

Impatiens chashanensis (Balsaminaceae) sp. nov. from Sichuan, China

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Impatiens chashanensis H. Y. Bi & S. X. Yu (Balsaminaceae), a new species from the Sichuan Province in China, is described and illustrated. In comparison with the morphologically close *I. dicentra*, both species have succulent stems and the lobes of the lateral united petals end in a long hair, but *I. chashanensis* differs in having white flowers, four lateral sepals, lacerate apex of the inner sepal, shorter spur with swollen, slightly bifid apices. Moreover, leaf epidermal characters also support the recognition of the new species.

Impatiens L., one of the two genera (the other one in monotypic *Hydrocera* Bl.) in the Balsaminaceae, contains about 1000 species (Grey-Wilson 1980). About 240 species are known from China, most of which are distributed in southwest China and a large number of endemic species are found in Yunnan, Sichuan and Xizang Provinces (Chen 2001, Chen et al. 2008).

A few preliminary studies have been conducted on the pollen morphology of *Impatiens* (Lu 1991, Janssens et al. 2005), suggesting that pollen morphology is important in the classification of *Impatiens*. Pollen provide useful taxonomic features for distinguishing closely related species with similar gross morphology.

During taxonomic revision for a project on *Impatiens*, a puzzling specimen was discovered in the Sichuan Province that was difficult to refer to any known species. It was thus suggested that it might represent a new species. Further studies on the morphology, features of the leaf epidermis, and the distribution confirmed the recognition of this taxon as a new species and it is here described and illustrated.

Material and methods

The examined plants were collected from Maoxian County in the Sichuan Province. Observations of macroscopic features, such as leaf length, were made on living material in the field. Vouchers will be deposited in the herbarium of the Inst. of Botany, CAS (PE).

For microscopic observation of pollen, mature, full, pollen grains and seeds from specimens were directly

observed and measured under magnification using an anatomical lens. We then mounted the pollen grains on stubs using double sided adhesive tape and coated them with a layer of gold and studied and photographed them using a Hitachi S-4800 SEM, fitted with a digital camera. Terminology follows Punt et al. (2007).

The material for light microscopic study was boiled in water before being macerated in 35% NaClO. Pieces of leaf epidermis were stained with safranin–alcohol (50%), and then dehydrated in an ethanol series before being mounted in Canada balsam. The stomata index (SI) was calculated using the formula: $SI = S/(S + E) \times 100\%$, where S = number of stomata per unit area and E = number of epidermal cells per same unit area (Dilcher 1974).

Results

Pollen grains

In *Impatiens chashanensis*, the pollen size ($P \times E1 \times E2$) is $(11.7 - 13.4) \times (24.6 - 27.1) \times (16.1 - 17.8) \mu\text{m}$, and the pollen is tetracolpate, colpi long, thin, contracted, exine with reticulate ornamentation and with dense granules in lumina (Fig. 2A–D).

Leaf epidermis

In *Impatiens chashanensis*, the leaf epidermis is irregular, with stomata on abaxial sides of the leaf only, I (abaxial epidermis) = 1.82–2.26%. In *Impatiens dicentra*, the leaf

epidermis is irregular, with stomata on both sides of the leaf, I (abaxial epidermis) = 2.82–3.21%.

***Impatiens chashanensis* H. Y. Bi & S. X. Yu
sp. nov. (Fig. 1, 2)**

Haec species I. dicentrae affinis, sed floribus albis, sepalis lateralibus 4, eis interioribus obovatis, apice laceratis, sepalo inferiore calvari brevissimo, inflato, apice bilobo, petalo superiore margine dentato differt.

Type: China. Sichuan Province, Maoxian County, Chashan Mountain, Shady places in forest, alt. 2500 m a.s.l., 20 Aug 2006, Yu Sheng-Xiang 3874 (holotype: PE, isotype: IBK). Annual herb, 50–70 cm tall. Stems succulent, glabrous, erect, often branched above. Leaves alternate, aggregated towards the top of the stems, petiolate. Petiole 2–3 cm long.

