



## *Impatiens cavaleriei* (Balsaminaceae), a new species from the Miaoling Mountains in Guizhou Province, China

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**ABSTRACT:** *Impatiens cavaleriei* X.X.Bai & R.X.Huang, sp. nov. from the Miaoling Mountains of Guizhou, belonging to *I. sect. Uniflorae*, is described and illustrated here. While *I. cavaleriei* morphologically resembles *I. notolopha* Maximowicz and *I. undulata* Y.L.Chen & Y.Q.Lu in ovate or ovate-elliptic leaves, yellow flowers and a cymbiform lower sepal, this new species can be easily distinguished by its comprehensive characteristics, including a slightly transparent capsule, lateral united petals clawed, 2-flowered, and seed surface with warty protrusions. A detailed description, color photographs and a provisional IUCN Red List assessment are provided along with discussions of the geographical distribution and morphological relationships of *I. cavaleriei* with similar species.

**KEY WORDS:** Balsaminaceae, Guizhou, *Impatiens notolopha*, *Impatiens undulata*, Pierre Julien Cavalerie, sect. *Uniflorae*.

### INTRODUCTION

The genus *Impatiens* L. belongs to Balsaminaceae A. Rich. of the order Ericales, and contains over 1000 species. Five conspicuous diversification centers in the Paleotropical Regions can be recognized: tropical Africa, Madagascar, South India and Sri Lanka, Southeast Asia, and eastern Himalaya (Grey-Wilson, 1980; Song *et al.*, 2003). In China, 352 species of *Impatiens* have been recorded, including 273 species endemic to China, which are concentrated in the generalized Qinling Mountains, southern Tibet, the generalized Hengduan Mountains, the Yunnan-Guizhou-Guangxi karst region, the middle and lower reaches of the Yangtze River and other regions (Yuan *et al.*, 2022a). Guizhou belongs to the subtropical humid monsoon climate, located in the Yunnan-Guizhou Plateau, which breeds abundant resources of the genus *Impatiens* L. (Yu *et al.*, 2021). In recent years, three new species have been recorded (Peng *et al.*, 2021; Ren *et al.*, 2022; Yuan *et al.*, 2022b). In the early days, most of the related research was based on the examination of specimens. However, it can be challenging to generate and dissect specimens for observation due to the genus's typically succulent, juicy stems and fragile flowers (Chen, 2001). Therefore, field surveys are necessary for an accurate description of characteristics.

In July 2020, during the investigation of *Impatiens* L. in Doupeng Mountains, Duyun City, we encountered an unusual population of *Impatiens* species. The plants were found growing on the side of the road under the forest and beside a stream. The morphological characteristics of this species, especially the capsule, are different from those of other similar species. The shape of the capsule is an important characteristic of the genus. In July 2021, we revisited Doupeng Mountains for a further field investigation to record the morphological characteristics

of the species. After a thorough morphological study based on the literature (Hooker, 1908a, b; Chen and Lu, 1990; Luo and Deng, 2015; Chen *et al.*, 2007; Yu, 2012; Kuang, 2015; Yu, 2021) and digital specimens deposited in P, K, E, PE, IBSC, KUN, GZAC (acronyms after Thiers, 2023 ongoing) and other domestic and foreign herbariums, we concluded that the comprehensive morphological characteristics of this species differed from those of previously reported taxa. Therefore, the species was confirmed as a new species and described here.

### MATERIALS AND METHODS

The morphological description of the new species is based on morphological observation and the measurements of fresh material and plant specimens in the field, with relevant literature and digital specimens deposited in the herbariums. Morphological comparisons with closely related species were based on information gathered from field surveys, digital specimens and the literature.

### TAXONOMIC TREATMENT

*Impatiens cavaleriei* X.X.Bai & R.X.Huang, *sp. nov.*

**Figs. 1 & 2**

**Type:** CHINA. Guizhou, Qiannan Buyi and Miao Autonomous Prefecture, Duyun City, Doupeng Mountains, 26°21'1.85"N, 107°22'1.05"E, elev. 1151 m, 8 July 2021, X.X. Bai, L.Y. Ren, R.X. Huang DPS-252 (holotype: GZAC!; isotype: PE!).

