



Three New Species of *Burmeistera* (Campanulaceae) Endemic to Ecuador

NATHAN MUCHHALA¹ & BROCK MASHBURN²

Department of Biology, University of Missouri–St. Louis, St. Louis, Missouri 63121, U.S.A.

¹ [✉ muchhalan@umsl.edu](mailto:muchhalan@umsl.edu); [ORCID](https://orcid.org/0000-0002-4423-5130) <https://orcid.org/0000-0002-4423-5130>

² [✉ brockmashburn@gmail.com](mailto:brockmashburn@gmail.com); [ORCID](https://orcid.org/0000-0001-7426-4461) <https://orcid.org/0000-0001-7426-4461>

Abstract

Three species of *Burmeistera* discovered during fieldwork in Ecuador are described here. *Burmeistera velutina* and *Burmeistera catulum* are unusual in being nearly completely covered in indumentum, short and velvety in the former and remarkably long (up to 4 mm) and silky in the latter. *Burmeistera jostii* possesses bright red corollas, rare in a genus typically characterized by dull green flowers, and yellow to tan strigose hairs. We provide a discussion of each species' etymology, phenology, and ecology, a list of all specimens examined, and distribution maps and photos.

Keywords: Lobelioideae, Mashpi Reserve, South America, cloud forests, taxonomy

Resumen

Tres especies nuevas de *Burmeistera* descubiertas durante trabajo de campo en Ecuador son descritas aquí. *Burmeistera velutina* y *Burmeistera catulum* son inusuales por estar casi completamente cubiertas por un indumento, corto y aterciopelado en *B. velutina* y notablemente largo (hasta 4 mm) y sedoso en *B. catulum*. *Burmeistera jostii* posee corolas rojas brillantes, raro en un género típicamente caracterizado por corolas verdes, y pelos estrigosos de amarillos a marrón claro. Se presenta una descripción de la etimología, fenología, y ecología de cada especie, junto con una lista de cada espécimen examinado, mapas de distribución, y fotos.

Palabrasclaves: Lobelioideae, Reserva Mashpi, Suramérica, bosques nublados, taxonomía

The Neotropical genus *Burmeistera* Triana (1854: 13) (Campanulaceae) comprises ca. 125 species distributed from Guatemala to Peru (Lammers 2007; González & Luteyn 2019; González & Garzón-Venegas 2020). Molecular phylogenetic work suggests that the genus diversified extremely rapidly, originating in the northern Andes only 2.6 million years ago (Lagomarsino *et al.* 2016; Bagley *et al.* 2020). The greatest species richness occurs in Ecuador and Colombia, with more than 50 species known to occur in each country, while new species continue to be described (e.g., González & Vélez-Puerta 2018; Vallejo *et al.* 2018; Mashburn *et al.* 2020). *Burmeistera* is closely related to the genera *Centropogon* C.Presl (1836: 48) and *Siphocampylus* Pohl (1831: 104), but can be distinguished from both by a series of morphological synapomorphies including an inflated corolla, dilated anther orifice, isodiametric seeds, and the fact that the flowers, style, and staminal column do not remain attached to the developing fruit (i.e., they are deciduous post-anthesis; Lammers 1998).

In the course of revising the taxonomy of *Burmeistera*, we discovered three species endemic to Ecuador which we describe here. Two of these were discovered on the same day during a collecting trip to the Mashpi Reserve in Pichincha province. These species are remarkable in that both are nearly completely covered in indumentum, with the hairs of one species reaching up to 4 mm long, far longer than any other species in the genus. The third species was first collected 30 years ago in Pastaza province, and we now have enough collections to describe it. It is noteworthy in its bright red flowers, a trait common among hummingbird-pollinated species from the genus *Centropogon* but very rare in *Burmeistera*, which typically possess dull green flowers tinged with maroon and are pollinated by bats (Muchhala 2008; Lagomarsino *et al.* 2017). Only *B. rubrosepala* (E.Wimmer 1924: 252) E.Wimmer (1932: 10) and *B. antioquiensis* Garzón & J.M.Vélez (2013: 120) have similar all-red flowers. The former species was found to be

pollinated by hummingbirds (Muchhala 2006) and based on its color and floral morphology we suspect that this new species is similarly hummingbird-adapted. For the following descriptions of these three new species, we took all measurements from dried herbarium specimens. Since color often changes after *Burmeistera* specimens are dried, we obtained color traits from photographs taken in the field and from descriptions on labels.

