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A new species of *Bertolonia* (Melastomataceae) from the Southeastern Brazilian Atlantic Forest

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Abstract

A new species of *Bertolonia* (Melastomataceae; Bertolonieae) endemic to the Brazilian Atlantic Forest is described and illustrated. *Bertolonia organensis* is known from only one locality in the Serra dos Órgãos National Park, state of Rio de Janeiro. The main diagnostic characteristics that distinguish *B. organensis* are the leaves with bullate adaxial surface and foveolate abaxial surface, cordate base and seven acrodromous veins, petiole and hypanthium glandulose-punctate, setulose and setulose-glandulose, the external calyx lobes erect, thick, narrow-triangular, apex acuminate-glandulose, margin entire, not ciliate, and the anthers connective dorsally appendaged, trilobed or with an acute calcar. Comparisons with similar species, geographic distribution and habitat are presented for the new species, as well as a key to identify all *Bertolonia* taxa known from the state of Rio de Janeiro. *Bertolonia organensis* is classified as Critically Endangered (CR).

Key Words: *Bertolonieae*, conservation, endemism, Rio de Janeiro

Introduction

Bertolonia Raddi (1820: 384) is a Neotropical genus occurring in tropical, subtropical and temperate regions, with most of the taxa (19 species and one variety) restricted to the Brazilian Atlantic Forest Biome; two species are endemic to Venezuela (Baumgratz 1990; Berry 2001; Baumgratz 2010; Baumgratz *et al.* 2011; Bacci *et al*. 2016). In Brazil, the genus is restricted to the Atlantic Forest, and it has 10 species and one variety endemic to the southeastern portion of Brazil, in the states of Espírito Santo, Minas Gerais, Rio de Janeiro and São Paulo (Baumgratz *et al*. 2010; Flora do Brasil 2020). The state of Rio de Janeiro has the highest *Bertolonia* taxa concentration (7 spp. and 1 var.; 47% of the total), which are recorded only in Atlantic Rain Forest (*Floresta Ombrófila Densa*, according to Veloso *et al.* 1991), between 230 and 1.150 m, generally near watercourses, hollows and rocky cliffs and humid and shady areas. They grow directly on rocks, on humus and shallow soils on rocks or as epiphytes on the trunks of tree ferns ("samambaiaçus") (Baumgratz 1990; Baumgratz *et al.* 2011).

Species of *Bertolonia* are perennial herbs that may be erect, prostate or decumbent, rarely creeping, and are usually terrestrial, sometimes epiphytic or rupicolous, with glandulose-punctate or also with other types of indumenta, rarely glabrous. The leaves are generally opposite or occasionally alternate, sometimes apparently in a rosette due to the short stem. The blades have 3-9 acrodromous, basal veins, rarely suprabasal. The inflorescences are frequently scorpioid cymes, with pedicellate, 5-merous flowers, white, pink or lilac petals, and anthers generally uniporose, dorsally appendaged or rarely unappendaged. The fruit is an obtriquetrous, *bertolonidium*-type capsule, with seeds usually rostrate at the apex, obovate to clavate and tuberculate (Baumgratz 1985, 1990; Baumgratz *et al.* 2011).

Recent studies of Melastomataceae in the Serra dos Órgãos range (Baumgratz *et al.* 2014; Silva-Gonçalves 2016), and based on the monographic revision of *Bertolonia* by Baumgratz (1990), have revealed a new species of *Bertolonia* that is endemic to Rio de Janeiro state and to the Brazilian Atlantic Forest. We describe and illustrate here the new

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species, and provide comments on its diagnostic characteristics, taxonomic affinities, geographic distribution and conservation status. We also provide an identification key to the species and varieties of *Bertolonia* in Rio de Janeiro. The results presented are also based on the analysis of several collections of *Bertolonia*, along with digital images of types available from BR, CEPEC, G, K, NY, P, R, RB, RBR and US (acronyms, according to Thiers 2015). All specimens were analyzed using a Leica MZ75 stereomicroscope (Leica Microsystems, Wetzlar, Germany).

Results

Taxonomic Treatment

Bertolonia organensis Baumgratz, Gonçalves-Silva & Nunes-Freitas *sp. nov.* (Figures 1–2)

Bertolonia organensis closely resembles *B. carmoi* Baumgratz (1990: 120), *B. maculata* DC. (1828: 114) and *B. marmorata* (Naudin 1848: 382) Naudin (1851: 318), due to the size, cordate base and variegated adaxial surface of the leaves and the dorsally appendaged connectives. However, the latter are distinguished mainly by the leaves with 3-5 acrodromous veins and the membranaceous, oblong, obovate or ovate calyx lobes, with a rounded, obtuse or truncate apex and ciliate-glandulose margins.

Type:—BRAZIL. Rio de Janeiro: mun. Magé, Distrito de Santo Aleixo, Parque Nacional da Serra dos Órgãos, trilha da Cachoeira Grande, após o reservatório da CEDAE, em Floresta Ombrófila Densa Submontana alterada, 22°34'23"S, 43°07'49"W, 236 m, local úmido, com solo argiloso, humoso e sombreado, January 2012, fl., fr., *Baumgratz et al.* 1187-A (holotype RB!).