**Diagnosis:** This new species is most similar to *Impatiens notolopha* Maximowicz in terms of its leaf morphology, yellow flowers and cymbiform lower sepal, but it can be distinguished from the latter by 2-flowered (vs. 3–5-flowered), flower 1.8–2.8 cm long (vs. ca. 1 cm long), dorsal petal abaxial mid-vein slightly thickened,

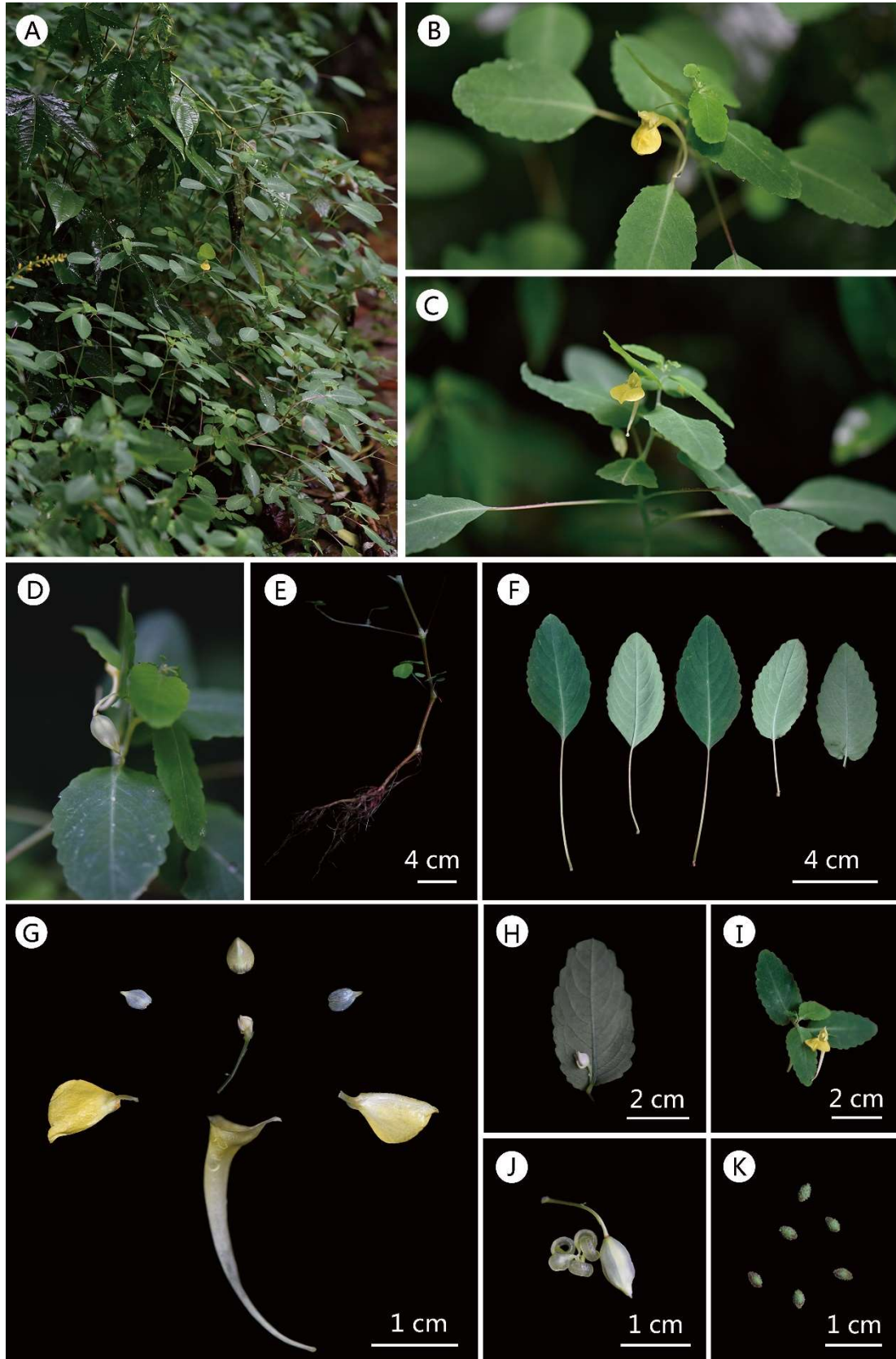


Fig. 1. *Impatiens cavaleriei* A. habit, B. plant, C. flower in face view, D. capsule, E. root, F. leaf, G. dissected flower, H. buds, I. flower, J. capsule, K. seeds. Photographs by Xin-xiang Bai.

