



Impatiens wawuensis (Balsaminaceae): a new species from Sichuan, China

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Abstract

We describe *Impatiens wawuensis* B. Ding & S. X. Yu, a new species from Mt. Wawu, Sichuan Province, China. The new species is superficially similar to *I. oxyanthera* in having an inflorescence consisting of two pink flowers with a reddish vein. Differences include smaller leaves and flowers, lower sepals with shorter and slightly incurved spur, lower petal of lateral united petals with an elongate linear auricle inserted into the spur, and a fusiform capsule that is sparsely verrucous. We also present for the new species its seed micromorphology and palynological features under Scanning Electron Microscopy.

Key words: Balsaminaceae, China, *Impatiens*, new species, Sichuan

Introduction

The genus *Impatiens* Linnaeus (1753: 937) is considered to be a taxonomically difficult group, containing over 1000 species (Grey-Wilson 1980, Fischer 2004). It is distributed largely in the tropical and subtropical regions of the Old World, with the greatest diversity seen in tropical Africa, Madagascar, southern India and Sri Lanka, eastern Himalaya and Southeast Asia (Yuan *et al.* 2004). *Impatiens* is divided into two subgenera, i.e., *Clavicarpa* and *Impatiens*, and the latter is further subdivided into seven sections (Yu *et al.* 2016).

China contains approximately 270 species of *Impatiens*, of which roughly 240 are native (Yu 2012). However, the diversity of this genus coupled with insufficient field work has meant that several species new to science are still being discovered (Zhang and Zhang 2011, Zhang *et al.* 2013, Cai *et al.* 2015, Luo *et al.* 2015, Zeng *et al.* 2015, Wang *et al.* 2016). Most species are restricted to southwest China, in Guangxi, Guizhou, Sichuan, Yunnan, and Xizang (Tibet) (Yu 2012).

Wawu Mountain (29°25'–29°34' N, 102°49'–103°00' E, 1023–3522 m) is a typical mesa mountain, with an 11-km² plateau on the summit. It runs largely from north to south, and is named after the eastern and western edges that slant like the roof of a “wawu” (a type of dwelling in China). Wawu Mountain is located in the transition zone between the Sichuan Basin and the Hengduan Mountains, and is geologically and environmentally very heterogeneous in altitude, temperature, and precipitation.

This mountain lies in the center of a wet and humid part of West China, and has a subtropical climate with abundant monsoon rainfall. It was also a refugium during the quaternary glaciations and consequently exhibits high biodiversity (Wang *et al.* 2005). The flora is affected by the Sino-Japanese forest subkingdom as well as the Sino-Himalayan forest subkingdom. Several new species have been discovered in this region, such as those belonging to *Carex* (Cyperaceae; Liang 1999) and *Primula* (Primulaceae; Xu 2014).

Unknown plants of *Impatiens* were collected during our botanical survey in Wawu Mountain Provincial Nature Reserve in 2014 and 2015. Based on a detailed morphological study, we recognize them as representing a species new to science.

Material & Methods

Morphological traits, including habit and various leaf, inflorescence and flower characters were described/measured with both fresh and dried specimens (vouchers preserved in PE). Leaves and flowers were fixed with a formalin-acetic acid-alcohol (FAA) solution after they were photographed in the field.

Pollen grains and seeds were fixed to stubs and sputter-coated with gold (EIKO IB-5) before examination and photography with a scanning electron microscope (SEM; Hitachi S-4800). Pollen was treated as in the protocol of Punt *et al.* (2007) and evaluated as in Janssens *et al.* (2012). Seeds were treated as in Song *et al.* (2005), and the traits evaluated as in Cai *et al.* (2013).

Taxonomic treatment

Impatiens wawuensis B. Ding & S. X. Yu, *sp. nov.* (Figs. 1–3)

Diagnosis: Similar to *I. oxyanthera* Hooker & Joseph Dalton (1908: 254) with the inflorescence comprising two pink flowers with a reddish vein, but differing from this species by smaller leaves and flowers, lower sepals with shorter and a slightly incurved spur, the lower petal of the lateral united petals with an elongate linear auricle inserted into the spur, and a fusiform capsule that is sparsely verrucous.

