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Liuyi Ren, Yi Chen, Taohua Yuan, Rongxin Huang, Meijun Li, Xinxiang Bai

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***Impatiens bijieensis* (Balsaminaceae), a new species from karst plateau in Guizhou, China**

Liu-Yi Ren, Yi Chen, Tao-Hua Yuan, Rong-Xin Huang, Mei-Jun Li, Xin-Xiang Bai

College of Forestry, Guizhou University CN-550025 Guiyang, China.

Corresponding author: Xin-Xiang Bai (254715174@qq.com); Mei-Jun Li (59787607@qq.com)

Abstract

Impatiens bijieensis X.X. Bai & L.Y. Ren, a new species from northwest Guizhou Province, China, is here described and illustrated. This new species is distributed discontinuously in Jiulongshan, Dafang County and Dajiucaiping, Hezhang County, both of which belong to the Wumeng Mountain area, a karst plateau landform. It is morphologically similar to *I. lasiophyton* J.D. Hooker and *I. leptocaulon* J.D. Hooker in height, leaf blade shape and flower form, especially resembling *I. lasiophyton* in the plant pilose. However, it differs in its deep purplish-red to rose-red flower, 2-lobed lower sepal apex and cylindrical capsule. A detailed description, colour photographs and a provisional IUCN Red List assessment are provided and its geographical distribution, ecology and morphological relationship with relevant similar species are discussed.

Keywords

Balsaminaceae, China, *Impatiens bijieensis*, morphology, new species

Introduction

The genus *Impatiens* Linnaeus (1753: 937), belonging to the family Balsaminaceae, consists of more than 1000 species, mainly distributed in the montane forests of the tropics and subtropics of the Old World with five centres of diversity, namely tropical Africa, Madagascar, south India and Sri Lanka, eastern Himalaya and Southeast Asia (Grey-Wilson 1980; Mabberley 2017). In recent years, a few species have also been found in the northern temperate regions of Europe, Russia and China, as well as North America (Liao et al. 2021). Currently, there are more than 320 species of *Impatiens* in China (Yu et al. 2021) which are distributed mainly in the southwest and northwest mountainous regions, especially in southwest provinces (including Guizhou, Yunnan, Sichuan) and 60 species of *Impatiens* have been reported in Guizhou Province (Yu 2021; Yuan 2021).

Impatiens are morphologically characterised by its petals always united in pairs into lateral, united petals; fruit a fleshy, explosive capsule; seeds often dispersed elastically from valves when ripe (Chen et al. 2007). From September 2014 to October 2021, during our field investigation in Bijie City, northwest Guizhou Province, China, we encountered an unknown *Impatiens* species. The plants were found growing in the gullies between gently sloping

mountain meadows of karst plateau, its special habitat distinguishing it from other species. After a thorough morphological study, based on literature (Chen 2001; Wu 2006; Chen et al. 2007; Yu 2012; Kuang et al. 2014; Tan et al. 2015) and herbarium materials (GZAC!), we concluded that this *Impatiens* species should be placed in *I.* subg. *Impatiens* as it differed from previously reported or described taxa and we describe it here as a new species.

Materials and Methods

The material for this study was mainly collected from the survey of wild ornamental plant resources in Guizhou Province, China. The morphological description of the new species was based on careful examination of fresh material in the field and herbarium specimens. Comparisons with other species were referenced to virtual herbarium specimens from IBSC, IBK, HIB, PE and GZAC, photographs and literature (Grey-Wilson 1980; Chen et al. 2001; Chen et al. 2007; Yu et al. 2012).

Taxonomic treatment

Impatiens bijieensis X.X. Bai & L.Y. Ren, sp. nov.

Figs. 1 and 2

Type. CHINA, Guizhou Province, Hezhang County, Xingfa Town, Dajiucaiping, alt. 2763 m, 29°59'53"N, 104°45'29"E, 20 August 2021, X.X. Bai & L.Y. Ren *DJCP 20210820* (Holotype: GZAC!; Isotype: IBK!).

