

The rediscovery of *Impatiens sigmoidea* Hook. f. (Balsaminaceae) in Guizhou, China after more than 100 years

RONG-XIN HUANG^{1,4}, YI CHEN^{1,5}, BAI-QIU HE^{1,6}, MEI-JUN LI^{1,7}, WEN-KE DONG^{3,8} & XIN-XIANG BAI^{1,2,9*}

¹ College of Forestry, Guizhou University CN-550025 Guiyang, China

² Qianxinan Academy of Agricultural and Forestry Sciences, 562400 Xingyi, Guizhou, China

³ Beijing Florascape Co., Ltd, 100044 Beijing, China

⁴  1752676554@qq.com;  <https://orcid.org/0000-0002-7824-2451>

⁵  1206117085@qq.com;  <https://orcid.org/0000-0002-6955-0225>

⁶  3084425252@qq.com;  <https://orcid.org/0009-0009-7491-3586>

⁷  59787607@qq.com;  <https://orcid.org/0009-0001-3433-4987>

⁸  victor_dawn@163.com;  <https://orcid.org/0000-0003-3710-6186>

⁹  254715174@qq.com;  <https://orcid.org/0000-0003-2449-6664>

*Author for Correspondence

Abstract

Impatiens sigmoidea was described in 1908 by the eminent British plant taxonomist J. D. Hooker based on specimens collected by the French missionaries E. M. Bodinier *et al.* from Guizhou, China. However, there has been no other records since then. After years of concern, we rediscovered *I. sigmoidea* in one of its type localities, Gao-po Town, in 2018. A revised description, colour photographs and a provisional IUCN Red List assessment of this species are provided, along with discussions of its geographical distribution, ecology and morphological comparison with *I. lasiophyton*. The lectotype of *I. sigmoidea* is also designated here. The rediscovery provides an essential basis for enriching the botanical resources of the genus *Impatiens*.

Keywords: Balsaminaceae, China, Guizhou, rediscovery, *I. lasiophyton* Hook.f.

Introduction

The genus *Impatiens* Linnaeus (1753: 937), belonging to Balsaminaceae, contains over 1000 species, chiefly distributed in the montane forests of the tropics and subtropics of the Old World with five centers of diversity, namely tropical Africa, Madagascar, South India and Sri Lanka, Southeast Asia, and eastern Himalaya (Grey-Wilson 1980, Song *et al.* 2003, Yuan *et al.* 2004, Mabberley 2017). In China, 352 species of *Impatiens* have been recorded (Yuan *et al.* 2022), with a general pattern of spreading from tropical and subtropical regions to higher latitudes and altitudes. In general, the Hengduan Mountains, southern Tibet, Yunnan-Guizhou-Guangxi karst areas, and the middle and lower reaches of the Yangtze River are hot spots for the concentrated distribution of *Impatiens*, and most of them are endemic to China or to a narrow region of the country, especially in the limestone regions of Yunnan-Guizhou-Guangxi (Chen 2001).

The climate of Guizhou Province is warm and humid and is classified as the subtropical humid monsoon climate. It is located in the Yunnan-Guizhou Plateau. There are four types of landforms: plateau, mountain, hill and basin, with typical karst landform. The flora lies in the transitional zone of the Pan-Arctic flora between the China-Japan forest flora subregion and the China-Himalayan forest flora subregion (Kuang 2015), with rich plant resources of genus *Impatiens* (Yu *et al.* 2021). In the early days, most of the related researches were based on specimens, including the publication of new species and taxonomic studies. However, it was challenging to dissect flowers on the specimens of *Impatiens* for observation due to the fragile and delicate petals (Chen 2001). Therefore, fresh materials obtained from field surveys are necessary for an accurate description of characteristics.