Type:—CHINA. Sichuan Province: Hongya County, Wawu Township, Baisha River, Wawu Mountain Provincial Nature Reserve, 29°26'34.4"N, 102°54'37.8"E, ca. 2350 m a.s.l., 24 September 2015, B. Ding 201509062 (holotype PE!, isotype KUN!, IBK!).

Description:—*Herbs*, annual, 15–30 cm tall, *Stems* erect or creeper, slender, branched. *Leaves* alternate, petiolate or subsessile on upper stem; petiole 0.5–1 cm; leaf blades ovate-oblong, 2–4 × 1–1.5 cm, membranaceous, abaxially puberulent, with 2 stipitate glands at base, base cuneate, margin crenate, apex acuminate. *Inflorescences* axillary, 2-flowered, peduncle 1.5–2.5 cm long, puberulent, pedicels 0.5–1 cm long, bracteate above base, bracts persistent, lanceolate, 2–3 mm. *Flowers* pink, 0.5–1 cm long; *lateral sepals* 2, ovate, ca. 3 × 2 mm, entire, apex acuminate, mucronulate. *Lower sepal* navicular, ca. 0.5 cm long, spur narrowed into a slightly incurved spur; spur stout, obtuse; mouth oblique, tip acute; *dorsal petal* orbicular, ca. 5 × 5 mm, base retuse, apex rostellate, abaxial midvein puberulent; *lateral united petals* not clawed, with fuchsia striations, ca. 0.5 cm long, 2-lobed; upper lateral united petals orbicular; *lower lateral united petals* dolabriform, auricle linear, elongate, inserted into spur. *Stamens* 5, filaments linear, anther small, apex obtuse. *Ovary* 4–5 mm long, erect, apex acuminate, glabrous. *Capsule* erect, fusiform, 1–1.5 cm long, 5-angled, sparsely verruculose along ribs.

Palynology—Pollen grains subellipsoid in polar view, 4-colpate, P×E = (17.7–19.5) 18.4 × (27.9–29.3) 28.7 μm, broadly ellipsoid in equatorial view; sexine ornamentation reticulate, bottom of ridge with irregular granules, lumina sparsely granulated (Fig. 3A–C).

Seed micromorphology—*Seeds* ellipsoid, 2.5 (2.3–2.7) × 1.5 (1.4–1.8) mm, local epidermal cells digitiform (Fig. 3D), digitiform cells channeled (Fig. 3F), most epidermal cells irregularly alveolate (Fig. 3E).

Etymology—The species epithet *wawuensis* refers to the locality of the type specimen: Wawu Shan Provincial Nature Reserve, Sichuan, China.

Phenology—Flowering and fruiting from August to November.

Ecology and distribution—*Impatiens wawuensis* occurs in forest understories, along canals, shaded moist places, and roadsides at ca. 2300–2400 m a.s.l. It grows together with *I. imbecilla* Hooker & Joseph Dalton (1910: 2917), *I. undulata* Chen & Yi Lin[g] & Lu & Ying-ching (1990: 23–25) and *I. tortisepala* Hooker & Joseph Dalton (1910: 270), and with species of various other genera such as *Berberis* Linnaeus & Carl von (1753: 330), *Cardamine* Linnaeus & Carl von (1753: 654), *Cyperus* Linnaeus & Carl von (1753: 44), and *Ribes* Linnaeus & Carl von (1753: 200), and with *Chimonobambusa szechuanensis* Keng & Pai Chieh (1948: 15), *Picea brachytyla* Pritzell & Ernst Georg (1900: 216–217), *Pilea notata* Wright & Charles Henry (1899: 476), *Philadelphus calvescens* Hwang & Shu Mei (1991: 11), *Rubus setchuenensis* Bureau & Louis Édouard & Franchet & Adrien (1891: 46), *Salvia tricuspis* Franchet & Adrien René (1891: 150), *Sorbaria arborea* Schneider & Camillo Karl (1905: 490), *Stranvaesia davidiana* Decaisne & Joseph (1874: 179), *Tetracentron sinense* Oliver & Daniel (1889: 1892), and *Tsuga chinensis* Pritzell & George August (1901: 217). *Impatiens wawuensis* is currently known from only two small populations in the Wawu Mountain Provincial Nature Reserve.