Diagnosis. *Impatiens bijieensis* X.X. Bai & L.Y. Ren is similar to *I. lasiophyton* and *I. leptocaulon* in plant height, leaf blade shape and flower form, especially resembling *I. lasiophyton* in plant pilose, obtuse anther apex and higher distribution of 1915-2800 m alt., but distinguished by its deep purplish-red to rose-red flower, bract abaxial mid-vein thickened and margin ciliate, membranous bract, 2-lobed lower sepal apex and cylindrical capsule.

Description. Perennial herb, 30-60 cm high, densely pilose. Root-system developed, with adventitious roots on lower stem nodes. Stem fleshy, erect, branched. Leaves simple, alternate, aggregated at stem apex; petiole 0.3-0.8 cm long; leaf blade elliptic, ovate or ovate-lanceolate, 3.5-5 cm × 1.3-1.8 cm, base cuneate, with a pair of conical glands, margin serrulate, apex acuminate, adaxial surface densely pilose, green; abaxial surface pilose along veins, pale green, lateral veins 6-8 pairs. Inflorescences axillary, 2- or 3-flowered. Peduncles 2-3.2 cm long, pedicels 1.5-2 cm long, slender, bracteate above middle; bract 1, persistent, linear-lanceolate,

0.3-0.5 cm long, abaxial mid-vein thickened, margin membranous, ciliate.

