Burmeistera zamorensis (Campanulaceae, Lobelioideae), a New Species from Southern Ecuador

Nathan Muchhala

Department of Biology, University of Missouri–St. Louis, St. Louis, Missouri 63121, U.S.A.
muchhalan@umsl.edu

Álvaro J. Pérez

Herbario QCA, Escuela de Ciencias Biológicas, Pontificia Universidad Católica del Ecuador, Apartado 17-01-2184, Quito, Ecuador. ajperezc@puce.edu.ec

ABSTRACT. *Burmeistera zamorensis* Muchhala & Á. J. Pérez (Campanulaceae, Lobelioideae) is described from cloud forests in Zamora Chinchipe, Ecuador. It is distinctive in possessing inflated fruit with thick, fleshy walls, and in the maroon coloration of the ventral surface of its leaves, which contrasts sharply with the dark green of the dorsal leaf surfaces. Although similar to *B. ceratocarpa* Zahlbr. and *B. glabrata* (Kunth) Benth. & Hook. f. ex B. D. Jacks., the new species can be distinguished from these and all other species of *Burmeistera* Triana by a combination of characters that includes leaf arrangement, fruit morphology, and calyx lobe morphology.

Key words: *Burmeistera*, Campanulaceae, Ecuador, Lobelioideae, South America.

The Neotropical genus *Burmeistera* Triana (Campanulaceae, Lobelioideae) comprises 111 species distributed from Guatemala to Peru (Lammers, 2007; Garzón-Venegas & Gonzalez, 2012; Garzón-Venegas et al., 2012, 2013). Members are distinguished from the closely related genera *Centropogon* C. Presl and *Siphocampylus* Pohl (Antonelli, 2008; Knox et al., 2008) by their oblong to fusiform seeds (vs. ellipsoid or lenticular), the open orifice of their anther tubes (vs. dorso-ventrally compressed and occluded), their baccate, often inflated fruit (vs. capsular in *Siphocampylus*), and the fact that the corolla and staminal column are deciduous (vs. persistent) from developing fruit (Lammers, 1998, 2002). *Burmeistera* reaches its highest diversity and endemism in mid-elevations (1500–2500 m) of the Andes of northern South America, where up to six species can co-occur in a single location (Muchhala, pers. obs., Muchhala & Potts, 2007; Moreno & Muchhala, 2011). Thirty-six species of *Burmeistera* are known to occur in Ecuador (Jeppesen, 1981; Lammers, 2007), although diversity drops off sharply in the southern provinces, and only four species are known to occur south of Ecuador in Peru (Stein, 1987; Lammers, 2007).

Here we describe a new species from Zamora Chinchipe, the southernmost Ecuadorian province. Only two other *Burmeistera* species are known from this province, based on a single collection in each case: *B. ceratocarpa* Zahlbr. (*Montenegro 58*, MO, QCNE) and *B. pallida* (Drake) E. Wimm. (*Harling 23727*, GB). The new species was discovered in the Tapichalaca Reserve at 2450–2500 m above sea level. Here it co-occurs with another *Burmeistera*, which also likely represents a new species, although further study and access to fruiting material are needed to confirm its identity. As is typical for the genus, flowers of both species open at dusk, and are pollinated by the nectar bats *Anoura caudifer* Geoffroy and *A. geoffroyi* Gray (Muchhala, unpublished data). *Burmeistera* species are nearly universally adapted to bat pollination, with only one documented case of a species pollinated primarily by hummingbirds (Muchhala, 2003, 2006, 2008).

Burmeistera zamorensis Muchhala & Á. J. Pérez, sp. nov. TYPE: Ecuador. Zamora Chinchipe: Reserva Tapichalaca, 04°29.629′S, 79°07.825′W, cloud forest, 2478 m, 13 Nov. 2010, *N. Muchhala 467* (holotype, QCA-206843). Figure 1.

Diagnosis. This new species, known only from the Zamora Chinchipe province of Ecuador, is similar in flower size, shape, and color, and anther shape and exsertion to *Burmeistera glabrata* (Kunth) Benth. & Hook. f. ex B. D. Jacks., but differs from it in its distichous leaf arrangement, much shorter and triangular calyx lobes, and shorter fruits (<15 mm) with walls ca. 3.3 mm thick.

