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SYSTEMATICS

Begonia chongzuoensis (sect. *Coelocentrum*, Begoniaceae), a new calciphile from Guangxi, China

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ABSTRACT. *Begonia chongzuoensis* Yan Liu, S. M. Ku & C.-I Peng (sect. *Coelocentrum*), a new species from Guangxi Zhuangzu Autonomous Region, China, is here described and illustrated. A somatic chromosome number of $2n = 30$ was determined. *Begonia chongzuoensis* somewhat resembles *B. obliquifolia* S. H. Huang & Y. M. Shui, from which it differs by the moderately to sparsely setulose leaf surface; glabrous inflorescences, flowers and fruits; and crescent-shaped abaxial wing of the fruit. The new species is known only from a limestone hill in western Guangxi.

Keywords: *Begonia chongzuoensis*; *Begonia obliquifolia*; *Begonia* sect. *Coelocentrum*; Begoniaceae; China; Chromosome number; Guangxi; Limestone flora; New species; Rare species.

INTRODUCTION

In continuation of our studies of Asian *Begonia* (e.g., Hughes et al., 2011; Ku et al., 2008; Liu et al., 2007; Nguyen et al., 2010; Peng and Ku, 2009; Peng et al., 2006a,b, 2007, 2008a,b, 2010), we report the discovery of another undescribed species, *B. chongzuoensis* Yan Liu, S. M. Ku & C.-I Peng (sect. *Coelocentrum*), from a karst limestone hill in Guangxi, China.

NEW SPECIES

Begonia chongzuoensis Yan Liu, S. M. Ku & C.-I Peng, sp. nov. —TYPE: CHINA. Guangxi Zhuangzu Autonomous Region, Chongzuo Shi, Jiangzhou Qu, Banli Xiang, Nongguanshan, elev. ca. 230 m, at base of limestone slope, in rock crevices with or without abundant leaf litter, shaded, moist, rare, associated with *Iodes ovalis*, *Psychotria*, *Schefflera*, *Cleidion brevipetiolatum*, *Tetrastigma panicaule*, *Piper sarmentosum*, *Desmos chinensis*, *Asarum*, *Maesa japonica*, *Erythropalum scandens*, 17 Mar 2005. Specimens pressed from cultivated plant on 23 Aug 2005, *Ching-I Peng, Yan Liu, Shin-Ming Ku, Huan-Yu Chen 20390-A* (holotype: IBK; isotype: HAST).崇左秋海棠 Figures 1, 2

Species description. Herbs, monoecious, epipetric, perennial, rhizomatous. *Rhizome* 6-15 cm or longer, (5-)7-10(-12) mm thick, internodes (3.5-)5-10(-12) mm long, reddish brown, nearly glabrous. *Stipules* eventually caducous, ovate or triangular-ovate, 8-9 mm long, 6.5-8.5 mm wide, reddish hyaline, with red venation, herbaceous, weakly or not keeled, glabrous or with few hairs along midrib, margin eciliate or sparsely ciliolate, apex aristate, arista 2-3 mm long, hair-like. *Leaves* 2-7, alternate, simple, asymmetric, unlobed or very shallowly lobed, broadly ovate, base deeply cordate, margin crenate-denticulate and ciliate, apex acuminate or shortly so, (6-)7-11(-13) cm long (basal lobes included), (5-)6-8(-10) cm wide, usually dark brownish to purplish red between major veins and major lateral veins, texture papery, surface slightly rugose, adaxially moderately to sparsely setulose (trichomes 0.3-1 mm long, whitish-hyaline or reddish), abaxially pilose along veins; venation basally 6(-7)-palmate, midrib distinct, veins pinnate along midrib, with 1-2 major lateral veins on each side, other primary veins branching dichotomously or nearly so, tertiary veins reticulate and weakly percurrent, forming a divergence angle of 70-100° to major veins, minor veins reticulate, all veins on abaxial surface prominently raised; petiole terete, 4.5-15 cm long, 2-3.8 mm thick, brownish red, sparsely hirsute-villous. *Inflorescences* axillary, dichasial cymes, 1-3 or more, arising directly from rhizome, usually below the leaf blades, branched 2 to 3 times. Flowers 4-8 per inflorescence; staminate flowers 3-6, carpellate flowers 1-2; peduncle terete, erect or ascending, 5-12 cm long, 1-1.8 mm thick, reddish brown or greenish, glabrous. Bracts caducous, oblong, ovate or rounded, margin denticulate and ciliate, apex obtuse or rounded, 2-8 mm long, 1.8-6 mm wide, smaller on distal pairs. *Staminate flowers*: pedicel 1-1.3 cm long, glabrous or subglabrous; tepals 4, outer

