Park, 2850 m (M. Suzuki *et al.* 9170959, 26 Aug. 1991, TI); 2950 m (M. Suzuki *et al.* 9170993, 27 Aug. 1991, TI); Pategaon–Ghodi Lehk Deorali–Badigaon, 3250 m (M. Suzuki *et al.* 9170663, 16 Aug. 1991,

TI). **Kalikot Distr.**, Panipokhari–Bajangeneta–Beuli–a pass–Chaukebada, 2800 m (M. Suzuki *et al.* 9170231, 4 Aug. 1991, TI). **Rasuwa Distr.**, a Kharka–Pabil Kharka, 3300 m (F. Miyamoto *et al.* 9420189*, 6 Aug. 1994, TI); a Kharka–Pati. Kharka, 3720 m (F. Miyamoto *et al.* 9420166*, 4

Aug. 1994, TI); Chyauche Kharka—a bridge—Lingju, 3580 m (F. Miyamoto *et al.* 9420242*, 12 Aug. 1994, TI); Deolari—Sing Gomba (T. Hoshino *et al.* 9535090, 9535107, 9536044, 9539060, 9539061, 22 July 1995, TI); Laurebinayak—Sing Gomba (T. Hoshino *et al.* 9539215, 30 July 1995, TI); Mängen—Khodang Danda (H. Hara *et al.* 723206, 28 Aug. 1972, TI); 3000 m (H. Hara *et al.* 722023, 723206, 28 Aug. 1972, TI); Pati Kharka—cross a river—a Kharka (near Pabil Kharka), 3800 m (F. Miyamoto *et al.* 9420180*, 5 Aug. 1994, TI); Sing Gomba—Laurebinayak, 3800 m (T. Hoshino *et al.* 9533102, 23 July 1995, TI); Trisuli Khola—Singum Gompa, 3200 m (H. Hara *et al.* 723205, 22 Aug. 1972, TI). **Sindhupalchok Distr.**, Jangdang Kharka—Tingoang, 3100 m (H. Kanai *et al.* 672949, 24 Sept. 1970, TI); Thale—Thale Bisauana, 2600 m (H. Kanai, Ch. Chuma & T. Nagano 675182, 10 Sept. 1970, TI); Tingoang—Khosori Khabre, 3000 m (H. Kanai, Ch. Chuma & T. Nagano 675183, 675181, 12 Sept. 1970, TI).

12) *Impatiens williamsii* H.Hara, J. Jap. Bot. 47: 142 (1972). Hara, in Hara and Williams (eds.), Enum. Fl. Pl. Nepal 2: 80 (1979). Press *et al.*, Annotated Checklist Fl. Pl. Nepal: 24 (2000).

Type: Nepal. Between Jumla and Garjigoth, 1000 ft (Polunin, Sykes & Williams 5041, 8 Aug. 1952, BM, holo).

Distribution: Endemic to Nepal (west).

Altitudinal range in Nepal: 2400–3100 m.

Ecology in Nepal: Hills at mid elevations.

Flowering in Nepal: August.

Nepalese specimen examined: Type only.

13) *Impatiens falcifer* Hook.f., Bot. Mag. 129: t. 7923 (1903). Hara, in Hara and Williams (eds.), Enum. Fl. Pl. Nepal 2: 78 (1979). Akiyama *et al.*, in Ohba and Malla (eds.), Himal. Pl. 2: 72, f. 7, col. pl. 5a, b (1991). Grey-Wilson, in Grierson and Long (eds.), Fl. Bhutan 2: 95, f. 12r, s (1991). Press *et al.*, Annotated Checklist Fl. Pl. Nepal: 22 (2000). Chen *et al.*, in Wu and Raven (eds.), Fl. China 12: 83 (2007). S.-X. Yu, Balsaminaceae China: 188, col. figs. (2012).

Type: [India]. [Sikkim. Regio. temp. alt. 8–1000 ped.] [Lachin 9–10–11000 ft] ([J. D. H. s.n., 31 July 1849], K000694739, lecto, designated here) (Fig. 5). [Sikkim. Lachung River, 8–9000 ft.] ([J. D. H. s.n., 2 Oct. 1849], K000694740, syn).

I. serrata auct. non Benth.: Hook. f. in Fl. Brit. India 1: 473 (1875), p.p.

Distribution: Nepal (central, east) and E Himalaya.