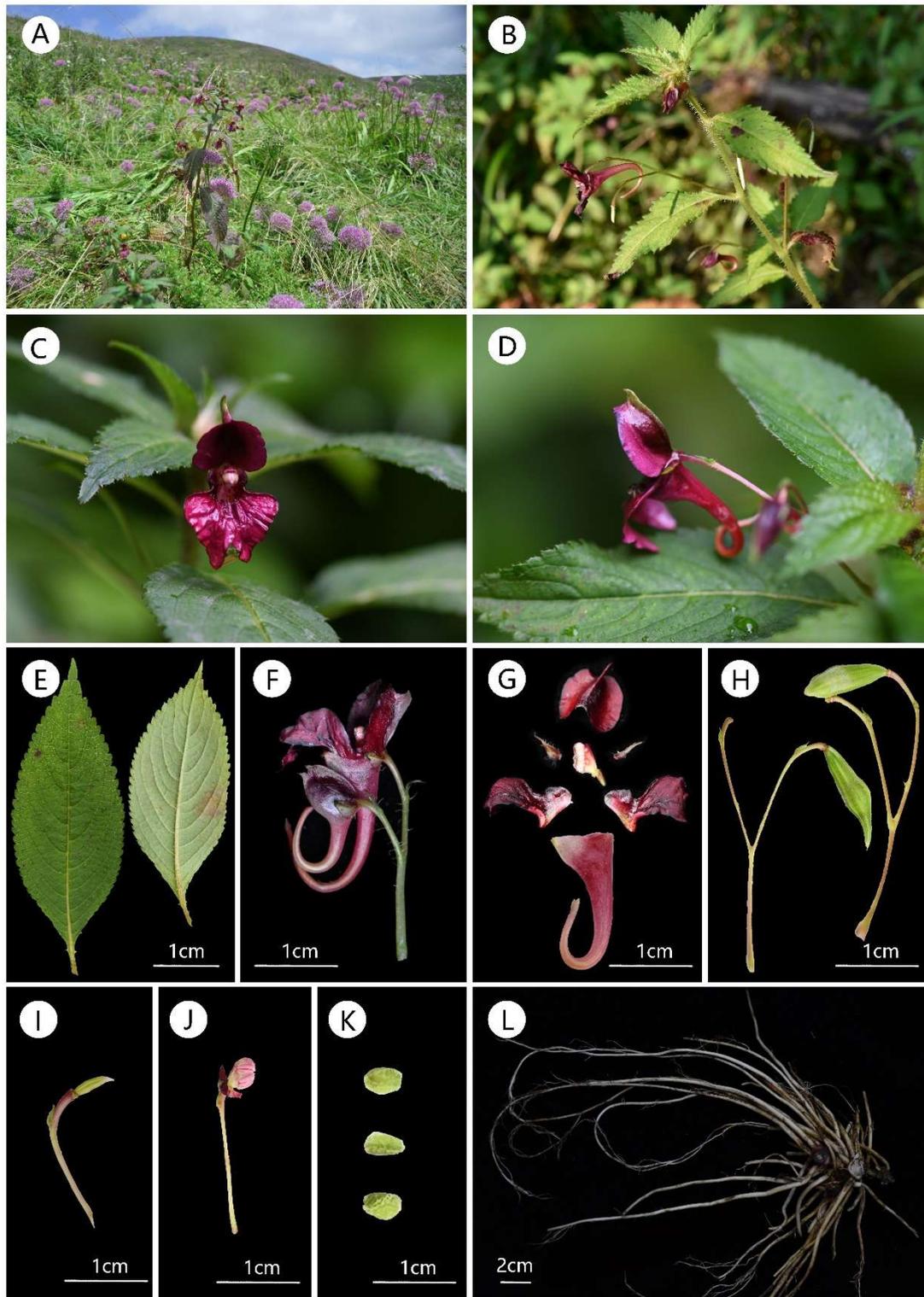


Figure 1. *Impatiens bijieensis* X.X. Bai & L.Y. Ren **A** habit; **B** plant; **C** flower in front view; **D** flower in lateral view; **E** leaf adaxial surface (left) and abaxial surface (right); **F** inflorescence; **G** different parts of the flower; **H** fruit; **I** ovary; **J** anther; **K** seeds; **L** root. Photos by Xin-Xiang Bai.

Flowers deep purplish-red to rose-red, 2.3-2.5 cm long. Lateral sepals 2, ovate, ca. 0.5 cm × 0.2 cm, margin ciliate, mid-vein carinate, apex acuminate or caudate. Lower sepal navicular,

ca. 0.5 cm deep (excluding spur), mouth vertical, ca. 0.8 cm wide, narrowed into an incurved, long spur, ca. 2 cm, apex 2-lobed. Dorsal petal reniform, ca. 0.8 cm × 1.5 cm, base truncate or suborbicular, apex concave, abaxial mid-vein carinate, apex acuminate. Lateral united petals sessile, ca. 1.7 cm long, deep purplish-red with whitish-pink base and reddish patches near auricle, 2-lobed; basal lobes ca. 0.4 cm × 0.2 cm, oblong to obovate-oblong; distal lobes ca. 1 cm × 0.6 cm, dolabriform. Stamens 5, filaments linear, anthers apex obtuse; ovary 5-carpellate, narrowly fusiform, 0.4-0.5 cm, erect. Capsule fusiform, 1.3-1.8 cm long, apex acuminate, 5-valved, fleshy. Seed ellipsoid, surface irregular protrusions.

