



Impatiens sterilis, a rare new species of *Impatiens* with reduced sterile inflorescences from Yunnan, China

Yong-Xiu SONG, Yi-Yan CONG*, Ren-Ping KUANG, Yang-Cheng PENG, Yi-Ming ZHENG

Hunan Normal University, Hunan Province, Changsha, 410081, China.

*Corresponding author's email: 908158033@qq.com

(Manuscript received 15 October 2020; Accepted 10 January 2021; Online published 15 January 2021)

ABSTRACT: *Impatiens sterilis* (Balsaminaceae), discovered in Yunnan, China, is described and illustrated here. It belongs to *I.* section *Racemosae* and is related to *I. scutisepala*. *I. sterilis* differs from the latter species in the shape of the leaf blades and the lower sepal, the number of lateral sepals, and producing some reduced sterile inflorescences at the end of anthesis. Detailed notes on morphology, key diagnostic characters, distribution, pollen and seed morphology, conservation status and color photographs are provided for the identification of the new species.

KEY WORDS: Balsaminaceae, China, *Impatiens scutisepala*, morphology, pollen, taxonomy.

INTRODUCTION

The family Balsaminaceae contains two genera, the monotypic *Hydrocera* Blume ex Wight & Arnott and *Impatiens* Linnaeus. *Impatiens* L. is one of the largest genera of angiosperms, comprising over one thousand species (Mabberley, 2008; Bhaskar, 2012; Yu, 2012), mainly occurring in the tropical and subtropical regions of the Old World as well as in the northern temperate regions (Fischer, 2004; Mabberley, 2008). Within its distribution range, five hotspots of diversity are recognized: tropical Africa, Madagascar, Southeast Asia, Southern India, and the Sino-Himalayan region (Yuan *et al.*, 2004). There are more than 270 species of *Impatiens* recorded in China (Chen, 2001; Chen *et al.*, 2007; Yu, 2012), and majority of them are restricted to the southwest China: Yunnan, Sichuan, Guizhou, Xizang (Tibet) and Guangxi.

During a floristic expedition of *Impatiens* carried out in September 2008 in Tengchong County, Yunnan, the authors encountered an extraordinary species of *Impatiens* with reduced filiform inflorescences of infertility. Specimens were collected for further research. After critical examination of the specimens and thorough scrutiny of literature (Chen *et al.*, 2007; Cong *et al.*, 2008; Zeng *et al.*, 2015; Lu *et al.*, 2020), the authors found that the species was hitherto undescribed and close to *I. scutisepala* Hook. f. (1984). Hence it is described here as a new species with a detailed description and illustrations.

MATERIALS AND METHODS

The new species was collected exclusively from Tengchong County. Various morphological characters, such as leaf size and shape, inflorescence type, flower color, etc., were carefully observed, measured and quality photographs were taken in the field. Mature

whole pollen grains and seeds were collected from the field and observed and measured directly under anatomical microscope (Olympus SZX10). Dried pollen grains and seeds were mounted on stubs with double-sided adhesive tape and sputter-coated with a layer of gold using the JEC-3200 Auto Fine Coater. Coated pollen grains and seeds were then examined and photographed with the JEOLJSM-6360LV scanning electron microscope. Morphological characters were described following Wang and Wang (1983) and Lu (1991) for pollen grains, and Liu *et al.* (2004), Lu and Chen (1991), and Song *et al.* (2005) for seeds.

TAXONOMIC TREATMENT

Impatiens sterilis Y. Y. Cong & Y. X. Song, *sp. nov.*

絲序鳳仙花 Figs. 1 & 2

Type: CHINA. Yunnan, Tengchong County, Jietou Township, Shaba Village, at the edge of bamboo forest near the top of the mountain, 98°51'00.70"E, 24°97'06.14"N, 3296 m, 14 September 2008, Yi-Yan Cong 791435 (holotype: HNNU; isotype: HNNU).

Diagnosis: *Impatiens sterilis* is most similar to *I. scutisepala* Hook. f. (1984), but can be distinguished by the leaf blades oblong to ovate, membranaceous, base suborbicular, lower sepal cup-shaped with purple spotted, lateral sepals 4, producing filiform reduced and sterile inflorescences at the later stage of the florescence.

