

Begonia bamaensis (sect. *Coelocentrum*, Begoniaceae), a new species from limestone areas in Guangxi, China

Yan LIU¹, Shin-Ming KU², and Ching-I PENG^{2,*}

¹Guangxi Institute of Botany, Guangxi Zhuangzu Autonomous Region and the Chinese Academy of Sciences, Guilin 541006, China

²Herbarium (HAST), Research Center for Biodiversity, Academia Sinica, Nangang, Taipei 115, Taiwan

(Received May 30, 2007; Accepted August 21, 2007)

ABSTRACT. *Begonia bamaensis* Yan Liu & C.-I Peng, a new species of sect. *Coelocentrum* from Guangxi Zhuangzu Autonomous Region, China, is described and illustrated. Its somatic chromosome number ($2n = 30$) is here reported. *Begonia bamaensis* is somewhat similar to *B. cirrosa* L.B. Smith & D.C. Wasshausen, differing in the leaves adaxially densely setulose or hispidulous and adorned with white bands or white patches between major veins; stipules abaxially glabrous or with few hairs along midrib; peduncle pilose or sparsely so; staminate flower with outer tepals $7-14.5 \times 7-13.5$ mm; ovary whitish or reddish pilose; capsule 7-12 mm long, and abaxial wing of capsule distinctly curved on one side. SEM micrographs of leaves of *B. bamaensis* revealed prominently elevated stomata complex, which is unique for the genus *Begonia*. Like many congeners in sect. *Coelocentrum*, *B. bamaensis* is a handsome species with variegated leaves. It has a restricted distribution, currently known only from two nearby karst caves in western Guangxi.

Keywords: *Begonia bamaensis*; *Begonia cirrosa*; *Begonia morsei*; *Begonia bonii*; Begoniaceae; China; Chromosome number; Guangxi; Limestone flora; New species; Rare species; sect. *Coelocentrum*; Stomata complex.

INTRODUCTION

Our ongoing botanical inventory in recent years in the limestone areas in Guangxi Zhuangzu Autonomous Region, China has resulted in the discovery of a dozen new taxa of *Begonia* in sect. *Coelocentrum* (Ku et al., 2004; Peng et al., 2005a, 2005b; Liu et al., 2005; Fang et al., 2006; Ku et al., 2006; Peng et al., 2007) and a new species in sect. *Diploclinium* (Peng et al., 2006). A total of 38 species and two additional varieties are recognized for *Begonia* sect. *Coelocentrum* in the Flora of China (Gu et al., 2007). In this paper we report the finding of another new species, *B. bamaensis*, found in karst caves in western Guangxi, China.

MATERIALS AND METHODS FOR CRYO SCANNING ELECTRON MICROSCOPY

Fresh leaves of *Begonia bamaensis* and *B. cirrosa* were dissected and loaded on stub. The samples were frozen by liquid nitrogen slush, and then transferred to sample preparation chamber at -160°C . After 5 minutes, when the temperature raised to -130°C , the samples were fractured. The samples were etched 10 minutes at -85°C . After

coating at -130°C , the samples were transferred to SEM chamber and observed at -160°C in cryo scanning electron microscope (FEI Quanta 200 SEM/Quorum Cryo System PP2000TR FEI).

NEW SPECIES

Begonia bamaensis Yan Liu & C.-I Peng, sp. nov.—
TYPE: CHINA. Guangxi Zhuangzu Autonomous Region, Bama Yaozu Zizhixian, $24^{\circ}18'05''$ N, $107^{\circ}05'58''$ E, on soil and limestone rock at entrance and inside (near opening at the rear end) of a gigantic karst cave, Baimodong (literally, Hundred Devils' Cave), abundant. 19 May 2007, *Ching-I Peng 21087* (holotype: IBK; isotype: HAST), accompanied by Hai-Shan Gao, Kuo-Fang Chung and Ming-Chao Yu. 巴馬秋海棠

Figures 1, 2

Begonia bamaensis similis *B. cirrosae* L.B. Smith & D.C. Wasshausen, a qua differt foliis supra dense setulosis vel hispidulosis et inter nervos albo-vittatis vel albo-maculatis, stipulis subtus glabris vel secus costam sparse pilosis, pedunculis pilosis vel sparse pilosis, tepalis exterioribus floris staminati $7-14.5 \times 7-13.5$ mm, ovario albido-piloso vel rubello-piloso, capsula 7-12 mm longa, capsulae ala abaxiali distincte curvata versus unum laterem.

*Corresponding author: E-mail: bopeng@sinica.edu.tw.