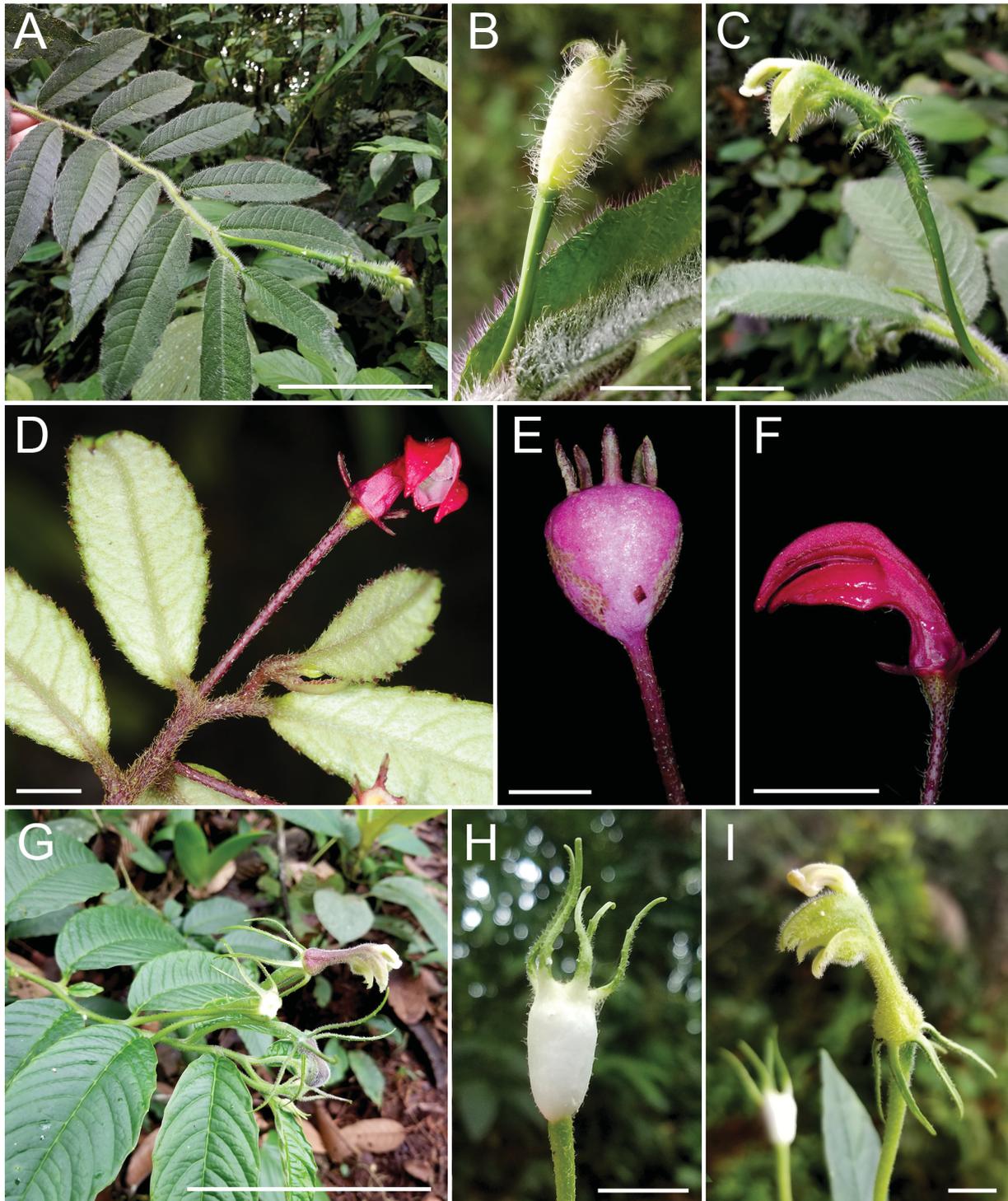


FIGURE 1. Images of leaves, fruits, and flowers of the new species. A–C. *Burmeistera catulum* Muchhala & Mashburn; photographs by N. Muchhala. D–F. *Burmeistera jostii* Muchhala & Mashburn; photographs by J.L. Clark. G–I. *Burmeistera velutina* Muchhala & Mashburn; photographs by N. Muchhala. Scale bars correspond to 10 cm in A and G, and 10 mm in all other panels. Images correspond to the collections *N. Muchhala & J. Gruhn 553* (A, C), *N. Muchhala & J. Gruhn 558* (B), *J.L. Clark & L. Clavijo 14255* (D–F; note scale bars are approximated here based on other collections, as we did not have access to this collection), *N. Muchhala & J. Gruhn 556* (G), *N. Muchhala & J. Gruhn 554* (H, I).



FIGURE 2. *Burmeistera catulum* Muchhala & Mashburn. Holotype, N. Muchhala & J. Gruhn 558 (MO). Image produced with permission.

