Phytotaxa 460 (1): 089–096
https://www.mapress.com/j/pt/

Article

ISSN 1179-3155 (print edition)
PHYTOTAXA
ISSN 1179-3163 (online edition)

https://doi.org/10.11646/phytotaxa.460.1.5

A new critically endangered species of *Bertolonia* (Melastomataceae, Bertolonieae) from Espírito Santo, Brazil

LUCAS F. BACCI[1*], DIEGO TAVARES IGLESIAS[2] & RENATO GOLDENBERG[3]

[1]*Pós Graduação em Botânica, Departamento de Botânica, Universidade Federal do Paraná, Centro Politécnico, Postal Box 19031, Curitiba, Paraná, 81531-970, Brazil.* https://orcid.org/0000-0001-5825-9216

[2]*Instituto de Ciências Agrárias, Universidade Federal de Minas Gerais, Montes Claros, MG, 39404-547, Brazil.* https://orcid.org/0000-0002-9160-9959; diegotavaresiglesias@gmail.com

[3]*Departamento de Botânica, Universidade Federal do Paraná, Centro Politécnico, Postal Box 19031, Curitiba, Paraná, 81531-970, Brazil.* https://orcid.org/0000-0002-7047-6720; renato.goldenberg@gmail.com

[*]*Corresponding author:* lucasfbacci@gmail.com

Abstract

We describe here *Bertolonia lucernula*, a new endemic species from the state of Espírito Santo, Brazil. It is only known from one locality, the "Área de Proteção Ambiental Mestre Álvaro", in the municipality of Serra. The new species can be recognized by the branches and petioles covered with sessile and short-stalked glands and scattered unbranched trichomes, flat leaf blade surfaces covered only with sessile and short-stalked glands, small flowers with a widely campanulate hypanthium covered with the same trichomes as the petioles, calyx with membranaceous, truncate sepals, and short, triangular external teeth, asymmetric and obovate petals, with the apex covered with sessile and short-stalked glands on the adaxial surface. According to IUCN criteria, *Bertolonia lucernula* should be classified as Critically Endangered (CR).

Key words: Atlantic Forest, endemism, taxonomy

Resumo

Neste trabalho é descrita *Bertolonia lucernula*, uma nova espécie endêmica do estado do Espírito Santo, Brasil. A espécie é encontrada somente na Área de Proteção Ambiental Mestre Álvaro, no município de Serra. *Bertolonia lucernula* é caracterizada pelos ramos e pecíolos recobertos por glândulas sésseis ou curto pediceladas e tricomas simples esparsos, lâmina foliar plana, recoberta somente por glândulas sésseis e curto pediceladas, flores pequenas com o hipanto largamente campanulado, recoberto por tricomas semelhantes aos dos pecíolos, cálice com sépalas membranáceas truncadas e dentes externos curtos e triangulares, pétalas assimétricas, obovadas, com o ápice revestido por glandulas sésseis e curto pediceladas na face adaxial. De acordo com os critérios da IUCN, *Bertolonia lucernula* deve ser classificada com Criticamente em Perigo (CR).

Palavras-chave: Endemismo, Mata Atlântica, taxonomy

Introduction

Melastomataceae are a monophyletic family recognized mainly by the acrodromous leaves (*sensu* Hickey 1973), bisexual, radial and diplostemonous flowers with well-developed hypanthia and stamens with enlarged and usually appendaged connectives (Clausing & Renner 2001). Melastomataceae have a pantropical distribution, but they are more diverse in the Neotropics (Renner 1993). The family is represented by 556 species in the Atlantic Forest biome of Brazil, from which 395 (ca. 71%) are endemic to this region (Flora do Brasil 2020 under construction). Several taxonomic studies on this family have been recently conducted in the Atlantic Forest, mainly in its central and northern regions. In the state of Espírito Santo, treatments were carried out for Melastomataceae in the "Estação Biológica de Santa Lúcia" (Goldenberg & Reginato 2006), "Parque Estadual do Forno Grande" (Meirelles & Goldenberg 2012) and in the "Área de Proteção Ambiental Mestre Álvaro" (Iglesias *et al*. 2017), and also state Floras for *Miconia* Ruiz & Pav. (1794: 60; Bacci *et al*. 2016a), Cambessedesieae (Bochorny *et al.* 2019: 296; Bochorny & Goldenberg 2017) and

Accepted by Lucas Majure: 4 Sept. 2020; published: 21 Sept. 2020

Bertolonia Raddi (1820: 384; Bacci *et al*. 2017). Additionally, a vast number of new species from different lineages within the family were recently described for the state.