Description: Annual herb, 70–88 cm tall. Stem erect, robust, base 0.55–0.81 cm in diam, well branched, basal nodes swollen with adventitious roots. Leaves alternate, often aggregated or subverticillate on upper part of stem, with 2.1–5.9 cm long petioles at middle and lower stem, shortly petiolate or sessile on upper stem. Lamina 8.5–13.9 × 3.4–6.3 cm, oblong to ovate, membranaceous, glabrous on both surfaces, apex acuminate to cuspidate, base suborbicular, with 1 pair of sessile globose glands,

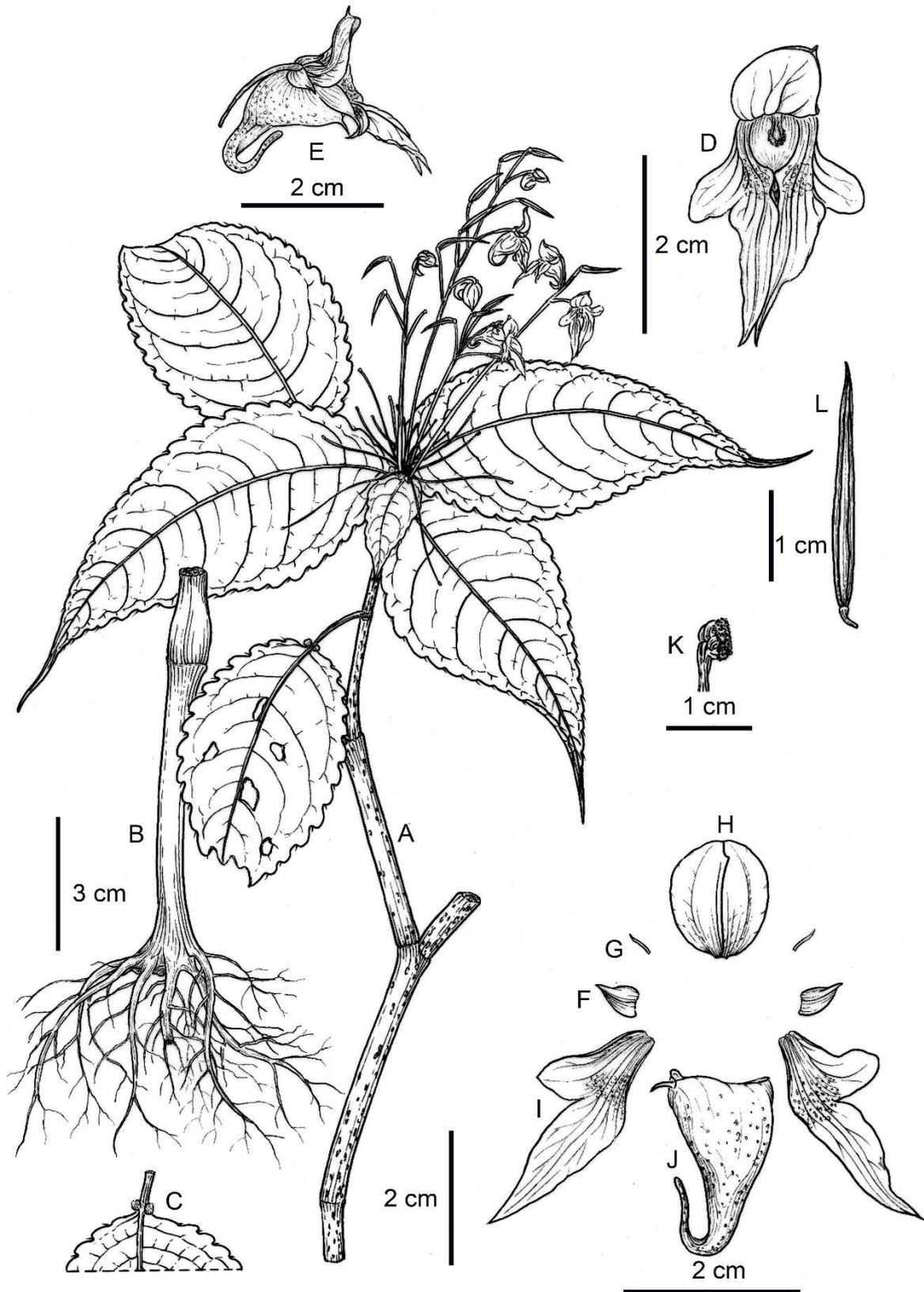


Fig. 1. *Impatiens sterilis* Y. Y. Cong & Y. X. Song, sp. nov. **A.** Upper part of plant; **B.** Lower part of plant; **C.** Basal portion of adaxial leaf surface; **D.** Flower in front view; **E.** Flower in lateral view; **F.** Outer lateral sepals; **G.** Inner lateral sepals; **H.** Dorsal petal; **I.** Lateral united petal; **J.** Lower sepal; **K.** Androecium; **L.** Capsule.