Scandent hemi-epiphytic herb or subshrub, climbing to 3 m; stems 2.5–3.4 mm diam., glabrous, pale green; latex white. Leaves strictly distichous, patent, glabrous; petiole 1.0–1.5 cm, 0.8–1.2 mm diam., 1/10 to 2/10 as long as the lamina; lamina elliptic, apex acuminate, base cuneate, 4.5–11 × 1.6–4.2 cm, distal leaves slightly smaller than proximal leaves;

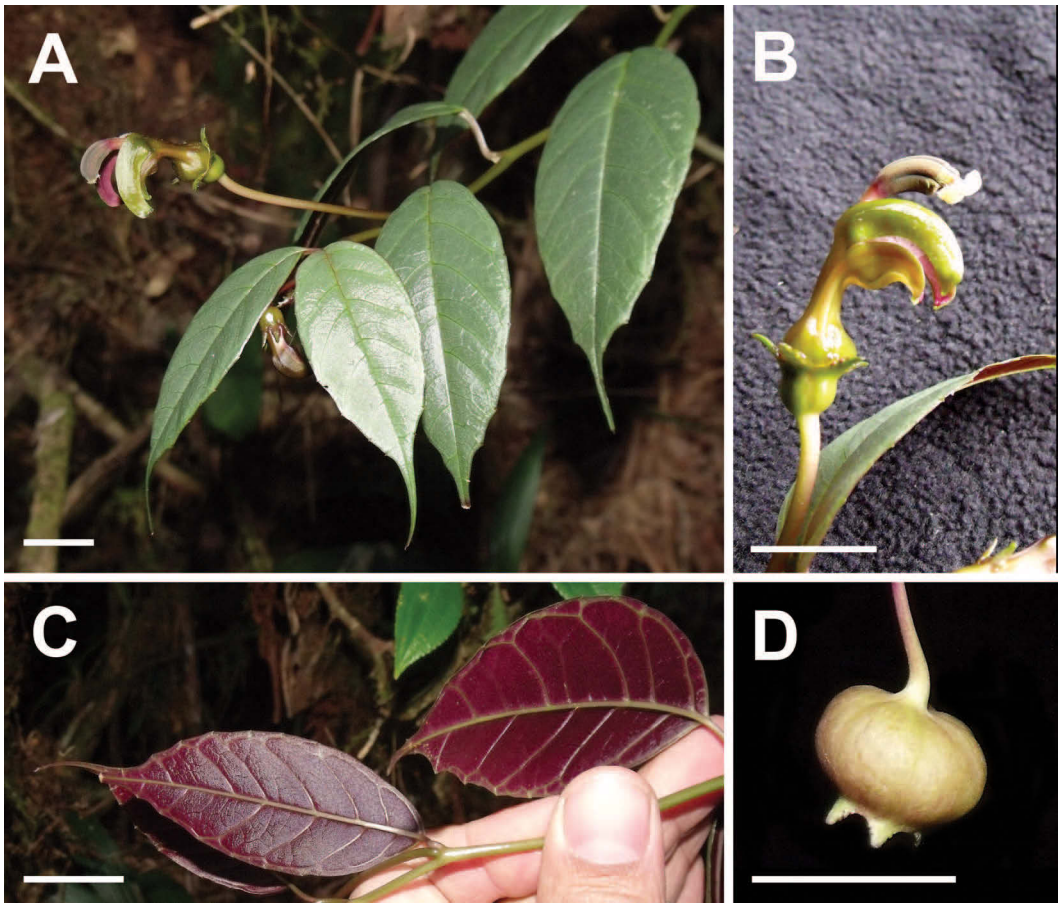

Figure 1. *Burmeistera zamorensis* Muchhala & Á. J. Pérez. —A. Dorsal view of branch with flower in male phase (early anthesis). —B. Close-up of flower in female phase (late anthesis). —C. View of ventral leaf surfaces. —D. Close-up of fruit. Photos taken by N. Muchhala at the type locality in Reserva Tapichalaca, Zamora Chinchipe, Ecuador. Scale bars = 2 cm.

