



## Balsaminaceae of Myanmar

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### Key words

*Hydrocera*  
*Impatiens*  
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taxonomy

**Abstract** A revision of the *Balsaminaceae* of Myanmar is presented based on herbarium collections and a field trip in 2015. Sixty-five species, unevenly distributed across one monotypic (*Hydrocera*) and one species-rich genus (*Impatiens*), are recognised. An identification key to species is presented. Twenty species are new records for the country, 17 names are typified and seven species names are synonymized. For each species, a description of the morphology, phenology, ecology and distribution range is provided.

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## INTRODUCTION

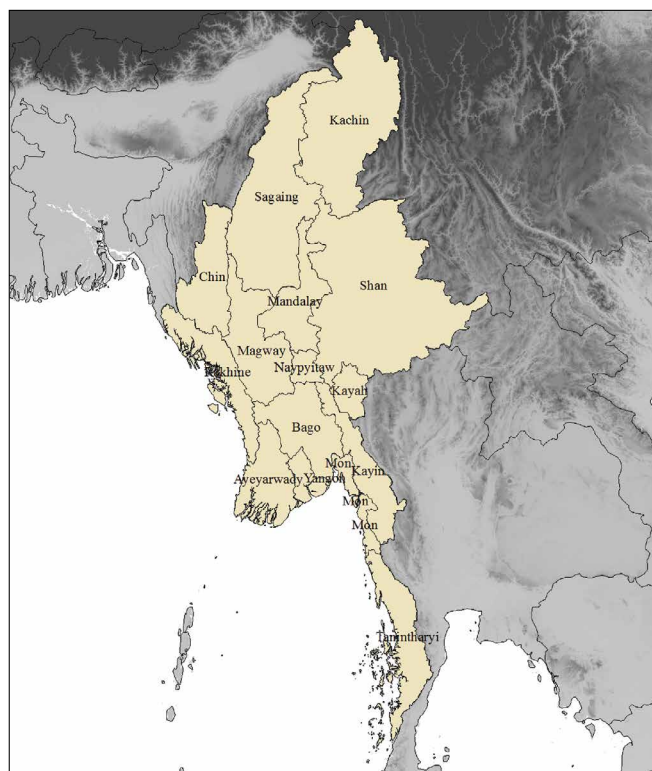
*Balsaminaceae* consists of two genera: *Impatiens* L. (1753: 937) and *Hydrocera* Blume ex Wight & Arn. (1834: 140). While *Impatiens* contains over a thousand species and is mainly distributed across the Old World tropics and subtropics, the latter includes only *Hydrocera triflora* distributed from India to Southeast Asia (Janssens et al. 2009). Most *Impatiens* species occur in one of five informally recognised hotspots of diversity for the genus: tropical Africa, Madagascar, southern India and Sri Lanka, the Sino-Himalayan region and Southeast Asia (Yuan et al. 2004).

*Impatiens* was first mentioned in the 'Turner's herbal' (1568) as *Balsamina*, and it was later formally named *Impatiens balsamina* by Linnaeus (1753). In his *Species Plantarum*, Linnaeus (1753) named six other species of *Balsaminaceae*, including *Impatiens triflora* L. (1753: 938), now known as *Hydrocera triflora*. More recently, one of the most important students of *Impatiens*, Joseph Dalton Hooker, spent a lifetime trying to unravel the complex taxonomy of the Asian species (Hooker & Thomson 1860, Hooker 1875, 1904b, 1905, 1908, 1909, 1911a–c).

Myanmar, the largest country on mainland Southeast Asia, is situated between northern latitudes 9–29°, and eastern longitudes 92–102°. The country borders China in the north, Laos and Thailand in the east, and India in the west (Map 1, 2). Myanmar has a diverse topography with lowlands in the center and south of the country, and mountainous areas in the west, east, and north. The highest peak, Hkakabo Razi, reaches 5881 m. As a result of these latitudinal and altitudinal gradients, Myanmar is characterized by a large variety of climate zones and natural habitats. The country is largely situated in the tropical climate zone, except for the high altitude regions in the north that are characterized by an alpine climate. The climate is mostly monsoonal: most precipitation falls during the

hot summer months (June to September), whereas the period from December to April is dry and cool (Stamp 1924). An exception is the Tanintharyi Region in the south, where rainfall occurs throughout the year (Stamp 1924).

The vegetation of Myanmar consists of temperate evergreen rain forests and evergreen mountain forests (> 1000 m above sea level) in the north, east and west; evergreen lowland forests in the south; semi-evergreen rain forests in a narrow belt between evergreen forest and deciduous forest; an arid zone in central Myanmar; deciduous forests that surround the central arid zone and alpine vegetation in the north (Map 1; Kress et al. 2003, Stibig & Beuchle 2003). The climatic and habitat variation is associated with high overall plant species richness (Kress et al. 2003). Myanmar geographically lies at the intersection



**Map 1** Administrative division of Myanmar.

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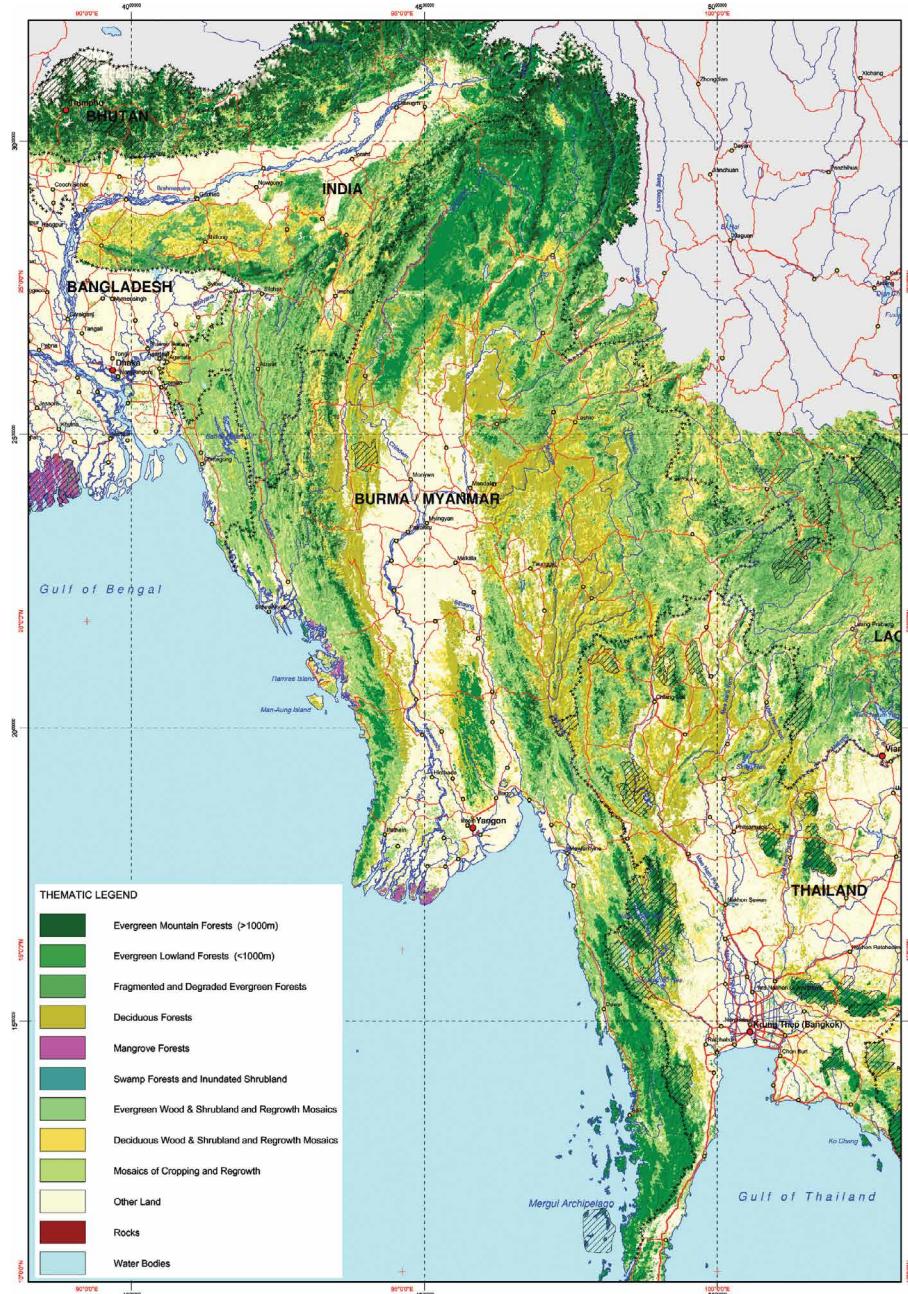
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**Map 2** Forest covers of Myanmar (edited from Stibig & Beuchle 2003).

of two *Balsaminaceae* hotspots. Given its diverse topography and various vegetation, the country may harbour a wide range of *Impatiens* species.

Historically, collections of *Balsaminaceae* in Myanmar were made by Wallich (1826–1827), Lobb (1846), Parish (1862), King (1879), Khalili (1893), Mokim (1897–1898), Lace (1909), Vening (1910), E.M. Buchanan (1910–1911), Toppin (1911–1912), Parkinson (1925) and Kingdon-Ward (1914–1956). In 1905, Hooker published a detailed comparative study, including a species identification key in 'An epitome of the British Indian species of *Impatiens*', partly focusing on Burmese (Myanmar) taxa. The treatment contains description of 52 Burmese *Balsaminaceae* species, including species from Assam to Tanasserim, of which 39 were considered endemic to that area. However, the area he studied differs from current Myanmar. Later on, Toppin (1920) described six new species from the Kachin Hills in northern Myanmar. Fischer (1926) recognised an additional two species from Kachin State, followed by three more species from the north by Comber (1934). Relatively little botanical work was done on the Burmese flora until Kress

et al. (2003) published the plant checklist of Myanmar, where 47 species of *Balsaminaceae* are reported as native to the country. Between 2006–2016, several field trips to Myanmar by the Makino botanical garden team, New York botanical garden, and Flora of Pan-Himalaya project, have been carried out. Eight new species were recently described from these expeditions (Tanaka et al. 2015, Ruchisansakun et al. 2017, 2018, Yang et al. 2017). Given the addition of several species since Hooker (1905) published his identification key for Myanmar species, and given that several *Impatiens* specimens of Myanmar that are present in herbaria (including those of local institutes RAF and RANG) are not always accounted for, a revision of the *Balsaminaceae* in Myanmar is needed.

The aim of this study is to revise the *Balsaminaceae* of Myanmar. Our objective was to use historical and modern collections to assess species delimitations, provide descriptions of morphology, phenology, ecology and the distribution range of all taxa, as well as to construct a dichotomous identification key. We also designate type specimens for all names.

**Table 1** Comparison of terminology for each floral part used by various authors.

	sepal	inner sepals	outer sepals	lip	dorsal petal (standard)	wings	basal lobe of wings	distal lobes of wings
Hooker (1905)								
Shimizu (1970)	lateral sepals	inner sepals	outer sepals	lip	standard	wing-petals	basal lobes	distal lobes
Grey-Wilson (1980a)	lateral sepals	the upper pair	the lower pair	lower sepal	dorsal petal	lateral united petals	upper petals	lower petals
Chen et al. (2007)	lateral sepals	inner	outer	lower sepal	upper petal	lateral united petals	basal lobes	distal lobes
Fischer & Rahelivololona (2007)	lateral sepals	–	–	lower sepal	dorsal petal	lateral united petals	upper petal	lower petal
Suksathan & Triboun (2009)	lateral sepals	the inner pair	the outer pair	lower sepal	dorsal petal	lateral united petals	upper petals	lower petals
Grey-Wilson (1989a)	lateral sepals	the inner upper pair	the outer, lower, pair	lower sepal	dorsal petal	lateral united petals	upper petal of each pair	lower petal of each pair
Ruchisansakun et al. (2014)	lateral sepals	the inner pair	the outer pair	lower sepal	dorsal petal	lateral united petals	the upper pair	the lower pair
Tanaka et al. (2015)	lateral sepals	–	lower sepal	lower sepal	dorsal petal	lateral united petals	upper lobes	lower lobes
Souvannakhoumane & Suksathan (2015)	lateral sepals	the inner pair	the outer pair	lower sepal	dorsal petal	lateral united petals	upper petal	lower petal
Prabhukumar et al. (2015)	lateral sepal	–	–	lower sepal	dorsal petal	lateral united petals	upper lobe	lower lobe
Guo et al. (2016)	lateral sepals	–	the outer pair	lower sepal	upper petal	lateral united petals	upper petal of each pair	lower petal of each pair

## MATERIAL AND METHODS

The revision is based on material from two sources, herbarium specimens and field collections made during this study. To document the full diversity of *Balsaminaceae* in Myanmar and visit previously under-collected areas, a collecting expedition was carried out between July and December 2015. Herbarium specimens were prepared, at least in threefold, for each collection. *Balsaminaceae* flowers often contain important taxonomic information that is lost upon pressing. To retain the maximum amount of diagnostic information, floral parts were flattened and fixed on hard paper. Specimens were deposited in Naturalis herbarium (L; Leiden, the Netherlands) and, depending on the number of duplicates, in at least two of Myanmar's three herbaria: the Myanmar Forest Herbarium at Yesin (RAF), Yangon University (RANG) and the University of Mandalay (MAND).

Herbarium collections were sourced from material recently collected during expeditions organized by the Makino Botanic Garden (2013–2015), the New York Botanic Garden (2015) and the Flora of Pan-Himalaya project (2014). Additional specimens were studied from the following herbaria: AAU, BK, BKF, BR, K, L, MAND, QBG, RAF, RANG and SING (herbarium codes from Index Herbariorum at <http://sweetgum.nybg.org/ih/>). All specimens cited here have been studied, unless indicated otherwise, specimens seen only as image are denoted with asterisks (\*). Morphological terminology for species descriptions follows Grey-Wilson (1980a). Because of the confusion of the terms used for floral parts in previous studies, some of the technical terms are compared here (Table 1). The colour of each part was determined from fresh specimens or based on information on specimen labels, drawings or literature. All characters recorded were compiled in a data sheet to improve the comparison between each specimen before extracting this information into a description. In this revision, we have used the most recent infrageneric classification of *Impatiens* (Yu et al. 2015).

## MORPHOLOGY OF BALSAMINACEAE

We focus on the morphological variation among *Impatiens* species from Myanmar. States of the selected characters of each species are shown in Table 2.

### Habit

*Balsaminaceae* in Myanmar are generally terrestrial, often lithophytic in limestone habitat. A few taxa, *Hydrocera triflora*, *Impatiens chinensis* and *I. pulchra*, are semi-aquatic. Most species are annuals, with only few perennials. *Impatiens parishii* and *I. kerriae* can grow as perennial shrubs but with soft and succulent stems. Only *I. duclouxii* is a woody-stemmed perennial. Few species (e.g., *I. arguta*, *I. forrestii* and *I. holocentra*) are perennial with thin fascicled roots in different shapes. Interestingly, there is no clear link between growth-form and woodiness, some shrubby species may appear woody but do not show woodiness anatomically, while *I. violiflora* is an annual herb with thin and fragile stems but shows real woodiness (Lens et al. 2012).

### Stem

The stem is mostly succulent, fragile and soft, green to purple. Red or purple dots are sometimes present. Only shrub-like species (*I. kerriae* and *I. parishii*) have a dry brownish grey stem surface basally. Most taxa have an erect stem, but some are decumbent in the lower part, and sometimes rooting at nodes. Most species have a glabrous stem, but some are either entirely pilose or pilose only in the upper part. The stem is usually cylindrical below and commonly angular or rarely winged-ridged in the upper parts.

**Table 2** Presence of selected characters of Myanmar *Balsaminaceae*.

1. Habit: perennial shrub (S), annual herb (H), perennial herb with thin fusiform tuberous root (F), perennial herb with rhizome (R), perennial woody shrub (W). – 2. Stem: glabrous (G), pilose (P). – 3. Leaves arranged: spirally (S), opposite (O). – 4. Inflorescence: pedunculate (P), epedunculate (E). – 5. Lateral sepals number: two (2), four (4). – 6. Lower sepal: navicular (N), deeply navicular (DN), bucciniform (B), deeply bucciniform (DB), clavate (C), infundibular (I), saccate (S). – 7. Dorsal petal: flat (F), cucullate (C). – 8. Abaxial midvein of dorsal petal: simple (S), narrow crest (N), oblong crest (O), crescent-shaped crest (C), slightly crest at the base (CB), obtuse crest (O), keel shaped crest (K), with acute appendage (A). – 9. Lateral united petals: free (F), connated (C). – 10. Ovary and fruit: glabrous (G), pilose (P), scabrous (S). – 11. Fruit: globose (G), fusiform (F), clavate (C), cylindrical (Y), linear (L).

Species	1	2	3	4	5	6	7	8	9	10	11
<b>Hydrocera</b>											
1 <i>triflora</i>	H	G	S	P	4	B	C	S	F	G	G
<b>Impatiens</b>											
2 <i>laevigata</i> var. <i>laevigata</i>	W	G	S	P	4	B	C	O	F	G	Y
3 <i>parishii</i>	S	G	S	E	4	N	C	N	C	G	Y
4 <i>kerriae</i>	S	G	S	E	4	N	C	S–N	C	G	Y
5 <i>capillipes</i>	H	G	S	E	2	S	F	S	C	G	C
6 <i>lobbiana</i>	H	G	S	E	2	N	F	CB	C	G	C
7 <i>micromeris</i>	H	G	S	E	4	N	C	–	C	G	F
8 <i>psittacina</i>	H	G	S	E	2	DB	F	CB	C	G	L–C
9 <i>tanintharyiensis</i>	H	G	S	E	2	DB	F	CB	C	G	Y
10 <i>forrestii</i>	F	G	S	P	2	DB	F	K+A	F	G	L
11 <i>radiata</i>	H	G	S	P	2	N	C	S–N	F	G	L
12 <i>graciliflora</i>	H	G	S	P	2	N	C	S–N	F	G	L
13 <i>margaritifera</i> var. <i>humilis</i>	H	G	S	P	2	N	C	S–N	F	G	L
14 <i>casseeabrieae</i>	H	G	S	P	2	N	C	S	F	G	–
15 <i>racemosa</i>	H	G	S	P	2	N	C	S–C	F	G	L
16a <i>siculifer</i> var. <i>siculifer</i>	H	G	S	P	2	DN	F	S–N	F	G	L
16b <i>siculifer</i> var. <i>porphyria</i>	H	G	S	P	2	DN	F	S–N	F	G	L
17 <i>austroyunnanensis</i>	R	G	S–O	P	2	DB	F	S	F	G	L
18 <i>prainii</i>	H	G	S	P	2	DN	C	N	F	G	L
19 <i>bracteolata</i>	H	G	S	P	2	DN	C	S–N	F	G	L
20 <i>citrina</i>	H	G	S	P	2	DN	F	S–N	F	G	L
21 <i>drepanophora</i>	H	G	S	P	2	DN	F	CB	F	G	L
22 <i>holocentra</i>	F	G	S	P	2	I	C	C	F	G	L
23 <i>kachinensis</i>	H	G	S	P	2	DN	F	S	F	G	L
24 <i>sarissiformis</i>	H	G	S	P	2	DN	–	–	F	G	–
25 <i>chimaliensis</i>	H	G	S	P	4	B	F	N	F	G	L
26 <i>sinlumiensis</i>	H	G	S	P	2	B	F	S	F	G	L
27 <i>clavicuspis</i>	H	G	S	P	2	B	C	N	F	G	L
28 <i>ceratophora</i>	H	G	S	P	2	B	C	N	F	G	L
29 <i>arguta</i>	F	G	S	P	4	DB	C–F	O	F	G	Y
30 <i>duclouxii</i>	H	G	S	P	2	DB	C	A	F	G	Y
31 <i>ecalcarata</i>	H	G	O	E	2	N	C	N	F	G	F
32 <i>masonii</i>	H	G	O	E	2	DN	F	N	F	G	F
33 <i>chinensis</i>	H	G	O	E	2	N	C	N	F	G	F
34 <i>helferi</i>	H	G	O	E	2	N	C	N	F	G	F
35 <i>oppositifolia</i>	H	G	O	E	2	N	C	N	F	G	F
36 <i>decurva</i>	H	P	S	E	2	N	C	S–N	F	P	F
37 <i>balsamina</i>	H	P	S	E	2	N	C–F	K	F	P	F
38 <i>curvipes</i>	H	P	S	E	2	N	C	K	F	P	F
39 <i>florulenta</i>	H	G–P	S	E	2	N	C	K	F	P	F
40 <i>oblongata</i>	H	G–P	S	E	2–4	N	F	A	F	P	F
41 <i>violiflora</i>	H	P	S	E	2	N	F	N	F	P	F
42 <i>mokimi</i>	H	G	S	E	2	N	F	S–N	F	P	–
43 <i>allanii</i>	H	G	O	P	2	N	C	S–N	F	G	F
44 <i>hartnolliae</i>	H	G	S	P	2	N	F	S–N	F	G	F
45 <i>parkinsonii</i>	H	P	S	P	2	N	C–F	S	F	G	F
46 <i>peguana</i>	H	G	O	P	2	N	C	S	F	G	–
47 <i>circaeoides</i>	H	G	S–O	P	2	N	C	S	F	G	F
48 <i>rangoonensis</i>	H	G	S	P	2	N	C	S–C	F	G	F
49 <i>tavoyana</i>	H	G	S–O	P	2	N	–	–	F	G	F
50 <i>tripetala</i>	H	P	S–O	E–P	2	S	C	O–A	F	G	F
51 <i>trilobata</i>	H	G–P	O	P	2	S	C	K	F	G	F
52 <i>kingdon-wardii</i>	H	P	S	P	2	S	C	N	F	P	F–G
53 <i>xanthina</i> var. <i>xanthina</i>	H	G	S	P	2	N	C	CB	F	G	F
54 <i>fugongensis</i>	H	P	S	P	2	DN	C	S–N	F	G	F
55 <i>striolata</i>	H	G	S	P	2	B	C	N–O	F	G	–
56 <i>putaoensis</i>	H	P	S	P	2	N	C	N	F	G	–
57 <i>porrecta</i>	H	P	S	P	2	B	C	C–K	F	P	F
58 <i>erubescens</i>	H	P	S	P	2	B	C	C	F	G	F
59a <i> khasiana</i> var. <i> khasiana</i>	H	P	S	P	2	B	C	C	F	G	F
59b <i> khasiana</i> var. <i> toppinii</i>	H	P	S	P	2	B	C	C	F	G	F
60 <i>kamtilongensis</i>	H	P	S	P	2	B	C	A	F	G–S	F
61 <i>lacei</i>	H	P	S	P	2	DB	C	C	F	G	F
62 <i>andersonii</i>	H	G–P	S	P	2	B	C	N–O	F	G	F
63 <i>delicata</i>	H	G	S	P	2	B	C–F	C	F	G	–
64 <i>gongshanensis</i>	H	G	S	P	2	B	C	C	F	G	F
65a <i>pulchra</i> var. <i>pulchra</i>	H	G	S	P	2	B	C	C	F	G	F
65b <i>pulchra</i> var. <i>burmanica</i>	H	G	S	P	2	B	C	C	F	G	F
Percentage of each characters	H 90 % F 4 % S 3 % R 1 % W 2 %	G 72 % P 22 % G–P 6 %	S 84 % O 12 % S–O 4 %	P 71 % E 28 % E–P 1 %	2 90 % 4 9 % 2–4 1 %	N 43 % B 25 % DN 15 % DB 10 % S 6 % I 1 %	C 67 % B 25 % DN 15 % C–F 6 %	vary F 27 % C–F 6 %	F 90 % C 10 %	G 86 % P 13 % G–S 1 %	F 52 % Y 10 % L 30 % C 3 % G 2 % L–C 1 % F–G 1 %

## Leaves

All species have simple leaves, which in most cases are spirally arranged. However, some species such as *I. chinensis* and its phylogenetically relatives (e.g., *I. masonii*, *I. ecalcarata*) have decussate leaves (Ruchisansakun et al. 2015). A few species can have decussate leaves below and spirally arranged leaves above (e.g., *I. circaeoides*). Although a petiole is present in most species, a few taxa that are relatives to *I. chinensis* have sessile to sub-sessile leaves. Stipular glands on the petiole base are present in many species. The shape of the lamina varies from lanceolate to ovate, elliptic, obovate or linear. Lanceolate leaves are the most common among Myanmar *Impatiens*, whereas linear leaves are characteristic of *I. chinensis* and its close relatives. Leaf margins are serrate with mucronate teeth or usually crenate with the teeth apices set in the sinus.

## Inflorescence

Flowers of *Balsaminaceae* can be solitary or arranged in inflorescences. The inflorescence can be epedunculate or pedun-

culate, with the latter more common among Myanmar taxa. All species with pedunculate inflorescences have flowers in racemes, mostly borne on a long peduncle. Some species have short peduncles, and a few have a variable peduncle length (e.g., *I. tripetala*). An inflorescence can contain 2–many flowers. Although most species have 3–5-flowered inflorescences, some have more than ten flowers per inflorescence, particularly in sect. *Racemosae*. All *Impatiens* species have a persistent or caducous bract at the base of the pedicel.

## Flowers

Flowers are protandrous and either zygomorphic or asymmetric. With the exception of *I. capillipes*, all species have resupinate flowers. According to Grey-Wilson (1980a), *Balsaminaceae* flowers can be classified into two main types (Fig. 1): flat-type and funnel-type flowers. Flat-type flowers have a navicular or deeply navicular lower sepal with a long spur, whereas funnel-type flowers have a bucciniform, or saccate lower sepal, mostly with a short spur (Grey-Wilson 1980a). The

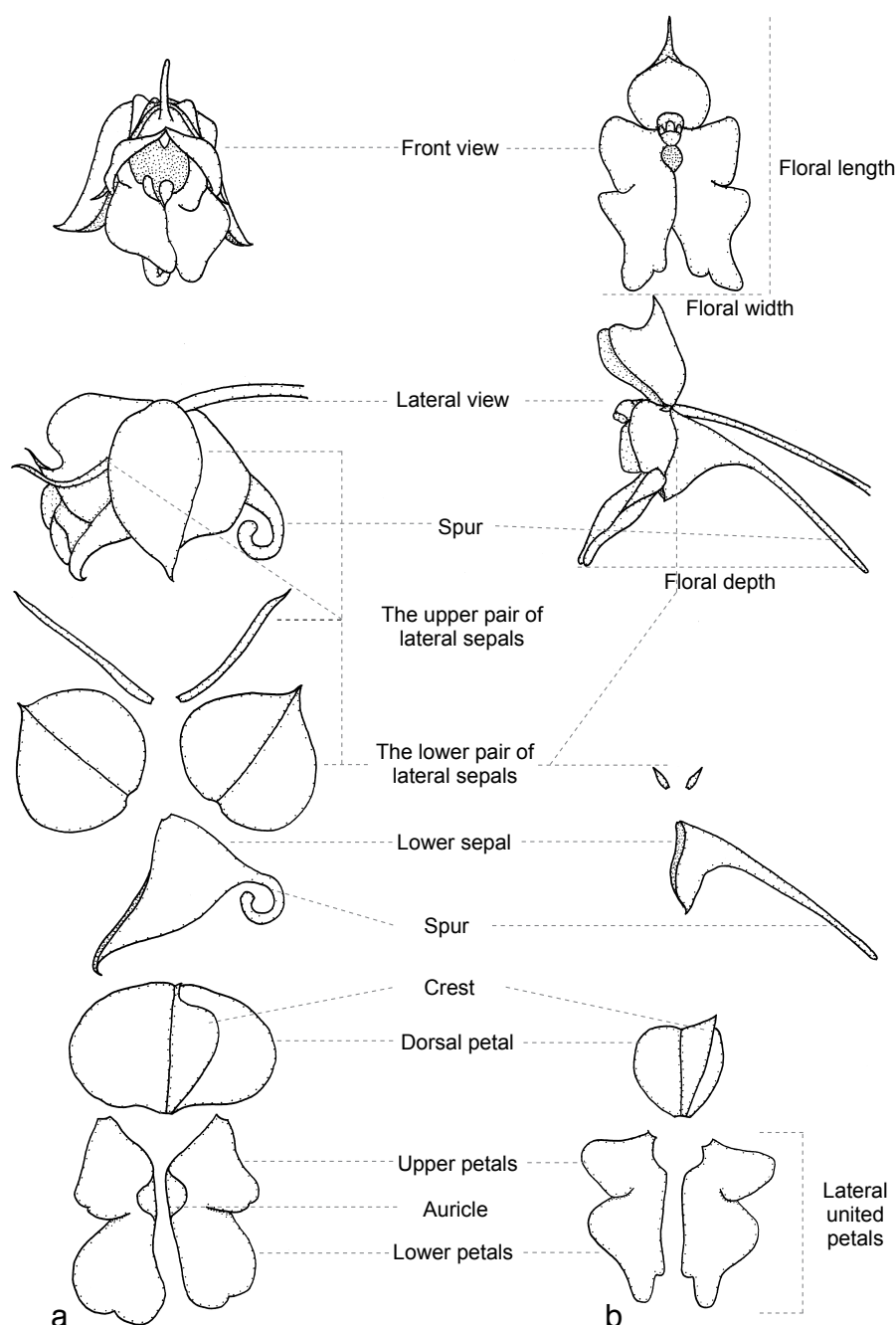
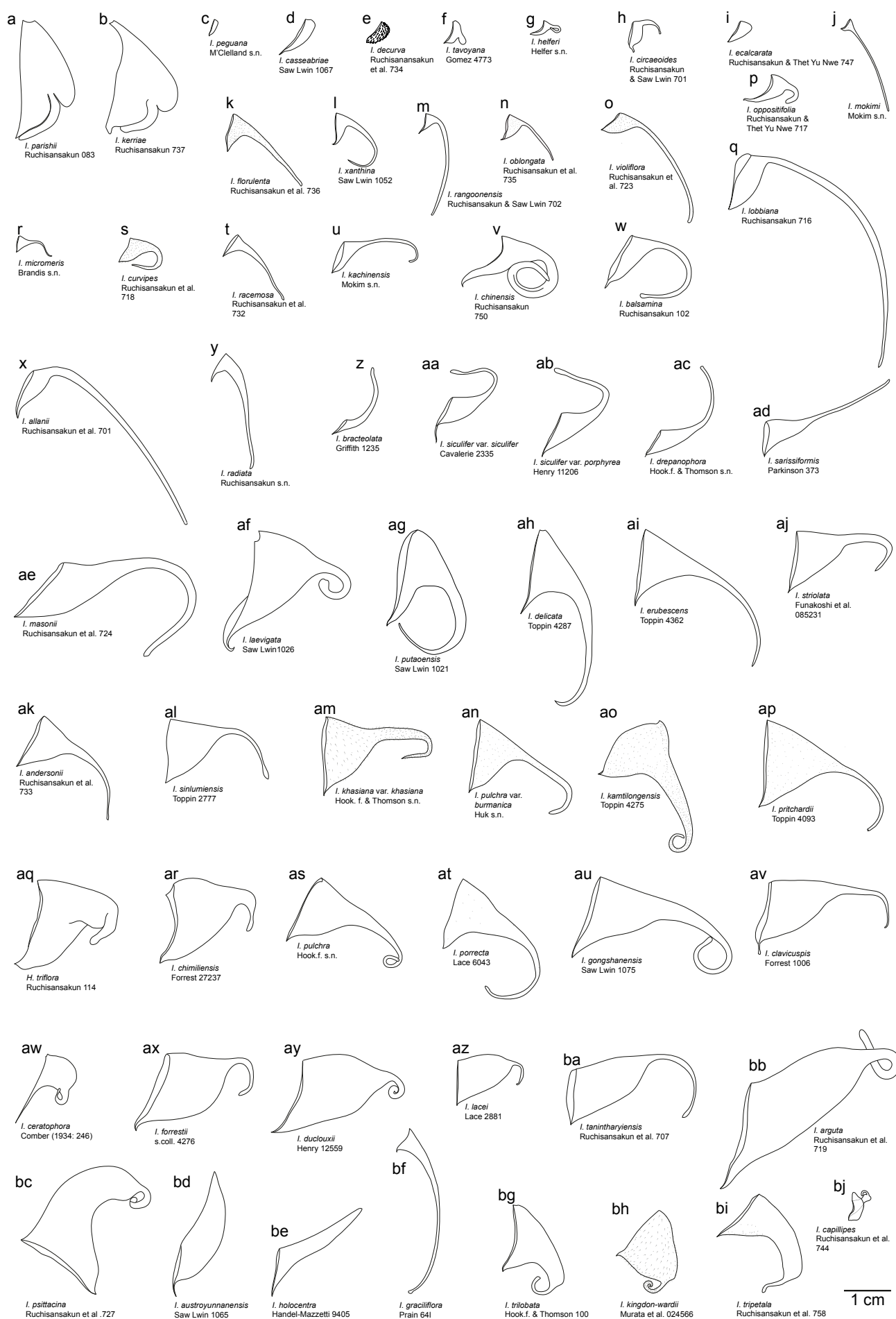


Fig. 1 Floral parts of the two main types of flowers in *Impatiens*. a. Funnel-type flower; b. flat-type flower. — Drawn by Saroj Ruchisansakun.



**Fig. 2** Variation in shape of lower sepal and spur: lower sepal. a–u. navicular; v–ae. deeply navicular; af–aw. bucciniform; ax–bd. deeply bucciniform; be–bf. infundibular; bg–bj. saccate. — Drawn by Saroj Ruchisansakun.

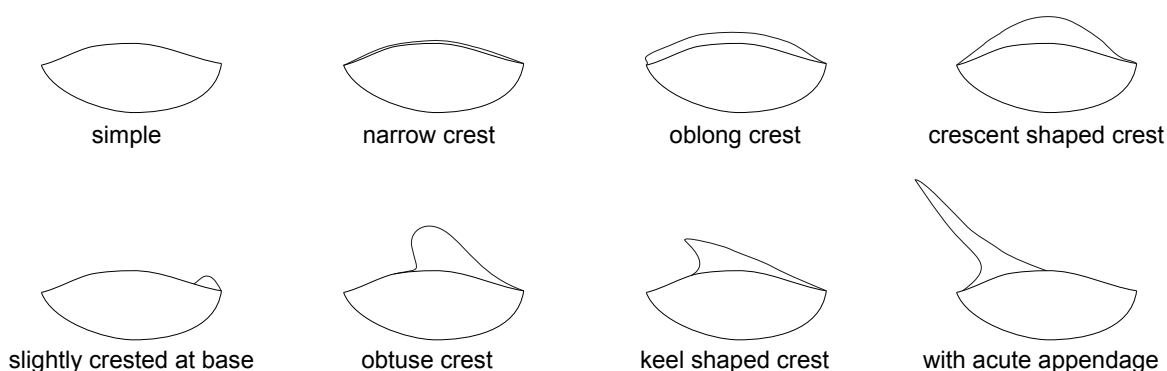


Fig. 3 Variation in abaxial side of dorsal petal. — Drawn by Saroj Ruchisansakun.

floral size varies from 7 mm in length in *I. ecalcarata* to 40 mm in *I. parishii*. Flower colour varies from white, yellow or pink to purple. Species with vivid deep red-coloured flowers have not been found in Myanmar.

### Sepals

*Balsaminaceae* have three or five sepals: one lower sepal and two or four lateral sepals (Caris et al. 2006). The upper pair of lateral sepals may be rudimentary or absent in many species (Caris et al. 2006, Janssens et al. 2012, Ruchisansakun et al. 2015). The lower pair of lateral sepals can be distinct and showy, as in the case of *I. arguta* and *I. kerriae*, or very small, as in *I. violiflora*. The lower sepal is commonly larger in size than the other sepals and has a nectar-producing spur. The shape of the lower sepal and spur is highly variable ranging from navicular, deeply navicular, bucciniform, deeply bucciniform, infundibular to saccate (Fig. 2).

### Petals

*Balsaminaceae* have five petals, which are free in *Hydrocera*. *Impatiens* has a dorsal petal and four lateral petals. The lateral petals in *Impatiens* are always fused to each other on each side and are referred to as lateral united petals. The dorsal petal varies from flat to cucullate, with the abaxial midvein often crested or with an appendage (Fig. 3). The lateral united petals are prominent in most species. The upper petals can be very small or reduced in some species (e.g., *I. circaeoides*). In general, they are not connate between the pairs, except in *I. kingdon-wardii*, in which they form a helmet-like structure.

Although the lower petals are mostly free from each other among the Myanmar species, they are mostly connate in sect. *Semeiocardium* (Ruchisansakun et al. 2015).

### Stamens

Flowers of all *Balsaminaceae* have five stamens. The filaments are flat, partially fused at the upper part, and lying close to the ovary. The anthers are connate, forming a cap over the stigma until they fall off.

### Pistil

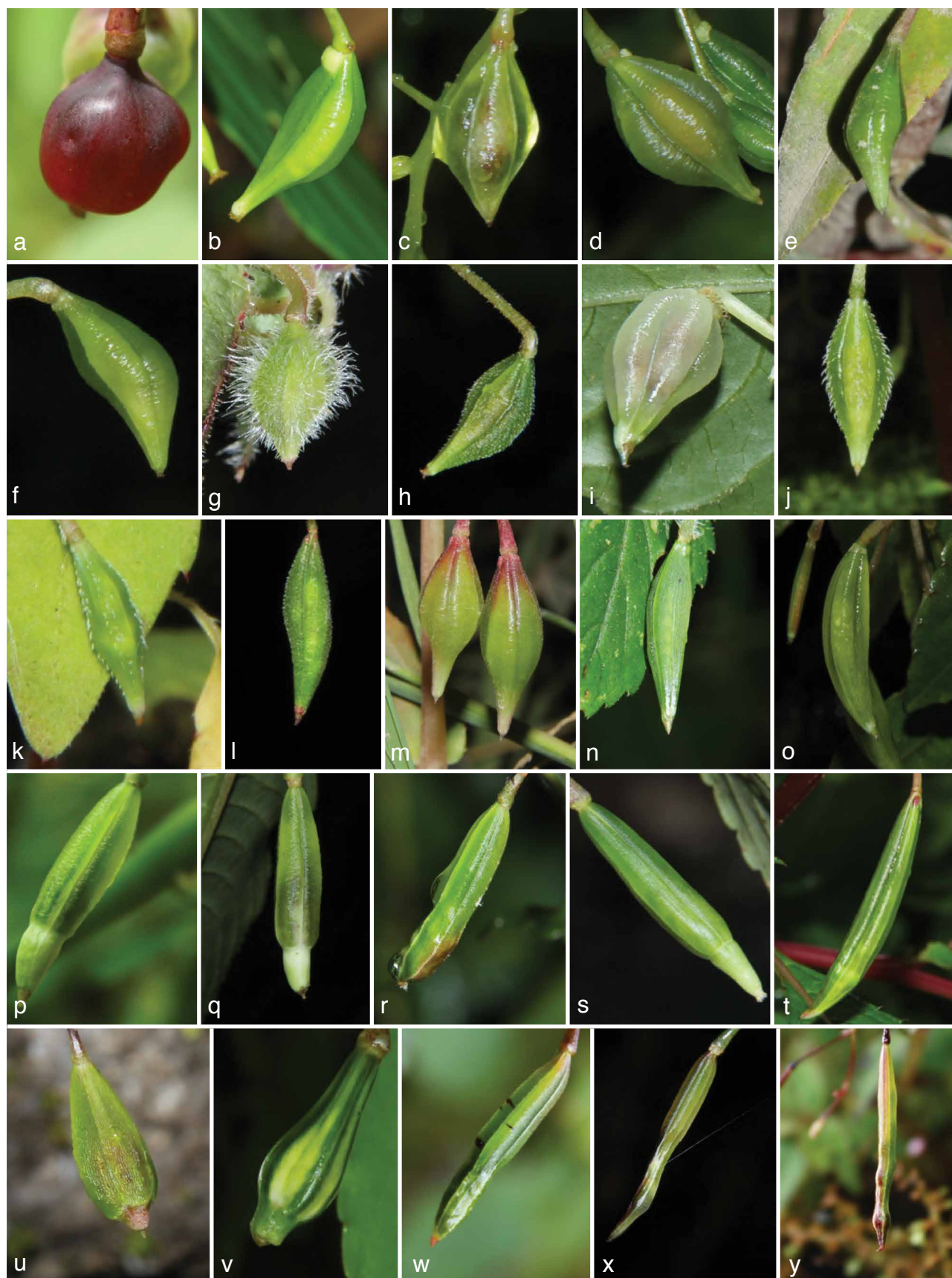
The style is indistinct or very short (Caris et al. 2006). Most species have a 5-locular ovary, but it is 4-locular in subg. *Clavicarpa* and subg. *Impatiens* sect. *Semeiocardium* (Shimizu & Takao 1985, Ruchisansakun et al. 2015). The ovary colour is green to pellucid green in most species. Only *I. andersonii* and *I. capillipes* sometimes have a white ovary. Most species have a glabrous ovary.

### Fruits

*Hydrocera* has a globose berry-like drupe (Grey-Wilson 1980b, Ramadevi & Narayana 1990), whereas *Impatiens* is characterized by explosively dehiscent loculicidal capsules. Fruits are 4- or 5-lobed depending upon the number of locules in the ovary (Fig. 4). The shape varies from fusiform, clavate or cylindrical to linear (Fig. 5) (Yu et al. 2015). In Myanmar, most species have fusiform fruits, but some have linear, cylindrical or clavate fruits. Most fruits are glabrous.



Fig. 4 Polar views of *Impatiens* fruits showing the number of locules. a. 4-locular fruit in *I. tanintharyiensis*; b. 5-locular fruit in *I. andersonii*. — Photos by Saroj Ruchisansakun.



**Fig. 5** Variation in fruit shape. — a. Globose: *H. triflora*. — b–o. Fusiform: b. *I. allanii*; c. *I. circacoides*; d. *I. rangoonensis*; e. *I. oppositifolia*; f. *I. ecalcarata*; g. *I. curvipes*; h. *I. violiflora*; i. *I. andersonii*; j. *I. florulenta*; k. *I. pseudomuscicola*; l. *I. oblongata*; m. *I. chinensis*; n. *I. kamtilongensis*; o. *I. pulchra*. — p–t. Cylindrical: p. *I. parishii*; q. *I. kerriae*; r. *I. drepanophora*; s. *I. taniinthyriensis*; t. *I. arguta*. — u–v. Clavate: u. *I. capillipes*; v. *I. lobbiana*. — w–y. Linear: w. *I. racemosa*; x. *I. holocentra*; y. *I. radiata*. — Photos by Saroj Ruchisansakun.

## TAXONOMIC TREATMENT

### *Balsaminaceae* A.Rich.

*Balsaminaceae* A.Rich. (1822) 173, nom. cons.; DC. (1824) 685; Du Mortier (1829) 46; Y.L.Chen et al. (2007) 43.

*Hydroceraceae* Blume (1825) 241, nom. illeg.; Reveal (1993) 218.

*Impatiéntaceae* Barnhart (1895) 16; Saff. (1905) 296; Henkel (1906) 38.

Terrestrial, lithophytic, epiphytic or semi-aquatic, perennial or annual, shrub or herb. *Stem* erect or procumbent, usually succulent, often rooting at lower nodes. *Leaves* simple, spirally, decussate, or whorled, petiolate or sessile. *Lamina* papryaceous or coriaceous, apex acute to acuminate, margin serrate or crenate, often with glands at the base or on the petiole. *Inflorescence* axillary to subterminal, erect or pendulous, solitary, fascicled, or racemose. *Peduncle* mostly cylindrical, often angular. *Flowers* bisexual, zygomorphic or asymmetrical, mostly resupinate, rarely non-resupinate. *Sepals* 3 or 5. *Lateral sepals* 2 or 4: the upper pair often reduced or absent; the lower pair free or connate, distinct. *Lower sepal* navicular, deeply navicular, bucciniform, deeply bucciniform, infundibular, to saccate, tapering or abruptly constricted into a spur, sometimes spurless. *Dorsal petal* flat or cucullate, abaxial midvein often with crest. *Lateral petals* 4, connate (except in *Hydrocera*): upper petals free (connate only in *I. kingdon-wardii*); lower petals free or connate in sect. *Semeiocardium*. *Stamens* 5: filaments partially fused, adnate to the ovary; anthers connate, forming a cap over the stigma. *Ovary* 4 or 5 carpellate. *Fruits* a fleshy dehiscent capsule, or indehiscent pseudoberry-like drupe in *Hydrocera*.

## KEY TO GENERA OF BALSAMINACEAE IN MYANMAR

1. Petals free; fruit a fleshy, indehiscent pseudoberry-like drupe ..... I. *Hydrocera*
1. Lateral petals united in pairs; fruit a fleshy explosive dehiscent capsule ..... II. *Impatiens*

## I. *Hydrocera* Blume ex Wight & Arn.

*Hydrocera* Blume ex Wight & Arn. (1834) 140; Hook.f. (1911a) 628; Y.L.Chen et al. (2007) 113, nom. cons. against *Tytonia* G.Don (1831) (Raju et al. 2002). — *Hydrocera* Blume (1825) 241, nom. nud. — Type: *Impatiens natans* Willd. (Wight & Arnott 1834, Raju et al. 2002).

*Tytonia* G.Don (1831) 749, syn. in Wight & Arnott (1834) 140. — Type: *Tytonia natans* G.Don.

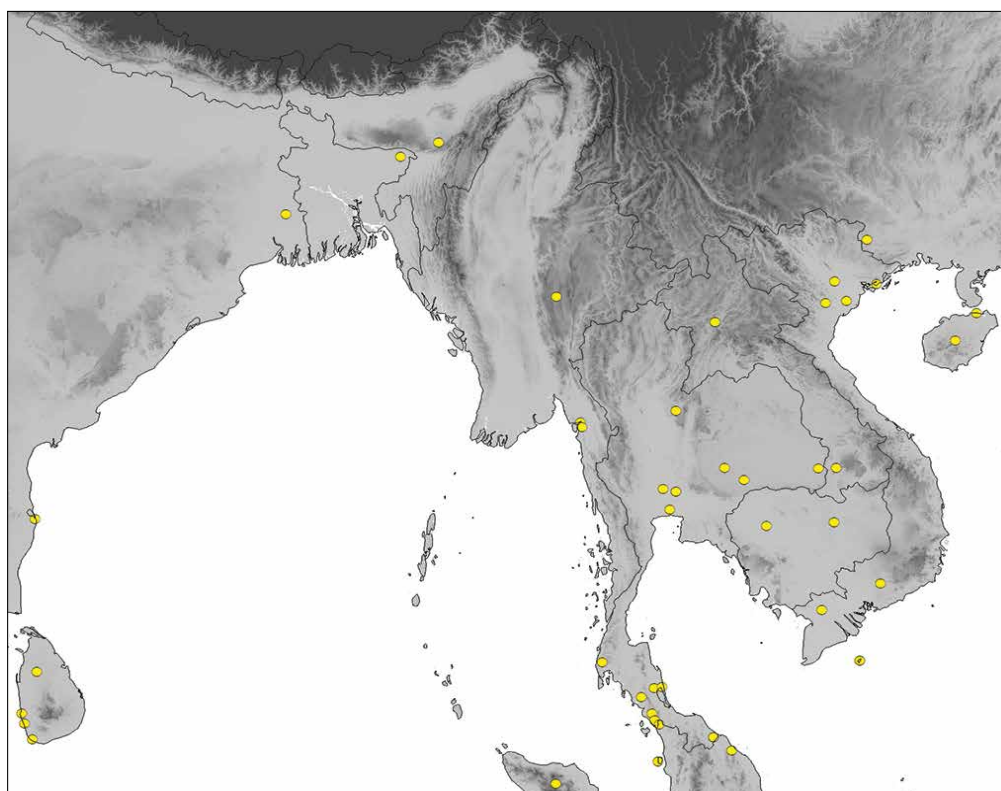
Semi-aquatic herb. *Stem* erect or decumbent in the lower part, 5-angled. *Leaves* spirally arranged, sessile, with 2 basal glands, margin serrate. *Inflorescence* axillary, 1–5-flowered. *Flowers* zygomorphic, resupinate. *Sepals* 5. *Lateral sepals* 4: lower pair oblong or elliptic-oblong; inner pair elliptic-oblongate. *Lower sepal* navicular, spurred. *Petals* 5, all free. *Dorsal petal* subcucullate, obovate. *Upper lateral petals* 2 narrowly oblong. *Lower lateral petals* 2. *Stamens* 5, connate. *Ovary* 5 locules. *Fruits* indehiscent pseudoberry-like drupe, globose. *Seeds* 5 (1 per locule).

### 1. *Hydrocera triflora* (L.) Wight & Arn. — Map 3; Plate 1a

*Hydrocera triflora* (L.) Wight & Arn. (1834) 140; Wight (1837) 4; Steud. (1840) 804, 805; (1841) 727; Meisn. (1843) 42; Prain (1903) 297; Hook.f. (1904a) 27, 31, 32; F.Lewis (1919) 144; Bose (1920) 198; Merr. (1921) 363; Venkat. & B.S.M.Dutt (1961) 545; Amaratunga (1970) 455; V.Singh (1971) 340; Grey-Wilson (1980b) 21; K.Hou (1982) 240; Ramadevi & L.L.Narayana (1990) 43; Tan et al. (1992) 128; I.M.Turner (1993) 44; (1995) 146; I.M.Turner et al. (1994) 2, 12; Chew et al. (1997) 174; W.J.Kress et al. (2003) 169; Wu (2006) 67. — *Impatiens triflora* L. (1753) 938; G.Don (1831) 750; Steud. (1840) 804, 805; Hook.f. (1904a) 27, 31. — *Tytonia triflora* (L.) C.E.Wood (1975) 413. — Type: *Hermann Herb.* 3: 35, 315 (lecto, designated in Grey-Wilson (1980b) BM BM000621927).

*Impatiens natans* Willd. (1798) 1175; Roxb. & Carey (1824) 455; G.Don (1831) 749; Pidd. (1832) 45, 184; Roxb. (1832) 652; Steud. (1840) 804. — *Tytonia natans* (Willd.) G.Don (1831) 749; Steud. (1841) 727; Hook.f. (1904a) 27, syn. in Steudel (1840). — Type: *Klein s.n.* (lecto, designated here HAL HAL0118810\*), India.

*Hydrocera angustifolia* Blume (1825) 241; Hook.f. (1911a) 629; Ridl. (1922) 340, syn. in Grey-Wilson (1980b). — *Impatiens angustifolia* Blume (1823) 49. — *Balsamina angustifolia* Blume (1825) 239. — Type: *Wight s.n.* (lecto, designated here K K000741571).



Map 3 Distribution of *Hydrocera triflora*.

Semi-aquatic perennial herb, 0.5–1.5 m tall. *Stem* up to 1.5 cm diam, annual, erect or decumbent below, moderately unbranched, angular, pale green to reddish green, the portion below the water whitish, glabrous, hollow. *Leaves* spirally arranged, sessile to very short. *Petiole* absent – 10 mm long, c. 5 mm diam, glabrous. *Lamina* 100–270 by 10–45 mm, narrowly lanceolate to narrowly elliptic, apex acute, base cuneate to attenuate, margin serrate, papyraceous, adaxial dark green,

abaxial pale green, glabrous, with one pair of glands at the base margin; lateral veins 10–12 pairs. *Inflorescence* axillary, pendulous to horizontal, 2–5-flowered raceme. *Peduncle* up to 20 mm long, c. 2 mm diam, angular, winged, green to red, glabrous. *Rachis* 5–8 mm long, c. 1 mm diam. *Flowers* c. 30 mm long, 20–25 mm wide, 20–25 mm deep, pink and red with yellow markings at the centre of lower sepal. *Pedice*l 10–30 mm long, 1–1.5 mm diam, white to green to red, glabrous. *Bracts*



**Plate 1** a. *Hydrocera triflora* (L.) Wight & Arn; b. *Impatiens laevigata* Wall. ex Hook.f. & Thomson; c. *Impatiens kerriae* Craib; d. *Impatiens capillipes* Hook.f. & Thomson; e. *Impatiens lobbiana* Turcz.; f. *Impatiens psittacina* Hook.f.; g. *Impatiens tanintharyiensis* Ruchis., Suksathan & Saw-Lwin; h. *Impatiens cassebriae* Y.H.Tan, S.S.Zhou & B.Yang. — Photos by: a–g. Saroj Ruchisansakun; h. Saw-Lwin.

5–9 by 1–2.5 mm, oblong to lanceolate to narrowly ovate, apex acute to acuminate, base cuneate, margin entire, green to red, glabrous, caducous. *Lateral sepals* 4: the upper pair 12–14 by 6–7.5 mm, ovate to obovate, apex obtuse, base cuneate, pale pink, glabrous to remotely pilose; the lower pair 15–19 by 8–12 mm, free, elliptic to obovate, concave, apex acute to obtuse and mucronate, base cuneate to obtuse, pale pink, glabrous to remotely pilose. *Lower sepal* 12–20 mm long, 7–9 mm wide, 8–17 mm deep, bucciniform, apex acute to acuminate, base obtuse, dark red with yellow mark at the centre inside, glabrous to remotely pilose, abruptly constricted into an incurved spur, 5–13 mm long, 1 tip, swollen, green. *Dorsal petal* 12–18 by 11–20 mm, broadly elliptic, slightly cucullate, apex round and mucronate, base cuneate, pale pink, sometimes semipellucid, glabrous to remotely pilose outside. *Upper lateral petals* 13–15 by 8–9 mm, obovate, apex round, base obtuse to cuneate, pale pink with dark red line at the centre. *Lower lateral petals* 2–3 by 5–8 mm, free, obovate to oblong, apex round to obtuse, base with distinct auricle, dark red, glabrous. *Stamens*: filaments, 7–10 mm, white to pale pink; anthers connate, pink. *Ovary* 7–10 mm long, 1–2 mm diam, 5-locular, green, glabrous. *Fruits* 9–15 mm long, 9–13 mm diam, pseudoberry, globose, slightly 5-lobed, green to deep red, glabrous.

Phenology — Flowering: June to August; fruiting: June to September.

Distribution — Myanmar (Mon State, Shan State), India (Bengal, Madras), Ceylon, southern China (Hainan), Cambodia, Laos, Malay Peninsula, SW Celebes, Java.

Ecology — Ditches, marshy places, stagnant pools and rice paddies, 0–100 m altitude.

*Other collections examined.* MYANMAR, Mon State, Ruchisansakun & Thet Yu New 714 (L L2071076, RAF), Mawlamyine, Kalagon, N16°32'00.29" E97°42'53.85", alt. 39 m, 20 Aug. 2015; Shan State, Dewan Mohinder Nath Nair & U Maung Pyone 1563 (RANG RANG2460), in Phaw Kone village, Inie lake, 2 May 1957.

Notes — *Hydrocera* is distinctly different from *Impatiens* by its berry-like instead of dehiscent fruit and five free petals instead of lateral united petals.

We select *Klein s.n.* (HAL0118810) as lectotype because it was verified by Willdenow and deposited in Halle, Germany, where he worked before the protologue was published (Tkach et al. 2016).

## II. *Impatiens* Riv. ex L.

*Impatiens* Riv. ex L. (1753) 937; (1754) 403; DC. (1824) 687; Roxb. & Carey (1824) 452; Roxb. (1832) 651; Wight & Arn. (1834) 135; Hook.f. & Thomson (1860) 118; Hook.f. (1875) 440; Vivek. et al. (1997) 99; Y.L.Chen et al. (2007) 43. — Type: *Impatiens noli-tangere* L. (1753) 938.

*Balsamina* Tourn. ex Scop. (1772) 183; Mill. (1754) without page numbers. — *Balsamina* Tourn. (1719) 418, synonym in Druce (1913) 429. — Type: *Balsamina noli-tangere* Scop. (1772) 184.

*Chrysaea* Nieuwl. & Lunell in Lunell (1916) 473. — *Chrysaea* Cusa in Daléchamps (1587) 876. — Type: *Chrysaea biflora* Nieuwl. & Lunell in Lunell (1916) 473.

*Impatientella* H.Perrier (1927) 22; A.W.Hill (1938) 144, 303. — Type: *Impatientella inaperta* H.Perrier (1927) 22.

*Petalonema* Peter (1928) 84; Brenan (1945) 213. syn. in Schulze (1935). — Type: *Petalonema fissibracteum* Peter (1928) 84.

*Semeiocardium* Zoll. (1858) 245; Backer (1935) 70; Grey-Wilson (1989a) 107; Utami (2009) 22; S.X.Yu et al. (2015) 13; Ruchis. et al. (2015) 1063, syn. in Grey-Wilson (1989a). — Type: *Semeiocardium arriensii* Zoll. (1858) 245.

*Trimorphopetalum* Baker (1887) 454; Eb.Fisch. & Raheliv. (2002) 279, syn. in Fischer & Rahelivololona (2002). — *Impatiens* subg. *Trimorphopetalum* (Baker) Eb.Fisch. (2002) 279. — Type: *Trimorphopetalum dorstenioides* Baker (1887) 455.