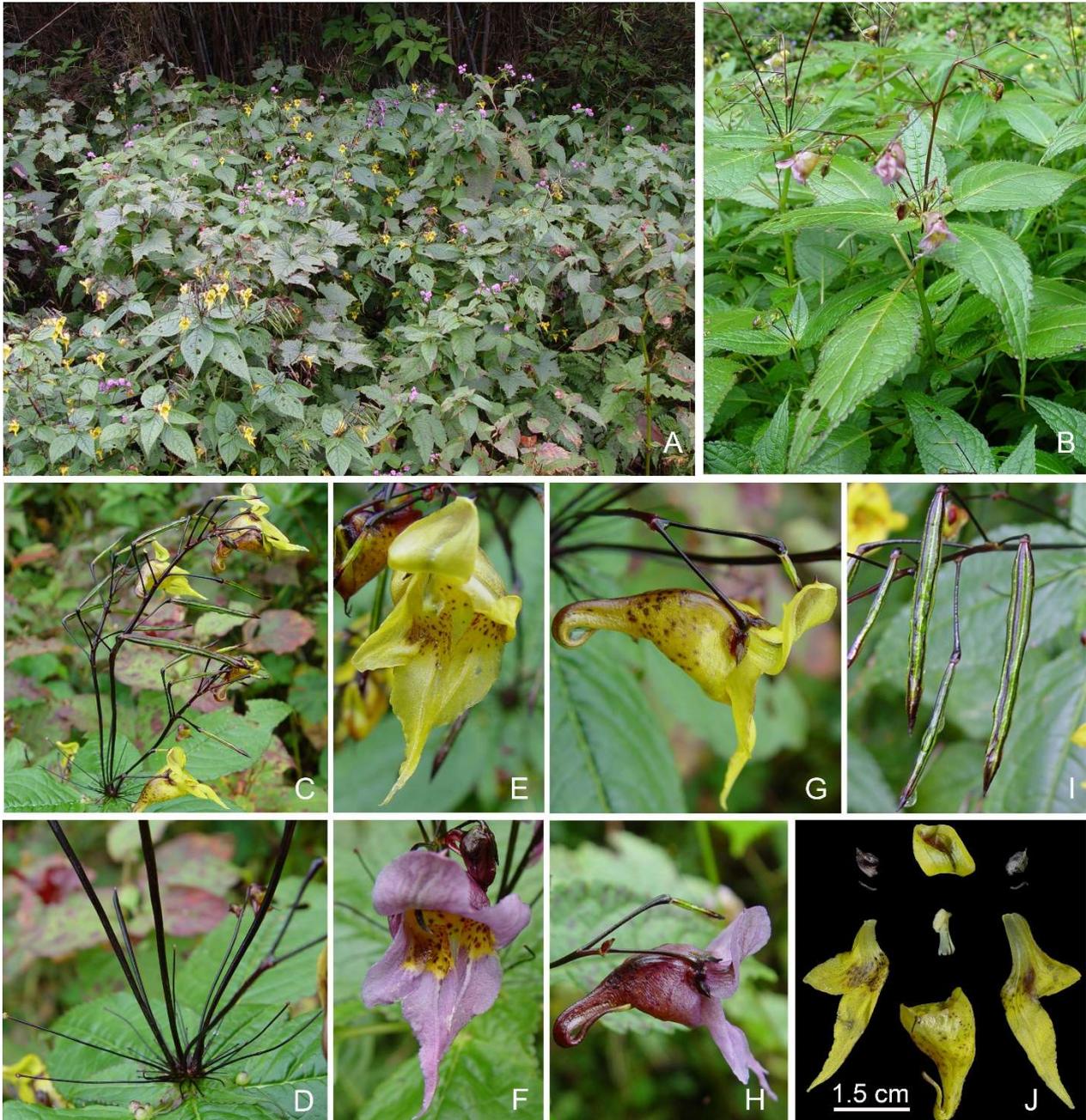


Fig. 2. *Impatiens sterilis* Y.Y. Cong & Y.X. Song, sp. nov. **A.** Habit; **B.** Flower branches; **C.** Inflorescences; **D.** Sterile inflorescences and basal portion of fertile inflorescences; **E. F.** Flower in front view; **G. H.** Flower in lateral view; **I.** Capsules; **J.** Flower anatomy.