adaxial leaf surface dark forest-green; abaxial blade surface maroon with pale green veins; margin entire to finely denticulate distally; venation semicraspedodromous, with 5 to 8 pairs of secondary veins. Flowers solitary in upper leaf axils, light green suffused with maroon; pedicels 35–70 mm, slightly curved and ascending at anthesis, curved and declined in fruit, 0.9–1.4 mm diam., ebracteate. Hypanthium hemispherical, 4.3 × 4.6 mm; calyx lobes triangular, 3.3 × 1.7 mm, ascending to patent at anthesis, margin finely denticulate, with 3 or 4 teeth per side; apex acute; corolla light green suffused with maroon externally, maroon within, 18 mm; corolla tube slightly decurved, 7.1 mm, distended at base to 5.5 mm diam., wider than hypanthium, dorsoventrally compressed at middle to 2.7 mm tall; dorsal corolla lobes lanceolate, falcate, 13 × 3.5 mm, acute at apex; ventral lobes narrowly triangular, falcate, 7.6 × 2.3 mm, acute at apex; staminal column long-exserted (to ca. 15 mm beyond dorsal lobes); filament tube 19 × 1.5 mm, maroon; anther tube curved-cylindrical, puberulous, 4.1 mm diam., dark purple; dorsal anthers 9.8 mm; ventral anthers 5.1 mm with apical hairs. Berries somewhat inflated with walls 3.3 mm thick, subglobose, oblate, light green suffused with maroon, 9–15 × 11–17 mm, crowned by the persistent calyx lobes.

Distribution and ecology. *Burmeistera zamorensis* is endemic to the Andes of southern Ecuador and known only from the type locality, where it grows in cloud forest at elevations of 2450–2500 m. It produces a strong musky odor, which likely serves to attract its nectar-bat pollinators.

IUCN Red List category. *Burmeistera zamorensis* is currently only known from the Tapichalaca Reserve, a privately owned reserve, where it is relatively rare. However, the surrounding areas have

not been heavily collected by botanists, so the species may be more widespread; in particular, it is not clear whether it occurs in the adjacent Podocarpus National Park, or in northern Peru. Therefore we classify this species as Data Deficient (DD) according to the IUCN Red List criteria (IUCN, 2001); more information is needed to adequately assess its conservation risk.

Etymology. The specific epithet derives from the name of the Ecuadorian province, Zamora Chinchipe, to which the species is endemic.

Relationships. *Burmeistera zamorensis* is most similar to *B. glabrata* (Kunth) Benth. & Hook. f. ex B. D. Jacks. and *B. ceratocarpa* Zahlbr., but can be distinguished from these and all other *Burmeistera* by the combination of its leaf arrangement, calyx lobe morphology, and fruit morphology. The fruit of *B. zamorensis* is particularly unusual for the genus, being inflated yet fleshy, with a 3.3-mm-thick pericarp. Most *Burmeistera* have either inflated fruits with very thin walls, or non-inflated, fleshy fruits. The fruits of *B. ceratocarpa* are similarly semi-inflated, and this species also possesses a dark purple anther tube and maroon coloration inside the corolla. However, *B. ceratocarpa* differs from *B. zamorensis* in having a spiral leaf arrangement (vs. distichous); a short-exserted anther tube (to 4 mm beyond dorsal lobes) that is obliquely cup-shaped (vs. long-exserted, to 15 mm, and curved-cylindrical); and linear calyx lobes 13–16 mm long (vs. triangular and 3 mm long). The flowers of *B. glabrata* are most similar in size, shape, and color to those of the new species, and both possess long-exserted, curved-cylindrical anthers. However, *B. glabrata* has a spiral leaf arrangement (vs. distichous), lanceolate calyx lobes 9–15 mm long (vs. triangular and 3 mm long), and 20–35 mm long, highly inflated fruit with ca. 2 mm thick walls (vs. 9–15 mm and slightly inflated with 3.3-mm-thick walls).