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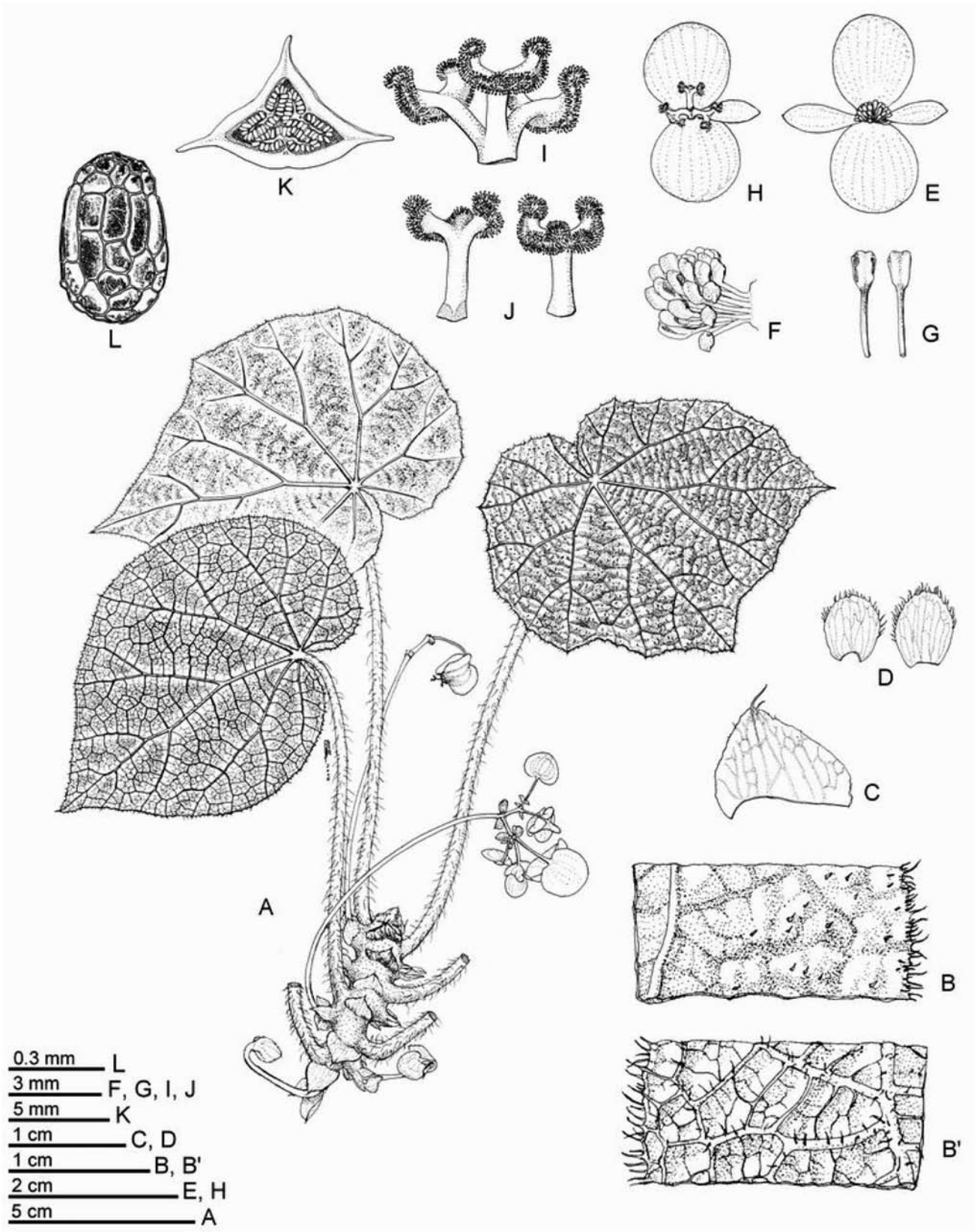