Bertolonia stands out as the Neotropical lineage of Melastomataceae with the highest proportion of newly described species in this century (14 out of a total of 31 spp.). The genus is endemic and widely distributed in the Atlantic Forest (Bacci *et al.* 2018), ranging from the states of Santa Catarina (to the south) to Pernambuco (to the north; Flora do Brasil 2020 under construction). Its species are small, perennial herbs that usually inhabit moist and shaded areas (Baumgratz 1990), although with species reaching drier areas in Deciduous Seasonal Forest introgressions within the Caatinga in Bahia (Bacci 2019; Bisewski *et al*. 2020). Species of *Bertolonia* usually grow on forest litter, but also on rocks or shallow soils, on decaying logs or as epiphytes on the base of tree trunks, and frequently the bases of tree ferns (Bacci *et al.* 2016b). The plants are usually glandulose-punctate but may be covered or not with other types of trichomes (Baumgratz 1990). They are also characterized by scorpioid inflorescences and triquetrous capsules, also known as bertolonidia (following Baumgratz 1983–1985).

Most of the recently described species of *Bertolonia* are endemic to the central and northern regions of the Atlantic Forest (Baumgratz *et al.* 2011; Bacci *et al.* 2016b, 2016c, 2017, 2018), with only one described from its southern portion (Silva-Gonçalves *et al.* 2016). Besides increasing the number of species, these discoveries have changed our knowledge regarding distribution and morphology of the genus. Until the last revision for *Bertolonia* (Baumgratz 1990), the genus was regarded as more diverse in southern Atlantic Forest (mainly in the states of Paraná and Rio de Janeiro), with few species occurring in the northern Atlantic Forest. Most species were known to have flowers with white petals and yellow stamens, with a few exceptions with pink petals and cream-colored stamens. Bacci *et al.* (2018) noticed a shift in our knowledge about patterns of diversity in the genus, from the southern to the northern Atlantic Forest, and indicated the central region of Espírito Santo as an important diversity center. Furthermore, they showed that the flowers with pink petals and cream-colored stamens were much more common than expected. From the 14 new species described for the genus in the 21th century, four occur in Espírito Santo: *B. duasbocaensis* Bacci & Goldenberg in Bacci *et al*. (2016b: 3) and *B. macrocalyx* Bacci & Goldenberg in Bacci *et al*. (2016b: 8) are endemic to one or a few localities in the metropolitan region of Vitória (the capital of the state), while *B. ruschiana* Bacci & R. Goldenb. in Bacci *et al*. (2016b: 12) and *B. michelangeliana* Bacci & R. Goldenb. in Bacci *et al*. (2017: 1670) are widespread along the mountainous region in central Espírito Santo.

Despite all recent discoveries, there are probably different and interesting species of *Bertolonia* to be described in the central and northern Atlantic Forest. During a survey of Melastomataceae in the "Área de Proteção Ambiental Mestre Álvaro", in the municipality of Serra, Espírito Santo (Iglesias *et al*. 2017), one species of *Bertolonia* was tentatively determined as *B. ruschiana*. Further studies and sampling showed that this was actually an undescribed species, endemic to this protected area. We describe here this new species and provide comparisons with closely related species, information about distribution and conservation status, and images of living and dry specimens.

Methods

Specimens were collected and processed following the traditional procedures for botanical specimens (Mori *et al.* 1989). The study was based on literature, analysis of specimens of *Bertolonia* from the herbaria UPCB and VIES (acronyms according to Thiers 2020) and living plants found during field trips to Espírito Santo, Brazil. Conservation status assessment was based on geographic range size (criterion B2) and very small or restricted populations (criterion D, according to IUCN (2014). The Area of Occupancy (AOO) was calculated through the GeoCAT tool (Bachman *et al*. 2011).

Taxonomy

Bertolonia lucernula Bacci, D.T. Iglesias & R. Goldenb. *sp. nov.* (Figs. 1, 2)

Diagnosis: *Bertolonia lucernula* is most similar to *B. duasbocaensis*, as both have ovate to elliptic leaves with flat surfaces, usually short petioles covered with sessile and short-stalked glands along with scattered unbranched trichomes. They also share flowers with white petals with a pinkish apex covered with sessile and short-stalked glands, and yellow isomorphic stamens with undulate thecae, which are dehiscent through an apical and introrse pore. *Bertolonia lucernula* differs from *B. duasbocaensis* mainly by the shorter hypanthium (1.2–1.6 mm long) covered with short-stalked glands and also unbranched trichomes, these distributed throughout its

surface (vs. longer, 2.5–2.7 mm hypanthium, covered with short-stalked glands and sometimes also by a few unbranched trichomes, these distributed only on the upper half of the hypanthium in *B. duasbocaensis*) and the shorter (7.5–8.5 mm) but wider (5–6 mm) obovate petals with a truncate base (vs. longer (10.8–12 mm) but narrower (4.5–5 mm) elliptic petals with a slightly attenuate base).