Altitudinal range: 2500–3400 m.

Ecology: Hills at mid elevations to alpine.

Flowering: June to October.

Nepalese specimens examined (in addition to those cited in Akiyama *et al.*, 1991): Arun Valley, Chyamtang, 9000 ft. (J. D. A. Stainton 1745, 21 Sept. 1956, A, BM-44260, E). near Bhuanjeng (27°55′–85°30′), 3300 m (J. H. de Haas 2117, 8 Aug. 1974, BM-43971). Shepherd-houses, E of Dobato, (3200 m) 3500 m (J. H. de Haas 2806, 19 Sept. 1974, BM-43985). Iswa Khola, 11000 ft. (L. W. Beer 25561, 5 Oct. 1975, BM-43884). Jshade-Magan, 10–11000 ft. (S. B. Malla 9559, 29 July 1967, BM-44155). Kasua Khola, 12000 ft. (L. W. Beer 9538, 2 July 1971, BM-43874). Kasuwa Khola, 10000 ft. (L. W. Beer 25321, 17 Aug. 1975, BM-43881). Kharte, 37°36′86°42′, 3000 m (J. F. Dobremez 302, 4 July 1970, BM-44094). Langtang, 11500 ft. (O. Polunin 530, 22 June 1949, BM-44166). Magan—Ghopte, 10000 ft. (T. B. Shrestha & P. R. Shakya 3768, 9 Sept. 1965, US2582296). Maney Dara, 13–14000 ft. (Lall Dhwoj 505, in 1930, E). Panghu Danda—Mere Danda (H. Kanai & S. B. Malla 674694, 23 Aug. 1969, TI). Phulchoki, south of Kathmandu, 2650 m (H. Hara *et al.* 723210, 15 July 19725, TI). Riala, 5000 ft. (Polunin, Sykes & Williams 1317, 2 Sept. 1952, E). Tamur Valley, Mewa Khola, 10000 ft. (J.D.A. Stainton 1309, 9 Aug. 1956, BM-44257). Tamba Khola, 27°30′N, 87°57′E, 9500 ft. (L. H. J. Williams 921, 24 June 1969, BM-44375). Wabak Khola, 9500 ft. (L. W. Beer 9485, 27 July 1971, BM-43871). **Gorkha Distr.**, Lungdang Gompa, 3170 m (M. Suzuki *et al.* 9460512, 29 July 1994, TI). Lalitpur Distr., Phulchoki (H. Kanai 673414,



Fig. 5. Lectotype of *Impatiens falcifer* Hook. f. (J. D. Hooker s.n., 31 July 1849, K000694739).

9 Aug. 1969, TI). **Rasuwa Distr.**, Langtang vil-
lage area, 11500 ft. (O. Polunin 1561, 1 Aug.
1949, BM-44171); Between Syarpagaon &
Langtang, 3000m (D. Nicolson 2555, 20 Sept.

1966, BM-44159, US2571537); Gopte–Thale
Patil (H. Hara *et al.* 723211, 26 Aug. 1972, A,
BM-44052, TI; 723217 26 Aug. 1972, TI); Lama
Hotel–Langtang–Shingdum (S. Noshiro 9154521,