Figure 1. *Begonia chongzuoensis* Yan Liu, S. M. Ku & C.-I Peng. A, Habit; B, Portion of leaf, adaxial surface showing margin and indumentum, B', abaxial surface; C, Stipule; D, Bracts; E, Staminate flower; F, Androecium; G, Stamens; H, Carpellate flower, face view; I, J, Style and stigmas; K, Cross section at middle of young fruit; L, Seed. All from *C.-I Peng et al. 20390* (HAST).

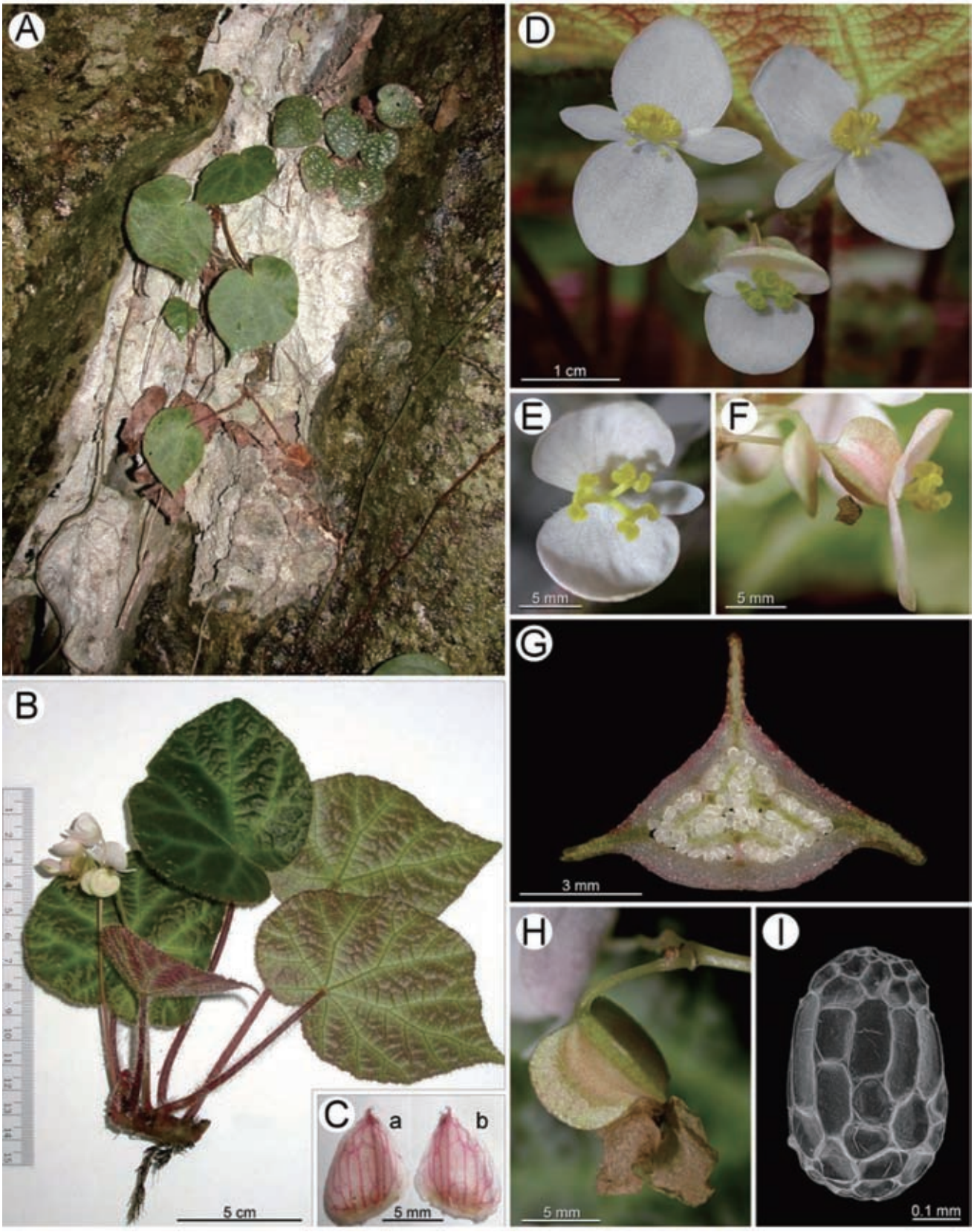

Figure 2. *Begonia chongzuoensis* Yan Liu, S. M. Ku & C.-I Peng. A, Habitat; B, Habit; C, Stipules, a: adaxial surface, b: abaxial surface; D, Staminate and carpellate flowers; E, Carpellate flower, face view; F, Carpellate flower, side view; G, Cross section at middle of young fruit; H, Fruit; I, Seed SEM microphotograph. All from *C.-I Peng et al. 20390* (HAST).

2 suborbicular, base rounded or slightly cordate, margin usually eciliate, sometimes remotely ciliate, apex rounded, 11-14.5 mm long, 11-15 mm wide, white or slightly pinkish, glabrous; inner 2 tepals obovate or narrowly so, base cuneate, margin eciliate, apex obtuse or rounded, 9-11 mm long, 3.5-5 mm wide, white, glabrous; androecium zygomorphic, subglobose, stamens 25-35, golf-club-shaped; filaments subequal, 1.2-3 mm long, nearly free; anthers ± ascending, 2-locular, slightly compressed, obovoid, connective apex emarginate, 1-1.5 mm long, 0.7-1 mm wide, yellow. *Carpellate flowers*: pedicel 6-7 mm long, horizontally spreading to pendent, bracteole absent; tepals 3, caducous, outer 2 tepals suborbicular or oblate-ovate, margin usually eciliate, 9.5-11.5 mm long, 10-11.5 mm wide, white or slightly pinkish, glabrous; inner tepal elliptic or broadly lanceolate, base cuneate, apex obtuse or acute, 