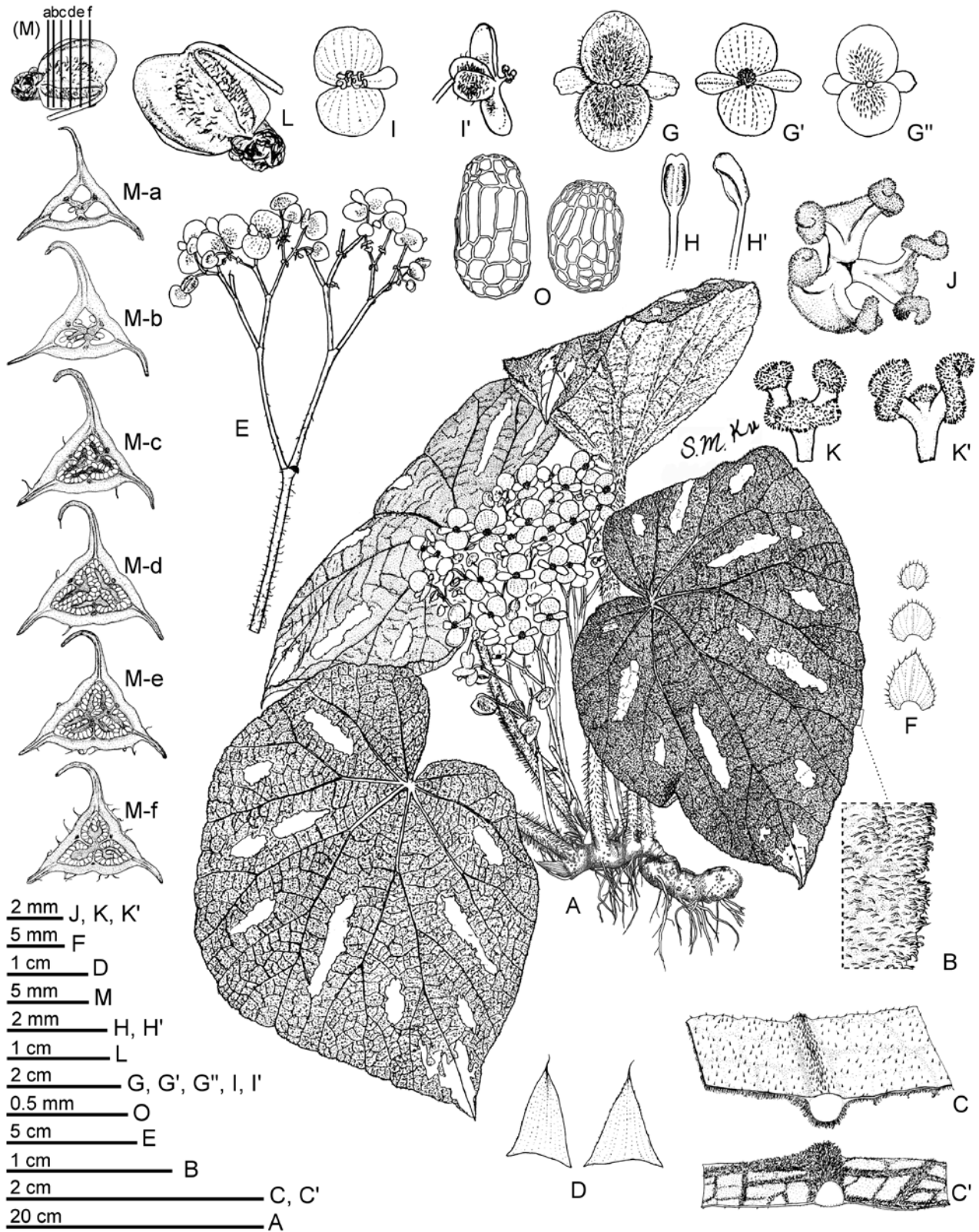


Figure 1. *Begonia bamaensis* Yan Liu & C.-I Peng. A, Habit; B, Leaf margin; C, C', Portion of leaf, showing indumentum on adaxial and abaxial surfaces; D, Stipules; E, Inflorescence; F, Bracts; G, Staminate flower, showing ciliate margin and densely pilose abaxial surface; G', Staminate flower, face view; G'', Staminate flower, back view; H, H', stamens; I, Carpellate flower, face view; I', Carpellate flower, side view; J, K, K', Styles and stigmas; L, Capsule; M, Serial cross sections of fruit, showing parietal placentation and curved abaxial wing. All from the living plant (Peng 18752-A) cultivated in the experimental greenhouse.