In May 2018, we discovered an *Impatiens* species in bloom during a botanical investigation in Huaxi District and Longli County, Guizhou Province, China. In April 2022, we revisited Longli County for a further field investigation to record the morphological characters of the species. After a thorough morphological study, detailed literature review

(Hooker 1908a, 1908b, Xiong 1990, 1996, Chen *et al.* 2007, Yu 2012, Luo & Deng 2015, Kuang 2015, Liang *et al.* 2020, Peng *et al.* 2021) and specimen examination, we conclude that this species is *Impatiens sigmoidea* (Hooker 1908a: 267), which was described more than one hundred years ago, but has never been collected again since then.

Materials and methods

The materials for this study were mainly collected in the field in 2018 and 2022. Observations and measurements of morphological characters were done based on fresh materials.

The guidelines and recommendations of Article 9 of the ICN (Turland *et al.* 2018) were followed while designating the lectotype of *Impatiens sigmoidea*.

Taxonomic treatment

Impatiens sigmoidea Hook.f., Nouv. Arch. Mus. Paris. Nat. sér. 4, 10: 267. 1908.

(Figs. 1, 3, 4, 5A–C)

Type:—CHINA. Guizhou: Guiyang City, Kao-po [Gaopo Town], 11 September 1899, *E. M. Bodinier & J. Laborde* 2688 (lectotype here designated: E00313668; isoelectotype: P00780758) (Fig. 1). Remaining syntype: CHINA. Guizhou: Pin-fa [Yunwu Town], 21 August 1902, *J. P. Cavalerie* 287 (E00313667).

Notes:—According to the protologue of *Impatiens sigmoidea* (Hooker 1908a), three collections, viz. *E. M. Bodinier* 2688, *J. Laborde & R. P. Bodinier* 2689 and *J. P. Cavalerie* 287, were cited and no holotype was designated. Thus, these three collections are all syntypes. Two herbarium specimens *E. M. Bodinier & J. Laborde* 2688 are extant at E (E00313668) and P (P00780758). The specimen E00313668 agrees better with the information given in the literature and contains the pencil drawing of flower parts and the dissected flower parts pasted on the sheet. It also contains the mentioning of collecting locality (Kao-po). Therefore, the specimen E00313668 is designated here as the lectotype. However, *E. M. Bodinier & J. Laborde* 2689 is actually the type collection of *I. labordei* (Hooker 1908a: 250) (Figs. 1 & 2), and should not belong to *I. sigmoidea*.



FIGURE 1. A Lectotype of *Impatiens sigmoidea* (*E. M. Bodinier & J. Laborde* 2688, E00313668) B Isoelectotype (P00780758).



FIGURE 2. A Syntype of *Impatiens sigmoidea* (J. P. Cavalerie 287, E00313667) B Isotype of *I. labordei* (E. M. Bodinier & J. Laborde 2689, E00313666) C Holotype of *I. labordei* (E. M. Bodinier & J. Laborde 2689, P00780709).

Revised description:—Annual herb, 30–60 cm tall. Stem erect, simple, middle and upper part white or pink pilose. Leaves alternate, petioles 1.5–3 cm long, with 2 basal glands. Lamina 3–15×1.5–5 cm, lanceolate or ovate-lanceolate, apex acuminate, margin serrulate, teeth mucronate, adaxial surface green, abaxial surface pale green, lateral veins 5–8 pairs, midvein white. Inflorescences in upper leaf axils, 1- or 2-flowered, peduncles 4–5 cm long, pedicels 8–15 mm long, bracteate above middle, persistent, ovate-lanceolate, apex acuminate, margin denticulate, 6–10 mm long. Flower white to greenish white, 2.5–3 cm deep. Lateral sepals 2, ovate, S-shaped curving, 6–9 mm long, 4–6 mm wide, apex acuminate, inequilateral, entire or denticulate on one side, abaxial midvein thickened. Lower sepal funnelform, mouth vertical, apex abruptly acuminate, base abruptly constricted into a middle inflexed, coarse spur, 1.5–2 cm long. Dorsal petal oblong, cucullate, apex mucronate, abaxial midvein thickened, carinate. Lateral united petals 2-lobed, 1.2–2 cm long, base with reddish dots, basal lobes ovate, small, 4–6 mm long, distal lobes dolabriform, 1.2–2 cm long, 8–15 mm wide, apex sharp and acuminate, abaxially with conspicuous auricle inflexed, apex obtuse. Filaments short, broad; anthers 2-locular, apically obtuse; ovary fusiform, erect, acuminate. Capsule clavate, 8–15 mm long, apically cuspidal; seeds few, 3–5 mm long, smooth.