1. *Burmeistera catulum* Muchhala & Mashburn, *sp. nov.* TYPE: Ecuador. Pichincha: Mashpi Lodge, on ‘Jungle Swing’ trail, 971 m, 00°09’59.63”N 78°52’54.413”W, 06 Jul. 2018 (fl, fr), N. Muchhala & J. Gruhn 558 (holotype, MO-6773327!; isotypes, HUTI!, QCA!, QCNE!). Figures 1A-C, 2.

Diagnosis. This new species from northwest Ecuador is differentiated from other *Burmeistera* by being covered entirely (except the pedicel) with 1–4 mm long, translucent-white to violet tinged appressed hairs, as well as having long (130–200 mm) often oblanceolate leaves, a narrowly turbinate hypanthium (15–18 × 4–5 mm), and narrow (15 × 8 mm) cylindrical fruits.

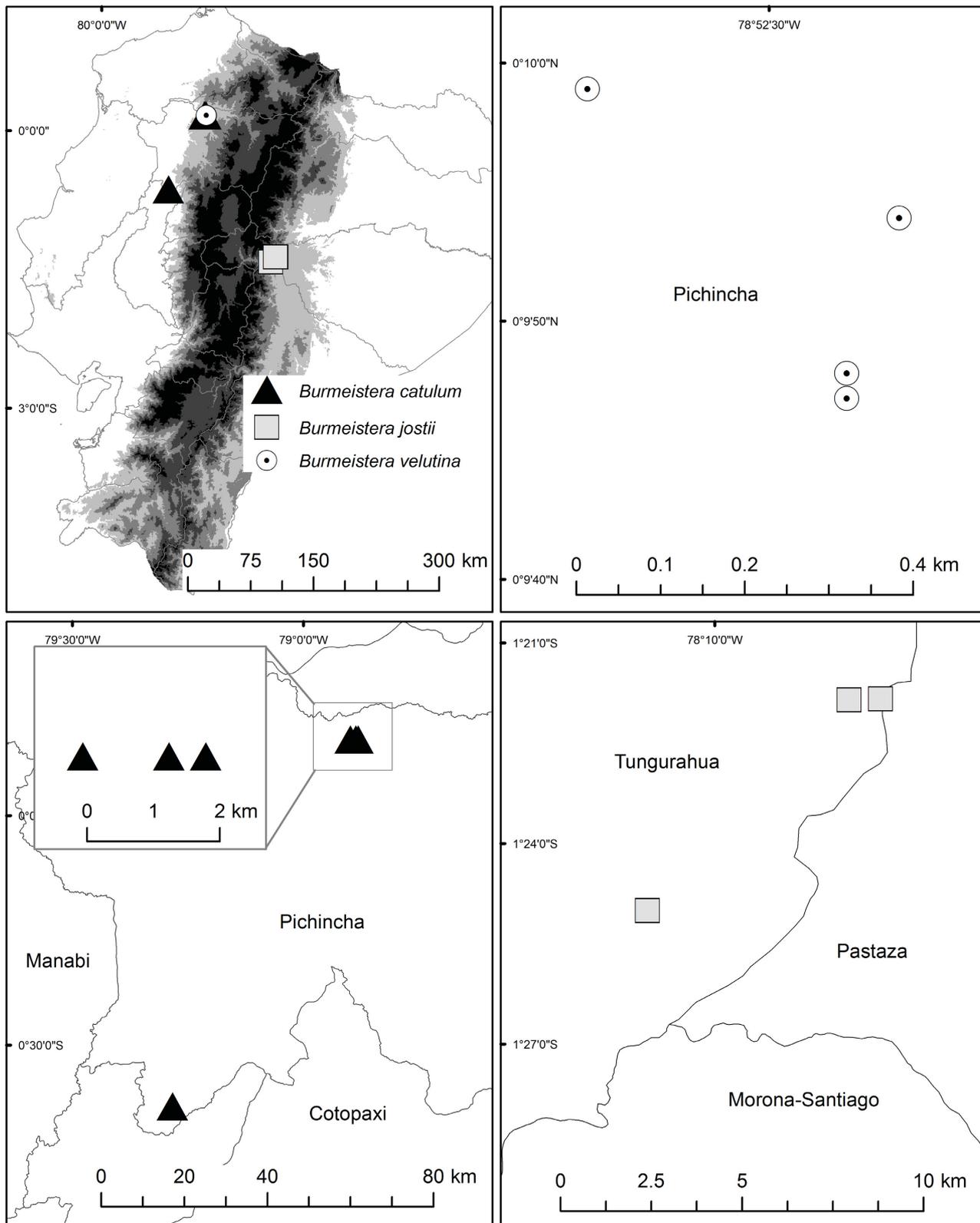


FIGURE 3. Geographic distribution maps of known herbarium collections. Triangles correspond to *Burmeistera catulum* Muchhala & Mashburn, squares to *Burmeistera jostii* Muchhala & Mashburn, and circles to *Burmeistera velutina* Muchhala & Mashburn.

