



## *Begonia floriprolifera*, a new Species of *Begonia* (Begoniaceae) from Southwestern Guangxi of China and Northern Vietnam

Jinye ZHOU<sup>1,#</sup>, Qian SONG<sup>1,#</sup>, Feicheng ZHAO<sup>2</sup>, Thanh Son HOANG<sup>3</sup>, Dayan TAO<sup>1</sup>, Shikai GUAN<sup>1</sup>, Haixia YAN<sup>1</sup>, Daiké TIAN<sup>4,5,\*</sup>

1. Flower Research Institute, Guangxi Academy of Agricultural Sciences, Nanning, Guangxi, 530007 China. 2. Guangxi Nanning Fengcheng Horticulture Co., Ltd., Chongzuo, Guangxi, 532800 China. 3. Silviculture Research Institute, Vietnamese Academy of Forest Sciences, Ha Noi, 10999 Vietnam. 4. Chenshan Research Center of CAS Center for Excellence in Molecular Plant Sciences, Shanghai, 201602 China. 5. Eastern China Conservation Centre for Wild Endangered Plant Resources, Shanghai Chenshan Botanical Garden, Shanghai, 201602 China. #contributed equally; \*Corresponding author's email: dktian@cemps.ac.cn

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**ABSTRACT:** *Begonia floriprolifera* is a new species of *Begonia* sect. *Coelocentrum* distributed in the karst area of southwestern Guangxi of China and northern Vietnam. Morphologically, it is mostly similar to *B. bonii*, but differs mainly by its nearly glabrous stipules, shorter inflorescence, bilaterally symmetric and upward curved androecium with fewer stamens, and concave apex of anthers. Due to the narrow distribution area and unfavorably environmental changes of its natural habitat, the new species is assigned to Endangered according to the IUCN Red List Categories and Criteria.

**KEY WORDS:** *Begonia bamaensis*, *Begonia bonii*, *Coelocentrum*, South China, Northern Vietnam, karst region, new taxon.

### INTRODUCTION

*Begonia* L. is one of the most mega-diverse genera in vascular plants and 2140 accepted begonia species have been published so far (Hughes *et al.*, 2015–Present). This genus is widely distributed in the humid tropical and subtropical regions of Asia, America and Africa, mostly in small niches such as valleys, stream banks, caves and the places near waterfalls, and there are over 1000 species in Asia (Shui and Chen, 2018; Moonlight *et al.*, 2018; Hughes *et al.*, 2015–Present). China is one of the most important distribution centers of *Begonia*, and the majority of species in this country are from the sections of *Platycentrum*, *Coelocentrum* and *Diploclinium* (Tian *et al.*, 2018). With the deepening of the investigation and research on the wild begonias, more and more new taxa from China have been published (Ding *et al.*, 2022, 2023; Feng *et al.*, 2021; Feng *et al.*, 2022, 2023; Tian *et al.*, 2021). At present, 280 *Begonia* species (including 3 subspecies, 14 varieties and 7 natural hybrid species), are already described, and the total is expected to reach 300 species or even more in the future (Tian *et al.*, 2018; iBegonia, 2022; Ding *et al.*, 2023; Feng *et al.*, 2023; Yue *et al.*, 2023). Yunnan and Guangxi are the distribution centers of *Begonia* in China, having 84% of the total known species of *Begonia* in the country (iBegonia, 2022).

In May 2017, an unknown species of *Begonia* was discovered in a karst cave in Southwestern Guangxi, China, by Mr. Zhao. Later, Jinye Zhou, Haixia Yan, Shikai Guan and Qian Song introduced this species from Mr. Zhao on 1 June, 2019, but could not identify it after reviewing literature and considered it possibly new to science. Then they went to the original habitat to collect

data and take photos on 3 June, 2020, 11 September, 2021, and 26 November, 2021, respectively. At the same time, they consulted with Dr. Daiké Tian, who considered it a new species of *Begonia* sect. *Coelocentrum* after observing the morphological characteristics of the plants. During this period, Dr. Daiké Tian also received a request from Mr. Thanh Son Hoang for identifying an unknown *Begonia* species, which was found at Ban Gioc (Vietnamese name for Detian) Waterfall in Northern Vietnam. Then Dr. Daiké Tian went on a field trip to Ban Gioc Waterfall on 6 November, 2023. Through the detailed observation and comparison, Dr. Daiké Tian considered the two populations to be the same species, here named *Begonia floriprolifera* J.Y.Zhou & D.K.Tian and described it below.