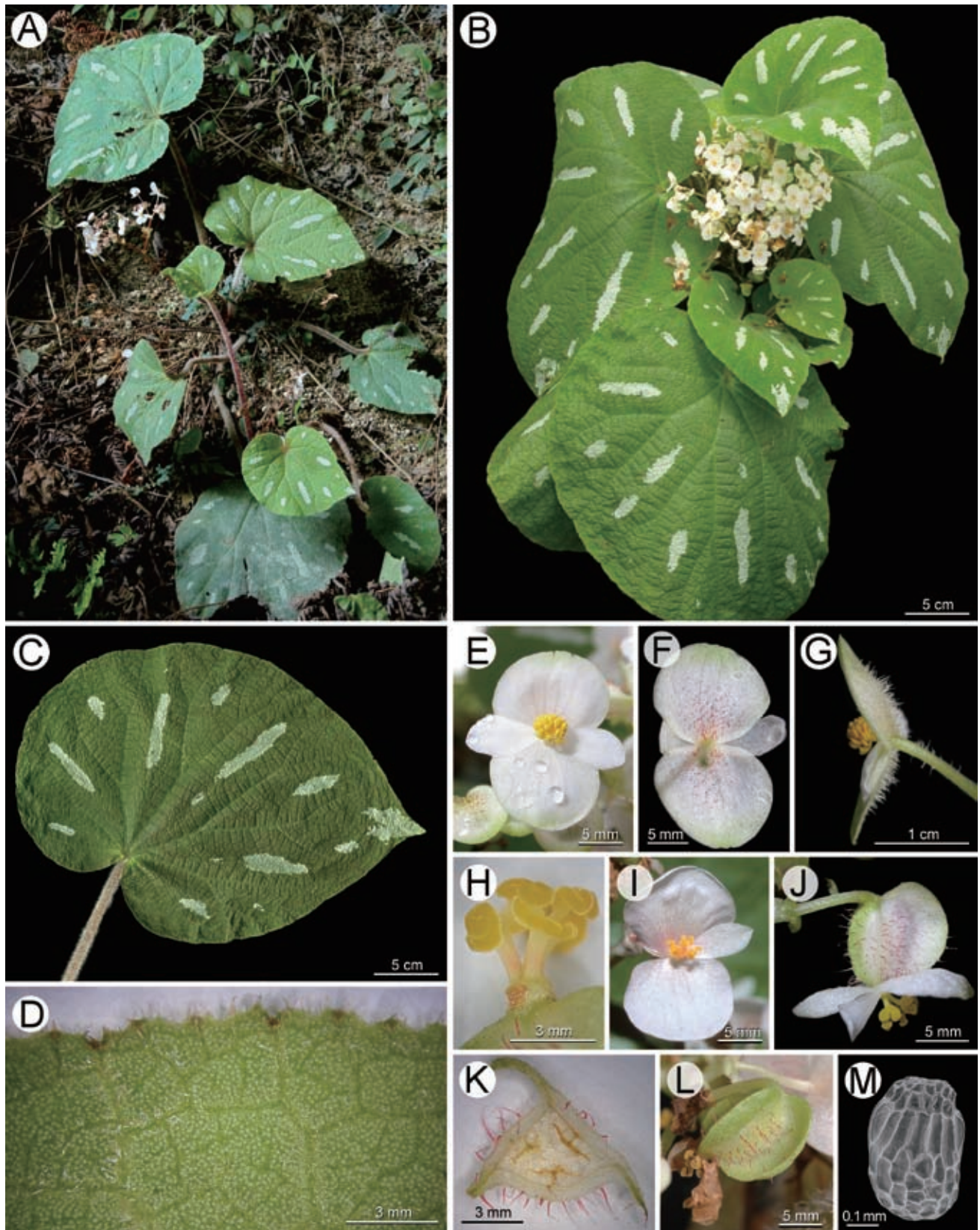


Figure 2. *Begonia bamaensis*. A, Habit; B, Cultivated plant; C, Leaf; D, Portion of leaf, showing abaxial surface and margin; E, Staminate flower, face view; F, Staminate flower, back view; G, Staminate flower, side view; H, Styles and stigmas; I, Carpellate flower, face view; J, Carpellate flower, side view; K, Middle cross section of an ovary; L, Capsule; M, Seed SEM micrograph.

Herbs monoecious; epipetric; perennial; rhizomatous. *Rhizome* 3-15 cm or longer, 9-17 mm thick, internodes (3-)5-7(-10) mm long, brown, reddish brown or greenish brown, villous near petiole bases and leaf scars. *Stipules* caducous, ovate-triangular, 7-10 mm long, 5-13 mm wide, greenish or reddish-hyaline, herbaceous, weakly keeled or not keeled, abaxially glabrous or with few hairs along midrib, margin serrulate-ciliolate or subentire, apex aristate, arista 0.5-4 mm long, hair-like. *Leaves* 2-9, alternate, simple, asymmetric, unlobed, broadly ovate or suborbicular, base deeply cordate, margin crenate-denticulate and ciliolate, apex shortly acuminate, or acute,

rarely obtuse, variable in size, (7-)10-25(-32) cm long (basal lobes included), (5.7-)9-20(-30) cm wide, adaxial surface green, usually adorned with white bands or white patches between major veins, greenish on abaxial surface, texture papery, surface rugose or rugulose, adaxially densely setulose to hispidulous (Figure 3A) trichomes 0.2-0.6 mm long, whitish-hyaline), abaxially pilose-tomentulose to tomentose, pronounced on veins (Figure 3C); venation basally 7-palmate, midrib distinct, veins pinnate along midrib, with 1-3 major lateral veins on each side, other primary veins branching dichotomously or nearly so, tertiary veins reticulate and weakly percurrent,