Herbaceous shrubs to scandent herbs, reaching ca. 2.5 m; vegetative parts covered with 1–4 mm long, translucent-white, sometimes violet-tinged, appressed, simple, multicellular, uniseriate hairs. *Latex* unknown. *Stems* up to 5 mm wide on terminal branches, yellow-green. *Leaves* alternate, distichous, the internodes 20–35 mm long; petioles 5–20 mm long, pale green; lamina 130–230 × 40–70 mm, narrowly elliptic to oblanceolate, the base attenuate, the apex

attenuate to acuminate, the margins callose-dentate, the teeth often alternating small and large in size, spaced 5–10 mm apart; adaxial surface dark green; abaxial surface lighter green; venation camptodromous, the primary vein prominent, raised, the secondary veins only slightly raised, the tertiary veins faintly visible. *Pedicels* ebracteolate, 55–100 mm long at anthesis and in fruit, yellow-green to dark green, glabrous (rarely with a few dispersed hairs). *Flowers* 44–46 mm long, solitary in the upper leaf axils, 1–3 per stem; hypanthium 15–18 × 4–5 mm, turbinate, green, villose (rarely glabrous); calyx lobes 4–8 × 1–2 mm, deltate, patent to slightly recurved at anthesis, dark green, the exterior villose, the interior glabrous, the margins dentate with 3–5 callose teeth, the apex acute; corolla dark green, becoming yellow-green distally, villose; corolla tube 5–6 mm wide basally, the throat narrowing to 4–5 mm wide; corolla lobes lanceolate, the two dorsal lobes 15–16 × 4–5 mm, falcate, arched forwards, the dorsal sinus 14–16 mm from the corolla base, the two lateral lobes 12–14 × 4–5 mm, falcate, slightly recurved, the ventral lobe 10–12 × 4–5 mm, slightly recurved, the ventral sinus 8–10 mm from the corolla base; androecium 27–28 mm long, exerted 19–20 mm from the ventral opening, the filament tube green, glabrous, the anther tube 6–9 × 5–6 mm, yellow-green, sparsely puberulous between the sutures, the three dorsal anther tips glabrous, the two ventral anther tips densely pubescent with white hairs; the style and stigma cream-colored, the stigma lobes fringed with short white hairs along the margins. *Fruits* ca. 15–16 × 6–8 mm, cylindrical, maturing white; seeds unknown.

Etymology. The specific epithet, *catulum*, comes from Latin, meaning ‘young dog, puppy’, in reference to the unique long hairs on the leaves, stems, and flowers of this species.

Phenology. This species has been collected with flowers and fruits in July and fruits in February.

Distribution & Conservation Status. The few collections of *Burmeistera catulum* come from just two disjunct locations west of the Andes in Ecuador in the provinces of Los Ríos and Pichincha, roughly 95 km apart (Fig. 3). While it is possible that other subpopulations exist between the two known collection locales, it is indicative of the rarity of this species that no other collections are known from what is otherwise a well-collected region of the country. The narrow extent of occurrence (EOO) of 82.553 km² supports an IUCN Red List (IUCN 2019) status of ‘Critically Endangered’ (criterion B1), while the area of occupancy (AOO) of 12 km² supports a status of ‘Endangered’ (criterion B2). While the subpopulation in Pichincha is likely safe in long-term, as it is found on the property of Mashpi Reserve, we suspect that the subpopulation in Los Ríos has already been destroyed in the time since its collection 30 years ago, due to clearing for agriculture activities. Thus, following the IUCN (2019) guidelines, we propose an assessment of *B. catulum* as ‘Critically Endangered’ (CR B1ab[iv]).

Discussion. *Burmeistera catulum* is unique among *Burmeistera* species in its long, translucent-white to violet-tinged appressed hairs on every part of the plant except the pedicel. The narrow elongated hypanthium and cylindrical fruits exemplified by *B. catulum* are reminiscent of *B. holm-nielsenii* Jeppesen (1981: 35), also endemic to Ecuador, and the Ecuadorian/Colombian species *B. marginata* H.Karst & Triana (1856: 445), plus a yet undescribed species from Ecuador (Mashburn, in press), suggesting a potential relationship between these four species

Paratypes. ECUADOR: **Los Ríos:** Road Patricia Pilar, Montañas de Ila, km 18, N side of Torre de Bijagual, below antenas, 620–680 m, 00°38’S 79°17’W, 28 Feb. 1993 (fr), Øllgaard & Borchsenius 100690 (QCA). **Pichincha:** Mashpi Lodge, next to scientific station, 951 m, 00°09’59.70”N 78°53’12.343”W, 06 Jul. 2018 (fr), Muchhala & Gruhn 553 (MO); Mashpi Lodge, on road between scientific station and lodge, 951 m, 00°09’59.70”N 78°53’12.343”W, 06 Jul. 2018 (fl, fr), Muchhala & Gruhn 557 (MO).