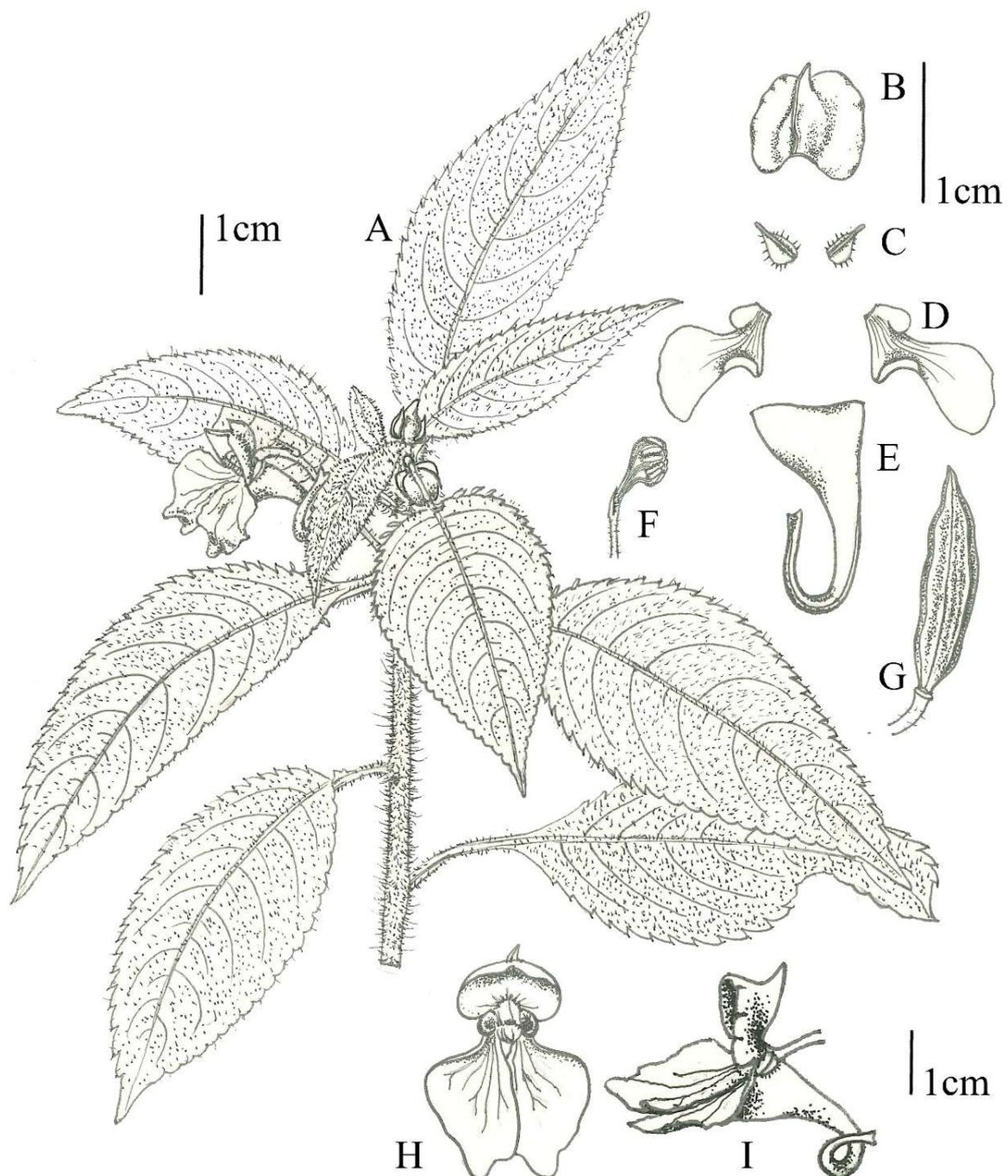


Figure 2. *Impatiens bijieensis* X.X. Bai & L.Y. Ren **A** plant; **B** dorsal petal; **C** lateral sepal; **D** lateral united petal; **E** lower sepal; **F** anther; **G** fruit; **H** flower in front view; **I** flower in lateral view. Drawings by Yi Chen.

Etymology. The specific epithet ‘bijieensis’ refers to the type locality where the new species was found, located in Bijie City, northwest Guizhou Province, China. The Chinese name is given as “毕节凤仙花”.

Phenology. Flowers and fruits from August to October.

Distribution. *Impatiens bijieensis* is distributed in the highlands above 1915 m. So far, the specimen has been observed in Bijie City, Guizhou Province with subpopulations in Hezhang County and Dafang County. We found at Dajiucaiping, Hezhang that the plants grow along the creek on the slopes of gentle hilltops or on the side slope of the ridge, while some were found under the cliffs with water dripping from streams. At Jiulongshan, Dafang, the population was distributed in evergreen broad-leaved forest margins.

Ecology. *Impatiens bijieensis* was collected at an elevation of 1915-2800 m. Species of *Rubus coreanus* Miq. (Rosaceae), *Elatostema involucreatum* Franch. et Sav. (Urticaceae) and *Allium wallichii* Kunth (Liliaceae) were found to grow in the nearby vicinity of this species.