margin crenate-serrate, setose between marginal teeth, lateral veins 5–8 pairs, arcuate. Inflorescences racemose, terminal or axillary, 3–13-flowered; peduncle 1.7–5.3 cm, glabrous (at the later stage of the florescence, producing some reduced sterile inflorescences, slender, filiform, growing on inner side of the fertile inflorescences), pedicels 0.9–2.3 cm, slender, with a bract at base, bract 1.8–3.1 mm long, ovate, caducous. Flowers pale yellow or pale purple, 2.5–3.3 cm long. Sepals: lateral sepals 4, the outer 2 obliquely ovate, 3–

5.1 × 2–3 mm, apex mucronate, the inner 2 extremely small, linear, 2–3.1 mm long; lower sepal purple spotted, poculiform, 0.9–1.3 cm deep excluding spur, 1.1–1.5 cm wide, apex mucronate, base abruptly constricted into a spur, spur 1.0–1.55 cm long, incurved. Petals: Dorsal petal cucullate, 9–13 mm long, 4.7–10 mm wide, base suborbicular, apex rostellate, abaxial midvein inconspicuously thickened; lateral united petals long clawed, 1.8–2.7 cm, 2-lobed, basal lobe 10–14.3 × 4–10 mm, broadly ovate, apex obtuse-acute, distal lobe 12–

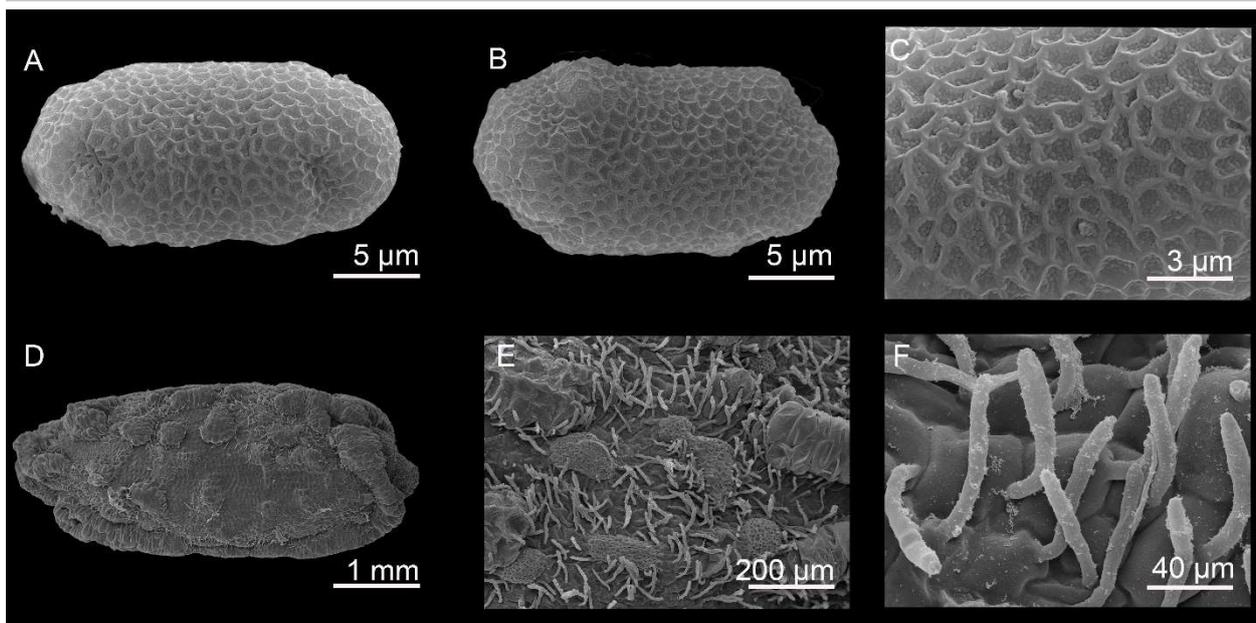


Fig. 3. SEM micrographs of pollen grains and seeds of *Impatiens sterilis* Y. Y. Cong & Y. X. Song. **A–C.** SEM images of pollen grains; **A.** Equatorial view; **B.** Polar view; **C.** Exine sculpture; **D–F.** SEM images of seeds; **D.** Whole view; **E, F.** Partial view.