2. *Burmeistera jostii* Muchhala & Mashburn, *sp. nov.* TYPE: Ecuador. Tungurahua: Baños, Parque Nacional Llanganates, Cordillera Sacha Llanganates, summit ridge, overlooking Amazon lowlands to east, Río Zuñac watershed to west, 2740 m, 01°21’50”S 78°07’32”W, 28 Nov. 2001 (fl, fr), D. Neill, L. Jost, J. Caranqui & E. Toapanta 13469 (holotype, MO-5945905!; isotype, QCNE-162813!). Figures 1D–F, 4.

Diagnosis. This new species is differentiated from other *Burmeistera* by the presence of small (16–18 mm) flowers with red corolla lobes and its yellow to tan strigose hairs.

Scandent herbs, reaching ca. 0.5 m. *Latex* unknown. *Stems* up to 3 mm wide on terminal branches, tan, basally glabrous, scaly, apically strigose with 0.2–1.5 mm long, yellow to tan, simple, multicellular, uniseriate hairs. *Leaves* alternate, distichous, the internodes 5–15 mm long; petioles 3–6 mm long, tan, strigose; lamina 25–70 × 10–22 mm, elliptic, the base cuneate, the apex attenuate, the margins callose-serrate; adaxial surface dark green, glabrous; abaxial surface light green, strigose with yellow to tan hairs; venation craspedodromous, the primary vein slightly raised, the secondary veins barely visible, the tertiary veins not visible. *Pedicels* ebracteolate, 15–20 mm long, green to tan, strigose. *Flowers* 16–18 mm long, solitary in the upper leaf axils; hypanthium 3–4 × 3–4 mm, green to tan, strigose, the ridges slightly raised; calyx lobes 4–5 × 0.5–1 mm, linear, patent to reflexed at anthesis, green, strigose; corolla pink to red, drying to a translucent pale-yellow to violet color, sparsely pilose with tan hairs, membranous; corolla tube 3–4 mm wide basally, the throat narrowing to 2–3 mm wide; corolla lobes lanceolate, the margins smooth, the

two dorsal lobes 9–12 × 5–6 mm, ascending further than the androecium, the dorsal sinus 10–11 mm from the corolla base, the two lateral lobes 8–11 × 4–5 mm, slightly falcate, recurved, the ventral lobe ca. 9–10 × 4–5 mm, the ventral sinus 5–6 mm from the corolla base; androecium 13–14 mm, exerted 6–8 mm from the ventral opening, the filament tube pale green, pilose with white hairs, the anther tube pale-green, glabrous, the three dorsal anther tips glabrous, the two ventral anther tips sparsely pubescent with white hairs; style and stigma unknown. *Fruits* turbinate, pink; seeds unknown.



FIGURE 4. *Burmeistera jostii* Muchhala & Mashburn. Holotype, D. Neill, L. Jost, J. Caranqui, & E. Toapanta 13469 (MO). Image produced with permission.

Etymology. This species is named in honor of Lou Jost, mathematician, ecologist, conservationist, and orchid

taxonomist, who helped to discover the species. Along with his intellectual contributions to biological literature, Lou is to be commended for his dedication to protecting Ecuadorian forests and keeping them accessible to scientists and nature enthusiasts. Fundacion Ecominga, which Lou and colleagues established in 2006, now owns a network of twelve preserves across Ecuador that conserve a total of 14,000 acres of forest.



FIGURE 5. *Burmeistera velutina* Muchhala & Mashburn. Holotype, *N. Muchhala & J. Gruhn 556* (MO). Image produced with permission.

Phenology. This species has been collected with flowers in November and February.

Distribution & Conservation Status. *Burmeistera jostii* occurs in wet, high elevation cloud forest. This species is known from a narrow distribution near the border of Tungurahua and Pastaza provinces in central Ecuador (Fig. 3).

Two collections come from the type location, inside the southern portion of Llanganates National Park, in the Cantón de Baños (Tungurahua province). A third collection is labelled from Pastaza province, but also states “Rio Zuñag, north of Rio Topo,” which is likely very close to the other collections in Tungurahua (no GPS location given). The lack of collections of this species result in a narrow extent of occurrence (<1 km²) and area of occupancy (4 km²). Given that these collections come from just inside Llanganates National Park, it is presumed *B. jostii* also occurs in nearby unprotected areas bordering the park. We project a continued decline in area and quality of habitat, as this forest outside of the National Park is subject to continued deforestation for pastures and other agriculture activities. Therefore, we propose assessing *B. jostii* with a status of ‘Critically Endangered’ (CR B1ab[iii]) following the IUCN (2019) guidelines.