### TAXONOMIC TREATMENT

*Begonia floriprolifera* J.Y.Zhou & D.K.Tian, *sp. nov.*

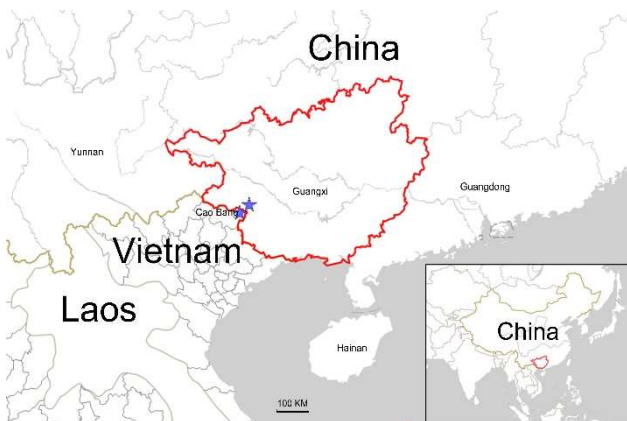
**Figs. 2, 3 & S1**

**Type:** China: Fuxin Town, Tiandeng County, Chongzuo City, Guangxi Zhuang Autonomous Region, China, the rock wall of cave mouth, 22°55'N, 106°53'E, elev. ca. 500 m, on 12 June, 2023, J.Y. Zhou & D.K. Tian TDK5327 (holotype: CSH! CSH0200387; isotypes: CSH!).

**Diagnosis:** *Begonia floriprolifera* is morphologically close to *B. bonii* Gapnep. in the same section, but can be mainly distinguished from the latter by its nearly glabrous (vs. pilose) stipules, short shorter inflorescence (2.5–20 cm vs. over 20 cm), bilaterally symmetric and upward curved (vs. radially symmetric and capitate) androecium, fewer (up to 32 vs. usually over 40) stamens, and anther apex (concave vs. rounded) (Table 1, Fig. S2). Moreover,