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

	<i>B. bamaensis</i> (Figures 1, 2)	<i>B. bonii</i> (Figure 5)	<i>B. cirrosa</i> (Liu et al., 2005: Figures 5, 6)	<i>B. morsei</i> (Liu et al., 2005: Figure 7)
Stipule	Abaxially glabrous or with few hairs along midrib	Pubescent throughout abaxial surface	Pubescent throughout abaxial surface	Pubescent along midrib
Leaf				
Size (cm)	(7-)10-25(-32) × (5.7-)9-20(-30)	(5.2-)7-11 × (4.6-)5-7.2	(8-)11-18(-20) × (6-)9-14(-17)	ca. 5-9 × 4-7
Indumentum	Densely setulose or hispidulous (Figure 3-A, C)	Moderately setulose	Sparsely to moderately pilose or pilose-setose (Figure 3-B, D)	Densely pilose-setulose
Maculation (adaxial surface)	Adorned with white maculation in intercostal area	No maculation	No maculation	Adorned with a broad whitish ring between leaf center and margin
Stomata complex	Markedly elevated (Figures 3-E, G; 4-A, B)	Not observed	Nearly flat (Figure 3-F, H)	Not observed
Peduncle	Pilose or sparsely so, glabrous in poorly developed inflorescences	Sparsely pilose or subglabrous	Densely villous or hispid-villous	Glabrous
Staminate flower				
Outer tepals	7-14.5 × 7-13.5 mm, abaxially pilose	8-10 × 7-10 mm	7-17 × 7-22 mm	6-10.5 × 6.5-10 mm
Androecium				
Symmetry	Zygomorphic	Actinomorphic	Zygomorphic	Unknown (probably zygomorphic)
Filaments	Slightly fused at base	Slightly fused at base	Nearly free	Fused at base into an androphore 0.7-1.25 mm
Capsule				
Size (mm)	7-12 × 5-7	ca. 8 × 4-5	13-19 × 7-9	6.5-9 × 3.5-4.5
Indumentum	Hirsute-pilose or villous-pilose	Glabrous or nearly so	Villous-setose or hispid-setose	Glabrous or nearly so
Abaxial wing	Markedly curved toward one side	Straight	Straight	Straight
Distribution	Southern China	Northern Vietnam	Southern China	Southern China