Discussion. This species is unique among *Burmeistera*, especially those in Ecuador, because of its relatively small pink to red flowers. *Burmeistera jostii* is most similar to the Colombian endemic *B. antioquiensis*, but differs in having 0.2–1.5 mm long, yellow to tan strigose hairs on the stem, abaxial leaf surface, pedicel, hypanthium, and corolla (vs. entirely glabrous in *B. antioquiensis*); in its attenuate leaf apices (vs. acute to acuminate); and in having generally shorter (15–20 mm long) pedicels at anthesis (vs. 18–45 mm long). The leaves of *B. jostii* are similar to those of *B. arbusculifera* Lammers (2002: 207), but the green flowers of the latter are much larger (ca. 34 mm vs. 16–18 mm long), and the calyx lobes are longer (7–11 mm vs. 4–5 mm long).

Paratypes. ECUADOR. **Pastaza:** Rio Zuñag, north of Rio Topo, 2600 m, 23 Feb. 1990 (fl), *A. Hirtz 4614* (QCNE). **Tungurahua:** Banos Cantón, Parque Nacional Llanganates, Cordillera Sacha Llanganates. Flat ridge above Río Zuñac, 2550 m, 01°21′51″S 78°08′00″W, 28 Nov. 2001 (fl), *Neill et al. 13451* (MO, QCNE).

3. *Burmeistera velutina* Muchhala & Mashburn, *sp. nov.* TYPE: Ecuador. Pichincha: Mashpi Lodge, on ‘Palma Caminante’ path, 1047 m, 00°09′47.59″N 78°52′26.823″W, 06 Jul. 2018 (fl), *N. Muchhala & J. Gruhn 556* (holotype, MO-6773326!; isotypes, QCA!, HUTI!). Figures 1G–I, 5.

Diagnosis. This new species from Ecuador is similar to *Burmeistera smaragdi* Lammers (2002: 213), especially in the presence of long, narrow calyx lobes (15–23 × 0.5–1.5 mm), but is primarily differentiated by the yellow to cream-colored hairs that cover all of the vegetative and reproductive parts of the plant except for the adaxial leaf surface.

Herbaceous shrubs to scandent herbs, reaching ca. 6 m. *Latex* unknown. *Stems* up to 4 mm wide on terminal branches, yellow-green, villose with yellow to cream-colored hairs. *Leaves* alternate, distichous, the internodes 15–25 mm long; petioles 5–10 mm long, green, villose; lamina 80–145 × 25–40 mm, narrowly elliptic, the base attenuate, the apex attenuate to acuminate, the margins shallow callose-dentate, nearly entire, the teeth intramarginal; adaxial surface dark green, glabrous; abaxial surface lighter green, villose, especially along the main veins; venation camptodromous, the primary vein prominent, raised, the secondary veins only slightly raised, the tertiary veins faintly visible. *Pedicels* ebracteolate, 65–95 mm long at anthesis and in fruit, green, villose, especially distally. *Flowers* 32–37 mm long, solitary in the upper leaf axils; hypanthium 7–11 × 4–6 mm, turbinate, the base barely distinguishable from the pedicel, green, villose, the ridges slightly raised; calyx lobes 15–23 × 0.5–1.5 mm, linear, reflexed at anthesis, green, the exterior villose, the interior glabrous, the margins shallow callose-serrate, the apex acute; corolla green to green tinged with maroon-violet, villose; corolla tube 5–6 mm wide basally, the throat narrowing to 3–4 mm wide; corolla lobes lanceolate, the two dorsal lobes 12–15 × 3–4 mm, falcate, arched forwards, the dorsal sinus 14–15 mm from the corolla base, the two lateral lobes 8–9 × 3–4 mm, falcate, slightly recurved, the ventral lobe 7–8 × 3–4 mm, the ventral sinus 11–12 mm from the corolla base; androecium 25–29 mm long, exerted 15–17 mm from the ventral opening, the filament tube green, sparsely puberulous with white hairs, the anther tube ca. 5 × 4 mm, green, violet along the sutures, sparsely puberulous between the sutures, all five anther tips glabrous to sparsely puberulous; the style and stigma cream-colored, the stigma lobes fringed with white hairs along the margins. *Fruits* ca. 11 × 8 mm, obovoid, not inflated, maturing white; seeds unknown.