Paratypes. ECUADOR. **Zamora Chinchipe:** Reserva Tapichalaca, Jocotoco Trail, 04°29.2591′S, 79°7.6715′W, cloud forest, 2480 m, 13 Nov. 2010, *N. Muchhala 468*, *470* (QCA-206846, 206847); Reserva Tapichalaca, Tangaras Trail, 04°29′43.6″S, 79°07′55.2″W, cloud forest, 2500 m, 21 June 2014, *A. Perez 7142* (MO).

Acknowledgments. The authors thank the National Geographic Society for financial assistance (grant #8722-09), the Fundación de Conservación Jocotoco for logistical support and access to the Reserva Tapichalaca, and D. Proaño, D. Serrano, and G. Gilbert for assistance in the field. Fieldwork was approved by the Ministry of the Environment of Ecuador (permit no. 006-IC-FAU/FLO-DPZCH/MA).

Literature Cited

Antonelli, A. 2008. Higher level phylogeny and evolutionary trends in Campanulaceae subfam. Lobelioideae: Molecular signal overshadows morphology. Molec. Phylogen. Evol. 46: 1–18.

Garzón-Venegas, J. & F. Gonzalez. 2012. Five new species and three new records of *Burmeistera* (Campanulaceae-Lobelioideae) from Colombia. Caldasia 34: 309–324.

Garzón-Venegas, J., F. González & J. M. V. Puerta. 2012. *Burmeistera minutiflora* (Campanulaceae-Lobelioideae), a new species from the high Andes of Antioquia (Colombia) with the smallest flowers in the genus. Anales Jard. Bot. Madrid 69: 243–246.

Garzón-Venegas, J., J. M. V. Puerta & F. González. 2013. Three new species of *Burmeistera* (Campanulaceae-Lobelioideae) from Colombia. Brittonia 65: 119–127.

IUCN. 2001. IUCN Red List Categories and Criteria, Version 3.1. IUCN Species Survival Commission. IUCN, Gland, Switzerland, and Cambridge, United Kingdom.

Jeppesen, S. 1981. Lobeliaceae. Pp. 12–48 *in* Flora of Ecuador. University of Gothenburg, Gothenburg, and Riksmuseum, Stockholm.

Knox, E. B., A. M. Muasya & N. Muchhala. 2008. The predominantly South American clade of Lobeliaceae. Syst. Bot. 33: 462–468.

Lammers, T. G. 1998. Review of the Neotropical endemics *Burmeistera*, *Centropogon*, and *Siphocampylus* (Campanulaceae: Lobelioideae), with a description of 18 new species and a new section. Brittonia 50: 233–262.

Lammers, T. G. 2002. Seventeen new species of Lobelioideae (Campanulaceae) from South America. Novon 12: 206–233.

Lammers, T. G. 2007. World Checklist and Bibliography of Campanulaceae, Royal Botanical Gardens, Kew.

Moreno, M. P. & N. Muchhala. 2011. Campanulaceae. *In* R. Valencia, N. Pitman, S. León-Yánez & P. M. Jorgensen (editors), Libro Rojo de las Plantas Endémicas del Ecuador, Segunda Edición. Herbario QCA, Pontificia Universidad Católica del Ecuador, Quito.

Muchhala, N. 2003. Exploring the boundary between pollination syndromes: Bats and hummingbirds as pollinators of *Burmeistera cyclostigmata* and *B. tenuiflora*. Oecologia 134: 373–380.

Muchhala, N. 2006. The pollination biology of *Burmeistera* (Campanulaceae): Specialization and syndromes. Amer. J. Bot. 93: 1081–1089.

Muchhala, N. 2008. Functional significance of extensive interspecific variation in *Burmeistera* floral morphology: Evidence from nectar bat captures in Ecuador. Biotropica 40: 332–337.

Muchhala, N. & M. D. Potts. 2007. Character displacement among bat-pollinated flowers of the genus *Burmeistera*: Analysis of mechanism, process and pattern. Proc. Roy. Soc. Edinburgh B 274: 2731–2737.

Stein, B. A. 1987. Synopsis of the genus *Burmeistera* (Campanulaceae, Lobelioideae) in Peru. Ann. Missouri Bot. Gard. 74: 494–496.