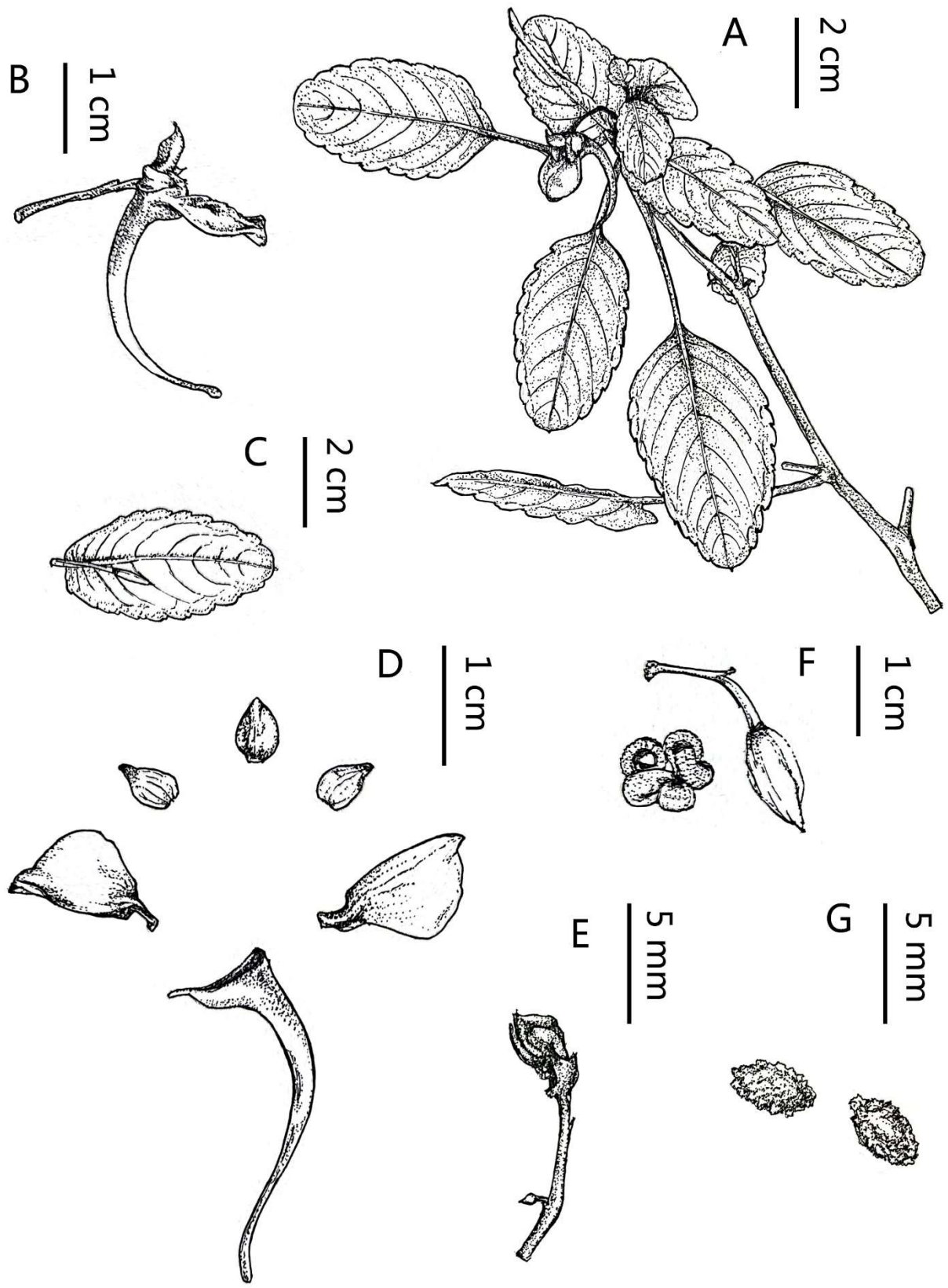


Fig. 2. *Impatiens cavaleriei* A. plant, B. flower, C. leaf, D. dissected flower, E. anther, F. capsule, G. seeds. Drawn by Bai-qiu He.

**Table 1.** Comparison of morphological characteristics of *Impatiens cavaleriei*, *I. notolopha*, and *I. undulata*.

Characteristics	<i>I. cavaleriei</i>	<i>I. notolopha</i>	<i>I. undulata</i>
Number of flowers	2	3–5	1–3
Flower	1.8–2.8 cm long	ca. 1 cm long	ca. 2 cm long, ca. 1 cm wide
Length of peduncles	8–15 mm	30–40 mm	14–16 mm
Lateral sepal	white, 4-veined	green	yellow
Lower sepal	ca. 2 cm deep	8–10 mm deep	ca. 2 cm deep
Dorsal petal	abaxial mid-vein slightly thickened, apex mucronulate	abaxial mid-vein green, broadly carinate, apex rounded	abaxial mid-vein carinate, green, apex rounded
Lateral united petals	clawed	sessile	sessile
Basal lobes	oblong to obovate-oblong, small, ca. 3 × 2 mm	suborbicular, small	small
Distal lobes	broadly dolabriform, ca. 12 × 7 mm, apex slightly acute	orbicular or broadly dolabriform, apex slightly acute	dolabriform, apically retuse
Anther	acute	obtuse	acute
Capsule	fusiform, slightly transparent, apex acute	narrowly fusiform	fusiform, nearly black