Conservation status. This species is currently known only from Bijie City, Guizhou Province, China with two subpopulations. The Extent of Occurrence (EOO) is less than 100 km² and the known Area of Occupancy (AOO) is less than 15 km². The conservation status can be evaluated as Vulnerable (VU) D2, based on the IUCN Red List Categories and Criteria (IUCN 2019). About 150 and 300 individuals were known in the two subpopulations of Hezhang County and Dafang County and both of them are exposed to human disturbance.

Additional specimens examined. Paratypes. China. Guizhou Province. Bijie City: Dafang County, Jiulongshan. 27°19'37"N, 105°52'50"E, 1915 m alt., 8 September 2021, X. X. Bai et al., *JLS 20210908* (GZAC!).

Discussion

Impatiens bijieensis is most similar to *I. lasiophyton* in its plant pilose, elliptic, ovate or ovate-lanceolate leaf blade, but can be easily distinguished by its deep purplish-red to rose-red flower (vs. yellow or white), abaxial mid-vein thickened and margin ciliate, membranous bract (vs. hirsute bract and inconspicuous mid-vein), navicular and apex 2-lobed lower sepal (broadly funnelform and unlobed), apex concave, abaxial mid-vein carinate, apex acuminate dorsal petal (vs. apex obtuse, abaxial mid-vein thickened, cristate apically) and cylindrical capsule (vs. linear). *I. bijieensis* is similar to *I. leptocaulon* in the length of its petiole, serrulate leaf blade

margin and navicular lower sepal, but differs from its adaxial surface densely pilose and abaxial surface pilose along veins (vs. glabrous), ciliate margined lateral sepals and carinate mid-vein (vs. hyaline margined, denticulate on one side). In order to illustrate the morphological circumscription of this new species, we compare the new species with two species with similar morphological characters in Table I: *Impatiens lasiophyton* J.D. Hooker. (1908:2871), *I. leptocaulon* J.D. Hooker. (1908:2872). Colour photographs are given in Figure 3.

The morphological characters, including perennial herb, racemose inflorescence, 5-carpellate ovary, cylindrical capsule and ellipsoid seed indicate that *Impatiens bijieensis* is a distinct member of the *I.* subg. *Impatiens*. It is known that *Impatiens* mainly grows in places with high relative temperature and low elevation, yet this new species is distributed in the karst plateau area which is characterised by its cold habitat and high altitude. This character distinguishes it from its sibling species. Additionally, because of the development of tourism, their habitat is currently threatened by human activities.