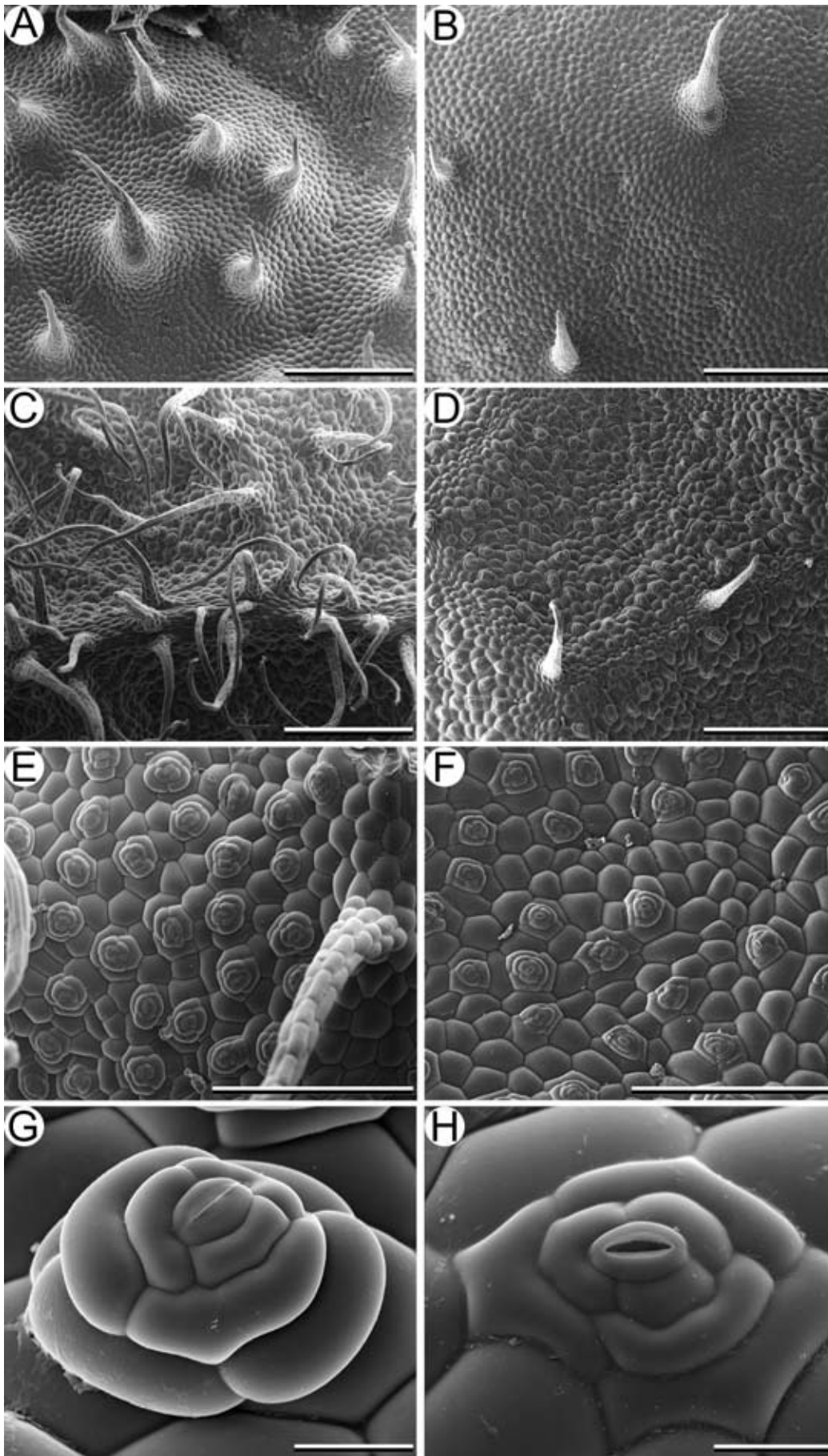


Figure 3. Scanning electron microscope (SEM) micrographs of foliar trichomes and stomata of *Begonia bamaensis* (A, C, E, G) and *B. cirrosa* (B, D, F, G). A, B. Leaf upper surface; C, D, E, F. Leaf lower surface; G, H. Stomata complex. Scale bar = 1 mm (A, B, C, D); 500 μm (E, F); 50 μm (G, H).

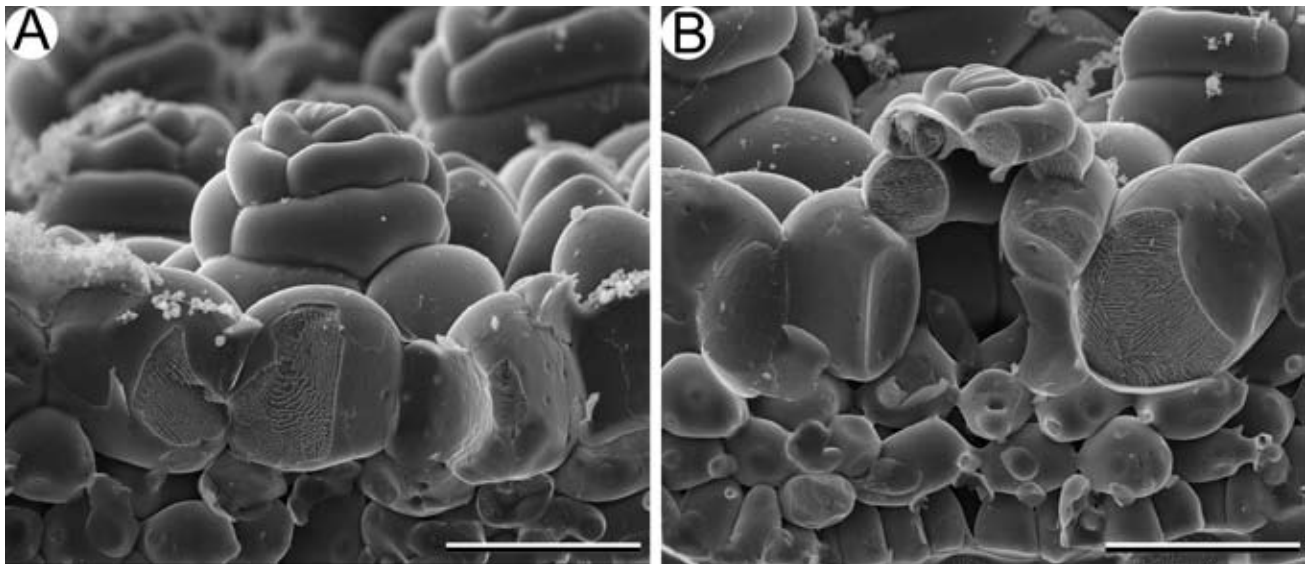


Figure 4. SEM micrographs of a stomata complex of *Begonia bamaensis*. A, Stomata complex in side view; B, Stomata complex in transverse section and side view, showing the stomata raised on column. Scale bar = 100 μm . (Photo by Wann-Neng Jane)