31 Aug. 1991, TI); Oo Kharka, 3400 m (H. Kanai & P. R. Shakya 672370, 7 July 1970, TI); Shingdum–Kyanjin Gompa–Langshisa Kharka (S. Noshiro 9154536, 1 Sept. 1991, TI). **Sankhuwasawa Distr.**, Bhainsi Kharka, 3030 m (M. Suzuki *et al.* 8850751, 31 July 1988, TI); Bhainsi Kharka–Danda Kharka–Unshisa Kharka–Khongma (M. Suzuki *et al.* 8820497, 8880454, 8880461, 15 July 1988, TI); 2555 m (M. Minaki *et al.* 9010109, 4 Aug. 1990, TI); 3200 m (M. Minaki *et al.* 9020582, 4 Aug. 1990, TI); 2850 m (M. Minaki *et al.* 9020596, 4 Aug. 1990, TI); 2940 m (M. Minaki *et al.* 9080115, 4 Aug. 1990, TI); Danda Kharka (Dhari Kharka), 2800 m (M. Suzuki *et al.* 8850345, 15 July 1988, TI); E bank of Upper Saldim Khola, below bridge, NW of Hatiya, 27°45'N, 87°17'E, 2920 m (D. G. Long *et al.* 723, 12 Oct. 1991, E); Upper Kashwa Khola, Dhap, above Hedangha, 2800 m (Grey-Wilson *et al.* 4377, 8 Sept. 1981, K); Khongma (Kauma)–Unshisa Kharka–Bhainsi Kharka–Utise Kharka–Tashi Gaun (Tashigaon), 3060 m (M. Suzuki *et al.* 8860373, 31 July 1988, TI); Singoa Kharka–Pahakhola (H. Ohba *et al.* 9110452*, 9120401*, 11 Aug. 1991, TI). **Sindhupalchok Distr.**, Kuri–Charikot, 3100 m (H. Kanai *et al.* 674667, 29 Sept. 1970, TI); Thale Bisauna–Tingoang, 2800 m (H. Kanai & T. B. Shrestha 675180, 11 Sept. 1970, TI); Forested ridge between Tashigaon and Kauma, 27°37'N, 87°14'E, 2650 m (D. G. Long *et al.* 248, 25 Sept. 1991, E). **Solukhumbu Distr.**, around Rangdu Kharka, 3320 m (M. Wakabayashi *et al.* 9715117, 9 Aug. 1997, TI); Chhatarwa–a pass–Kurke, 3620 m (F. Miyamoto *et al.* 9596522, 29 Aug. 1995, TI); Dudh Kund–Hinku Khola–Thasing Dingma, 3270 m (F. Miyamoto *et al.* 9584267, 27 Aug. 1995, TI); Gnaula–Pike, 3270 m (F. Miyamoto *et al.* 9584035, 22 July 1995, TI); 3325 m (F. Miyamoto *et al.* 9596092, 22 July 1995, TI); Pangkongma–Pangkongma La–Hinku Khola–Nashing Dingma, 2840 m (M. Wakabayashi *et al.* 9720102, 3 Aug. 1997, TI); Pangonba–Chhotu–Hinku Khola–Najing Ding, 3000 m (F. Miyamoto *et al.* 9592136, 29 July 1995, TI); Tashing Dingma–Thuli Kharka, 3400 m (M. Wakabayashi *et al.*

9720294, 27 Aug. 1997, TI); Thasing Dingma–Chhatarwa, 3700 m (F. Miyamoto *et al.* 9596504, 28 Aug. 1995, TI). **Taplejung Distr.**, Diorali Bhanjang–Bhandukay, 3100 m (H. Hara *et al.* 6300481, 14 Nov. 1963, TI).

14) *Impatiens bajurensis* S.Akiyama & H.Ohba, J. Jap. Bot. 68: 157 (1993). Press *et al.*, Annotated Checklist Fl. Pl. Nepal: 21 (2000).

Type: Far W Nepal. Seti Zone: Bajura Distr., Kaudegaon–Babali, alt. 1520 m (M. Suzuki *et al.* 9171054, 29 Aug. 1991, TI, holo; KATH, iso).

Distribution: Endemic to Nepal (west).

Altitudinal range in Nepal: 1500–3000 m.

Ecology in Nepal: Hills at mid elevations, on edge of forest.

Flowering in Nepal: April to October.

Nepalese specimens examined: Doti–Sili-garhi, 4500 ft. (N. Ecker-Racz 38, 1 Apr. 1967, US). Between Munigaon and Chutta, S.E. of Jumla, 9500 ft. (Polunin, Sykes & Williams 4901, 24 July 1952, E). Mugu Kamali Valley, near Lumsa, 7000 ft. (Polunin, Sykes & Williams 5186, 14 Aug. 1952, E). Ratuligaon (Bis Ram 350, 19290502, NY). Samla, 7000 ft. (Polunin, Sykes & Williams 5560, 4 Oct. 1952, BM-44221, E). Tibrikot, 2700 m (S. Einarsson *et al.* 1761, 6 July 1973, BM-44017).

15) *Impatiens tricornis* Lindl., Bot. Reg. 26: t. 7 (1840). Akiyama & Ohba, Bull. Natl. Mus. Nat. Sci. 42: 128 (2016).

Type: Illustration, t. 7 published in Bot. Reg. 26 (1840) (lecto) (Akiyama and Ohba, 2016).