Terrestrial, lithophytic or epiphytic, perennial or annual, herbs or rarely shrubs. *Stem* erect or procumbent, usually succulent, often rooting at lower nodes. *Leaves* simple, arranged spirally,

decussate, or in whorls, petiolate or sessile. *Petiole* cylindrical or often flat. *Lamina* apex acute to acuminate, margin serrate or crenate, with mucronate teeth or with the teeth apices set in the sinus, papyraceous or coriaceous, often with glands at the base or on the petiole. *Inflorescence* axillary to terminal to subterminal, erect or pendulous, racemose or flowers solitary or in fascicles. *Peduncle* cylindrical or often angular. *Flowers* bisexual, zygomorphic or asymmetrical, mostly resupinate. *Sepals* 3 or 5. *Lateral sepals* 2 or 4: the upper pair reduced, or often absent; the lower pair always present, free or connate with each other. *Lower sepal* navicular, deeply navicular, bucciniform, deeply bucciniform, infundibular, to saccate, tapering or abruptly constricted into a spur. *Dorsal petal* flat or cucullate, abaxial midvein often with crest. *Lateral petals* on each side connate into 'lateral united petals' (wing petals): the upper petals mostly distinct, often reduced, usually smaller than the lower, mostly free, rarely connate with the opposite upper petal into a hood; the lower petals free or connate. *Stamens*: filaments lying close to ovary, flat; anthers connate. *Ovary* of 4 or 5 carpels. *Fruit* a fleshy dehiscent capsule.

## KEY TO THE SPECIES OF IMPATIENS IN MYANMAR

1. Fruits 4-lobed, ovary 4-carpellate or 4-lobed; lower lateral united petals connate (except in *I. laevigata*) ..... 2 (sect. *Semeiocardium*)
1. Fruits 5-lobed, ovary 5-carpellate or 5-lobed; lower lateral united petals free ..... 9
2. Lateral united petals free; upper pair of lateral sepals linear ..... 2. *I. laevigata*
2. Lateral united petals connate; upper pair of lateral sepals ovate to elliptic or absent ..... 3
3. Perennial shrub, (45–)150–300 cm tall; basal stems grey, 10–80 mm diam ..... 4
3. Annual herb, 15–40(–100) cm tall; stem green to red to purple, 2–7(–22) mm diam ..... 5
4. Pedicels shorter than petioles ..... 3. *I. parishii*
4. Pedicels longer than petioles ..... 4. *I. kerriæ*
5. Flowers non-resupinate, very small, up to 10 mm, spur facing upward and incurved ..... 5. *I. capillipes*
5. Flowers resupinate, bigger than 10 mm, spur downward, incurved or straight ..... 6
6. Lower sepal navicular (Fig. 2q, r) ..... 7
6. Lower sepal deeply bucciniform (Fig. 2ba, bc) ..... 8
7. Lateral sepals 2; upper petals and lower lateral united petals similar in shape and size ..... 6. *I. lobbiana*
7. Lateral sepals 4; upper lateral united petal less than half of the lower lateral united petal in length ..... 7. *I. micromeris*
8. Flowers zygomorphic; pedicel pendulous; spur short, hook-like, shorter than 6 mm ..... 8. *I. psittacina*
8. Flowers asymmetric; pedicel erect; spur curved, longer than 10 mm ..... 9. *I. tanintharyiensis*
9. Fruits linear, clavate or cylindrical ..... 10
9. Fruits fusiform ..... 29
10. Inflorescence 1–3-flowered; crest of abaxial dorsal petal with long acute appendage; fruits linear or cylindrical ..... 10. *I. forrestii* (sect. *Impatiens*)
10. Inflorescence many-flowered (except *I. prainii*); abaxial dorsal petal without long acute appendage; fruits linear ..... 11 (sect. *Racemosae*)
11. Inflorescence verticillate ..... 12
11. Inflorescence racemose ..... 13
12. Spur 17–24 mm ..... 11. *I. radiata*
12. Spur longer than 25 mm ..... 12. *I. graciliflora*

13. Lower sepal spurless . . . . . 14  
 13. Lower sepal spurred . . . . . 15  
 14. Leaves ovate . . . . . 13. *I. margaritifera* var. *humilis*  
 14. Leaves narrowly elliptic to narrowly oblanceolate . . . . .  
 . . . . . 14. *I. casseabriae*  
 15. Lower sepal navicular, deeply navicular, deeply bucciniform,  
 or infundibular . . . . . 16  
 15. Lower sepal bucciniform (Fig. 2al–4aw) . . . . . 26  
 16. Spur incurved . . . . . 15. *I. racemosa*  
 16. Spur straight or upcurved . . . . . 17  
 17. Bracts persistent . . . . . 18  
 17. Bracts caducous . . . . . 22  
 18. Lower sepal infundibular (Fig. 2be), spur straight . . . . .  
 . . . . . 22. *I. holocentra*  
 18. Lower sepal navicular or deeply bucciniform, spur dilate to  
 upcurved . . . . . 19  
 19. Spur strongly upcurved . . . . . 16. *I. siculifer*  
 19. Spur dilate to slightly upcurved . . . . . 20  
 20. Lower sepal deeply bucciniform, spur dilate at the middle  
 (Fig. 2bd) . . . . . 17. *I. austroyunnanensis*  
 20. Lower sepal navicular, narrowed into spur . . . . . 21  
 21. Leaves narrowly elliptic to narrowly lanceolate; petals  
 purple . . . . . 18. *I. prainii*  
 21. Leaves ovate to elliptic; petals yellow . . . . . 19. *I. bracteolata*  
 22. Leaves ovate or elliptic . . . . . 23  
 22. Leaves narrowly elliptic or linear-oblong . . . . . 25  
 23. Upper lateral petals equal in size with lower lateral petals  
 . . . . . 20. *I. citrina*  
 23. Upper lateral petals < 2/3 of the lower lateral petals . . . . . 24  
 24. Lateral sepals with long-awned apex, dorsal petal reflexed  
 at the middle . . . . . 21. *I. drepanophora*  
 24. Lateral sepals mucronate, dorsal petal not reflexed . . . . .  
 . . . . . 22. *I. holocentra*  
 25. Leaves narrowly elliptic . . . . . 23. *I. kachinensis*  
 25. Leaves linear-oblong . . . . . 24. *I. sarissiformis*  
 26. Lateral sepals 4 . . . . . 25. *I. chimiliensis*  
 26. Lateral sepals 2 . . . . . 27  
 27. Bracts 7.5–12 mm long, completely covering the young  
 flower . . . . . 26. *I. sinlumiensis*  
 27. Bracts up to 7 mm long, not covering the young flower . . . . .  
 . . . . . 28  
 28. Apex of bracts and lateral sepals with long awn . . . . .  
 . . . . . 27. *I. clavicuspis*  
 28. Apex of bracts and lateral sepals acute to acuminate . . . . .  
 . . . . . 28. *I. ceratophora*  
 29. Fruits fusiform or cylindrical, 20–25 mm long, inflorescence  
 a subscorpioid cyme or fascicle (if a fascicle, then sepals  
 4 and roots fleshy, fasciculate) . . . . . 30  
 29. Fruits fusiform, 5–16 (rarely –20) mm long (if long fusiform,  
 then not with fasciculate storage roots); inflorescence a  
 fascicle with 2 (or 3) flowers (rarely a raceme with 2(–5)  
 flowers) . . . . . 31 (sect. *Uniflorae*)  
 30. Inflorescence a fascicle with 2 (or 3) flowers; lateral sepals  
 4 . . . . . 29. *I. arguta* (sect. *Fasciculatae*)  
 30. Inflorescence a subscorpioid cyme with 3–5 (–25) flowers;  
 lateral sepals 2 . . . . . 30. *I. duclouxii* (sect. *Scorpioidae*)  
 31. Peduncle absent or indistinct; flower solitary or in a fasci-  
 cle . . . . . 32  
 31. Peduncle distinct; inflorescence racemose . . . . . 43  
 32. Leaves decussate or subdecussate . . . . . 33  
 32. Leaves spirally arranged . . . . . 37  
 33. Flowers spurless . . . . . 31. *I. ecalcarata*  
 33. Flowers spurred . . . . . 34  
 34. Lateral sepals ovate . . . . . 32. *I. masonii*  
 34. Lateral sepals linear . . . . . 35  
 35. Flowers 35–45 mm long . . . . . 33. *I. chinensis*  
 35. Flowers less than 20 mm long . . . . . 36  
 36. Leaves linear to narrowly oblong, up to 7 mm wide . . . . .  
 . . . . . 34. *I. helferi*  
 36. Leaves ovate, elliptic, to oblong, wider than 15 mm . . . . .  
 . . . . . 35. *I. oppositifolia*  
 37. Flowers spurless . . . . . 36. *I. decurva*  
 37. Flowers spurred . . . . . 38  
 38. Stem stout; leaves narrowly elliptic to lanceolate . . . . .  
 . . . . . 37. *I. balsamina*  
 38. Stem slender; leaves ovate to elliptic to obovate to narrowly  
 ovate . . . . . 39  
 39. Leaves mostly crowded towards the apex of stems and  
 branches . . . . . 40  
 39. Leaves not crowded towards the apex of stems and branch-  
 es . . . . . 41  
 40. Dorsal petal flat, fruiting pedicels strongly recurved . . . . .  
 . . . . . 38. *I. curvipes*  
 40. Dorsal petal cucullate, fruiting pedicels spreading or slightly  
 recurved . . . . . 39. *I. florulenta*  
 41. Upper lateral united petal oblong . . . . . 40. *I. oblongata*  
 41. Upper lateral united petal obovate to oblanceolate . . . . . 42  
 42. Flowers longer than 13 mm . . . . . 41. *I. violiflora*  
 42. Flowers shorter than 12 mm long . . . . . 42. *I. mokimi*  
 43. Inflorescence more than 5-flowered, peduncle long; upper  
 lateral petal shorter than 1/3 of the lower petal, lower petal  
 without auricle . . . . . 44  
 43. Inflorescence with 3–5 flowers, peduncle short; upper  
 lateral petal longer than 1/2 of the lower petal, lower petal  
 with auricle . . . . . 50  
 44. Flowers longer than 25 mm long . . . . . 45  
 44. Flowers shorter, up to 20 mm long . . . . . 46  
 45. Leaves decussate; lateral sepals elliptic to ovate . . . . .  
 . . . . . 43. *I. allanii*  
 45. Leaves spirally arranged; lateral sepals orbicular . . . . .  
 . . . . . 44. *I. hartnolliae*  
 46. Leaves oblanceolate . . . . . 45. *I. parkinsonii*  
 46. Leaves ovate to elliptic . . . . . 47  
 47. Lower sepal spurless, lateral sepals orbicular to broadly  
 ovate . . . . . 46. *I. peguana*  
 47. Lower sepal spurred, lateral sepals linear to ovate . . . . . 48  
 48. Lateral sepals linear, spur shorter than 10 mm, incurved  
 (Fig. 2h) . . . . . 47. *I. circaeoides*  
 48. Lateral sepals ovate, spur globose or linear . . . . . 49  
 49. Spur linear, straight to slightly curved (Fig. 2m), longer than  
 15 mm . . . . . 48. *I. rangoonensis*  
 49. Spur globose (Fig. 2f) . . . . . 49. *I. tavoyana*  
 50. Petiole base with several glands . . . . . 51  
 50. Petiole base without glands . . . . . 52  
 51. Peduncle short (up to 2 mm) . . . . . 50. *I. tripetala*  
 51. Peduncle long (longer than 4 mm) . . . . . 51. *I. trilobata*  
 52. Apices of the two upper lateral petals connate; sepals large  
 and densely pilose . . . . . 52. *I. kingdon-wardii*  
 52. Apex of upper petals free; sepals not as above . . . . . 53  
 53. Flowers shorter than 15 mm long; lower sepal shallowly  
 navicular to bucciniform . . . . . 54  
 53. Flowers longer than 20 mm long, lower sepal buccini-  
 form . . . . . 55  
 54. Lower sepal shallowly navicular . . . . . 53. *I. xanthina*  
 54. Lower sepal bucciniform . . . . . 54. *I. fugongensis*

55. Apex of upper lateral united petal acute or cuspidate . 56  
 55. Apex of upper lateral united petal rounded . . . . . 57  
 56. Flowers yellow . . . . . 55. *I. striolata*  
 56. Flowers white. . . . . 56. *I. putaensis*  
 57. Stem pilose, at least in upper part . . . . . 58  
 57. Stem glabrous . . . . . 61  
 58. Flowers pink to purple . . . . . 59  
 58. Flowers orange to yellow. . . . . 57. *I. porrecta*  
 59. Lamina and peduncle glabrous . . . . . 58. *I. erubescens*  
 59. Lamina and peduncle pilose . . . . . 60  
 60. Dorsal petal cristate. . . . . 59. *I. khasiana*  
 60. Dorsal petal spurred . . . . . 60. *I. kamtilongensis*  
 61. Leaf margin with many long hairs, up to 10 mm long . . .  
 . . . . . 61. *I. lacei*  
 61. Leaf margin without long hairs . . . . . 62  
 62. Lateral sepals falcate to obliquely ovate; stem erect . . .  
 . . . . . 62. *I. andersonii*  
 62. Lateral sepals ovate to lanceolate; stem erect or decumbent . . . . . 63  
 63. Plant decumbent, stems up to 12 cm tall . 63. *I. delicata*  
 63. Plant erect, taller than (10–)15–60 cm . . . . . 64  
 64. Flowers bluish purple . . . . . 64. *I. gongshanensis*  
 64. Flowers orange to reddish orange. . . . . 65. *I. pulchra*

## SPECIES DESCRIPTIONS

### Subgenus *Impatiens*

Section *Semeiocardium* (Zoll.) S.X.Yu & Wei Wang in S.X.Yu et al. (2015) 13

### 2. *Impatiens laevigata* var. *laevigata* Wall. ex Hook.f. & Thomson — Fig. 7; Map 4; Plate 1b

*Impatiens laevigata* var. *laevigata* Wall. ex Hook.f. & Thomson (1860) 146; Hook.f. (1875) 473; (1905) 30; W.J.Kress et al. (2003) 170; Gogoi et al. (2013) 311. — *Impatiens laevigata* Wall. (1831) 168, nom. nud. — Type: *Francis De Silva* 326 (Wall. Cat. no. 4753) (lecto, designated here K K000694815; isolecto G G00237319\*, G G00237320\*, K K001039825, L L2325369, M M0211761\*, M M0211762\*, P P04543237, P P04543244, PH PH00015839\*, S-G-33525), Sylhet (Sillet), Oct. 1820.

*Impatiens rubrolineata* Hook.f. (1910a) 300; Toppin (1920) 359, syn. nov., non *I. rubrolineata* H.Perrier (1934) 84. — Type: *Meebold* 6275 (K, not found, only a specimen drawing was present (Fig. 6)), Laimatak, 1525 m, Nov. 1907.

*Impatiens purpurea-picta* Hook.f., nom. nud. in herb. — Specimens: *Lace* 4992 (K K000694809, K K000694810), Myanmar, N. Shan State Gokteik Gorge, 12 Nov. 1909.

Terrestrial, perennial woody shrub, glabrous, 30–100 cm tall. *Stem* erect, simple to richly branched, green to red. *Leaves* spirally arranged, crowded on the upper part. *Petiole* (8–)25–70 mm long. *Lamina* 75–190 by 30–65 mm, elliptic, oblanceolate, to narrowly oblanceolate, apex acute to acuminate and mucronate, rarely emarginate, base attenuate to cuneate, margin shallowly serrate to shallowly crenate with minute teeth at sinus, adaxial pale green to dark green, abaxial pale green, with one pair of distinct short stalked-clavate glands on the petiole; lateral veins 5–6(–8) pairs. *Inflorescence* axillary, 1–4-flowered subumbellate raceme. *Peduncle* 8–20 mm long, with many white silica streaks. *Rachis* < 1 mm long. *Flowers* 25–26 mm long, 35–40 mm deep, yellowish white, tinged with pink, slightly asymmetric. *Bracts* (4–)6–10 by (2–)3–4 mm, ovate to ovate-lanceolate, apex acute, base cuneate to obtuse, margin slightly crenate, with two glands on each side of the margin, green, persistent. *Pedicel* (10–)14–20 mm. *Lateral sepals* 4: the upper pair 12–20 by 1.5–4 mm, falcate, apex acute, base cuneate, pale yellow; the lower pair 11–12 by 3–9 mm, free, broadly ovate to orbicular, apex acute to obtuse and mucronate, base obtuse to round,

margin slightly serrate with 2 pairs of glands, greenish yellow, margin slightly serrate with 2 or 3 teeth. *Lower sepal* 13–18 mm long, 10–12 mm deep, bucciniform, apex acute and mucronate, red inside, distal part rapidly constricted into a hooked spur, 14–22 mm long, tip swollen. *Dorsal petal* 15–16 by 22–23 mm, broadly elliptic to broadly obovate, apex cuspidate, base truncate, yellow, abaxial midvein with a broadly obtuse crest, 2–3 mm wide. *Lateral united petals* 25–26 mm long, free: the upper petals 11–12 by 11–12 mm, elliptic, yellow and pink; the lower petals c. 15 by 7 mm, obovate, apex slightly emarginate, base auricled, yellow and streaked with red lines. *Stamens*: filaments 8–12 mm long, pale green to pale yellow; anthers yellow. *Ovary* 22–38 by 18–20 mm, 4-locular. *Fruits* 20–22 mm long, 4–5 mm diam, cylindrical. *Seeds* c. 2, 3 mm diam.

*Phenology* — Flowering: August to December; fruiting: October to December.

*Distribution* — Myanmar (Kachin State), India, Bangladesh, Nepal.

*Habitat & Ecology* — Growing in shady areas in evergreen forest, 400–1600 m altitude.

*Other collections examined.* MYANMAR, Kachin State, *Lace* 6035 (K H2015/00092 151), Myitkyina, Trinton, alt. 600–3000 ft (183–914 m), 18 Nov. 1912; *Toppin* 4300 (K H2015/00092 153), Kachin Hills, Kumtat, 1500 ft (457 m), Hologany 1350 ft (412 m), Hja Kha 1300 ft (400 m); *Kingdon-Ward* 7322 (K), *Kingdon-Ward* 7325 (K), Valley of the Nam Hat, N27°35' E97°55', alt. 2000–3000 ft (610–914 m), 20 Aug. 1926; *Saw-Lwin* KSL1026 (L), Hkakabo Razi National Park, 2015.

*Notes* — *Impatiens laevigata* var. *laevigata* is very similar to *I. laevigata* var. *grandifolia* Hook.f. (1910a: 299), an endemic to Northeast India, but differs in having yellow flowers and oblong bracts, whereas *I. laevigata* var. *grandifolia* has white-yellowish flowers, ovate to ovate-lanceolate bracts. This species is highly

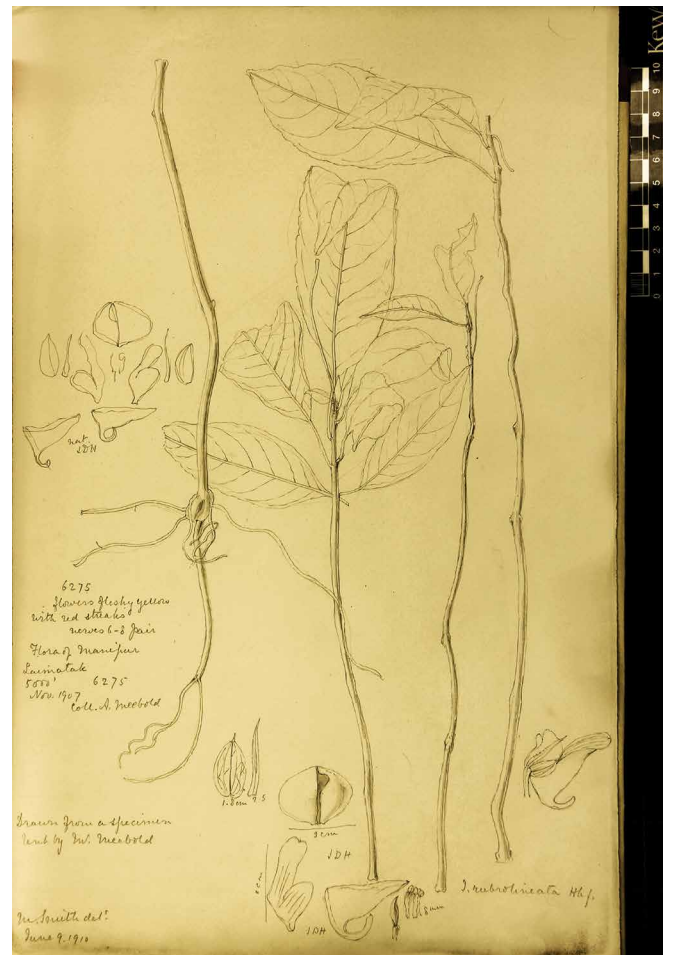
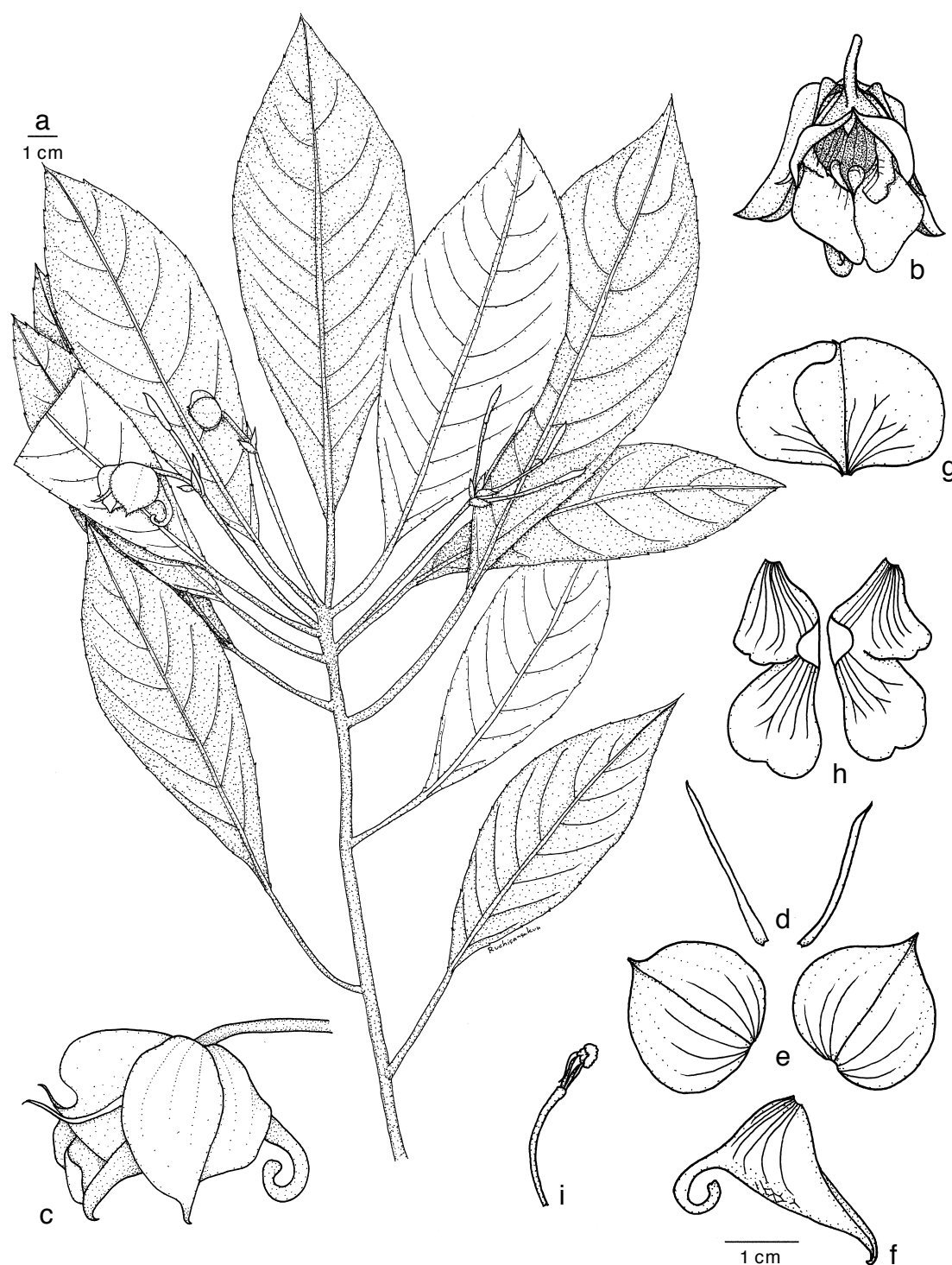


Fig. 6 Drawing of the holotype of *Impatiens rubrolineata* Hook.f.



**Fig. 7** *Impatiens laevigata* var. *laevigata* Wall. ex Hook.f. & Thomson. a. Habit; b. front view of flower; c. lateral view of flowers; d. upper lateral sepals; e. lower lateral sepals; f. lower sepals; g. dorsal petal; h. lateral united petals; i. pedicel and stamens covering the ovary. — Drawn by Saroj Ruchisansakun.

variable in leaf size and although Hooker (1910a) described *I. laevigata* var. *grandifolia* using the larger leaf size as a distinguishing character from *I. laevigata* var. *laevigata*, we found that variation in leaf size is continuous without clear distinct size ranges.

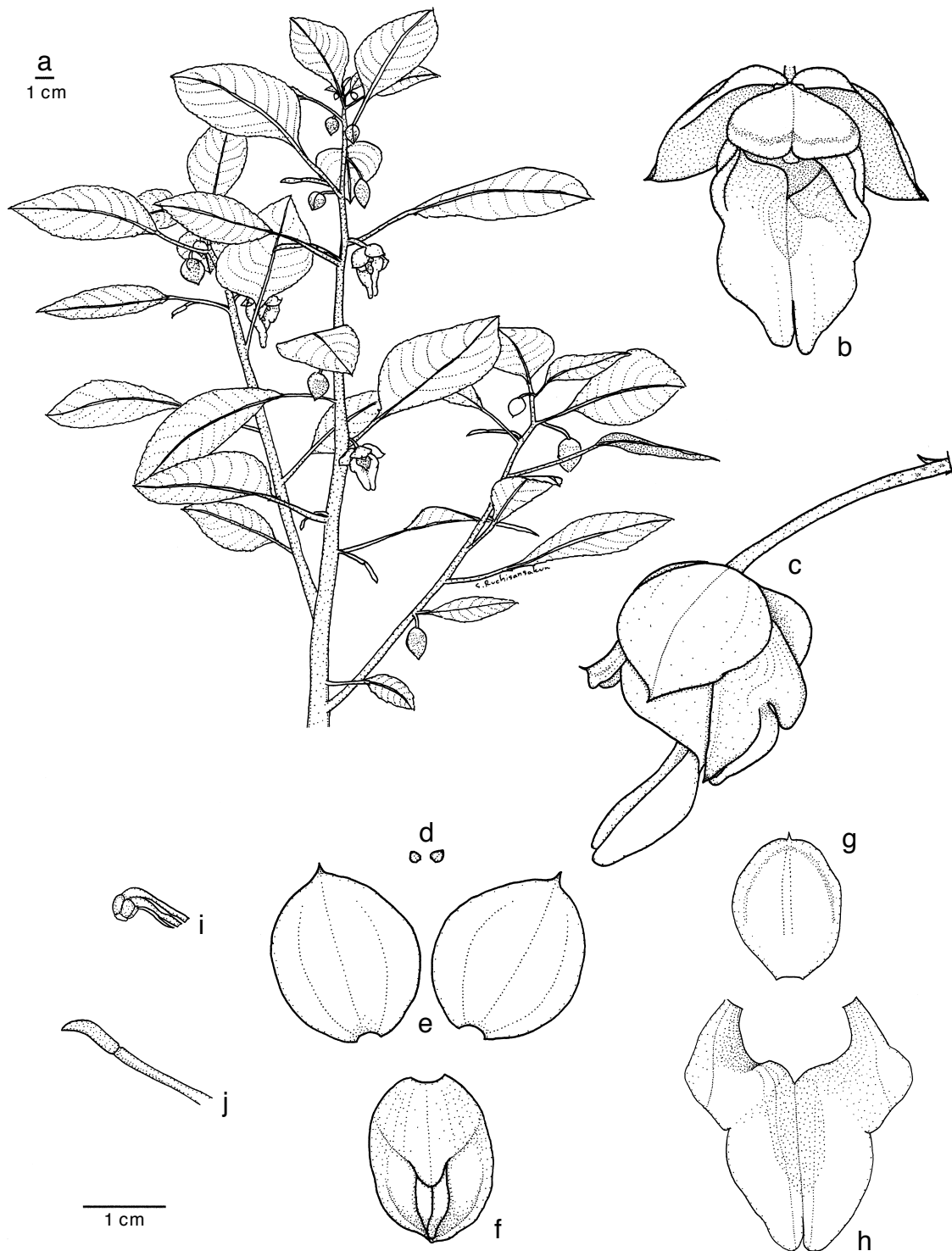
Since there are several duplicates of Wall. Cat. no. 4753, we select the specimen Wall. Cat. no. 4753 (K000694815) as the lectotype of *I. laevigata* var. *laevigata* because it is a complete specimen with a dissected flower and also included illustration by Hooker.

*Impatiens rubrolineata* was distinguished from *I. laevigata* by Hooker (1910a), based on ovate-oblong leaves and obliquely ovate-oblong lateral sepals. The epithet 'rubrolineata' refers to

red lines on the lower petals. However, all of those characters are also found in *I. laevigata*. We therefore decided to synonymize it. The holotype of *I. rubrolineata*, Meebold 6275, has disappeared, and only the drawing of the type was found in Kew Herbarium. It completely differs from *I. rubrolineata* H.Perrier (1934), described from a specimen collected in Madagascar and renamed as *I. oniveensis* Eb.Fisch. & Raheliv. in Fischer & Rahilevololona (2004).

### 3. *Impatiens parishii* Hook.f. — Fig. 8; Map 4

*Impatiens parishii* Hook.f. (1875) 456; (1905) 30; Craib (1926b) 212; T.Shimizu (1970) 189; W.J.Kress et al. (2003) 170. — Type: *Parish s.n.* (lecto, designated here K 000694782), Myanmar, Moulmein, Tenasserim, 1862.



**Fig. 8** *Impatiens parishii* Hook.f. a. Habit; b. front view of flower; c. lateral view of flowers; d. upper lateral sepals; e. lower lateral sepals; f. lower sepals; g. dorsal petal; h. lateral united petals; i. stamens; j. ovary. — Drawn by Saroj Ruchisansakun.

Lithophytic, caudiciform perennial, glabrous herb, 45–100 cm tall. *Stem* erect, cylindrical, c. 15 mm diam, richly branched, green when young and grey on lower parts, marked with old leaf scars on the lower part. *Leaves* spirally arranged. *Petiole* 55–75 mm long, c. 3 mm diam, green. *Lamina* 135–210 by 70–95 mm, ovate to ovate-lanceolate, apex acuminate, base round to obtuse to attenuate, sometimes unequal, coriaceous, margin serrate, with a gland on each side of the margin at the base; lateral veins 7–10 pairs, green. *Inflorescence* axillary, pendulous, solitary. *Flowers* 32–40 mm, 13–15 mm deep, slightly asymmetric, white to pale pink, with yellow mark on the lower petals. *Bracts* c. 5 by 1.5 mm, lanceolate, apex acute, base cuneate, margin entire, green, persistent. *Pedicel* 20–40

mm long, c. 1.5 mm diam, cylindrical, pale green. *Lateral sepals* 4, free; the lower pair c. 12 by 11 mm, free, orbicular to ovate, apex acute to acuminate and mucronate, base obtuse, white to pale pink; the upper pair 1–1.5 mm long, ovate. *Lower sepal* 13–23 by 16–18 mm, 6–8 mm deep, navicular, apex acuminate, base obtuse, white to pale pink, distal part abruptly constricted into gourd spur and slightly bifid at apex, c. 5 mm long. *Dorsal petal* c. 12 mm long, elliptic, cucullate, apex round and mucronate, base obtuse, abaxial midvein with a narrow crest terminating in a short acute point. *Lateral united petals* 35–36 mm long, connate: the upper petals 17–18 by 9–10 mm, obovate, apex truncate, base cuneate, white; the lower petals 27–29 by 9–10 mm, connate, elliptic to obovate, apex

obtuse, white with yellow mark at the base. *Stamens*: filaments c. 10 mm long, white; anthers yellow. *Ovary* 7–8 mm long, c. 2 mm diam, 4-carpellate, green; ovules, in 2 rows per locule, 3–5 ovules per row. *Fruits* 24 mm long, 6 mm diam, clavate, 4-lobed. *Seeds* unknown.

*Phenology* — Flowering: June to October; fruiting: August to November.

*Distribution* — Southern Myanmar (Mon State), northern and north-western Thailand.

*Ecology* — There is no information on the ecology of this species for Myanmar. In Thailand, it grows on limestone in lowland forest, sometimes in shady areas near waterfalls, 300–1000 m altitude.

*Note* — *Impatiens parishii* is very similar to *I. kerriae* but differs in having a shorter pedicel than petiole, four lateral sepals instead of two, wavy red streaks on the lower lateral united petals rarely present while always present and showy in *I. kerriae*. Shimizu (1970) mentioned that the spur of *I. parishii* is not bilobed, whereas *I. kerriae* has a deeply bilobed spur, however, we found that this character is variable within both species. *Impatiens parishii* usually grows at around 500 m altitude while *I. kerriae* grows at around 1500 m altitude.

#### 4. *Impatiens kerriae* Craib — Fig. 9; Map 4; Plate 1c

*Impatiens kerriae* Craib (1926a) 161; (1926b) 210; T. Shimizu (1970) 189. — Type: *Kerr 6544* (lecto, designated here ABD\*; islecto BK BK257749, BM BM000797447, K K000675564), Thailand, Chiang Mai, Doi Chiangdao, alt. 1800 m, 3 Nov. 1922.

Lithophytic, perennial, glabrous herb, 1.5–3 m tall. *Stem* erect, cylindrical, the main stem part c. 80 mm diam, moderately to richly branched, the branches c. 10 mm diam green to grey to brown, marked with old leaf scars. *Leaves* spirally arranged. *Petiole* 30–90 mm long, 2–4 mm diam, pale green. *Lamina* 160–260 by 70–95 mm, ovate to elliptic, apex acuminate, base attenuate to cuneate, margin serrate, sometimes unequal, coriaceous; lateral veins (6–)15–17 pairs, with a red globose gland on each side of the upper margin at the base, adaxial green, abaxial pale green. *Inflorescence* axillary, pendulous, 2-flowered fascicle. *Peduncle* very short, < 1 mm long, c. 2.5 mm diam, green. *Flowers* 30–37 by 25–33 mm, 28–30 mm deep, slightly asymmetric, white to pale pink, yellow lip with red lines. *Bracts* 2–3 by 2 mm, triangular, apex acute, base cuneate, margin entire, pinkish green, persistent. *Pedicel* 40–80(–120) mm long, 1.5–2 mm diam, cylindrical, pale green. *Lateral sepals* 2, 17–20 by 12–16 mm, free, elliptic to ovate, cucullate, apex acute to acuminate and mucronate, base obtuse, pale pink with some large red spots and green tip. *Lower sepal* 20–22 by 15–19 mm, 11–13 mm deep, navicular, apex obtuse and mucronate, base obtuse, white to pale pink, sometimes with dark pink tinge at the distal part, distal part abruptly constricted into a short incurved and deeply bilobed spur, 8–10 mm long, green. *Dorsal petal* 15–17 by 12–13 mm, elliptic, cucullate, apex round to slightly emarginate and mucronate, base obtuse, white to pale green, abaxial midvein simple or with a narrow crest terminating in a short acute point. *Lateral united petals* 32–35 mm long, connate: the upper petals 10–16 by 10–13 mm, orbicular to obovate, apex truncate, base cuneate, white with yellow base and red lines; the lower petals 25–28 by 6–8 mm, connate, oblong to narrowly ovate, apex obtuse, yellow with red lines. *Stamens*: filaments c. 5–6 mm long, pale green; anthers pale yellow. *Ovary* 5–6 mm long, 4-carpellate, green. *Fruits* 30 mm long, 7 mm diam, clavate, 4-lobed, green. *Seeds* 16–30, brick shaped, c. 2.5 mm long, brown, pilose.

*Phenology* — Flowering: November to December; fruiting: November to January.

*Distribution* — Myanmar (Shan State), northern Thailand.

*Ecology* — Growing on limestone in shady or open areas in mixed deciduous forest, 1200–2200 m altitude.

*Other collections examined*. MYANMAR, Shan State, *Makino BG exped.* 3274 (L, MBK, RAF), Taunggyi District; *Ruchisansakun & Makino BG 737* (L, MAND, RAF), Taunggyi District, Nagali village, N21°07'32.67" E96°23'47.82", alt. 1257 m, 29 Sept. 2015.

*Notes* — *Impatiens kerriae* is a new record for Myanmar, previously only found in Thailand. It is very similar to *I. parishii* but differs in having a longer pedicel than petiole, 2 lateral petals, and wavy red streaks on the lower lateral united petals, while *I. parishii* always has a yellow mark at the base of the lower lateral united petals.

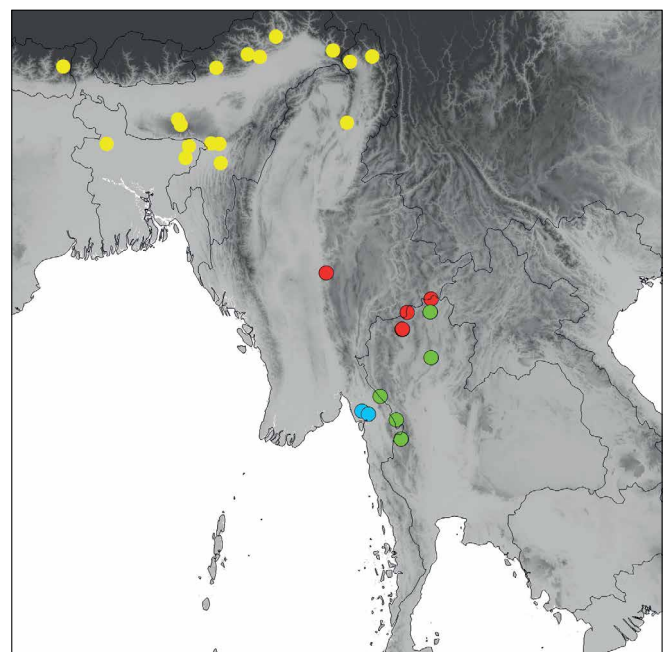
The population in Taunggyi differs from the population in Chiang Mai in having longer petioles (65–90 mm vs < 10 mm), much larger laminae (16–26 by 7–95 mm vs 110 by 60 mm), and in the number of lateral veins (14–16 vs 6–12). These differences may be explained by the higher altitude of the Chiang Mai site, where a windy and nutrient-poor environment may lead to reduced growth. Hooker annotated the specimens *Khalil s.n.* (K K000694776) and *Lace 4154* (K H2015/00092 27) as *I. platysepala*, non *Impatiens platysepala* Y.L. Chen (1988) 6, but this was never officially published. We found no differences between those specimens and *I. kerriae*.

This species is pollinated by bumblebees (Ruchisansakun et al. 2016). Due to the asymmetric lower lateral sepals, the body of the bumblebee tilts over to the right-hand side when it enters the flower resulting in the deposition of the pollen on the left side of the upper thorax.

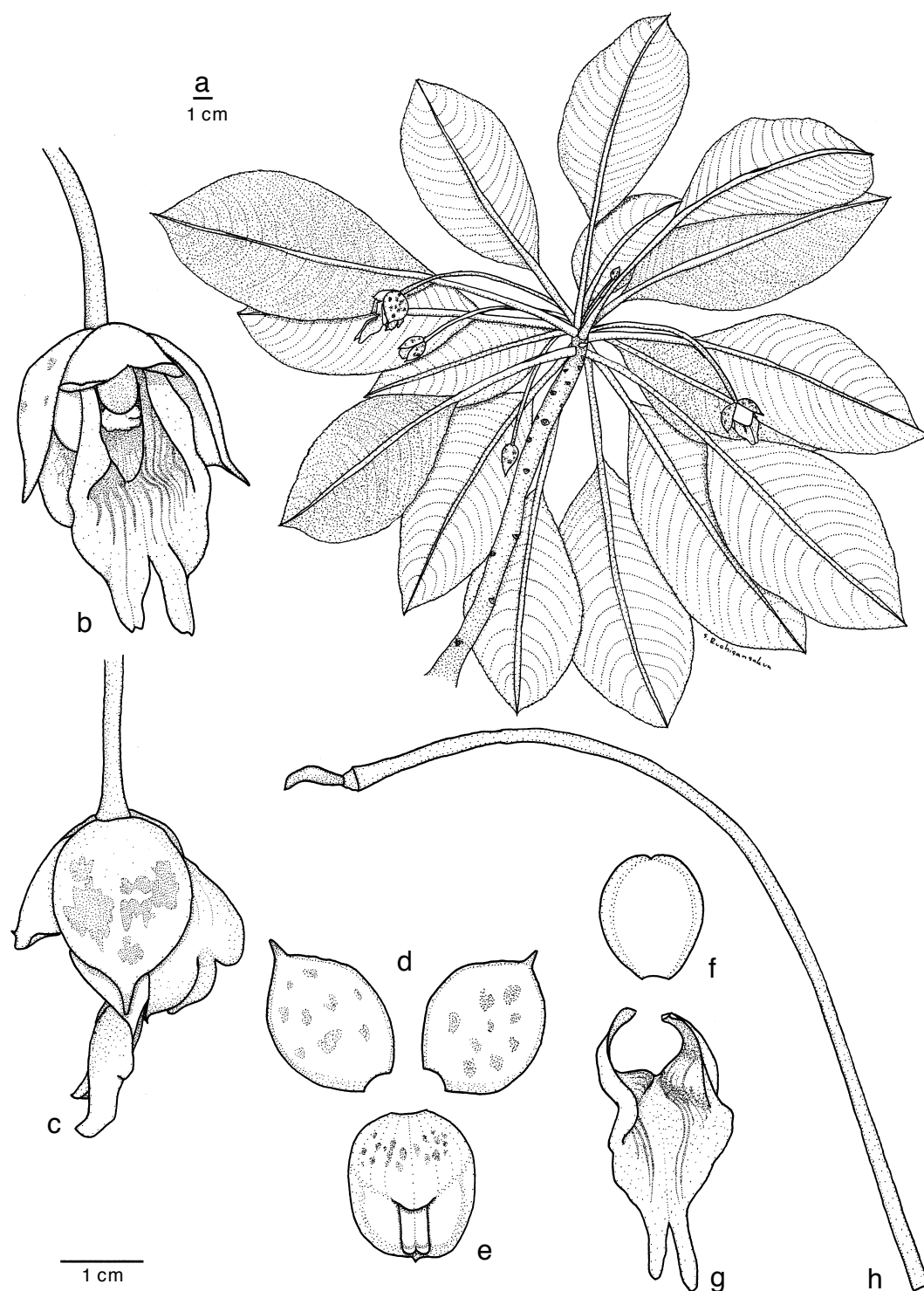
#### 5. *Impatiens capillipes* Hook.f. & Thomson — Fig. 10; Map 4; Plate 1d

*Impatiens capillipes* Hook.f. & Thomson (1860) 135; Hook.f. (1875) 456; (1905) 26; W.J. Kress et al. (2003) 169. — Type: *Lobb 388* (lecto, designated here K K000694718; islecto K K000694717), Myanmar (Burma), Moulmein, 1892.

Lithophytic, annual, glabrous herb, 25–40 cm tall. *Stem* erect, 2–4 mm diam, richly branched, angular, purple. *Leaves* spirally arranged. *Petiole* 8–15 mm long, 1–1.5 mm diam, angular,



**Map 4** Distribution of *Impatiens laevigata* Wall. ex Hook.f. & Thomson var. *laevigata* (●), *I. kerriae* Craib (●), *I. parishii* Hook.f. (●) and *I. capillipes* Hook.f. & Thomson (●).



**Fig. 9** *Impatiens kerriae* Craib. a. Habit; b. front view of flower; c. lateral view of flowers; d. lower lateral sepals; e. lower sepals; f. dorsal petal; g. lateral united petals; h. ovary and pedicel. — Drawn by Saroj Ruchisansakun.

purple. *Lamina* 45–90 by 9–18 mm, narrowly ovate to narrowly lanceolate, apex acute to acuminate, base obtuse to attenuate, margin serrate, adaxial dark green, abaxial glaucous, with a purple clavate gland on each side of margin at or near the base; lateral veins 12–14 pairs. *Inflorescence* axillary, 2–4-flowered racemes. *Peduncle*, absent – 2 mm long, < 1 mm diam, green. *Flowers* 8–10 by 8–9 mm, 4–5 mm deep, non-resupinate, white with pink and yellow marks. *Pedicel* c. 8 mm long, < 1 mm diam, green to purple. *Rachis* c. 10 mm long, < 1 mm diam, green to purple. *Bracts* < 1 by 1 mm, lanceolate, apex acute, base cuneate, green. *Lateral sepals* 2, c. 1.5 by 1 mm, free, ovate to elliptic, apex acute, base obtuse, pale green. *Lower sepal* c. 3–4 by 2.5 mm, c. 2 mm deep, shallowly navicular, white with yellow mark and red dots at basal part, distal part abruptly

constricted into an upward incurved spur, 1.5 mm long, white with green tip, blunt. *Dorsal petal* c. 5 by 2 mm, oblong, flat, apex acuminate, base cuneate, white, abaxial midvein simple. *Lateral united petals* connate: the upper pair c. 5 by 2–2.5 mm, ovate, apex acuminate, base obtuse, white; the lower pair 2.5–3 by 1–1.5 mm, connate, ovate, apex acuminate, white with purple spots at the base. *Stamens*: filaments c. 2 mm long, pink; anthers purple. *Ovary* c. 1.5 mm long, < 1 mm diam, 4-carpellate, white. *Fruits* c. 8 mm long, 2.5–3 mm diam, clavate, 4-lobed, purplish green. *Seeds* 4.

*Phenology* — Flowering: November to December; fruiting: November to December.

*Distribution* — Endemic to southern Myanmar (Kayin State, Mon State).



**Fig. 10** *Impatiens capillipes* Hook.f. & Thomson. a. Habit; b. front view of flower; c. lateral view of flowers; d–f. lower sepal; g. lateral sepals; h. lateral united petals; i. dorsal petal; j. ovary and pedicel; k, l. fruit. — Drawn by Saroj Ruchisansakun.

**Ecology** — Growing on limestone in mixed deciduous forest, 10–100 m altitude.

**Other collections examined.** MYANMAR, Kayin State, *Ruchisansakun & Thet Yu Nwe 744* (L, RAF, YNG), Hpa-An, Hae Pyan Cave, N16°50'08.0" 97°34'13.0", alt. 10 m, 18 Oct. 2015; *Ruchisansakun & Thet Yu Nwe 749* (L, RAF, YNG), Hpa-An, N16°44'59.8" E97°47'04.8", 20 Oct. 2015; Mon State, *Lobb 368* (K K000694716), Moulmein, 1846; *Parish 454* (K), 1862; *Parish s.n.* (P04614864), 1862.

**Notes** — *Impatiens capillipes* is a distinct taxon characterized by very small, non-resupinate white flowers. It cannot be confused with any other *Impatiens* species from Myanmar.

Hooker annotated two sheets of *Lobb 388* (K000694717, K000694718) as *I. capillipes*. We select K000694718 as lecto-type because it includes a dissected flower and drawing.

## 6. *Impatiens lobbiana* Turcz. — Map 5; Plate 1e

*Impatiens lobbiana* Turcz. (1859) 270. — Type: *Lobb 384* (lecto, designated here KW K0001000647\*; isolecto K K000694801), Myanmar (Burma), Moulmein, 1846.

Lithophytic, annual, glabrous herb, 30–60 cm tall. *Stem* erect, the lower part sometimes decumbent, 4–7 mm diam, moderately or richly branched, green with red dots. *Leaves* spirally arranged. *Petiole* 15–60 mm long, 2–2.5 mm diam, cylindrical, green with red dots adaxially. *Lamina* 85–130 by 35–50 mm, ovate, apex acuminate, base attenuate, margin crenate, adaxial green, abaxial greyish green, with one pair of cylindrical glands near the lamina base; lateral veins 6 or 7 pairs. *Flowers* solitary, axillary, (18–)26–45 by (19–)28–45(–50) mm, (20–)30–40(–42) mm deep, pink. *Pedicel* cylindrical, 45–

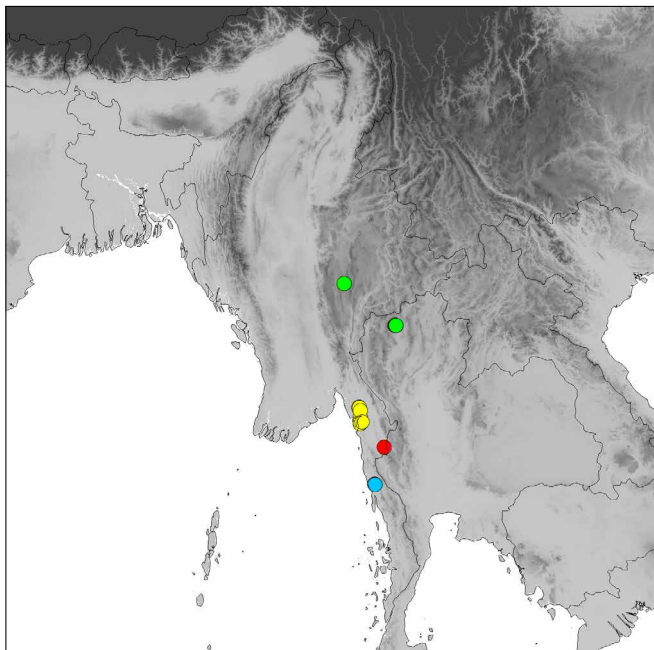
60 mm long, 1–1.5 mm diam, green. *Bracts* 4–7 by 1.5–3 mm, oblanceolate, apex acute, base cuneate, margin entire, green, persistent. *Lateral sepals* 2, 5–8 by 4–7 mm, free, ovate, apex acuminate, base obtuse, green. *Lower sepal* 11–15 by 5–5.5–7 mm, 3–7 mm deep, navicular, apex acute and mucronate, base obtuse, pale green, distal part abruptly constricted into a narrow straight to curved spur, 30–45 mm long, green. *Dorsal petal* 7–22 by 7–25 mm, obovate, strongly reflected, flat, apex obcordate and mucronate, base cuneate, pink, abaxial midvein with a crescent-shaped crest at the base. *Lateral united petals* 17–32 mm long, connate: the upper pair 10–25 by 7–21 mm, broadly oblong to obovate, apex obcordate and cuspidate, base stipitate, pink with white mark at the base (yellow when dry); the lower pair 15–27 by 6–15 mm, connate, oblong to obovate, apex shallowly emarginate and cuspidate, base without auricle, pink with white mark at the base (yellow in dried specimens), sometimes with a red line around the white mark. *Stamens*: filaments 2–4 mm long, pale green; anthers white. *Ovary* 2–4 mm long, 1–1.5 mm diam, 4-carpellate, green. *Fruits* c. 13 mm long, 4 mm diam, clavate, 4-lobed, green. *Seeds* 20–24, ellipsoid, c. 2 mm long, brown.

**Phenology** — Flowering: August to October; fruiting: August to December.

**Distribution** — Endemic to southern Myanmar (Kayin State, Mon State).

**Ecology** — Growing on limestone in shady or open areas in the mixed deciduous forest, 30–70 m altitude.

**Other collections examined.** MYANMAR, Mon State, *Ruchisansakun & Thet Yu Nwe 711* (L L2071071, RAF, RANG), Mawlamyine, Himeinkanein, N16°19'19.43" E97°42'34.06", 19 Aug. 2015; *Ruchisansakun & Thet Yu Nwe 712* (L L2071074, RAF, RANG), Mawlamyine, Himeinkanein, N16°19'02.07" E97°42'19.07", 20 Aug. 2015; *Ruchisansakun & Thet Yu Nwe 713* (L L2071075, RAF, RANG), Mawlamyine, Kalagon, N16°32'00.29" E97°42'53.85", 20 Aug. 2015; *Ruchisansakun & Thet Yu Nwe 741* (L L2071147), Mawlamyine, N16°22'48.6" E97°45'45.4", Kayin State, *Ruchisansakun & Thet Yu Nwe 716* (L L2071080, RAF, RANG), Hpa-An, Zwegabin Mountain, N16°49'41.99" E97°40'28.74", 20 Aug. 2015; *Ruchisansakun & Thet Yu Nwe 743* (L L2071149), Hpa-An, Sadan cave, N16°44'21.7" E97°43'00.2", 18 Oct. 2015; *Ruchisansakun & Thet Yu Nwe 746* (L), Hpa-An, Zwegabin mountain, 18 Oct. 2015; *Ruchisansakun & Thet Yu Nwe 748* (L L2071159), Hpa-An, 20 Oct. 2015.



**Map 5** Distribution of *Impatiens lobbiana* Turcz. (●), *I. micromeris* Hook.f. (●), *I. psittacina* Hook.f. (●) and *I. tanintharyiensis* Ruchis., Suksathan & Saw-Lwin (●).

**Notes** — *Impatiens lobbiana* is highly variable in flower size between populations. The populations we observed in Mawlamyine have much smaller flowers than those from Hpa-An (18–26 mm vs 40–45 mm). This species is similar to *I. spectabilis* Triboun & Suksathan (Suksathan & Triboun 2009: 176) from Thailand but differs in having an obcordate apex on the upper lateral petals, instead of a truncate to obtuse apex.

Turczaninow (1859) cited the specimen *Lobb 184* in the protologue, but *Lobb 184* (K000858226) is *Henckelia marginata* (C.B.Clarke) A.Weber from Peninsular Malaysia. However, we believe that *Lobb 384* (KW001000647) – deposited in the National Herbarium of Ukraine (KW) – was the specimen Turczaninow was referring to, although Singapore is written on the label. However, a duplicate at Kew (K000694801) was collected in Moulmein (Moolmein), Myanmar, and *Lobb 380–385* is also from Myanmar. As we cannot confirm with certainty that the specimen *Lobb 384* (KW001000647) is a holotype, we designate it as lectotype, because it best matches the protologue.

### 7. *Impatiens micromeris* Hook.f. — Fig. 11; Map 5

*Impatiens micromeris* Hook.f. (1905) 26; W.J.Kress et al. (2003) 170. — Type: *Brandis s.n.* (lecto, designated here K K000694789), Myanmar, Tenassarim.

Annual herb, 18–20 cm tall. *Stem* erect, c. 2.5 mm diam, richly branched. *Leaves* spirally arranged. *Petiole* 16–22 mm long, c. 1 mm diam. *Lamina* 25–31 by 12–15 mm, ovate to elliptic, apex acute to acuminate, base attenuate, the margin crenate, pilose on both sides, with one small and inconspicuous gland on each side of margin near lamina base; lateral veins 4 or 5 pairs. *Inflorescence* axillary, erect, solitary. *Flowers* c. 10 by 7 mm, c. 10 mm deep. *Bracts* linear, apex acute, base cuneate, margin entire, glabrous, persistent. *Pedicel* 14–17 mm long, < 1 mm diam. *Lateral sepals* 4: the upper pair c. 0.5 mm by < 0.5 mm, narrowly elliptic, apex obtuse to acute, base cuneate, glabrous; the lower pair free, c. 2 by 1 mm, ovate, apex acute and mucronate, base obtuse. *Lower sepal* c. 2.5 mm long, 2.5 mm deep, navicular, apex acute and mucronate, glabrous, distal part gradually tapering into a straight or curved slender spur, c. 5 mm long, with a single tip. *Dorsal petal* c. 5 by 3.5 mm, ovate to elliptic to oblong, apex round and mucronate, base obtuse, glabrous. *Lateral united petals* 9.5–10 mm long, connate: the upper petals c. 3 by 2 mm, ovate to obovate, apex round, base cuneate; the lower petals 8–8.5 by 3.5–4 mm, connate, ovate, apex obtuse to acute, base without auricle. *Stamens* unknown. *Ovary* c. 1.5 mm long, c. 0.5 mm diam. *Fruits* c. 5 mm long, 2 mm diam, fusiform. *Seeds* 1.5 mm long.