19.5 × 3.4–6 mm, lanceolate, auricle inflexed. Stamens 5, 5–7.5 mm long, filaments linear, free for about 1/2 of their length. Anthers ovoid, joined into a ring surrounding the ovary apex, apex obtuse, 1.2–2.1 mm long; ovary superior, 5-carpellate, erect, fusiform, placentation axile, 3–5 mm long. Capsule linear, 2.35–3.6 cm long, 5-valved, fleshy.

Phenology: Flowering and fruiting from July to October.

Etymology: The specific epithet "sterilis" refers to the sterile inflorescences that grow on the inner side of fertile inflorescences of the new species.

Conservation status: *Impatiens sterilis* is currently known to occur in Tengchong County only. The IUCN status proposed is 'DD' (data deficient), based on IUCN (2019) guidelines.

Micromorphological observations: Pollen grains: pollen grains oblong-elliptic in polar view, 4-colpate, with long colpi, thin, exine with reticulate ornamentation, spherical particles of various sizes in the net visible under high magnification (Fig. 3 C), with average size of $E1 \times E2 = 23.02$ (21.92–23.56) × 12.44 (11.80–13.28) μm (Fig. 3 A–C). Seeds: oblong, 3.47 (3.29–3.61) × 1.62 (1.57–1.64) mm, L (long)/W (wide) = 2.15, surface with reticulate ornamentation, some of the epidermal cells are elevated significantly higher and arranged in ridges, part of nonprotrusive epidermal cells with filiform derivants (Fig. 3D–F).

DISCUSSION

Yu et al. (2016) divided the genus *Impatiens* into two subgenera, subgen. *Clavicularpa* S. X. Yu & Wei Wang in

Yu et al. (2016: 191) and subgen. *Impatiens*. Subgenus *Impatiens* was further subdivided into seven sections. In our study, *Impatiens sterilis* is nested within *I.* sect. *Racemosae* by its inflorescences racemose or subverticillate, many-flowered, capsule linear, lateral sepals 4 with inner 2 reduced, ovary 5-carpellate. Morphologically, *Impatiens sterilis* is somewhat similar to *I. cyathiflora*, *I. clavicuspis*, *I. loulanensis*, *I. scutisepala*, *I. cyanantha*, *I. blinii*, *I. purpurea*, *I. pseudokingii*, and *I. yaoshanensis* in China. The above species have the following features in common: stem cylindrical, leaves alternate, inflorescences racemose or subverticillate, many-flowered, pedicels slender, bracteate at base, flowers 2–5 cm long. But *Impatiens sterilis* can be easily distinguished from the nine similar species by having suborbicular leaf blade base, producing some filiform reduced sterile inflorescences, lateral sepals 4, lateral united petals long clawed, basal lobe broadly ovate. The new species and the nine similar species of *Impatiens* may be identified through the following key.

Taxonomic key to the similar species in *Impatiens*

- 1a. Bracts persistent, apex long acuminate or glandular-aristate 2
- 1b. Bracts caduceous, apex acuminate 5
- 2a. Petiole without basal glands, bracts and lateral sepals apically glandular-aristate *I. loulanensis*
- 2b. Petiole with 1 pair of globose or stipitate basal glands, bracts and lateral sepals apically long glandular aristate, shortly acuminate or mucronulate 3
- 3a. Lamina thinly papery, lower sepal saccate *I. clavicuspis*
- 3b. Lamina membranous or submembranous, lower sepal cup-shaped or funnelliform 4
- 4a. Flowers yellow, Lateral sepals obliquely ovate or subtrigonous, apex long glandular, lateral united petals clawed *I. cyathiflora*
- 4b. Flowers purple, Lateral sepals broadly ovate, apex mucronulate,



- lateral united petals not clawed *I. purpurea*
 5a. Lower sepal broadly funnellform with an erect spur 6
 5b. Lower sepal cup-shaped, saccate or narrowly infundibular with an incurved spur 7
 6a. Leaf blade base with 2 globose glands, flowers purple-violet, dorsal petal broadly obovate *I. blinii*
 6b. Leaf blade base with scutiform or digitate glands, flowers pale pink, dorsal petal orbicular *I. pseudokingii*
 7a. Leaf blade with 2 stipitate glands 8
 7b. Leaf blade with 2 sessile globose glands 9
 8a. Dorsal petal orbicular, midvein fine, lateral united petals 2-lobed *I. cyanantha*
 8b. Dorsal petals ubreniform, abaxial midvein inconspicuously thickened, lateral united petals 3-lobed *I. yaoshanensis*
 9a. Lamina base broadly cuneate, all inflorescence fertile, lateral sepals 2, obliquely orbicular or suborbicular, lower sepal saccate, lateral united petals not clawed *I. scutisepala*
 9b. Lamina base suborbicular, some of inflorescence sterile, lateral sepals 4, the outer 2 obliquely ovate, the inner 2, linear, lateral united petals long clawed *I. sterilis*