Type:—BRAZIL. Espírito Santo: Mun. Serra, Área de Proteção Ambiental Mestre Álvaro, 20°10'8"S 40°18'45"W, 730 m elev., 28 December 2016 (fl., fr), *R. Goldenberg, D. T. Iglesias & D. V. Goldenberg 2255* (holotype: UPCB 0030602; isotype: NY 03287738).

Herbs 7–50 cm tall, terrestrial; adventitious roots branched, growing from several points along the stem, but larger next to its base; stem 2.2–6 mm thick, terete and slightly costate, the older portions plagiotropic, aphyllous, the young ones erect and bearing leaves. Branches, leaves, inflorescences, pedicels, hypanthia and calyces with sparse to dense, sessile and short-stalked (then less than 0.1 mm long) glands, branches and petioles also with scattered unbranched trichomes (ca. 0.5 mm long), these also moderately covering the hypanthia. Leaves opposite, occasionally subopposite; petioles 0.9–11.2 cm long, quadrangular, costate; blade 7.9–18 × 4.7–10.5 cm, flat, ovate, chartaceous, base cordate, apex acute or seldom round, margins crenulate and sparsely ciliate, adaxial surface dark-green, covered with sessile glands, abaxial surface light-green or lilac, covered with sessile and short-stalked glands, acrodromous veins five, plus a shorter marginal pair that do not reach the leaf apex, basal. Inflorescences thyrsoid, 5.2–14 cm long, terminal (but pseudo-lateral in older, fruiting specimens), with one pair of paraclades, these cymose, scorpioid, the branches pinkish to light-brownish; bracteoles ca. 0.5 mm long, narrowly triangular to linear, apex acute, both surfaces covered only with sessile glands. Flowers 5-merous, 6.5–7 mm long, on pedicels ca. 1 mm long, densely covered with sessile and short-stalked glands. Hypanthium pinkish to brownish, 1.2–1.6 × 2–2.5 mm, widely campanulate, 10-costate, covered with sessile and short-stalked glands and also sparse, unbranched, eglandular trichomes ca. 0.2 mm long. Calyx caducous in fruit, sepals ca. 1 mm long, membranaceous, truncate, margins entire, both surfaces covered with sessile and short-stalked glands, external teeth ca. 0.7 mm long, light pink, triangular, slightly concave to sometimes cucullate. Petals white, with a light-pink apex, 7.5–8.5 × 5–6 mm, asymmetric, obovate, membranaceous, base truncate, apex acute and apiculate, lacking a trichome on its tip, margins entire, both surfaces papillose, adaxial surface also covered with sparse sessile and short-stalked glands at the apex. Stamens 10, 5.5–8 mm long, isomorphic; filaments 3–4 mm long, papillose, slightly widened at the base; thecae yellow, 2.5–3.5 mm long, oblong-subulate, undulate, pore apical, introrse; connective prolonged 0.7–0.9 mm below the thecae, dorsally thickened (0.3–0.5 mm long). Ovary free, apex glabrous, 3-locular, placentation axillary; style 4.5–5.5 mm long, curved at the apex, glabrous; stigma slightly capitate, papillose. Capsules obtriquetrous (bertolonidium-type, following Baumgratz 1983–1985), 4.5–7 × 5.5–7.5 mm; seeds not seen.

Distribution, ecology and phenology:—The five known specimens of *Bertolonia lucernula* have been collected in the last decade, all of them in the "Área de Proteção Ambiental Mestre Álvaro" (APAMA). The APAMA is an important conservation unit located within the metropolitan region of Vitória, in the municipality of Serra, Espírito Santo. It has an area of 3,470 ha, and reaches 833 m in elevation, mostly covered with Atlantic Rainforest known as "Floresta Ombrófila Densa Submontana/Montana" following the official Brazilian system (Veloso *et al*. 1991), and also extensive rupiculous vegetation on high rocky outcrop areas (Costa *et al.* 2013). New species endemic to the APAMA have been recently described, such as *Behuria mestrealvarensis* Iglesias & Goldenberg (2016: 281; now *Huberia mestrealvarensis* (Iglesias & Goldenberg) Bochorny & Michelangeli in Bochorny *et al.* 2019) and *Anthurium angustifolium* Valadares & Sakuragui (2014: 31). The specimens are terrestrial herbs that inhabit shaded places in the understory layer of the rainforest, at ca. 700 m elev., and very close to the top of the mountain. This area is known as "Vale da Jararaca", a small valley surrounded by exposed rock slopes, therefore, a soil deposition area that enabled the establishment of a montane rainforest surrounded by low vegetation (>1m tall) on the adjacent slopes. Flowers were documented in December and January, and fruits in February, April, and September.