forming a divergence angle of $70\text{-}90^\circ$ to major veins, minor veins reticulate, all veins on abaxial surface prominently raised; petiole terete, (5-)9-22(-26) cm long, 3-7 mm thick, brownish or brownish red, hirsute-villous. *Stomata* raised on columns (Figures 3-E, G; 4-A, B). *Inflorescences* axillary, 1-6 or more, arising directly from rhizome, sometimes with inflorescence scales at peduncle base, flowers 8-36 in a dichasial cyme, branched 3 to 6 times; staminate flowers 7-32, carpellate flowers 2-6; peduncle well developed, terete, erect or ascending, (2-)4-14(-19) cm long, 1.5-3 mm thick, brownish, reddish brown or greenish, pilose or sparsely pilose, sometimes glabrous. Bracts caducous, reniform, oblong or ovate,

margin denticulate and ciliate (cilia with a minute, glandular tip), apex rounded, obtuse or acute, 2-6 mm long, 1.5-5 mm wide, greenish or brownish, membranous. *Staminate flowers*: pedicel 8-20 mm long, glabrous or pilose, erect or ascending; tepals 4, outer 2 broadly ovate or suborbicular, base rounded or slightly cordate, margin entire, eciliate or sometimes ciliate on first flower, apex rounded, 7-14.5 mm long, 7-13.5 mm wide, pinkish, white or greenish white, abaxially pilose (trichomes reddish or whitish); inner 2 tepals obovate, narrowly obovate, elliptic or oblanceolate, base cuneate, margin entire, eciliate, apex obtuse or rounded, 6-10 mm long, 2.5-5 mm wide, white, glabrous; androecium zygomorphic, subglobose, stamens



Figure 5. Distribution of *Begonia bamaensis* (star) in Guangxi Zhuangzu Autonomous Region, China.

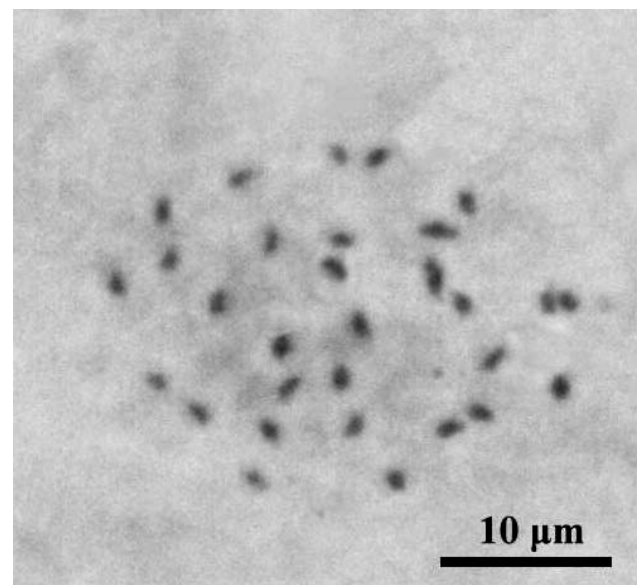


Figure 6. Mitotic chromosome spread of *Begonia bamaensis* ($2n=30$).