**Phenology** — Flowering: September.

**Distribution** — Endemic to southern Myanmar (Tenassarim, possibly Tanintharyi Region, Mon State, Kayin State).

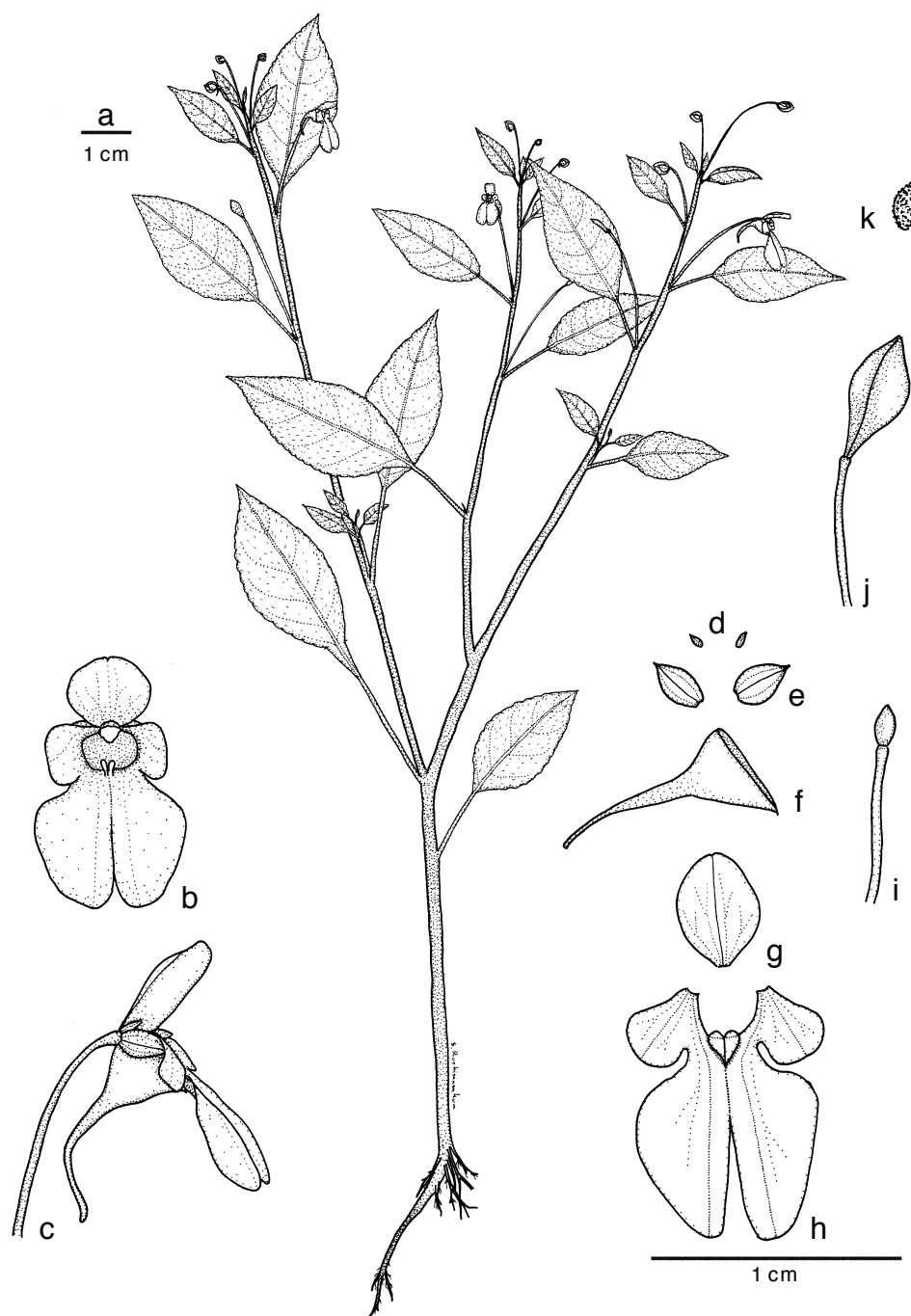
**Ecology** — Unknown.

**Note** — The authors have not seen *I. micromeris* *in situ*. The species was described only from the type specimen. Hooker (1905) published this species with an identification key of other *Impatiens* and their locality but did not provide a detailed description.

### 8. *Impatiens psittacina* Hook.f. — Map 5; Plate 1f

*Impatiens psittacina* Hook.f. (1901) t. 7809; (1905) 30; Craib (1926b) 213; T.Shimizu (1970) 189; W.J.Kress et al. (2003) 169. — Type: *Hildebrand 5* (holo K K000694762), Myanmar, 5 Oct. 1900.

Lithophytic, annual, glabrous herb, 30–100 cm tall. *Stem* erect, 3–22 mm diam, solitary moderately branched, angular, purple. *Leaves* spirally arranged. *Petiole* 35–80 mm long, 1.5–2 mm diam, green to purple. *Lamina* 40–115 by 27–75 mm, ovate, apex acute to acuminate, base round to attenuate, margin



**Fig. 11** *Impatiens micromeris* Hook.f. a. Habit; b. front view of flower; c. lateral view of flowers; d. upper lateral sepals; e. lower lateral sepals; f. lower sepals; g. dorsal petal; h. lateral united petals; i. pedicel and ovary; j. fruit; k. seed. — Drawn by Saroj Ruchisansakun.

serrate, adaxial green, abaxial pale green, with a short clavate gland on each side of margin near the base; lateral veins 9 or 10 pairs. *Inflorescence* axillary, pendulous, 2-flowered raceme. *Peduncle* 1–2 mm long, c. 1 mm diam, green. *Rachis* c. 1 mm long, < 1 mm diam. *Flowers* 33–37 by 27–34 mm, 37–45 mm deep, pink. *Pedicel* 36–37 mm long, c. 1 mm diam, green. *Bracts* 3–4 by 1 mm, linear to lanceolate, apex acute, base cuneate, margin entire, without gland, green, persistent. *Lateral sepals* 2, 10–13 by 9–11 mm, free, elliptic to obovate, apex round and mucronate, base obtuse, white to green to dark pink. *Lower sepal* 15–16 by 17–18 mm, 25–27 mm deep, deeply bucciniform, apex acuminate and mucronate, white, and red on basal part, with a yellow mark inside, distal part abruptly constricted into a short hook-like spur, 5–6 mm long, green. *Dorsal petal* 15–16 by 17–18 mm, orbicular, flat, apex round and slightly emarginate, base obtuse to round, white to pale pink, abaxial midvein with a wide crescent-shaped crest at the base, 4–5 mm wide, green to pink. *Lateral united petals* 42–45 mm

long, connate: the upper pair 12–13 by 14–16 mm, orbicular to broadly ovate, apex round, base cuneate, white with a pale pink margin; the lower pair 33–35 by 10–11 mm, connate, broadly oblong, apex round to slightly emarginate, pink, white at the base with a yellow mark. *Stamens*: filaments 9–10 mm long, white; anthers white. *Ovary* 9–10 mm long, c. 1 mm diam, 4-carpellate, green. *Fruits* 20–22 mm long, 2.5–3 mm diam, clavate, 4-lobed, green. *Seeds* c. 6–8, ellipsoid to brick shaped with papillae, c. 2 mm long.

*Phenology* — Flowering: September to October; fruiting: November to December.

*Distribution* — North-eastern Myanmar (Shan State), northern Thailand.

*Ecology* — Growing on limestone with little organic matter in shady areas in mixed deciduous forest, 1000–1100 m altitude.

*Other collections examined.* MYANMAR, Shan State, Ruchisansakun et al. 727 (L L2071111, MAND, RAF), Taunggyi District, Lwa Taw village, N20°40'44.35" E97°10'31.93", 22 Sept. 2015.

Note — *Impatiens psittacina* is well-known to plant collectors and horticulturists. Populations in Myanmar have mainly red spurs, whereas populations in Thailand are characterized by green spurs. The species is pollinated by bumblebees (Ruchisansakun et al. 2016), which have the pollen deposited on their thorax as they enter the flower, while their wings are spread.

**9. *Impatiens tanintharyiensis* Ruchis., Suksathan & Saw-Lwin**  
— Map 5; Plate 1g

*Impatiens tanintharyiensis* Ruchis., Suksathan & Saw-Lwin in Ruchisansakun et al. (2017) 171. — Type: *Ruchisansakun & Thet Yu Nwe 707* (holo L L2071066; iso L, RAF, RANG), Myanmar, Tanintharyi Region, Dawei, Thet Kal Kwet Village, Hawang falls, alt. c. 146 m, 17 Aug. 2015.

Lithophytic, annual, glabrous herb, 15–25 cm tall. *Stem* erect, cylindrical with small ridges near the nodes, 3–7 mm diam, unbranched to sparsely branched, upper part slightly zigzag, not swollen at nodes, red to purple with dark purple dots. *Leaves* spirally arranged, adaxial green, abaxial pale green. *Petiole* 10–30 mm long, 1–1.5 mm diam, green to red with dark red dots. *Lamina* 40–65 by 15–25 mm, elliptic to ovate to lanceolate, apex acute, base obtuse to attenuate, margin shallowly serrate; lateral veins 4 or 5 pairs; extrafloral nectaries present as a stalked short gland on each side of the margin at the base. *Inflorescence* axillary, 1-flowered, erect. *Flowers* 35–42 by 22–26 mm, 28–32 mm deep, highly asymmetric, pink with white centre and a pair of yellow marks on base of the lower lateral petals. *Bracts* c. 2 by 1 mm, narrowly triangular, apex acute, green. *Pedicel* 20–30 mm long, c. 1 mm diam, pink with red dots. *Lateral sepals* 2, 5–7 by 5–6 mm, ovate to broadly ovate, sometimes slightly oblique, apex acute to acuminate and mucronate, base obtuse to cordate, pink with green tips. *Lower sepal* 13–16 by 8–10 mm, 14–15 mm deep, deeply bucciniform, pink outside and whitish inside with pink veins and a yellow mark, distal part gradually constricted into a curved spur, 19–22 mm long, pink with deep pink dots, blunt. *Dorsal petal* 12–13 by 15–17 mm, broadly ovate to broadly elliptic to broadly obovate, flat, recurved near the base, pink with a green tip, curved backward, apex cordate and mucronate, base cuneate, abaxial midvein with a narrow crescent-shaped crest near the base, c. 1 mm wide. *Lateral united petals* connate: the upper petals 12–15 by 18–22 mm, broadly obovate, apex truncate, pink with white base; the lower petals 23–30 by 9–13 mm, connate, obovate, apex round to shallowly bilobed, pink with white base and yellow mark at the base. *Stamens*: filaments c. 4 mm long, white; anthers white. *Ovary* 4 mm long, 1 mm diam, 4-carpellate, green, glabrous. *Fruits* 15–17 mm long, c. 3 mm diam, clavate, 4-lobed, 14–16-seeded. *Seeds* c. 2.5 by 1 mm, brown.

Phenology — Flowering: August to September; fruiting: September.

Distribution — Endemic to southern Myanmar (Tanintharyi Region).

Ecology — Growing on decaying organic material that is present on granular metamorphic rock of granitic schist facies, shady or open sunny areas along a waterfall, 140–160 m altitude.

*Other collections examined.* MYANMAR, Tanintharyi Region, *Ruchisansakun & Thet Yu Nwe 708* (L L2071069, RAF, RANG), Dawei, Thet Kal Kwet Village, Rachaung falls, N14°24'38.08" E98°11'10.43", alt. 155 m, growing on rocks in shady areas along a waterfall, 17 Aug. 2015.

Note — *Impatiens tanintharyiensis* is closely related to *I. spectabilis*, *I. psittacina* and *I. cardiophylla* Hook.f. (1909: 14) although it is morphologically quite distinct (Ruchisansakun et al. 2017). The species differs from *I. spectabilis* in having asymmetric flowers and a longer spur. Further details on the

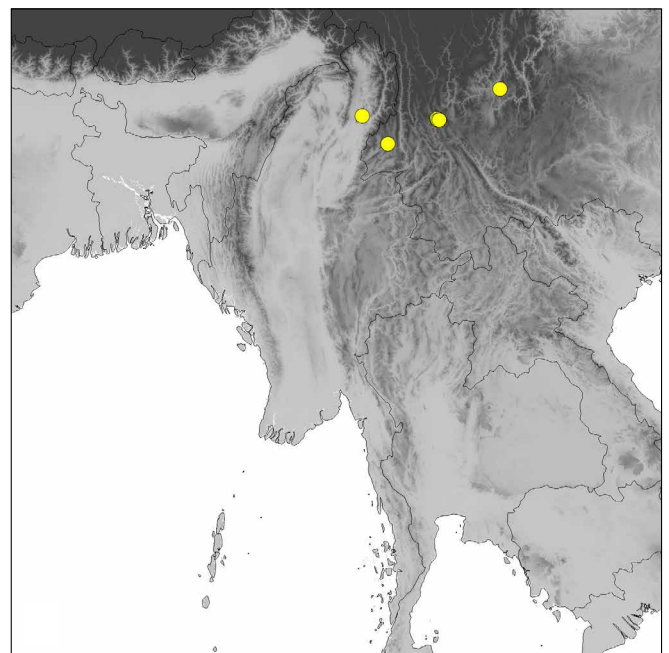
differences between *I. tanintharyiensis* and its close allies are provided in Ruchisansakun et al. (2017).

Section *Impatiens* in S.X.Yu et al. (2015) 191

**10. *Impatiens forrestii* Hook.f. ex W.W.Sm. — Map 6**

*Impatiens forrestii* Hook.f. ex W.W.Sm. in Smith & Forrest (1915) 339; Grey-Wilson (2008) 139. — Type: *Forrest 4275* (lecto, designated by Grey-Wilson (2008) E E00313622; isolecoto K000694041), China, West Yunnan, inside valleys on the eastern flank of the Tali Range, lat. N25°40', alt. 9000–10000 ft, July 1906.

Perennial herb, 30–90 cm tall, swollen and semi-woody at the very base, with fascicled roots. *Stem* erect, slender, unbranched to sparsely branched, green to purple, glabrous to papillate at the upper nodes. *Leaves* spirally arranged. *Petiole* 2–26 mm long, slender, glabrous. *Lamina* 70–150 by 30–54 mm, elliptic to ovate to lanceolate, apex acute to acuminate, base cuneate to attenuate, margin serrate, membranous, adaxial deep green and pilose, abaxial pale green and remotely pilose; lateral veins 5–6(–9) pairs. *Inflorescence* axillary, erect when young but pendulous in mature stage, (1- or) 2- (or 3-)flowered raceme. *Peduncle* 30–70 mm long, slender, green to purple, pilose to glabrous, with two glands on each side of peduncle base. *Rachis* 3–12.5 mm long. *Flowers* 26–38 mm long, 30–37 mm deep, purple to red, with dark red lines on the lower sepal and the lateral united petals. *Bracts* 2.5–5 by 1–4 mm, lanceolate to elliptic, apex mucronulate, base obtuse, margin entire, without gland, abaxially pilose, persistent. *Pedicel* 7–20 mm long, slender, glabrous. *Lateral sepals* 2, 7–9 by 5–7 mm, free, ovate to obliquely ovate, apex mucronulate, base obtuse to truncate, abaxial glabrous to pilose. *Lower sepal* 15–25 mm long, 14–18 mm deep, deeply bucciniform with an oblique mouth, apex acuminate and mucronate, glabrous to slightly pilose, abruptly constricted into an incurved and spiral spur, 10–19 mm long, slightly bilobed at the tip of the spur. *Dorsal petal* 12–20 by 18–27 mm, broadly ovate to broadly elliptic, flat, apex emarginate, base truncate, pink, slightly pilose near the midrib, abaxial midvein with a keel-shaped crest and long acute appendage, 5–6 mm long. *Lateral united petals* 25–35 mm long, free: the upper petals 10–13.5 by 7.5–8 mm, obovate to orbicular, apex obtuse, base cuneate, pink; the lower petals 28–30 by 12–15 mm,



**Map 6** Distribution of *Impatiens forrestii* Hook.f. ex W.W.Sm.

free, obovate, apex slightly obliquely emarginate, base auricled, glabrous. *Stamens*: filaments 5–5.5 mm long; anthers acute. *Ovary* up to 5 mm long, c. 1.5 mm diam, glabrous. *Fruits* 22–30 mm long, linear, green, glabrous.

**Phenology** — Flowering: July to December; fruiting: August to December.

**Distribution** — Northern Myanmar (Kachin State), southwestern China (Yunnan, Sichuan).

**Ecology** — Growing in shady and moist areas in evergreen forest, 2500–3000 m altitude.

*Other collections examined.* MYANMAR, upper Burma, *Forrest 1002* (para K H2015/60092 18), on the Irrawadi-Ming-Kwang divide, also in the Irrawadi basin, lat. N25°50', alt. 8000–10000 ft, Oct. 1905.

**Note** — This species is slightly similar to *I. arguta* but differs in having a keel-shaped crest and a long acute appendage on the abaxial midvein of dorsal petal instead of crescent-shaped to obtuse crest without appendage (Fig. 3).

Section ***Racemosae*** Hook.f. & Thomson (1860) 113

### 11. *Impatiens radiata* Hook.f. — Map 7

*Impatiens radiata* Hook.f. (1875) 476; C.B. Clarke (1877) 137; Delavay (1889) 122; Höck (1909) 475; Biswas (1966) 210; H.Hara (1966) 196; H.Hara & L.H.J. Williams (1979) 80; S.Akiyama et al. (1995) 159; W.J. Kress et al. (2003) 170; Y.L. Chen et al. (2007) 77. — *Impatiens radiata* Hook.f. & Thomson in Hook.f. (1905) 15; Diels (1912) 222; Wu (2006) 97. — Type: *Hooker s.n.* (lecto, designated in Akiyama (2018) K K000694747; isolecto K K000694746), India, Sikkim, Lachung, alt. 6000–12000 ft, 6 July 1849.

Terrestrial, annual herb, 40–80 cm tall. *Stem* erect or decumbent in the lower part, heavily branched, glabrous. *Leaves* spirally arranged. *Petiole* 1–25 mm, glabrous. *Lamina* 55–140 by 20–60 mm, elliptic to ovate to lanceolate, apex acuminate, base cuneate, margin crenate with small teeth, papyraceous, green with red margin, remotely pilose, one distinct gland at the petiole base; lateral veins 7–9 pairs. *Inflorescence* axillary to subterminal, erect, verticillate, many-flowered raceme, radiate, 2–4-flowered per node. *Peduncle* 20–50 mm long, green and red, glabrous. *Rachis* 70–90 mm long. *Flowers* 20–22 mm long, 27–33 mm deep, white to pale pink. *Bracts* 6–8 by

1–2 mm, broadly lanceolate, apex aristate with a gland, base obtuse, margin entire, green with red at apex, glabrous, persistent. *Pedicel* 17–25 mm long, red, glabrous. *Lateral sepals* 2, 2–4 by 1.5–2 mm, free, obliquely ovate, apex aristate, base obtuse, dark pink, glabrous. *Lower sepal* 4–8 by c. 1 mm, 2–2.5 mm deep, navicular, apex mucronate, white or pink, glabrous, distal part gradually narrow into a straight spur, 17–24 mm long. *Dorsal petal* 5–5.5 by 4–5.5 mm, orbicular, cucullate, apex mucronate to aristate, base obtuse, white or pink, with red midrib, glabrous, abaxial midvein simple or with a narrow crest terminating in a short acute point. *Lateral united petals* 13–14 mm long, free: the upper petals 2.5–4 by 3 mm, ovate to obovate, apex round to truncate, base cuneate, white or pink; the lower petals 7–12 by 3–4 mm, free, ovate to oblong, apex acute, white or pink, glabrous. *Stamens*: filaments c. 4 mm long, white; anthers white. *Ovary* 4–4.5 mm long, c. 1 mm diam, 5-carpellate, green, glabrous. *Fruits* up to 16 mm long, 3 mm diam, linear, 5-lobed, glabrous; fruiting pedicels 21–26 mm long, < 1 mm diam. *Seeds* unknown.

**Phenology** — Flowering: July to December; fruiting: October to December.

**Distribution** — Myanmar (Chin State, Mandalay Region), Bhutan (Bumthang district), China (Yunnan Province), India (Meghalaya, Sikkim, west Bengal State), Thailand (northern Thailand).

**Ecology** — Growing among grass in open areas within the evergreen forest, 1800–3700 m altitude.

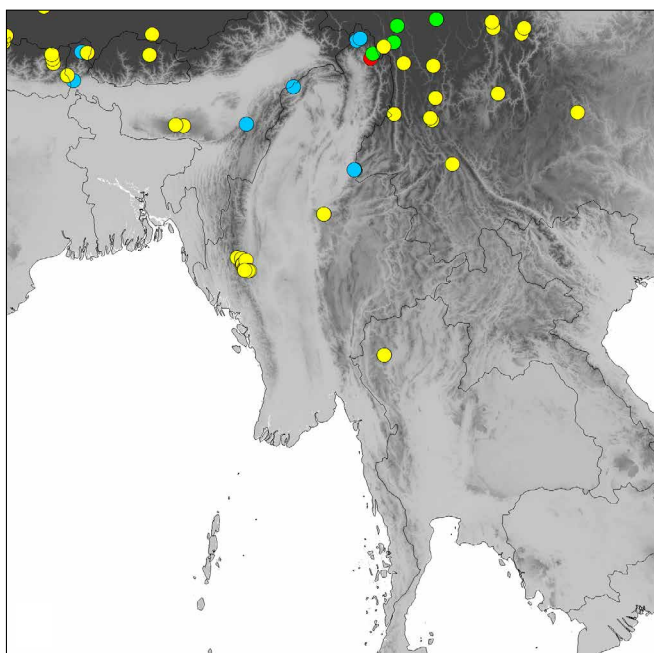
*Other collections examined.* MYANMAR, Chin State, *U Mg Gale-2 5762* (RAF8274/2 sheet 1 & 2), Kanpetlet Dist., Esaken, alt. 5700 ft, 5 Sept. 1962; *Murata et al. 024564* (QBG QBG61252), Natma Taung National Park, at the foot of Mt Victoria, alt. 1800–2000 m, 2 Dec. 2002; *Kingdon-Ward 22649* (BM), *ibid.*, alt. 6000 ft, 2 Sept. 1956; *Fujikawa et al. 053432* (QBG QBG62063), N21°12'45.4" E94°1'15", alt. 2260 m, 12 Aug. 2008; *Ling Shein Man 055281* (QBG QBG78573), Natma Taung National Park, 2 Aug. 2007; *Fujikawa et al. s.n.* (MBK086951), 3–4 miles from the entrance of National Park, Natma Taung National Park, alt. c. 2200 m, 21 Feb. 2012; *Ling Shein Man 087637* (QBG QBG61275), Old Town area, Kanpetlet Township, alt. c. 1750 m, 23 Oct. 2011; *Mu Mu Aung et al. 092311* (QBG QBG70765), N21°23.790' E93°50.366', alt. 2330 m, 3 July 2013.

**Note** — *Impatiens radiata* is very similar to *I. graciliflora* but differs in having a shorter spur, 17–24 mm long vs 30 mm long.

### 12. *Impatiens graciliflora* Hook.f. — Map 7

*Impatiens graciliflora* Hook.f. (1905) 15; Fedde (1905) 432. — Type: *Pantling 641* (lecto, designated in Akiyama (2018) K K000694665), India, Sikkim, Lenchul, alt. 6000 ft, Aug. 1903.

Annual herb, 40–50 cm tall. *Stem* erect, 3–4.5 mm diam, simple to rarely branched, glabrous. *Leaves* spirally arranged. *Petiole* absent–15 mm long, c. 1 mm diam, glabrous. *Lamina* 73–135 by 19–40 mm, elliptic to ovate-lanceolate to lanceolate, apex acute to acuminate, base attenuate, margin serrate, glabrous, a single stipulate gland at the base of petiole and adnate to the stem; lateral veins 10–12 pairs. *Inflorescence* terminal, erect, 20–28-flowered, verticillate raceme, 3- or 4-flowered at each node. *Peduncle* 36–55 mm long, c. 1 mm diam, glabrous. *Rachis* 45–90 mm long, slender, glabrous. *Flowers* c. 13–15 mm long, c. 20 mm deep, pink. *Bracts* 3–6 by c. 1 mm, lanceolate, apex aristate with long awns, base cuneate to obtuse, margin entire, glabrous, persistent. *Pedicel* 14–20 mm long, slender, glabrous. *Lateral sepals* 2, 4–5 by 1 mm, free, falcate, apex aristate with long awns, 1.5–3 mm long, base cuneate, glabrous. *Lower sepal* 4–5.5 mm long, 34–37 mm deep including spur, navicular, apex mucronate, glabrous, tapering into a long straight spur, c. 30 mm long, single tip. *Dorsal petal* 4.5–6 by 4–7 mm, ovate to broadly elliptic, cucullate, apex mucronate, base obtuse, glabrous to remotely pilose, abaxial midvein simple or with a narrow crest terminating in a short acute point.



**Map 7** Distribution of *Impatiens radiata* Hook.f. (●), *I. graciliflora* Hook.f. (●), *I. margaritifera* var. *humilis* Y.L. Chen (●) and *I. casseabriae* Y.H. Tan, S.S. Zhou & B. Yang (●).

*Lateral united petals* 12–14 mm long, free: the upper petals, c. 2 by 1.5 mm, elliptic, apex round, base obtuse; the lower petals 10.5–11 by 5.5–6.5 mm, ovate-triangular, apex obtuse, base slightly auricled, glabrous. *Stamens*: filaments c. 3 mm long; anthers obtuse. *Ovary* c. 3 mm long, glabrous. *Fruits* 18–18.5 by 1.5–2 mm, linear to clavate, glabrous; fruiting pedicels up to 20.5 mm long.

Phenology — Flowering: August; fruiting: August.

Distribution — Myanmar (Kachin State), India (Sikkim State).

Ecology — Unknown, 1500–1850 m altitude.

*Other collections examined.* MYANMAR, Kachin State, Kingdon-Ward 6700 (K), Seinghku-Adung confluence, 9 May 1926; *Toppin* 2776 (K H 2015/00092 21; K H 2015/00092 22; sheet 3; sheet 4; BM), Sinlum.

Note — *Impatiens graciflora* is very similar to *I. radiata* but differs in having a longer spur. The spur length of *I. radiata* is rather variable, but it is never as long as in this species.

### 13. *Impatiens margaritifera* var. *humilis* Y.L.Chen — Map 7

*Impatiens margaritifera* var. *humilis* Y.L.Chen (1978) 45; Y.L.Chen et al. (2007) 79. — Type: Yu 12841 (holo PE PE00039573\*; iso HUH HUH00230517\*, PE PE00039571\*, PE PE00039572\*, PE PE00039574\*), China, Sichuan, Daocheng, Mowu, alt. 1128–1219 m.

Annual glabrous herb, 10–26 cm tall. *Stem* erect, unbranched to sparsely branched, glabrous. *Leaves* spirally arranged and decussate at the lower nodes. *Petiole* 10–20 mm long, glabrous. *Lamina* 48–57 by 18–23 mm, ovate, apex acute to acuminate, base obtuse to cuneate, margin distinctly crenate with teeth, glabrous, with or without 1 pair of glands at the base of the lamina; lateral veins 4 or 5 pairs. *Inflorescence* axillary, erect, 2–6-flowered subumbellate raceme. *Peduncle* 20–30 mm long, glabrous. *Rachis* 1–4 mm long, glabrous. *Flowers* 12–14 mm long, 3–5 mm deep, pink to pale purple to pale greenish yellow. *Bracts* c. 4 by 1 mm, linear, apex acute, base cuneate, margin entire, persistent. *Pedice* 5–6 mm long. *Lateral sepals* 2, c. 3 by 2 mm, ovate, apex acute, base obtuse. *Lower sepal* c. 7 mm long, c. 3 mm deep, navicular, without spur. *Dorsal petal* c. 6 by 5 mm, ovate, cucullate, apex obtuse, base obtuse, abaxial midvein simple or with a narrow crest. *Lateral united petals* c. 15 mm long, free: the upper petals c. 8 mm long, ovate, apex obtuse to acute; the lower petals c. 8 mm long, free, narrowly ovate, apex obtuse to acute. *Stamens* unknown. *Ovary* unknown. *Fruits* unknown. *Seeds* unknown.

Phenology — Flowering: July to August.

Distribution — Myanmar (Kachin State), China (Sichuan Province, Yunnan Province).

Ecology — Growing in evergreen forest, 2000–4000 m altitude.

*Other collections examined.* CHINA, Yu 22301 (para PE PE00078824\*), Mekong-Salwin Divide, Sila, alt. 4000 m, 11 Aug. 1938. — MYANMAR, Kachin State, Kingdon-Ward 7164 (K), Valley of Di Chu, alt. 7000 ft, 22 July 1926.

Note — *Impatiens margaritifera* var. *humilis* is similar to var. *margaritifera*, but differs in having a shorter stem, a shorter rachis and fewer flowers in each inflorescence. It is also similar to *I. tenerrima* Y.L.Chen (1978: 51) but differs in having a 2–6-flowered raceme (vs a solitary flower), lateral united petals of c. 15 mm long (vs 25–30 mm), a taller stem and longer leaves.

### 14. *Impatiens casseabryae* Y.H.Tan, S.S.Zhou & B.Yang — Fig. 12; Map 7; Plate 1h

*Impatiens casseabryae* Y.H.Tan, S.S.Zhou & B.Yang in Yang et al. (2017) 104. — Type: Myanmar Exped. 248 (holo HITBC not seen; iso KUN not seen, RAF not seen), Myanmar, Kachin State, Putao, Hakabo Razi National Park, N27°43'28" E97°51'9", alt. 1200 m, 28 Nov. 2014.

Terrestrial, annual, glabrous herb, 17–30 cm tall. *Stem* lower part erect to decumbent, upper part erect, richly branched, glabrous. *Leaves* spirally arranged. *Petiole* absent—3 mm long, glabrous. *Lamina* 35–70 by 6–8 mm, narrowly elliptic to narrowly oblanceolate, apex acute, base cuneate, margin deeply sinuate, glabrous, adaxial green with red margin, abaxial pale green; lateral veins 10 or 11 pairs; without distinct extrafloral nectary glands on lamina base nor petiole. *Inflorescence* subterminal, erect, 1- or 2-flowered raceme. *Peduncle* 15–20 mm long, glabrous. *Rachis* 5 mm long. *Flowers* 30 mm long, 5 mm deep, white, slightly asymmetric. *Bracts* c. 3 by 1.5 mm, elliptic, apex acute and mucronate, base obtuse, margin entire, glabrous, persistent. *Pedice* 10–12 mm long, glabrous. *Lateral sepals* 2, c. 3 by 2 mm, free, obliquely ovate, apex acute and mucronate, base obtuse, white to pale green, sometimes with red, glabrous apex. *Lower sepal* c. 9 mm long, 3–4 mm deep, navicular, apex acuminate and mucronate, white, glabrous, spurless. *Dorsal petal* c. 8 by 4 mm, ovate, cucullate, apex acute and aristate, base cuneate, glabrous, white, abaxial midvein simple. *Lateral united petals* 27–32 mm long, free: the upper petals 8–9 by 2.5–3 mm, obliquely ovate, apex acute, base cuneate, white-purple; the lower petals 25–30 by 4–6 mm, free, sickle-shaped to narrowly obovate, apex acute, white, base white with a yellow mark. *Stamens*: filaments c. 2.5 mm long, white; anthers white. *Ovary* c. 2–2.5 mm long, 1 mm diam, green, glabrous.

Phenology — Flowering: October.

Distribution — Endemic to Myanmar (Kachin State). So far only known from the type locality.

Ecology — Growing on wet rocks along a waterfall in evergreen forest.

*Other collection examined.* MYANMAR, Kachin State, Saw-Lwin 1067 (L 2 sheets, RAF, RANG), Hakabo Razi National Park.

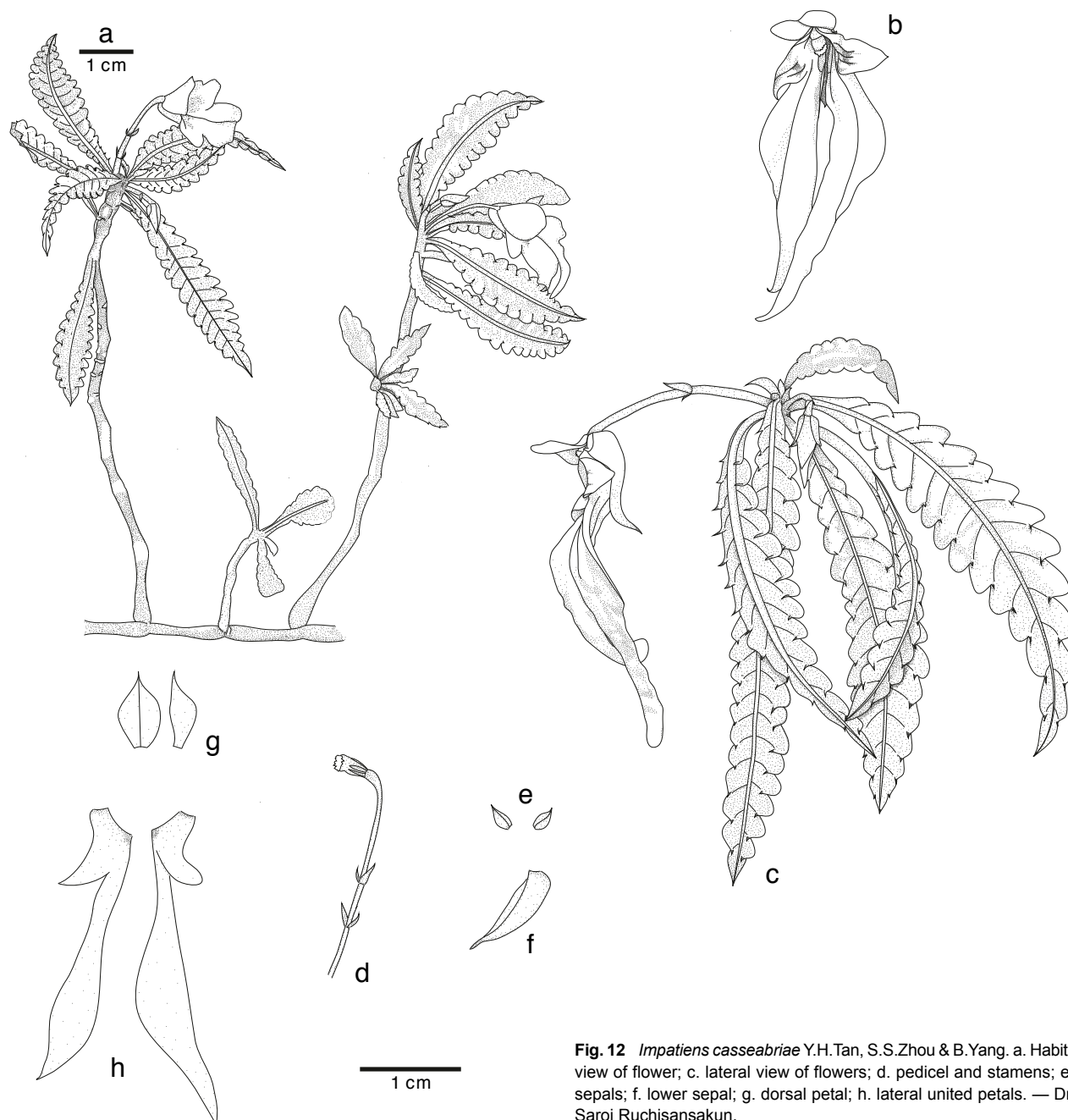
Note — *Impatiens casseabryae* is morphologically similar to *I. margaritifera* var. *humilis* but differs in having a shorter petiole, narrowly elliptic to narrowly oblanceolate longer lower petals.

### 15. *Impatiens racemosa* DC. — Map 8; Plate 2a

*Impatiens racemosa* DC. (1824) 688; D.Don (1825) 203; Wall. (1831) 167; Hook.f. (1875) 479; (1904b) 6; (1905) 16, 31; Craib (1926b) 213; T.Shimizu (1970) 190; Y.L.Chen et al. (2007) 57. — Type: Wall. Cat. s.n. (lecto, designated here G G00218030\*), Nepal, 1821.

*Impatiens racemosa* DC. var. *ecalcarata* Hook.f. (1904b) 9, syn. nov. — Type: *Prair* 39f (lecto, designated here K K000694752), India, Sikkim Himalaya. *Impatiens microsciadia* Hook.f. (1905) 16. — Type: *Pantling* s.n. (lecto, designated here K with illustration by Hooker), Sikkim, alt. 6000 ft

Terrestrial, annual herb, 30–90 cm tall. *Stem* erect, 2.5–6 mm diam, simple to richly branched, glabrous, with some globular glands on the ridge. *Leaves* spirally arranged. *Petiole* 5–15 mm long, glabrous. *Lamina* 55–120 by (15–)32–40 mm wide, elliptic to ovate to lanceolate, apex acuminate to acute, base cuneate to attenuate, margin crenate, papery, adaxial green, abaxial pale green, glabrous, with a pair of globular glands at the petiole base; lateral veins 7–10(–12) pairs. *Inflorescence* axillary, erect, 7–13(–19)-flowered raceme. *Peduncle* (20–)40–50(–90) mm long, glabrous. *Rachis* (20–)30–40(–60) mm long. *Flowers* 7–11 mm long, 10–21 mm deep, yellow with red dots at lateral petals base. *Bracts* 1–2(–4) by 1 mm, ovate to lanceolate, apex mucronate to aristate, base cuneate, margin entire, glabrous, persistent. *Pedice* 10–16 mm long, glabrous. *Lateral sepals* 2, 1.5–2 by 1.5–2 mm, free, ovate to obliquely ovate, apex mucronate to aristate, 2 mm long, base obtuse, green, glabrous. *Lower sepal* 3–7 mm long, 1.5–3 mm deep, navicular, apex mucronate to aristate, 2 mm long, glabrous, distal part gradually narrowing into a recurved to straight spur, 11–17 mm long, yellow. *Dorsal petal* 3.5–5 mm long, obovate, apex



**Fig. 12** *Impatiens casseabryae* Y.H.Tan, S.S.Zhou & B.Yang. a. Habit; b. front view of flower; c. lateral view of flowers; d. pedicel and stamens; e. lateral sepal; f. lower sepal; g. dorsal petal; h. lateral united petals. — Drawn by Saroj Ruchisansakun.

obtuse, base obtuse, glabrous, abaxial midvein simple or with narrowly crescent-shaped crest. *Lateral united petals* free: the upper petals 2–5 by 1.5–3 mm, ovate to orbicular, apex obtuse, base cuneate, yellow with red dots at the base; the lower petals free, 6–14 by 4–7 mm ovate, apex obtuse, base without auricle, yellow with red dots at the base. *Stamens*: filament green to yellow; anther yellow to white. *Ovary* green, glabrous. *Fruits* 12–17 mm long, 2–2.5 mm diam, linear, 5-lobed, glabrous. *Seeds* 2 mm long, obovoid, compressed.

**Phenology** — Flowering: July to November; fruiting: September to December.

**Distribution** — Bhutan, China (Tibet and Yunnan Province), India (Sikkim and Uttarakhand State), Myanmar (Chin, Kachin, Mandalay, Shan), Nepal (Dhaulagiri Zone, Dhawalagiri Zone, Gandaki Zone, Janakpur Zone, Koshi Zone, Mechi Zone, Sagarmatha Zone), northern Thailand.

**Ecology** — Growing in open or shady areas in deciduous to evergreen forest, 1700–2300 m altitude.

*Other collections examined.* MYANMAR, Chin State, Huk s.n. (K H2015/00092 39), Chin Hills, July 1892; Venning 132 (K sheet 1, 2, 3), Chin Hills, Sihaung

road, 2 miles from Haka, alt. 7500 ft, 11 Oct. 1910; Murata *et al.* 024574 (QBG024574), Natma Taung National Park, at the foot of Mt Victoria, alt. 1800–2000 m, 2 Dec. 2002; Ling Shein Man 055282 (QBG QBG78499), Natma Taung National Park, 2 Aug. 2007; Ling Shein Man 087645 (QBG QBG61278), Old Town area, Kanpetlet Township, alt. c. 1750 m, 23 Oct. 2011; Fujikawa *et al.* 090548 (QBG QBG70760), N21°12'10.5" E94°01'47.1", alt. 1945 m, 4 Dec. 2012; Fujikawa *et al.* 094011 (QBG), N21°12'22.3" E94°01'26.5", alt. 2075 m, 20 Aug. 2013; Funakoshi *et al.* 085068 (QBG QBG61268), N21°12.162' E94°01.447', alt. 1955 m, 3 Sept. 2011; Mandalay Region, Lace 6008 (E E00752884, K H2015/00092 38), Ruby mine district, Mogok & Bernamyo, 25 Oct. 1912; Shan State, Ruchisansakun *et al.* 732 (L L2071119, MAND, RAF, RANG), Taunggyi district, Pindaya, N20°58'49.53" E96°37'41.62", alt. 1909 m, 26 Sept. 2015.

**Notes** — The spur length of flowers of *I. racemosa* varies from absent to 17 mm. Spurless and spurred flowers can be found on the same plant (Chiang Mai population, Thailand). Therefore, we do not to recognise *I. racemosa* var. *ecalcarata* as a distinct taxon.

De Candolle (1824) only mentioned that *I. racemosa* was collected in Napaulia by Wallich but did not specify the specimens. We designate the specimen GDC00218030 as the lectotype

because it is a complete specimen and is deposited in the De Candolle Herbarium and matches the protologue.

Hooker (1904b) did not clearly designate the holotype of *I. racemosa* var. *ecalcarata*. We select the specimen *Prain 391* (K000694752) as the lectotype because Hooker made illustrations and wrote *I. racemosa* var. *ecalcarata* on the sheet. Hooker (1905) mentioned only the locality and altitude for *I. microsciadia* but did not provide other information for the type. We found two sheets of this species from Sikkim, 6000 ft altitude, *Pantling s.n.* (one with illustration and another one without illustration), annotated by Hooker. We select *Pantling s.n.* (K, with illustration) as the lectotype.

## 16. *Impatiens siculifer* Hook.f.

*Impatiens siculifer* Hook.f. (1908) 246; Y.L.Chen et al. (2007) 55, 68; Gogoi & Borah (2013) 146. — *Impatiens siculifera* Hook.f. in Kress et al. (2003) 170. — Type: *Bodinier 2335* (lecto, designated here P00780759; isolecoto E E00313594), China, Environs de Tou-chan Province de Kouy-Tchéou, 2 June 1898.

Terrestrial annual herb, 35–100 cm tall. *Stem* erect with some long roots on the lower node, 4–5 mm diam, moderately branched, slightly winged on the upper part, pale green, glabrous to remotely pilose with some glandular hairs on the upper part. *Leaves* spirally arranged. *Petiole* flat, 5–20 mm long, 1–1.5 mm diam, glabrous, with stipular wings with 3–many glands on each side of petiole base. *Lamina* 50–97 by 15–35 mm, elliptic to oblanceolate, apex acute to acuminate, base cuneate to attenuate, margin crenate with teeth at the ridge, green, glabrous, with 1–3 of linear stipular glands on each side along the midrib near lamina base; lateral veins 6–9 pairs. *Inflorescence* axillary to subterminal, erect, 5–10-flowered raceme. *Peduncle* 17–36 mm long, c. 1 mm diam, pale green, glabrous. *Rachis* 5–32 mm long, < 1 mm diam, green, glabrous. *Flowers* 10–25 mm long, 17–20 mm deep, asymmetric, yellow with a red spur. *Bracts* 3–8 by 2–3 mm, ovate to narrowly lanceolate to narrowly elliptic, apex acute and mucronate, base obtuse, margin entire, without glands, green, glabrous, persistent to caducous in fruiting stage. *Pedice*l 13–16 mm long, < 1 mm diam, green, glabrous. *Lateral sepals* 2, 5–6 by 1–3.5 mm, free,

linear-falcate to obliquely ovate, apex acute to acuminate and mucronate, base cuneate, yellow, glabrous. *Lower sepal* 7.5–10 mm long, 18–25 mm deep including spur, deeply navicular, apex acuminate to aristate with long awns, up to 5 mm, yellow with green awns, glabrous, distal part gradually narrowing into an upcurved spur, red. *Dorsal petal* 8–9 by 7–10 mm, elliptic to broadly lanceolate, flat, strongly reflexed backward, apex obtuse to round, base obtuse to truncate, green, glabrous, abaxial midvein simple or with a narrow crest, c. 1 mm high. *Lateral united petals* 18.5–21 mm long, free, slightly different in size and shape between both sides: the upper petals; the left one 9–10 by 5 mm, triangular to broadly lanceolate to obovate, apex acute to round, base cuneate, yellow; the right one 8–11 by 5 mm, obliquely triangular to broadly lanceolate to elliptic, apex acute to obtuse, base cuneate; the lower petals free; the left one 12–15 by 1–1.5 mm, linear and spiral, apex acute, base without to slightly auricled, c. 1 mm high, yellow, glabrous; the right one 13–13.5 by 1–2 mm, linear and spiral, apex acute to obtuse, base slightly spiral, c. 1 mm high, yellow, glabrous. *Stamens*: filaments c. 4 mm long; anthers yellow. *Ovary* 3–4 mm long, c. 1 mm diam, green, glabrous. *Fruits* 19–25 mm long, 2–3 mm diam, linear, 5-lobed, glabrous: fruiting pedicel up to 20 mm long, straight. *Seeds* unknown.

Note — *Impatiens siculifer* is very similar to *I. stenantha* Hook.f. (1875: 478) but the floral bract of *I. stenantha* drops before the flower expands. In the Flora of China (Chen et al. 2007), differences in the shape of the lateral sepals and lower sepal apex are mentioned, but those characters are somewhat confusing. Nevertheless, a more detailed study is necessary to delineate *I. stenantha* and *I. siculifer*.

### Key to varieties of *Impatiens siculifer*

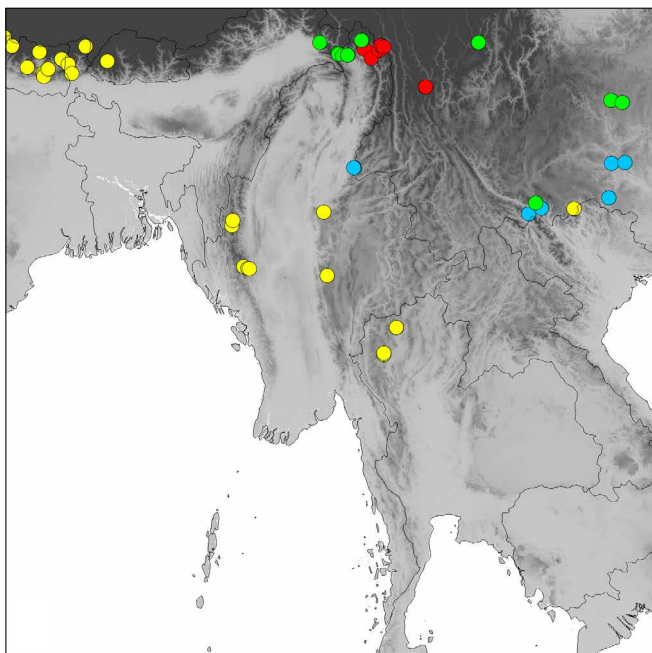
- Petals yellow ..... a. var. *siculifer*
- Petals purple ..... b. var. *porphyrea*

#### a. var. *siculifer* — Map 8; Plate 2b

*Impatiens siculifer* var. *siculifer* Hook.f. in Chen et al. (2007) 68.

Herb 80–100 cm tall. *Stem* slightly winged on the upper part, pale green, glabrous to remotely pilose with some glandular hairs on the upper part. *Petiole* 5–10 mm long, 1–1.5 mm diam, with stipular wings with 3–many glands on each side of petiole base. *Lamina* 50–80 by 15–25 mm, elliptic to oblanceolate, apex acute, base cuneate, with 1–3 linear stipular glands on each side along the midrib near the lamina base; lateral veins 7–9 pairs. *Inflorescence* subterminal, 7- or 8-flowered. *Peduncle* 20–30 mm long, pale green. *Rachis* 5–7 mm long, < 1 mm diam. *Flowers* 25 mm long, 20 mm deep, yellow with a red spur. *Bracts* 3–4 by 2 mm, ovate, green, persistent to caducous in fruiting stage. *Pedice*l 13–15 mm long, < 1 mm diam, green. *Lateral sepals* 5–6 by 1 mm, linear-falcate, apex acute and mucronate, base cuneate, yellow. *Lower sepal* c. 10 mm long, 7–10 mm deep apex aristate with long awns, up to 5 mm, yellow with green awns; spur 15–18 mm long, red. *Dorsal petal* c. 8 by 7 mm, elliptic, strongly reflexed backward, apex obtuse, base obtuse, green. *Lateral united petals* 19–21 mm long, the left upper petal c. 10 by 5 mm, triangular to broadly lanceolate, apex acute, yellow; the right upper petal c. 8 by 5 mm, obliquely triangular to broadly lanceolate, apex acute; the left lower petal c. 15 by 1 mm, base slightly auricled, c. 1 mm high, yellow; the right lower petal c. 13 by 1 mm, base slightly spiral, c. 1 mm high, yellow, glabrous. *Stamens*: filaments c. 4 mm long. *Ovary* 3–4 mm long, c. 1 mm diam. *Fruits* c. 19 mm long, 3 mm diam: fruiting pedicel up to 20 mm long, straight. *Seeds* unknown.

Phenology — Flowering: June to October; fruiting: October to November.



**Map 8** Distribution of *Impatiens racemosa* DC. (●), *I. siculifer* var. *siculifer* Hook.f. (●), *I. siculifer* var. *porphyrea* Hook.f. (●) and *I. austroyunnanensis* S.H.Huang (●).



**Plate 2** a. *Impatiens racemosa* DC.; b. *Impatiens siculifer* var. *siculifer* Hook.f.; c. *Impatiens drepanophora* Hook.f.; d. *Impatiens holocentra* Hand.-Mazz.; e. *Impatiens arguta* Hook.f. & Thomson; f. *Impatiens ecalcarata* Collett & Hemsl.; g. *Impatiens masonii* Hook.f.; h. *Impatiens chinensis* L. — Photos by: a, c–h. Saroj Ruchisansakun; b. Saw-Lwin.

**Distribution** — Myanmar (Kachin State), India (Arunachal Pradesh, Lohit district) (Gogoi & Borah 2013), China (Fujian, Guangxi, Guizhou, Hubei, Hunan, Jiangxi, Sichuan, Yunnan) (Chen et al. 2007).

**Ecology** — Growing among grasses in shady areas of ever-green forest, c. 1500 m altitude.

**Other collections examined.** CHINA, Yunnan Province, *Henry 10038 A* (syn K K000694601); *Henry 10038 B* (syn B B100365130, K K000694602,

K K000694603, PE PE00039613\*), Mengtze, alt. 5000 ft. — MYANMAR, Kachin State, *Saw-Lwin KSL1072* (L sheet 1, 2, 3; RAF), 24 Oct. 2015; *Jin et al. PT-ET 520* (PE PE2472706\*, PE PE2472706\*), Putao, Ziyadam to Chaungsone Camp, N27°34' E97°18', alt. 850–1050 m, 14 Oct. 2016.

**Note** — *Impatiens siculifer* is a confusing species. In the protologue, Hooker cited the specimens *Henry 10030 A, B* (K) and *Bodinier 2335* (P). We select *Bodinier 2335* (P00780759) as the lectotype because it contains well-dissected flowers

and a clear illustration. In addition, we did not find specimen *Henry 10030 A, B* (K), but we found *Henry 10038 A, B* (K), with Hooker's hand drawing and annotation as *I. siculifer*. We think it likely that the discrepancy is caused by a typographical error in the protologue and therefore regard specimens *Henry 10038A* (K) and *Henry 10038B* (K) to be syntypes.

**b. var. *porphyrea* Hook.f. — Map 8**

*Impatiens siculifer* var. *porphyrea* Hook.f. (1908) 247; Y.L.Chen et al. (2007) 68. — Type: *Henry 11206* (holo K K000694768), China, Yunnan.  
*Impatiens porphyrea* Toppin (1920) 363; W.J.Kress et al. (2003) 170. — Type: *Toppin 2744* (holo K K000694765; iso K K000694766, K K000694767, SING SING0150199), Myanmar, Kachin Hills, Sinlum.

Herb more than 35 cm tall. *Stem* glabrous. *Petiole* 9–20 mm long. *Lamina* 55–97 by 25–35 mm, elliptic, apex acuminate, base attenuate, with one pair of linear stipular glands at petiole base, 2.5–3 mm long; lateral veins 6–9 pairs. *Inflorescence* axillary to subterminal, 5–10-flowered. *Peduncle* 17–36 mm long. *Rachis* 7–32 mm long. *Flowers* 10–25 mm long, 17–20 mm deep, purple. *Bracts* 5–8 by 2–3 mm, narrowly lanceolate to narrowly elliptic, persistent. *Pedicel* 14–16 mm long. *Lateral sepals* 4.5–7.5 by 2–3.5 mm, obliquely ovate, apex acuminate, base oblique. *Lower sepal* 7.5–9 mm long, 5–10 mm deep, apex acuminate, purple; spur 13–16 mm long. *Dorsal petal* c. 9 by 10 mm, broadly lanceolate, apex round, base truncate, dark pink. *Lateral united petals* 18.5–20 mm long: the left upper petal c. 9 by 5 mm, obovate, apex round, purple; the right upper petal c. 11 by 5 mm, elliptic, apex obtuse, pink; the left lower petal c. 12 by 1.5 mm, base without auricle, purple; the right lower petal c. 13.5 by 2 mm, pink. *Stamens* unknown. *Ovary* unknown. *Fruits* 23–25 mm long, 2–2.5 mm diam.

Phenology — Flowering: August to October; fruiting: August to October.

Distribution — Myanmar (Kachin State), China (Yunnan Province).

Ecology — Unknown.

*Other collection examined.* MYANMAR, Kachin State, *Kingdon-Ward 21465* (BM), the north triangle, Tama Bum, alt. 9500 ft, 13 Oct. 1953.

**Note** — *Impatiens siculifer* var. *porphyrea* can be easily distinguished from its close relatives by its deep purple flower. Hooker (1908) clearly designated *Henry 11206* (K) as type for *I. siculifer* var. *porphyrea* and we found only a single specimen. The name *I. stenantha* var. *porphyrea* Hook.f. was annotated on some sheets of this taxa.

**17. *Impatiens austroyunnanensis* S.H.Huang — Fig. 13; Map 8**

*Impatiens austroyunnanensis* S.H.Huang in Huang et al. (2003) 262, 276. — Type: *Shui Yu-Min 003306* (holo YUKU not seen), China, Yunnan Province, Wemshan, Laojunshan, alt. 2450 m, 5 Aug. 1993; *Wu et al. 3065* (para KUN KUN0772011\*), *Wu et al. 3438* (para KUN KUN0772012\*), *Wu et al. 3753* (para KUN KUN0772011\*), China, Yunnan Province, Jinping, Maandi, Wutaishan, alt. 2400–2700 m, 10 Sept. 1996.

Terrestrial, perennial herb, with procumbent rhizome, 15–20 cm tall. *Stem* erect to decumbent, up to 4 mm diam, moder-

ately branched, green to purple, glabrous. *Leaves* decussate or spirally arranged. *Petiole* absent–5 mm long, c. 1 mm diam, glabrous. *Lamina* c. 43 by 13 mm, elliptic to obovate, apex acute, base obtuse, margin slightly serrate, adaxial green, abaxial pale green, glabrous, with one pair of glands on lamina base; lateral veins 3 or 4 pairs. *Inflorescence* axillary to subterminal, erect, 2–4-flowered raceme. *Peduncle* 7 mm long, < 1 mm diam, green with purple dots, glabrous. *Rachis* 5 mm long, green, glabrous. *Flowers* 20–25 mm long, 15–20 mm deep, asymmetric, yellow to purple. *Bracts* c. 5 by 2 mm, lanceolate, apex acute and mucronate, base cuneate, margin entire, without glands, pale green, glabrous, persistent. *Pedicel* 20 mm long, < 1 mm, pale green to purplish green, glabrous. *Lateral sepals* 2, 3 by 1.5 mm, free, obliquely lanceolate, apex acute and mucronate, base obtuse, glabrous. *Lower sepal* 7 mm long, 17 mm deep including spur, deeply bucciniform, protruding upward, apex acute and mucronate, pale pink, glabrous, distal part elongate as spur, dilated at middle. *Dorsal petal* c. 7 by 7 mm, broadly ovate, flat, apex acuminate and mucronate, base round, pale pink, glabrous, abaxial midvein simple. *Lateral united petals* 24–28 mm long, free, slightly different in shape between both sides, the left one slightly longer than the right one: the left upper petal c. 5 by 3 mm, broadly ovate to triangular, apex acute, base cuneate, purple to yellow; the right upper petal c. 6 by 2–3 mm, broadly ovate to triangular, apex acute, base cuneate; the lower petals free; the left lower petal c. 24 by 2 mm, narrowly oblong, apex acute to obtuse, base distinctly yellow auricled, purple, glabrous; the right lower petal shorter, c. 19 by 3 mm, narrowly oblong, apex acute to obtuse, base yellow with a distinct auricle. *Stamens* c. 4 mm long. *Ovary* 3 mm long, 1 mm diam, green, glabrous. *Fruits* linear, green, glabrous. *Seeds* unknown.

Phenology — Flowering: September to October; fruiting: September to November.

Distribution — Myanmar (Kachin State), China (Yunnan).

Ecology — Growing in shady areas in evergreen forest, 2400–2800 m altitude.