6-8 mm long, 2.5-3 mm wide, white, glabrous; ovary trigonous-ellipsoid, slightly compressed, 5-6.5 mm long, 4.5-5.3 mm thick (wings excluded), glabrous, 3-winged; 1-locular with intruded parietal placentation (axile at base); placentae 3, each 2-branched and T-shaped; styles 3, nearly free, yellow, 2.8-3.5 mm long, apically C-shaped; stigmatic band spiraled. *Capsule* nodding, trigonous-ellipsoid, somewhat compressed, 7.5-10 mm long, 5-5.5 mm thick (wings excluded), apex with persistent styles; wings equal or subequal; lateral wings 2-2.5 mm tall; abaxial wing crescent-shaped or nearly so, 2.5-3 mm tall. *Seeds* numerous, brown, ellipsoid or ovoid-ellipsoid, 0.5-0.57 mm long, 0.29-0.32 mm thick, chalazal end rounded, micropylar end obtuse, outer periclinal walls of mature seeds concave; collar cells elongated, straight, nearly rectangular, 10-13 cells in a ring, occupying 1/4-1/2 of seed length. Somatic chromosome number, $2n = 30$ (Figure 3).

Additional specimens examined. **CHINA.** Guangxi Zhuangzu Autonomous Region, Chongzuo Shi, Jiangzhou Qu, Banli Xiang, Nongguanshan, elev. ca. 230 m, at base of limestone slope, in rock crevices with or without abundant leaf litter, shaded, moist, rare, 17 Mar 2005, *Ching-I Peng, Yan Liu, Shin-Ming Ku, Huan-Yu Chen 20390* (HAST, field collection of the type); Chongzuo Xian, Banli Xiang, White-headed Langur (*Trachypithecus leucocephalus*) Reserve, in sparse forests on limestone hill slope, elev. ca. 220 m, 25 Aug 2004, *White-headed Langur Reserve Compl. Exped. B0564* (IBK).

Distribution and ecology. Known only from the type locality in southwestern Guangxi, China (Figure 4). Base of a steep limestone slope in an evergreen forest.