apex mucronulate (vs. broadly carinate, green, apex rounded), anther acute (vs. obtuse) and seed ellipsoid (vs. smooth). The new species is also similar to *I. undulata* Y.L.Chen & Y.Q.Lu, but they are different in dorsal petal abaxial mid-vein slightly thickened, apex mucronulate (vs. carinate, green, apex rounded), lateral united petals clawed (vs. sessile) and distal lobes apex slightly acute (vs. retuse).

**Description:** Annual herbs, glabrous, 30–60 cm tall. Stem erect, simple, lower nodes swollen with adventitious roots. Leaves opposite in lower and middle parts, alternate in upper part, petiole 5–7.5 cm long, lamina 4–6 × 3–4 cm, ovate or ovate-elliptic, apex slightly acute, base cuneate or truncate, margin undulate, mucronulate in the depression between crenatures, green adaxially, pale green abaxially, with white powder, lateral veins 8–10 pairs. Inflorescences axillary, twisting under the leaves, 2-flowered (only 1 flower developed). Peduncles 8–15 mm long, pedicels 4–8 mm long, bracteate above the middle; bract 1, persistent, linear-lanceolate, 2–3 mm long. Flowers yellow, 1.8–2.8 cm long. Lateral sepals 2, white, ovate, ca. 4 × 3 mm, apex mucronulate, green, 4-veined. Lower sepal cymbiform, ca. 2.5 cm deep, mouth vertical, apex slightly acute, narrowed into a long spur, ca. 2 cm. Dorsal petal small, orbicular, 4–6 mm in diam., base truncate, abaxial mid-vein slightly thickened, apex mucronulate. Lateral united petals 2-lobed, clawed, ca. 1.5 cm long, basal lobes oblong to obovate-oblong, small, ca. 3 × 2 mm, apex acute; distal lobes broadly dolabriform, ca. 12 × 7 mm, apex slightly acute. Stamens 5, filaments linear, anther acute; ovary 5-carpellate. Capsule fusiform, slightly transparent, ca. 1 cm long, apex acute, seeds ellipsoid, surface with warty protrusions.

**Etymology:** The specific epithet ‘cavaleriei’ is in honor of Pierre Julien Cavalerie (1869–1927), a French missionary who collected plant specimens in Guizhou in early years.

**Vernacular name:** Miáo Lǐng Fèng Xiān Huā (Chinese pronunciation); 苗嶺鳳仙花 (Chinese name).

**Distribution, habitat and phenology:** *Impatiens cavaleriei* has been found in Doupeng Mountains, Duyun City, Guizhou Province. We found that the plants growing on the side of the road, under the forest and beside a stream, coexisting with *Pilea notata* C.H.Wright, *Acer oliverianum* Pax, *Dioscorea bulbifera* R.Br. and others. The flowering period of *I. cavaleriei* is from June to August, and the fruiting period is from July to September.

**Conservation status:** Only one population with approximately 30 mature individuals was found at the type locality and the habitat is exposed to human disturbance. We visited Doupeng Mountains several times in the last three years and did not find other populations. Before carrying out further investigations, this species should be assessed as “Data Deficient” (DD), according to the IUCN standards (IUCN, 2022).

## DISCUSSION

*Impatiens cavaleriei* morphologically resembles *I. notolopha* and *I. undulata*, all of them have ovate or ovate-elliptic leaves, yellow flowers and a cymbiform lower sepal, but *I. cavaleriei* has a slightly transparent capsule, and a seed surface with warty protrusions. To better morphologically distinguish the new species from *I. notolopha* and *I. undulata*, we listed additional details in Table 1 and Fig. S1. Based on the above characteristics, *I. cavaleriei* is nested within *I. sect. Uniflorae* (Yu *et al.*, 2016).

In addition, the distribution of *Impatiens cavaleriei* is in the southern part of Guizhou Province, located in the Miaoling Mountains, while *I. notolopha* and *I. undulata* are located in Sichuan Province and Gansu Province, in the generalized Qinling Mountains and Hengduan Mountains. These three species are relatively independent in geographical distribution. Since a clear taxonomy is a key basis for the study and utilization of germplasm resources, we consider it necessary to report *I. cavaleriei* as a new species and distinguish it from other species.



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Supplementary materials are available from Journal Website