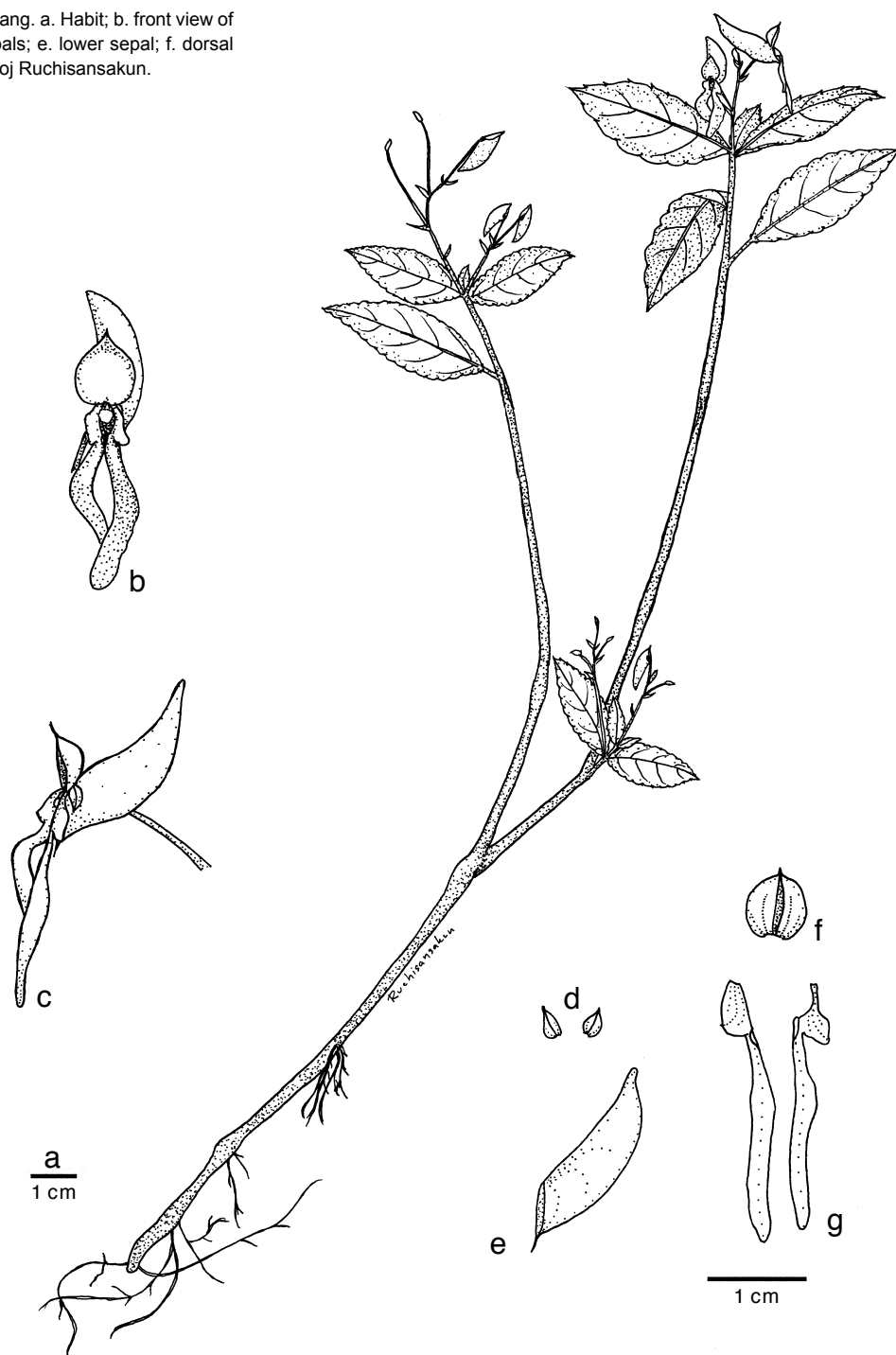
*Other collections examined.* MYANMAR, Kachin State, *Kingdon-Ward 7443* (K), Valley of the Sengku, N28°05' E97°30', 8000–9000 ft, 21 Sept. 1926; *Kingdon-Ward 7459* (K), *ibid.*, 25 Sept. 1926; *Saw-Lwin KSL1065* (L), Hkakabo Razi National Park, 23 Oct. 2015.

**Notes** — *Impatiens austroyunnanensis* was previously only poorly known. Some specimens in PE and KUN were identified as *I. microcentra*. However, they are very different from the description in the protologue (Handel-Mazzetti 1933: 653) and the holotype of *I. microcentra*, *Handel-Mazzetti 9244* (WU0059594), in having a shorter stem, longer peduncle, deeply bucciniform lower sepal (instead of cylindrical lower sepal), c. 17 mm deep lower sepal including spur (instead of a 5 mm deep sepal), narrowly oblong lower lateral petals (instead of ovate to obovate lateral petals) (Table 3). This confusion is possibly due to the fact that Chen in 1973 annotated *Yu 20313* (PE00039564, PE00039565) as a 'topotype'; mentioning this on the specimen sheets; subsequently this led to the use of the wrong illustration in later publications (Akiyama et al. 1995: 158, Wu 2006: 80, 127, Chen et al. 2007: 50, 71). The index Florae Yunnanensis and Vascular Plants of the Hengduan Mountains refer to the type

**Table 3** Comparison of morphological characters between *Impatiens austroyunnanensis*, *I. microcentra*, and *I. holocentra*.

Characters	<i>I. austroyunnanensis</i>	<i>I. holocentra</i>	<i>I. microcentra</i>
Plant	15–20 cm tall	30–50 cm	25–30 cm tall
Peduncle	up to 7 mm long	13–20 mm long	up to 30 mm long
Lower sepal	deeply bucciniform, dilating in the middle, protruding upward, c. 7 mm long, c. 17 mm deep	deeply bucciniform, 10 mm long, 15 mm deep, including the spur	cylindrical, 3–5.5 mm long, c. 5 mm deep
Lateral united petals	24–28 mm long	23–25 mm long	6–7 mm long
Lower lateral petals	narrowly oblong, apex acute to obtuse	linear to oblong	ovate to obovate, apex round

**Fig. 13** *Impatiens austroyunnanensis* S.H.Huang. a. Habit; b. front view of flower; c. lateral view of flowers; d. lateral sepals; e. lower sepal; f. dorsal petal; g. lateral united petals. — Drawn by Saroj Ruchisansakun.



specimens only, so there is no mistake in that publication (Wu 1984: 303). In Flora of China (Chen et al. 2007), *I. austroyunnanensis* was not treated because the authors did not see any herbarium specimens.

*Impatiens austroyunnanensis* is most similar to *I. holocentra* but differs in having a deeply bucciniform spur that dilates in the middle.

#### 18. *Impatiens prainii* Hook.f. — Fig. 14; Map 9

*Impatiens prainii* Hook.f. (1905) 14; (1911d) t. 2959; S.Akiyama (2017) 314. — Type: *Prain 377* (lecto, designated in Akiyama (2017) K000694764; isoelecto K sheet 1 with illustration, K sheet 2), India, eastern Himalaya, Sikkim, Lachung Valley, near Choongtang.

Herb, 10–40 cm tall. *Stem* up to 3.5 mm diam, erect to decumbent, moderately branched, glabrous. *Leaves* spirally arranged, crowded towards apex of the stem. *Petiole* absent–2 mm long, glabrous. *Lamina* 25–50 by 6.5–11 mm, narrowly el-

liptic to lanceolate, apex acute to acuminate, base cuneate, margin crenate-serrate to deeply crenate with small teeth, coriaceous, adaxial deep green and glabrous, abaxial purple and remotely pilose, one pair of stipular glands at petiole base; lateral veins 5–7 on each side of midrib. *Inflorescence* axillary, erect, (1–)2(–4)-flowered raceme. *Peduncle* 6.5–12 mm long, glabrous. *Rachis* 3–5 by 1–1.5 mm, ovate to lanceolate, apex acuminate or aristate, base obtuse, margin entire, glabrous. *Flowers* 12–18 mm long, 16–23 mm deep, asymmetric, purple. *Bracts* 3–5 by 1–1.5 mm, ovate to lanceolate, apex acuminate or aristate, base obtuse, margin entire, glabrous, persistent. *Pedice* 9–20 mm long, c. 1 mm diam, glabrous. *Lateral sepals* 2, 3.5–4.5 by 2–2.5 mm, free, obliquely ovate, apex acuminate to aristate, base obtuse to cordate, purple, glabrous. *Lower sepal* 8.5–9.5 by 4–4.5 mm, 5–6 mm deep, deeply navicular, apex acuminate and aristate, c. 2 mm long, purple, glabrous, distal part gradually narrowed into a straight to upcurved spur, incurved in young flowers, 12–14 mm long. *Dorsal petal* 8.5–10 by

7–8 mm, ovate to orbicular, cucullate, apex obtuse and mucronate, base obtuse to truncate, purple, glabrous, abaxial midvein with a narrow crest. *Lateral united petals* 25–50 mm long, free: the upper petals 8.5–9 by 4–5.5 mm, ovate to obovate, apex obtuse, base cuneate, purple with white base; the lower petals 18–25 by 4–5 mm, free, narrowly ovate to narrowly elliptic to oblong, apex acute, base without auricle. *Stamens*: filaments 3–3.5 mm long. *Ovary* c. 3 mm long, glabrous. *Fruits* 17–25 mm long, c. 2 mm diam, linear, glabrous.

**Phenology** — Flowering: July to September; fruiting: August to September.

**Distribution** — Myanmar (Kachin State), Bhutan (Mionggar District), India (Sikkim State), Nepal (Sankhuwasabha District).

**Ecology** — Growing on wet rocks in shady areas in ever-green forest, 2500–3400 m altitude. Despite its relatively wide distribution, this species is rare in Myanmar.

*Other collections examined.* MYANMAR, Kachin State, *Kingdon-Ward* 12976 (BM, K), Mungku Hkyet, N27°45' E97°50', alt. 8000–9000 ft (2440–2740 m), 19 Aug. 1937.

**Note** — *Impatiens prainii* is closely related to *I. holocentra* but differs in having narrower leaves.

#### 19. *Impatiens bracteolata* Hook.f. — Map 9

*Impatiens bracteolata* Hook.f. (1905) 31; Fedde (1905) 433. — Type: *Hooker & Thomson s.n.* (lecto, designated here K 000694724), Bangladesh, Khasia Hills, alt. 5000 ft

Terrestrial, annual herb, up to 30 cm tall. *Stem* erect, slender, simple to moderately branched, glabrous. *Leaves* spirally arranged. *Petiole* absent–20 mm long, glabrous. *Lamina* 80–210 by 35–90 mm, ovate to elliptic, apex acuminate, base cuneate to attenuate, margin serrate to crenate with teeth, glabrous, with



**Fig. 14** *Impatiens prainii* Hook.f. a. Habit; b. lateral view of flowers; c. pedicels and ovaries; d, e. lateral sepals; f, g. lower sepals; h–j. dorsal petal; k, l. lateral united petals. — Drawn by Saroj Ruchisansakun.

1 or 2 pair(s) of glands near leaf base; lateral veins 6–8 pairs. *Inflorescence* axillary to subterminal, 8–9(–16)-flowered raceme. *Peduncle* 60–80 mm long, glabrous. *Rachis* 15–55 mm long. *Flowers* 15–20 mm long, 15–27 mm deep, asymmetric, yellow. *Bracts* c. 2–4 by 1 mm, lanceolate to elliptic, apex acute to acuminate, base cuneate, margin entire, glabrous, persistent. *Pedice* 12–18 mm long, glabrous. *Lateral sepals* 2, 3–3.5 by 1–2 mm, free, obliquely broadly lanceolate to obliquely ovate, apex acute to acuminate and aristate, base oblique, glabrous. *Lower sepal* 6–9 mm long, 18–23 mm deep including spur, deeply navicular, apex acute and mucronate, tapering into a straight or upcurved spur, 16 mm long. *Dorsal petal* 6 mm long, elliptic, apex mucronate, base obtuse, abaxial midvein simple or with a narrow crest. *Lateral united petals* c. 20 mm long, free. *Stamens*: filaments c. 3.5 mm long. *Ovary* c. 3.5 mm long, glabrous. *Fruits* linear, glabrous. *Seeds* unknown.

Phenology — Unknown.

Distribution — Myanmar (Kachin State), Bangladesh.

Ecology — 1500–1600 m altitude.

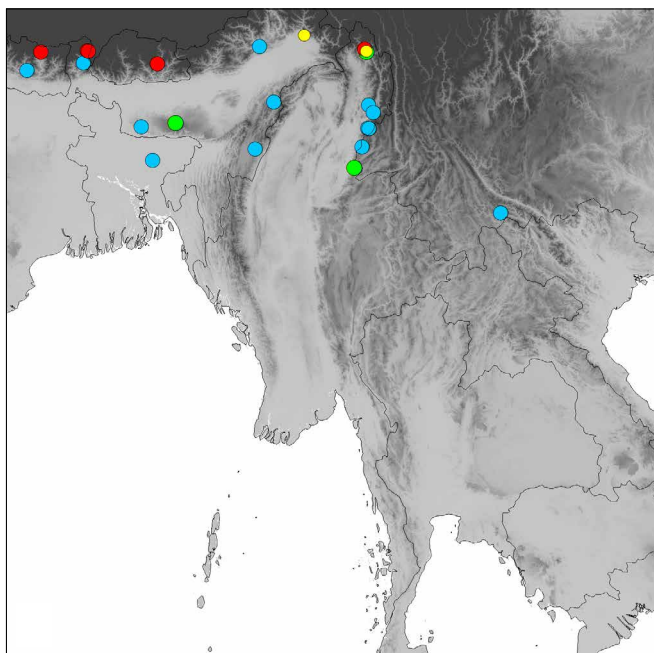
*Other collections examined.* MYANMAR, Kachin State, Toppin 2678 (K H2015/00092 112, 113, 114, 115, 116, 117; SING0150195; SING0150196; SING0150197), near Sinlum; Armstrong et al. 1337 (NY2649163\*), Putao district, Naungmung Township, Hkakabo Razi National Park, between Shing-sankhu rest house and Golle village, 27.6529° 97.8943°, alt. 891 m, 9 Nov. 2015.

**Notes** — *Impatiens bracteolata* is very similar to *I. angustiflora* but differs in having ovate or elliptic leaves (never lanceolate). It is also similar to *I. siculifer* but does not have a strongly upcurved spur, and the lower sepal does not have a long-awned apex.

Hooker did not clearly designate a type specimen of *I. bracteolata*. We found two sheets of Hooker & Thomson s.n., K000694724 and K000694725, in the Kew Herbarium, which were annotated as *Impatiens bracteolata*. The specimen K000694724 exactly matches the protologue (Hooker 1905), so we select it as lectotype. This species used to be part of *Impatiens angustiflora* Hook.f. (1875) 481.

## 20. *Impatiens citrina* Hook.f. — Map 9

*Impatiens citrina* Hook.f. (1905) 17, 22. — Type: Griffith 1235 (lecto, designated here K K000694584), India, Arunachal Pradesh, Mishmi Hills.



**Map 9** Distribution of *Impatiens prainii* Hook.f. (●), *I. bracteolata* Hook.f. (●), *I. citrina* Hook.f. (●) and *I. drepanophora* Hook.f. (●).

Terrestrial, annual herb, up to 50 cm tall. *Stem* erect, simple to laxly branched, glabrous. *Leaves* spirally arranged. *Petiole* 7–15 mm long, glabrous. *Lamina* 350–400 by 80–85 mm, ovate to elliptic, apex acute to acuminate, base obtuse to cuneate, margin crenate, adaxial green, abaxial pale green, glabrous, without stipular glands; lateral veins 7 or 8 pairs. *Inflorescence* axillary to subterminal, erect, 10–15-flowered raceme. *Peduncle* 70–75 mm long, green, glabrous. *Rachis* 55–80 mm long. *Flowers* c. 25 mm long, c. 50 mm deep, asymmetric, yellow. *Bracts* ovate, caducous. *Pedice* 18–20 mm long, slender, glabrous. *Lateral sepals* 2, c. 5 by 4 mm, free, obliquely elliptic to ovate, apex acute to obtuse and mucronate, base obtuse, green, glabrous. *Lower sepal* 8–10 mm long, 18–20 mm deep, deeply navicular, apex acuminate and aristate with long awn, yellow, glabrous, constricted into an upcurved spur, sometimes involute, 5–15 mm long, minutely bifid. *Dorsal petal* 9–17 by 5 mm, ovate to orbicular, flat, strongly reflexed backward, apex obtuse to round, base cuneate to obtuse, abaxial midvein simple or with a narrow crest, glabrous. *Lateral united petals* free, asymmetric: the left upper petal 8–10 by 3–4 mm, curved spatulate, apex acute, base stipitate; the right upper petal c. 9 by 5 mm, obovate to elliptic, apex acuminate, base obtuse, margin entire; the lower petals free; the left lower petal 14–22 by 2–5 mm, oblong to dolabriform, apex obtuse, glabrous; the right lower petal c. 15 by 3 mm, lanceolate, apex acute. *Stamens*: filaments c. 4 mm long. *Ovary* glabrous. *Fruits* 9–13 mm long, 1–2 mm diam, linear, glabrous.

Phenology — Flowering: September to November; fruiting: September to November.

Distribution — Myanmar (Kachin State), India (Arunachal Pradesh State).

Ecology — Growing in gullies near streams, 1100–1200 m altitude.

*Other collections examined.* MYANMAR, Kachin State, Armstrong et al. 1326 (NY NY02649175\*), Putao District, Naungmung Township, N27°40'51.3" E97°53'59.3", alt. 1182 m, 6 Nov. 2015.

**Notes** — *Impatiens citrina* differs from *I. pseudocitrina* Hareesh (Hareesh et al. 2017: 231) in having a 10–15-flowered inflorescence vs 2- or 3-flowered inflorescences, and in lacking stipular glands.

Hooker (1905) did not designate a type specimen of this species in the protologue. We select the specimen Griffith 1235 (K000694584) as lectotype because it is the only specimen written as *I. citrina* with an illustration by Hooker.

## 21. *Impatiens drepanophora* Hook.f. — Map 9; Plate 2c

*Impatiens drepanophora* Hook.f. (1905) 17; Fedde (1905) 432; Diels (1912) 7; Toppin (1920) 364; H.Hara & L.H.J.Williams (1979) without page number; Y.L.Chen et al. (2007) 55. — Type: Hooker & Thomson 56 (lecto, designated here K K000694682; isolecto K K000694683, K K000694684, K K000694685, K K000694686, K K000694687, L L0388881), India, Khasia Hills, 6 July 1850, alt. 6000 ft.

Terrestrial, annual herb, 35–40 cm tall. *Stem* erect, simple to laxly branched, glabrous. *Leaves* spirally arranged. *Petiole* 0.5–3(–5) mm long, glabrous. *Lamina* 50–130 by 18–60 mm, ovate to ovate-lanceolate, apex acuminate, base cuneate to attenuate, margin serrate, glabrous, with 2 stipitate glands near leaf base; lateral veins (5–)7–9 pairs. *Inflorescence* axillary to subterminal, erect, (5–)7–15(–34)-flowered raceme. *Peduncle* 30–75 mm long, glabrous. *Rachis* 10–60 mm long. *Flowers* 30–45 mm long, asymmetric, white to yellow. *Bracts* 1.5–5 by 0.5–2 mm, ovate to lanceolate, apex acuminate and aristate with long awn, base cuneate, margin entire, glabrous, caducous. *Pedice* 9–22 mm long, slender, glabrous. *Lateral sepals* 2, 2.5–4 by 1–2 mm, free, ovate-falcate, the long apex aristate, base obtuse, glabrous. *Lower sepal* 8–10 mm long,

18–20 mm deep, deeply navicular, apex acuminate and aristate with long awn, yellow with red dots, glabrous, constricted into an upcurved spur, sometimes involute, 5–15 mm long, minutely bifid. *Dorsal petal* 9–17 by 5 mm, ovate to orbicular, flat, strongly reflexed backward, apex obtuse to round, base cuneate to obtuse, abaxial midvein simple or with a narrow crest, glabrous. *Lateral united petals* free, asymmetric: the left upper petal 8–10 by 3–4 mm, curved spatulate, apex acute, base stipitate; the right upper petal c. 9 by 5 mm, obovate to elliptic, apex acuminate, base obtuse, margin entire; the lower petals free; the left lower petal 14–22 by 2–5 mm, oblong to dolabriform, apex obtuse, glabrous; the right lower petal c. 15 by 3 mm, lanceolate, apex acute. *Stamens*: filaments c. 4 mm long. *Ovary* glabrous. *Fruits* 9–13 mm long, 1–2 mm diam, narrowly clavate, glabrous.

**Phenology** — Flowering: July to November; fruiting: September to November.

**Distribution** — Myanmar (Kachin State), China (Tibet Region, Yunnan Province), India (Khasia Hills).

**Ecology** — Growing in open, grassy areas in evergreen forest, 1100–2200 m altitude.

**Other collections examined.** CHINA, Yunnan Province, Wu et al. 2451 (PE PE01878257\*), Hydrologic Station, 23 Oct. 1995; Tibet Region, Unknown 1698 (PE PE00061865\*), Medog County, 10 Aug. 1974. — MYANMAR, Kachin State, Toppin 2778 (K H2015/00092 7, H2015/00092 8, H2015/00092 9, BM), NE Burmah, alt. 5000–7000 ft (1524–2134 m); Buchanan 5568 (E E00753037, E E00753038, K H2015/00092 10), Myitkyina, Sima Hills, east of Irrawaddy, 3500–4000 ft (1067–1219 m), 1 Nov. 1911; Kaulback 327 (BM), Myitkyina, N26°06' E97°58', alt. 4500 ft, 9 Aug. 1939; Ruchisansakun & Thet Yu Nwe 753 (L L2071175, MAND, RAF), Myitkyina, Sa Daung village, along the road side, N25°25'40.8" E97°56'32.3", alt. 1452 m, 18 Nov. 2015; Kaulback s.n. (BM), Nam Taqmai Valley, N27°42' E97°54', alt. 4000 ft (1219 m), 14 Aug. 1938.

**Notes** — *Impatiens drepanophora* differs from *I. stenantha* by having a narrowly clavate fruit vs a linear fruit, a slightly upcurved spur vs a strongly re-upcurved spur, and a broadly ovate-falcate, long aristate spur vs a linear-falcate spur with an acute to obtuse apex.

Hooker did not clearly designate a type specimen of *I. drepanophora*. We select Hooker & Thomson 56 (K000694682) as lectotype because it was collected by Hooker and includes an illustration.

During our expedition, we observed that this species was visited and pollinated by bees.

## 22. *Impatiens holocentra* Hand.-Mazz. — Map 10; Plate 2d

*Impatiens holocentra* Hand.-Mazz. (1933) 647; Y.L.Chen et al. (2007) 54. — Type: *Handel-Mazzetti 9405* (holo WU0059598\*), China, Yunnan Province, in a valley near boarder of Tibet-Myanmar, N27°53', alt. 1725–2150 m, 6 July 1916.

Terrestrial, perennial herb, 50 cm tall, with tuberous root. *Stem* erect, 2–5 mm diam, moderately branched, terete, green to purplish green, glabrous. *Leaves* spirally arranged. *Petiole* 4–6 mm long, 1.5–2 mm diam, angular, glabrous. *Lamina* 70–125 by 35–40 mm, ovate, apex acuminate, base cuneate, margin serrate, papyraceous, adaxial dark green, abaxial glaucous, glabrous, with one pair of red, clavate glands at petiole base; lateral veins 6–9 pairs. *Inflorescence* axillary, erect, 2–4-flowered raceme. *Peduncle* 13–20 mm long, < 1 mm diam, green, glabrous. *Rachis* 2–17 mm long, < 1 mm diam. *Flowers* 25–30 mm long, 17 mm deep, asymmetric, yellow. *Bracts* c. 2 by < 1 mm, linear, apex acute, base cuneate, margin entire, without glands, red to brown, glabrous, persistent to caducous. *Pedice* 10–15 mm long, < 1 mm diam, green, glabrous. *Lateral sepals* 2, c. 2 by 1.5 mm, free, ovate, apex acute and mucronate, base obtuse, green to yellow. *Lower sepal* c. 10 by 5 mm, 15 mm deep including spur, infundibular, apex short aristate, c. 1 mm,

yellow, glabrous, dorsal part gradually narrow into a straight spur, yellow. *Dorsal petal* c. 10 by 8 mm, c. 4 mm deep, ovate, cucullate, apex round to obtuse, base truncate to cordate, yellow, glabrous, abaxial midvein with a narrowly crescent-shaped crest, c. 3 mm wide crest. *Lateral united petals* 23–25 mm long, free: the upper petals c. 9 by 3–4 mm, elliptic, apex acute, base cuneate, yellow with red steaks, the right one reflected at the base; the lower petals 17–20 by 2–2.5 mm, free, linear, apex acute to obtuse, base without auricle, yellow, glabrous. *Stamens*: filament unknown. *Ovary* 5-carpellate, green, glabrous. *Fruits* c. 27 mm long, c. 3 mm diam, linear, 5-lobed, glabrous. *Seeds* unknown.

**Phenology** — Flowering: July to November.

**Distribution** — Myanmar (Kachin State), China (Yunnan).

**Ecology** — Growing in moist and shady areas in evergreen forest, 1700–2200 m altitude.

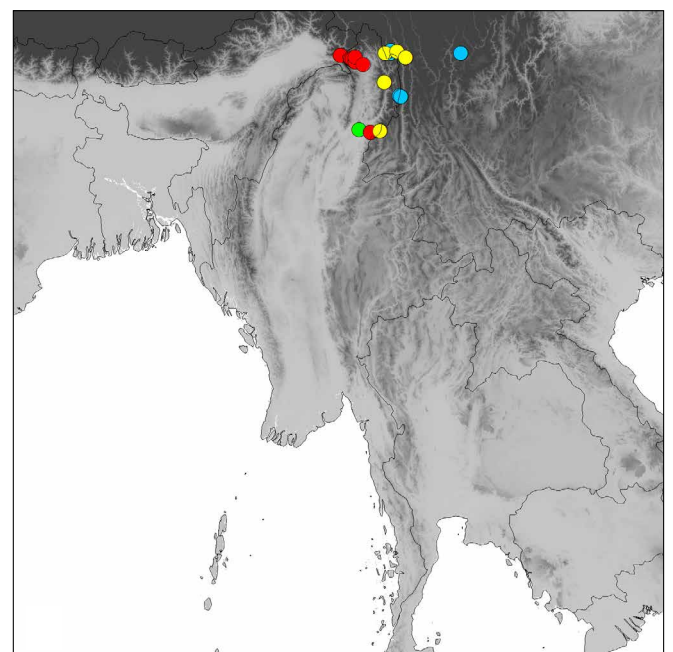
**Other collections examined.** MYANMAR, Kachin State, Ruchisansakun & Thet Yu Nwe 755 (L L2071185, MAND, RAF), Myitkyina, Kan Paik Ti, N25°24'08.6" E98°06'56.4", alt. 1998 m, 18 Nov. 2015; *Kingdon-Ward 21084* (BM), Tama Bum, alt. 9500 ft, 26 June 1953.

**Note** — *Impatiens holocentra* can be easily distinguished from the other species in the sect. *Racemosae* in Myanmar by its deeply bucciniform lower sepal. Handel-Mazzetti (1933) clearly designated that the type is *Handel-Mazzetti 9405* deposited in WU.

## 23. *Impatiens kachinensis* Hook.f. ex Toppin — Map 10

*Impatiens kachinensis* Hook.f. ex Toppin (1920) 366; W.J.Kress et al. (2003) 170. — Type: *Mokim s.n.* (lecto, designated here K K000694658).

Terrestrial herb, 21–50 cm tall. *Stem* erect, simple to rarely branched, red, glabrous. *Leaves* spirally arranged. *Petiole* 5–20 mm long, glabrous. *Lamina* 54–140 by 12–23 mm, narrowly elliptic, apex acute to acuminate and mucronate, base cuneate, margin serrate, glabrous, with one pair of red clavate glands at petiole base; lateral veins 6–15 pairs. *Inflorescence* axillary, erect, 4–8-flowered raceme. *Peduncle* 25–75 mm long, glabrous. *Rachis* 7–25 mm long. *Flowers* 14–25 mm long, 22–32 mm deep, asymmetric, entirely light orange-yellow. *Bracts* 3.5–6 by 4–5 mm, elliptic, concave, apex acute, base



**Map 10** Distribution of *Impatiens holocentra* Hand.-Mazz. (●), *I. kachinensis* Hook.f. ex Toppin (●), *I. sarissiformis* C.E.C.Fisch. (●) and *I. chimiliensis* H.F.Comber (●).

obtuse, margin entire, glabrous, caducous. *Pedice* 13–20 mm long, glabrous. *Lateral sepals* 2, 4–4.5 by 2–2.5 mm, free, obliquely ovate, apex acute and mucronate, base cuneate to obtuse, glabrous. *Lower sepal* 7.5–10 by 4–7 mm, 10–15 mm deep, navicular, apex acute and mucronate, glabrous, dorsal part tapering into a straight to upcurved spur, 17–25 mm long. *Dorsal petal* c. 10 by 8 mm, obovate, flat, strongly reflexed backward, apex round, base cuneate, abaxial midvein simple. *Lateral united petals* 22–26 mm long, free, different in size and shape: the left upper petal c. 13 by 6 mm, broadly obovate, apex obtuse, base cuneate; the right upper petal c. 10 by 2–3 mm, oblong; the lower petals free; the left lower petal c. 14 by 4 mm, narrowly ovate, apex acute, base without auricle, glabrous; the right lower petal c. 20 by 2 mm, narrowly oblong to linear, apex acute. *Stamens*: filaments 3–4 mm long. *Ovary* 4 mm long, 1 mm diam, glabrous. *Fruits* linear, the seeds being in the upper portion only. *Seeds* 7–17.

Phenology — Flowering: September to March; fruiting: October to November.

Distribution — Endemic to Myanmar (Kachin State).

Ecology — Growing along the stream, in evergreen forest, 350–1000 m altitude.

*Other collections examined.* MYANMAR, Kachin State, Mokim s.n. (K000694657), upper Burma, Kachin Hills, Mar. 1898; *Toppin* 4286 (K H2015/00092 145, K H2015/00092 146), Kachin Hills, Sumprang 1250', Ban Kan 1400', Kumtat 1450', alt. 1250–1450 ft (381–442 m); *Jin et al.* *PT-ET* 1027 (PE PE2472783\*, PE PE2472784\*), Putao, Hkamdaukmyit Camp, N27°36'48.91" E96°48'55.30", alt. 2457 m, 21 Oct. 2014; *Jin et al.* *PT-ET* 1403 (PE PE2472650\*, PE PE2472651\*, PE PE2472652\*, PE PE2472653\*, PE PE2472654\*), Putao, Makohwa, 27 Oct. 2014; *Jin et al.* *PT-ET* 87 (PE PE2472757\*, PE PE2472758\*, PE PE2472759\*, PE PE2472760\*, PE PE2472761\*, PE PE2472762\*), Putao, Upper Shankang, N27°25'52" E97°17'50", alt. 450 m, 12 Oct. 2014.

Notes — *Impatiens kachinensis* is similar to *I. drepanophora* and *I. sarissiformis*, but differs in having narrowly elliptic lamina vs ovate (*I. drepanophora*) or linear-oblong (*I. sarissiformis*) lamina.

We found two sheets of Mokim s.n. annotated as *I. kachinensis* and select K000694658 because it has a complete dissected flower and good flower illustration.

Toppin (1920) recorded that *I. kachinensis* is visited by butterflies and bees, similar to *I. racemosa* (Ruchisansakun et al. 2016), *I. drepanophora* and *I. longiloba* Craib (Ruchisansakun, pers. obs).

#### 24. *Impatiens sarissiformis* C.E.C.Fisch. — Map 10

*Impatiens sarissiformis* C.E.C.Fisch. (1926) 467; W.J.Kress et al. (2003) 170. — Type: *Parkinson* 373 (holo K K000694743), Myanmar, Kachin State, Myitkyina District, 6 Dec. 1925.

Terrestrial, annual herb, 30–34 cm tall. *Stem* lower portion decumbent, upper portion erect, up to 9 mm diam, simple to moderately branched on decumbent part, angular with short wings, green to purple, glabrous. *Leaves* spirally arranged. *Petiole* absent–15 mm long, 1–2 mm diam, flat, glabrous. *Lamina* 50–90 by 3–13 mm, linear-oblong, apex acute, base cuneate, margin serrate, coriaceous, adaxial dark green, abaxial pale green, glabrous, with one pair of red clavate glands at petiole base; lateral veins 4–6 pairs. *Inflorescence* axillary to subterminal, erect, (2–)6–20-flowered raceme. *Peduncle* 22–40 mm long, c. 1 mm diam, angular, green, glabrous. *Rachis* 2–60 mm long, c. 1 mm diam. *Flowers* 15–20 mm long, asymmetric, deep yellow. *Bracts* c. 2 by < 1 mm, elliptic to linear, apex acute, base obtuse to cuneate, margin entire, without glands, green, glabrous, caducous. *Pedice* 10–14 mm long, c. 1 mm diam, green, glabrous. *Lateral sepals* 2, 2–5 by 1–2 mm, free, ovate, apex acuminate, base obtuse, glabrous. *Lower sepal*

c. 8 mm long, c. 9 mm deep, deeply navicular, apex acute and mucronate, glabrous, distal part gradually tapering into a straight spur, 15–17 mm long. *Dorsal petal* unknown. *Lateral united petals* 19 mm long, free: the upper petals c. 10 by 3 mm, oblong, apex obtuse, base cuneate, yellow; the lower petals c. 12 by 2 mm, free, narrowly oblong. *Stamens* unknown. *Ovary* unknown. *Fruits* unknown. *Seeds* unknown.

Phenology — Flowering: September to December.

Distribution — Endemic to Myanmar (Kachin State), only known from the Myitkyina district.

Ecology — Growing near water or in stream beds.

*Other collection examined.* MYANMAR, Kachin State, Waung Po Khout Tonerflew 1868 (K H2015/00092 48), Myitkyina District, Pidaung chang, 5 Sept. 1926.

Note — *Impatiens sarissiformis* is very similar to *I. kachinensis* but differs in having linear-oblong leaf lamina vs narrowly elliptic leaf lamina. The specimens of this species have incomplete flowers. More specimens are needed to complete the description of this species. Fischer (1926) clearly designated C.E. Parkinson 373 deposited in K as the type specimen.

#### 25. *Impatiens chimiliensis* H.F.Comber — Map 10

*Impatiens chimiliensis* H.F.Comber (1934) 246; W.J.Kress et al. (2003) 169; Y.L.Chen et al. (2007) 61. — Type: *Forrest* 24931 (holo E00841623; iso E00848145), Myanmar, Kachin State, western flank of the Chimili, N'Maikha-Salwin divide, N26°23' E98°48', alt. 11000 ft, Sept. 1924.

Perennial herb with fascicled roots, 60–125 cm tall. *Stem* up to 5 mm diam, erect, rarely branched, glabrous. *Leaves* spirally arranged. *Petiole* 15–20 mm long, glabrous. *Lamina* 55–65 by 40–50 mm, ovate to broadly ovate to orbicular, apex acute to truncate, base ovate and acuminate, margin serrate, membranous, adaxial green and pilose, abaxial pale green and glabrous, no distinct glands present, but 2 pairs of hair present at the base; lateral veins 4–7 pairs. *Inflorescence* axillary, erect, 3–9-flowered raceme. *Peduncle* up to 35 mm long, glabrous. *Rachis* c. 12 mm long, c. 1 mm diam. *Flowers* more than 22 mm long, up to 22 mm deep, yellow sometimes with purple tinge. *Bracts* 3–4 by 2–3 mm, ovate to elliptic, apex acuminate, base obtuse, margin entire, glabrous, persistent. *Pedice* 18–20 mm long, glabrous. *Lateral sepals* 4: the upper pair up to 6 mm long, obliquely ovate, apex acute; the lower pair c. 7 by 4 mm, free, obliquely ovate, apex acute and mucronate, base obtuse, glabrous. *Lower sepal* up to 17 by 10 mm, 19–25 mm deep, bucciniform, apex acute and mucronate, glabrous, abruptly constricted into a curved spur, 4–8 mm long, bifid. *Dorsal petal* 7–8 mm, orbicular, flat, apex emarginate, mucronate, abaxial midvein with narrow crest. *Lateral united petals* 25–30 mm, free: the upper petals broadly ovate; the lower petals elliptic-lanceolate, apex obtuse, base broadly auricled. *Stamens*: filaments c. 5 mm; anthers obtuse. *Ovary* unknown. *Fruits* c. 20 mm long, linear. *Seeds* unknown.

Phenology — Flowering: July to October; fruiting: July to October.

Distribution — Myanmar (Kachin State), China (Tibet Province, Yunnan Province).

Ecology — Shaded and humid places at thicket margins and streamsides, c. 3200 m altitude.

*Other collection examined.* MYANMAR, Kachin State, *Forrest* 27237 (para BM), western flank of the Chimili, N'Maikha-Salwin divide, N26°25' E98°48', alt. 12000–13000 ft, Sept. 1925.

Note — *Impatiens chimiliensis* is most similar to *I. duclouxii* but differs in having a longer peduncle, a longer rachis, broader lamina and a straight spur. Comber (1934) clearly designated G. Forrest 24931 deposited in E as type specimen.

**26. *Impatiens sinlumiensis* Grey-Wilson — Map 11**

*Impatiens sinlumiensis* Grey-Wilson (1989c) 714; W.J.Kress et al. (2003) 170. — Type: *Toppin 2777* (holo K K000694937; iso BM, K K000694934, K K000694935, K K000694936), Myanmar, NE Burma, Kachin Hills, Sinlum, alt. 1700–1800 m.

*Impatiens cymbifera* sensu Toppin (1920) 362, non Hook.f. (1875) 474.

Terrestrial, annual herb, 10–20 cm tall. *Stem* erect, branched in the lower part, glabrous. *Leaves* spirally arranged. *Petiole* 7–58 mm long, glabrous. *Lamina* 58–116 by 17–62 mm, ovate to elliptic to lanceolate-elliptic, apex acuminate to acuminate-caudate, base attenuate, margin serrate to crenate, adaxial glabrous or glabrous with short hairs on the veins, abaxial glabrous, with one pair of globose glands on each side of petiole base; lateral veins 9–13 pairs. *Inflorescence* axillary to subterminal, erect, (6–)11–17-flowered raceme. *Peduncle* 50–90 mm long, glabrous. *Rachis* 12–20 mm long. *Flowers* 16–19 mm long, 26–36 mm deep, asymmetric, mauve, marked with dark purple. *Bracts* 7.5–12 by 7–10 mm, ovate, concave, completely covering the young flower, apex acute to acuminate, base obtuse to round, margin entire, without glands, glabrous, caducous. *Pedicel* 14.5–25 mm long, glabrous. *Lateral sepals* 2, 6.5–7.5 by 3.5–4 mm wide, free, obliquely ovate, apex acuminate and long mucronate, base obtuse, glabrous. *Lower sepal* 10–12.5 by 10–11 mm, bucciniform, apex acute and mucronate, glabrous, dorsal part gradually tapering into a straight or curved spur, 16–21 mm long, slightly bifid. *Dorsal petal* 8.5–9 by 7.5–8 mm, ovate to elliptic, flat, apex obtuse to round, base cuneate to obtuse, glabrous, abaxial midvein simple. *Lateral united petals* 20 mm long, free: the upper petals 6–9 by 4–5 mm, falcate to triangular-ovate, apex obtuse, base cuneate; the lower petals 11–17 by 2.5–4 mm, free, narrowly elliptic, base without auricle, glabrous. *Stamens*: filaments unknown. *Ovary* unknown. *Fruits* 16–17(–29) mm long, c. 1.5 mm diam, linear, glabrous. *Seeds* unknown.

Phenology — Flowering: August to September; fruiting: September.

Distribution — Endemic to Myanmar (Kachin State).

Ecology — Montane forest, in damp shady places along streamsides, 1700–1800 m altitude.

Note — The specimens of *I. sinlumiensis* were previously identified as *I. cymbifera* by Toppin, but Grey-Wilson (1989c) noticed that they constitute a different species and described it as a new species, *I. sinlumiensis*.

**27. *Impatiens clavicuspis* Hook.f. ex W.W.Sm. — Map 11**

*Impatiens clavicuspis* Hook.f. ex W.W.Sm. in Smith & Forrest (1915) 337; W.J.Kress et al. (2003) 169. — Type: *Forrest 1004* (lecto, designated here K K000694594; iso E E00313653), China, Yunnan, between Mekong and Yongchang valleys on Tengyue-Dalifu road, N25°20', alt. 8000–9000 ft, Sept. 1905.

Annual herb, 30–60 cm tall. *Stem* erect, 2 mm diam, sparsely branched, glabrous with few glandular hairs on the ridges in upper part of stem. *Leaves* spirally arranged. *Petiole* 11.5–30 mm long, glabrous, with one pair of stipular glands at petiole base. *Lamina* 30–41 by 19–25 mm, ovate-lanceolate to lanceolate, apex acuminate, base cuneate to attenuate, margin crenate with teeth, glabrous, with 1 pair of glandular hairs near lamina base; lateral veins 4–6 pairs. *Inflorescence* axillary, erect, 8–17-flowered raceme. *Peduncle* 26–65 mm long, c. 1 mm diam, glabrous. *Rachis* 14.5–40 mm long, c. 1 mm diam, glabrous. *Flowers* 22–24 mm long, 25–32 mm deep, pale yellow with purple base. *Bracts* 3–7 by 1.5–2 mm, ovate to lanceolate, apex aristate with long glandular awn, base obtuse, margin entire, glabrous, persistent. *Pedicel* 11.5–12.5 mm long, < 1 mm diam, glabrous. *Lateral sepals* 2, 3.5–5 by 2.5–4 mm, free, elliptic to obliquely elliptic, apex aristate with long awn,

1.5–2.7 mm long, base obtuse, glabrous. *Lower sepal* 11.5–16 mm long, 12–16 mm deep, bucciniform, apex aristate with long awns, 2–3 mm long, glabrous, distal part gradually narrowed into an incurved spur, 17–18 mm long. *Dorsal petal* 7.5–9 by 7–9 mm, ovate to elliptic to orbicular, cucullate, apex round and mucronate, base obtuse, glabrous, abaxial midvein with narrow crest, c. 1 mm high. *Lateral united petals* c. 22–27 mm long, free: the upper petals 10–11 by 6–7 mm, broadly elliptic, apex acute, base cuneate; the lower petals 13–19 by 3–3.5 mm, free, narrowly lanceolate to narrowly ovate, apex acute, base with distinct auricle, c. 2 mm high, glabrous. *Stamens*: filaments c. 5 mm long. *Ovary* c. 4 mm long, < 1 mm diam, glabrous. *Fruits* 17 mm long, 1 mm diam, linear, glabrous; fruiting pedicels c. 18 mm long, straight.

Phenology — Flowering: September to October; fruiting: October to November.

Distribution — Myanmar (Kachin State), China (Yunnan).

Ecology — Understories of mixed forests, along canals, moist places, 2100–2800 m altitude.

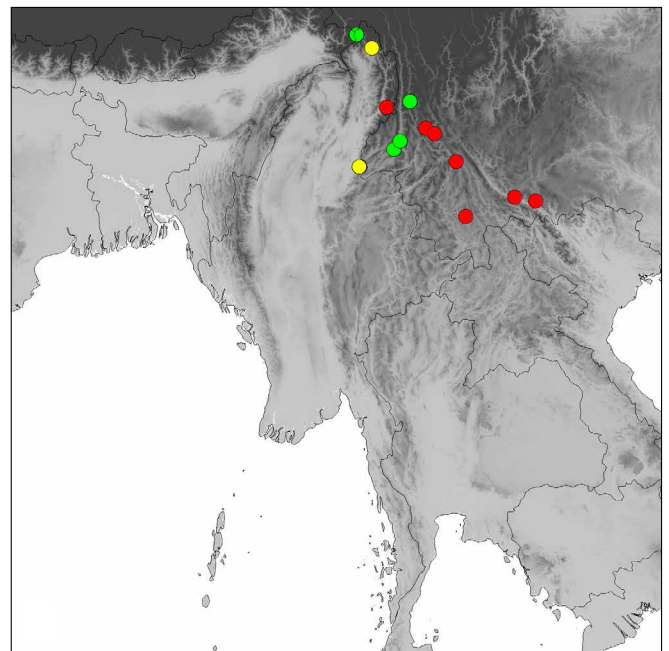
*Other collections examined.* CHINA, *Henry 9762* (syn K K000199723), *Ducloux 432* (syn K K000199724), Yunnan. — MYANMAR, *Forrest 1006* (syn K K000694595, E E00313652), upper Burma and N.W. Yunnan, the Ming-Kwong-Irrawadi divide, lat. N26°, alt. 7000–8000 ft, Oct. 1905.

Note — *Impatiens clavicuspis* is similar to *I. ceratophora* but differs in having long-awned apices on bracts and lateral sepals vs acute to acuminate apices.

**28. *Impatiens ceratophora* H.F.Comber — Map 11**

*Impatiens ceratophora* H.F.Comber (1934) 245; W.J.Kress et al. (2003) 169; Y.L.Chen et al. (2007) 70. — Type: *Forrest 9144* (holo K), Myanmar, upper Burma, descent from the Sansi gorge to the Sadon, lat. N25°20', alt. 2743 m, Sept. 1912.

Terrestrial, annual, glabrous herb, 60–100 cm tall. *Stem* erect, simple to sparsely branched. *Leaves* spirally arranged. *Petiole* absent–40 mm long. *Lamina* c. 130 by 40 mm, lanceolate or elliptic-lanceolate, apex acuminate, base cuneate, margin crenate to serrate, adaxial dark green, abaxial pale green; lateral veins 8–11 pairs. *Inflorescences* axillary to subterminal, 8–20-flowered raceme. *Flowers* 15 mm long, 25 mm deep, yellowish with purple spots. *Bracts* c. 3 mm long, linear, persistent.



**Map 11** Distribution of *Impatiens sinlumiensis* Grey-Wilson (●), *I. clavicuspis* Hook.f. ex W.W.Sm. (●) and *I. ceratophora* H.F.Comber (●).

*Pedice* 10–20 mm long. *Lateral sepals* 2, obliquely orbicular, curved, apex acuminate or aristate. *Lower sepal* bucciniform, apex long cuspidate or aristate, distal part rapidly constricted into an incurved or involute, clavate spur. *Dorsal petal* orbicular, cucullate, abaxial midvein with narrow crest. *Lateral united petals* c. 25 mm, free: the upper petals, broadly ovate; the lower petals obliquely elliptic, apex acuminate. *Stamens*: filaments c. 5 mm long; anthers obtuse. *Ovary* glabrous. *Fruits* linear, c. 25 mm. *Seeds* unknown.

**Phenology** — Flowering: August to September; fruiting: August to September.

**Distribution** — Myanmar (Kachin State), China (Yunnan Province).

**Ecology** — Understory of mixed forests, along canals, moist places, 1700–2700 m altitude.

*Other collections examined.* CHINA, *Forrest 9004* (para E E00120035), western flank of the Shweli-Salwin divide, lat. N25°20', alt. 8000–9000 ft (2440–2740 m), Aug. 1912. — MYANMAR, Kachin State, *Kingdon-Ward 7471* (K), valley of the Seingku, N28°8' E97°25', alt. 9000–10000 ft, 26 Sept. 1926.

**Note** — *Impatiens ceratophora* is similar to *I. clavicuspis* but differs in having acute to acuminate bract apices vs long-awned apices.

## Section *Fasciculatae* S.X. Yu & Wei Wang in Yu et al. (2015) 13

### 29. *Impatiens arguta* Hook.f. & Thomson — Map 12; Plate 2e

*Impatiens arguta* Hook.f. & Thomson (1860) 137; Hook.f. (1875) 470; (1905) 17; Collett & Hemsl. (1890) 29; Biswas (1966) 207; S. Akiyama et al. (1995) 152; W.J. Kress et al. (2003) 169; Y.L. Chen et al. (2007) 49. — Type: *Hooker 101* (lecto, designated here K 000694618; islecto B100365169, K 000694619, G 00023736\*, G 000237327\*, G 000237328\*, G 000237929\*, MPU MPU019012\*, SG SG3349\*), India, Sikkim, Himalaya, Darjeeling, alt. 4000–7000 ft.

*Impatiens arguta* Hook.f. & Thomson var. *bulleyana* Hook.f. (1908) t. 2875. — Type: *Forrest T.1000* (lecto, designated here K 000694030; islecto K 000694028, K 000694029), China, Yunnan, W Yunnan wood near Chu Jung road, Sept. 1903.

*Impatiens gagei* Hook.f. (1911d) t. 2951. — Type: *Burkill 27744* (lecto, designated here K 000694617), India, Tonglo slopes, below Simana, alt. 6000–8000 ft.

Terrestrial, perennial, glabrous herb, 50–150 cm tall, with fascicled roots. *Stem* 3–6 mm diam, erect, the lower portion rarely decumbent, angular, moderately branched, green to purple, glabrous. *Leaves* spirally arranged. *Petiole* 15–30 mm long, 2–3 mm diam, angular, pale green to pale pink, glabrous. *Lamina* 70–140 by 43–65 mm, ovate to elliptic, apex acuminate, base attenuate, margin distinctly serrate, adaxially dark green, abaxially greyish green, glabrous, with one pair of globose glands at lamina base or on leaf margin near lamina base; lateral veins 12 or 13 pairs. *Inflorescence* axillary, erect, 2-flowered racemes. *Peduncle* up to 4 mm long, c. 2 mm diam, angular, purple, glabrous. *Rachis* c. 2 mm long, c. 1.5 mm diam. *Flowers* 27–34 by 23–25 mm, c. 45 mm deep, slightly asymmetric, lilac. *Pedice* 28–31 mm long, c. 1 mm diam, pinkish green, glabrous. *Bracts* 9–10 by c. 1 mm, linear to lanceolate, apex acute, base cuneate, margin entire, without glands, green, glabrous, persistent. *Lateral sepals* 4: the upper pair 6–7 by 1–1.5 mm, free, linear to narrowly ovate, apex acute and mucronate, base cuneate, pale green to deep pink, glabrous; the lower pair 10–11 by 3–5 mm, broadly obliquely lanceolate, apex acuminate, base obtuse, pale green to deep pink, glabrous. *Lower sepal* 18–21 by 7–10 mm, 16–25 mm deep, deeply bucciniform, apex acuminate and mucronate, lilac, distal part abruptly constricted into a strongly incurved spur, 17–20 mm long, pale green with purple dots. *Dorsal petal* 13–26 by 16–21 mm, ovate to broadly elliptic to orbicular to broadly

obovate, cucullate to flat, apex acuminate or emarginate and mucronate, curved, base truncate to cordate, lilac, often spotted, glabrous, abaxial midvein with crescent-shaped to obtuse crest, pale to dark pink. *Lateral united petals* 28–32 mm long, free: the upper petals 17–20 by 6–10 mm, ovate to broadly oblong, apex emarginate and mucronate, base cuneate, lilac with pink dots near the base; the lower petals 22–25 by 7–12 mm, free, narrowly obovate, apex emarginate and mucronate, base auriculate, lilac, with yellow auricle. *Stamens*: filaments 5–6 mm long, white; anthers white. *Ovary* c. 4.5–5 mm long, c. 1 mm diam, 5-carpellate, green, glabrous. *Fruits* c. 25 mm long, c. 4 mm diam, cylindrical, 5-lobed, green, glabrous.

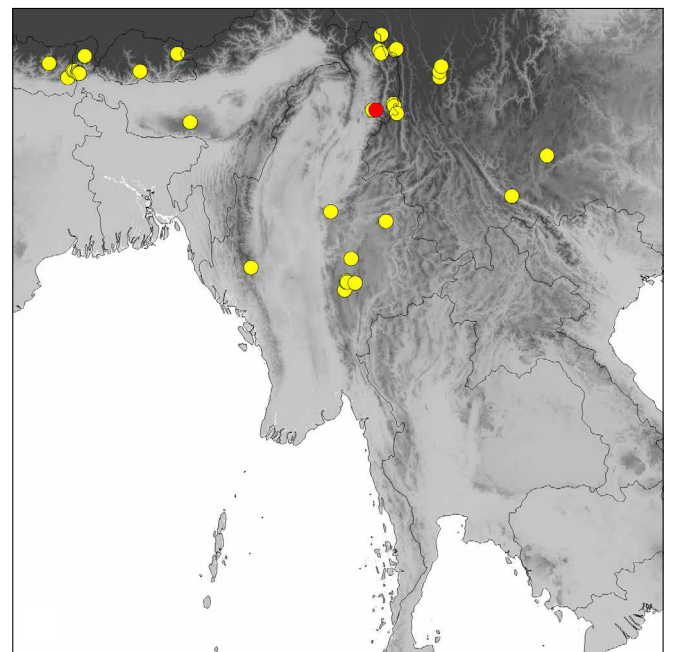
**Phenology** — Flowering: May to November; fruiting: July to December.

**Distribution** — Myanmar (Chin State, Kachin State, Shan State), Bhutan (Trashiyangtse District), China (Yunnan Province), India (Meghalaya State, Arunachal State, Sikkim State), Nepal (Dhawalagiri Zone).

**Ecology** — Growing in shady areas along roadsides, in mixed deciduous montane forest, 1400–2300 m altitude.

*Other collections examined.* INDIA, *Hooker s.n.* (syn M0211776, M0211777), Sikkim, Himalaya, Darjeeling, alt. 4000–7000 ft. — MYANMAR, Chin State, *Mu Mu Aung et al. 092811* (QBG), Natma Taung National Park, alt. 3070 m, N21°14.035' E93°54.039', 30 July 2013; *Kingdon-Ward 22634* (BM), Eran, Mt Victoria, 6000 ft, 2 Sept. 1956; Kachin State, *Toppin 2677* (BM), NE Burmah, alt. 4500–5000 ft; *Kaulback 314* (BM), Dinghputyang, N25°58' E97°53', alt. 2000 ft, 5 Aug. 1939; *Armstrong et al. 1016* (NY2648897\*), Putao district, Naungmung Township, buffer zone of Hkakabo Razi National Park, N27.6212°, E98.1682°, alt. 1590 m, 26 Oct. 2015; *Armstrong et al. 1192A* (NY2649106\*), Putao district, Naungmung Township, Hkakabo Razi National Park, between Aliaung village and Ran Nam rest house, N27.7105°, E98.1024°, alt. 942 m, 1 Nov. 2015; *Kaulback 125* (BM), *Kaulback 126* (BM), *Kaulback 136* (BM), Taron Valley, N28°10' E98°10', alt. 7500 ft, 19 Oct. 1938; Shan State, *Ruchisansakun et al. 719* (L L2071089, MAND, RAF), Taunggyi, N20°46'49.61" E97°03'07.39"; *Dewan Mohinder Nath Nair et al. 6375* (RANG015305), Taunggyi, 6 Oct. 1963; *Ruchisansakun et al. 722* (L L2071096, MAND, RAF), Taunggyi, N20°46'49.61" E97°03'07.39"; *Ruchisansakun et al. 729* (L L2071114, MAND, RAF), Taunggyi, N20°45'33.34" E97°18'34.39"; *Robertson 343* (K), Taunggyi, alt. 5000 ft; *U Mg Gale-2 12162* (RAF9663/2), *ibid.*, 27 Sept. 1970.

**Notes** — *Impatiens arguta* is a widespread species, distributed from India to China, with a variable flower colour between populations.



**Map 12** Distribution of *Impatiens arguta* Hook.f. & Thomson (●) and *I. duclouxii* Hook.f. (●).

*Impatiens namchabarwensis* R.J.Morgan et al. (2005) was mentioned as a synonym under *I. arguta* in the Flora of China (Chen et al. 2007). However, *I. arguta* differs in having a deeply bucciniform lower sepal, which is abruptly constricted into a strongly incurved spur, while *I. namchabarwensis* is characterized by an infundibular lower sepal which gradually tapers into a spur. Moreover, *I. namchabarwensis* has a bright, ultramarine-blue colour, which is never found in *I. arguta*. Hooker & Thomson (1860) mentioned many specimens in the protologue but did not indicate a holotype. We select *Hooker 101* (K000694618), with Hooker's drawing and handwriting, as lectotype.

Section **Scorpioidae** S.X.Yu & Wei Wang in Yu et al. (2015) 13

### 30. *Impatiens duclouxii* Hook.f. — Map 12

*Impatiens duclouxii* Hook.f. (1908) 245; Grey-Wilson (1989b) 121; Y.L.Chen et al. (2007) 64. — Type: *Henry 11080* (lecto, designated in Grey-Wilson (1989b) K 000694006), China, Yunnan Province, Mentse, alt. 8500 ft (2591 m).

*Impatiens jurpioides* T.Shimizu (1969) 39, syn. in Grey-Wilson (1989b). — Type: *Iwatsuki et al. T9687* (holo KYO; iso A00051220\*, BKF, SHIN, SING, G0062204), Thailand, Chiang Rai, Doi Pa Hom Pok, below the summit of Doi Pa Hom Pok, northwest of Phan, alt. 2000–2350 m, 13 Sept. 1967.