I. praetermissa Hook.f., J. Linn. Soc. Bot. 37: 29 (1904). Type: Wallich s.n. (not found).

I. scabrida auct. non DC.: Wight, Icon. Pl. Ind. Orient. 2: t. 323 (1840). Hook. f., Fl. Brit. India 1: 472 (1875); Rec. Bot. Surv. India 4: 7 & 10 (1904). Hara, Fl. E. Himal.: 196 (1966); 2nd rep.: 75 (1971); in Hara and Williams (eds.), Enum. Fl. Pl. Nepal 2: 80 (1979). Polunin and Stainton, Fl. Himal.: 70 (1984). Akiyama *et al.*, in Ohba and Malla (eds.), Himal. Pl. 2: 83, fig. 16, Pl. 6 a–c (1991); J. Jap. Bot. 67: 192 (1992). Press *et al.*, Annotated Checklist Fl. Pl. Nepal: 23 (2000).

Chen *et al.*, in Wu and Raven (eds.), Fl. China 12: 83 (2007). S.-X. Yu, Balsaminaceae China: 200, col. figs. (2012).

I. cristata auct. non Wall.: Hook. f., Rec. Bot. Surv. India 4: 7 & 10 (1904); 22 (1905). Grey-Wilson, in Grierson and Long (eds.), Fl. Bhutan 2: 92, fig. 12a–c (1991).

Distribution: Nepal (west, central), W Himalaya, and E Himalaya.

Altitudinal range in Nepal: 1000–2700 m.

Ecology in Nepal: Hills at mid elevations.

Flowering in Nepal: August to September.

Nepalese specimens examined (in addition to those cited in Akiyama and Ohba, 2016): Dadeldhura, 2000 m (P. R. Shakya & D. P. Joshi 479, 5 May 1971, TI). Dhanche, 1800 m (P. R. Shakya & Dr. Adhikari 611, 19 July 1971, TI). Dhampus / Lumle, 2100 m (H. Flatt 107, 8 Oct. 1969, TI). Near Balangra Pass, 3600 m (Polunin, Sykes & Williams 2628, 28 July 1952, TI). Takumsibang, 1650 m (Stainton, Sykes & Williams 4247, 6 Sept. 1954, TI). **Bajhang Distr.**, Chainpur–Subeda–Seti Nadi–Sudaya–Sangur Khola–Laitola–Newtomi–Jimkot, 1200 m (M. Suzuki *et al.* 9170946, 25 Aug. 1991, TI); Dhaulun–a pass–Ghat Khola–Jima–Rasa, 1980 m (M. Suzuki *et al.* 9170804, 20 Aug. 1991, TI); Berseni–Shalkatiyan–Naulakot–Pirekot–Pandusen–Porakya Deorali–Porakya, 2130 m (M. Suzuki *et al.* 9170507, 12 Aug. 1991, TI); Serigaon–Ukhadi–a river–Jugalo–a pass–Budhiganga Khola–Bashala, 1600 m (M. Suzuki *et al.* 9170590, 14 Aug. 1991, TI). **Dolakha Distr.**, Gungur Khpla–Jagat, 1120 m (S. Noshiro *et al.* 20710213, 24 Sept. 2007, TI); Jamune, 1040 m (S. Noshiro *et al.* 20710051, 14 Sept. 2007, TI). **Gorkha Distr.**, Syaule Bhatti–Thado Bharyang–Jagat, 1000 m (M. Suzuki *et al.* 9470146, 23 July 1994, TI). **Jumla Distr.**, Munigaon–Chutta, SE. of Jumla, 2850 m (Polunin, Sykes & Williams s.n., 24 July 1952, TI). **Kalikot Distr.**, Chaukebada–Haudi–Sukativ–Battis–Tila Khola–Badarigaon (M. Suzuki *et al.* 9170299, 5 Aug. 1991, TI). **Kaski Distr.**, Tikhedhunga (Tirkhedhunga)–Hile (Hille)–Birethanti–Chandrakot–Kande (Kaare) (M. Suzuki *et al.* 8881795, 7 Sept. 1988, TI); 1300 m