**Table 1.** Comparison of *Begonia floriprolifera*, *B. bonii* and *B. bamaensis*.

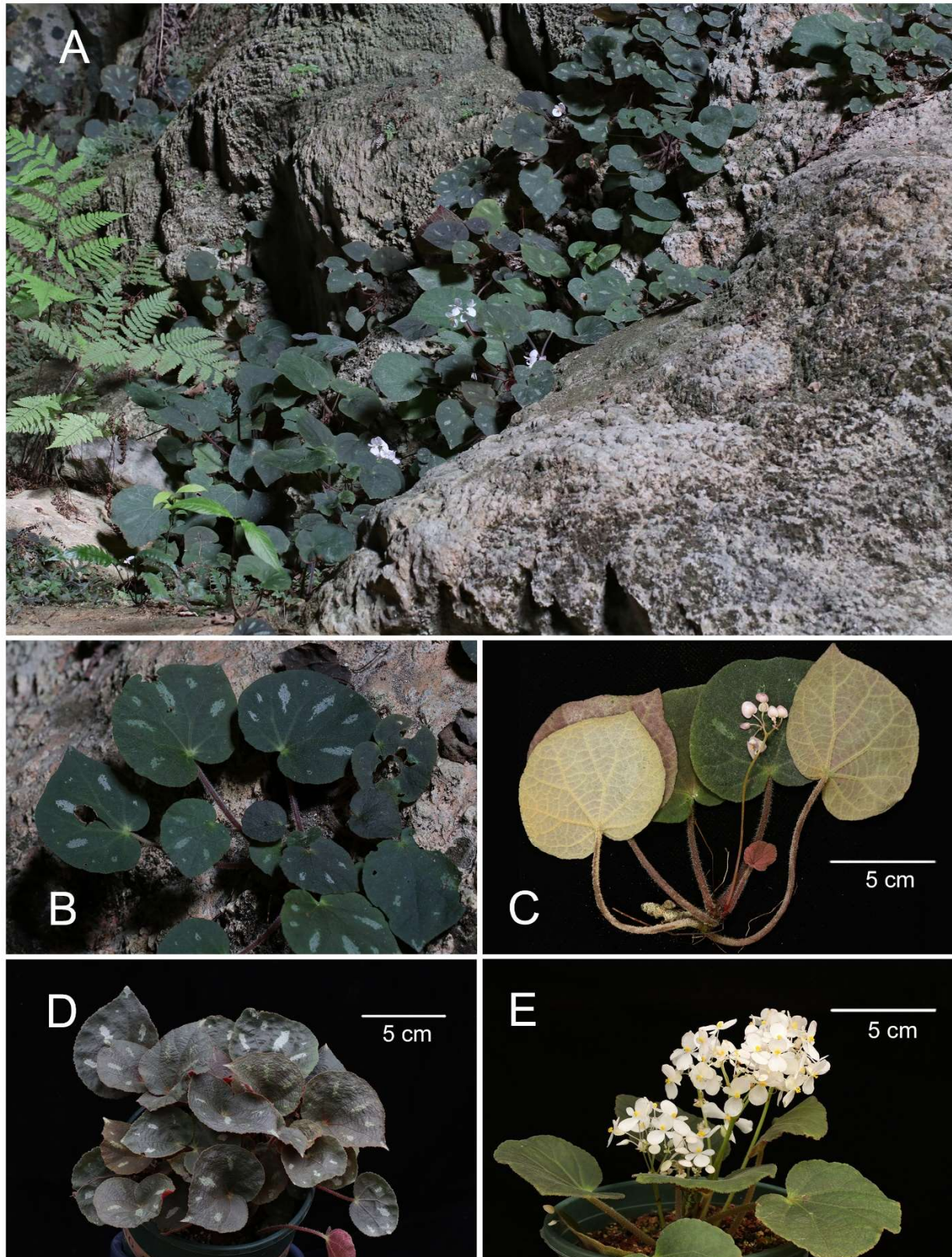
| Characters           | <i>B. floriprolifera</i>   | <i>B. bonii</i>                                       | <i>B. bamaensis</i>   |
|----------------------|--|---|---|
| <b>Leaf</b>          |  |   |   |
| size (cm)            | (2.6–)6–12(–24) × (1.9–)2.8–12(–17.5)  | (5.2–)7–11 × (4.6–)5–7.2                              | (7–)10–25(–32) × (5.7–)9–20(–30)  |
| indumentum           | densely papillose-hispid, abaxially densely setulose in interveinal area                   | moderately setulose                                   | densely setulose, abaxially tomentose                                     |
| apex                 | slightly acuminate to nearly obtuse  | acuminate   | short acuminate or acuminate, rarely obtuse                               |
| abaxial veins        | slightly convex  | greatly convex  | greatly convex  |
| <b>Inflorescence</b> |  |   |   |
| length (cm)          | 2.5–20, slightly above leaf  | usually over 20, greatly above leaf                   | less than 20, slightly above leaf   |
| peduncle             | sparsely pubescent to glabrous   | pubescent   | pilose or sparsely so   |
| staminate flower     | outer tepals white to pink, 8.5–16 × 7.5–15.8 mm, abaxially glabrous to sparsely pubescent | outer tepals pink, 8–10 × 7–10 mm, indumentum unknown | outer tepals white to pink, 7–14.5 × 7–13.5 mm, abaxially densely villous |
| <b>Androecium</b>    |  |   |   |
| shape                | bilaterally symmetric and upward curved  | radially symmetric, capitate                          | bilaterally symmetric and upward curved                                   |
| stamen No.           | 11–21(–32)   | usually over 40                                       | 20–35   |
| anther apex          | concave  | rounded   | concave   |
| Ovary                | white to red pubescent   | glabrous or nearly so                                 | hirsute-pilose or villous-pilose  |
| Fruit                | tiny verrucous protuberances   | glabrous or nearly so                                 | hirsute-pilose or villous-pilose  |
| Phenology            | flowering Apr.–Jul., Oct. –Dec.,<br>fruiting May–Feb.                                      | unknown   | flowering May–Nov.,<br>fruiting Jun. –Mar.                                |
| Stipule              | sparsely pubescent   | pilose  | abaxially glabrous or with few hairs along midrib                         |