Blades 8–11 cm long, 3–5 cm wide, ovate or ovate-oblong; lateral veins in 5–7 pairs; margin crenate-serrate, with simple narrow teeth; apex acute, base crenate. Racemes in upper axils, 2–3-flowered with peduncle ca 2.5–3.0 cm long. Bracts ca 2 mm long, ovate-lanceolate, inconspicuous. Pedicels 1.5–2.0 cm long, slender, glabrous. Flowers white. Lateral sepals 4, the outer pair 5–7 mm long and 3–4 mm wide, ovate-oblong, conchate, 9-veined, apex mucronate; inner lateral sepals ca 1–2 mm long, ovate-lanceolate, lacerate. Lower sepal ca 1.0–1.5 cm long, ca 1 cm deep excluding spur, infundibuliform, the base abruptly constricted into a 3–5 mm long incurved spur, swollen, bi-lobed to the middle part. Upper petal ca 1.2–1.3 cm long and 0.8–1.0 cm wide, elliptic or ovate-elliptic, apex mucronate, dorsally with a narrow crest, with 2 teeth on each lateral margin. Lateral united petals 1.8–2.0 cm long, upper petal of each pair 1.0–1.2 cm long and 8–10 mm

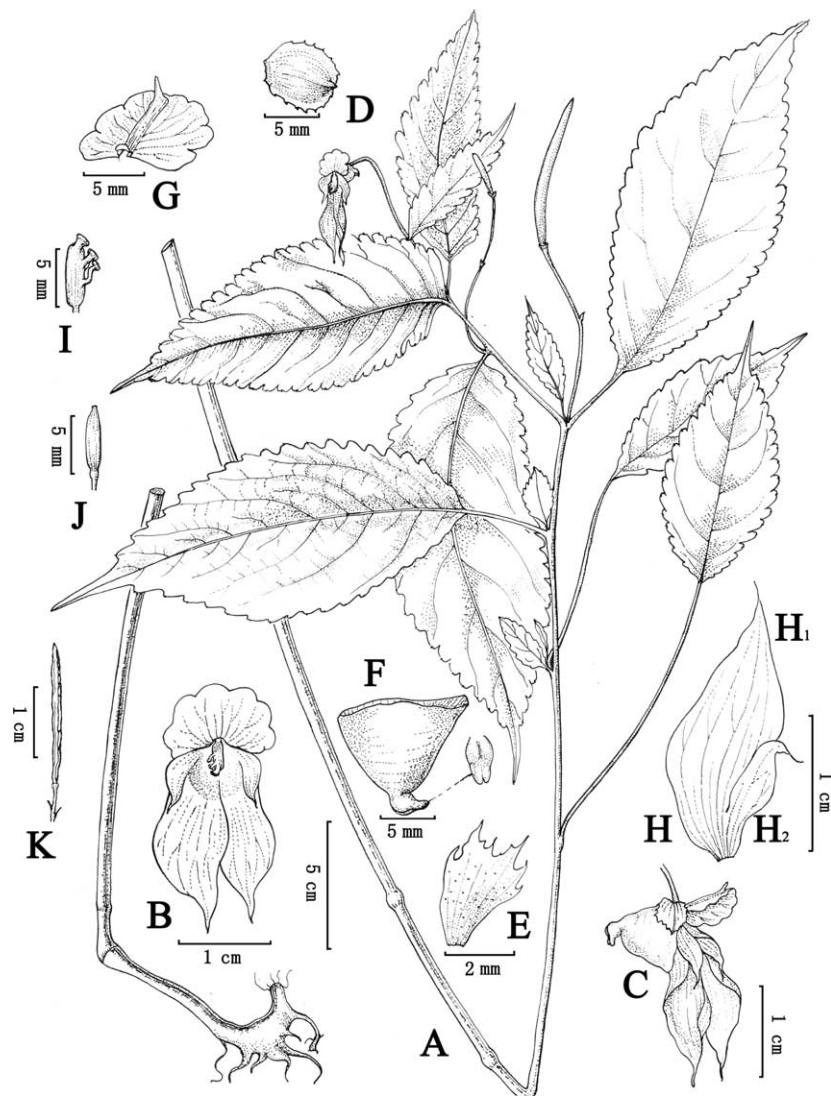


Figure 1. *Impatiens chashanensis* sp. nov. (A) habit, (B) flower, front view, (C) flower, lateral view, (D) outer lateral sepal, (E) inner lateral sepal, (F) lower sepal, (G) dorsal petal, (H) lateral united petal: H₁=lower petal, H₂=upper petal, (I) androecium, (J) ovary, (K) capsular fruit. Drawn by P. Liu from S. X. Yu 3874.

wide, shortly stalked, ovate-orbicular, with mid-vein ending in a long filamentous tail; lower petal of each pair ca 1.8 cm long and ca 8 mm wide, obovate-oblong, with mid-vein ending in a long hair-like tip. Stamens 5; filaments 3–5 mm long, flat; anthers obtuse. Pollen grains $(11.7–13.4) \times (24.6–27.1) \times (16.1–17.8) \mu\text{m}$ ($P \times E1 \times E2$), tetracolpate, colpi long, thin, contracted, exine with reticulate ornamentation, dense granules in lumina (Fig. 2A–D). Ovary glabrous. Capsule glabrous, ca 3.0–3.5 (–4) cm long.