Conservation status:—This species was collected only in a small forest patch (>1 km²) inside a partially protected area (APAMA), which means that small-scale agriculture activities and cattle breeding are allowed in the area that in turn may lead to forest fragmentation. According to the IUCN criteria B2 (AOO: 4 km²) and D (very small or restricted populations), *B. lucernula* should be classified as Critically Endangered (CR).

Etymology:—The epithet "*lucernula*" refers to the shape of the flower after anthesis, when the petals close and persist on the short hypanthium, the whole structure resembling a small lamp on a minute nozzle.

Paratypes:—BRAZIL. Espírito Santo: Mun. Serra, Área de Proteção Ambiental Mestre Álvaro, 20°10'8"S 40°18'45"W, 25 April 2010 (fr.), *V.B. Sarnaglia Júnior 279* (VIES); ibid, 24 Feb 2013 (fr.), *D.T. Iglesias & W.C. Cardoso 94* (VIES); ibid, 15 Jan 2014 (fl.), *D.T. Iglesias & A.D. Firmino 167*, *168* (VIES).

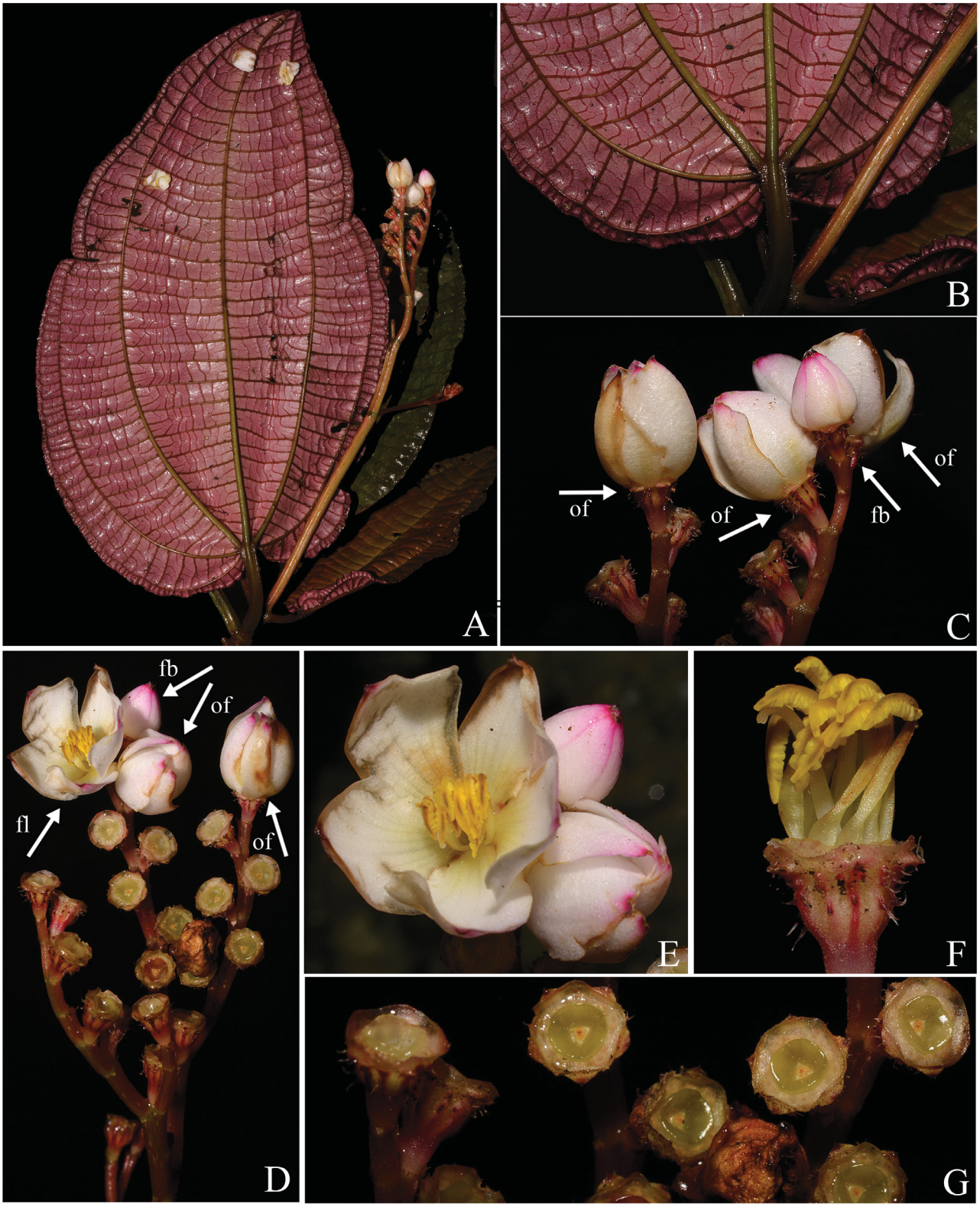

FIGURE 1. Photographic plate of ***Bertolonia lucernula***. (A) Leaves and inflorescence. (B) Leaf base, abaxial surface. (C) Apex of an inflorescence with flower buds (fb) and old flowers (of). (D) Inflorescence showing flower buds (fb), open (fl) and old flowers (of), and young fruits. (E) Flowers and flower bud. (F) Flower, petals removed, showing the stamens. (G) Young fruits. Photos by R. Goldenberg based on *Goldenberg et al. 2255* (UPCB).