**Fig. 1.** Distribution of *Begonia floriprolifera* J.Y.Zhou & D.K.Tian (Pentagrams show).

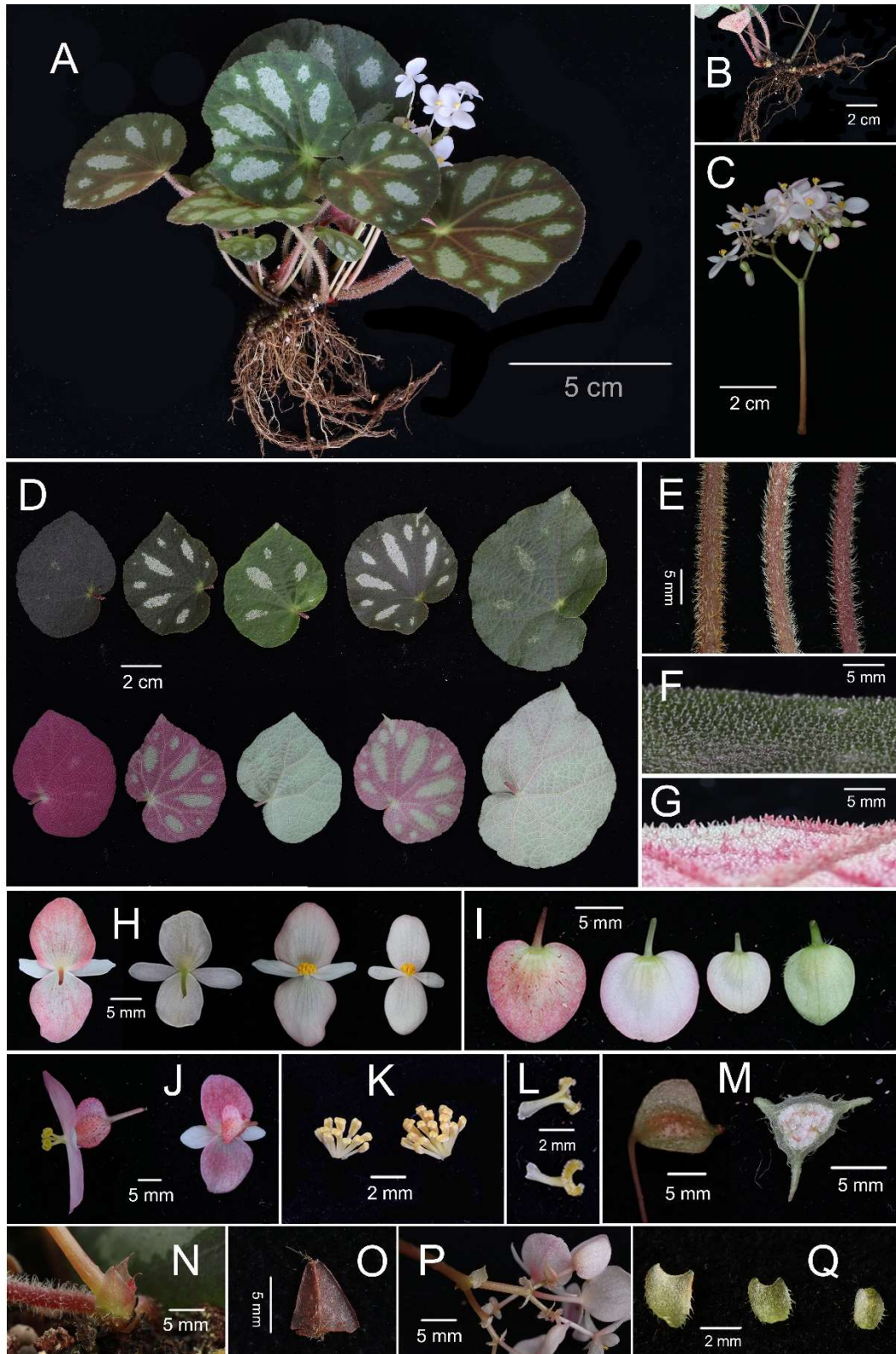
this species showed rich variation in leaf color (adaxially green to brownish red, abaxially light green to deep red), size and color of variegation patches (absent to large), and flower color (white to pink) (Fig. 2 and 3). In addition, this species is also morphologically similar to *B. bamaensis* Yan Liu & C.I Peng and *B. lui* S.M.Ku, C.I Peng & Yan Liu in the same section. However, it differs from *B. bamaensis* by leaf size and color, indumentums of leaf and flower, stamen number and fruit morphology (Liu *et al.*, 2007). It could be also distinguished from *B. lui* in plant size, leaf morphology (blade color, leaf maculations, etc.), morphology of flower and fruit, and flowering time (Liu *et al.*, 2020).