Etymology. The specific epithet is derived from the type locality, Chongzuo City.

Phenology. Flowering from May to Sep; fruiting from June to Oct.

MATERIALS AND METHODS

Chromosome preparations

Root tips of *Begonia chongzuoensis* were pretreated with 2 mM 8-hydroxyquinoline solution at 15-18°C for about 8 h and fixed overnight in ethanol-acetic acid (3:1) below 4°C. Chromosome preparations were made by the enzyme squash method in an enzyme mixture of 4% Cellulase Onozuka R10 (Yakult Honsha, Tokyo, Japan) and 2% Pectolyase (Sigma, St. Louis, MO, USA) at 37°C for about 1 h. Chromosomes were stained with a 2% Giemsa solution (Merck, Darmstadt, Germany).

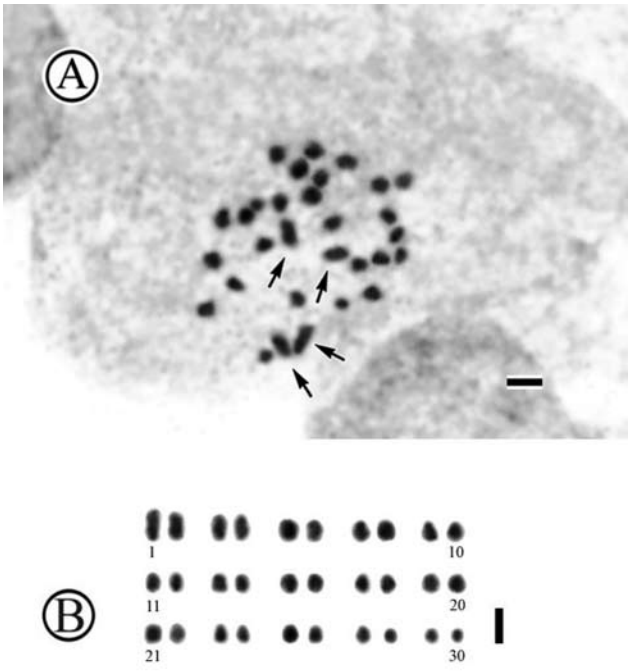

Figure 3. Somatic chromosomes at metaphase of *Begonia chongzuoensis*, $2n = 30$ (from *C.-I Peng et al. 20390-A*). A, Microphotograph. Arrows indicate longer metacentric chromosomes in the complement; B, Somatic chromosomes serially arranged by length and position of centromeres. Scale bars = 2 μm.

Figure 4. Distribution of *Begonia chongzuoensis* (★) in Guangxi Zhuangzu Autonomous Region, China.

Classification of the chromosome complement based on centromere position at mitotic metaphase follows Levan et al. (1964). A voucher specimen (*Peng et al. 20390-A*) has been deposited in HAST.

Cryo scanning electron microscopy

Fresh leaves of *Begonia chongzuoensis* Yan Liu, S. M. Ku & C.-I Peng and B. *obliquifolia* S. H. Huang & Y. M. Shui were dissected and attached to a stub. The samples