Terrestrial, perennial with woody stem, 40–50 cm tall. *Stem* erect, up to 2.5 mm diam, unbranched, glabrous. *Leaves* spirally arranged. *Petiole* 24–35 mm long, c. 1 mm diam, glabrous. *Lamina* 110–122 by 44–47 mm, ovate, apex acuminate, base attenuate, margin serrate with teeth, adaxial pilose, with 2 pairs of glands at leaf base; lateral veins 8 or 9 pairs. *Inflorescence* axillary, pendulous, 6-flowered. *Peduncle* 18–20 mm long, < 1 mm diam, glabrous. *Rachis* up to 31 mm long, < 1 mm diam. *Flowers* c. 34 mm long, c. 44 mm deep. *Bracts* 2–3 by 1.5 mm, ovate, apex acute and mucronate, base obtuse, margin entire, without glands, glabrous, persistent. *Pedicel* c. 16 mm long, < 1 mm diam, glabrous. *Lateral sepals* 2, c. 8 by 5 mm, obliquely ovate, free, apex acute and mucronate, base cuneate, glabrous. *Lower sepal* 19–20 mm long, 19–22 mm deep, deeply bucciniform, apex acuminate, glabrous, abruptly constricted into a spiral spur, c. 7–10 mm long. *Dorsal petal* c. 15 by 20 mm, broadly elliptic, cucullate, apex shallowly cordate, base obtuse, glabrous, abaxial midvein with acute appendage, c. 10 mm long. *Lateral united petals* 28–32 mm long, free: the upper petals 15–16 by 7–10 mm, ovate, apex obtuse, base cuneate; the lower petals 15–20 by 12–13 mm, free, obovate, apex obtuse, glabrous. *Fruits* c. 20 mm long, cylindrical. *Seeds* unknown.

Phenology — Flowering: July to September; fruiting: July to September.

Distribution — Myanmar (Kachin State), China (Yunnan Province), Thailand (Chiang Mai Province).

Ecology — Growing in shady areas in mixed deciduous forest or broad-leaved evergreen forest, 1900–2200 m altitude.

*Other collections examined.* CHINA, *Fr. Ducloux* 2613 (syn P P04614775, P P04614778), Yunnan; *Delavay s.n.* (syn K K000694005, P P04614773, P P04614774, P P04614776), Pee tsao long, 1895; *Henry* 12559 (syn B B100365159\*, E E00313630, K K000694007, K K000694008, NY NY00387525\*), Szemao, alt. 5000 ft; *Henry* 9267 (syn K K000694004), Mengtsze, alt. 7000 ft (2134 m), 1898. — MYANMAR, Kachin State, *Kaulback* 410 (BM), Hkawng Gaw, N25°58' E98°00', alt. 2500 ft (762 m), 12 Sept. 1939; *Toppin* 2745 (K), Kachin Hills, Sinlum, 13 Aug. 1912, alt. 1980–2130 m; *Armstrong et al.* 1153 (NY2687903), Putao district, Naungmung Township, Hkakabo Razi National Park, between Ta Pai rest house and Aliaung village, N27.6704° E98.1456°, alt. 983 m, 30 Oct. 2015.

Note — *Impatiens duclouxii* belongs to the *Impatiens jurpia* complex (Grey-Wilson 1989b). It is very similar to *I. jurpia* Buch.-Ham. ex Hook.f. & Thomson (Hooker & Thomson 1860: 140) but differs in having a shorter peduncle (shorter than 22 mm). It is also similar to *I. kathmanduensis* Grey-Wilson (1989b: 119)

but differs from that species in having a longer dorsal petal appendage (longer than 4 mm). In Myanmar, it is most similar to *I. chimiliensis* but differs from it in having a shorter peduncle, a shorter rachis and a spur that ends in a hook or spiral.

Section **Uniflorae** Hook.f. & Thomson (1860) 113

### 31. *Impatiens ecalcarata* Collett & Hemsl. — Fig. 15; Map 13; Plate 2f

*Impatiens ecalcarata* Collett & Hemsl. (1890) 30; (1891) 454; W.J.Kress et al. (2003) 169, non *Impatiens ecalcarata* Blank. (1905) 84, nom. illeg. = *Impatiens ecornuta* Moore (Moore et al. 2012) 60. — Type: *Collett & Hemsley s.n.* (lecto, designated here illustration in Collett & Hemsley 1890 plate IV (Fig. 15)), Myanmar, Shan State, Shan Hills, alt. 4000 ft (1219 m). *Impatiens angustisepala* Tardieu (1944) 180, syn. nov. — Type: *Poilane* 15637 (holo P P00780663), Laos, Pakson, Province de Bassac, alt. 1200 m, 19 Sept. 1919.

Terrestrial, annual herb, 25–40 cm tall. *Stem* erect, 2–3(–6) mm diam, cylindrical, unbranched to rarely branched, green to red, glabrous. *Leaves* decussate. *Petiole* sessile–2 mm long, c. 1.5 mm diam, green to red. *Lamina* 45–60 by 4–9 mm, linear to narrowly oblong, apex acute, base truncate; lateral veins 4 or 5 pairs; margin shallowly serrate, adaxial green, abaxial pale green. *Inflorescence* axillary, erect, in 2-flowered fascicles. *Flowers* 9–10 by 9–10 mm, 7–8 mm deep, white to pale pink with purple reticulate lines at centre. *Bracts* c. 1 by < 1 mm, linear, apex acute and mucronate, base cuneate, green to red. *Pedicel* 12–14 mm long, less 1 mm diam, reddish pink, abaxially pilose. *Lateral sepals* 2, 4–5 by 0.5–1 mm, free, linear, apex acute, base cuneate, pale pink with green tip, glabrous. *Lower sepal* 4.5–5 by c. 3.5 mm, c. 3 mm deep, navicular, apex acute and mucronate, white to pale pink with purple reticulate lines and yellow mark at centre, glabrous, spurless. *Dorsal petal* c. 4 by 5 mm, c. 1.5 mm deep, broadly ovate, cucullate, white with green tip, apex round and mucronate, base round, abaxial midvein with narrow crest terminating in a short acute point. *Lateral united petals* 9–10 mm long, free: the upper pair c. 3 by 1.5 mm, falcate to ovate, apex obtuse to acute, base cuneate, white; the lower petals 5–6 by 4–5 mm, free, orbicular, apex round, base obtuse, white with purple reticulate vein at the base. *Stamens*: filaments c. 2 mm long, white; anthers white to pale purple. *Ovary* c. 2 mm long, < 1 mm diam, 5-carpellate, green, glabrous. *Fruits* 10–12 mm long, 3–4 mm diam, fusiform, 5-lobed, green, glabrous. *Seeds* c. 2 mm long, black and shiny.

Phenology — Flowering: April to November; fruiting: April to November.

Distribution — Myanmar (Shan State, Kayin State), Laos (Champasak Province).

Ecology — Growing in open areas, 500–1300 m altitude.

*Other collections examined.* LAOS, *Poilane* 15777 (para P P04542465), entre Pakson et Nong Bok Kao; *Poilane* 28442 (para P P04542464), *ibid.*, 13 Nov. 1938. — MYANMAR, Karen State, *Ruchisansakun & Thet Yu New* 747 (L L2071157, RAF, RANG), Hpa-An, Zwegabin mountain, N16°49'15.8" E97°40'19.5", alt. 481 m, 19 Oct. 2015.

Notes — *Impatiens ecalcarata* is morphologically similar to other species with decussate leaves and flowers arranged in fascicles (*I. chinensis*, *I. helferi*, *I. masonii*, *I. oppositifolia*). However, it can be easily distinguished by its spurless lower sepal. The distribution of this taxon is unusual. It is known from southern and north-eastern Myanmar and Laos, but has not been found in Thailand so far.

*Impatiens ecalcarata* is identical to *I. angustisepala*, both in reproductive and vegetative parts. Hence, we decided to synonymize *I. angustisepala* under *I. ecalcarata*.

Collett & Hemsley (1890) mentioned that *I. ecalcarata* was collected in the Shan Hills at 4000 ft. Since we could not find

Collett &amp; Hemsl.

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Fig. 15 The lectotype *Impatiens ecalcarata* Collett & Hemsl. Illustration taken from Collett & Hemley (1860).

any specimens, but an illustration of this plant is present in the protologue (Collett & Hemsley plate IV), we select this as lectotype. Based on its small white flowers, we predicted that this species is an autogamous species, similar to *I. muscicola* (Ruchisansakun et al. 2016). Moreover, we found that the open stamens remain and touch the stigma.

Tardieu-Blot (1944) clearly designated *Poilane 15637* as a type of *I. angustisepala*.

### 32. *Impatiens masonii* Hook.f. — Map 13; Plate 2g

*Impatiens masonii* Hook.f. (1905) 29, 34; W.J.Kress et al. (2003) 170. — Type: *Badalkhan 119* (lecto, designated here K K000694709), Myanmar, upper Burma, Mandalay district, 40 miles from Mandalay, July 1888.

*Impatiens craddockii* Hook.f. (1905) 29, 34; Craib (1926b) 210; Tardieu (1945) 562; W.J.Kress et al. (2003) 169, syn. nov. — Type: *Craddock 58* (lecto, designated here K K000694704; isolecto K K000694703), Myanmar, upper Burma, Nahi, alt. 3800 ft (1158 m), July 1901.

*Impatiens pseudochinensis* T.Shimizu (1969) 37, syn. nov. — Type: *Shimizu, Hutoh, Chaiglom T-8932* (holo KYO not seen; iso BKF006048, E E00313656), Thailand, Loei, Phu Kradueng, Phu Kradueng National Park, on the plain at its summit, alt. 1200 m.

Terrestrial, annual, glabrous herb, 50–100 cm tall. *Stem* erect, 3–3.5 mm diam, unbranched, green to reddish green to red, glabrous. *Leaves* decussate. *Petiole* sessile—2 mm long, up to 1 mm diam, green, glabrous. *Lamina* 60–90 by 10–15 mm, narrowly elliptic, apex acute, base cuneate, margin serrate, adaxial

green and scabrous, abaxial greyish green and glabrous, with one pair of globose stipular glands at petiole base; lateral veins 4 or 5 pairs. *Inflorescence* axillary, 1- or 2-flowered fascicles. *Peduncle* c. 1.5 mm long, c. 1.5 mm diam, green to red, glabrous. *Flowers* c. 35 by 30 mm, c. 40 mm deep, pink. *Pedicel* 40–45 mm long, c. 1 mm diam, green to red, glabrous. *Bracts* c. 3 by 1 mm, triangular, apex acute, base cuneate, margin entire, green, glabrous, persistent. *Lateral sepals* 2, 10–11 by c. 6 mm, free, ovate to lanceolate, apex mucronate, base obtuse, red with green apex, glabrous. *Lower sepal* c. 15 by 5 mm, c. 12 mm deep, navicular, apex acute and mucronate, base obtuse, deep pink, distal part gradually constricted into a straight or incurved spur, 23–27 mm long, red with green tip. *Dorsal petal* c. 19 by 26 mm, broadly elliptic, flat, recurved backward at the middle, apex obcordate, base round, abaxial midvein with narrow crest, pink with darker pink on crest, glabrous. *Lateral united petals* c. 30 mm long, free: the upper petals 15 by 9 mm, falcate, apex round, base cuneate, pink; the lower petals c. 23 by 17 mm, free, ovate to elliptic, apex round, pink, glabrous. *Stamens*: filaments c. 4 mm long, pink; anthers yellow. *Ovary* c. 3.5 mm long, c. 1 mm diam, 5-carpellate, green, glabrous. *Fruits* c. 16 mm long, c. 5 mm diam, fusiform, 5-lobed, green, glabrous. *Seeds* 7–12, ellipsoid, c. 2 mm long, brown.

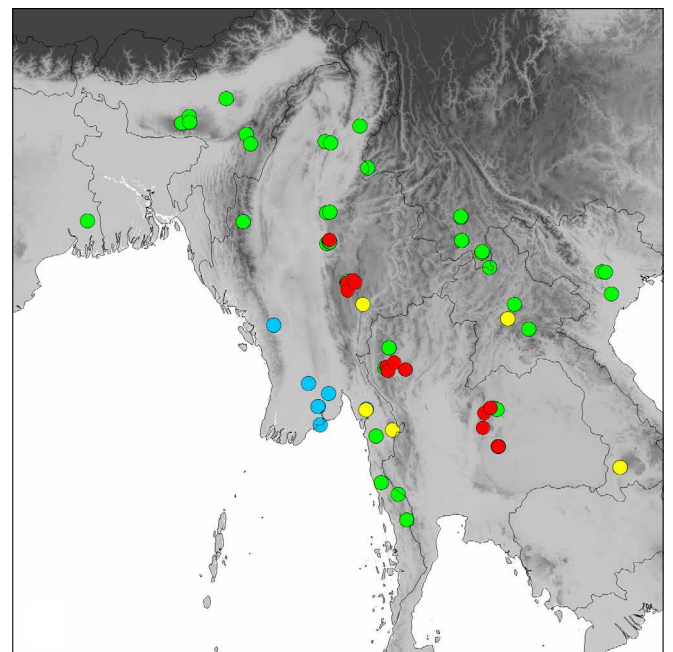
*Phenology* — Flowering: July to September; fruiting: September to November.

*Distribution* — Myanmar (Mandalay, Shan State), Thailand (Chaiyaphum, Chiang Mai, Lamphun, Loei, Phetchabun).

*Ecology* — Growing among grasses in open grassland or mixed montane forest, 1200–1600 m altitude.

*Other collections examined.* MYANMAR, Mandalay Region, *Lace 3269* (E E00753105, E E00753106), Maymyo, alt. 3500 ft, 7 July 1908; *Lace 1016* (K), *ibid.*, Shan State; *Ruchisansakun et al. 720* (L L2071093, MAND, RAF), Taunggyi district, on the way to Shwephonpwiat, N20°46'00.79" E97°03'36.03", alt. 1578 m, 19 Sept. 2015; *Ruchisansakun et al. 724* (L L2071102, MAND, RAF), N20°50'51.62" E97°14'14.34", alt. 1196 m, 20 Sept. 2015; *Ruchisansakun et al. 728* (L L2071113, MAND, RAF), Sangaw village, N20°45'49.78" E97°18'20.73", alt. 1501 m, 23 Sept. 2015. — THAILAND, *Bunpheng 571* (para BKF), Loei, Phu Kradueng, Phu Kradueng National Park, on the plain at its summit, alt. 1200 m.

*Notes* — *Impatiens craddockii* and *I. pseudochinensis* were published as distinct species because they seemingly differed in the shape of their lateral sepals, leaves, and in floral size.



Map 13 Distribution of *Impatiens ecalcarata* Collett & Hemsl. (●), *I. masonii* Hook.f. (●), *I. chinensis* L. (●) and *I. oppositifolia* L. (●).

However, since these characters vary continuously, both names are synonymized under *I. masonii*. The names *I. masonii* and *I. craddockii* were published in the same publication (Hooker 1905). However, the description of *I. masonii* comes before that of *I. craddockii*, so *I. masonii* is regarded as the accepted name and *I. craddockii* as a synonym.

*Impatiens masonii* is most similar to *I. chinensis* but differs in having large upper lateral petals and ovate to lanceolate lateral sepals as opposed to *I. chinensis*. Moreover, *I. masonii* is always associated with non-swampy grasslands whereas *I. chinensis* always grows in swampy areas.

Hooker (1905) did not designate types for *I. masonii* and *I. craddockii*. We select *Badalkhan 119* (K000694709) as lectotype of *I. masonii* because it is the only specimen with illustrations by Hooker. For *I. craddockii*, we found two specimens and select *Craddock 58* (K000694704) because it provides more details.

### 33. *Impatiens chinensis* L. — Map 13; Plate 2h

*Impatiens chinensis* L. (1753) 937; Collett & Hemsl. (1890) 30; Hook.f. & Thomson (1860) 119; Tardieu (1945) 559; W.J.Kress et al. (2003) 169; Y.L.Chen et al. (2007) 57; J.R.N.Dessai & Janarth. (2011) 26, 40. — *Balsamina chinensis* (L.) DC. (1824) 686. — Type: *Anonymous s.n.* (lecto, designated in Singh (2017) LINN-HL1053-1\*).

[Onapu, Van Rheede tot Drakestein 1689: 89, t. 47]. — *Impatiens fasciculata* Lam. (1785) 363; Wight & Arn. (1834) 138; Hook. (1852) t. 4631; Wight (1846) t. 748. — *Balsamina fasciculata* (Lam.) DC. (1824) 686; G.Don (1831) 749, syn. in Hooker & Thomson (1860). — Type: *Van Rheede tot Drakestein Tab. 47* (1689) (lecto, designated here illustration).

*Balsamina setacea* Colebr. ex Hook. (1824) t. 137. — *Impatiens setacea* Colebr. MSS. ined. (Hooker 1824), syn. in Hooker & Thomson (1860). — Type: India, Korrera Mountain.

*Impatiens chinensis* L. var. *brevicornis* E.Barnes (1939) 99, syn. in J.R.N.Dessai & Janarthanum (2011). — Type: *Barnes 558* (lecto, designated in Dessai & Janarthanum (2011) K K000580488), India, Kerala, Idukki district, Travancore, Munnar, 20 Oct. 1932.

*Impatiens chinensis* L. var. *gracilissima*, nom. nud., in herb. — *Buchanan 2* (K K000694706), Myanmar, Kachin State, Myitkyina, east bank of the Ir-rawaddy opposite Myitkyina, alt. 153 m, 30 Nov. 1910.

*Impatiens cosmia* Hook.f. (1910b) t. 2915. — Type: *Faber s.n.* (lecto, designated in Dessai & Janarthanum (2011) W0016508\*; *Jacobs 186* (syn K K000381731), China, Cheking, Jungkun (Tungkun).

*Impatiens heterophylla* Wall. (1824) 458. — *Balsamina heterophylla* G.Don (1831) 749, syn. in Hooker & Thomson (1860). — Type: *De Silva & H. Bruce s.n.*, Wall. Cat. no. 4748A (lecto, designated here K K001039813 (left specimen)), Sylhet, 1821.

Terrestrial to semi-aquatic, annual herb, 40–75 cm tall. *Stem* erect, the lower portion sometimes decumbent and often rooting at nodes, 4–9 mm diam, unbranched or rarely branched at the lower portion, reddish green to red, glabrous. *Leaves* decussate. *Petiole* sessile–3 mm long, c. 1 mm diam, green, glabrous. *Lamina* 35–90 by 5–10 mm, oblong to linear, apex acute, base obtuse to truncate, margin shallowly crenate, adaxial dark green and hirsute, abaxial greyish green and glabrous, with one pair of stipular glands at petiole base; lateral veins 5 or 6 pairs. *Inflorescence* axillary, in 2- or 3-flowered fascicles. *Flowers* 35–45 by 30–40 mm, 3.5–3.8 mm deep, pink. *Pedicel* 45–50 mm long, 1–1.5 mm diam, cylindrical, red, glabrous. *Bracts* 2–2.5 by 0.5–1 mm, lanceolate, apex acute, base cuneate, margin entire, green, glabrous, persistent. *Lateral sepals* 2, 13–15 by 2–3 mm, free, linear to falcate, apex acute, base cuneate, dark pink with green tip, glabrous. *Lower sepal* 15–16 by 8–9 mm, c. 15 mm deep, navicular, apex acute and mucronate, base obtuse, pale pink, with dark pink reticulate lines, a white patch and yellow mark at the centre, apex green, glabrous, distal part abruptly constricted into an incurved to linear spur, sometimes laterally compressed, 20–22 mm long, pink. *Dorsal petal* 11–12 by 12–14 mm, broadly ovate, cucullate, apex acute and mucronate, base obtuse to truncate, pink, glabrous, abaxial midvein with a narrow crest terminating in a short acute point, crest

green or pink. *Lateral united petals* 32–37 mm long, free: the upper petals 7–11 by 4–5 mm, falcate, apex acute to acuminate, base stipitate, pink; the lower petals 24–28 by 17–21 mm, free, broadly ovate, apex round to slightly bilobed, base auriculate, pink with dark pink auricles, glabrous. *Stamens*: filaments c. 8 mm long, pink or green; anthers yellow. *Ovary* c. 7 mm long, c. 2 mm diam, 5-carpellate, green, glabrous. *Fruits* 13–14 mm long, c. 3 mm diam, fusiform, 5-lobed, green, glabrous.

Phenology — Flowering: June to December.

Distribution — Myanmar (Chin State, Kachin State, Mandalay Region, Shan State, Tanintharyi Division), India, China, Laos, Thailand, Vietnam.

Ecology — Growing in swampy areas, 150–1300 m altitude.

*Other collections examined.* MYANMAR, Chin State, Venning 101 (K), Chin Hills, Kachin State, *Ruchisansakun & Thet Yu Nwe 750* (L L2071165), Indawgyi lake Wildlife Sanctuary, base of Singaung Taung (Elephant mountain), N25°01'13" E96°19'28", alt. 184 m; Mandalay division, *Lace s.n.* (E E00753068), Maymyo Plateau, alt. 3500 ft, 1911; *Lace 3260* (K), *ibid.*, 19 June 1908; *Ruchisansakun 704* (L L2071063, MAND, RAF), near to the lake, N22°00'30.82" E96°28'08.78", alt. 1080 m, 8 Aug. 2015; *Dewan Mohinder Nath Nair 3726* (RANG4749), Enesakhan, near Maymyo, 22 Dec. 1958; *Ruchisansakun & Thet Yu Nwe 761* (L L2071198, MAND, RAF), Mogok, Mintatar quarter, N22°55'03.7" E96°28'39.6", alt. 1133 m, 23 Nov. 2015; Shan State, *Ruchisansakun 725* (L L2071103, MAND, RAF), Taunggyi, 20 Sept. 2015; *Melville 92* (BM), *ibid.*; Tanintharyi Region, *Ruchisansakun et al. 739* (L L2071142), RAF nursery, 15 Oct. 2015; *Toppin 2780* (K H2015/00092 66, 67, 68), NE Burma, alt. 3000 ft, 18 Oct. 1914; *Wall. Cat. no. 4748B* (K K001039817), Taong (Toong) Dong, 1826.

Note — *Impatiens chinensis* has a large variation in leaf and spur shape between populations. It is most similar to *I. oppositifolia* but differs in having an incurved spur vs a short hook-like spur. Many published taxa have been synonymized under *I. chinensis* (see Dessai & Janarthanum (2011) for a detailed report).

### 34. *Impatiens helferi* Hook.f.

*Impatiens helferi* Hook.f. (1905) 28; W.J.Kress et al. (2003) 169. — Type: *Helfer 1215* (lecto, designated here K K000694702; isolecto P P04543314), Myanmar (Burma), Tanintharyi division, Tenasserim, 1838.

Annual herb, 20–40 cm tall. *Stem* erect, 2–4 mm diam, unbranched to rarely branched, glabrous. *Leaves* decussate. *Petiole* up to 1 mm long, c. 1 mm diam, glabrous. *Lamina* 45–65 by 4–7 mm, linear to narrowly oblong, apex acute to obtuse, base truncate to obtuse, margin slightly serrate, glabrous on both sides, with one stipular gland on each side of petiole base; lateral veins inconspicuous. *Inflorescence* axillary, erect, 1–3-flowered fascicle. *Flowers* 6–11 mm long, 5–7 mm deep. *Bracts* c. 1 by < 1 mm, linear, apex acute, base cuneate, margin entire, without glands, glabrous, persistent. *Pedicel* 10–15 mm long, < 1 mm diam, pilose above. *Lateral sepals* 2, 3.5–4 mm long, < 1 mm diam, free, linear, apex acute and mucronate, base cuneate, glabrous. *Lower sepal* 4–5 mm long, 1.5 mm deep, navicular, apex acuminate and mucronate, glabrous, distal part abruptly constricted into a curved to incurved spur, 4–5 mm long. *Dorsal petal* c. 2 by 3 mm, cordate, cucullate, apex emarginate and mucronate, base cuneate, glabrous, abaxial midvein simple. *Lateral united petals* 8–10 mm long, free: the upper petals 2–3 by 1–1.5 mm, obovate, apex obtuse, base cuneate; the lower petals 5–6 by 3–4 mm, free, obovate, apex round, base with distinct auricle, c. 0.5 mm wide, glabrous. *Stamens*: filaments c. 2 mm long. *Ovary* c. 2 mm long, c. 1 mm diam, glabrous. *Fruits* 6.5–7 mm long, 2.5 mm diam, short fusiform, glabrous; fruiting pedicels 18–20 mm long, straight. *Seeds* 2.5 mm long, globose, black shiny; seed coat smooth.

Phenology — Unknown.

Distribution — Endemic to Myanmar (Tanintharyi division), only known from the type locality.

Ecology — Unknown.



**Plate 3** a. *Impatiens oppositifolia* L.; b. *Impatiens decurva* Ruchis. & S.B.Janssens; c. *Impatiens balsamina* L.; d. *Impatiens curvipes* Hook.f.; e. *Impatiens florulenta* Hook.f.; f. *Impatiens oblongata* Ruchis. & Niet; g. *Impatiens violiflora* Hook.f.; h. *Impatiens allanii* Hook.f. — Photos by: a–h. Saroj Ruchisansakun.

**Notes** — *Impatiens helferi* is very similar to *I. chinensis* but differs in having much smaller flowers. Due to these small flowers, it is also similar to *I. oppositifolia* but differs in having linear to narrowly oblong leaf lamina up to 7 mm wide vs ovate, elliptic, to oblong leaf lamina which is wider than 15 mm.

Hooker did not designate a holotype of *I. helferi*. We found two specimens collected by Helfer and named as *I. helferi* and we selected *Helfer 1215* (K000694702) as lectotype since it has an illustration by Hooker.

### 35. *Impatiens oppositifolia* L. — Map 13; Plate 3a

*Impatiens oppositifolia* L. (1753) 937. — Type: *Paul Hermann s.n* (lecto, designated in Grey-Wilson (1985) BM BM000621557), Sri Lanka. *Impatiens reticulata* Wall. (1830) 19; Hook.f. (1875) 448; W.J.Kress et al. (2003) 170. — Type: *Coloured illustration in Wallich* (1830) t. 19 (lecto, designated here), Myanmar, Rangoon.

Terrestrial, annual, glabrous herb, 20–40 cm tall. *Stem* erect, 2–5 mm diam, moderately branched, slightly angular, reddish green. *Leaves* decussate. *Petiole* absent—2 mm long, c. 1.5 mm

diam, green. *Lamina* 25–60 by 15–18 mm, ovate to elliptic to obovate, apex round to acute, base cuneate to obtuse, margin shallowly crenate, adaxial green, abaxial greyish green, glabrous, with one pair of stipular glands at the base of petiole; lateral veins 5 or 6 pairs. *Inflorescence* axillary, erect, 2-flowered fascicles. *Flowers* 13–15 by 9–12 mm, 13–15 mm deep, pink. *Pedice*l 22–24 mm long, c. 1 mm diam, pink. *Bracts* c. 2.5 by 1 mm, linear, apex acute, base cuneate, margin entire, without glands, green, persistent. *Lateral sepals* 2, 5–7 by 1 mm, free, falcate, apex acute, base cuneate, pink with green apex. *Lower sepal* 8–9 by 4–5 mm, c. 5 mm deep, navicular, apex acute and mucronate, pale pink, semi-transparent, with red reticulate veins, distal part abruptly constricted into a short hook-like spur, 5–6 mm long, red to green. *Dorsal petal* 5–5 by 6–7 mm, broadly ovate to broadly elliptic, cucullate, apex round to mucronate, base truncate to slightly cordate, pink, glabrous, abaxial midvein with a narrow crest terminating in a short acute point. *Lateral united petals* 15–17 mm long, free: the upper petals 5–6 by 1.5–2 mm, falcate, apex acute, base cuneate, pink with red lines at the base; the lower petals 11–12 by 7–8 mm, free, ovate to elliptic to obovate, apex round to slightly emarginate, midrib curved and wavy near the base, pink with dark pink near the base of midrib. *Stamens*: filaments 3–3.5 mm long, white; anthers pink. *Ovary* c. 3 mm long, c. 1 mm diam, 5-carpellate, green, glabrous. *Fruits* c. 10 mm long, 4–5 mm diam, fusiform, 5-lobed. *Seeds* c. 5, globose, c. 2 mm long, black.

Phenology — Flowering: August to January; fruiting: September to January.

Distribution — Myanmar (Kayin State, Mon State, Yangon Region), India (Madras), Thailand (western and southern).

Ecology — Growing near paddies, but not in swampy areas, 16–30 m altitude.

*Other collections examined.* INDIA, Johann Peter Rottler 89 (LINN-HS1379-6), Madras. — MYANMAR, Kayin State, Ruchisansakun & Thet Yu Nwe 717 (L L2071083, RAF, RANG), Hpa-An, the road to Zwegabin mountain, N16°50'12.59" E97°40'58.34", 20 Aug. 2015; Mon State, Lase 5578 (K H2015/00092 47), Amherst district (Kyaikkami), Dali reserve, alt. 100 ft (30 m), 11 Jan. 1912; Yangon Region, Parkinson 15016 (K H2015/00092 46), Rangoon district, Thayagon, 18 Sept. 1932; Wall. Cat. no. 4750 (K K001039821), Rangoon, 1826.

Notes — *Impatiens oppositifolia* is similar to *I. chinensis* but differs in having a semipellucid lower sepal with reticulate veins, and a short-hook-like spur. It is also similar to *I. helferi* but differs in having flowers which are 13–15 mm long vs 6–11 mm long, ovate, elliptic to oblong lamina wider than 15 mm vs linear to narrowly oblong leaf laminae which are up to 7 mm wide.

Wallich published *I. reticulata* without referencing any specimen. However, he included a detailed coloured illustration in the protologue (Wallich 1830: t. 19). We decided to select that illustration as lectotype.

### 36. *Impatiens decurva* Ruchis. & S.B.Janssens — Map 14; Plate 3b

*Impatiens decurva* Ruchis. & S.B.Janssens in Ruchisansakun et al. (2018). — Type: Ruchisansakun & Makino BG Exped 734 (holo L L2071124; iso L, RAF, RANG), Myanmar, Shan State, Kalaw, N20°39'21.92" E96°34'55.89", 27 Sept. 2015.

Lithophytic, annual herb, 6–30 cm tall. *Stem* erect, 1–3 mm diam, cylindrical, simple to moderately branched, red, glabrous. *Leaves* spirally arranged, mostly crowded towards apex of the stems. *Petiole* absent–7 mm long, c. 1 mm diam, pale green to green to pink, glabrous. *Lamina* 10–40 by 5–15 mm, ovate to elliptic to obovate, apex acute to acuminate, base cuneate to attenuate, margin shallowly serrate, adaxial green and pilose along the leaf veins and margin, abaxial pale green and gla-

brous, with 3–5 long red hairs along the margin near the base; lateral veins 3–5 pairs. *Flowers* solitary, axillary, erect, 10–11 by 8–10 mm, 6–8 mm deep, pale pink and white, with yellow marks at the centre. *Bracts* < 1 by < 1 mm, linear to narrowly lanceolate, apex acute and mucronate, base cuneate, green with red apex, persistent. *Pedice*l 10–15 mm long, < 1 mm diam, pale green, pilose. *Lateral sepals* 2, < 1 by 1 mm, free, ovate to lanceolate, apex acute, base obtuse, pale green with red tip, glabrous. *Lower sepal* 4–5 by 2.5–3 mm, c. 2 mm deep, navicular, apex acuminate and mucronate, white with red tip, pilose outside, spurless. *Dorsal petal* 4–5 by 5–5.5 mm, broadly ovate, cucullate, apex round and slightly mucronate, base truncate to shallowly cordate, white, glabrous, but pilose on midrib, abaxial midvein simple or with narrow crest, c. 1 mm wide, green. *Lateral united petals* 7–9 mm long, free: the upper petals 4.5–5 by 2.5–3 mm, ovate, apex round, base cuneate, white to pale pink; the lower petals 6–7 by 3.5–4 mm, free, elliptic to obovate, apex unequally bilobed, pink with yellow mark at the base. *Stamens*: filaments c. 2.5 mm long, white to pale pink; anthers pale pink. *Ovary* 2 mm long, < 1 mm diam, 5-carpellate, green, pilose. *Fruits* 8–10 mm long, 2.5–3 mm diam, fusiform, 5-lobed, green, pilose; pedicel strongly decurved from the middle in young fruiting stage. *Seeds* 9–11, c. 2 mm long, ovoid, brown.

Phenology — Flowering: September to October; fruiting: October.

Distribution — Endemic to Myanmar (Shan State).

Ecology — Growing on limestone at the top of montane areas in fragmented evergreen forest, 1500–1600 m altitude.

Note — *Impatiens decurva* is similar to *I. pendula* and *I. muscicola* but differ in having lower lateral petals with an unequally bilobed apex and a pedicel that is strongly decurved from the middle at fruiting stage.

### 37. *Impatiens balsamina* L. — Map 14; Plate 3c

*Impatiens balsamina* L. (1753) 938; Wall. (1824) 453; Pidd. (1832) 45; Roxb. (1832) 651; Wight & Arn. (1834) 135; Miq. (1860) 162, 396; Hook.f. & Thomsom (1860) 130; Hook.f. (1875) 453; (1904b) 4; (1905) 13; (1909) 7; T.Shimizu (1970) 188; Y.L.Chen et al. (2007) 44. — *Balsamina hortensis* DC. (1824) 685. — *Impatiens balsamina* L. var. *vulgaris* Wight & Arn. (1834) 136. — Type: *Anonymous s.n.* (lecto, designated in Christenhusz & Jarvis (2010) LINN-HL1053.5\*).

*Impatiens cornuta* L. (1753) 937. — *Balsamina cornuta* DC. (1824) 686. — *Impatiens balsamina* L. var. *sylvestris* Wight & Arn. (1834) 136. syn. in Hooker (1904a) 25. — Type: *Paul Hermann* 3: 9, no. 316 (lecto, designated in Singh (2017) BM BM000621820), Sri Lanka.

*Impatiens coccinea* Sims (1810) 1256; Wall. (1831) 167, n 4732. — *Balsamina coccinea* (Sims) DC. (1824) 685; G.Don (1831) 748, syn. in Hooker (1904a) 25. — Type: Sims (1810) 1256, illustration of specimen cultivated in Sloane street by Mr. Salisbury, seeds received from Mr Roxburgh, east India.

*Impatiens balsamina* L. var. *longifolia* Wight & Arn. (1834) 136. — *Impatiens longifolia* Benth. ex Wall. (1831) n. 4734, nom. nud., syn. in Hooker (1904a) 25. — Type: Wall. Cat. no 4734 (K K001039792).

*Impatiens arcuata* Wight & Arn. (1834) 136. — *Impatiens balsamina* L. var. *arcuata* Hook.f. (1875) 454, syn. in Hooker (1904a) 25. — Type: Wall. Cat. no. 4735 (K K000694978), India.

*Impatiens salicifolia* Bojer ex Baker (1884) 115. — *Balsamina salicifolia* Bojer MSS. — Type: *Perrotet* 185 (iso KW KW001000613\*), India, Nilgeriensis. *Impatiens stapfiana* Gilg (1909) 111. — Type: *Whyte s.n.* (syn B B100153247\*; syn K K000419536), Kenya, Aug. 1903.

*Impatiens eriocarpa* Launert (1962) 59. — Type: *Sousa* 1668 (LISC not seen), Mozambique, N Maniamba, Missão de S. Antônio de Unango, 1934.

Terrestrial, annual herb, up to 90 cm tall. *Stem* annual, erect, c. 7 mm diam, stout, laxly branched, light green, pilose. *Leaves* spirally arranged. *Petiole* sessile–2 mm long, c. 3 mm diam, green, pilose. *Lamina* up to 140 by 33 mm, narrowly elliptic to lanceolate, apex acute, base cuneate, margin serrate, coriaceous, adaxial green and remotely pilose, abaxial pale green,

with one pair of spherical glands at the base; lateral veins 6 or 7 pairs. *Flowers* solitary, axillary, erect, c. 20 mm long, white to pink to red to variegate. *Pedicel* up to 15 mm long, c. 1 mm diam, pale green to pale pink, strigose. *Bracts* c. 1 by < 1 mm, narrowly triangular, apex acute, green, glabrous. *Lateral sepals* 2, c. 2 by < 1 mm, free, ovate, apex mucronate, base obtuse, green, scabrous. *Lower sepal* c. 15 by 7 mm, 5 mm deep, navicular, apex mucronate, base obtuse, pinkish white, reddish white, or white, with yellow lines at the centre, pilose, dorsal part abruptly constricted into an incurved spur, up to 30 mm long, pink with green at tip. *Dorsal petal* c. 20 by 27 mm, broadly obovate, cucullate to flat, apex obcordate and mucronate, base obtuse, white to pink to red to variegate, glabrous, abaxial midvein with a keel-shaped crest. *Lateral united petals* free: the upper petals c. 15 by 20 mm, broadly obovate, apex emarginate, base cuneate, white to pink to red to variegate; the lower petals 18 by 24 mm, free, broadly obovate, apex emarginate, white to pink to red to variegate, glabrous. *Stamens*: filaments c. 3 mm long, pale pink; anthers pinkish white. *Ovary* 5-locular, c. 4 mm long, green, densely pilose. *Fruits* c. 9 mm long, 4 mm diam, fusiform, 5-lobed, green, densely pilose. *Seeds* 3–4 mm long, globose; seed coat granulate.

**Phenology** — Flowering: October to March; fruiting: September to March.

**Distribution** — Very common, with a wide distribution from India to Indonesia. This species is also cultivated as garden ornamental.

**Ecology** — Cultivated in gardens and along roadsides, 0–1700 m altitude.

**Other collections examined.** MYANMAR, Chin State, *Ling Shein Mang* 092955 (MBK MBK0250394), around Kanpetlet, Natma Taung National Park, alt. 1350 m, semi-evergreen forest, along stream, 1 July 2013; *Wall. Cat. no.* 4733 (K K001039791), Irrawaddy river, 1826.

**Notes** — Linnaeus (1753) did not clearly designate the type in the protologue but the specimen *Anonymous s.n.* (LINN-HL1053.5) was deposited at the Linnean Society of London Herbarium (LINN) and was labelled with number 5, which likely represents the species number of *I. balsamina* in the Species Plantarum.

*Impatiens balsamina* is highly variable in colour. It is unclear whether this variation is natural or represents selective breeding of cultivars.

This species has already been widely cultivated a long time ago (Dodoens 1583), so it is very difficult to identify whether populations are wild or cultivated.

### 38. *Impatiens curvipes* Hook.f. — Map 14; Plate 3d

*Impatiens curvipes* Hook.f. (1905) 25, 32; W.J.Kress et al. (2003) 169; non *Impatiens curvipes* sensu T.Shimizu (1970) 196. — Type: *Collett* 47 (lecto, designated here K K000694694; isolecto K K000694695), Myanmar, Shan States, Shan Hills, alt. 4000 ft (1219 m), Nov. 1887.

Terrestrial, annual, glabrous herb, 30–40 cm tall. Stem erect, 2–2.5 mm diam, solitary or rarely branched, red to reddish green, glabrous to remotely pilose. *Leaves* spirally arranged, sometimes decussate at the lower nodes of the stem, mostly congested at apex of stem. *Petiole* sessile–9 mm long, c. 1.5 mm diam, pale green, pilose. *Lamina* 20–80 by 13–30 mm, ovate to elliptic to obovate, apex acute, base cuneate, margin serrate, adaxial green with white base and pilose, abaxial greyish green and remotely pilose, with 2–4 pink hairs on each side of margin near the base, up to 2 mm long; lateral veins 3 or 4 pairs. *Flowers* solitary, axillary, erect, 17–18 by 18–12 mm, 13–15 mm deep, pink. *Pedicel* 20–22 mm long, c. 1 mm diam, cylindrical, green, pilose. *Bracts* c. 1 by < 1 mm, linear, apex acute, base obtuse, margin entire, without glands, green,

pilose, persistent. *Lateral sepals* 2, c. 1 by < 0.5 mm, free, linear to ovate, apex acuminate, base cuneate, pale green, glabrous. *Lower sepal* 5–6 by 3–3.5 mm, 8–10 mm deep, navicular, apex acuminate and mucronate, pink, distal part tapering into an incurved spur, 13–15 mm long. *Dorsal petal* c. 8 by 13 mm, broadly elliptic, cucullate, apex round, base obtuse to cordate, pink, glabrous, pilose at midrib, abaxial midvein with a keel-shaped crest, 2 mm wide. *Lateral united petals* 15–17 mm long, free: the upper petals c. 5 by 4 mm, orbicular, apex round to truncate, base cuneate to obtuse, deep pink; the lower petals 10–13 by 7–10 mm, free, obliquely ovate to rhombic, apex obtuse, pink with white and yellow mark at the base. *Stamens*: filaments 3.5–4 mm long, pink; anthers green to pale pink. *Ovary* 3.5–4 mm long, < 1 mm diam, 5-carpellate, green, pilose. *Fruits* c. 12 mm long, c. 6 mm diam, fusiform, 5-lobed, green, pilose. *Seeds* c. 25, ellipsoid, c. 1.5 mm long.

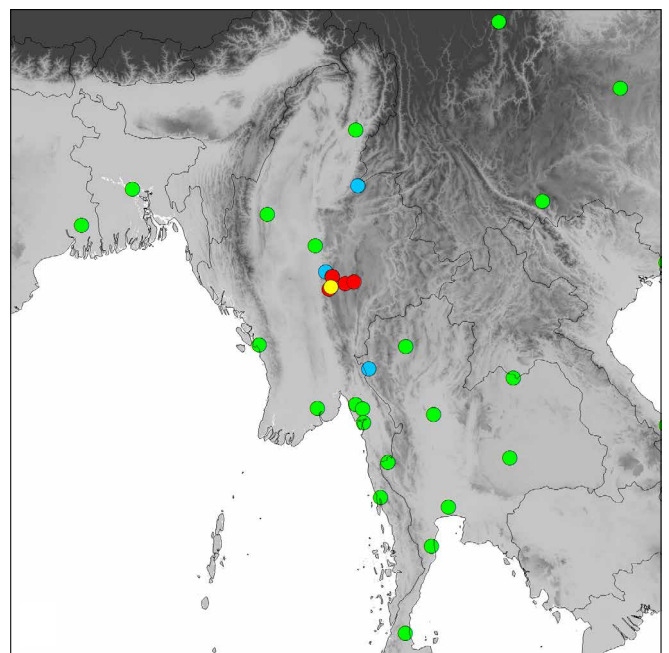
**Phenology** — Flowering: September to November; fruiting: September to November.

**Distribution** — Endemic to Myanmar (southern Shan State).

**Ecology** — Growing in shady or open areas in mixed deciduous forest, locally abundant, 1200–1800 m altitude.

**Other collections examined.** MYANMAR, Shan State, *Melville* 60 (BM), Taunggyi district, Kalaw Township, alt. 3500 ft, 25 Nov. 1903; *Tanaka et al.* 080208 (QBG QBG61265), Kalaw Township, Yae Aye Kan, N20°35'41" E96°31'46", alt. c. 1200 m, 26 Nov. 2008; *Srisanga et al.* M1-271 (QBG QBG80456), Pindaya Township, Pin Sein Pin Village, N20°59'01.73" E96°37'56.07", alt. c. 1714 m, 14 Dec. 2014; *Ruchisansakun et al.* 718 (L L2071086, RAF, RANG), Taunggyi district, Thansen cave, N20°49'00.46" E97°20'06.24", alt. 1259 m, 18 Sept. 2015; *Ruchisansakun et al.* 721 (L L2071094, RAF, RANG), Taunggyi district, on the way to Shwephonpwiat, N20°46'12.47" E97°03'31.42", 19 Sept. 2015; *Ruchisansakun et al.* 731 (L L2071117, RAF, RANG), Taunggyi district, Pindaya, N20°58'49.53" E96°37'41.62", alt. 1742–1909 m, 26 Sept. 2015; *Craddock s.n.* (K K000694696), southern Shan States, alt. 4800–5800 ft (1463–1768 m), Oct. 1901; *Collett* 949 (K K000694695), *ibid.*, Nov. 1888; *Khalil s.n.* (K K000694697), Shan State, Taunggyi, 1893; *Robertson* 353 (K), *ibid.*, alt. 5000 ft, 26 June 1911; U MG Gale2 12159 (RAF966012, 2 sheets), *ibid.*, 27 Sept. 1970.

**Notes** — *Impatiens curvipes* can be easily distinguished from other taxa by its high keel-shaped crest on the abaxial side of the dorsal petal and small upper lateral petals. It is most similar to *I. florulenta* but differs in having a flat instead of a cucullate dorsal petal, and strongly decurved, instead of spreading or slightly recurved pedicels at fruiting stage. It usually has a



**Map 14** Distribution of *Impatiens decurva* Ruchis. & S.B.Janssens (●), *I. balsamina* L. (●), *I. curvipes* Hook.f. (●) and *I. florulenta* Hook.f. (●).

white leaf base, which is distinct from other species and also detectable in dried herbarium specimens.

Hooker (1905) published *I. curvipes* but did not designate a type. He wrote this name on some specimens in Kew. We select *Collett 47* (K000694694) as lectotype because its locality matches the prologue and it is a complete specimen with detailed illustrations.

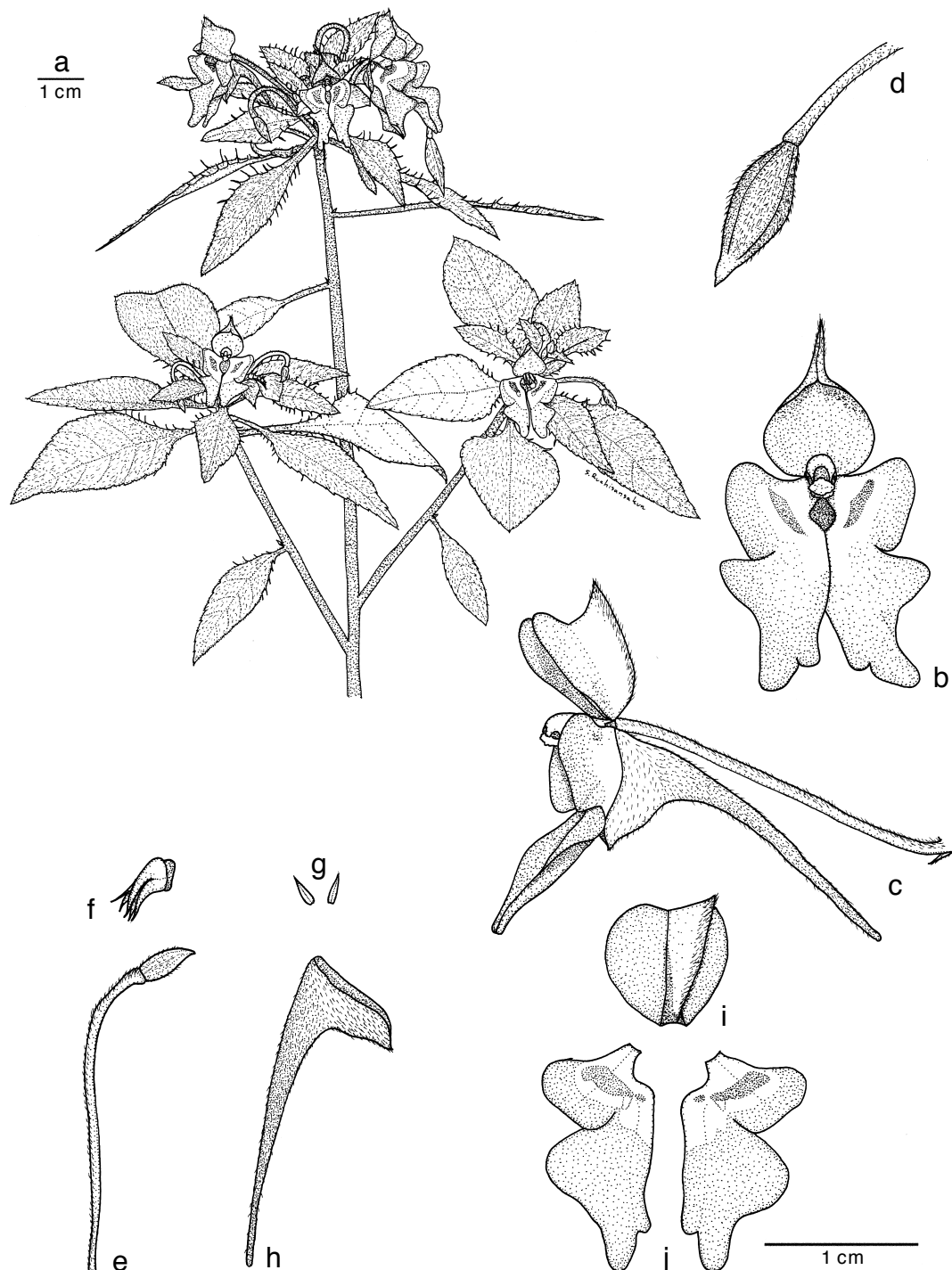
**39. *Impatiens florulenta* Hook.f. — Fig. 16; Map 14; Plate 3e**

*Impatiens florulenta* Hook.f. (1905) 25, 32; W.J.Kress et al. (2003) 169. — Type: *Khalil s.n.* (lecto, designated here K K000694673), Myanmar, southern Shan State, Saga, 1893.

*Impatiens curvipes* sensu T.Shimizu (1970) 196, non Hook.f.

Terrestrial, annual herb, 15–45 cm tall. *Stem* erect, cylindrical, 2–4 mm diam, sometimes swollen at nodes, richly branched,

red to green, glabrous, remotely pilose towards apex. *Leaves* decussate at first basal node, otherwise spirally arranged, usually congested at apex of stem. *Petiole* 15–45 mm long, c. 1 mm diam, angular, green to pink, nearly glabrous, remotely pilose. *Lamina* 40–60 by 20–35 mm, ovate to elliptic, apex acute to acuminate, base attenuate, margin serrate, adaxial green and pilose, abaxial pale green and remotely pilose, with 3–many long red hairs along the margin near the base; lateral veins 4–6 pairs. *Flowers* solitary, axillary, erect, 19–25 by 10–13 mm, 20–25 mm deep, pink with white centre. *Bracts* c. 1 by < 1 mm, linear to narrowly lanceolate, apex acute and mucronate, base cuneate, green with red apex, persistent. *Pedice*l 25–27 mm long, c. 1 mm diam, red to green, pilose. *Lateral sepals* 2, c. 1 by < 1 mm, free, linear to narrowly lanceolate, apex acute, base obtuse, pale green with red tip, glabrous. *Lower sepal* 7–8 by 3–4 mm, 3–4 mm deep, navicular, apex acuminate



**Fig. 16** *Impatiens florulenta* Hook.f. a. Habit; b. front view of flower; c. lateral view of flowers; d. fruit; e. pedicel and ovary; f. stamens; g. lower lateral sepals; h. lower sepal; i. dorsal petal; j. lateral united petals. — Drawn by Saroj Ruchisansakun.

and mucronate, white to pale pink, pilose outside, distal part gradually tapering into a straight spur, 15–16 mm long, pink with red tip. *Dorsal petal* 7–8 by 8–9 mm, obovate to broadly obovate to orbicular, cucullate, apex emarginate, base obtuse to round, pink, glabrous with pilose midrib, abaxial midvein with a keel-shaped crest, c. 3 mm wide, pink to white. *Lateral united petals* 14–15 mm long, free: the upper petals c. 6 by 4–5 mm, orbicular to obovate, apex round, base cuneate, pink with white base, and deep pink lines at the base; the lower petals 11–12 by 6–7 mm, free, broadly lanceolate to broadly ovate to broadly elliptic, apex unequally bilobed, pink with white base, sometimes with small yellow mark at the base. *Stamens*: filaments c. 4 mm long, white to pink; anthers pink. *Ovary* 4 mm long, c. 1 mm diam, 5-carpellate, green, pilose. *Fruits* 10–11 mm long, 4–5 mm diam, fusiform, 5-lobed, green, pilose with short hairs. *Seeds* 17–20, c. 1.5 mm long, ovoid, brown.

**Phenology** — Flowering: September to October; fruiting: September.

**Distribution** — Myanmar (Shan State), northern Thailand.

**Ecology** — Growing in open or shady areas in mix deciduous forest, 1150–1300 m altitude.

**Other collections examined.** MYANMAR, Shan State, *Ruchisansakun et al.* 736 (L L2071132, MAND, RAF), Taunggyi District, N21°08'00.68" E96°24'44.97", alt. 1150 m, 29 Sept. 2015.

**Notes** — *Impatiens florulenta* is most similar to *I. curvipes* but differs in having a cucullate dorsal petal, a spreading or slightly recurved pedicel in fruiting stage, and fruits with short hairs, while *I. curvipes* has a flat dorsal petal and strongly decurved pedicel in fruiting stage. Hooker (1905) mentioned that this species is characterized by a glabrous fruit, yet the type specimen has pilose fruits (with short hairs). The population in Thailand was misidentified as *I. curvipes* (Shimizu 1970).

Similar to many taxa in Hooker (1905), Hooker did not designate a type of *I. florulenta*. We found only one specimen (with an illustration), *Khalil s.n.* (K000694673), on which the name *I. florulenta* is based and which matches the protologue, except pilose fruits, so we selected it as lectotype.

#### 40. *Impatiens oblongata* Ruchis. & Niet — Map 15; Plate 3f

*Impatiens oblongata* Ruchis. & Niet (in Ruchisansakun et al. 2018) 70. — Type: *Ruchisansakun & Makino BG Exped.* 735 (holo L L2071128; iso L L2071129, L L2071130, L L2071131, RAF, RANG), Myanmar, Shan State, Kalaw, N20°39'24" E96°34'96", alt. 1569 m, 27 Sept. 2015.

Terrestrial, annual herb, 30–50 cm tall. *Stem* erect, 1–4 mm diam, angular, simple, or moderately to richly branched, red, glabrous, only remotely pilose towards apex. *Leaves* spirally arranged. *Petiole* 3–10 mm long, c. 1 mm diam, pale green to pink, pilose. *Lamina* 50–75 by 10–20 mm, lanceolate to narrowly ovate, apex acute, base cuneate to attenuate, margin serrate, adaxial green, abaxial pale green, pilose on both sides, with 3–5 long red hairs along the margin near the base; lateral veins 6 or 7 pairs. *Inflorescence* axillary, erect, solitary. *Flowers* 19–20 by 16–18 mm, 14–17 mm deep, pink, with small dark pink dots and small yellow dots at the centre. *Bracts* c. 2 mm by < 1 mm, linear, apex acute, base cuneate, green with red apex, pilose, persistent. *Pedicel* 18–20 mm long, < 1 mm diam, pink, pilose. *Lateral sepals* 4, sometimes the upper pair reduced: the upper pair c. 2 by < 1 mm, sometimes absent, linear to oblong, apex acute, base cuneate, pale green with red tip, pilose; the lower pair 1.5–2 by 1.5–2 mm, ovate, apex acuminate, base obtuse, pink, glabrous. *Lower sepal* 5–6 by 3–4 mm, 3–4 mm deep, navicular, apex acuminate and mucronate, pale pink with dark pink mark near the base, pilose outside, distal part abruptly constricted into a straight or curved spur, 8–12 mm long, pink with dark pink tip. *Dorsal petal* 5–6 by 6–9 mm, broadly obovate, flat, apex truncate and stipitate, up to 2 mm long, base

truncate, pink with green stipitate tip, glabrous with pilose midrib and tip, abaxial midvein with an acute appendage, < 1 mm tall, pink or green. *Lateral united petals* 12–14 mm long, free: the upper petals 7–8 by 4–5 mm, broadly oblong, apex truncate to slightly emarginate, base cuneate, pink; the lower petals 10–11 by 4–5 mm, free, elliptic to obovate, apex truncate to slightly bilobed, pink with yellow dot and dark pink dot at the base. *Stamens*: filaments c. 2.5 mm long, pale pink; anthers pale pink. *Ovary* c. 2 mm long, c. 1 mm diam, 5-carpellate, green, pilose with short hairs. *Fruits* 15–20 mm long, 4–5 mm diam, fusiform, 5-lobed, green, pilose with short hairs. *Seeds* 6 or 7, c. 3 mm long, ovoid, brown.

**Phenology** — Flowering: September to October; fruiting: September to October.

**Distribution** — Endemic to north-eastern Myanmar (Shan State), only known from the type locality.

**Ecology** — Growing in shady areas at the top of the mountain in open fragmented evergreen forest, 1500–1600 m altitude.

**Note** — *Impatiens oblongata* usually has four lateral sepals, rarely two, in contrast to similar species, such as *I. patula*, *I. violiflora*, *I. curvipes* and *I. florulenta*.

#### 41. *Impatiens violiflora* Hook.f. — Map 15; Plate 3g

*Impatiens violiflora* Hook.f. (1875) 457 (as '*Impatiens violæflora*'); (1905) 26, 32; Toppin (1920) 352; T. Shimizu (1970) 198; W.J. Kress et al. (2003) 170; Wu (2006) 76. — *Impatiens violiflora* Hook.f. in Craib (1926b) 214. — Type: *Lobb s.n.* (lecto, designated here K K000694901), Myanmar, Mon State, Moulmain (Mawlamyine).

*Impatiens aureliana* Hook.f. (1908) t. 2851; (1909) 7; (1911a) 616; Y.L. Chen et al. (2007) 58, syn. nov. — Type: *Prince d'Orléans s.n.* (holo P00780659), Indo-China, 30 June 1892.