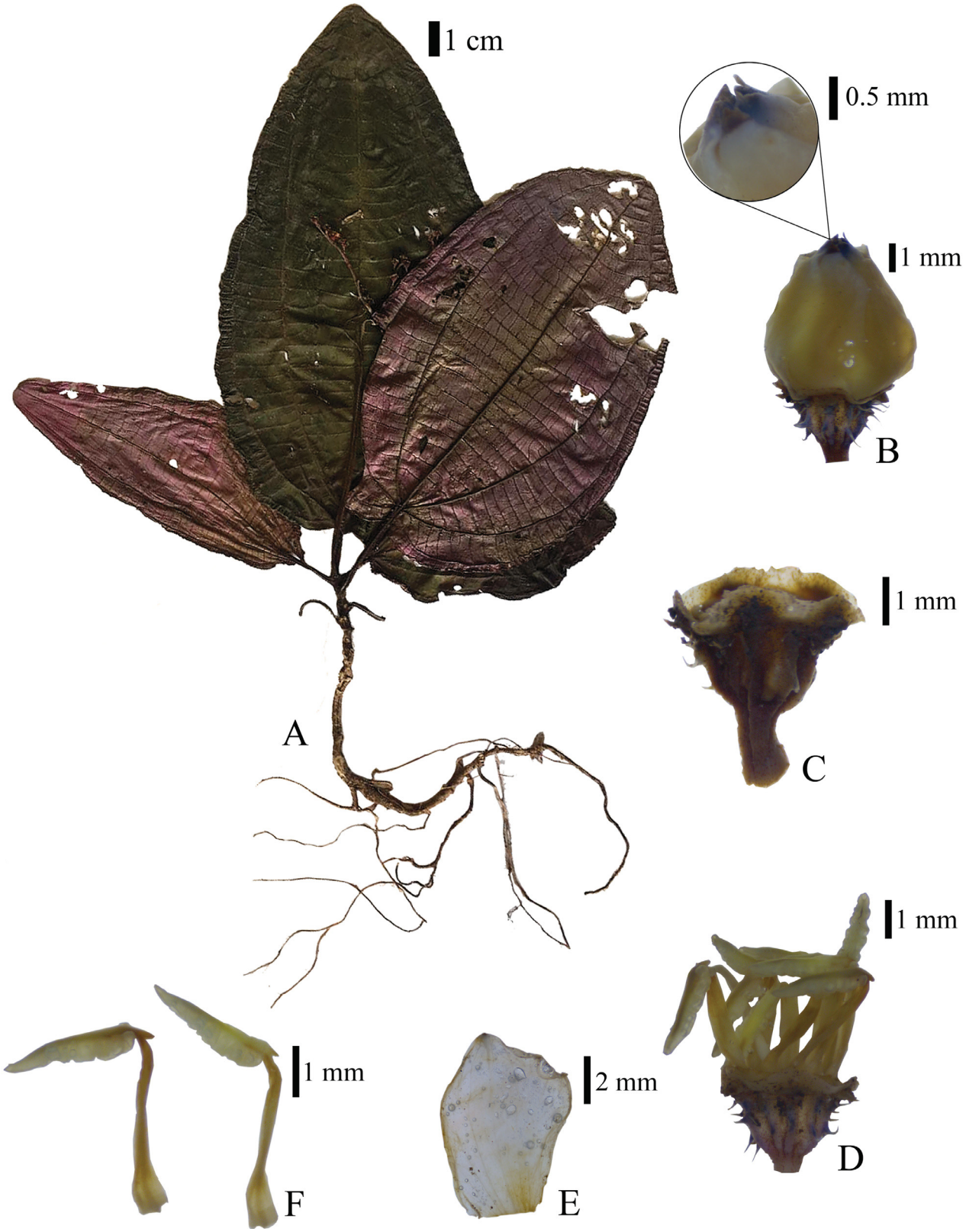

FIGURE 2. Plate of ***Bertolonia lucernula***. (A) Young branch with inflorescence. (B) Flower bud with a detail of the acute and apiculate apex of the petals. (C) Hypanthium and calyx. (D) Flower, petals removed. (E) Abaxial surface of the petal. (F) Stamens. All photos based on *Goldenberg et al. 2255* (UPCB).

Bertolonia lucernula is characterized by the branches and petioles covered with sessile and short-stalked glands and scattered unbranched trichomes, flat leaf blade surfaces covered only with sessile and short-stalked glands, small flowers with a widely campanulate hypanthium covered with the same trichomes as the petioles, persistent calyx with membranaceous sepals and triangular external teeth, asymmetric, obovate petals with the apex covered with sessile and short-stalked glands on the adaxial surface. Moreover, interesting information regarding its flowers is that after anthesis, the petals return to the same position as in the buds, resulting in a globose shape, a bit wider and more loosely arranged than in the buds (Fig. 1). This feature is not very common in Melastomataceae, where the petals usually fall right after anthesis, but it seems to be quite frequent in *Bertolonia*, probably related to spontaneous self-pollination (L. S. Passos pers. comm.).

Following the identification key of *Bertolonia* species in Espírito Santo (Bacci *et al*. 2017), *Bertolonia lucernula* should be placed together with *B. ruschiana*, *B. duasbocaensis* and *B. macrocalyx*. Iglesias *et al.* (2017) suspected that the material collected on Mestre Álvaro was a new species but ended up considering it as belonging to *B. ruschiana. Bertolonia duasbocaensis* and *B. macrocalyx* share with the new species the flat leaf surfaces covered with only sessile and short-stalked glands; both species occur near the only population found for the new species, in the "Reserva Biológica de Duas Bocas" and surroundings (Bacci *et al.* 2016b); this area (Duas Bocas) is actually part of the "Corredor Ecológico Duas Bocas – Mestre Álvaro" (Costa *et al.* 2013), which is an ecological corridor composed by several forest fragments (inside or outside conservation units) that connects both APAMA and the "Reserva Biológica de Duas Bocas" (Coelho & Lovate 2018). A morphological comparison among these species is presented in Table 1.