Phenology:—Flowering and fruiting occur from May to October.

Distribution and habitat:—*Impatiens sigmoidea* is known in Huaxi District, Guiyang City, and Longli and Guiding counties of Qiannan Buyi and Miao Autonomous Prefecture. The species grows on gentle slopes next to streams or under broadleaved evergreen forests.

Additional specimens examined:—CHINA. Guizhou: Guiyang City, Huaxi District, Gaopo Town, 26°18'54.48"N, 106°47'58.8"E, elev. 1288m, 15 May 2018, X. X. Bai GP 2018051501 (GZAC); Qiannan Buyi and Miao Autonomous Prefecture, Longli County, Houzigou, 26°24'13.68"N, 106°59'42.91"E, elev. 1262m, 9 April 2022, X. X. Bai HZG 20220409 (GZAC).

Proposed IUCN conservation status:—About 2100 mature individuals were known in the two subpopulations of Longli County and Huaxi District. And the ecological environment is well protected. According to the IUCN Red List Categories and Criteria (IUCN 2019), it is assessed as Least Concern (LC).

Discussions on type localities:—The French missionaries E. M. Bodinier and L. Martin collected plant specimens in Guizhou between 1898 and 1901, such as Gaopo Mountain in Qingyan Town, Zhaosi (Tchao-se). The French Catholic priest J. P. Cavalerie collected plant specimens in Guiyang in 1894 and Yunwu Town (South of Guiding County, formerly known as [Pin-Fa]) from 1901 to 1909 (Xiong & Cao 2017). Many plant specimens collected by the missionaries were shipped abroad and studied by many taxonomists in various countries.