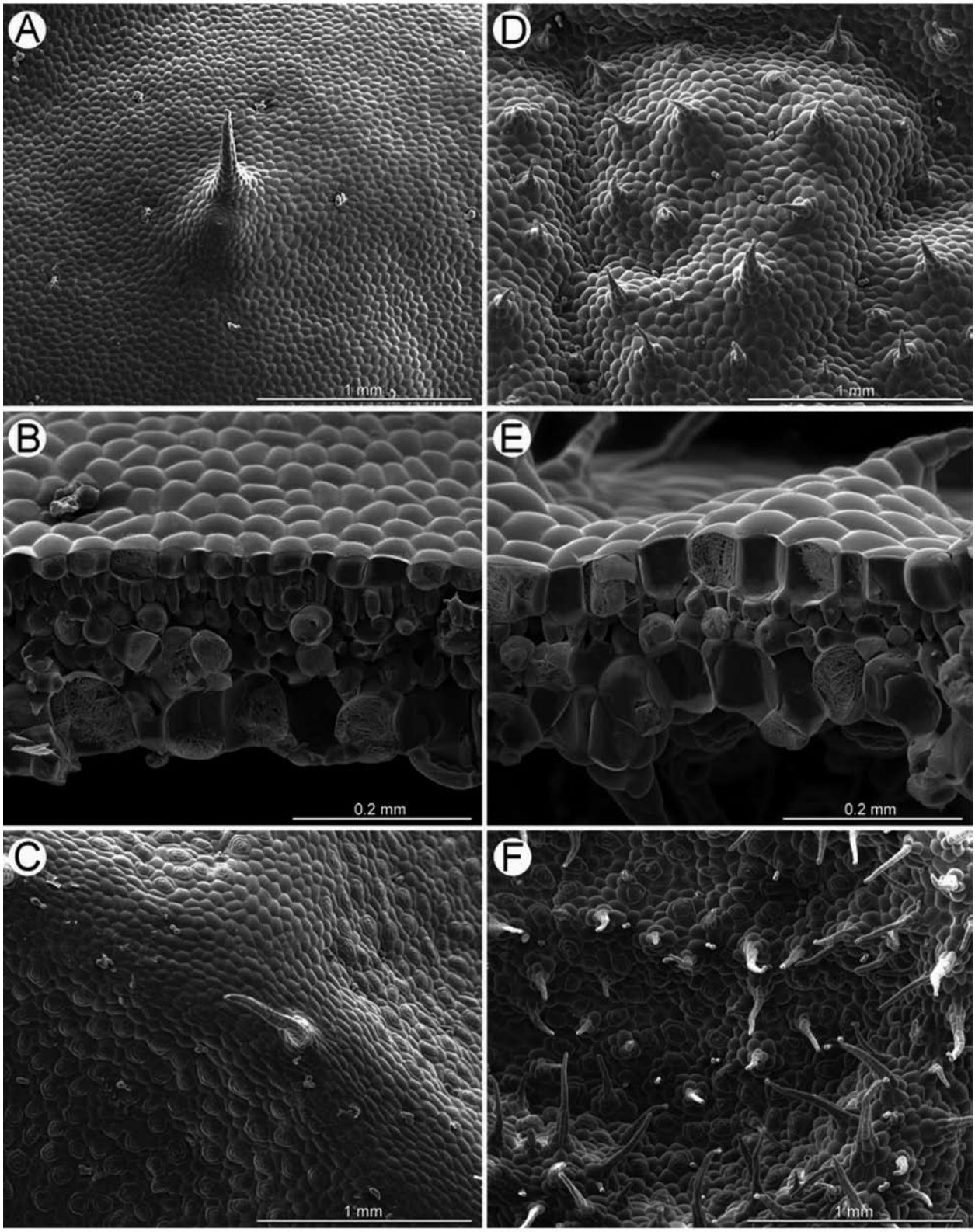

Figure 5. *Begonia* leaf SEM microphotographs. A-C, *Begonia chongzuoensis*; D-F, *B. obliquifolia*; A, D, Trichomes on upper epidermis; B, E, Lamina, cross section; C, F, Trichomes on lower epidermis.

were frozen with liquid nitrogen slush, then transferred to a sample preparation chamber at -160°C. After 5 min, when the temperature rose to -130°C, the samples were fractured. The samples were etched for 10 min at -85°C. After coating at -130°C, the samples were transferred to the SEM chamber and observed at -160°C with a cryo scanning electron