Notes

Impatiens chashanensis grows sparsely in small populations, and is only found in northwestern Sichuan, at ca 2700 m a.s.l. Flowering occurs in Aug–Oct and fruiting in Sep–Nov. The species is close to *I. dicentra* based on gross morphology. However, the former can be easily distinguished by having white flowers, four lateral sepals, lacerate inner sepal apex, shorter spurs, swollen, slightly bi-lobed

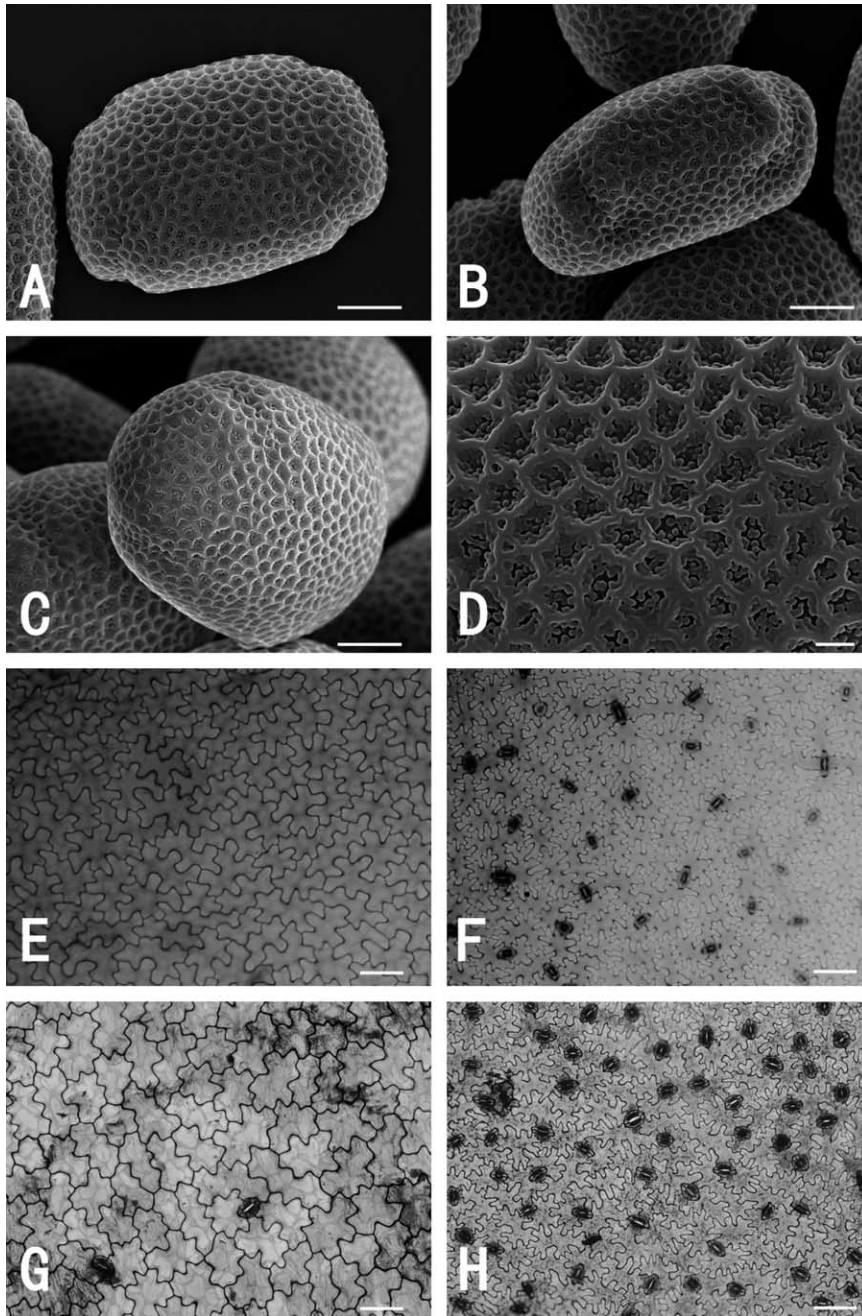


Figure 2. *Impatiens chashanensis* sp. nov. (A)–(D) scanning electron photomicrographs of pollen morphology. (A) polar (or short equatorial) view $3500 \times$, scale bar = $5 \mu\text{m}$, (B) long equatorial view, scale bar = $5 \mu\text{m}$, (C) short equatorial view, scale bar = $5 \mu\text{m}$, (D) part view, scale bar = $1 \mu\text{m}$. (E)–(H) light photomicrographs of leaf epidermis micro-morphology. (E)–(F) *I. chashanensis*, (E) adaxial epidermis, scale bar = $100 \mu\text{m}$, (F) abaxial epidermis, scale bar = $100 \mu\text{m}$. (G)–(H) *I. dicentra*, (G) adaxial epidermis, scale bar = $100 \mu\text{m}$, (H) abaxial epidermis, scale bar = $100 \mu\text{m}$.

Table 1. Morphological comparison of *Impatiens chashanensis*, *I. dicentra* and *I. platychlaena*.

Characters	<i>I. chashanensis</i>	<i>I. dicentra</i>	<i>I. platychlaena</i>
Lateral veins	5–7 pairs	6–8 pairs	7–8 (–9) pairs
Floral colour	white	yellow	white
Outer lateral sepals	ovate–orbiculate, green	ovate, green, mid-vein	ovate, purple
Mid-vein of outer lateral sepals	inconspicuous	conspicuous	conspicuous
Inner lateral sepals	obovate, apex lacerate	lacking	lacking
Doral sepals	slightly infundibuliform	deeply infundibuliform	deep infundibuliform
Spur	swollen, slightly bifid	not swollen, deeply bifid	not swollen, deep bifid

apices. Furthermore, *I. chashanensis* is very special because of its upper petal margin dentate, a character that makes it readily distinguish from other *Impatiens* in China. According to previous studies, *I. platychlaena* is confined to western Sichuan and also morphologically similar to *I. chashanensis* (Hooker 1908). *Impatiens chashanensis*, *I. dicentra* and *I. platychlaena* are compared with each other, on the basis of their vegetative characters in Table 1.