Terrestrial, annual herb, up to 50 cm tall. *Stem* erect, c. 6 mm diam, moderately branched, green, glabrous to pilose towards apex. *Leaves* spirally arranged, sometime decussate to subopposite at the lower nodes. *Petiole* up to 20 mm long, c. 2 mm diam, cylindrical, green to red, with many glandular hairs, pilose. *Lamina* up to 75 by 30 mm, ovate to ovate-oblong, apex acute to acuminate, base attenuate, margin serrate, papyraceous, green pilose on both sides, with many glandular hairs at the margin in basal third of the leaf; lateral veins 6 or 7 pairs. *Inflorescence* axillary, erect, 1- or 2-flowered fascicle. *Flowers* c. 25 mm long, pink. *Pedicel* c. 35 mm long, c. 1 mm diam, green, pilose. *Bracts* c. 2 by 1 mm, linear, apex acute, pink, pilose. *Lateral sepals* 2, c. 2 by 1 mm, free, ovate, apex acute, base cuneate, brownish green, glabrous. *Lower sepal* c. 7 by 7 mm, 6 mm deep, navicular, apex mucronate, base obtuse, pinkish white, pilose outside, dorsal part abruptly constricted into a narrow slightly incurved spur, up to 32 mm long, pink with dark pink tip. *Dorsal petal* c. 14 by 22 mm, broadly obcordate, flat, apex emarginate, base round, pink, glabrous to pilose on midrib, abaxial midvein with narrow crest, green tip. *Lateral united petals* free: the upper petals 12 by 8 mm, obovate, apex obtuse to truncate, base cuneate, pink; the lower petals c. 13 by 8 mm, free, obovate, apex obtuse, pink, with yellow spot at the base, glabrous. *Stamens*: filaments c. 3 mm long, white; anthers purple. *Ovary* c. 3 mm long, 5-locular, green, pilose. *Fruits* c. 15 mm long, c. 8 mm diam, fusiform, 5-lobed, green, pilose. *Seeds* 6–8.

**Phenology** — Flowering: June to December; fruiting: July to December.

**Distribution** — Myanmar (Kachin State, Mandalay Region, Shan State, Kayin State, Tanintharyi Region), China (Yunnan Province), Thailand (Chiang Mai, Chiang Rai, Prachin, Kanchanaburi, Tak), Vietnam.

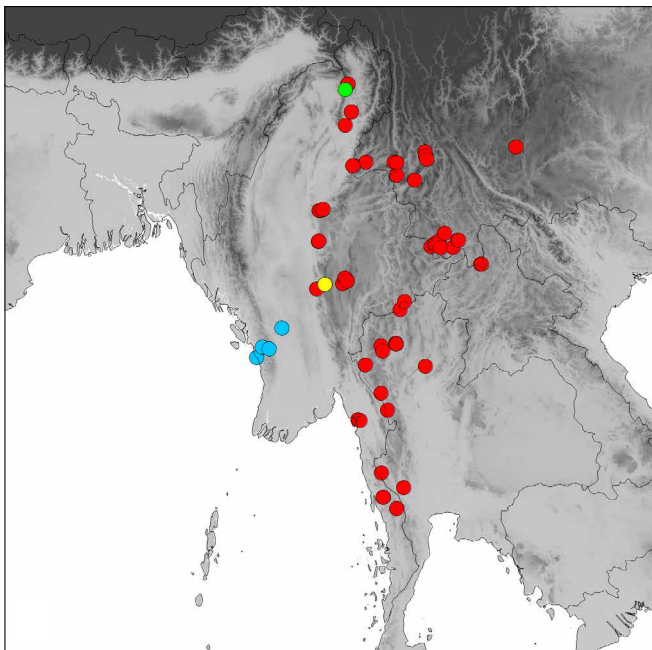
**Ecology** — Growing in open areas, along roadsides in evergreen forest or mixed deciduous forest, abundant when present, 550–1450 m altitude.

**Other collections examined.** MYANMAR, Kachin State, *Buchanan* 4 (E E00752726, K H2015/00092 161), Myitkyina, Suma Hills, alt. 3000–4000 ft (914 m), 30 Nov. 1910; *Buchanan* 5565 (K H2015/00092 164, H2015/00092 165), Myitkyina, Suma Hills, near side of Irawaddy, alt. 3500–5000 ft, 29 Oct. 1911; *Toppin* 2679 (K), Sinlum; *Keenan* et al. 3899 (RAF7466/3, 2 sheets), Sumprabum subdivision, N26°40' E97°20', alt. 5000–7000 ft, Mar. 1962; Mandalay Region, *Lace* 5496 (E E00752727; K H2015/00092 163, H2015/00092 166), Pyin Oo Lwin district (Maymyo), Anisakam falls, alt. 2500 ft, 15 Oct. 1911; *Ruchisansakun* 759 (L L2071189, L L2071190), Mogok, Mogok along the roadside, N22°54'10.9" E96°23'53.0", alt. 1390 m, 22 Nov. 2015; *Ruchisansakun* 762 (L L2071199, L L2071200, L L2071201, L L2071202), Mogok, Mintatar quarter, N22°55'03.7" E96°28'39.6", alt. 1134 m, 23 Nov. 2015; *Lace* 5983 (E E00752725, E E00752728, K H2015/00092 162), Ruby Mines district (Mogok), Wapundaung, alt. 1000–5000 ft; *Daw Nilar Khin & Daw Nu Nu Yee* 31 (RANG), Yamethin district, Momi Taung, 16 Oct. 2002; Shan State, *Ruchisansakun* 723 (L L2071099, L L2071100, L L2071101, MAND, RAF, RANG), Taunggyi district, N20°50'59.09" E97°14'13.67" and Lomkok mountain, N20°49'03.45" E97°13'28.19", alt. 1169–1191 m, 20 Sept. 2015.

**Note** — In previous studies, populations from Myanmar and Thailand were identified as *I. violiflora*, whereas populations from China and Indochina were identified as *I. aureliana* (Hooker 1911a, Chen et al. 2007). However, *I. aureliana* cannot be distinguished morphologically from *I. violiflora*. It seems to have smaller flowers, but we observed that *I. violiflora* is characterized by extensive size variation with regard to both floral and vegetative parts, even within the same population. Furthermore, the long red hairs and glands at the base of the lamina and petioles were mentioned as distinct characters of *I. aureliana*, but we also found these in *I. violiflora* (Wu 2006). Hence, we decided to synonymize *I. aureliana* under *I. violiflora*. Hooker (1875) did not designate a type *I. violiflora*. We found only *Lobb s.n.* (K000694901), which matches the protologue. Hence, we designate it as lectotype. For *I. aureliana*, we believe that specimen P00780659 is the holotype because it is the only specimen that matches the protologue and the drawing on this specimen is exactly similar to the illustration in the protologue (Hooker 1908).

#### 42. *Impatiens mokimi* Hook.f. — Map 15

*Impatiens mokimi* Hook.f. (1905) 26; W.J.Kress et al. (2003) 170. — Type: *Mokim s.n.* (lecto, designated here K K000694787), Myanmar (Burma), upper Burma, Kachin Hills, 1897.



**Map 15** Distribution of *Impatiens oblongata* Ruchis. & Niet (●), *I. violiflora* Hook.f. (●), *I. mokimi* Hook.f. (●) and *I. allanii* Hook.f. (●).

Annual herb, c. 16 cm tall. *Stem* erect, c. 1 mm diam, moderately branched, glabrous. *Leaves* spirally arranged but decussate at the two lowest nodes. *Petiole* 7–9 mm long, glabrous. *Lamina* 30–42 by 8.5–10 mm, narrowly elliptic, apex acute, base attenuate, margin serrate, adaxial pilose to densely pilose, abaxial glabrous to pilose, with 1 or 2 long hairs along the margin near lamina base and 2–5 globose glands on each side of petiole; lateral veins 4 or 5 pairs. *Flowers* solitary, axillary, erect, c. 7.5 by 7 mm, c. 13 mm deep, pink. *Bracts* linear. *Pedicel* 19.5 mm long, pilose. *Lateral sepals* 2, c. 1 mm long, obliquely ovate, apex acute and mucronate, base obtuse, green. *Lower sepal* c. 3 mm long, 2.5 mm deep, navicular, apex acute and mucronate, glabrous to pilose, distal part rapidly constricted into a slender spur, 19 mm long. *Dorsal petal* c. 4 by 6 mm, broadly oblanceolate, flat, apex truncate, base cuneate, glabrous, abaxial midvein simple or with narrow crest. *Lateral united petals* 4.5–5 mm long, free: the upper petals c. 3.5 by 2.5 mm, broadly oblanceolate, apex truncate, base cuneate; the lower petals c. 3.5 by 4 mm wide, free, broadly oblanceolate, apex truncate. *Stamens*: filaments c. 2.5 mm long. *Ovary* 1.5–2 mm long, 1 mm diam, pilose. *Fruits* fusiform, turgid in the middle, narrowed at both ends. *Seeds* unknown.

Phenology — Unknown.

Distribution — Endemic to northern Myanmar (Kachin Hills).

Ecology — Unknown.

**Notes** — *Impatiens mokimi* is similar to *I. violiflora* but differs in having smaller flowers and narrowly elliptic leaves with a cuneate base. More information is required to infer its status. Hooker (1905) did not designate a type of *I. mokimi*. We found only one specimen, *Shaik Mokim s.n.* (K000694787), written *I. mokimi* with an illustration that matches the protologue, so we selected it as the lectotype.

#### 43. *Impatiens allanii* Hook.f. — Map 15; Plate 3h

*Impatiens allanii* Hook.f. in Ridley (1914) 325; Prain (1922) t. 3038; W.J.Kress et al. (2003) 169. — Type: *Allan s.n.* (holo K K000694629), Myanmar, Henzada, S. Mayanaung Reserve, Kyibin Chaung.

Terrestrial, annual, glabrous herb, 37–70 cm tall. *Stem* erect, 3–30 mm diam, solitary or rarely branched, green to red, glabrous. *Leaves* decussate. *Petiole* 10–40 mm long, 1.5–2 mm diam, red to green, glabrous. *Lamina* 55–120 by 30–50 mm, ovate to elliptic to obovate, apex acute, base obtuse to cuneate to attenuate, margin shallowly crenate, adaxial green, abaxial greyish green, with many long hairs on each side of margin near the base, up to 3 mm long; lateral veins 5 or 6 pairs. *Inflorescence* subterminal, erect, 7–10-flowered racemes. *Peduncle* 58–125 mm long, 1.5–3 mm diam, red or green, glabrous. *Rachis* 10–30 mm long, 1–1.5 mm diam. *Flowers* 28–47 mm long, pink, with yellow in some parts. *Pedicel* 10–20 mm long, c. 1 mm diam, green or green with red base, glabrous. *Bracts* 4.9–10 by 2–5 mm, ovate to elliptic to obovate, apex acute to acuminate and mucronate, base obtuse, margin entire, without glands, orange to red, glabrous, persistent. *Lateral sepals* 2, 5–8 by 4–7 mm, free, elliptic to ovate, apex round to acute and mucronate, base obtuse, yellow or orange or green, with red dots, glabrous. *Lower sepal* 10–11 by 6–6.5 mm, 2–3 mm deep, navicular, apex acuminate or mucronate, curved, yellow, sometimes with a pink arrow-shaped mark near apex, distal part abruptly constricted into a long spur, 40–73 mm long, red to pale pink. *Dorsal petal* 8–10 by 6–12 mm, ovate to broadly lanceolate, apex acute to obtuse, base ovate, truncate, or cordate, yellow, glabrous, abaxial midvein simple to with a narrow crest. *Lateral united petals* 28–37 mm long, free: the upper petals 1.5–6.5 by 1–4 mm, falcate to curved ovate, apex round or acute, base stipitate, sometimes with wavy margin inside, yellow; the lower petals 24–32 by 14–20 mm, free,

ovate to elliptic, apex acute to obtuse, pink with darker mark at the base. *Stamens*: filaments 3–4.5 mm long, yellow; anthers yellow. *Ovary* 3–4.5 mm long, 1–1.5 mm diam, 5-carpellate, green, glabrous. *Fruits* 12–15 mm long, 3–4 mm diam, fusiform, 5-lobed. *Seeds* c. 50, ellipsoid, c. 1 mm long.

Phenology — Flowering: July to January.

Distribution — Endemic to Myanmar (Ayeyarwady Region, Magway Region, Rakhine State).

Ecology — Growing along roadsides in open areas of ever-green forest. The species is also found near the beach, 10–900 m altitude.

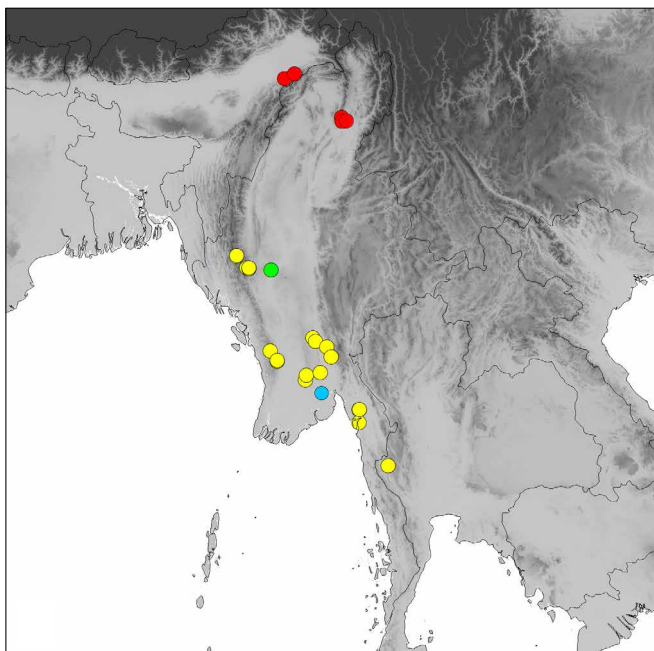
*Other collections examined.* MYANMAR, Magway Region, *Roger 1* (K), Thayetmyo, Ale Chaung, alt. 700 ft, 28 Oct. 1911; *Roger 2* (K), Sheolaung stream, alt. 750 ft, 3 Nov. 1911; Rakhine State, *Ruchisansakun & Saw-Lwin 700* (L L2071055, RAF, RANG), Thongup road, N18°39'51.5" E94°45'28.7", alt. 892 m; *Ruchisansakun & Saw-Lwin 703* (L L2071061, L L2071062, RAF, RANG), Thandwe district, Ngapali beach, N18°23'42.3" E94°20'16.8", alt. 18 m.

Note — *Impatiens allanii* has large, flat, bicoloured flowers with long spurs. It can grow in dry, open lowland areas but also in very humid conditions. Hence, this species is highly recommended for horticultural use. It is most similar to *I. bracteata* Colebr. ex Roxb. (Roxburgh & Carey 1824: 459) but differs in having bracts with entire margins, instead of ciliate ones. Ridley (1914) clearly mentioned *Allan s.n.* (K000694629) as type in the protologue and this specimen also includes a complete illustration drawn by Hooker that is exactly the same to the specimens.

#### 44. *Impatiens hartnolliae* Hook.f. ex Ruchis. & Suksathan — Map 16

*Impatiens hartnolliae* Hook.f. ex Ruchis. & Suksathan in Ruchisansakun et al. (2018). — Type: *Hartnoll s.n.* (holo K000694663), Myanmar (Burma), Rakhine State (Arakan), Akyab, Urittaung pagoda, 5 Sept. 1907.

Terrestrial, annual herb, up to 36 cm tall. *Stem* erect, c. 12 mm diam, richly branched, glabrous. *Leaves* spirally arranged. *Petiole* 6–12 mm long, c. 1 mm diam, glabrous. *Lamina* 110–120 by 45–50 mm, ovate to elliptic, apex acute to acuminate, base round to obtuse to cuneate, margin crenate to serrate, adaxial glabrous to remotely pilose, abaxial glabrous, with 2 or 3 pairs of long hairs along the margin near lamina base; lateral veins



**Map 16** Distribution of *Impatiens hartnolliae* Hook.f. ex Ruchis. & Suksathan (●), *I. parkinsonii* C.E.C.Fisch. (●), *I. peguana* Hook.f. (●) and *I. circaeoides* Wall. ex Hook.f. & Thomson (●).

8 or 9 pairs. *Inflorescence* subterminal, erect, 6- or 7-flowered racemes. *Peduncle* 10–15 mm long, c. 1 mm diam, glabrous. *Rachis* 7–14 mm long, c. 1 mm diam. *Flowers* c. 18 mm long, c. 15 mm wide, c. 23 mm deep. *Pedicel* 9–10 mm long, c. 1 mm diam, glabrous. *Bracts* 2.5–3.5 by 1.5–2 mm, ovate, apex acute to mucronate, base round, margin entire, glabrous, persistent. *Lateral sepals* 2, 6.2–6.6 by 7.5–8 mm, free, orbicular to broadly elliptic, apex round to mucronate, base round, glabrous. *Lower sepal* c. 10 mm long, c. 8 mm deep, navicular, apex acuminate to mucronate, glabrous, distal part gradually tapering into a straight or curved spur, 15–17 mm long. *Dorsal petal* c. 6.5 by 8 mm, broadly obovate, apex emarginate, base obtuse, truncate, glabrous, abaxial midvein simple or with a narrow crest. *Lateral united petals* c. 15.5 mm long, free: the upper petals 9–10 by 5–5.5 mm, obliquely broadly oblong, apex truncate and slightly emarginate, base cuneate; the lower petals 8.5–9 by 3.5–4 mm, free, oblong, apex truncate, base without auricle. *Stamens*: filaments 4–5 mm long; anthers obtuse. *Ovary* c. 3.5 mm long, c. 1 mm diam, glabrous. *Fruits* fusiform, glabrous. *Seeds* ellipsoid, c. 1.6–2 mm long, pilose.

Phenology — Flowering: September; fruiting: September.

Distribution — Endemic to Myanmar (Rakhine State).

Ecology — Growing in limestone soils.

Note — *Impatiens hartnolliae* can easily be distinguished from other Myanmar species by racemose inflorescence, truncate lateral united petals, an emarginate dorsal petal and a fusiform fruit.

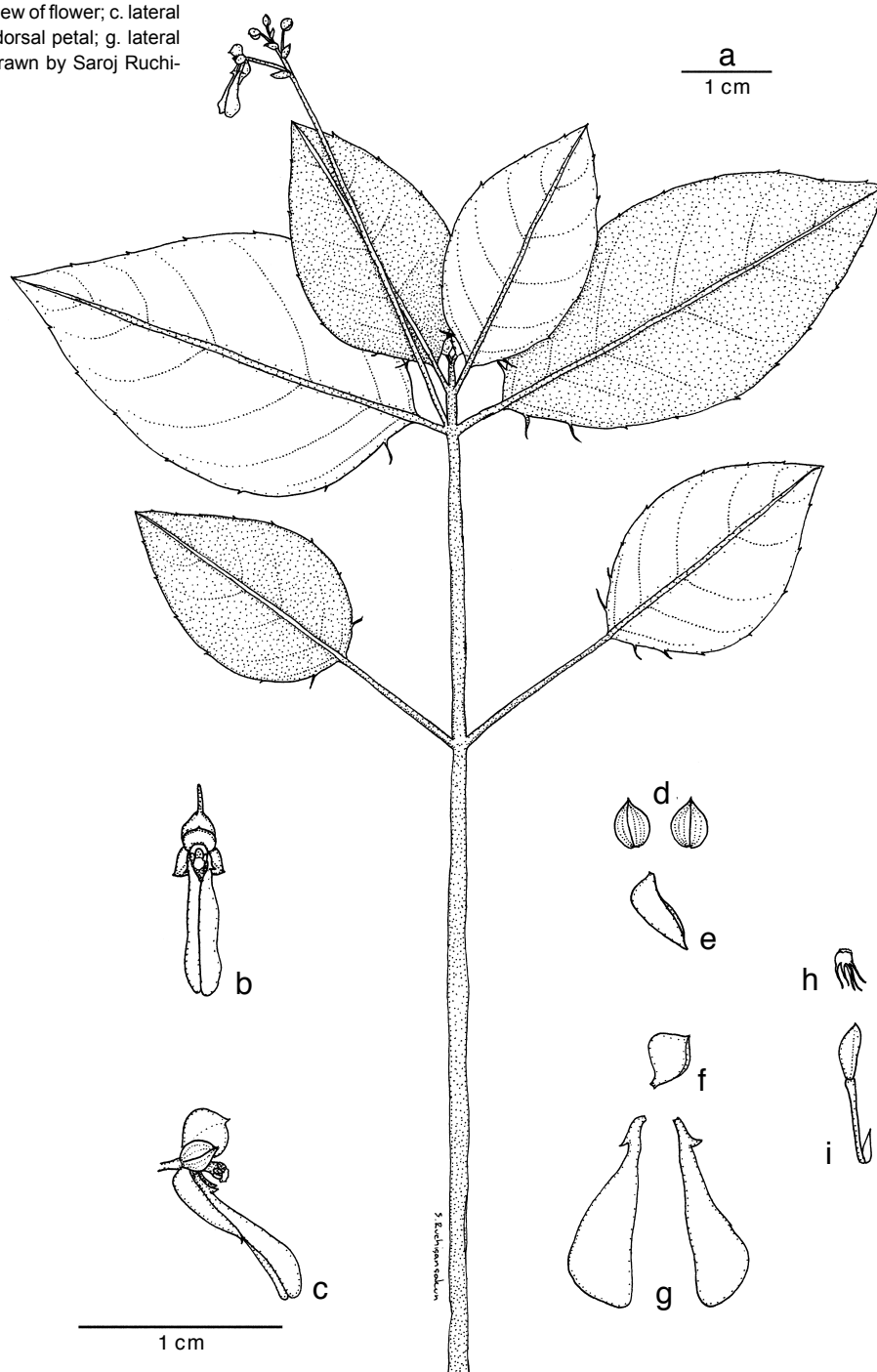
#### 45. *Impatiens parkinsonii* C.E.C.Fisch. — Map 16

*Impatiens parkinsonii* C.E.C.Fisch. (1926) 467; W.J.Kress et al. (2003) 170; Gogoi et al. (2015a) 383. — Type: *Parkinson 407* (lecto, designated in Gogoi et al. (2015a) K K000694778; isolecto K K000694779), Myanmar, Myitkyina district, Namti Chaung Feeder, 11 Dec. 1925.

*Impatiens hukaungensis* J.Murata & Nob.Tanaka in Tanaka et al. (2018) 23, syn. nov. — Type: *Jin Murata et al. 040920* (holo TI not seen; iso MBK not seen, RAF not seen), Myanmar, Kachin State, west of Shinbweyan, Tanai Township, Myitkyina district, N26°41'44"-57" E96°11'13"-23", 200–250 m alt., 8 Dec. 2005.

Perennial herb, 15–30 cm tall. *Stem* erect, but decumbent in the lower part, unbranched to rarely branched in the lower part, ridged or slightly winged, pilose. *Leaves* spirally arranged. *Petiole* absent–13 mm long, flat, glabrous. *Lamina* (20–)44–70 by (5–)14–20 mm, oblanceolate to narrowly ovate, apex acute, base cuneate to attenuate, margin shallowly crenate with small teeth, glabrous, no distinct gland; lateral veins 4–8 pairs. *Inflorescence* axillary, erect, (1–)6–14-flowered raceme. *Peduncle* 45–55 mm long, glabrous. *Rachis* 5–20 mm long. *Flowers* c. 12 mm long, c. 7 mm deep, purple with deep purple streaks. *Bracts* 3–6 by 2–3.5 mm, ovate to elliptic, apex acute to acuminate and mucronate, base round to cuneate, margin entire without glands, yellowish green with pink tinge at the base, glabrous, persistent. *Pedicel* 5–10 mm long, green with pink tinge, glabrous. *Lateral sepals* 2, 4.5–6 by 3–4.5 mm, free, orbicular to obliquely ovate, apex round to acuminate and mucronate, base round to obtuse, membranous, yellowish green with pink tinge, glabrous. *Lower sepal* c. 7 mm long, 4 mm deep, navicular, apex acute, purplish white, distal part abruptly constricted into an incurved spur, 15–20 mm long, light purple. *Dorsal petal* up to 10 by 10 mm, ovate, cucullate to flat, apex obtuse, white with purple streaks, abaxial midvein simple. *Lateral united petals* c. 15 mm long, free, light purple: the upper petals up to 3 mm wide, triangular-ovate, apex acute, distinctly clawed; the lower petals, up to 7 mm wide, dolabriform, apex acute to obtuse, basal auricles present, up to 1 mm wide, brown. *Stamens*: anthers obtuse. *Fruits* up to 9 mm long, 3 mm diam, fusiform, 5-lobed, greenish with purple tinge, glabrous; pedicels at fruiting stage up to 12 mm long. *Seeds* 4 or 5, black, smooth.

**Fig. 17** *Impatiens peguana* Hook.f. a. Habit; b. front view of flower; c. lateral view of flowers; d. lateral sepals; e. lower sepals; f. dorsal petal; g. lateral united petals; h. stamens; i. ovary and pedicel. — Drawn by Saroj Ruchisansakun.



Phenology — Flowering: July to December; fruiting: December.

Distribution — Myanmar (Kachin State), India (Arunachal Pradesh, Nagaland) (Gogoi et al. 2015a).

Ecology — Growing in water or rocky places near streams, 900–1000 m altitude.

*Other collection examined.* MYANMAR, Kachin State, Maung Po Khanh 1873 (SING SING0150198), Myitkyina District, Pidaung Reserve, 7 July 1926.

**Note** — *Impatiens parkinsonii* is very different from all other *Impatiens* species in Myanmar. The most similar species is *I. rangoonensis*, but *I. parkinsonii* has smaller flowers, as well as an oblanceolate to narrowly ovate leaf lamina. It is also similar to *I. acuminata* Benth. ex Hook.f. & Thomson (1860: 145) but differs in having a longer peduncle and ovate to elliptic bracts. *Impatiens hukaungensis* was just published this year (Tanaka et al. 2018), but its description and photographs are exactly similar to *I. parkinsonii*.

**46. *Impatiens peguana* Hook.f. — Fig. 17; Map 16**

*Impatiens peguana* Hook.f. (1905) 29, 34; Fedde (1905) 433; W.J.Kress et al. (2003) 170. — Type: *M'Clelland s.n.* (lecto, designated here K 000694711), Myanmar, Pegu.

Annual herb, 11–21.5 cm tall. *Stem* erect, c. 2 mm diam, cylindrical, unbranched, glabrous. *Leaves* decussate. *Petiole* 7–21 mm long, c. 1 mm diam, glabrous. *Lamina* 42–48 by 22–26 mm, ovate, apex acute, base obtuse to round and attenuate, margin shallowly crenate with small teeth, adaxial glabrous, abaxially pilose, with 1–3 pair(s) of long hairs near lamina base, up to 1.5 mm long; lateral veins 5 or 6 pairs. *Inflorescence* axillary, erect, 4–6-flowered raceme. *Peduncle* 32–42 mm long, c. 0.5 mm diam, glabrous. *Rachis* 4–6 mm long, < 0.5 mm diam. *Bracts* 1.5–2 by c. 1 mm, ovate, apex acuminate and mucronate, base obtuse, glabrous, persistent. *Pedicel* 2–5 mm long, < 1 mm diam, glabrous. *Lateral sepals* 2, c. 2 by 1.6 mm, free, broadly ovate to orbicular, apex round and

mucronate, base round, glabrous. *Lower sepal* c. 3.5 mm long, 1 mm deep, navicular, apex mucronate, glabrous, spurless. *Dorsal petal* c. 2 by 2.5 mm, broadly elliptic, cucullate, apex round and mucronate, base obtuse, glabrous, abaxial midvein simple. *Lateral united petals* 7–8 mm long, free: the upper petals 1.5–2 by 0.5 mm, falcate, apex acute, base cuneate; the lower petals 6–7 by 2.5–3 mm, free, obovate, apex round, base without auricle, glabrous. *Ovary* c. 2 mm long.

Phenology — Unknown.

Distribution — Endemic to Myanmar (Bago Region).

Ecology — Unknown.

Notes — *Impatiens peguana* was included in *I. circaeoides* in the Flora of British India (Hooker 1875), but Hooker later decided to describe it as a new species (Hooker 1905: 34). It is very similar to *I. circaeoides*, *I. rangoonensis* and *I. tavoyana* and no differences can be found in vegetative morphology, based on the Hooker (1905) description that includes details on leaf arrangement. *Impatiens peguana* differs from the three above-mentioned species in having a spurless lower sepal and broadly ovate to orbicular lateral sepals. The authors have not seen living plants or any additional specimens beyond the type specimen. Consequently, the current description is based on the type. Hooker did not include a detailed description in the protologue (Hooker 1905).

Since Hooker did not designate a type, we select *M'Clelland s.n.* (K000694711), the only specimen we found with the name *I. peguana* and illustration, as lectotype.

**47. *Impatiens circaeoides* Wall. ex Hook.f. & Thomson — Map 16; Plate 4a**

*Impatiens circaeoides* Wall. ex Hook.f. & Thomson (1860) 114, 130; Hook.f. (1875) 453; (1905) 29, 34; W.J.Kress et al. (2003) 169. — *Impatiens circaeoides* Wall. (1831) 168, nom. nud., non *Impatiens circaeoides* Turcz. (1863) 594. — Type: *Wall. Cat. no. 4772B* (lecto, designated here K K001039868), Myanmar (Burma), Yangon (Rangoon), 16 Aug. 1826.

*Impatiens lineata* Turcz. (1859) 271. — Type: *Lobb 391* (holo KW001000649\*), Myanmar, Mon State, Mawlamyine (Moulmain).

*Impatiens brandisii* Hook.f. (1905) 29; W.J.Kress et al. (2003) 169, syn. nov. — Type: *Brandis s.n.* (lecto, designated here K K000694710; isolecto L L0388789), Myanmar, Tenasserim, at Thoungyeen.

Terrestrial, annual, glabrous herb, 25–35 cm tall. *Stem* erect, 2–5 mm diam, laxly branched, green. *Leaves* spirally arranged but decussate at the lowest node. *Petiole* 8–22 mm long, up to 1 mm diam, cylindrical, green, glabrous. *Lamina* 30–70 by 17–34 mm, ovate, apex acute to acuminate, base attenuate, margin shallowly crenate with many long hairs near the base, adaxial green, abaxial greyish green, glabrous, without glands; lateral veins 4–6 pairs. *Inflorescence* subterminal, in 12–14-flowered racemes. *Peduncle* 30–45 mm long, c. 1 mm diam, cylindrical, purple, glabrous. *Flowers* c. 20 by 13 mm, c. 8 mm deep, yellow. *Pedicel* 8–15 mm long, < 1 mm diam, green, glabrous. *Bracts* 1.5–2 by c. 0.5 mm, lanceolate, apex acute, base cuneate, margin entire, green, glabrous, persistent. *Lateral sepals* 2, 1.5–2.5 by c. 0.5 mm, free, linear to lanceolate, curved, apex acute to obtuse, base cuneate, green, glabrous. *Lower sepal* 5–7 by 2–3 mm, 1.5–22 mm deep, navicular, apex acute and mucronate, base obtuse, yellow, quite pellucid, with red reticulate lines, green apex, distal part abruptly constricted into a narrow incurved spur, 5.5–7 mm long, yellow with green tip. *Dorsal petal* c. 4.5 by 1.5–2 mm, ovate, cucullate, apex acute to obtuse, base cordate to round, yellow, glabrous, abaxial midvein simple. *Lateral united petals* 16–17 mm long, free: the upper petals 1.5–2 by 0.5–1 mm, falcate, apex acute, base stipitate, yellow; the lower petals 10–12 by 6.5–7 mm, free, obliquely ovate, apex round, base cuneate, yellow, glabrous. *Stamens*: filaments 2.5–3 mm long, white; anthers pale yellow to white. *Ovary* 2.5–3 mm long,

c. 1 mm diam, 5-carpellate, green, glabrous. *Fruits* 8–9 mm long, 2–3 mm diam, fusiform, 5-lobed, green, glabrous. *Seeds* 4–6, ellipsoid, c. 1.5 mm long, brown.

Phenology — Flowering: August to November; fruiting: August to January.

Distribution — Myanmar (Ayeyarwady Division, Bago Division, Chin State, Kayin State, Magway Division, Mon State, Rakhine State, Yangon Division), Thailand (Kanchanaburi Province).

Ecology — Growing in shady areas along roadsides in cloud forests or mixed deciduous forests, abundant at localities, 60–900 m altitude.

*Other collections examined.* MYANMAR, *Wall. Cat. no. 4772A* (para K K001039867), Pyay (Promé); Ayeyarwady Region, *Allan s.n.* (E E00753094), Hinthada (Henzada) district, Kyangin Reserve, 22 Sept. 1908; *Lace 3115* (K K000694712, 4 sheets), *ibid.*, May 1908; Bago division, *Rogers 5* (K 2 sheets), Tharrawaddy district, Myaung Chaung, west slope Pegu Yoma, 24 Nov. 1911; *Rogers s.n.* (E E00753095), Tharrawaddy district, Thapau Reserve, alt. 500 ft, 28 Oct. 1912; *Lacei 5400* (K 2 sheets), Toungoo, Kyunpadaung Range near Kyaukkyi, 11 Aug. 1911; *Lace 5034* (K), Toungoo district, Vujunpadaung Range, near Kyaukkyi, 11 Aug. 1911; *Lace 5033* (E E00753096, K), Bago division, Toungoo district, donyan chaung, pasrsura reserve, 19 Dec. 1909; *Kurz 1872* (K), Pegu Yomah, east and west slope, 7 Jan. 1971; Chin State, *Ling Shein Man & Ha Shein Aung 087435* (QBG QBG61273), Ma Kyauk Ah Village area, Kanpetlet Township, alt. c. 5000 ft, 24 June 2011; *Fujikawa, Srisanga, Maknoi, Tin Mya Soe, Ling Shein Man, Tun Tin & Law Shine 094311* (QBG QBG70790), along foot path and unpaved new car road between Kanpetlet and Yelong Pan village, Kanpetlet Township, Natma Taung National Park, alt. 1260–1435 m, N21°13'07.9" E94°03'46.4", 23 Aug. 2013.

Notes — Hooker cited *Wall. Cat. no. 4772* in the protologue of *I. circaeoides*. However, this number consists of two specimens; *Wall. Cat. no. 4772A* (K001039867) and *Wall. Cat. no. 4772B* (K001039868). We select the *Wall. Cat. no. 4772B* (K001039868) as the lectotype because it has an illustration by Hooker.

This species is similar to *I. tavoyana* but differs in having a linear incurved spur vs a globose spur.

*Impatiens circaeoides* Turcz. (1863: 594) is an illegitimate name and was synonymized under *I. goughii* Wight (1840: 160) by Hooker (1875).

We found two sheets of *Brandis s.n.* with the name *I. brandisii* with matching information to the protologue (Hooker 1905). We select *Brandis s.n.* (K000694710) as lectotype because it also has an illustration.

**48. *Impatiens rangoonensis* Hook.f. — Map 17; Plate 4b**

*Impatiens rangoonensis* Hook.f. (1905) 29, 34; Fedde (1905) 433; W.J.Kress et al. (2003) 170. — Type: *King 4772B* (lecto, designated here K K000694745), Myanmar, Rangoon, 14 Aug. 1879.

Terrestrial, annual, glabrous herb, 27–40 cm tall. *Stem* erect, cylindrical, 2–4 mm diam, sparsely branched, green. *Leaves* spirally arranged. *Petiole* 5–35 mm long, c. 1 mm diam, red. *Lamina* 45–85 by 30–42 mm, ovate to elliptic, apex acute, base obtuse to attenuate; lateral veins 4–6 pairs; margin shallowly crenate with many long hairs near the base, adaxial green, abaxial pale green. *Inflorescence* axillary, erect, in 9–16-flowered racemes. *Peduncle* 45–90 mm long, c. 1 mm diam, cylindrical, red, glabrous. *Rachis* 10–40 mm long, < 1 mm diam. *Flowers* 11–12 by 12–13 mm, 10–11 mm deep, pale pink. *Bracts* 2.5–3 by 1.5–2 mm, ovate, apex acute and mucronate, base cuneate to obtuse, green with red dots, bright green tip. *Pedicel* 5–8 mm long, < 1 mm diam, green, glabrous, persistent. *Lateral sepals* 2, 2.5–3 by 1.5–2 mm, free, elliptic, apex acute, base obtuse, green, glabrous. *Lower sepal* 5–6 by 3.5 mm, c. 3 mm deep, navicular, apex acuminate and mucronate, recurved, pale green, distal part rapidly constricted into a long spur, 18–21 mm long, pink with white tip, blunt. *Dorsal petal*



**Plate 4** a. *Impatiens circaeoides* Wall. ex Hook.f. & Thomson; b. *Impatiens rangoonensis* Hook.f.; c. *Impatiens tripetala* Roxb. ex DC.; d. *Impatiens porrecta* Wall. ex Hook.f. & Thomson; e. *Impatiens andersonii* Hook.f.; f. *Impatiens gongshanensis* Y.L.Chen; g, h. *Impatiens pulchra* var. *pulchra* Hook.f. — Photos by: a–e, g, h. Saroj Ruchisansakun; f. Saw-Lwin.

c. 4 by 3 mm, ovate, cucullate, pale green, apex acute and mucronate, base cordate, abaxial midvein simple or with a narrowly crescent-shaped crest. *Lateral united petals* 11–14 mm long, free: the upper petals c. 1 by 1 mm, orbicular, apex obtuse, base cuneate, white to pale green; the lower petals 8–12 by 5–7 mm, free, ovate, apex acute, base cuneate, pale pink with dark pink mark at the base. *Stamens*: filaments c. 2 mm long, white; anthers white. *Ovary* 2 mm long, < 1 mm diam, 5-carpellate, green, glabrous. *Fruits* 8–9 mm long, 2.5–3

mm diam, fusiform, 5-lobed, green, glabrous. *Seeds* 10–13, c. 2 mm long, brown.

**Phenology** — Flowering: July to August; fruiting: July to August.

**Distribution** — Endemic to Myanmar (Rakhine State, Yangon Region).

**Ecology** — Growing in shady areas near water canals along the roadside, 0–10 m altitude.

*Other collections examined.* MYANMAR, Rakhine State, *Ruchisansakun* & *Salwin* 702 (L L2071059, RAF, RANG), Thandwe district, N18°29'39.8" E94°22'23.6", alt. c. 13 m, 30 July 2015; Yangon Region, *Parkinson* 14634 (K H2015/00092), (Rangoon), Inyalake (Victoria Lake), 15 July 1932; *M'Clelland* s.n. (E E00753093), Rangoon.

**Notes** — The vegetative parts of *I. rangoonensis* are very similar to *I. circaeoides* but the flowers are distinctly different by virtue of its ovate sepals and long spur.

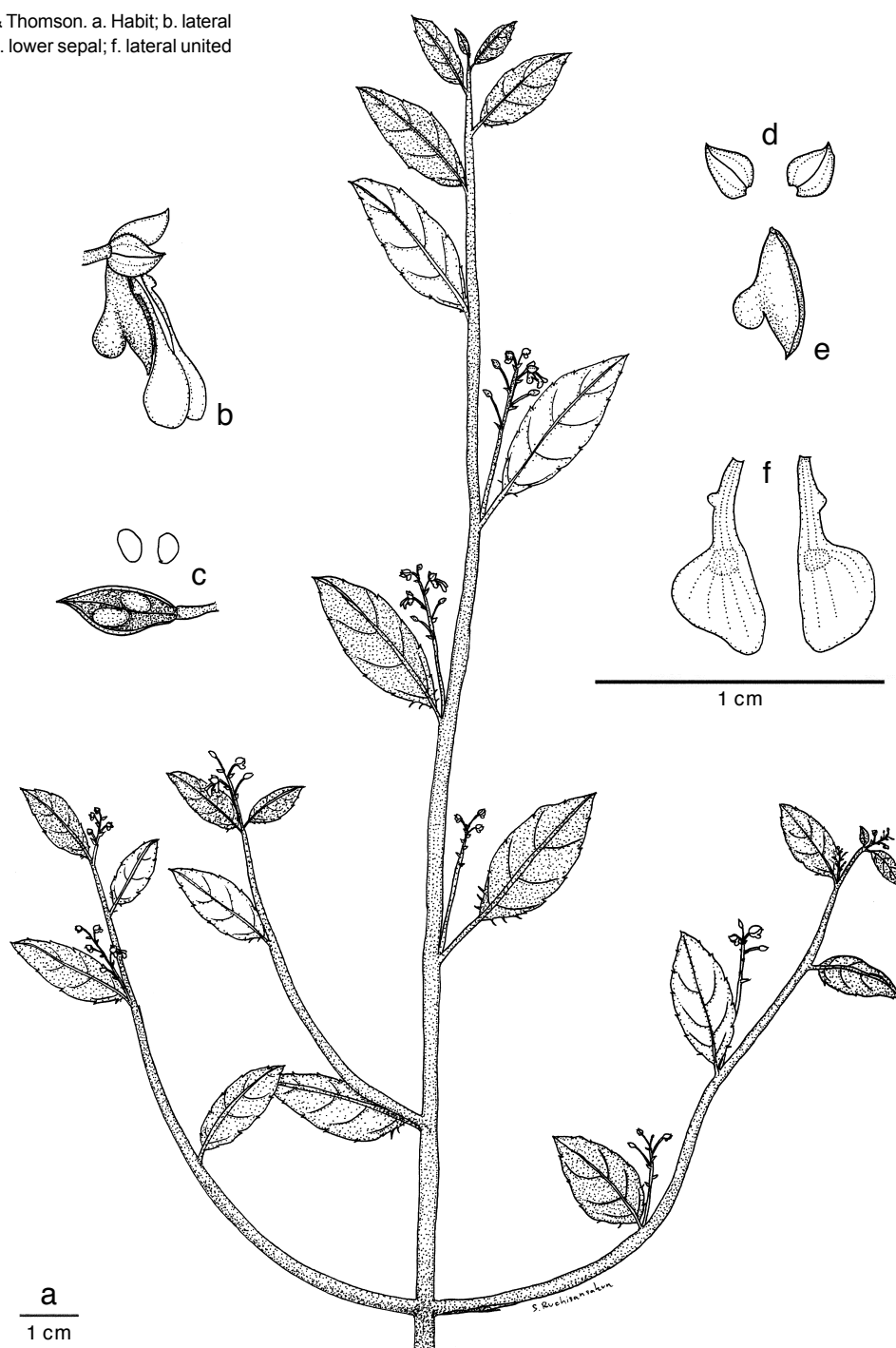
Hooker (1905) did not designate a type. We found only one specimen, *King* 4772B (K000694745), with the name *I. rangoonensis* on the sheet. It matches the protologue, so we selected it as lectotype.

**49. *Impatiens tavoyana* Benth. ex Hook.f. & Thomson — Fig. 18; Map 17**

*Impatiens tavoyana* Benth. ex Hook.f. & Thomson (1860) 114, 146. — *Impatiens tavoyana* Wall. in Hook.f. (1904a) 29; Hook.f. (1905) 29. — *Impatiens tavagua* Benth. in Steudel (1840) 805. — *Impatiens tavoyana* Benth. in Wall. (1831) 168; Hook.f. (1875) 468; (1905) 34; W.J.Kress et al. (2003) 170. — Type: *Wall. Cat. no. 4773* (lecto K K001039869), Myanmar, Tavoy.

Annual herb, 18–23 cm tall. *Stem* erect, 1.5–2.5 mm diam, moderately branched, green, glabrous. *Leaves* spirally arranged, decussate only in the lowest node. *Petiole* 5–15 mm long, < 1 mm diam, glabrous. *Lamina* 21–43 by 11–16 mm, elliptic to ovate, apex acute, base cuneate, margin shallowly serrate, glabrous, with 3 or 4 pairs of long hairs near lamina base, 1–2 mm long; lateral veins 5 or 6 pairs. *Inflorescence* axillary, erect, 6- or 7-flowered raceme. *Peduncle* 10–17 mm long, < 0.5 mm diam, glabrous. *Rachis* 4–7 mm long, glabrous. *Flowers* 8–9 mm long, c. 3 mm deep. *Bracts* c. 1 by 0.5 mm, ovate, apex acute

**Fig. 18** *Impatiens tavoyana* Benth. ex Hook.f. & Thomson. a. Habit; b. lateral view of flowers; c. fruit; d. lower lateral sepals; e. lower sepal; f. lateral united petals. — Drawn by Saroj Ruchisansakun.



to acuminate, base obtuse to cuneate, margin entire, glabrous, persistent. *Pedice*l c. 2.5 mm long, < 1 mm, glabrous. *Lateral sepals* 2, c. 2 by 1.5 mm, free, ovate, apex acuminate and mucronate, base obtuse, glabrous. *Lower sepal* c. 3 mm long, c. 1.5 mm deep, navicular, apex acute and mucronate, distal part rapidly constricted to a globose spur, c. 0.8 mm long. *Dorsal petal* unknown. *Lateral united petals* c. 6.5 mm long, free: the upper petals 2.5–3 mm long, completely reduced as a stipe of lower petals; the lower petals 3.5–4 by 2.5–3 mm, free, broadly ovate, apex truncate, base without auricle. *Stamens* unknown. *Ovary* unknown. *Fruits* 3.5 mm long, 1.5–2 mm diam, short fusiform, glabrous. *Seeds* 2 or 3, c. 1.5 mm long.

Phenology — Unknown.

Distribution — Endemic to Myanmar (Tanintharyi Region).

Ecology — Unknown.

Notes — *Impatiens tavoyana* is morphologically very similar to *I. circaeoides*, *I. rangoonensis* and *I. peguana*, but differs in having a globose spur.

The specimen *Wall. Cat. no.* 4773 (K001039869) is designated as lectotype here as it is the only specimen we found.

### 50. *Impatiens tripetala* Roxb. ex DC. — Map 17; Plate 4c

*Impatiens tripetala* Roxb. ex DC. (1824) 687. — *Impatiens tripetala* Roxb. (1814) 18, nom. nud.; Wall. (1824) 453; G. Don (1831) 750; Roxb. (1832) 651; Hook.f. (1904a) 25, 27, 31; W.J. Kress et al. (2003) 170. — Type: s. coll. (lecto, designated in Karthigeyan & Gogoi (2016) G G00218033\*), India, 1818.

*Impatiens multiflora* Wall. ex Hook.f. & Thomson (1860) 126. — *Impatiens multiflora* Wall. (1831) 168, nom. nud., syn. in Hooker (1904a) 25, 31. — Type: *De Silva, Wallich Cat. no.* 4742 (lecto, designated here K K001039802), Bangladesh, Pundua.

*Impatiens ternifolia* Buch.-Ham. ex Hook.f. & Thomson (1860) 126, nom. nud. — *Impatiens ternifolia* Buch.-Ham. in Hook.f. (1904a) 27, nom. nud., syn. in Hooker (1904a) 27, 31. — Based on: *Hb. Ham., Wall. Cat.* 4752B (K K001039802), India, Assam State, Goalpara, 8 May 1862.

Terrestrial, annual herb, up to 40 cm tall. *Stem* erect, more than 4 mm diam, unbranched, pilose towards apex. *Leaves* subopposite to spirally arranged. *Petiole* 20–60 mm long, 1.5–2 mm diam, glabrous to remotely pilose. *Lamina* 80–145 by 25–45 mm, elliptic to ovate to lanceolate, apex acuminate, base

attenuate, margin crenate with small teeth to slightly serrate, papyraceous, adaxial pilose, abaxial glabrous, with 2–5 pairs of short hairs near lamina base and 2–many pairs of stipular glands at petiole base; lateral veins 8–12 pairs. *Inflorescence* axillary, erect, 2–10-flowered raceme. *Peduncle* 1–2(–11) mm long, c. 1 mm diam, glabrous. *Rachis* 1–10 mm long, c. 1 mm diam. *Flowers* 20–30 mm long, 20–30 mm deep, purple. *Bracts* 1–2 by < 1 mm, lanceolate, apex acute, base cuneate, margin entire, glabrous, persistent. *Pedice*l 10–18 mm long, < 1 mm diam, glabrous to remotely pilose. *Lateral sepals* 2, free, 2–3 by 1 mm, ovate to lanceolate, apex, base cuneate, green, glabrous to pilose. *Lower sepal* 14–18 mm long, 15–20 mm deep, saccate, apex acuminate, purple with yellow mark, glabrous to remotely pilose abaxially, distal part abruptly constricted into an incurved spur, 5–7 mm long, slightly bilobed. *Dorsal petal* 9–12 by 10–12 mm, broadly obovate to broadly elliptic, cucullate, apex emarginate, base round, purple, pilose, abaxial midvein with an obtuse crest or an acute appendage, 2–3 mm long. *Lateral united petals* 22–25 mm long, free: the upper petals 9–10 by 8–9 mm, broadly ovate to broadly ob-ovate, apex round to truncate, base cuneate, purple; the lower petals 14–15 by 8–10 mm, free, ovate to elliptic, apex round and slightly obliquely emarginate, purple, glabrous, base with yellow auricle. *Stamens*: filaments 5–6 mm long. *Ovary* c. 5 mm long. *Fruits* 15–16 mm long, 2–3 mm diam, fusiform, glabrous. *Seeds* unknown.

Phenology — Flowering: July to October.

Distribution — Myanmar (Kachin State, Mandalay division, Shan State), India (Assam State), Bangladesh.

Ecology — Growing in organic matter on limestone in open areas, 1300–1600 m altitude.

*Other collections examined.* MYANMAR, Kachin State, *Toppin* 2680 (K H2015/00092 154, 155, 156), Sinlum, 1372–1524 m, 29 Sept. 1911; *Toppin* 2779 (K K000694906, K H2015/00092 157, 158, 159, 160), Sinlum, 24.284120, 97.382417, between Momauk and Balong Gatuang, N24°17'02.8" E97°22'56.7"; *Murata, Kobayashi, Hayami & Takashima* 040890 (MBK MBK0140389), 1–4 miles from Shinbweyan towards Pansaung, N26°42'26"–43°56" E 96°11'25"–12°33", alt. 190–270 m, forest margin, 6 Dec. 2005; *Murata, Kobayashi, Hayami & Takashima* 040884 (QBG QBG61256), *ibid.*, 6 Dec. 2005; Mandalay Region, *Ruchisansakun & Thet Yu Nwe* 758 (L L2071186, MAND, RAF), N22°54.13' E96°22.62', alt. 1297 m, 22 Nov. 2015.

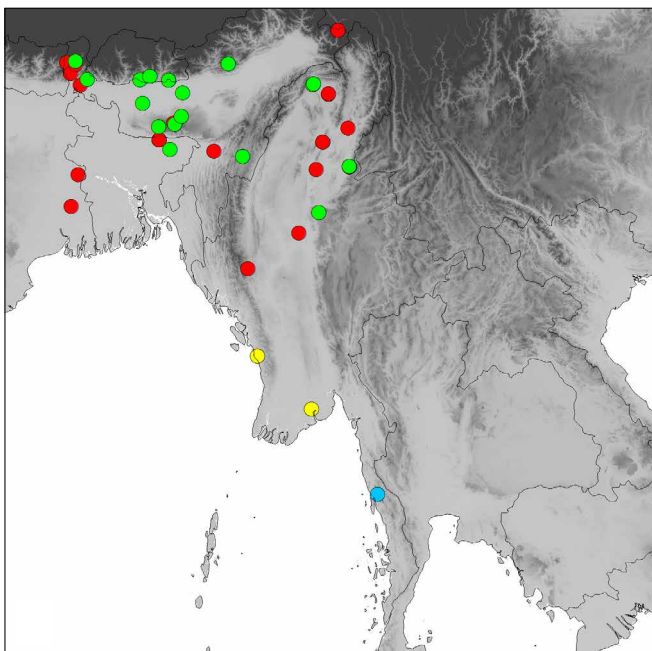
Notes — *Impatiens tripetala* is morphologically similar to *I. trilobata* but differs in having a short or inconspicuous peduncle < 3 mm, while *I. trilobata* has a long peduncle exceeding 10 mm.

*Impatiens tripetala* is characterized by a large number of morphologically variable features. Leaves are mostly decussate, yet sometimes spirally arranged especially along the upper part of the stem. This variation can be found even at the population level, like in *Toppin* 2680.

### 51. *Impatiens trilobata* Colebr. — Map 17

*Impatiens trilobata* Colebr. in Hook.f. (1824) 141; D. Dietr. (1839) 846; Hook.f. & Thomson (1860) 126; Hook.f. (1875) 451. — Type: Hooker (1824) t. 141 (lecto, designated in Karthigeyan & Gogoi (2016): Illustration of Colebrooke), Silhet.

Terrestrial, annual herb, 30–60 cm tall. *Stem* erect, rarely decumbent, unbranched to moderately branched, glabrous to pilose towards apex. *Leaves* decussate. *Petiole* (2–)5–15(–40) mm long, glabrous to pilose. *Lamina* (34–)60–75(–100) by (14–)25–30(–34) mm, ovate to elliptic to narrowly elliptic, apex acute to acuminate, base cuneate to attenuate, margin slightly crenate, adaxial glabrous to remotely pilose, abaxially pilose on the midrib and veins, with 2 or 3 stipular glands on each side of the petiole base; lateral veins (5–)7–9(–11) pairs. *Inflorescence* axillary, erect, (1–)2–4(–5)-flowered raceme. *Peduncle*



**Map 17** Distribution of *Impatiens rangoonensis* Hook.f. (●), *I. tavoyana* Benth. ex Hook.f. & Thomson (●), *I. tripetala* Roxb. ex DC. (●) and *I. trilobata* Colebr. (●).

(15–)20–40(–55) mm long, glabrous. *Rachis* 3–5 mm long. *Flowers* (14–)20–25(–30) mm long, (15–)20–27(–30) mm deep, pink. *Bracts* c. 3 by 1 mm, lanceolate, apex acute, base cuneate, margin entire, glabrous to pilose, persistent. *Pedice* 10–15 mm long, glabrous. *Lateral sepals* 2, 3–6 by 1.5–2 mm, free, ovate to elliptic, apex acuminate and mucronate, base cuneate, glabrous to pilose. *Lower sepal* 14–15(–19) mm long, (18–)20–22(–25) mm deep, saccate, apex acuminate and mucronate, pilose when young, remotely pilose in mature flower, dorsal part rapidly constricted into an incurved hooked to circular spur, 8–12(–15) mm long, sometimes swollen. *Dorsal petal* (8–)11–12 by (13–)16–17 mm, broadly elliptic to broadly obovate, cucullate, apex round to cordate, base round to obtuse to cordate, pink, glabrous to pilose near the midrib, abaxial midvein with a keel-shaped crest, 2–3 mm wide. *Lateral united petals* (24–)27–29 mm long, free: the upper petals 9–14 by 6–9 mm, orbicular to obovate, apex round to obtuse, base cuneate, pink; the lower petals (15–)17–20 by (8–)11–15 mm, free, ovate to elliptic to orbicular to obovate, apex round, slightly emarginate inside, base auricled, 2–3 mm wide, pink, glabrous. *Stamens*: filaments 5–6 mm long. *Ovary* c. 4 mm long, 1 mm diam, glabrous. *Fruits* 15–17 mm long, 5 mm diam, fusiform, glabrous. *Seeds* 2 mm long.

Phenology — Flowering: June to November; fruiting: July to November.

Distribution — Myanmar (Chin State, Kachin State, Mandalay Region, Sagaing Division), Bangladesh (Sylhet Division), India (Arunachal Pradesh State, Assam State, Sikkim State, West Bengal State).

Ecology — Growing in semi-evergreen forest, along the stream, 600–1200 m altitude.

*Other collections examined.* MYANMAR, Chin State, *Ling Shein Mang* 093093 (QBG QBG70782), around Kyat Chan village, Kanpetlet, Natma Taung National Park, alt. 1700 m, 13 July 2013; Kachin State, *Buchanan* s.n. (K), Myitkyina district, Namma Hopii Valley, 450 ft, Oct. 1909; *Buchanan* 1 (K H2015/00092 135), Myitkyina district, Trinton, alt. 450 ft, 30 Nov. 1910; *Buchanan* s.n. (E E00752744), *ibid.*, Oct. 1909; *Murata, Kobayashi, Hayami & Takashima* 040847 (QBG QBG61254), west of Lamon Village, 4 miles north of Tanaing, N26°25'28" E96°41'37", alt. 195–200 m, 2 Dec. 2005; Mandalay Region, *F.S.* (RANG5097), Kadu, 7 Jan. 1960; *Anonymous* s.n. (RANG011269), *ibid.*, Sagaing division; *Buchanan* 2 (K), Kale district, Nam-maw village, 18 Oct. 1908; *Lace* 5526 (E E00752745, K H2015/00092 134), Katha district, Bilumyo Reserve, 800 ft, 9 Nov. 1911.

Note — *Impatiens trilobata* can be easily distinguished by its decussate leaves, long peduncles, and saccate lower sepal. *Impatiens trilobata* is similar to *I. tripetala* but differs in having a longer peduncle.

## 52. *Impatiens kingdon-wardii* Nob.Tanaka & T.Sugaw. — Map 18

*Impatiens kingdon-wardii* Nob.Tanaka & T.Sugaw. in Tanaka et al. (2015) 90. — Type: *Murata et al.* 024566 (holo MBK not seen; iso QBG78496; RAF not seen, TI not seen), Myanmar, Chin State, Kanpetlet Township, at the foot of Mt Victoria, Natma Taung National Park, alt. c. 1800–2000 m, 2 Dec. 2002.