FIGURE 1. *Impatiens wawuensis* B. Ding & S. X. Yu. A. Flowering plant; B. Enlarged basal portion of leaf; C. Flower (lateral view); D. Flower (front view); E. Flower (dorsal view); F. Lateral sepal; G. Dorsal petal; H. Lower sepal; I. Lateral united petals; J. Ovary surrounded by stamens; K. Immature capsule; L. Mature capsule.

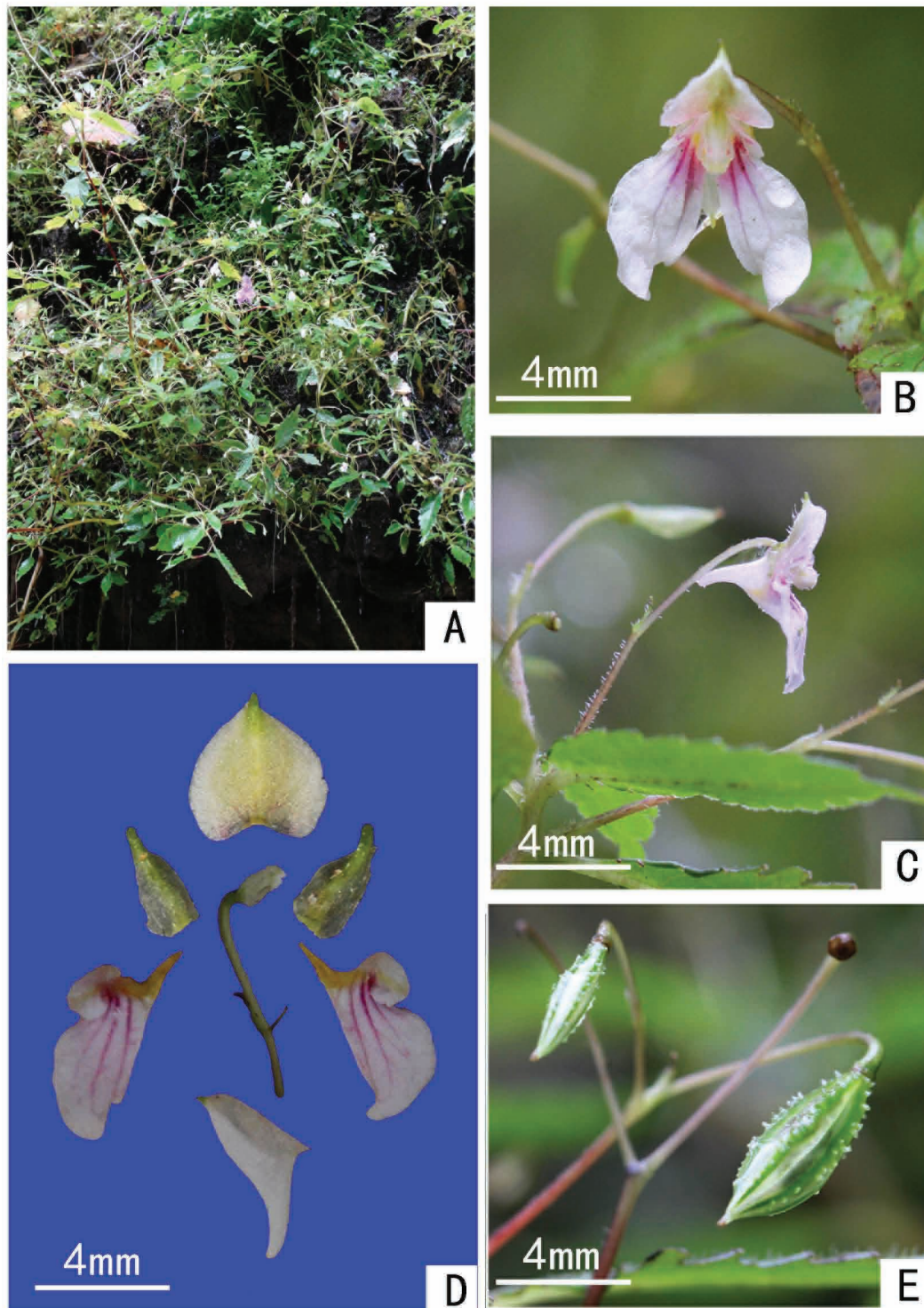


FIGURE 2. *Impatiens wawuensis* B. Ding & S. X. Yu. A. Habit. B. Flower, ventral view; C. Flower, lateral view; D. Individual flower parts, lateral view; E. Fruits.