(M. Suzuki *et al.* 8881778, 7 Sept. 1988, TI). **Lalitpur Distr.**, Godavari (H. Hara *et al.* 6306731, 18 Sept. 1963, TI); (H. Hara *et al.*, 69870, 19690528, TI); 1500 m (H. Kanai 674472, 1 Nov. 1969, TI). **Makwanpur Distr.**, Deorali–Kuli Khani, 1700 m (H. Kanai & T.B. Shrestha 672729, 3 Sept. 1970, TI). **Manang Distr.**, Latamanang, 2440 m (M. Mikage *et al.* 9485416, 14 Aug. 1994, TI). **Myagdi Distr.**, Ghodepani Deurali (Ghorapani)–Ranibas–Chitre–Phalante–Ghopte Kharka–Shika, 2400 m (M. Suzuki *et al.* 8881364, 25 Aug. 1988, TI); Shika–Khipang (Khibang)–Paudwar–Jibang–Gaunapani–Narchang (Nracheng), 1460 m (M. Suzuki *et al.* 8881449, 26 Aug. 1988, TI); 1700 m (M. Suzuki *et al.* 8881458, 26 Aug. 1988, TI). **Rasuwa Distr.**, Between Dhunche and Dhimsa, 1950 m (D. G. Long *et al.*, 130, 5 Oct. 2001, TI); Dhunche–Barku–Syabru (S. Noshiro 9154503, 29 Aug. 1991, TI); Lingju–Tibling, 2100 m (F. Miyamoto *et al.* 9420264*, 13 Aug. 1994, TI); Trisuli Khola–Singum Gompa, 2500 m (H. Hara *et al.* 721799, 22 Aug. 1972, TI).

16) *Impatiens scabrada* DC., Prodr. 1: 687 (Jan. 1824). Akiyama and Ohba, Bull. Natl. Sci. Mus., Ser. B 42: 129 (2016).

Type: Nepal [Nepauliâ]. (N. Wallich, G00218814, holo).

I. calycina Wall. in Roxb., Fl. Ind. 2: 463 (Mar.–June 1824). Type: Nepal. Chundrugiri [Chandragiri] [Chandaghiri on label] (N. Wallich 4769a, Aug. 1821, lecto) (Akiyama and Ohba, 2016)].

I. cristata Wall. in Roxb., Fl. Ind. 2: 456 (Mar.–June 1824). Type: No authentic specimen found.

Distribution: Nepal.

Altitudinal range in Nepal: Unknown.

Ecology in Nepal: Unknown.

Flowering in Nepal: Unknown.

Nepalese specimens examined: Known only from the types of *I. scabrada* and *I. calycina*.

17) *Impatiens serratifolia* Hook.f., Rec. Bot. Surv. India 4: 18, 23 (1905).



Fig. 6. Lectotype of *Impatiens serratifolia* Hook. f. (J. D. Hooker, 6 Aug. 1849, K000694938).

Type: Sikkim. Lachong, Regio temp., alt. 9–10000 ped (J. D. Hooker, 6 Aug. 1849, K000694938, lecto, designated here) (Fig. 6); Lachen, alt. 8–10000 ped (J. D. Hooker, 3 Aug.

1849, K, syn).

I. serrata auct. non Benth.: Hook. f., Fl. Brit. India 1: 473 (1875), p.p.

Distribution: Nepal (central, east) and E

Himalaya.

Altitudinal range in Nepal: 2400–3000 m.

Ecology in Nepal: Hills at mid elevations.

Flowering in Nepal: May to September.

Nepalese specimens examined: Arun Valley, Chyamtang, 8000 ft. (J.D.A. Stainton 413, 24 May 1956, A, BM; 1756, 21 Sept. 1956, A, BM). Kyapra to Phedi, Ghunsa Khola, 27°38'N, 87°55' E, 2700 m (KEKE 324, 7 Sept. 1989, E).

Notes: In the Kew Herbarium Catalogue database, the collector and collector number of specimen K000694938 is recorded as 'Hooker, J. D., 89;' the date of collection is given as 6 Aug. 1849, which accords with the date on the label of the specimen. Another Hooker specimen at K, but not in the database, was collected on 3 Aug. 1849 (see specimen label) is also numbered '89.' It is unreasonable to consider the latter to be a duplicate of K000694938, because of the different collection dates. I consider the second specimen numbered '89' to be a syntype, not an isolecotype. The number '89' is regarded as Hooker's species number in his study of *Impatiens* (see Hooker, 1903).

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