Bertolonia lucernula has been included in a phylogenetic analysis for the genus (Bacci *et al.* 2020), as *Bertolonia sp*. 2. It was recovered in a clade mainly with species that occur in Espírito Santo; it is closely related to *B. ruschiana* and *B. wurdackiana* Baumgratz (1990: 125), although with low support values, but not directly related to *B. duasbocaensis* and *B. macrocalyx* (Bacci *et al.* 2020). Despite the close relationship recovered in these analyses, the new species is easily distinguished from *B. wurdackiana* mainly by the flat leaf blade surfaces (vs. bullate/foveolate in *B. wurdackiana*), covered only with sessile and short-stalked glands (vs. also covered with unbranched trichomes) and sepals with entire margins (vs. sepals with fimbriate margins).

TABLE 1. Comparative table of species morphologically similar to *B. lucernula*, all from the state of Espírito Santo. Unbranch. trich. = unbranched trichomes; consist. = consistence; memb. = membranaceous.

Species/characters	Petioles with unbranch. trich.	Hypanhtium length (mm)	Hypanthium with unbranch. trich.	Calyx ext. teeth length, shape	Petals size (mm)	Petals consist., shape	Petals base	Petals apex
B. duasbocaensis	Yes	2.5–2.7	Yes	ca. 1 mm, triangular	10.8–12 × 4.5–5	Memb., elliptic	Slightly attenuate	Acute and apiculate
B. lucernula	Yes	1.2–1.6	Yes	ca. 0.7 mm, triangular	7.5–8.5 × 5–6	Memb., ovate	Truncate	Acute and apiculate
B. macrocalyx	No	2.5–2.7	Yes	2 mm, ovate	7–8.5 × 3–3.5	Memb., elliptic	Slightly attenuate	Acute and apiculate
B. ruschiana	No	2–2.5	No	0.5–0.7 mm, triangular	6–6.5 × 5.7–6	Fleshy, widely obovate	Slightly attenuate	Round to obcordate

Acknowledgements

We thank Fundação de Amparo a Pesquisa do Espírito Santo (FAPES, Processo 57226334/12) for financial support, CNPq/Brazil for the "Produtividade em Pesquisa" grant for RG (CNPq#308065/2017-4) and a Post-Doc grant for LFB (CNPq#150836/2019-8). We also thank Lucas Majure and two anonymous reviewers for suggestions on the original manuscript.