Etymology. The specific epithet, *velutina*, comes from Latin, in reference the dense covering of soft hairs exhibited by this species.

Phenology. Collections of this species have been made with flowers and fruits in July.

Distribution & Conservation Status. As of yet, collections of *Burmeistera velutina* come only from the type locality in Mashpi Reserve, Pichincha province, Ecuador (Fig. 3). It occurs in cloud forests at 970–1050 m in elevation. It occurs in cloud forests at 970–1050 m in elevation. The narrow extent of occurrence (0.045 km²) and area of occupancy (4 km²) suggest a conservation status of ‘Critically Endangered’ (CR). In addition to being known from only one location, the region surrounding Mashpi Reserve is increasingly deforested due to clearing for pasture and other agriculture activities. Thus, following the IUCN (2019) guidelines, we assess this species as ‘Critically Endangered’ (CR B1ab[iii]).

Discussion. *Burmeistera velutina* is likely to be closely related to *B. smaragdi*, which occurs in the provinces of Carchi, Esmeraldas, and Manabí, in eastern Ecuador. The flowers of each species are similar in shape, size, and color, and both species exhibit narrow calyx lobes that are quite long for the genus (reaching 28 mm long in *B. smaragdi*). However, *B. velutina* is differentiated from *B. smaragdi* by the presence of yellow to cream-colored villose hairs that cover the reproductive parts of the plant, whereas these parts are glabrous in *Burmeistera smaragdi*. In addition, the calyx lobes of *B. velutina* are strongly reflexed at anthesis, while those of *B. smaragdi* are ascending at anthesis. If the proposed relationship between *B. velutina* and *B. smaragdi* is true, this would place *B. velutina* in a clade with *B. tenuiflora* Donn. Sm. (1898: 147) from Panama and Costa Rica (Bagley *et al.* 2020).

Paratypes. ECUADOR. **Pichincha:** Mashpi Lodge, on ‘Palma Caminante’ path, 1034 m, 00°09’53.81”N 78°52’25.743”W, 06 Jul. 2018 (fl), *Muchhala & Gruhn 552* (MO); Mashpi Lodge, on ‘Palma Caminante’ path, 1031 m, 00°09’47.89”N 78°52’27.553”W, 06 Jul. 2018 (fl, fr), *Muchhala & Gruhn 554* (MO); Mashpi Lodge, on ‘Palma Caminante’ path, 1035 m, 00°09’47.05”N 78°52’27.273”W, 06 Jul. 2018 (fl), *Muchhala & Gruhn 555* (MO); Mashpi Lodge, on road to lodge, at start of ‘Copal’ trail, 978 m, 00°09’59.69”N 78°52’37.653”W, 06 Jul. 2018 (fl), *Muchhala & Gruhn 549* (MO).

Acknowledgements. The authors thank German Toasa for sending us images of *B. velutina* from Mashpi Lodge, which led to our expedition there and additional discovery of *B. catulum*. We are grateful to Nora Oleas for logistical help with permits and arranging the trip to Mashpi Reserve, to Mateo Roldán and the administrators of Mashpi Lodge for facilitating our stay there, and to Jennifer Gruhn for help in the field. We also thank Lou Jost and John L. Clark for sharing images and collections of *B. jostii*, Burgund Bassüner for her help in providing the map and IUCN Red List assessments, Juan Moreira for help proofing the Spanish abstract, and Favio González and an anonymous reviewer for detailed comments that improved this manuscript. Fieldwork was supported by the National Science Foundation (DEB #1754802) and conducted with permission from the Ministerio de Ambiente del Ecuador under permit #MAE–DNB–CM–2015–0017.