Annual herb, 20–100 cm tall. *Stem* erect, 0.5–6 mm diam, unbranched to moderately branched, green to purple, pilose to glabrous, but densely pilose towards apex. *Leaves* spirally arranged. *Petiole* 30–60 mm long, 1–1.5 mm diam, red to dark red, glabrous to sparsely pilose, with c. 1.5 mm long dark red to black hairs. *Lamina* 50–180 by 30–80 mm, ovate to elliptic to oblong to oblanceolate, apex acute to acuminate, base cuneate to attenuate, margin shallowly serrate to shallowly crenate, green on both sides, reddish on midrib, adaxial sparsely to densely pilose, abaxial glabrous to remotely pilose, with 4–6 long hairs near lamina base, 5.5–6 mm long; lateral veins 8–13 pairs. *Inflorescence* axillary, pendulous, 2–4(–9)-flowered

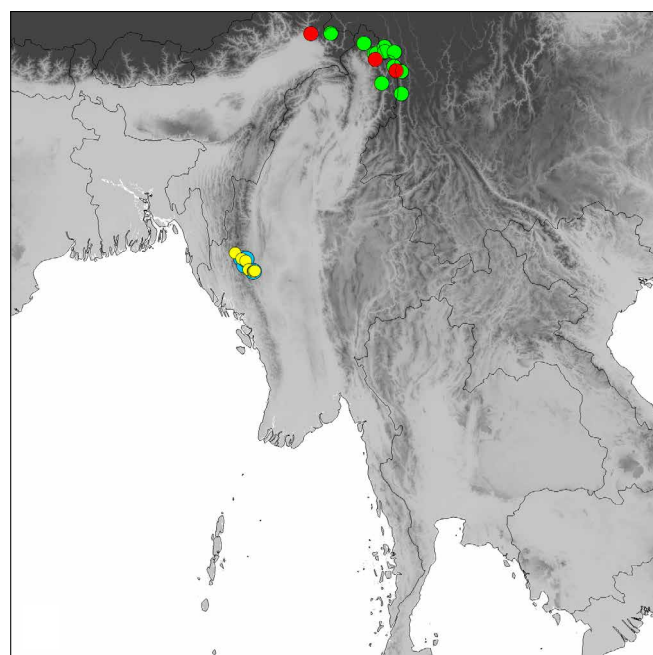
raceme. *Peduncle* 1.5–5(–26) mm long, c. 1 mm diam, pink to red, glabrous to densely pilose. *Rachis* 2–5(–16) mm long, c. 1 mm diam, glabrous to densely pilose. *Flowers* 20–24 mm long, 15–34 mm deep, purple to pink, rarely white or yellow. *Bracts* 1–5(–9) by 1–1.5(–3) mm, linear to lanceolate to elliptic to oblanceolate, apex acute and mucronate, base cuneate, margin entire, red to pink, glabrous to pilose, persistent, rarely caducous. *Pedice* 10–20 mm long, slender, pink, glabrous to pilose. *Lateral sepals* 2, 9.5–15 by 10–15 mm, free, orbicular to broadly elliptic, cucullate, completely covering the flower in young stage, apex round and mucronate, base round, pink, densely pilose. *Lower sepal* 15–20 mm long, 10 mm deep excluding spur, saccate, apex mucronate, pink with white base, densely pilose, base abruptly constricted into an incurved spur with spiral end, 5–13 mm long. *Dorsal petal* 10–13 by 7–8 mm, suborbicular, cucullate, light pink, adaxial pilose, abaxial midvein with a narrow crest. *Lateral united petals* 20–25 mm long, connate: the upper petals ovate, connate to each other in the upper part forming a helmet-like structure, the structure then blocked the floral entrance, apex with 2 yellow club-shaped protuberance, base cuneate, bright purple; the lower petals 10–14 by 6–8 mm, broadly obovate, apex round to obtuse, bright purple with white mark at the centre, glabrous. *Stamens*: filaments 3–4 mm long, glabrous; anthers apex obtuse. *Ovary* 2.5–4 mm long, fusiform, 5-carpellate, pilose. *Fruits* 8–11 mm long, 5–6 mm diam, short fusiform to globose, pink, pilose to densely pilose; fruiting pedicels 15–22 mm long. *Seeds* unknown.

Phenology — Flowering: June to December; fruiting: October to December.

Distribution — Endemic to Myanmar (Chin State).

Ecology — Growing along streams and in shady, wet places, 800–1600 m altitude.

*Other collections examined.* MYANMAR, Chin State, *Kingdon-Ward* 22664 (para BM), Kanpetlet Township, Mt Victoria; *Maung & Win* 024336 (para MBK\*, RAF\*, TI\*), Kanpetlet Township, Mt Victoria, 17 Sept. 2002; *Tanaka & Yukawa* 081231 (para MBK, RAF), Kanpetlet Township, along the trail to NE of Kanpetlet, via Yelong Pan village, Natma Taung National Park, alt. 1400–1600 m, N21°13'5" E94°3'37.6"–5°41.4", 26 June 2009; *Matsumoto* s.n. (para TNS-spirit), Kanpetlet Township, near old Kanpetlet Village, Natma Taung National Park, 31 Aug. 2012; *Fujikawa et al.* 090043



Map 18 Distribution of *Impatiens kingdon-wardii* Nob.Tanaka & T.Sugaw. (●), *I. xanthina* H.F.Comber (●), *I. fugongensis* K.M.Liu & Y.Y.Cong (●) and *I. striolata* Hook.f. (●).

(QBG QBG70758), between Kanpetlet and Oak Pho Village, 3 Dec. 2012; *Ling Shein Man 087636* (QBG QBG78495), Kanpetlet Township, Old Town area, alt. c. 1750 m, 23 Oct. 2011; *U Mg Gale-2 5761* (RAF RAF8773/5, 4 sheets), Kanpetlet Township, E Saken, alt. 5700 ft, 15 Sept. 1956; *Law Shein 091602* (QBG QBG70762), Natma Taung National Park, 3 Oct. 2012; *Tanaka & Yukawa 081231* (QBG QBG78502), Natma Taung National Park, along the trail to NE of Kanpetlet, via Yelong Pan village, N21°13'5.6"–5.4" E94°3'37.6"–5'41.4", alt. 1400–1600 m, 26 June 2009; *Ling Shein Mang 092931* (QBG QBG70779), Natma Taung National Park, around Kanpetlet, alt. 1700 m, 27 June 2013; *Fujikawa et al. 090549* (QBG QBG70761), around the entrance, N21°12'10.5" E94°01'47.1", alt. 1945 m, 4 Dec. 2012; *Fujikawa et al. 094896* (QBG QBG70797), Natma Taung National Park, c. 10 miles from Mindat between Mindat and Matupi (Mindat-Matupi road), Mindat Township, alt. c. 1800 m, 1 Sept. 2013; *Ling Shing et al. 024303* (MBK K0049683), Mt Victoria, Natmataung National Park, 31 July 2002.

Note — *Impatiens kingdon-wardii* is one of the most distinct species in Myanmar, due to its large, densely pilose lateral sepals and connate upper lateral petals that closes the floral entrance for visitors. The fruit is also very distinct from other species, due to the globose shape (as opposed to short fusiform).

### 53. *Impatiens xanthina* H.F.Comber — Map 18

*Impatiens xanthina* H.F.Comber (1934) 248; W.J.Kress et al. (2003) 170; Gogoi et al. (2015b) 272. — Type: *Forrest 29913* (holo E E00313662), China, Yunnan.

#### var. *xanthina*

Terrestrial, annual herb, 5–23 cm tall. *Stem* decumbent, up to 3 mm diam, richly branched in the decumbent part, green, glabrous. *Leaves* spirally arranged, congested on apex. *Petiole* sessile–7 mm long, glabrous to remotely pilose. *Lamina* 55–65 by 10–15 mm, narrowly elliptic to narrowly obovate, apex acute, base cuneate, margin serrate, adaxial green, abaxial pale green, glabrous to remotely pilose on both sides, with 1–3 pair(s) of clavate glands along the margin near lamina base, up to 2 mm long; lateral veins 8–11 pairs. *Inflorescence* axillary, erect, 1–3-flowered raceme. *Peduncle* 13–20 mm long, green, pilose. *Rachis* absent–2 mm long, pilose. *Flowers* 10–15 mm long, 7–10 mm deep, yellow with dark brown mark at the centre. *Bracts* 3–4 by 1 mm, linear to lanceolate, apex acute, base cuneate, margin entire, pilose, caducous to persistent. *Pedice*l c. 8 mm long, < 1 mm diam, densely pilose. *Lateral sepals* 2, 4–5 by c. 2.5 mm, free, triangular-ovate, apex acute, base truncate, green, glabrous. *Lower sepal* 7–8 mm long, 1.5–2 mm deep, navicular, apex acute and mucronate, yellow, glabrous, dorsal part abruptly constricted into a narrow incurved spur with spiral end, 22–25 mm long. *Dorsal petal* c. 6 by 4–8 mm, ovate, cucullate, apex round, base round, yellow with dark brown mark at the base, pilose along the midrib, abaxial midvein with a slight crest at the base. *Lateral united petals* 9–14 mm long, free: the upper petals 5–6 by 3–4 mm, elliptic, apex round, base cuneate, yellow with dark brown marks at the base; the lower petals 8–10 by 5–6 mm, free, elliptic to ovate, apex obtuse, yellow, glabrous. *Stamens*: filaments c. 3 mm long; anthers obtuse, yellow; pollen yellow. *Ovary* c. 3 mm long, c. 1 mm diam, green, glabrous. *Fruits* 6–10 mm long, 3–4 mm diam, fusiform, 5-lobed, green, glabrous; fruiting pedicels c. 7 mm long. *Seeds* unknown

Phenology — Flowering: May to December; fruiting: September to December.

Distribution — Myanmar (Kachin State), China (Yunnan Province), India (Arunachal Pradesh State).

Ecology — Growing in mossy places along streams in evergreen forest, 3000–3500 m altitude.

Other collections examined. MYANMAR, Kachin State, *Kingdon-Ward 13452* (BM), Nam Tamai valley, N28° E97°40', alt. 3000–4000 ft, 10 Nov. 1937;

*Kingdon-Ward 6682* (K), Nam Tamia, alt. 3500 ft, 3 May 1926; *Farrer 1833* (RAF 2 sheets), Nyitadi, alt. 5000–7000 ft, 18 Aug. 1920; *Armstrong et al. 1199* (NY2649102\*), Putao district, Naungmung Township, Hkakabo Razi National Park, between Aliaung village and Ran Nam rest house, N27.7071° E98.0754°, alt. 1117 m, 1 Nov. 2015; *Saw-Lwin KSL1052* (L, MAND, RAF), *ibid.*; *Kingdon-Ward 20798* (BM), the north triangle, Hkinkum, alt. 3000–4000 ft, 7 May 1953.

Note — *Impatiens xanthina* has small, bright yellow flowers. This colour, in combination with the arrangement in a 1–3-flowered raceme, is rather uncommon in *Impatiens*. Specimen *Saw-Lwin 1052* (L) approaches *I. xanthina* var. *pusilla* Y.L.Chen (1978: 49) in its short stem but has larger leaves and flowers. So far, *I. xanthina* var. *pusilla* is not found in Myanmar.

### 54. *Impatiens fugongensis* K.M.Liu & Y.Y.Cong — Map 18

*Impatiens fugongensis* K.M.Liu & Y.Y.Cong in Cong et al. (2008) 161; Gogoi et al. (2015b) 270. — Type: *Liu & Cong 791378* (holo HNNU\*; iso HNNU\*, KUN\*), China, north-western Yunnan Province, Fugong county, Gaoligong mountain, alt. 2200 m, on the damp cliff, 12 Oct. 2006.

Terrestrial herb, 9–10 mm tall. *Stem* erect to decumbent, branching at the decumbent parts, red to purple to green, pilose to densely pilose. *Leaves* spirally arranged. *Petiole* 5–10 mm long, red to green, pilose. *Lamina* 35–40 by 15–20 mm, ovate, apex acute, base cuneate, margin crenate, adaxial green and pilose to densely pilose, abaxial red to pale green, and glabrous, with 1–3 glands on each sides of petiole; lateral veins 6 or 7 pairs. *Inflorescence* axillary to subterminal, erect, 2-flowered raceme. *Peduncle* 9 mm long, green to purple, pilose to densely pilose. *Rachis* 1 mm long, red to green, pilose to densely pilose. *Flowers* c. 7 by 11 mm, white to yellow. *Bracts* c. 2 by < 1 mm, linear, apex acute and mucronate, base cuneate, margin entire, green, pilose. *Pedice*l c. 7 mm, green to reddish green, densely pilose. *Lateral sepals* 2, 3–4 by 1–1.5 mm, free, obliquely ovate, apex acute and mucronate, base cuneate, yellow to pale green, pilose. *Lower sepal* c. 5 mm long, c. 3 mm deep, deeply navicular, apex acute, yellow to white, pilose, dorsal part gradually tapering into a spiral spur, 16 mm long, yellow to red. *Dorsal petal* c. 5 by 4 mm, elliptic, cucullate, apex obtuse, base obtuse, yellow to white, pilose, abaxial midvein simple or with a narrow crest. *Lateral united petals* c. 9 mm long, free: the upper petals c. 4 by 1.5 mm, elliptic, apex acute, base cuneate, yellow to white, pink base; the lower petals c. 6 by 3 mm, free, obovate, apex round, base with distinct auricles, yellow to white, glabrous. *Stamens*: filaments yellow; anthers yellow. *Ovary* 2 mm long, < 1 mm diam, green, glabrous. *Fruits* fusiform, glabrous. *Seeds* unknown.

Phenology — Flowering: October; fruiting: October.

Distribution — Myanmar (Kachin State), China (Yunnan State), India (Gogoi et al. 2015b).

Ecology — Growing in open areas in mixed deciduous forest.

Other collections examined. MYANMAR, Kachin State, *Armstrong et al. 756* (NY NY2648696\*), Putao district, Naungmung Township, buffer zone of Hkakabo Razi National Park, between Hton Wan rest house and Khe Dam rest house, N27.5298° E98.0437°, alt. 2008 m, 17 Oct. 2015; *Saw-Lwin KSL1060A* (L), *ibid.*

Note — *Impatiens fugongensis* is morphologically similar to *I. xanthina*, but differs in having a pilose stem, pilose elliptic leaves, and a bucciniform lower sepal.

### 55. *Impatiens striolata* Hook.f. — Map 18

*Impatiens striolata* Hook.f. (1905) 28, 33. — Type: *Hooker & Thomson 91* (lecto, designated here K K000694624; isolecto P P04543679), India, Khasia Hills, alt. 4000–5000 ft (1524 m).

Annual herb, 20–40 cm tall. *Stem* erect, seldom decumbent in the lower part, up to 4 mm diam, unbranched to rarely branched, red, glabrous. *Leaves* spirally arranged. *Petiole* 11–30 mm

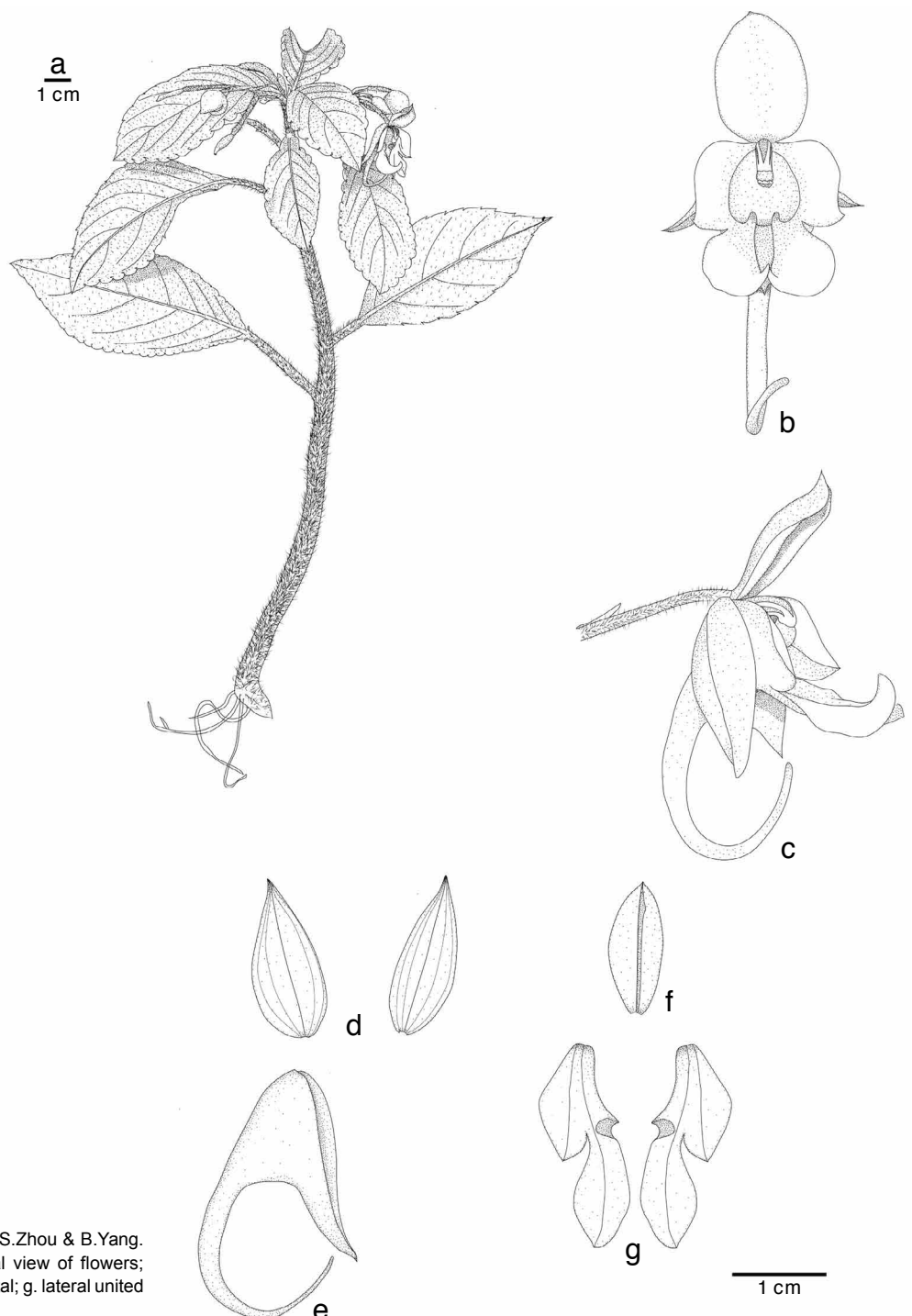
long, c. 1 mm diam, glabrous. *Lamina* 37–60 by 17–30 mm, ovate to elliptic, apex acute to acuminate, base attenuate to cuneate, margin serrate to slightly serrate, adaxial remotely pilose, green with red margin, abaxial glabrous, with one pair of glands on each side of margin near lamina base; lateral veins 6–9 pairs. *Inflorescence* axillary, erect, 1- or 2-flowered raceme. *Peduncle* 12–17 mm long, reddish green, glabrous. *Rachis* 20 mm long, red, glabrous. *Flowers* 25–31 mm long, 27–29 mm deep, yellow with red stripes and red spur. *Bracts* 2–3 by 1 mm, linear to narrowly lanceolate, apex acute, base cuneate, margin entire, without glands, red, glabrous, persistent. *Pedice/* 10–12 mm long, red, glabrous. *Lateral sepals* 2, 2–3.3 by 1.3–1.5 mm, free, ovate to lanceolate, apex acuminate, base obtuse, red, glabrous. *Lower sepal* 13.5–17 mm long, 7–10 mm deep, bucciniform, apex acute and mucronate, yellow to orange with red stripes, glabrous, gradually narrowed into an incurved spur, strongly incurved at half the length, tip straight,

18–20 mm long, red with yellow tip. *Dorsal petal* 11.5–12 by 10.5–12 mm, broadly ovate to broadly elliptic, apex emarginate and mucronate, base obtuse to truncate, yellow with deep red near the midrib, glabrous, abaxial midvein with a keel-shaped crest, 1–1.5 mm long. *Lateral united petals* 25–28 mm long, free: the upper petals 11–13 by 7–9 mm, obovate, apex acute to acuminate, base cuneate, yellow with red marks near the base; the lower petals 14–22 by 7.5–8 mm, free, ovate, apex acute to obtuse, base with distinct auricles, 1.5 mm long, round, glabrous. *Stamens*: filaments c. 5.2 mm long; anthers obtuse. *Ovary* c. 5 mm long. *Fruits* c. 14 mm long, 3 mm diam, fusiform, glabrous. *Seeds* unknown.

Phenology — Flowering: July to September; fruiting: September.

Distribution — Myanmar (Chin State), India (Assam State).

Ecology — Growing along streams in exposed areas of evergreen forest, 1500–2400 m altitude.



**Fig. 19** *Impatiens putaoensis* Y.H.Tan, S.S.Zhou & B.Yang. a. Habit; b. front view of flower; c. lateral view of flowers; d. lateral sepals; e. lower sepal; f. dorsal petal; g. lateral united petals. — Drawn by Saroj Ruchisansakun.

*Other collections examined.* MYANMAR, Chin State, *Mu Mu Aung & Law Shine 092642* (QBG QBG70773), along the roadside between 70 and 84 miles (Mindat-Matupi car road), Matupi Township, near the Natma Taung National Park, alt. 2225 m, N21°36.007' E93°39.313', 22 July 2013; *Funakoshi et al. 085231* (QBG QBG61271), 14 miles towards Madupi from Mindat, alt. 2355 m, N21°23.894' E93°45.901', 9 Sept. 2011; *Fujikawa et al. 094892* (QBG QBG70796), c. 10 miles from Mindat between Mindat and Matupi (Mindat-Matupi road), Mindat Township, Natma Taung National Park, alt. c. 1800 m, 1 Sept. 2013.

**Notes** — *Impatiens striolata* is most similar to *I. putaoensis* but differs in having bright yellow flowers and a glabrous stem. It is also similar to species numbered 56–65 below but can be easily distinguished by its acute to acuminate apex of the upper lateral petals.

Hooker (1905) mentioned that it was found in the Khasia Hills, at 4000–5000 ft altitude, but without any other detail about type specimens. However, Hooker annotated two specimens as *I. striolata*: *Hooker & Thomson 91* (K000694624) and *Hooker & Thomson 2026* (K000694625). We select K000694624 as lectotype because it is provided with a clear illustration and a dissected flower, and its locality matches the protologue.

**56. *Impatiens putaoensis*** Y.H.Tan, S.S.Zhou & B.Yang — Fig. 19; Map 19

*Impatiens putaoensis* Y.H.Tan et al. in Yang et al. (2017) 107. — Type: *Myanmar Exped. 105* (holo HITBC\*; iso KUN\*, RAF\*), Myanmar, Kachin State, Putao, Ghatu village, N27°43'28.99" E97°51'9.47", alt. 590 m, 25 Nov. 2014.

Terrestrial, annual herb, 24–33 cm tall. *Stem* erect, c. 3 mm diam, simple, green, densely pilose. *Leaves* spirally arranged. *Petiole* 12–25 mm long, 1.5–2 mm diam, densely pilose, with 3 or 4 long hairs on each side of the petiole. *Lamina* 55–70 by 25–30 mm, elliptic, apex acute to acuminate, base cuneate, margin slightly serrate, adaxial green, abaxial pale green, pilose on both sides, with 1 or 2 long hairs on each side along the midrib near lamina base; lateral veins 4 or 5 pairs. *Inflorescence* axillary to subterminal, erect, 3–5-flowered raceme. *Peduncle* 20–25 mm long, c. 1.5 mm diam, green, densely pilose, with long white hairs. *Rachis* 4–6 mm long, c. 1 mm diam. *Flowers* c. 30 mm long, c. 25 mm deep, white to greenish white. *Bracts* 5–6 by 1 mm, linear, apex acute, base cuneate, margin entire, without gland, green, pilose, persistent. *Pedicel* 17 mm long, < 1 mm diam, green, densely pilose with long white hairs. *Lateral sepals* 2, 15–18 by 8 mm, free, narrowly ovate, apex acute and mucronate, base obtuse, pale green, glabrous. *Lower sepal* 15–20 mm long, 10–15 mm deep, navicular, apex acuminate, white to pale green, glabrous, distal part gradually narrowing into an incurved spur, 25–30 mm long. *Dorsal petal* 18 by 6 mm, narrowly elliptic, slightly cucullate, apex acute and mucronate, base obtuse, pale green, glabrous, abaxial midvein with a narrow crest, c. 1 mm wide, green. *Lateral united petals* 22–28 mm long, free: the upper petals 12–13 by 6–7 mm, elliptic, apex acute, base cuneate, white; the lower petals 14–15 by 6 mm, free, elliptic to elliptic-obovate, apex acute, base with distinct auricles, 1.5–2 mm high, white with yellow auricles, glabrous. *Stamens*: filaments c. 7 mm long, white to pale green; anthers obtuse, pale yellow. *Ovary* c. 6 mm long, c. 1 mm diam, green, glabrous. *Fruits* 15 mm long, 5 mm diam, fusiform, green, glabrous; fruiting pedicel up to 16 mm long. *Seeds* unknown.

**Phenology** — Flowering: October to November; fruiting: October to February.

**Distribution** — Myanmar (Kachin State), only known from the type locality.

**Ecology** — Growing in an open mossy area of evergreen forest.

*Other collection examined.* MYANMAR, Kachin State, *Saw-Lwin KSL1021* (L, MAND, RAF), Hkakabo Razi National Park, 17 Oct. 2015.

**Note** — *Impatiens putaoensis* is similar to *I. porrecta* but has white to greenish white flowers and the upper lateral petals have an acute apex.

**57. *Impatiens porrecta*** Wall. ex Hook.f. & Thomson — Map 19; Plate 4d

*Impatiens porrecta* Wall. ex Hook.f. & Thomson (1860) 116, 138. — *Impatiens porrecta* Wall. (1831) 245, nom. nud.; Hook.f. (1875) 472; (1904) 29, 31; Toppin (1920) 352. — Type: *Wall. Cat. no. 7275* (lecto, designated here K K001127061), Sylhet.

*Impatiens bella* Hook.f. & Thomson (1860) 116, 138; Hook.f. (1875) 458, syn. nov. — Type: *Griffith s.n.* (lecto, designated here K K000694775), Khasia.

Terrestrial, annual herb, 10–20 cm tall. *Stem* erect to procumbent, 1–2.5 mm diam, branching in the decumbent part, densely pilose especially towards apex, sometimes nearly glabrous on the lower part. *Leaves* spirally arranged. *Petiole* 8–25 mm long, 1–1.5 mm diam, densely pilose with 1 or 2 pair(s) of glandular hairs on petiole. *Lamina* 21–45 by 10–28 mm, ovate to elliptic to obovate, apex acute to obtuse, base obtuse to cuneate to attenuate, margin serrate to cuneate, abaxial densely to remotely pilose, adaxial remotely pilose and densely pilose at veins to glabrous, with or without 1 pair of glands near lamina base; lateral veins 5–8 pairs. *Inflorescence* axillary, erect, 1–3-flowered raceme. *Peduncle* 7–35 mm long, c. 1 mm diam, densely pilose. *Rachis* absent–2 mm long, c. 1 mm diam, densely pilose. *Flowers* 15–25 mm long, 20–40 mm deep, yellow. *Bracts* 2–4 by 1–2 mm, linear to lanceolate, apex acute, base cuneate, margin entire, densely pilose, persistent. *Pedicel* 10–15 mm long, < 1 mm diam, pilose to densely pilose. *Lateral sepals* 2, 6–9 by 2.5–5 mm, free, ovate to narrowly ovate, apex acute to acuminate, base obtuse to cuneate, pilose to densely pilose. *Lower sepal* 9–15 mm long, 6–15 mm deep, bucciniform, apex acuminate, with dark red reticulated lines, pilose to remotely pilose, distal part rapidly constricted into a curved to incurved spur, 17–30 mm long. *Dorsal petal* 9.5–12 by 8–11 mm, elliptic to orbicular, cucullate, apex round to emarginate, base obtuse, pilose, abaxial midvein with a crescent-shaped to a keel-shaped crest. *Lateral united petals* 16.5–20 mm long, free: the upper petals c. 8 by 7 mm, obovate, apex truncate, base cuneate; the lower petals c. 10 by 6–8 mm, free, ovate, apex obtuse, base auricled. *Stamens* c. 5 mm long. *Ovary* 5 mm long, c. 1 mm diam, pilose. *Fruits* 12 mm long, c. 1 mm diam, fusiform, pilose. *Seeds* unknown.

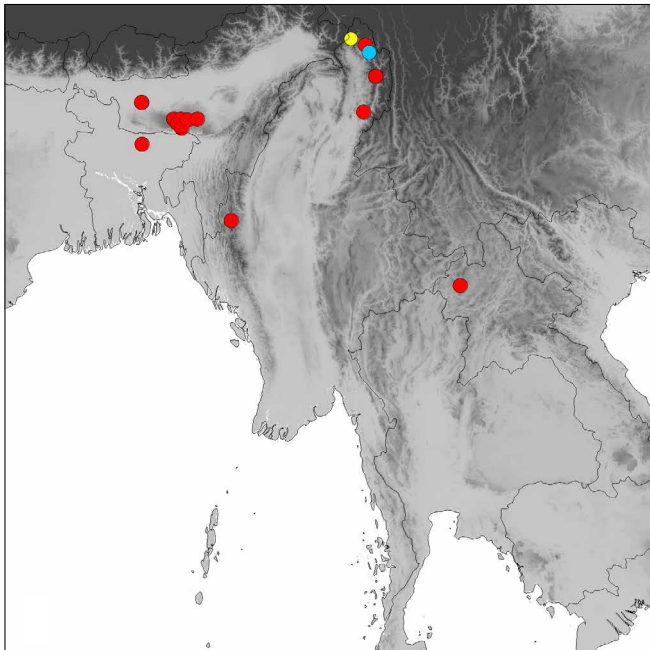
**Phenology** — Flowering: August to November; fruiting: October to November.

**Distribution** — Myanmar (Chin State, Kachin State); India (Assam State, Manipur State, Meghalaya State); Laos (Muang Curm).

**Ecology** — Growing along streams or in humid areas of evergreen forest, 600–1600 m altitude.

*Other collections examined.* INDIA, *Lobb s.n.* (syn K), Khasia; *Hooker & Thomson 92* (syn of *Impatiens bella* K, L L2326061, L L2326062, L L2326063, MPU019010\*), Khasia, near to Kalapane, alt. 4000–5000 ft, 6 Aug. 1850. — MYANMAR, Chin State, *Venning 84* (K), Chin Hills, Minkin, 29 July 1910; Kachin State, *Toppin 4359* (K 2 sheets), Kachin Hills, Kao Hka Gorge and Ngau Hka; *Lace 6043* (E E00752854, E E00752855, E E00752856, K), Myitkyina district, Wabaukyer, dongyakyer, 1500–2500 ft, 20 Nov. 1912; *Kingdon-Ward 20780* (BM), the north triangle, Hkinkum, alt. 4000 ft, 6 May 1953; *Kingdon-Ward 21131* (BM), *ibid.*, 9 July 1953; *Kingdon-Ward 21227* (BM), *ibid.*, 3 Aug. 1953; *Kingdon-Ward 7315* (K), N27°45' E97°55', alt. 5000–6000 ft, 19 Aug. 1926.

**Notes** — In the protologue, Hooker & Thomson (1860) mentioned that *I. porrecta* is similar to *I. bella* but that it differs in having multiple flowers on one peduncle (instead of one flower in *I. bella*). However, we found that this character is variable within *I. porrecta*, and no other characters provide a distinction between *I. bella* and *I. porrecta*. The lateral sepals also vary from glabrous to densely pilose.



**Map 19** Distribution of *Impatiens putaensis* Y.H.Tan, S.S.Zhou & B.Yang (●), *I. porrecta* Wall. ex Hook.f. & Thomson (●) and *I. erubescens* Dunn (●).

*Impatiens porrecta* is also morphologically similar to *I. khasiana* and *I. putaensis* but differs in having yellow instead of purple or white flowers.

The specimen Wall. Cat. no. 7275 (K001127061) is designated as lectotype of *I. porrecta* as it is the only specimen we found. It matches the protologue and was determined by Hooker as *I. porrecta* Wall.

Hooker & Thomson (1860) described *I. bella* as glabrous and listed the specimens that Hooker & Thomson collected from Kalapane. They mentioned at least three specimens for *I. bella* in the protologue. We designate the specimen Griffith s.n. (K000694775) as lectotype because it is in good condition and completely matches the protologue

### 58. *Impatiens erubescens* Dunn — Map 19

*Impatiens erubescens* Dunn in Toppin (1920) 349; W.J.Kress et al. (2003) 169. — Type: Toppin 4362 (lecto, designated here K 000694678; islecto K 000694721), Myanmar, Kachin State, Kachin Hills, Kao Hka gorge, Jan. 1912.

Terrestrial herb, 10–20 cm tall. *Stem* erect to decumbent, simple, or branched at the decumbent part, red, densely pilose to tomentose. *Leaves* spirally arranged. *Petiole* 5–17 mm long, pilose. *Lamina* 40–70 by 15–25 mm, lanceolate to elliptic, apex attenuate, base cuneate, margin serrate, adaxial dark green, abaxial pale red, glabrous, with 1–5 long hairs on each side of the midrib near lamina base, up to 1 mm long; lateral veins 5 or 6 pairs. *Inflorescence* axillary, erect, 1–3-flowered raceme. *Peduncle* 14–60 mm long, glabrous. *Rachis* 2 mm long. *Flowers* 32–40 mm long, 35 mm deep, pink. *Bracts* 2–3 by 1 mm, linear, apex acute, base cuneate, margin entire, glabrous, persistent. *Pedice* 10–15 mm long, glabrous. *Lateral sepals* 2, 6–8 by 3 mm, free, lanceolate to ovate to elliptic, apex acuminate, base obtuse, glabrous. *Lower sepal* 19–25 mm long, 8–13 mm deep, bucciniform, apex acute and mucronate, glabrous, distal part gradually tapering into an incurved spur, 30 mm long. *Dorsal petal* 10–12 by 11 mm, orbicular to elliptic, cucullate, apex obtuse, base obtuse, glabrous, abaxial midvein with a crescent-shaped crest. *Lateral united petals* 25–30 mm long, free: the upper petals c. 13 by 9 mm, oblanceolate to oblong, apex truncate, base cuneate; the lower petals 16–17 by 7–8 mm,

free, ovate, apex obtuse, base with distinct auricle, c. 2 mm wide, pink with yellow auricle, glabrous. *Stamens* 7 mm long. *Ovary* 4–6 mm long. *Fruits* 14–15 mm long, 4 mm diam, fusiform, glabrous. *Seeds* c. 1 mm long.

Phenology — Flowering: August to January; fruiting: January.

Distribution — Endemic to Myanmar (Kachin State).

Ecology — Altitude 500 m.

*Other collection examined.* MYANMAR, Kachin State, Kingdon-Ward 7302 (K), Frontier of Tibet, Valley of the Lam Tawai, N28.0° E97.35°, 16 Aug. 1926.

Note — *Impatiens erubescens* can be distinguished by red pilose stems, glabrous lanceolate to elliptic leaf lamina and pink flowers. It is very similar to *I. delicata* but this species has a glabrous stem. It is also similar to *I. khasiana* but differs in having glabrous narrower leaf lamina and glabrous peduncles. We found two sheets of Toppin 4362. The K000694678 include a dissected flower, colour illustration, and handwriting, so we selected it as a lectotype.

### 59. *Impatiens khasiana* Hook.f.

*Impatiens khasiana* Hook.f. (1905) 27, 33; Vivek. et al. (1997) 111, 162; Odyou et al. (2015) 85. — *Impatiens bella* var. *major* Hook.f. (1875) 459. — Type: Hooker & Thomson s.n. (lecto, designated in Odyou et al. (2015) K 000694831; islecto K 000694829, K 000694832), India, Meghalaya, Khasi Hills, 5000–6000 ft, 1850.

Annual herb, 20–50 cm tall. *Stem* erect to decumbent in the lower part, simple to branched in the decumbent part, pilose to densely pilose. *Leaves* spirally arranged. *Petiole* 10–45 mm long, pilose to densely pilose, with 1–3 pair(s) of glandular hairs. *Lamina* 40–140 by 21–50 mm, ovate to elliptic, apex acute to acuminate, base cuneate to attenuate, margin serrate to crenate with small teeth, adaxial pilose, abaxial remotely pilose, with 2–many pairs of glandular hairs on margin near lamina base and 1–3 pair(s) on petiole, up to 2 mm long; lateral veins 6–11 pairs. *Inflorescence* axillary to subterminal, erect, (1- or) 2- or 3-flowered raceme. *Peduncle* 10–35 mm long, densely pilose. *Rachis* 2–11 mm long. *Flowers* 20–35 mm long, 27–40 mm deep, pink. *Bracts* (3–)6–7 by 1–3.5 mm, narrowly ovate to lanceolate to narrowly lanceolate to elliptic, apex acute, base cuneate to obtuse, margin entire, without glands, pilose. *Pedice* (9–)15–17 mm long, pilose. *Lateral sepals* 2, 6–12 by 2–7 mm, free, obliquely ovate, angular on one side, apex acuminate, base cuneate, white with green tip, pilose. *Lower sepal* 10–23 mm long, 9–16 mm deep, bucciniform, apex acuminate and mucronate, with dark red reticulate lines, glabrous or remotely pilose, distal part gradually narrowed into an incurved spur, 15–22 mm long. *Dorsal petal* 13–18 by 9–16 mm, broadly ovate to elliptic, cucullate, apex acuminate to acute, base obtuse, pink, pilose, abaxial midvein with a crescent-shaped crest, c. 2 mm wide. *Lateral united petals* 26–30 mm long, free: the upper petals 9–12 by 6–10 mm, obovate, apex truncate, base cuneate, pink; the lower petals 18–20 by 8–10 mm, free, obliquely elliptic, apex acute to obtuse, with distinct auricles, glabrous. *Stamens*: filaments 5–6 mm long. *Ovary* 6.5–7 mm long, c. 1.5 mm diam, glabrous. *Fruits* c. 15 mm long, 3 mm diam, long fusiform, glabrous. *Seeds* unknown.

### Key to varieties of *Impatiens khasiana*

- Stem stout, erect, more than 40 cm tall . . . a. var. *khasiana*
- Stem slender, decumbent in the lower part, up to 30 cm tall . . . . . b. var. *toppinii*

### a. var. *khasiana* — Map 20

*Impatiens pritchardii* Toppin (1920) 359; W.J.Kress et al. (2003) 170, syn. nov. — Type: Toppin 4093 (lecto, designated here K 000694828; islecto K H2015/00092 149), Myanmar, Kachin State, Wasi, Kachin Hills, alt. 170 m, 12 Dec. 1911.

Herb more than 40 cm tall. *Stem* erect, stout, simple, 4–11 mm diam. *Petiole* (10–)25–45 mm long, 1.5–2 mm diam. *Lamina* 70–140 by 37–50 mm, apex acute to acuminate, base cuneate to attenuate, margin serrate with small teeth, adaxial pilose, abaxial remotely pilose, with 2–4 pairs of glandular hairs on margin near lamina base and 1–3 pair(s) on petiole, up to 2 mm long; lateral veins 10 or 11 pairs. *Inflorescence* axillary to subterminal, (1- or) 2- or 3-flowered. *Peduncle* 10–20 mm long, densely pilose. *Rachis* 2–11 mm long. *Flowers* 28–34 mm long, 27–40 mm deep, pink. *Bracts* 4–7 by 1.5–3.5 mm, narrowly lanceolate to elliptic, apex acute, base cuneate, margin entire, without glands, pilose. *Pedice* 14–17 mm long. *Lateral sepals* 8–12.5 by 5.5–7 mm, obliquely ovate, angular on one side, base cuneate, white with green tip. *Lower sepal* 16–23 mm long, 11–16 mm deep, glabrous or remotely pilose; spur 15–22 mm long. *Dorsal petal* 13–18 by 9–16 mm, broadly ovate to elliptic, apex acuminate to acute, abaxial midvein c. 2 mm wide. *Lateral united petals* 26–30 mm long: the upper petals 9–12 by 6–10 mm; the lower petals 18–20 by 8–10 mm, obliquely elliptic. *Stamens*: filaments 5–6 mm long. *Ovary* 6.5–7 mm long, c. 1.5 mm diam. *Fruits* c. 15 mm long, 3 mm diam.

Phenology — Flowering: May to September.

Distribution — Myanmar (Kachin State), India (Meghalaya State).

Ecology — Growing in damp shady areas, 150–200 m altitude.

Note — *Impatiens khasiana* var. *khasiana* differs from var. *toppinii* in a stout and erect stem, and a slightly recurved spur, while the latter has a slender and decumbent stem and strongly recurved spur. *Impatiens khasiana* var. *khasiana* grows at 150–200 m altitude, while *I. khasiana* var. *toppinii* grows at 1200–1800 m altitude. For *I. pritchardii*, we found two sheets of *Toppin* 4093. We select K000694828 as a lectotype because it is in better condition.

**b. var. *toppinii* (Dun) Ruchis. & Suksathan, stat. nov. — Map 20**

*Impatiens khasiana* var. *toppinii* (Dun) Ruchis. & Suksathan. — *Impatiens toppinii* Dun in *Toppin* (1920) 353; W.J.Kress et al. (2003) 170; Borah et al. (2015) 33. — Type: *Toppin* 2781 (lecto, designated in Borah et al. (2015) K K000694915; isolecto K K694913, K K694914, K K694916, K K694917, K K694948, K K694919), Myanmar, Kachin Hills, Sinlum, alt. 4000–5500 ft (1200–1700 m), 1911.

Herb up to 30 cm tall. *Stem* slender, 2–4 mm diam, erect to decumbent in the lower part, unbranched to branched in the decumbent part. *Petiole* 10–45 mm long, with 1–3 pair(s) of glandular hairs. *Lamina* 40–60 by 21–35 mm, margin serrate to crenate, with many pairs of glands near leaf base; lateral veins 6–9 pairs. *Inflorescence* 1- or 2-flowered. *Peduncle* 11–35 mm long. *Flowers* 20–35 mm long, 30–40 mm deep, purple. *Bracts* 3–6 by 1–3 mm, narrowly ovate to lanceolate, base cuneate to obtuse. *Pedice* 9–12 mm long. *Lateral sepals* 6–11 by 2–7 mm, ovate to lanceolate, base cuneate to obtuse, white with green tip. *Lower sepal* 10–18 mm long, 9–15 mm deep, densely pilose; spur 20–30(–37) mm long. *Dorsal petal* 9–13 by 9–13 mm, elliptic to obovate, apex round to acuminate to acute, abaxial midvein 1–2 mm wide. *Lateral united petals* 24–28 mm long: the upper petals, 9–12 by 5–9 mm; the lower petals 17–21 by 7–12 mm, ovate to obliquely elliptic. *Stamens*: filaments 5–7 mm long; anthers obtuse. *Ovary* 5–7 mm long.

Phenology — Flowering: May to November; fruiting: July to November.

Distribution — Myanmar (Kachin State, Mandalay Division), India (Arunachal Pradesh State) (Borah et al. 2015).

Ecology — Unknown, 1200–1800 m altitude.

Other collections examined. MYANMAR, Kachin State, *Lace* 5335 (K), Kadu, alt. 4000 ft, 10 July 1911; *Buchanan* 5 (K), Myitkyina district, Suma Hills, 30

Nov. 1910; *Buchanan* 5566 (K), *ibid.*, 1 Nov. 1911; Mandalay Region, *Lace* 6006 (E E00752949, E E00752950, K H2015/00092 139), Ruby mines district, 25 Oct. 1912.

Note — The photos in Borah et al. (2015: 34) show a glabrous stem and peduncle, but we do not have access to the photographed specimens. In order to fully understand the morphological variation of this species, a more thorough study is needed.

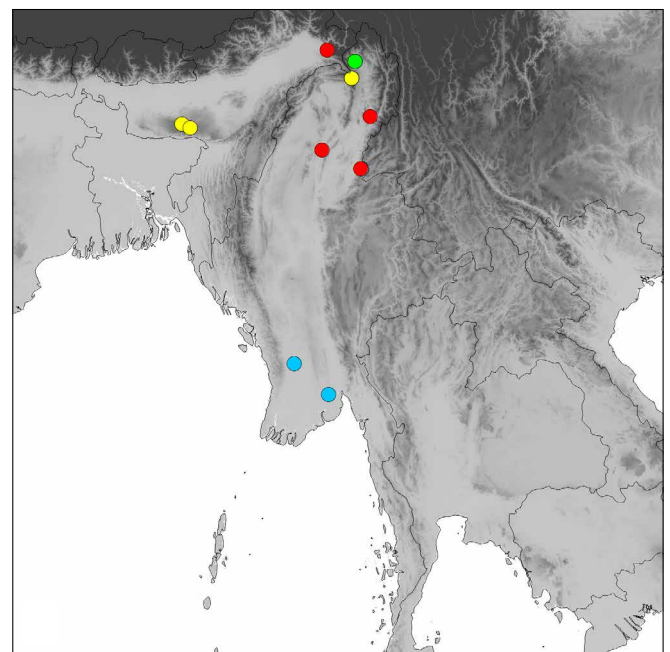
**60. *Impatiens kamtilongensis* Toppin — Map 20**

*Impatiens kamtilongensis* Toppin (1920) 356; W.J.Kress et al. (2003) 170.

— Type: *Toppin* 4275 (lecto, designated here K K000694653; isolecto K K000694654, K K000694655), Myanmar, Kamtilong Hills and Kachin Hills, Kumtat, Sinar. Dec. 1911.

— non S.Akiyama et al. (1996) 135; Y.L.Chen et al. (2007) 50, 93; V.T.Chinh et al. (2015) 332.

Terrestrial, annual herb, 13–28 cm tall. *Stem* erect to decumbent in the lower part, 3.2–5 mm diam, unbranched to rarely branched at the decumbent part, pilose to densely pilose towards apex. *Leaves* spirally arranged. *Petiole* 11.5–26 mm long, 1–1.5 mm diam, densely pilose, sometimes with 1 or 2 pair(s) of glandular hairs on petiole. *Lamina* 45–110 by 27–45 mm, elliptic to elliptic-obovate, apex acute to acuminate, rarely round, base attenuate, margin crenate to slightly serrate, densely pilose on both sides, with 1 or 2 pair(s) of long hairs on the margin near lamina base; lateral veins 7 or 8 pairs. *Inflorescence* axillary, erect, 1- or 2-flowered raceme. *Peduncle* 7 mm long, 1 mm diam, densely pilose. *Rachis* 4–4.5 mm long, c. 1 mm diam, densely pilose. *Flowers* 23 mm long, 23 mm deep, pink. *Bracts* 2–2.5 mm long, linear, apex acute, base cuneate, margin entire, without glands, densely pilose, persistent. *Pedice* 12.5–16 mm long, 0.5 mm diam, densely pilose. *Lateral sepals* 2, 9–11 by 4–5 mm, free, ovate to elliptic, apex acuminate to acute and mucronate, base obtuse to cuneate, densely pilose. *Lower sepal* 3.5–19 mm long, 8–14 mm deep, bucciniform, apex acuminate and mucronate, densely pilose, distal part abruptly constricted into an incurved spur, sometimes with spiral end, 21–26 mm long. *Dorsal petal* 10–12.5 by 7–8 mm, obovate, cucullate, apex emarginate, base obtuse to cuneate, pink, densely pilose on the midrib, abaxial midvein with an acute appendage, 2.5–4 mm



**Map 20** Distribution of *Impatiens khasiana* var. *khasiana* Hook.f. (●), *I. khasiana* var. *toppinii* (Dun) Ruchis. & Suksathan (●), *I. kamtilongensis* Toppin (●) and *I. lacei* Hook.f. (●).

long. *Lateral united petals* 18–25 mm long, free, pink: the upper petals 12.5–14 by 6–7 mm, broadly oblanceolate, apex truncate, base cuneate, pink; the lower petals 10–13.5 by 7–10 mm, free, ovate to broadly elliptic, apex round, base with distinct auricle, rounded, pink, glabrous. *Stamens*: filaments 5–5.5 mm long. *Ovary* 5–5.5 mm long, 1–1.5 mm diam, glabrous to scabrous. *Fruits* 14.5 mm long, 4 mm diam, long fusiform, glabrous to scabrous, green; pedicels at fruiting stage c. 15 mm long. *Seeds* unknown.

Phenology — Flowering: December; fruiting: December.

Distribution — Endemic to Myanmar (Kachin State).

Ecology — Growing in wet and shady areas of evergreen forest, 500–650 m altitude.

Notes — *Impatiens kamtilongensis* is very similar to *I. khasiana* and *I. porrecta* but differs in having a dorsal sepal with an acute appendage, instead of a crescent-shaped crest or keel-shaped crest, on the abaxial side of the dorsal petal.

Although Toppin (1920) mentioned that *I. khasiana* and *I. kamtilongensis* have different flower colours, dried flowers on the type specimens of both taxa are pink. In the description of *I. kamtilongensis*, Toppin (1920) states “Flores pallide sufflavi vel fere albi” (flowers yellowish or almost white), but this possibly refers to the colour of the lower sepal, not to the colour of the whole flower.

Akiyama et al. (1996), Chen et al. (2007) and Chinh et al. (2015) mention *I. kamtilongensis* as having yellow flowers, hence, we suspect that the specimens they refer to do not belong to this taxon in our sense.

Three sheets of the type specimen of *I. kamtilongensis*, Toppin 4275, were found. We select K000694653 as a lectotype because it is a complete specimen with dissected flowers.

#### 61. *Impatiens lacei* Hook.f. — Map 20

*Impatiens lacei* Hook.f. (1910b) t. 2912; W.J.Kress et al. (2003) 170. — Type: *Lace* 2881 (lecto, designated here K 000694822; isolecto K H2015/00092150), Myanmar, Pegu District, banks of Pyinma Chaong, N17°20' E96°10', 7 Jan. 1906.

Terrestrial herb, 16–28 cm tall. *Stem* erect, simple to rarely branched, mostly glabrous to remotely pilose, densely pilose towards apex. *Leaves* spirally arranged. *Petiole* 15–30 mm long, pilose. *Lamina* 65–110 by 22–45 mm, lanceolate to ovate, apex acute to acuminate, base obtuse to attenuate, margin serrate to shallowly serrate, pilose on both sides, with many long hairs around lamina base and on petiole, up to 10 mm long, and one pair of clavate glands on petiole; lateral veins 6–9 pairs. *Inflorescence* axillary, pendulous, 1–3-flowered raceme. *Peduncle* 5–11 mm long, glabrous. *Rachis* absent – 2 mm long. *Flowers* 23–30 mm long, 35–43 mm deep. *Bracts* c. 1 by < 1 mm, ovate to broadly ovate, apex acute and mucronate, base obtuse, margin entire, glabrous, persistent. *Pedicel* 7–16 mm long, glabrous. *Lateral sepals* 2, 4–5 by 2–2.5 mm, free, elliptic to ovate to obliquely ovate, apex acuminate to acute and mucronate, base obtuse to cuneate, glabrous. *Lower sepal* 15–18 mm long, 20–25 mm deep, deeply bucciniform, apex acute, glabrous, distal part abruptly constricted into an incurved spur, 8–13 mm long, bifid. *Dorsal petal* 10–11 by 12–15 mm, broadly elliptic to orbicular, cucullate, apex emarginate to round and mucronate, base round, glabrous, abaxial midvein with a crescent-shaped crest, 1–1.5 mm wide. *Lateral united petals* 20–23 mm long, free: the upper petals c. 13 by 9 mm, broadly ovate, obtuse, base cuneate; the lower petals c. 16 by 8 mm, free, obovate, obtuse, base with distinct auricles, glabrous. *Stamens*: filaments 4.5 mm long. *Ovary* c. 4 mm long, c. 1 mm diam. *Fruits* c. 12 mm long, 3.5 mm diam, fusiform, glabrous. *Seeds* unknown.

Phenology — Flowering: July to January.

Distribution — Endemic to Myanmar (Bago Region, Ayeyarwaddy Region).

Ecology — Unknown.

*Other collections examined.* MYANMAR, Ayeyarwaddy Region, *Allan* 4842 (E E00752958, E E00752959, K), Henzada district, 1 Dec. 1908, Bago Division.

Note — *Impatiens lacei* can be easily distinguished from other species by the presence of many long hairs on the leaf margin, measuring up to 10 mm long. We found 2 sheets of *Lace* 2881 and we select K000694822 as a lectotype because this specimen is more complete and included dissected flowers.

#### 62. *Impatiens andersonii* Hook.f. — Map 21; Plate 4e

*Impatiens andersonii* Hook.f. (1905) 27, 33; W.J.Kress et al. (2003) 169. — Type: *Anderson* s.n. (lecto, designated here K 000694627), Myanmar, Shan State, Hoetone, 1 Sept. 1868.

*Impatiens garrettii* Craib (1926a) 160, syn. nov. — Type: *Garrett* 94 (lecto, designated here K 000675566; isolecto BKF005985, E E00753953, K 000675566), Thailand, Chom Thong, Doi Angka, Pha Ngaem, Doi Inthanon National Park, Doi Angka, 1300–1675 m.

Terrestrial, annual herb, 22–40 cm tall. *Stem* erect, 3–8 mm diam, solitary to richly branched, angular, pale green, sometimes with purple dots, pilose towards apex, glabrous on the lower part. *Leaves* spirally arranged. *Petiole* 40–45 mm long, or much shorter in leaves subtending floral buds, measuring 1–2 mm long, 1–2 mm diam, angular, green to purple, glabrous. *Lamina* 50–100 by 20–45 mm, ovate to elliptic, papery, apex acute to acuminate, base obtuse to attenuate, margin crenate, adaxial green and pilose, abaxial pale green and remotely pilose, with a short clavate gland on each side of lamina base; lateral veins 11–14 pairs. *Inflorescence* axillary, pendulous, 1- or 2-flowered racemes. *Peduncle* 12–15 mm long, < 1 mm diam, cylindrical, green, pilose. *Rachis* < 1 mm long, < 1 mm diam. *Flowers* 20–25 mm long, 15–17 mm wide, 20–23 mm deep, pink with pale pink and yellow mark at lower sepal. *Pedicel* 3–4 mm long, < 1 mm diam, white to pale green, glabrous. *Bracts* up to 2 by < 1 mm, apex acute, base cuneate, margin entire, without glands, white to pale green, glabrous, persistent. *Lateral sepals* 2, 5–6 by 2–3 mm, free, obliquely ovate to falcate, apex acuminate and mucronate, base obtuse, white to green, semipellucid, with green apex, glabrous. *Lower sepal* 11–12 by 5–7 mm, 9–10 mm deep, bucciniform, apex acuminate, pale pink with darker pink lines and yellow mark adaxially, distal part gradually constricted into an incurved spur, 14–15 mm long, pale pink. *Dorsal petal* 9–10 by 5–6 mm, ovate, cucullate, apex acute and mucronate, base truncate, pink, glabrous, abaxial midvein with a slightly crescent-shaped or obtuse crest, c. 0.5 mm wide, white. *Lateral united petals* 18–19 mm long, free: the upper petals 6–7 by 5–6 mm, broadly obovate, apex truncate, base cuneate, pink; the lower petals 12–14 by 8–9 mm, free, ovate to elliptic, apex obtuse, pink, with yellow auricle at the base. *Stamens*: filaments 3–4 mm long, white to pale pink; anthers white. *Ovary* c. 3 mm long, c. 1 mm diam, 5-carpellate, white, glabrous. *Fruits* c. 9 mm long, c. 4 mm diam, fusiform, 5-lobed, white to pale green, semipellucid, glabrous. *Seeds* c. 5–7, ellipsoid, c. 2 mm long, remotely pilose.

Phenology — Flowering: July to September to October; fruiting: September to October.

Distribution — Myanmar (Shan State), northern Thailand.

Ecology — Growing in shady areas in mixed deciduous forest along roadsides, 1600–1700 m altitude.

*Other collections examined.* MYANMAR, Shan State, *Ruchisansakun* et al. 733 (L L2071122, MAND, RAF), Taunggyi District, Pindaya, Inzen village, N20°58'53.31" E96°38'03.14", 26 Sept. 2015.

Notes — *Impatiens garrettii* is similar to *I. andersonii*. No characters can be found that distinguish the two species and as a result they are synonymized here. The name *I. andersonii* Hook.f. subsp. *garrettii* (Craib) T. Shimizu was used to annotate some specimens but was never officially published. Hooker (1905) mentioned only the locality of *I. andersonii* but did not designate a type specimen. However, we found that only one specimen, *Anderson s.n.* (K000694627), matches the protologue (Hooker 1905). Hence, we designate this specimen as the lectotype. Regarding the unclear locality of this specimen, Hotone or Floetone, Yunan (Yunnan), we confirmed from Anderson's book that the lectotype was collected in Hoetone, near Bhamo, Myanmar (Anderson 1871: 382).

For *I. garrettii*, we found four sheets of *Garrett 94* and select K000675566 as lectotype because it is the most complete specimen with a dissected flower.

### 63. *Impatiens delicata* Toppin — Map 21

*Impatiens delicata* Toppin (1920) 350; W.J.Kress et al. (2003) 169. — Type: *Toppin 4287* (lecto, designated here K K000694679; isolecto K K000694680), Myanmar, Sumpuang, Kachin Hills, Dec. 1911.