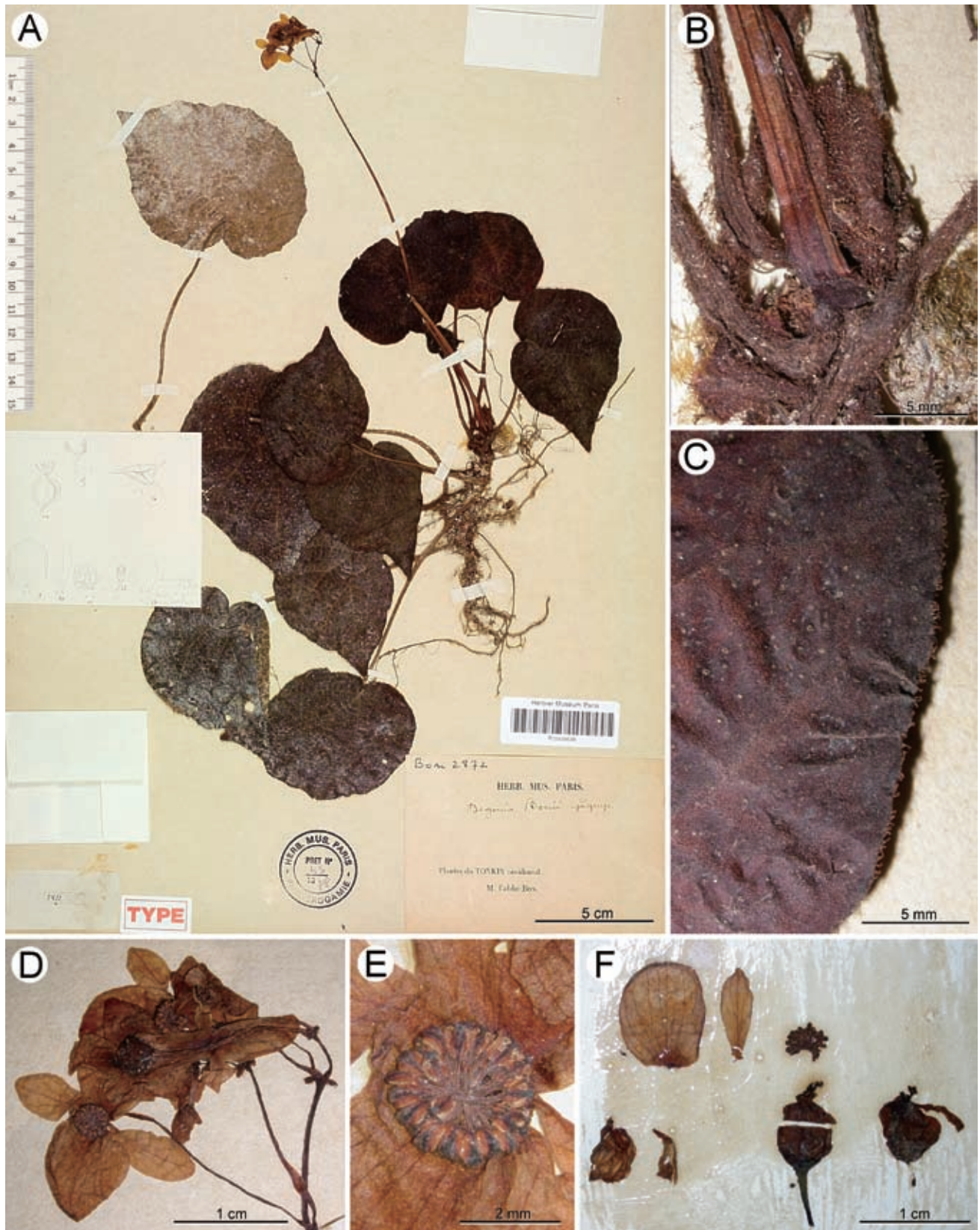


Figure 7. Holotype of *Begonia bonii* Gagnep. (Bon 2872, P) A, Whole sheet; B, Rhizome and stipules; C, Portion of adaxial leaf surface. D, Staminate flowers; E, Actinomorphic androecium; F, Materials in the fragment packet.

20-35, golf-club-shaped; filaments subequal, 1.1-1.3 mm long, partly fused at base; anthers \pm ascending, 2-locular, slightly compressed, oblong-obovoid, connective apex slightly emarginate, 0.9-1.3 mm long, 0.6-0.7 mm wide, yellow. *Carpellate flowers*: pedicel 4-15 mm long, horizontally spreading to pendent, bracteole absent or sometimes 1, small; tepals 3, caducous, if persistent not thickened when fruiting, outer 2 tepals suborbicular or broadly obovate, margin entire, eciliate, 7-13.5 mm long, 7-14.5 mm wide, white or pinkish, abaxially pilose; inner tepal oblanceolate, obovate or narrowly so, base cuneate, apex obtuse, 7-10 mm long, 3-4 mm wide, white, glabrous; ovary trigonous-ellipsoid, (4.5-)9-11.5 mm long, (2-)3.5-4.5 mm thick (wings excluded), white or reddish white, hirsute-pilose or villous-pilose (trichomes 1-2 mm long, \pm curly, white or reddish), 3-winged; 1-locular with intruded parietal placentation (axile at base); placentae 3, each bifurcate; styles 3, nearly free, yellow, ca. 2-3.5 mm long, apically C-shaped; stigmatic band spiraled. *Capsule* nodding, trigonous-ellipsoid, 7-12 mm long, 5-7 mm thick (wings excluded), apex with persistent styles; wings unequal or subequal; lateral wings 1-2.5 mm tall; abaxial wing crescent-shaped or nearly so, 3-5 mm tall, distinctly curved toward one side. *Seeds* numerous, brown, ellipsoid or broadly so, 0.43-0.63 mm long, 0.26-0.34 mm thick, chalazal end rounded, micropylar end obtuse or slightly constricted, outer periclinal walls of mature seeds concave; collar cells elongated, straight, nearly rectangular, 10-14 cells in a ring, occupying 1/4-1/2 of seed length.