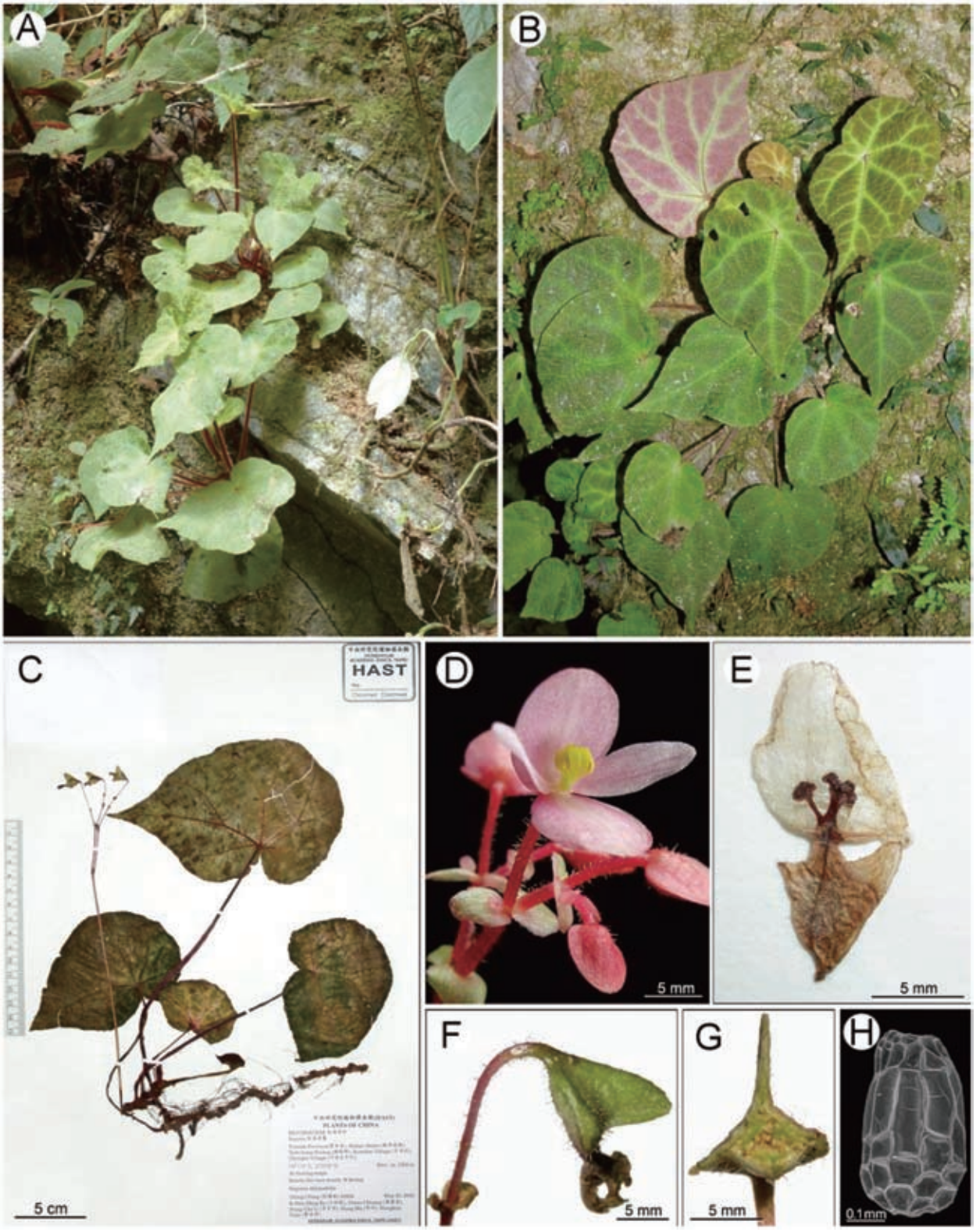

Figure 6. *Begonia obliquifolia* S. H. Huang & Y. M. Shui. A, B, Habit and habitat; C, Specimen; D, Inflorescence, showing staminate flower; E, Carpellate flower from specimen; F, Fruit; G, Fruit, middle cross section; H, Seed SEM microphotograph. All but E from *C.-I Peng et al. 20506* (HAST), E from *Xiao-Bai Jin 165* (PE).

Table 1. Comparison of *Begonia chongzuoensis* with *B. obliquifolia*.