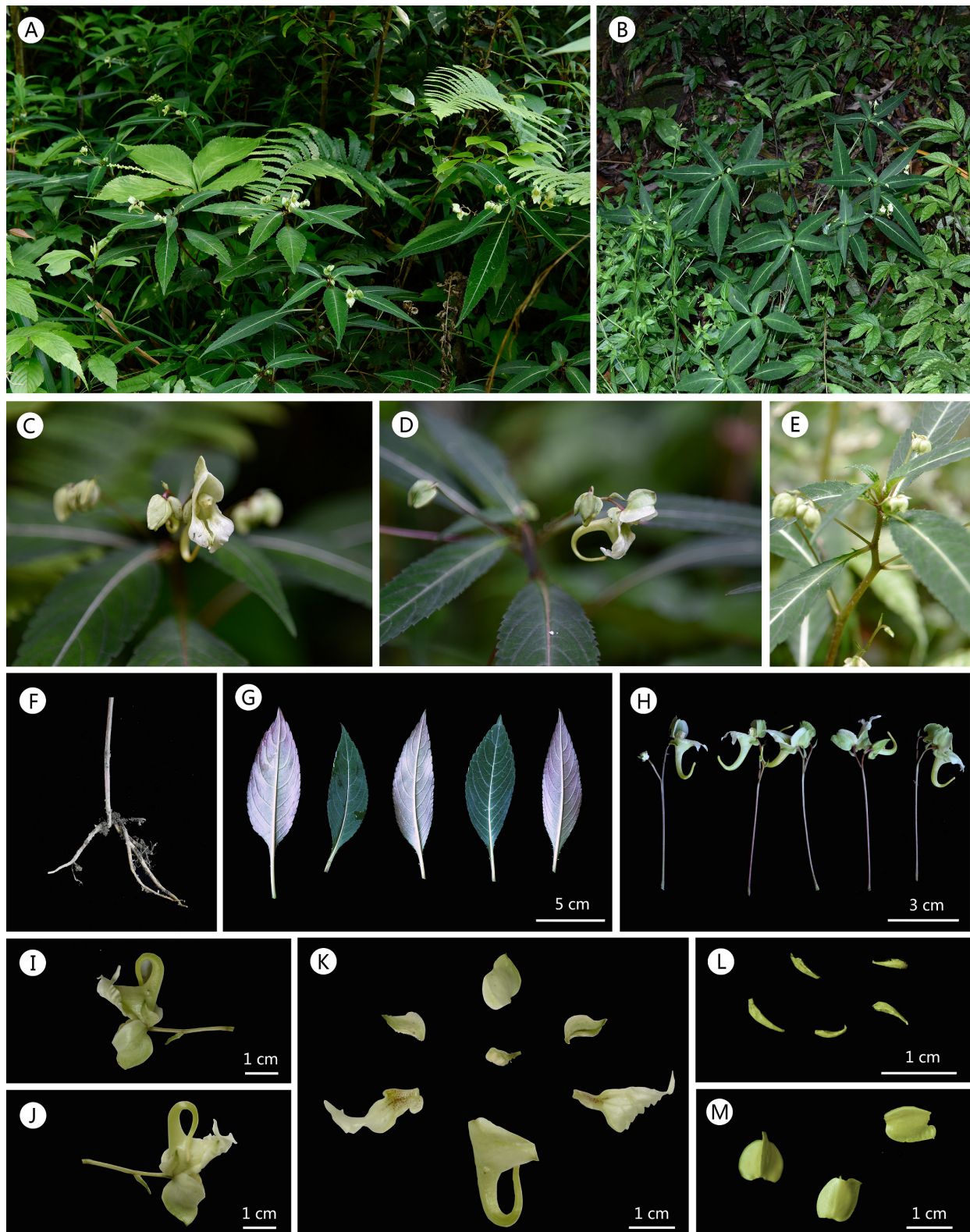


FIGURE 3. *Impatiens sigmoidea*. **A–B** Habit **C** Flower in face view **D** Flower in lateral view **E** Flowering branch **F** Base of stem and roots **G** Leaves **H** Inflorescences **I–J** Flower **K** Dissected flower **L** Bracts **M** Dorsal petals. Photographs by XIN-XIANG BAI.

After further literature review on place names, other plant specimens collected by E. M. Bodinier *et al.*, and preliminary inference of their activity tracks during this period, it can be concluded that the type localities of *I. sigmoidea* should be Gaopo Town (=Kao-po), Huaxi District and Yunwu Town (=Pin-fa), Guiding County. One distribution of this species recorded in *Flora of China* as “Pingba” should be a misreport of Pin-fa. “Pingba” was formerly known as Anping (Gan-pin), and renamed as Pingba Country in 1914, and now is the Pingba District of Anshun City.