Conservation status—Only two populations, with a total of about 400 individuals, were found in a small area (< 4 km²) in Wawu Mountain Provincial Nature Reserve. We classify the conservation status of *Impatiens wawuensis* as Vulnerable (VU D2), based on current information and following the International Union for Conservation of Nature and Natural Resources guidelines (IUCN 2011). Although the area is under protection as a national nature reserve, habitat disturbance brought about by human activities such as grazing, trampling and forest clearance (e.g., firebreaks) may have a negative impact on the species.

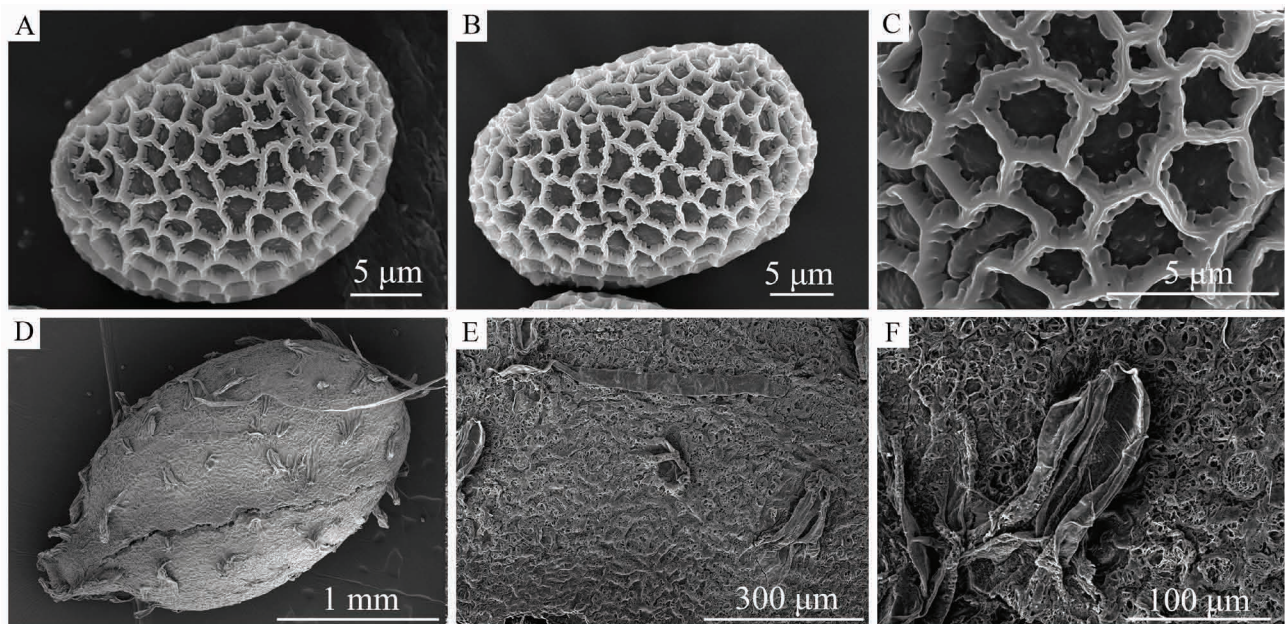


FIGURE 3. SEM micrographs of pollen grains and seeds of *Impatiens wawuensis* B. Ding & S. X. Yu. A–C. SEM images of pollen grains. A, B. Whole view; C. Exine sculpture; D–F. SEM images of seeds; D. Whole view; E–F. Partial view.

Paratypes—CHINA. Sichuan: Wawu Mountain Provincial Nature Reserve, 29°26'35.2"N, 102°54'38.0"E, elev. ca. 2300 m, 25 September 2015, B. Ding 201509064 (PE!).

Similar species—*Impatiens wawuensis* is superficially similar to *I. oxyanthera* in its inflorescence comprising two pink flowers with a reddish vein. However, it differs from this species by the following characters: flower much shorter: 0.5–1 cm vs. 2–2.5 cm; spur slightly incurved vs. incurved; lower petal of the lateral united petals with elongate linear auricle inserted into the spur vs. linear auricle absent; capsule fusiform vs. linear; capsule ribs verruculose vs. smooth.

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