**Description:** *Herb* monoecious, perennial, rhizomatous, 5–15 cm tall. *Rhizome* creeping, 5–20 cm or longer, unbranched to few branched, green to pale brown,

internodes 5–8 mm long, 3–15 mm thick. *Stipules* persistent, green to red, nearly glabrous, long triangular, 5–8 mm × 4–7 mm, apex acuminate. *Leaves* simple, alternate, basal, leaf blade broad ovate, (2.6–)6–12(–24) cm × (1.9–)2.8–12(–17.5) cm, decurrent part 0.2–5.5 cm long, papery, asymmetric, adaxially green to deep brownish red, usually adorned with white to light green radial patches between veins, densely papillose-hispid, abaxially light green to deep red, densely green to red setulose, main veins 5–7, reticulate, margin serrate, base slightly to nearly overlapped, apex acuminate. *Petiole* green to brownish red, (1.7–)5–12(–22) cm long, 1.5–6 mm thick, ungrooved, densely gray-white villous, hairs 1–5 mm long. *Inflorescence* axillary, 1–8, dichasial cymes arising from rhizome, 2.5–20 cm long, branched 2–3 times, peduncle light green to reddish brown, cylindrical, 1.5–15 cm long, 1–2.5 mm thick, glabrous to sparsely villous, flowers 3–30 per inflorescence. *Bracts* persistent or caduceus, ellipsoid to ovate, light green, abaxially pubescent or glabrous, margin sparsely pubescent, lower bracts 2–5 mm × 1–4 mm, upper ones 1–3 mm × 0.4–2.5 mm. *Staminate flower* pedicel glabrous to sparsely pubescent, 8–35.5 mm long, 0.5–1 mm thick, flower size 16.5–33.5 mm × 13.2–29 mm; tepals 4 (rarely 6), white to pink, entire, outer 2 broad ovate to elliptic, 8.5–16 mm × 7.5–15.8 mm, abaxially sparsely pubescent or glabrous, inner 2 oblong to oblanceolate, glabrous, 6.5–15 mm × 2.5–9 mm; androecium bilaterally symmetric, upward curved, 1.8–3.5 mm × 2–5 mm, stamens 11–21(–32), filaments yellow, 1–3 mm long, anthers yellow, cuneiform, 0.5–2 mm long, 0.5–0.8 mm wide, apex slightly concave. *Pistillate flower* pedicel glabrous to



**Fig. 2.** *Begonia floriprolifera* J.Y.Zhou & D.K.Tian. **A & B.** Habitat and habit, photographed in Tiandeng, China; **C.** Wild plant (holotype: CSH0200387), photographed in Tiandeng, China; **D & E.** Cultivated plants introduced from Tiandeng, China showing different patterns of leaf variegation. A, B, D & E were from the same population as C. (C photo by Daike Tian, the others by Jinye Zhou)