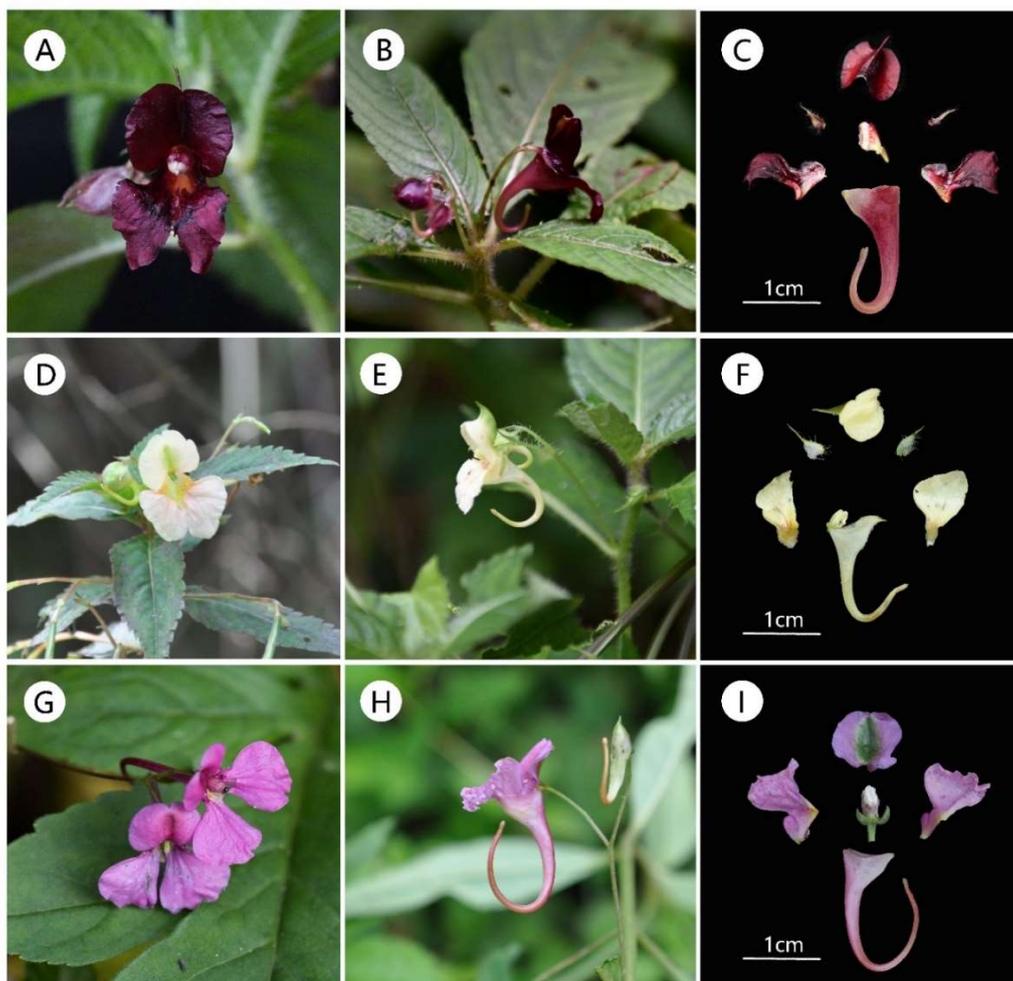


Figure 3. *Impatiens bijieensis* A-C: A flower in front view; B flower in lateral view; C different parts of the flower, *Impatiens lasiophyton*; D-F: D flower in front view; E flower in lateral view; F different parts of the flower, *Impatiens leptocaulon*; G-I: G flower in front view; H flower in lateral view; I different parts of the flower. Photos by X.X. Bai.

Table I. Comparison of morphological characters in *Impatiens bijieensis*, *I. lasiophyton* (data from Hooker 1909a) and *I. leptocaulon* (data from Hooker 1908b).

Character	<i>I. bijieensis</i>	<i>I. lasiophyton</i>	<i>I. leptocaulon</i>
Length of petiole	0.3-0.8 cm	1-3 cm	0.5-1.5 cm
Leaf blade	with a pair of conical glands at base, margin serrulate, adaxial surface densely pilose; abaxial surface pilose along veins	base acute, margin coarsely crenate or crenate-serrate, both surfaces hirsute	with few basal glands, base narrowly cuneate, margin serrulate
Bract	bracteate above middle, linear-lanceolate, abaxial mid-vein thickened	bracteate below flower; lanceolate	bracteate above middle; lanceolate
Flower	deep purplish-red to rose-red	yellow or white	purple-red
Lateral sepal	2, ovate, margin ciliate, mid-vein carinate, apex acuminate or caudate	2(or 4), subovate, hirsute, apex cuspidate	2, subovate, long cuspidate, inequilateral, hyaline margined, denticulate on one side
Lower sepal	navicular, spur apex 2-lobed	broadly funnellform	navicular, narrowed into an incurved, long spur
Dorsal petal	reniform, base truncate or suborbicular, apex concave, abaxial mid-vein carinate	orbicular, base cordate, apex obtuse, abaxial mid-vein thickened, cristate apically	orbicular, apex rostellate, abaxial mid-vein carinate
Basal lobes	oblong to obovate-oblong	small or rudimentary	orbicular, small
Distal lobes	dolabriform	broadly dolabriform or sublunar	obovate-oblong
Capsule	cylindrical	linear	linear
Distributed elevation	1915-2800 m	1700-2700 m	1200-2000 m

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