Terrestrial herb, 8–12 cm tall. *Stem* decumbent, c. 2 mm diam, branched at the decumbent parts, glabrous. *Leaves* spirally arranged. *Petiole* 5–15 mm long, glabrous. *Lamina* 30–70 by 13–20, the leaves on the upper nodes are larger than on the lower nodes, narrowly elliptic to lanceolate, apex acute, base cuneate, margin crenate, glabrous, with 1 or 2 long hairs on each side of the midrib near the base, 1–1.5 mm long; lateral veins 4 or 5 pairs. *Inflorescence* axillary, erect, 1- or 2-flowered raceme. *Peduncle* 14–22 mm long, 1–1.5 mm diam, glabrous. *Rachis* 1–1.5 mm long. *Flowers* 30–38 mm long, 30–35 mm deep, rose pink. *Bracts* 2–3 by 1 mm, lanceolate to ovate, apex acute and mucronate, base cuneate, margin entire, without glands, glabrous, persistent. *Pedice* 10–15 mm long, glabrous. *Lateral sepals* 2, 7–10 by 4–5.5 mm, free, ovate-lanceolate to lanceolate, apex acuminate and mucronate, base obtuse, pink, glabrous. *Lower sepal* 14–21 mm long, 13–18 mm deep, bucciniform, apex acute, deep pink, glabrous, distal part gradually constricted into a straight or curved spur, 25–30 mm long. *Dorsal petal* 11–13 by 10–11.5 mm, ovate to orbicular, cucullate

to flat, apex obtuse, base cordate, glabrous, abaxial midvein with a slightly crescent-shaped crest. *Lateral united petals* 29–31 mm long, free: the upper petals 12–13 by 8.5–9 mm, obovate, apex truncate, base cuneate, pink; the lower petals 19.5–20 by 8.5–9 mm, free, ovate to obovate, apex obtuse to acute, base with distinct auricle, pink-yellow. *Stamens*: filaments c. 6 mm long. *Ovary* c. 5 mm long, c. 1.5 mm diam, glabrous. *Fruits* unknown. *Seeds* unknown.

Phenology — Flowering: October to December.

Distribution — Endemic to Myanmar (Kachin State).

Ecology — Growing in mossy areas of evergreen forest, c. 400 m altitude.

*Other collections examined.* MYANMAR, Kachin State, Jin et al. *PT-ET 1276* (PE PE2472769\*, PE PE2472770\*), Putao, Machanbaw, N27°18'04.83" E97°35'08.61", alt. 420 m, 25 Oct. 2014; Jin et al. *PT-ET 20* (PE PE2472765\*, PE PE2472766\*, PE PE2472767\*), Putao, Mularshidi, N27°15'17.29" E97°25'26.89", alt. 460 m, 11 Oct. 2014.

Note — *Impatiens delicata* is similar to *I. erubescens* but differs in having a glabrous stem, instead of a pilose one. In the protologue, Toppin (1920) compared this species to *I. pulchra* and mentioned that *I. delicata* differs from *I. pulchra* by having 4 or 5 lateral veins. However, we found that it is easier to distinguish *I. delicata* by its pink instead of orange flowers and a straight or curved spur instead of a spiral one. We found two sheets of *Toppin 4287*. We select K000694679 as a lectotype because it is more complete and include dissected flowers.

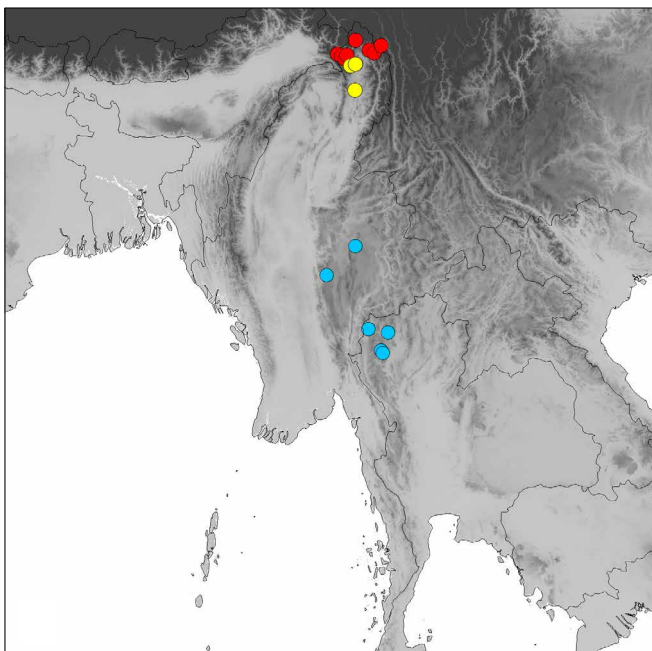
### 64. *Impatiens gongshanensis* Y.L.Chen — Map 21; Plate 4f

*Impatiens gongshanensis* Y.L.Chen (2000) 560. — Type: *Qinghai-Xizang Exped. 9165* (holo PE PE00039545\*; iso PE PE00039546\*, PE PE00039547\*), China, Yunnan, Gongshan, Dulongjiang-Qiujiang valley, alt. 1200–1300 m, 9 Aug. 1984.

Terrestrial, glabrous herb, 10–35 cm tall. *Stem* erect to decumbent in the lower part, 1–3 mm diam, unbranched to rarely branched at decumbent part, green, glabrous. *Leaves* spirally arranged. *Petiole* 5–15 mm long, < 1 mm diam, glabrous. *Lamina* 50–90 by 10–15 mm, narrowly elliptic to narrowly oblanceolate, apex acute, base cuneate, margin serrate, adaxial green, abaxial pale green, glabrous, without glands; lateral veins 5–8 pairs. *Inflorescence* subterminal to axillary, erect, 1- or 2-flowered raceme. *Peduncle* 13–20 mm long, c. 1 mm diam, green, glabrous. *Rachis* 5 mm long, < 1 mm diam, green, glabrous. *Flowers* 25–35 mm long, 35–40 mm deep, purple. *Bracts* 3–4 by 1–2 mm, elliptic to lanceolate, apex acute, base obtuse, margin entire, green, glabrous, persistent. *Pedice* 9–20 mm long, < 1 mm diam, green, glabrous. *Lateral sepals* 2, 6–10 by 4–7 mm, free, obliquely obovate, apex acute and mucronate, base obtuse, green with red dots, glabrous. *Lower sepal* 16–20 mm long, 13–16 mm deep, bucciniform, apex acute and mucronate, pinkish orange with red reticulations and yellow base, glabrous, distal part gradually tapering into a curved spur with spiral end, 20–30 mm long. *Dorsal petal* 13–15 by 12–17 mm, broadly ovate, cucullate, apex obtuse, base truncate, purple, glabrous, abaxial midvein with a crescent-shaped crest, 2–3 mm high. *Lateral united petals* 30–33 mm long, free: the upper petals 14–16 by 10–11 mm, broadly obovate, apex truncate, base cuneate, purple; the lower petals 20–22 by 8–9 mm, free, elliptic, apex obtuse, base with distinct auricle, pink, glabrous. *Stamens*: filaments pale pink to white; anthers obtuse, white to pale pink. *Ovary* c. 5 mm long, c. 1 mm diam, green, glabrous. *Fruits* 19–20 mm long, 3–4 mm diam, long fusiform, 5-lobed, green, glabrous; pedicel at fruiting stage 13–15 mm long, straight. *Seeds* unknown.

Phenology — Flowering: August to October.

Distribution — Myanmar (Kachin State), China (Yunnan Province).



**Map 21** Distribution of *Impatiens andersonii* Hook.f. (●), *I. delicata* Toppin (●) and *I. gongshanensis* Y.L.Chen (●).

**Ecology** — Growing in mossy areas of running streams, 1200–1300 m altitude.

**Other collections examined.** MYANMAR, Kachin State, *Kingdon-Ward 7302* (K H2015/00092 12), Putao, Valley of the Lam Tawai, N28°00' E97°35', 4000 ft, 16 Aug. 1926; *Saw-Lwin 1025* (L), *Saw-Lwin 1027* (L), *Saw-Lwin 1075* (L), Kachin State, 26 Oct. 2015.

**Note** — *Impatiens gongshanensis* is very similar to *I. pulchra* but differs in having purple flowers. It is also similar to *I. delicata* and *I. erubescens* in overall size, leaf shape and flower colour, but differs in having a curved spur with a spiral end.

### 65. *Impatiens pulchra* Hook.f.

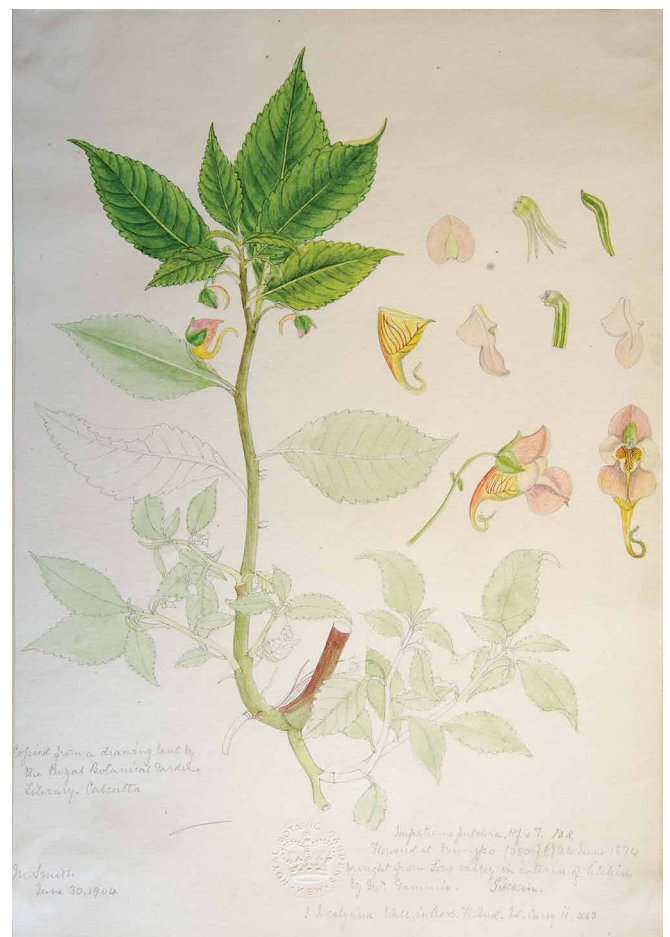
*Impatiens pulchra* Hook.f. in Hook.f. & Thomson (1860) 139; Hook.f. (1875) 139; (1905) 25, 32; Biswas (1966) 205; Vivek. et al. (1997) 111, 199; W.J. Kress et al. (2003) 170. — Type: *Hooker & Thomson 93* (lecto, designated here K K000694754; islecto B B100365132, C C10008239, G G00237316\*, K K000694753, K K000694755, M M0211744, P P04543743, P P04543746, S S-G-3355\*), India, Khasia, alt. 5000 ft.

Terrestrial to semi-aquatic, annual herb, 15–60 cm tall. *Stem* erect to decumbent below, slender or stout, 3–9 mm diam, unbranched to rarely branched, shallowly terete to cylindrical, green, glabrous to slightly scabrous. *Leaves* spirally arranged. *Petiole* 2–55 mm long, 1–3.6 mm diam flat, glabrous to remotely pilose. *Lamina* 40–150 by 15–60 mm, narrowly elliptic to narrowly oblanceolate to oblanceolate to obovate to elliptic, apex acute to acuminate, base cuneate to attenuate, margin serrate to crenate, coriaceous, dark green above, glaucous beneath, glabrous, sometimes pilose in young leaves, sometimes

with 1–4 pair(s) of linear glands near lamina base; lateral veins 5–8 pairs. *Inflorescence* axillary, erect, 1–5-flowered raceme. *Peduncle* 20–60 mm long, 1–2 mm diam, cylindrical, green to reddish green, glabrous to pilose. *Rachis* 1–6 mm long, 1–1.5 mm diam, glabrous. *Flowers* 20–50 by 22–25 mm, 25–50 mm deep, creamy to yellow to orange with darker shade at dorsal petal and upper lateral united petals base. *Bracts* (2–)3–9 by 1–2 mm, ovate to narrowly lanceolate, apex acute, base cuneate to obtuse, margin entire, green to red, glabrous or abaxially pilose, persistent. *Pedice* 10–30 mm long, c. 1 mm diam, cylindrical, green to purple, glabrous. *Lateral sepals* 2, 5–13 by 5–9 mm, free, ovate to broadly ovate to orbicular to elliptic, apex acute to acuminate and mucronate, base obtuse to truncate, deep orange to green, glabrous or abaxially pilose. *Lower sepal* 15–23 by 10–12 mm, 10–20 mm deep, buccini-form, apex acute to acuminate and mucronate, deep orange to pale orange with brown reticulations, glabrous, distal part abruptly constricted into an incurved spur with spiral end or initially straight but distally curved, 15–35 mm long. *Dorsal petal* 15–18 by 10–18 mm, ovate to elliptic to orbicular, cucullate, apex round to truncate and mucronate, base obtuse to truncate, creamy to orange with dark orange at centre, glabrous, abaxial midvein with a crescent-shaped crest, 1–3 mm wide. *Lateral united petals* 24–40 mm long, free: the upper petals 10–17 by 8–15 mm, orbicular to broadly oblanceolate to ovate to elliptic, apex truncate to obtuse, base cuneate, creamy to orange with dark orange at the base; the lower petals 13–23 by 7–15 mm, free, ovate to oblong to elliptic, apex obtuse, base with round yellow auricle, 2–3 mm high, creamy to orange, glabrous. *Stamens*: filaments 5–9 mm long, green; anthers obtuse, white. *Ovary* 4–7 mm long, 1–1.5 mm diam, 5-carpellate, green. *Fruits* 20–22 mm long, 4–6 mm diam, long fusiform, 5-lobed, green, glabrous. *Seeds* 30–35.



**Fig. 20** Water colour illustration from Kew which is annotated as *I. pulchra*.



**Fig. 21** Water colour illustration from Kew which is annotated as *I. pulchra*.

Note — We found that *I. pulchra* and *I. burmanica* are not sufficiently distinct to maintain them as different species. As a result, we decided to change the status of *I. burmanica* to *I. pulchra* var. *burmanica*.

#### Key to varieties of *Impatiens pulchra*

- Distal part of spur annular or almost annular. . . . . a. var. *pulchra*
- Distal part of spur straight and incurved, not annular . . . . . b. var. *burmanica*

#### a. var. *pulchra* — Map 22; Plate 4g

*Impatiens pulchra* var.  $\beta$  Hook.f. & Thomson (1860) 139. — Type: *Hooker 94* (lecto, designated here K 000694757; isolecto K 000694758), Nepal, Moyong valley, 4000–5000 ft, Oct. 1831.

*Impatiens annulifera* Hook.f. (1905) 27; Vivek. et al. (1997) 109, 119, syn. nov. — Type: *Meebold 6714* (lecto, designated here K 000694759), India, Manipur (Myring), Naga Hills, Dec. 1907.

*Impatiens mengtzeana* Hook.f. (1908) 240, 256; Craib (1911) 25; Y.L. Chen et al. (2007) 50, 92. — *Impatiens mengtzeana* Hook.f. (1911a) 613; Craib (1926b) 211, syn. nov. — Type: *Henry 11208* (lecto, designated in Verma et al. (2016) K 000199721; isolecto NY NY406461\*), China, Yunnan, Leng-chan-ten, alt. 7000 ft

Herb, 15–60 cm tall. *Stem* erect to decumbent below, 5–9 mm diam, unbranched to rarely branched, shallowly terete to cylindrical, green, glabrous to slightly scabrous. *Leaves* spirally arranged. *Petiole* 2–50 mm long, 3–3.6 mm diam flat, glabrous. *Lamina* 40–150 by 15–45 mm, narrowly elliptic to narrowly oblanceolate to oblanceolate to obovate to elliptic, apex acute to acuminate, base cuneate to attenuate, margin serrate to crenate, coriaceous, dark green above, glaucous beneath, sometimes pilose in young leaves, sometimes with 1 or 2 pair(s) of linear glands near lamina base; lateral veins 5–8 pairs. *Inflorescence* 1- or 2-flowered. *Peduncle* 20–60 mm long, reddish green. *Rachis* 1–6 mm long. *Flowers* 25–50 by 22–25 mm, 25–40 mm deep, creamy to yellow to orange with darker shade at dorsal petal and upper lateral united petals base. *Bracts* 3–7 by 1.5–2 mm, green to red, glabrous. *Pedice* 10–25 mm long, purple. *Lateral sepals* 5–13 by 5–9 mm, ovate to orbicular to elliptic, base obtuse to truncate, green, glabrous. *Lower sepal* 17–23 by 10–12 mm, 12–20 mm deep, orange to pale orange with brown reticulations; spur incurved with spiral

end, 15–35 mm long. *Dorsal petal* 15–18 by 10–18 mm, ovate to elliptic to orbicular, apex truncate, base obtuse to truncate, creamy to orange with dark orange at centre, abaxial midvein with a crest, 1–3 mm high, green. *Lateral united petals* 25–40 mm long: the upper petals 10–17 by 8–15 mm, orbicular to broadly oblanceolate, apex truncate, creamy to orange with dark orange at the base; the lower petals 15–23 by 8–15 mm, ovate to oblong to elliptic, base with round yellow auricle, 2–3 mm high, creamy to orange, glabrous. *Stamens*: filaments 6–9 mm long, green. *Ovary* 5–7 mm long, 1–1.5 mm diam, 5-carpellate, green. *Fruits* 20–22 mm long, 4–6 mm diam. *Seeds* 30–35.

Phenology — Flowering: August to December; fruiting: October to January.

Distribution — Myanmar (Chin State, Kachin State, Shan State), China (Yunnan), India (Mizoram State, Nagaland State, Sikkim State), Nepal (Kosi Zone), Thailand (Chiang Mai, Chiang Rai, Lampang).

Ecology — Growing in swamps or on organic matter on rocks near waterfalls.

*Other collections examined.* CHINA, *W. Hancock 56* (syn K 000694575), Mont. Mengtze, alt. 6000 ft; *Henry 12536B* (syn K 000199722), *Henry 12536C* (CAL not seen, K 000199726), *Henry 12356D* (CAL not seen, K 000199727), Szemao mountains. — MYANMAR, Chin State, *Clarke 41147A* (K), Keywiwa, Naga Hills, 26 Dec. 1885; *Tanaka et al. 031034* (MBK K0086117), Natma Taung (Mt Victoria) National Park, along the roadside near the Kanpetlet guest house, alt. 1680–1315 m, 22 May 2004; *Ling Shing Maung & Cho Cho Win 024326* (QBG QBG61250), Mt Victoria, Natmataung National Park, Western Myanmar, 17 Sept. 2002; *Kingdon-Ward 22664* (BM), Erakan, Mt Victoria, alt. 6000 ft, 6 Sept. 1956; *U Mg Gale-25765* (RAF8272/2 3 sheets), Kanpetlet Dist., Esaken, alt. 5700 ft, Sept. 1956; *Ling Shein Man et al. 087427* (QBG QBG61272), Kanpetlet Township, Ma Kyauk Ah Village area, alt. c. 4800 ft, 24 June 2011.

Notes — *Impatiens pulchra* var. *pulchra* is easily recognisable by its large yellow to orange flowers, which have a spur with a spiral distal part. The leaves are variable in shape. Hooker & Thomson (1860) separated *I. pulchra* with elliptic to narrowly lanceolate leaves and *I. pulchra* var.  $\beta$  with broadly elliptic to ovate-lanceolate leaves, but we did not find this a sufficient basis for taxonomic recognition.

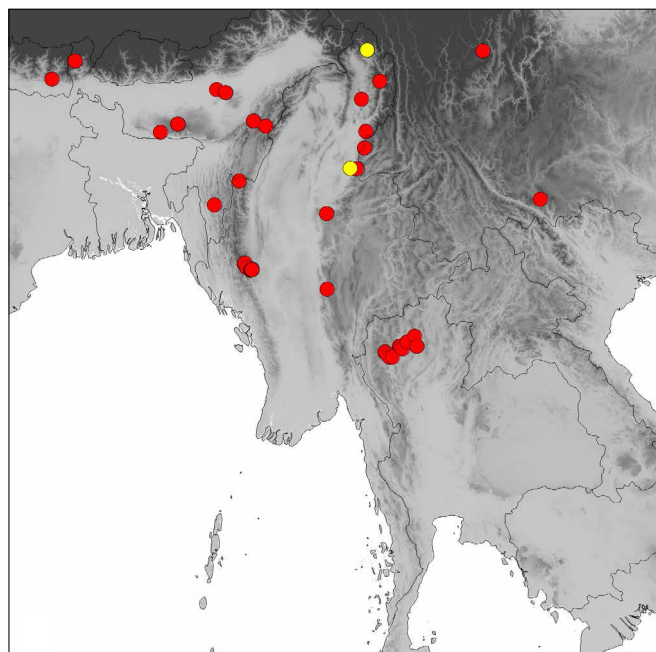
There are at least three sheets of syntypes of *I. pulchra*. We select *Hooker & Thomson 93* (K000694754) because it has more flowers and is in better condition than the other two sheets. For *I. pulchra* var.  $\beta$ , we found two syntypes and we select *Hooker 94* (K000694757) as lectotype because it has a completely dissected flower that shows all floral details.

*Impatiens mengtzeana* is synonymized under *I. pulchra* because we did not find any difference between them. Moreover, it is similar to the watercolour illustrations in the Kew Herbarium (Fig. 20, 21), annotated by Hooker as *I. pulchra*.

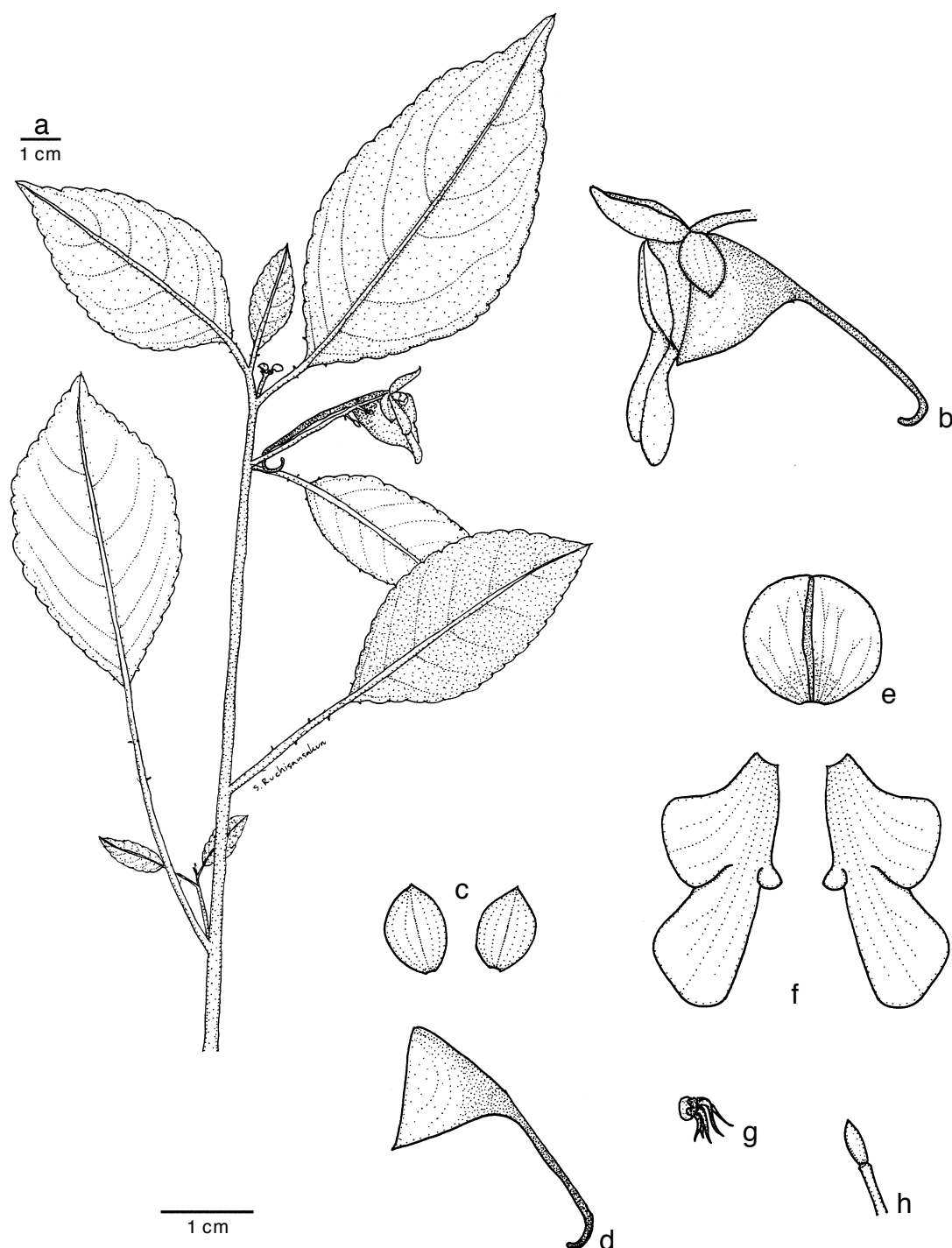
#### b. var. *burmanica* (Hook.f.) Ruchis. & Suksathan, *stat. nov.* — Fig. 22; Map 22

*Impatiens pulchra* Hook.f. var. *burmanica* (Hook.f.) Ruchis. & Suksathan. — *Impatiens burmanica* Hook.f. (1905) 27, 33; W.J. Kress et al. (2003) 169. — Type: *Huk s.n.* (lecto, designated here K 000694719), Myanmar, Upper Burma, Bhamo, June 1892.

Plant up to 40 cm tall. *Stem* stout, 3–6 mm diam, unbranched, glabrous. *Leaves* spirally arranged. *Petiole* 20–55 mm long, 1–3 mm diam, glabrous to remotely pilose. *Lamina* 70–130 by 35–60 mm, ovate to elliptic, margin serrate, sometimes with 1–4 pair(s) of glands on petiole; lateral veins 5–7 pairs. *Inflorescence* 2–5-flowered. *Peduncle* (35–)50–60 mm long, green. *Rachis* 4–6 mm long. *Flowers* 20–35 mm long, 30–50 mm deep, orange. *Bracts* (2–)4–9 by 1 mm, green, abaxially pilose. *Pedice* (22–)24–30 mm long, green. *Lateral sepals* (6–)7–9 by 5–6 mm, broadly ovate, base obtuse, deep orange



Map 22 Distribution of *Impatiens pulchra* var. *pulchra* Hook.f. (●) and *I. pulchra* var. *burmanica* (Hook.f.) Ruchis. & Suksathan (●).



**Fig. 22** *Impatiens pulchra* Hook.f. var. *burmanica* (Hook.f.) Ruchis. & Suksathan. a. Habit; b. lateral view of flowers; c. lateral sepals; d. lower sepal; e. dorsal petal; f. lateral united petals; g. stamens; h. ovary. — Drawn by Saroj Ruchisansakun.

to green, abaxially pilose. *Lower sepal* 15–19 mm long, (10–) 12–15 mm deep, deep orange; spur, initially straight but distally curved, (23–)30–35 mm long, orange with green tip. *Dorsal petal* 15–17 by 16–18 mm, elliptic, apex round, base obtuse, abaxial midvein with a crest, c. 1 mm high. *Lateral united petals* 24–30 mm long: the upper petals c. 14 by 9 mm, ovate to elliptic, apex obtuse, orange; the lower petals 13–14 by 7–9 mm, ovate, base with distinct auricle, orange. *Stamens*: filaments 5 mm long. *Ovary* 4 mm long, 1 mm diam. *Fruits* 20 mm long, 4 mm diam; pedicels at fruiting stage c. 26 mm long. *Seeds* unknown.

**Phenology** — Flowering: June to September; fruiting: August to September.

**Distribution** — Endemic to Myanmar (Kachin State).

**Ecology** — 400–1200 m altitude.

**Other collections examined.** MYANMAR, NE Burma, alt. 4000 ft, *Toppin* 2746 (BM, K H2015/00092 75, 76, 77, 78); Kachin State, Kachin Hills: Kumtat 1600' Pungyi Gyl 1250', *Toppin* 4136 (K H2015/00092 79); Kachin Hills, *Mokim* s.n. (K K000694720), N27°45' E97°50', alt. 2000 ft, 6 Sept. 1926, *Kingdon-Ward* 7373 (K); Bhamo, Palawaghahlaway, alt. 3000 ft, Sept. 1909, *Cubitt* 284 (K 2 sheets).

**Notes** — *Impatiens pulchra* var. *burmanica* differs from *I. pulchra* var. *pulchra* in having a straight spur with an incurved tip (Fig. 2am, 22). Colour illustrations by Toppin of this taxon are deposited in the Kew Herbarium.

Hooker (1905) mentioned the locality but did not designate a type for *I. burmanica*. We found just one specimen, *Huk* s.n. (K000694719), matching the protologue (Hooker 1905). Hence, we designate this specimen as lectotype for this species.

**Table 4** The number of species in each infrageneric taxon.

Subgenera	Sections	Species number (species in the list)
<i>Impatiens</i>	<i>Semeiocardium</i>	8 (2–9)
	<i>Impatiens</i>	1 (10)
	<i>Racemosae</i>	18 (11–28)
	<i>Fasciculatae</i>	1 (29)
	<i>Scorpioidae</i>	1 (30)
	<i>Uniflorae</i>	35 (31–65)
	<i>Tuberosae</i>	0
<i>Clavicarpa</i>		0

## DISCUSSION

### Subgeneric taxa of *Impatiens* in Myanmar

One subgenus and six out of the seven sections of Yu et al. (2015) are found in Myanmar (Table 4). The two groups lacking are subg. *Clavicarpa* and subg. *Impatiens* sect. *Tuberosae*.

Subgenus *Impatiens* sect. *Semeiocardium* is characterized by a 4-locular ovary with clavate, linear or cylindrical fruits, which are not hammerhead-shaped, and contain more than one ovule per locule (Yu et al. 2015). Most species in this section have connate lateral united petals (Ruchisansakun et al. 2015). *Impatiens laevigata* has long, linear upper lateral sepals and free lower lateral petals, similar to subg. *Clavicarpa*. However, the cylindrical fruit indicates that it belongs to subg. *Impatiens* sect. *Semeiocardium* (Yu et al. 2015, Ruchisansakun et al. 2015). Some species of sect. *Semeiocardium*, such as *I. damrongii*, *I. laevigata*, *I. stenosepala* and *I. wenshanensis* are different from the others by their long linear upper sepals and free lower lateral petals (Yu et al. 2015, Ruchisansakun et al. 2015). This group should perhaps be treated as a separate section.

Species of sect. *Racemosae* are distinguished by the combined presence of a racemose inflorescence and linear fruits. Most of

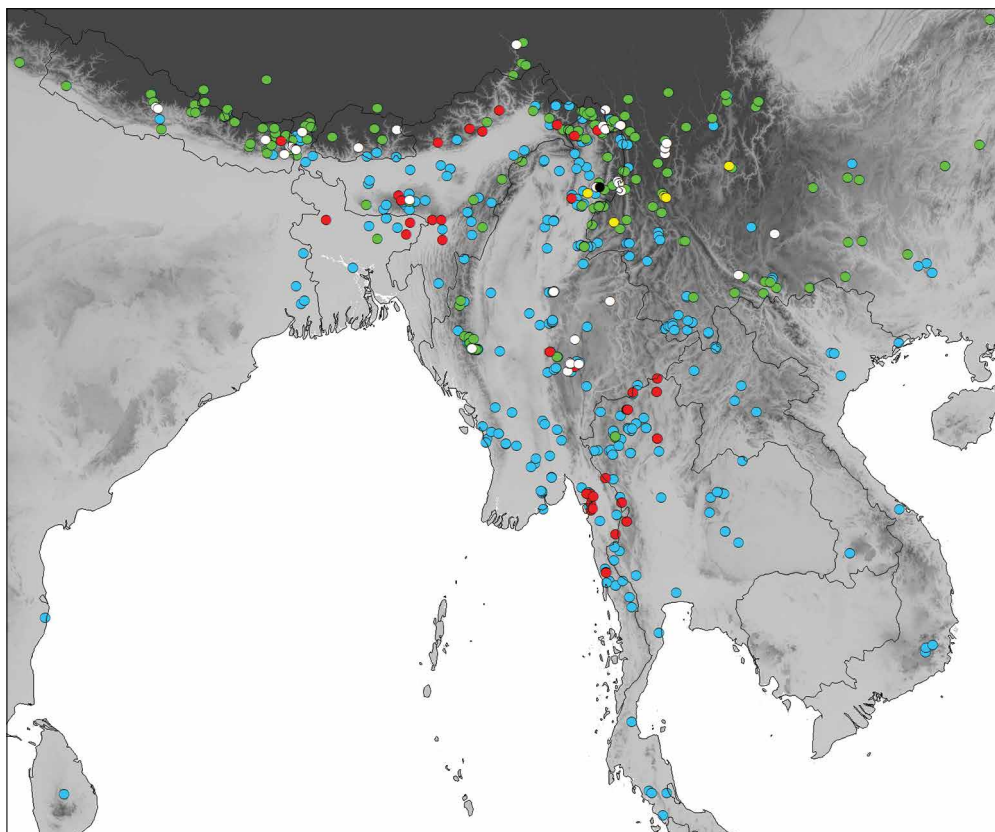
the species in this section have a navicular or deeply navicular lower sepal, except *I. ceratophora*, *I. chimiliensis*, *I. clavicuspis* and *I. sinlumiensis*, that have a large bucciniform lower sepal.

Section *Uniflora* contains a large number of species and is morphologically highly distinct. Among those that occur in Myanmar, we found several clusters of similar species: species 31–35 are characterized by decussate leaves and flowers in fascicles; species 43–49 by flowers in racemes and short, fusiform fruits; and species 55–65 by fusiform fruits and a large bucciniform lower sepal. Further morphological and phylogenetic studies are required to confirm whether these informal groups are monophyletic.

### The distribution of *Balsaminaceae* in Myanmar and surrounding areas

*Balsaminaceae* are widely distributed throughout most of Myanmar. A minority of species are known from lowland areas of central Myanmar, whereas most occur in montane areas (Map 23). In this revision we have included 65 species as native to the country. *Hydrocera triflora*, the most widespread species of the family, occurs in the lowlands of Mon and Shan State (Table 5), as well as in several other Southeast Asian countries (Map 3). Most *Impatiens* species in Myanmar have a narrow distribution, a situation that is quite typical for this genus (Grey-Wilson 1980a, Chen et al. 2007). Twenty-five *Impatiens* species (38 %) are endemic to Myanmar. Of the remaining *Impatiens* species, 21 are also distributed in India (32 %), 21 also occur in China (32 %) and 15 in Thailand (23 %) or other surrounding countries (Table 5). Widespread taxa include *I. arguta*, *I. balsamina*, *I. chinensis*, *I. pulchra* var. *pulchra*, *I. racemosa* and *I. radiata*.

Representatives of the various sections are not distributed equally in Myanmar (Map 23). Members of sect. *Semeiocardium* (species 2–9) are mainly distributed in southern Myanmar and Shan State, except *I. laevigata*, which is also distributed in



**Map 23** Distribution of *Impatiens* species that are growing in Myanmar (with inclusion of their extended distribution range in Southeast Asia): *Impatiens* subg. *Impatiens* sect. *Semeiocardium* (●), *Impatiens* subg. *Impatiens* sect. *Impatiens* (●), *Impatiens* subg. *Impatiens* sect. *Racemosae* (●), *Impatiens* subg. *Impatiens* sect. *Fasciculatae* (○), *Impatiens* subg. *Impatiens* sect. *Scorpioidae* (●) and *Impatiens* subg. *Impatiens* sect. *Uniflorae* (●).

Ayeyarwady Region (A), Bago Region (B), Chin State (C), Kachin State (K), Kayah State (Ka), Kayin State (Ky), Magway Region (M), Mandalay Region (Ma), Mon State (Mo), Rakhine State (R), Shan State (S), Sagaing Region (Sa), Tanintharyi Region (T), Yangon Region (Y), Naypyidaw Union Territory (N); Distribution to other areas. Endemic to Myanmar (En), Bangladesh (Ba), Bhutan (Bh), Cambodia (Ca), China (Ch), India (In), Indonesia (Id), Laos (La), Malaysia (MI), Nepal (Ne), Sri Lanka (Sr), Thailand (Th), Vietnam (Vt), Widespread (Wi).

Species	A	B	C	K	Ka	Ky	M	Ma	Mo	R	S	Sa	T	Y	N	Dist
<b>Hydrocera</b>																
1 <i>triflora</i>	–	–	–	–	–	–	–	–	Mo	–	S	–	–	–	–	Ba, Ca, Ch, In, Id, La, MI, Sr, Th, Vt
<b>Impatiens</b>																
2 <i>laevigata</i> var. <i>laevigata</i>	–	–	–	K	–	–	–	–	–	–	–	–	–	–	–	In
3 <i>parishii</i>	–	–	–	–	–	–	–	–	Mo	–	–	–	–	–	–	Th
4 <i>kerriae</i>	–	–	–	–	–	–	–	–	–	–	S	–	–	–	–	Th
5 <i>capillipes</i>	–	–	–	–	–	Ky	–	–	Mo	–	–	–	–	–	–	En
6 <i>lobbiana</i>	–	–	–	–	–	Ky	–	–	Mo	–	–	–	–	–	–	En
7 <i>micromeris</i>	–	–	–	–	–	–	–	–	–	–	–	–	T	–	–	En
8 <i>psittacina</i>	–	–	–	–	–	–	–	–	–	–	S	–	–	–	–	Th
9 <i>tanintharyiensis</i>	–	–	–	–	–	–	–	–	–	–	–	–	T	–	–	En
10 <i>forrestii</i>	–	–	–	K	–	–	–	–	–	–	–	–	–	–	–	Ch
11 <i>radiata</i>	–	–	C	–	–	–	–	Ma	–	–	–	–	–	–	–	Bh, Ch, In, Th
12 <i>graciliflora</i>	–	–	–	K	–	–	–	–	–	–	–	–	–	–	–	In
13 <i>margaritifera</i> var. <i>humilis</i>	–	–	–	K	–	–	–	–	–	–	–	–	–	–	–	Ch
14 <i>casseabriae</i>	–	–	–	K	–	–	–	–	–	–	–	–	–	–	–	En
15 <i>racemosa</i>	–	–	C	K	–	–	–	Ma	–	–	S	–	–	–	–	Bh, Ch, In, Ne, Th
16a <i>siculifer</i> var. <i>siculifer</i>	–	–	–	K	–	–	–	–	–	–	–	–	–	–	–	Ch, In
16b <i>siculifer</i> var. <i>porphyrea</i>	–	–	–	K	–	–	–	–	–	–	–	–	–	–	–	Ch
17 <i>austroyunnanensis</i>	–	–	–	K	–	–	–	–	–	–	–	–	–	–	–	Ch
18 <i>prainii</i>	–	–	–	K	–	–	–	–	–	–	–	–	–	–	–	Bh, In, Ne
19 <i>bracteolata</i>	–	–	–	K	–	–	–	–	–	–	–	–	–	–	–	Ba
20 <i>citrina</i>	–	–	–	K	–	–	–	–	–	–	–	–	–	–	–	In
21 <i>drepanophora</i>	–	–	–	K	–	–	–	–	–	–	–	–	–	–	–	Ch, In
22 <i>holocentra</i>	–	–	–	K	–	–	–	–	–	–	–	–	–	–	–	Ch
23 <i>kachinensis</i>	–	–	–	K	–	–	–	–	–	–	–	–	–	–	–	En
24 <i>sarissiformis</i>	–	–	–	K	–	–	–	–	–	–	–	–	–	–	–	En
25 <i>chimiliensis</i>	–	–	–	K	–	–	–	–	–	–	–	–	–	–	–	Ch
26 <i>sinlumienis</i>	–	–	–	K	–	–	–	–	–	–	–	–	–	–	–	En
27 <i>clavicuspis</i>	–	–	–	K	–	–	–	–	–	–	–	–	–	–	–	Ch
28 <i>ceratophora</i>	–	–	–	K	–	–	–	–	–	–	–	–	–	–	–	Ch
29 <i>arguta</i>	–	–	C	K	–	–	–	–	–	–	S	–	–	–	–	Bh, Ch, In, Ne
30 <i>duclouxii</i>	–	–	–	K	–	–	–	–	–	–	–	–	–	–	–	Ch, Th
31 <i>ecalcarata</i>	–	–	–	–	–	Ky	–	–	–	–	S	–	–	–	–	La
32 <i>masonii</i>	–	–	–	–	–	–	–	Ma	–	–	S	–	–	–	–	Th
33 <i>chinensis</i>	–	–	C	K	–	–	–	Ma	–	–	S	–	T	–	–	In, Ch, La, Th, Vt
34 <i>helferi</i>	–	–	–	–	–	–	–	–	–	–	–	–	T	–	–	En
35 <i>oppositifolia</i>	–	–	–	–	–	Ky	–	–	Mo	–	–	–	–	Y	–	Th
36 <i>decurva</i>	–	–	–	–	–	–	–	–	–	–	S	–	–	–	–	En
37 <i>balsamina</i>	A	B	C	K	Ka	Ky	M	Ma	Mo	R	S	Sa	T	Y	N	Wi
38 <i>curvipes</i>	–	–	–	–	–	–	–	–	–	–	S	–	–	–	–	En
39 <i>florulenta</i>	–	–	–	–	–	–	–	–	–	–	S	–	–	–	–	Th
40 <i>oblongata</i>	–	–	–	–	–	–	–	–	–	–	S	–	–	–	–	En
41 <i>violiflora</i>	–	–	–	K	–	Ky	–	Ma	Mo	–	S	–	T	–	–	Ch, Th, Vt
42 <i>mokimi</i>	–	–	–	K	–	–	–	–	–	–	–	–	–	–	–	En
43 <i>allanii</i>	A	–	–	–	–	–	M	–	–	R	–	–	–	–	–	En
44 <i>hartnolliae</i>	–	–	–	–	–	–	–	–	–	R	–	–	–	–	–	En
45 <i>parkinsonii</i>	–	–	–	K	–	–	–	–	–	–	–	–	–	–	–	In
46 <i>peguana</i>	–	B	–	–	–	–	–	–	–	–	–	–	–	–	–	En
47 <i>circaeoides</i>	A	B	C	K	–	–	M	Ma	–	R	–	–	–	Y	–	Th
48 <i>rangoonensis</i>	–	–	–	–	–	–	–	–	–	R	–	–	–	Y	–	En
49 <i>tavoyana</i>	–	–	–	–	–	–	–	–	–	–	–	–	T	–	–	En
50 <i>tripetala</i>	–	–	–	K	–	–	–	Ma	–	–	S	–	–	–	–	Ba, In
51 <i>trilobata</i>	–	–	C	K	–	–	–	Ma	–	–	–	Sa	–	–	–	Ba, In
52 <i>kingdon-wardii</i>	–	–	C	–	–	–	–	–	–	–	–	–	–	–	–	En
53 <i>xanthina</i> var. <i>xanthina</i>	–	–	–	K	–	–	–	–	–	–	–	–	–	–	–	Ch, In
54 <i>fugongensis</i>	–	–	–	K	–	–	–	–	–	–	–	–	–	–	–	Ch, In
55 <i>striolata</i>	–	–	C	–	–	–	–	–	–	–	–	–	–	–	–	In
56 <i>putaoensis</i>	–	–	–	K	–	–	–	–	–	–	–	–	–	–	–	En
57 <i>porrecta</i>	–	–	C	K	–	–	–	–	–	–	–	–	–	–	–	In, La
58 <i>erubescens</i>	–	–	–	K	–	–	–	–	–	–	–	–	–	–	–	En
59a <i> khasiana</i> var. <i> khasiana</i>	–	–	–	K	–	–	–	–	–	–	–	–	–	–	–	In
59b <i> khasiana</i> var. <i> toppinii</i>	–	–	–	K	–	–	–	Ma	–	–	–	–	–	–	–	In
60 <i>kamtilongensis</i>	–	–	–	K	–	–	–	–	–	–	–	–	–	–	–	En
61 <i>lacei</i>	A	B	–	–	–	–	–	–	–	–	–	–	–	–	–	En
62 <i>andersonii</i>	–	–	–	–	–	–	–	–	–	–	S	–	–	–	–	Th
63 <i>delicata</i>	–	–	–	K	–	–	–	–	–	–	–	–	–	–	–	En
64 <i>gongshanensis</i>	–	–	–	K	–	–	–	–	–	–	–	–	–	–	–	Ch
65a <i>pulchra</i> var. <i>pulchra</i>	–	–	C	K	–	–	–	–	–	–	S	–	–	–	–	Ch, In, Ne, Th
65b <i>pulchra</i> var. <i>burmanica</i>	–	–	–	K	–	–	–	–	–	–	–	–	–	–	–	En

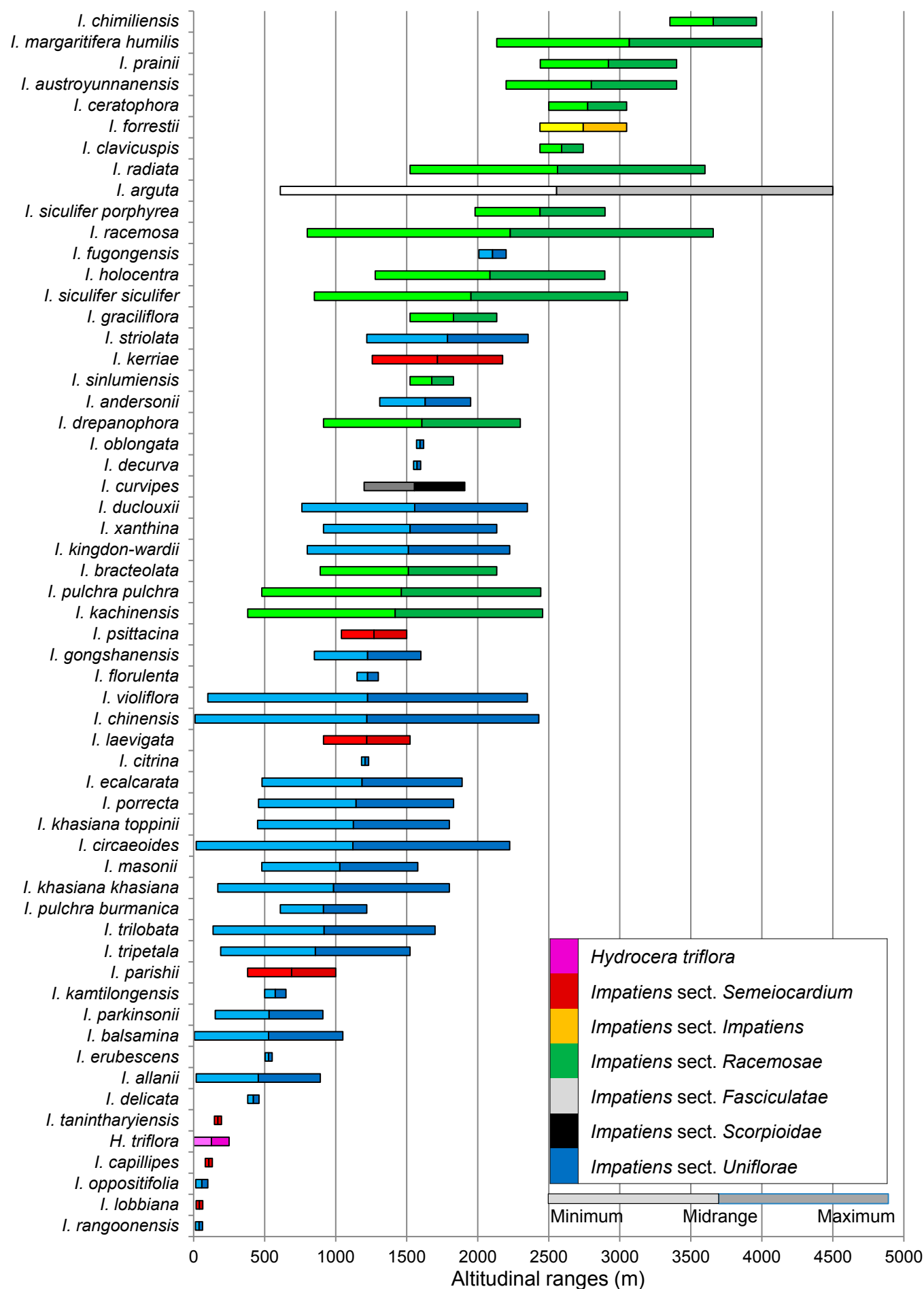


Fig. 23 The altitudinal range for most of the species of *Balsaminaceae* in Myanmar. For 10 species the range is unknown.

Kachin State and India (Map 4, 23). The single representative from sect. *Impatiens* (*I. forrestii*) is distributed in Kachin State near the Chinese border (Map 6, 23). Representatives from sect. *Racemosae* (species 11–28) are widespread, yet they occur mainly in the northern part of Myanmar, close to China and the Himalayan mountains (Map 6–11, 23). The single species from sect. *Fasciculatae* (*I. arguta*) is also widely distributed in Myanmar (Map 12). The southernmost distribution of this species is in Shan State. The single species from sect. *Scorpioidae* (*I. duclouxii*) is distributed in Kachin State. However, we expect that *I. duclouxii* is also distributed in Shan State because this species is also found in northern Thailand near Shan State. Section *Uniflorae* (species 31–65) is the most numerous represented group in Myanmar and is additionally the most widely distributed lineage in Myanmar as they are found in all states (Map 12–22, 23).

### Ecology and habitat

Most species grow in wet and humid forested areas, both evergreen lowland forest and evergreen montane forest (Map 2, 23). However, some of them, like *I. capillipes* and *I. rangoonensis*, occur in more arid regions at lower altitude where they are mostly restricted to streams or limestone habitats or they are annuals growing and flowering in the rainy season. *Hydrocera triflora* is the only semi-aquatic lowland taxon, whereas *I. chinensis* grows in swampy areas at higher altitude (Fig. 23). Many species of sect. *Semeiocardium* and sect. *Uniflorae* grow in deciduous lowland forest, where they are restricted to limestone bedrock. Many species, including *I. casseabryae*, *I. pulchra*, and *I. tanintharyiensis*, are restricted to the spray zone of waterfalls where the plants are provided with permanent moisture. Members of the sections *Racemosae*, *Fasciculatae*, *Impatiens* and *Scorpioidae* tend to prefer higher altitudes than other groups (Fig. 23).

### Floral biology and pollination

Most *Balsaminaceae* in Myanmar have a large floral chamber with a wide entrance, indicating that they are bee-pollinated (Ruchisansakun et al. 2016). During the field trip to Myanmar, Ruchisansakun confirmed visitation by bees in some species: *I. arguta*, *I. bracteolata*, *I. chinensis*, *I. kerriae*, *I. psittacina* and *I. racemosa*. Among these bee-pollinated taxa, we also found species with asymmetrical flowers: *I. arguta*, *I. kerriae*, *I. laevigata*, *I. parishii*, *I. siculifer* and *I. tanintharyiensis*. This unusual floral mechanism may facilitate coexistence of species, which share the same pollinator (Ruchisansakun et al. 2016). In contrast, we found that species with a long spur, a narrow entrance and pink flowers (*I. allanii*, *I. curvipes*, *I. lobbianae*, *I. rangoonensis* and *I. violiflora*) are pollinated by butterflies and bees. Also, we assume that taxa with the same floral traits, but for which no pollinators were observed (*I. florulenta*, *I. mokimi*, *I. oblongata*) are also pollinated by bees and butterflies. Species with small spurless white flowers, such as *I. casseabryae*, *I. decurva*, *I. ecalcarata* and *I. margaritifera* var. *humilis* are probably autogamous (Ruchisansakun et al. 2016).

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## IDENTIFICATION LIST

- |   |                           |  |
|---|---------------------------|--|
| 1 = <i>Hydrocera triflora</i>                 | 22 = <i>holocentra</i>    | 45 = <i>parkinsonii</i>                    |
| <i>Impatiens</i>                              | 23 = <i>kachinensis</i>   | 46 = <i>peguana</i>                        |
| 2 = <i>laevigata</i> var. <i>laevigata</i>    | 24 = <i>sarissiformis</i> | 47 = <i>circaeoides</i>                    |
| 3 = <i>parishii</i>                           | 25 = <i>chimaliensis</i>  | 48 = <i>rangoonensis</i>                   |
| 4 = <i>kerriae</i>                            | 26 = <i>sinlumiensis</i>  | 49 = <i>tavoyana</i>                       |
| 5 = <i>capillipes</i>                         | 27 = <i>clavicuspis</i>   | 50 = <i>tripetala</i>                      |
| 6 = <i>lobbiana</i>                           | 28 = <i>ceratophora</i>   | 51 = <i>trilobata</i>                      |
| 7 = <i>micromeris</i>                         | 29 = <i>arguta</i>        | 52 = <i>kingdon-wardii</i>                 |
| 8 = <i>psittacina</i>                         | 30 = <i>duclouxii</i>     | 53 = <i>xanthina</i> var. <i>xanthina</i>  |
| 9 = <i>tanintharyiensis</i>                   | 31 = <i>ecalcarata</i>    | 54 = <i>fugongensis</i>                    |
| 10 = <i>forrestii</i>                         | 32 = <i>masonii</i>       | 55 = <i>striolata</i>                      |
| 11 = <i>radiata</i>                           | 33 = <i>chinensis</i>     | 56 = <i>putaoensis</i>                     |
| 12 = <i>graciliflora</i>                      | 34 = <i>helferi</i>       | 57 = <i>porrecta</i>                       |
| 13 = <i>margaritifera</i> var. <i>humilis</i> | 35 = <i>oppositifolia</i> | 58 = <i>erubescens</i>                     |
| 14 = <i>casseabrieae</i>                      | 36 = <i>decurva</i>       | 59a = <i>hasiana</i> var. <i>hasiana</i>   |
| 15 = <i>racemosa</i>                          | 37 = <i>balsamina</i>     | 59b = <i>hasiana</i> var. <i>toppinii</i>  |
| 16a = <i>siculifer</i> var. <i>siculifer</i>  | 38 = <i>curvipes</i>      | 60 = <i>kamtlongensis</i>                  |
| 16b = <i>siculifer</i> var. <i>porphyrea</i>  | 39 = <i>florulenta</i>    | 61 = <i>lacei</i>                          |
| 17 = <i>austroyunnanensis</i>                 | 40 = <i>oblongata</i>     | 62 = <i>andersonii</i>                     |
| 18 = <i>prainii</i>                           | 41 = <i>violiflora</i>    | 63 = <i>delicata</i>                       |
| 19 = <i>bracteolata</i>                       | 42 = <i>mokimi</i>        | 64 = <i>gongshanensis</i>                  |
| 20 = <i>citrina</i>                           | 43 = <i>allanii</i>       | 65a = <i>pulchra</i> var. <i>pulchra</i>   |
| 21 = <i>drepanophora</i>                      | 44 = <i>hartnolliae</i>   | 65b = <i>pulchra</i> var. <i>burmanica</i> |
- Allan s.n. (E00753094): 47; s.n. (K000694629): 43; 4842: 61 – Alleizette 109: 1; 199: 1 – Amat 1: 1 – Anderson s.n. (K000694627): 62; 7214: 8 – Armstrong et al. 756: 54; 1016: 29; 1153: 30; 1192A: 29; 1199: 53; 1326: 20; 1337: 19.
- Backer s.n. (L2326324): 1; s.n. (L2326325): 1; s.n. (L2326327): 1; 4528: 1; 19158: 1; 26452: 1 – Badalkhan 119: 32 – Balansa 1130: 1; 3882: 33; 3883: 1; 4892: 1 – Banziger 492: 41 – Barber 5016: 37 – Barnes 558: 33 – Bartholomew et al. 1320: 30 – Bedi 692: 15 – Beijing Hengduan Mountain Team 1344: 22 – Beijing Institute of Botany 1424: 22 – Bernardi 14316: 1 – Blume s.n. (L2326317): 1; s.n. (P05251201): 1 – Bodinier 2335: 16a – Bon 527: 1 – Bor 6212: 12 – Bowes 9046: 29 – Brandis s.n. (K000694789): 7 – Brun et al. 319: 41 – Buchanan s.n. (E00752744): 51; 1: 51; 2: 51; 4: 41; 5: 59b; 5565: 41; 5566: 59b; 5567: 65a; 5568: 21 – Bunchuai 1297: 8; 1394: 65a – Bunpheng 571: 32 – Burkill 27744: 29.
- Cay Mong Nuoc 3418: 1 – Chand 1954: 57; 6329: 57 – Chantaranonthai et al. 90/88: 32; 90/655: 11 – Chao 1674: 33; 1689: 33; 1813: 33 – Charoemphol et al. 4644: 33 – Chatterjee s.n. (L2326844): 50 – Chen 624: 41; 1473: 33 – Chow et al. 80470: 41 – Clarke 5372: 57; 6114: 29; 13817: 51; 17567A: 11; 17954A: 51; 17985A: 51; 19222D: 57; 36595B: 51; 41147A: 65a; 42116A: 65a; 42226A: 57; 44713A: 57; 44842F: 11; 45185: 57; 45739B: 11; 46433: 11; 385636A: 29 – Clifford CBP 306: 37 – Collett 47: 38; 949: 38 – Craddock s.n. (K000694696): 38; 58: 32 – Cramer 2721: 1 – Cubitt 284: 65b.
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