ACKNOWLEDGMENTS

The authors are grateful to the anonymous reviewers and editors for their positive and constructive comments and suggestions on our manuscript. We are grateful to Jing Tian (HIB) for the beautiful drawing. We especially thank Ke-Ming Liu (HNNU) for assistance with the scientific name of new species. This study was supported by the National Science & Technology Fundamental Resources Investigation Program of China (2019FY101800).

LITERATURE CITED

- Bhaskar, V.** 2012. Taxonomic Monograph on *Impatiens* L. (Balsaminaceae) of Western Ghats, south India: The Key Genus for Endemism. pp.283 Centre for Plant Taxonomic Study, Bangalore, India.
- Chen, Y.-L.** 2001. Balsaminaceae. In: Flora Reipublicae Popularis Sinica, vol 47(2). Science Press, Beijing, pp. 1–243.
- Chen, Y.-L., S. Akiyama and H. Ohba.** 2007. Balsaminaceae. In: Wu Z.-Y., P.H. Raven and D.Y. Hong (eds.) Flora of China. vol. 12. Science Press, Beijing & Missouri Botanical Garden Press, St. Louis, pp. 43–113.
- Cong Y.-Y., K.-M. Liu, X.-Z. Cai, S.-Z. Tian.** 2008. *Impatiens fugongensis* (Balsaminaceae), a new species from Yunnan, China. Bot. Stud. 49(2): 161–165.
- Fischer, E.** 2004. Balsaminaceae. In: Kubitzki K. (ed.) The Families and Genera of Vascular Plants. vol 6. Springer, Berlin, pp. 20–25.
- IUCN Standards and Petitions Committee** 2019. Guidelines for Using the IUCN Red List Categories and Criteria. Version 14. Prepared by the Standards and Petitions Committee. (<http://www.iucnredlist.org/documents/RedListGuidelines.pdf>, accessed on 19.04.2020)
- Liu, C.-J., Q. Lin and J.-X. He.** 2004. Methods and terminology of study on seed morphology from China. Acta Bot. Boreali-Occident. Sin. 24: 178–188.
- Lu, Y.-Q.** 1991. Pollen morphology of *Impatiens* L. (Balsaminaceae) and its taxonomic implications. Acta Phytotaxon. Sin. 29: 352–357.
- Lu, Y.-Q. and Y.-L. Chen.** 1991. Seed morphology of *Impatiens* L. (Balsaminaceae) and its taxonomic significance. Acta Phytotaxon. Sin. 29: 252–257.
- Lu Z.-C., B. Pan, F.-Z. Huang, Y. Liu** 2020. *Impatiens gongchengensis* (Balsaminaceae), a new species from Guangxi, Southern China. Taiwania. 65(1): 1–4.
- Mabberley, D.J.** 2008. The Plant book – A Portable Dictionary of Plants. Cambridge University Press, Cambridge, UK, 1040 pp.
- Song, Y., Y.-M. Yuan, and P. Kupfer.** 2005. Seedcoat micromorphology of *Impatiens* (Balsaminaceae) from China. Bot. J. Linn. Soc. 149(2): 195–208.
- Wang, K.-F. and X.-Z. Wang.** 1983. Outline of palynology. Beijing university Press, Beijing, 205 pp.
- Yu, S.-X.** 2012. Balsaminaceae of China. Peking University Press, Beijing, 206 pp.
- Yu, S.-X., S.B. Janssens, X.-Y. Zhu, M. Liden, T.-G. Gao and W. Wang.** 2016. Phylogeny of *Impatiens* (Balsaminaceae): integrating molecular and morphological evidence into a new classification. Cladistics 32(2): 179–197.
- Yuan Y.-M., Y. Song, K. Geuten, E. Rahelivololona, S. Wohlhauser, E. Fischer, E. Smets, P. Küpfer.** 2004. Phylogeny and biogeography of Balsaminaceae inferred from ITS sequences. Taxon 53(2): 391–403.
- Zeng, L., Y.-N. Liu, R. Gogoi, L.-J. Zhang and S.-X. Yu.** 2015. *Impatiens tianlinensis* (Balsaminaceae), a new species from Guangxi, China. Phytotaxa 227(3): 253–260.