References

Bacci, L.F. (2019) *Unveiling the molecular phylogenetics of Bertolonieae s.l. (Melastomataceae) with emphasis on the biogeography and evolution of Bertolonia*. Universidade Estadual de Campinas, Ph.D. thesis, Campinas, pp. 265

Bacci, L.F., Caddah, M.K. & Goldenberg, R. (2016a) The genus *Miconia* (Melastomataceae) in Espírito Santo, Brazil. *Phytotaxa* 271 (1): 1–92.
http://dx.doi.org/10.11646/phytotaxa.271.1.1

Bacci, L.F., Amorim, A.M. & Goldenberg, R. (2016b) Three new species of *Bertolonia* (Melastomataceae) from Espírito Santo, Brazil. *PeerJ* 4: e2822.
http://dx.doi.org/10.7717/peerj.2822

Bacci, L.F., Amorim, A.M., Michelangeli, F.A. & Goldenberg, R. (2016c) A new species of *Bertolonia* (Melastomataceae) from southern Bahia, Brazil. *Phytotaxa* 265 (3): 251–258.
http://dx.doi.org/10.11646/phytotaxa.265.3.5

Bacci, L.F., Amorim, A.M. & Goldenberg, R. (2017) Flora do Espírito Santo: *Bertolonia* (Melastomataceae). *Rodriguésia* 68 (5): 1663–1676.
http://dx.doi.org/10.1590/2175-7860201768510

Bacci, L.F., Amorim, A.M., Michelangeli, F.A. & Goldenberg, R. (2018) Increased sampling in under-collected areas sheds new light on the diversity and distribution of *Bertolonia*, an Atlantic Forest endemic genus. *Systematic Botany* 43 (3): 767–792.
http://dx.doi.org/10.1600/036364418X697490

Bacci, L.F., Amorim, A.M., Michelangeli, F.A. & Goldenberg, R. (2020) Flower morphology is correlated with distribution and phylogeny in *Bertolonia* (Melastomataceae), an herbaceous genus endemic to the Atlantic Forest. *Molecular Phylogenetics and Evolution* 149: 106844.
https://doi.org/10.1016/j.ympev.2020.106844

Bachman, S., Moat, J., Hill, A.W., De la Torre, J. & Scott, B. (2011) Supporting Red List threat assessments with GeoCAT: geospatial conservation assessment tool. *Zookeys* 150: 117–126.
http://dx.doi.org/10.3897/zookeys.150.2109

Baumgratz, J.F.A. (1983–1985) Morfologia dos frutos e sementes de Melastomataceas brasileiras. *Arquivos do Jardim Botânico do Rio de Janeiro* 27: 113–155.

Baumgratz, J.F.A. (1990) O gênero *Bertolonia* Raddi (Melastomataceae): revisão taxonômica e considerações anatômicas. *Arquivos do Jardim Botânico do Rio de Janeiro* 30: 69–213

Baumgratz, J.F.A., Amorim, A.M. & Jardim, A.B. (2011) Two new species of *Bertolonia* (Melastomataceae) from the Brazilian Atlantic Forest. *Kew Bulletin* 66: 273–279.
http://dx.doi.org/10.1007/s12225-011-9281-0.

Bisewski, G.C.A., Bacci, L.F., Amorim, A.M. & Goldenberg, R. (2020) Novelties in Bertolonia (Melastomataceae) from northeastern Brazil. Brazilian Journal of Botany 43: 563-574.
https://doi.org/10.1007/s40415-020-00630-7

Bochorny, T. & Goldenberg, R. (2017) Flora do Espírito Santo: clado de *Merianthera* e gêneros afins (Melastomataceae). *Rodriguésia* 68 (5): 1677–1692.
http://dx.doi.org/10.1590/2175-7860201768511

Bochorny, T., Michelangeli, F.A., Almeda, F. & Goldenberg, R. (2019) Phylogenetics, morphology and circumscription of Cambessedesieae: a new Netropical tribe of Melastomataceae. *Botanical Journal of the Linnean Society* 190: 281–302.
https://doi.org/10.1093/botlinnean/boz018

Clausing, G. & Renner, S.S. (2001) Molecular Phylogenetics of Melastomataceae and Memecylaceae: implications for character evolution. *American Journal of Botany* 88: 486–498.
http://dx.doi.org/10.2307/2657114

Cogniaux, A.C. (1886) *Bertolonia In*: Martius, C.F.P. & Urban, I. (Eds.) *Flora brasiliensis*. Vol. 14. pars. 4. F. Fleischer, Lipsiae, pp. 49–58.