These species are readily distinguished also on leaf epidermal characters (Fig. 2). In both species the leaf epidermis (Fig. 2E–H) is irregular, the stomata are anomocytic, and the outlines of the guard cells are sub-orbiculate. In addition, on the abaxial side, the cell walls of the two species are also very similar. However, the characters of the adaxial epidermis differs between the two species. In *I. chashanensis*, the anticlinal walls are sinuate, whereas in *I. dicentra* they are sinuolate; *I. chashanensis* always lacks stomata while *I. dicentra* has some. The I of the abaxial epidermis is also different in these two species. In *I. chashanensis*, I (abaxial epidermis) = 1.82–2.26, but I (abaxial epidermis) = 2.82–3.21 in *I. dicentra*.

The *I. chashanensis* group, including two above mentioned species, are endemic to China and differ from all other *Impatiens* species of the world by its lateral united petal being filamentous apically. The group is confined to the sub-alpine regions of central to southwest China, i.e. the Sichuan, Yunnan, Gansu and Hubei Provinces (Hooker 1908).

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References

- Chen, Y. L. 2001. Balsaminaceae. – In: Chen, Y. L. (ed.), Flora Reipubl. Pop. Sin. 47: 1–4, 36–39, Science Press.
- Chen, Y. L. et al. 2008. Balsaminaceae. – In: Wu, Z. Y. and Raven, P. H. (eds), Flora of China 12: 43–113, Science Press, Miss. Bot. Gard. Press.
- Dilcher, D. L. 1974. Approaches to the identification of angiosperm leaf remains. – Bot. Rev. 40: 1–157.
- Grey-Wilson, C. 1980. *Impatiens* of Africa. – A. A. Balkema, pp. 1–26.
- Hooker, J. D. 1908. Les especes du genre '*Impatiens*' dans l'herbier du Museum de Paris. – Nov. Arch. Mus. Nat. Hist. Paris, ser. 4, 10: 233–272.
- Janssens, S. et al. 2005. Palynological variation in balsaminoid *Ericales*. II. Balsaminaceae, Tetrameristaceae, Pellicieraceae and general conclusions. – Ann. Bot. 96: 1061–1073.
- Lu, Y. Q. 1991. Pollen morphology of *Impatiens* L. (Balsaminaceae) and its taxonomic implications. – Acta Phytotax. Sin. 29: 352–357, in Chinese.
- Punt, W. et al. 2007. Glossary of pollen and spores terminology. – Rev. Palaeobot. Palynol. 143: 1–81.