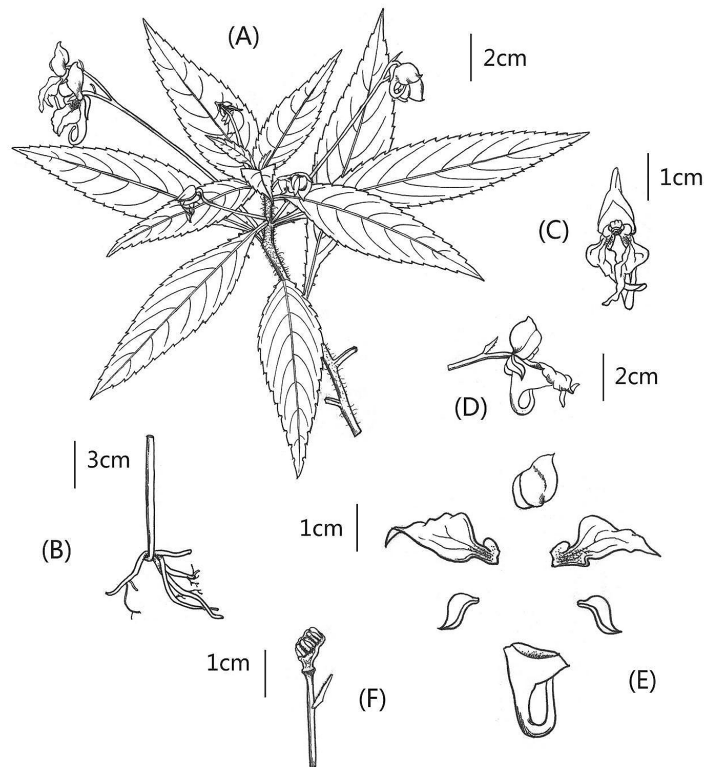


FIGURE 4. *Impatiens sigmoidea*. **A** Flowering branch **B** Base of stem and roots **C** Flower in face view **D** Flower in lateral view **E** Dissected flower **F** Anthers with pedicel and bract. Drawn by YI CHEN.

Discussion

Impatiens sigmoidea is described in the protologue as glabrous throughout. However, we observe that the upper part of its stem is pilose, so Hooker may overlook this characteristic at that time.

This species is morphologically most similar to *I. lasiophyton*, but differs by having the S-shaped curving (vs. subovate) lateral sepals, oblong and cucullate (vs. orbicular) dorsal petal, and pilose middle and upper part of stem (vs. densely pilose) (Fig. 5). According to the classification system of the genus *Impatiens* proposed by Yu *et al.* (2016), *I. sigmoidea* belongs to the *I.* sect. *Impatiens* due to its linear capsules, two lateral sepals, inflorescence of a raceme, and 5-carpellate gynoecium.

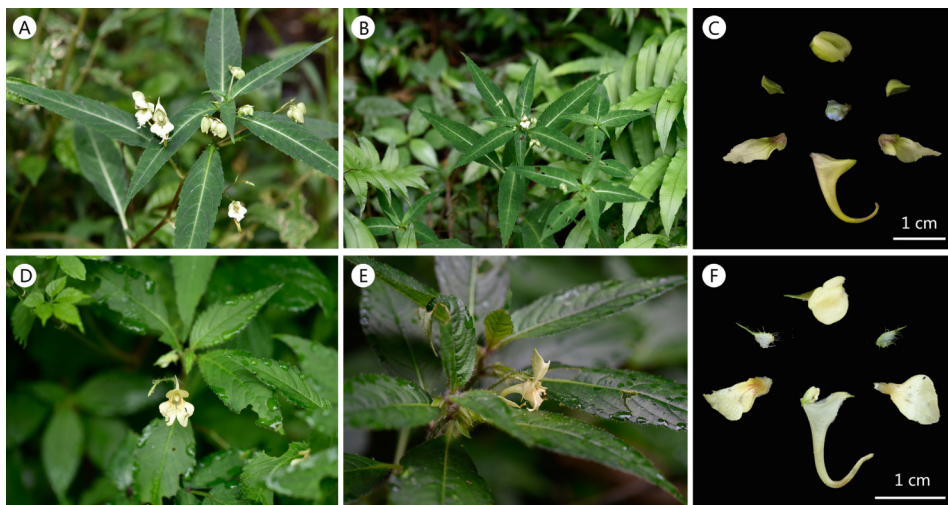


FIGURE 5. Morphological comparison between *Impatiens sigmoidea* and *I. lasiophyton*. **A–C** *I. sigmoidea*. **A–B** Habit **C** Dissected flower. **D–F** *I. lasiophyton*. **D** Flower in face view **E** Flower in lateral **F** Dissected flower. Photographs by XIN-XIANG BAI.

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