Literature Cited

- Bagley, J.C., Uribe-Convers, S., Carlsen, M.M. & Muchhala, N. (2020) Utility of targeted sequence capture for phylogenomics in rapid, recent angiosperm radiations: Neotropical *Burmeistera* bellflowers as a case study. *Molecular Phylogenetics and Evolution* 106769.
<https://doi.org/10.1016/j.ympev.2020.106769>
- Garzón-Venegas, J., Puerta, J.M.V. & González, F. (2013) Three new species of *Burmeistera* (Campanulaceae-Lobelioideae) from Colombia. *Brittonia* 65: 119–127.
<https://doi.org/10.1007/s12228-012-9259-8>
- González, F. & Luteyn, J.L. (2019) *Burmeistera villosa* (Campanulaceae, Lobelioideae), a new vested species from the Western Cordillera of Colombia. *Brittonia* 71: 49–54.
<https://doi.org/10.1007/s12228-018-9553-1>
- González, F. & Vélez-Puerta, J.M. (2018) Two new species of *Burmeistera* (Campanulaceae: Lobelioideae) from Antioquia, Colombia. *Caldasia* 40: 271–283.
<https://doi.org/10.15446/caldasia.v40n2.70457>
- González, F. & Garzón-Venegas, J. (2020) *Burmeistera andakiana* and *B. boyacensis* (Campanulaceae, Lobelioideae), two new species from the Eastern Cordillera of Colombia. *Phytotaxa* 474: 154–162.
<https://doi.org/10.11646/phytotaxa.474.2.5>
- IUCN (2019) *Guidelines for Using the IUCN Red List Categories and Criteria*, version 14. Prepared by the Standards and Petitions Subcommittee. 109 pp. Available from: <http://www.iucnredlist.org/documents/RedListGuidelines.pdf> (accessed 4 March 2021)
- Jeppesen, S. (1981) Lobeliaceae. In: Harling, G. & Sparre, B. (Eds.) *Flora of Ecuador* 14. Swedish Natural Science Research Council. Stockholm, pp. 9–170.
- Karsten, H. & Triana, J.J. (1856) *Plantae Columbiana*. *Burmeistera* Karst. et Triana. Lobeliacearum gen. nov. *Linnaea* 28: 444–446.
- Lagamarsino, L.P., Condamine, F.L., Antonelli, A., Mulch, A. & Davis, C.C. (2016) The abiotic and biotic drivers of rapid diversification in Andean bellflowers (Campanulaceae). *New Phytologist* 210: 1430–1442.
<https://doi.org/10.1111/nph.13920>
- Lagamarsino, L.P., Forrestel, E.J., Muchhala, N. & Davis, C.C. (2017) Repeated evolution of vertebrate pollination syndromes in a recently diverged Andean plant clade. *Evolution* 71: 1970–1985.

<https://doi.org/10.1111/evo.13297>

- 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.
<https://doi.org/10.2307/2807855>
- Lammers, T.G. (2002) Seventeen new species of Lobelioideae (Campanulaceae) from South America. *Novon* 12: 206–233.
<https://doi.org/10.2307/3392958>
- Lammers, T.G. (2007) *World Checklist and Bibliography of Campanulaceae*. Royal Botanical Gardens, Kew.
- Muchhala, N. (2006) The pollination biology of *Burmeistera* (Campanulaceae): Specialization and syndromes. *American Journal of Botany* 93: 1081–1089.
<https://doi.org/10.3732/ajb.93.8.1081>
- Muchhala, N. (2008) Functional significance of extensive interspecific variation in *Burmeistera* floral morphology: evidence from nectar bat captures in Ecuador. *Biotropica* 40: 332–337.
<https://doi.org/10.1111/j.1744-7429.2007.00381.x>
- Mashburn, B., Perez, A.J., Persson, C., Zapata, N., Cevallos, D. & Muchhala, N. (2020) *Burmeistera quimiensis* (Lobelioideae, Campanulaceae): A new species from the Cordillera del Cóndor range in southeast Ecuador. *Phytotaxa* 433: 67–74.
<https://doi.org/10.11646/phytotaxa.433.1.7>
- Mashburn, B., Ulloa, C.U. & Muchhala, N. (2021) Six new species of *Burmeistera* (Campanulaceae) endemic to Ecuador. *Novon* (In press).
- Pohl, J.B.E. (1831) *Plantarum Brasiliae Icones et Descriptiones hactenus ineditae*. Volume 2. Typis et charta Antonii Strauss, Vindobonae [Vienna], 152 pp.
- Presl, C.B. (1836) *Prodromus Monographiae Lobeliacearum*. Typis filiorum Theophili Haase, Prague, 52 pp.
- Smith, J.D. (1898) Undescribed Plants from Guatemala and Other Central American Republics. XX. *Botanical Gazette* 25: 145–157.
<https://doi.org/10.1086/327650>
- Triana, J.J. (1854) *Nuevos jeneros i especies de plantas para la flora neo-granadina*. Imprenta del Neo-Granadino, Bogotá, 26 pp.
- Vallejo, A.F., Perez, A.J., Cevallos, D. & Muchhala, N. (2018) New species of *Burmeistera* (Campanulaceae: Lobelioideae) from Ecuador. *Phytotaxa* 362: 263–270.
<https://doi.org/10.11646/phytotaxa.362.3.2>
- Wimmer, F.E. (1924) Lobelioideae. II. *Repertorium Specierum Novarum Regni Vegetabilis* 19: 211–265.
<https://doi.org/10.1002/fedr.19240192205>
- Wimmer, F.E. (1932) *Burmeistera*. Eine umstrittene Pflanzengattung und ihre Arten. *Repertorium Specierum Novarum Regni Vegetabilis* 30: 1–52, t. 123–126.
<https://doi.org/10.1002/fedr.19320300102>