Coelho, A.L.N. & Lovate, T.B. (2018) Evaluation of the emerging fragility of the conservation units from the ecological corridor Duas Bocas – Mestre Álvaro – ES – Brazil. *Ciência Geográfica* XXII (1): 97–114.

Costa, C.A., Nardoto, J.P. & Bergamaschi, R.B. (2013) Geoprocessamento aplicado à fiscalização de áreas de Proteção Permanente - a prática na Área de Proteção Ambiental "Mestre Álvaro" - Serra - ES. *In:* Neckel, A. & Rosa, D.P. (Orgs.) Geoprocessamento e suas diferentes aplicabilidades. Goellner, Passo Fundo. Available from: http://www.editoragoellner.com.br/livros_publicados/ciencias_exatas_e_da_terra/geoprocessamento_W.pdf (accessed 14 April 2020)

Flora do Brasil (2020 under construction). Jardim Botânico do Rio de Janeiro. Available from: http://floradobrasil.jbrj.gov.br/ (accessed 6 March 2020)

Goldenberg, R. & Reginato, M. (2006) Sinopse da família Melastomataceae na Estação Biológica de Santa Lúcia, Santa Teresa, Espírito Santo. *Boletim do Museu de Biologia Mello Leitão* 20: 33–58.

Hickey, L.J. (1973) Classification of the architecture of dicotyledonous leaves. *American Journal of Botany* 60 (1): 17–33. http://dx.doi.org/10.2307/2441319

IUCN Standards and Petitions Subcommittee (2014) *Guidelines for Using the IUCN Red List Categories and Criteria*. Version 11 (February 2014). Prepared by the IUCN species survival commission. IUCN Council, Gland, Switzerland and Cambridge, UK, 87 pp. Available from: http://www.iucnredlist.org/documents/RedListGuidelines.pdf (accessed 4 March 2020)

Iglesias, D.T. & Dutra, V.F. (2017) Melastomataceae na Área de Proteção Ambiental Mestre Álvaro, Serra, Espírito Santo, Brasil. *Rodriguésia* 68 (5): 1921–1937. http://dx.doi.org/10.1590/2175-7860201768524

Iglesias, D.T., Dutra, V.F. & Goldenberg, R. (2016) *Behuria mestrealvarensis* (Melastomataceae): a new species on an inselberg in Espírito Santo, Brazil. *Phytotaxa* 255 (3): 281–286. http://dx.doi.org/10.11646/phytotaxa.255.3.10

Meirelles, J. & Goldenberg, R. (2012) Melastomataceae do Parque Estadual do Forno Grande, Espírito Santo, Brasil. *Rodriguésia* 63: 831–855. http://dx.doi.org/10.1590/S2175-78602012000400008

Mori, A.S., Silva, L.A.M., Lisboa, G. & Coradin, L. (1989) *Manual de manejo de herbário fanerogâmico*. Centro de Pesquisas do Cacau, Ilhéus, 103 pp.

Raddi, G. (1820) Quaranta piante nuove del Brasile. *Memoria di Matematica e Fisica della Societa Italiana Del Scienze residente in Modena* 18: 382–414.

Renner, S.S. (1993) Phylogeny and classification of the Melastomataceae and Memecylaceae. *Nordic Journal of Botany* 13: 519–540.

Silva-Gonçalves, K.C., Baumgratz, J.F.A. & Amorim, A.M. (2016) A new species of *Bertolonia* (Melastomataceae) from the southeastern Brazilian Atlantic Forest. *Phytotaxa* 273 (2): 115–121. http://dx.doi.org/10.11646/phytotaxa.273.2.2

Thiers, B. (2020) Index herbariorum: a global directory of public herbaria and associated staff. New York Botanical Garden's Virtual Herbarium. Available from: http://sciweb.nybg.org/science2/IndexHerbariorum.asp (accessed 4 March 2020)

Valadares, R.T. & Sakuragui, C.M. (2014) A new species of *Anthurium* (Araceae) sect. *Urospadix* subsect. *Obscureviridia* from Espírito Santo, Eastern Brazil. *Systematic Botany* 39 (1): 31–35. https://doi.org/10.1600/036364414X678161

Veloso, H.P., Rangel-Filho, A.L.R. & Lima, J.C.A. (1991) *Classificação da vegetação brasileira, adaptada a um sistema universal*. IBGE. Rio de Janeiro, 124 pp.