	B. chongzuoensis (Figures 1, 2)	*B. obliquifolia* (Figure 6)
Rhizome		
Internode length (mm)	(3.5-)5-10(-12)	(4-)5-10(-11)
Indumentum	Subglabrous	Pilose
Stipules	With red venation	Without red venation
Petioles	Sparsely hirsute-villous	Densely pilose
Leaf		
Apex	Acuminate or shortly so	Acuminate
Adaxial surface	Nearly flat (Figure 5A)	Rugose (Figure 5D)
Indumentum on adaxial surface	Moderately to sparsely setulose (Figure 5A)	Densely hispidulous (Figure 5D)
Peduncle		
Indumentum	Glabrous	Glandular pilose
Length (cm)	5-12	11-24
Outer staminate tepals	Glabrous	Glandular pilose
Stamen number	25-35	9-13
Ovary and fruit		
Shape	Trigonous-ellipsoid	Trigonous-obovoid
Abaxial wing	Crescent-shaped	Obliquely subtriangular
Indumentum	Glabrous	Glandular pilose
Distribution	China. Guangxi: Chongzuo Shi	China. Yunnan: Malipo Xian

microscope (FEI Quanta 200 SEM/Quorum Cryo System PP2000TR FEI). Voucher specimens (*Begonia chongzuoensis*: *C.-I Peng et al. 20390*; *B. obliquifolia*: *C.-I Peng et al. 20506*) have been deposited at HAST.

Cytology. The somatic chromosome number at metaphase of *Begonia chongzuoensis* was determined to be $2n = 30$ (Figure 3). Among the 30 chromosomes, four were comparatively longer, ca. 1.5 to 1.9 µm, than the others (Figure 3A: arrows; 3B: Nos. 1-4); the remaining 26 chromosomes gradually varied from about 0.7 to 1.2 µm long. The four longer chromosomes were clearly metacentric, but the centromeric positions of some shorter chromosomes could not be resolved. Satellites were not observed.

The somatic chromosome number of all 18 taxa of *Begonia* in sect. *Coelocentrum* are uniformly $2n = 30$ (Fang et al., 2006; Ku et al., 2004, 2006, 2008; Liu et al., 2005, 2007; Peng et al., 2005a,b, 2007, 2008a,b). Our data reveal four taxa, namely *B. arachnoidea*, *B. kui*, *B. ningmingensis* var. *bella* and *B. pengii*, to have two remarkably long metacentric chromosomes (Fang et al., 2006; Ku et al., 2008; Peng et al., 2007, 2008b).

Leaf anatomy and vestiture. Adaxial surface with multiseriate trichomes 0.7-1.2 mm long (Figure 5A); upper epidermal cells conoidal; epidermis single-layered on both surfaces; hypoderm absent (Figure 5B). Abaxial surface with intermixed multiseriate trichomes and unicellular (globose) or bicellular (upper cell globose) microtrichomes near the veins (Figure 5C), a unique character shared only by two other species in sect. *Coelocentrum*: *B. asteropyrifolia* Y. M. Shui & W. H. Chen and *B. variifolia* Y. M. Shui & W. H. Chen. Stomatal complex single, helicocytic, subsidiary cells 5 or 6, moderately elevated (Figure 5C).

Morphological notes. Begonia chongzuoensis somewhat resembles *B. obliquifolia* S. H. Huang & Y. M. Shui (Figure 6), from which it differs by the moderately to sparsely setulose upper leaf surface; glabrous inflorescences, flowers and fruits, and crescent-shaped abaxial wing of the fruit. Detailed comparison of *B. chongzuoensis* with *B. obliquifolia* is presented in Table 1.

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中國秋海棠屬側膜組（秋海棠科）新種：崇左秋海棠

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本文報導中國廣西壯族自治區石灰岩地區的秋海棠屬側膜組（*Begonia* sect. *Coelocentrum*）一新種：崇左秋海棠（*B. chongzuoensis* Yan Liu, S. M. Ku & C.-I Peng）。本研究除提供線繪圖與彩色照片以資辨識外，並報導其染色體數（2*n* = 30）。崇左秋海棠與產於雲南省麻栗坡縣的斜葉秋海棠（*B. obliquifolia*）略似，但前者葉片之上表面具中度至稀疏的短刺毛、花序各部與果實皆光滑無毛，以及果實背翅爲新月形（上緣爲圓形）可資區別。目前僅知其族群分布於廣西西南部的一個陡峭的石灰岩山，爲稀有植物。

關鍵詞：崇左秋海棠；斜葉秋海棠；側膜組；秋海棠科；中國；染色體數；廣西；石灰岩植物；新種；稀有植物。