Additional specimens examined. CHINA. Guangxi Zhuangzu Autonomous Region, Bama Yaozu Zizhixian, Jiazhan Xiang, Renxiang Cun, at entrance of a cave, 410 alt., 24°19'23" N, 107°05'32" E, rare, 28 Aug 2005, Yan Liu L1278 (IBK); same locality as that of the type collection, 24 May 2002, C.-I Peng 18752 (HAST), accompanied by Yu-Min Shui and Wai-Chao Leong.

Ecology. On semishady rocky cliff at entrance of limestone caverns.

Distribution. Western Guangxi, China (Figure 5), rare, currently known only from two nearby karst caves in western Guangxi.

Etymology. The specific epithet is derived from the type locality, Bama Yaozu Zizhixian (Bama Yao Autonomous County).

Phenology. Flowering from May to December; fruiting from Jun to March.

Notes. *Begonia bamaensis* Yan Liu & C.-I Peng is similar to *B. cirrosa* L.B. Smith & D.C. Wasshausen, differing in the leaves adaxially densely setulose or hispidulous (vs. pilose or pilose-setose) and adorned with white bands or patches between major veins (vs. without white maculation); stipules abaxially glabrous or with few hairs along midrib (vs. pubescent throughout outer surface); peduncle pilose or sparsely so (vs. villous); staminate flower with outer tepals 7-14.5 \times 7-13.5 mm (vs. 7-17 \times 7-22 mm); ovary whitish or reddish pilose (vs.

red hispid-hirsute); capsule 7-12 mm long (vs. 10-20 mm long), abaxial wing of capsule distinctly curved on one side (vs. straight or slightly curved). SEM micrographs of leaves of *B. bamaensis* (Figures 3-E, G; 4-A, B) revealed prominently elevated stomata complexes, which is unique for the genus *Begonia*. A comparison of the salient characters of *B. bamaensis* with three other congeners in sect. *Coelocentrum*, one of which, *B. bonii*, from northern Vietnam, is shown in Table 1. *Begonia bamaensis* has a somatic chromosome number of $2n = 30$ (Figure 6), which agrees with all other members of *Begonia* sect. *Coelocentrum* for which chromosome numbers were reported (Ku et al., 2004; Peng et al., 2005a, 2005b; Liu et al., 2005; Fang et al., 2006; Ku et al., 2006; Peng et al., 2007).

Acknowledgements. We thank Wann-Neng Jane for guidance and support on Cryo Scanning Electron Microscopy; Qiner Yang for the Latin diagnosis; curators of K, KUN and P for the loan of *Begonia* types; Ming-Chao Yu for technical assistance; Wei-Bin Xu, Hai-Shan Gao, Wai-Chao Leong, Yu-Min Shui, Kuo-Fang Chung and Ming-Chao Yu for accompanying us in the field. This study was supported in part by grants from Guangxi Natural Science Foundation (GKJ0448089) to Yan Liu (IBK) and Research Center for Biodiversity, Academia Sinica, Taipei to Ching-I Peng (HAST).

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中國廣西石灰岩地區秋海棠屬側膜組一新種植物：巴馬秋海棠

劉 演¹ 古訓銘² 彭鏡毅²

¹廣西壯族自治區 中國科學院廣西植物研究所

²中央研究院生物多樣性研究中心 植物標本館

本文發表中國廣西產秋海棠屬一新種植物：巴馬秋海棠 (*Begonia bamaensis*)，並報導其染色體數目 ($2n = 30$)。此新種略似卷毛秋海棠，不同在於葉上表面密生短剛毛或糙硬毛，並在主脈間有白色條斑；托葉背面光滑無毛或僅在主脈上有些許毛；花序梗被柔毛或疏被柔毛；雄花的外花被片 $7-14.5 \times 7-13.5$ mm；子房表面有白色或紅色的柔毛；蒴果長 7-12 mm，背翅明顯向一側彎曲。以電子顯微鏡觀察巴馬秋海棠的葉片下表面，發現其氣孔複合體高度隆起，此在秋海棠屬植物甚為罕見。巴馬秋海棠為稀有植物，目前僅知生長於廣西巴馬瑤族自治縣兩個近鄰的石灰岩溶洞洞口附近。如同許多其他秋海棠屬側膜組植物，其葉片具斑紋，綠白相間，頗具觀賞價值。

關鍵詞：巴馬秋海棠；卷毛秋海棠；龍州秋海棠；越南秋海棠；秋海棠科；中國；染色體數；廣西；石灰岩植物；新種；稀有植物；側膜組；氣孔複合體。