**Fig. 3.** *Begonia floriprolifera* J.Y.Zhou & D.K.Tian. **A.** Cultivated mature plant in bloom; **B.** Rhizome; **C.** Inflorescence; **D.** Leaves showing diversity in colors and variegation patterns of two sides; **E.** Petioles; **F & G.** Leaf sections showing adaxial and abaxial indumentums; **H.** Front and back views of staminate flowers; **I.** Staminate flower buds showing different colors; **J.** Pistillate flowers (side and back views); **K.** Stamens; **L.** Dissected styles and stigmas; **M.** Young fruit and ovary dissection; **N & O.** Stipules; **P & Q.** Bracts. All the plants in photos were from the type specimen origin in Tiandeng, China. (photos by Jinye Zhou)



sparingly pubescent, 5–12.5 mm long, 0.5–0.8 mm thick, flower size 20.5–30 mm × 11–19 mm, tepals 3 (rarely 2 or 4), white to pink, entire, outer 2 elliptic to nearly round, 10–15 mm × 9–15.5 mm, glabrous, inner 1 (rarely 2 or absent), glabrous, oblong to cuneiform, 5–10.5 mm × 2–5 mm; style 3, yellow, connate base 0.5–1.6 mm long, free part 2.5–3.5 mm long, stigmatic band spiraled. Ovary light green to whitish, sparsely pilose when young, 1–locular, placentation parietal, placentae 3, each bifurcate. *Fruit* nearly glabrous, 8.5–10.5 mm × 6.5–9 mm, 3-winged, abaxial wing broad crescent-shaped, 2.7–4.2 mm × 6.7–8.4 mm; lateral wings equal, narrowly crescent-shaped, 2–3 mm × 6.5–8 mm. *Seeds* numerous, brown, elliptic.

**Phenology:** Flowering Apr.–Jul. and Oct.–Dec., fruiting May–Feb.

**Distribution and habitat:** *Begonia floriprolifera* grows on the rocky surface or in the rock crevices of the cave mouth or inside and the places under the forest near the waterfalls, at an altitude of 100–500 m. It is currently known from the small areas in Tiandeng county and Daxin county, Guangxi, China and Cao Bang, Vietnam close to China, based on many field investigations.

**Etymology:** The epithet is derived from the long flowering period (blooming twice a year) and a large number of flowers of this species (Fig. 2E). The Chinese name is given as “丰花秋海棠”.

**Other specimens examined:** **China:** The cave near Detian Waterfall in Daxin, Guangxi, 22°51'N, 106°42'E, elev. ca. 100 m, on 10 November, 2012, D.K. Tian & C. Li TDK793 (CSH!). The rock wall under the forest near Detian Waterfall in Daxin, Guangxi, 22°51'N, 106°43'E, elev. ca. 390 m, on 26 November, 2016, W.K. Dong, Z.X. Wang & F. Jiao TDK3147 (CSH!). **Vietnam:** the rock wall under the secondary broad-leaved evergreen forest at Ban Gioc Waterfall, Trung Khanh district, Cao Bang, 22°51'N, 106°43'E, elev. ca. 360 m, on 22 December, 2016, T.S. Hoang HS20164512 (VAFS!). Near the Ban Gioc Waterfall, Trung Khanh district, Cao Bang, 22°51'N, 106°43'E, elev. about 350 m, on 6 November, 2023, D.K. Tian, W.G. Wang, B. Chen & T.S. Hoang TDK5502 (CSH!).

**Provisional conservation assessment:** Both distribution area and occupied area of the new species are very small, and a very unique habitat either in cave or near the waterfall limits the expansion of its population. Other distribution locations may be found in the future. A relatively large population in the type locality of this species is located in a large cave of Guangxi, China, with a groundwater flow inside. However, recently no groundwater flow has been observed due to an unknown reason. As a result, some plants of this population already died, and the population is gradually shrinking in size. Based on the current data, this species should be categorized as Endangered (EN: B1B2ab (iii, v), C1) (IUCN, 2022).

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