Herbs 5–15 cm tall, terrestrial, prostrate; indumentum of the stem, leaves, inflorescences, bracts, bracteoles, hypanthium and calyx glandulose-punctate and sparsely setulose and setulose-glandulose, glandular head caducous or not; adventitious roots along the stem, mainly at its basal portion, short to long, branched; stem 0.9–2.5 cm long, usually single, subterete. **Leaves** opposite, apparently in a rosette due to the short stem; petiole 0.8–5.9 cm long, vinous, semi-terete; lamina 2.8–13 × 2.7–10 cm, discolor, adaxial surface variegated, with dark green to vinous bands along the acrodromous veins or green, abaxial surface vinous, bullate and shiny on adaxial surface, foveolate on abaxial surface, rigid-membranaceous, elliptic to ovate, base cordate, apex acute to obtuse, margin sparsely serrate-ciliate; veins 7, acrodromous basal; domatia axilar-primary on the abaxial surface, marsupiform, inconspicuous. **Inflorescences** ca. 6 cm long (5–12.5 cm long in fruiting), scorpioid cymes or dichasia of scorpioid cymes, vinous, terminal (pseudo-axillary in late fruiting), peduncle ca. 1.2 cm long, rachis ca. 4.8 cm long (4.7–7 cm long in fruiting), tetragonal; bracts 2.9–3.5 × 0.5–0.9 mm, bracteoles 1.5–1.8 × 0.3–0.4 mm, both narrow-triangular, apex acuminate-glandulose, persistent or late caducous. **Flowers** 5-merous, 13.5–15.8 mm long; pedicel ca. 1.3 mm long; hypanthium ca. 2.5 × 3 mm, thick, shortly tubulose, caducous in fruiting; inner torus glabrous; calyx 1.2–1.3 mm long, thick, caducous in fruiting, tube 0.4–0.5 mm long, external lobes 1.8–1.9 × 1.2–1.3 mm, erect, narrow-triangular, apex acuminate-glandulose, margin entire, not ciliate, with three vascular bundles, internal lobes inconspicuous, reduced to a lightly sinuate sheath ca. 0.1 mm long, membranaceous; petals 10–12 × 6–6.5 mm, light pink, patent, obovate-asymmetric, apex acute and apiculate-glandulose with 1-2 unbranched trichomes, margin entire, glabrous; stamens 10, subequal in size and shape, anthers narrow-triangular, thecae undulate, connective not prolonged below thecae, dorsally appendaged, pore terminal-ventral, antesepalous 6.1–7.5 mm long, with filaments 3.5–4.5 mm long, anthers 2.7–3 × 0.5–0.6 mm, appendage trilobate, lateral lobes larger (0.3–0.4 mm long) than the median lobe (0.2–0.25 mm long), acute to obtuse, antepetalous 5.5–6.1 mm long, with filaments 3–3.5 mm long, anthers 2.5–2.6 × 0.5–0.6 mm, appendage 0.4–0.6 mm long, acute calcar; ovary 2–2.1 × 2.2–2.3 mm, free inside the hypanthium, oblong, 3-celled, apex lobulate, thick, glabrous; style ca. 6 mm long, terete, slightly curved at the apex, stigma capitate. **Fruits** capsular, *bertolonidium* type, 4–6 × 5.5–6.6 mm, obtriquetrous, polispermic; placenta linear-subulate, lightly verrucose; seeds 0.4–0.5 × 0.3–0.6 mm, clavate or obovate to triangular, rostrate at the apex, rostrum 0.1–0.2 mm long, horizontal to erect, tuberculate at the dorsal angles and apex.

Material Examined:—BRAZIL, Rio de Janeiro: mun. Magé, Distrito de Santo Aleixo, Parque Nacional da Serra dos Órgãos, trilha da Cachoeira Grande, após o reservatório da CEDAE, em Floresta Ombrófila Densa Submontana alterada, local úmido, humoso e sombreado; 22°34'23"S; 43°7'49"W; 236 m alt., Nov. 2011, fr., *J.F.A. Baumgratz et al.* 1186, 1187 (RB); 24 Mar 2011, fr., L.A.F. Santos Filho *et al*. 178, 179, 180, 181 (RB).

Etymology:—The epithet "*organensis*" refers to the name of the national park where the species occurs.

FIGURE 1. ***Bertolonia organensis*** Baumgratz, Gonçalves-Silva & Nunes-Freitas: a–b. habit and infructescences; c. detail of the abaxial leaf blade, stem and roots; d. inflorescence with flower buds (Photos by *J. F. A. Baumgratz*).

Distribution and Habitat:—*Bertolonia organensis* is endemic to Brazil, and it was found in a single locality in southeastern Rio de Janeiro state, municipality of Magé, district of Santo Aleixo, in Serra dos Órgãos National Park, in the southeastern Serra do Mar range. It is restricted to Serra dos Órgãos, in Atlantic Rain Forest (*Floresta Ombrófila Densa Submontana*), at about 230 m elev., growing on clay soil at a shaded hillside bordering the trail, beneath a rock outcrop. The Serra dos Órgãos National Park is a Federal Conservation Unit established in 1939. It has a very rugged topography, with ca. 20.024 ha, and a wide altitudinal range (100 to 2.263 m), with the ocean side wetter than the north and west faces. The average annual temperature is between 13 and 23 °C and it is covered with dense submontane to high montane tropical rainforests (*Floresta Ombrófila Densa Submontana, Montana* and *Alto-Montana*), including high altitude grasslands (*Campos de Altitude*) (Cronemberger & Castro 2007).

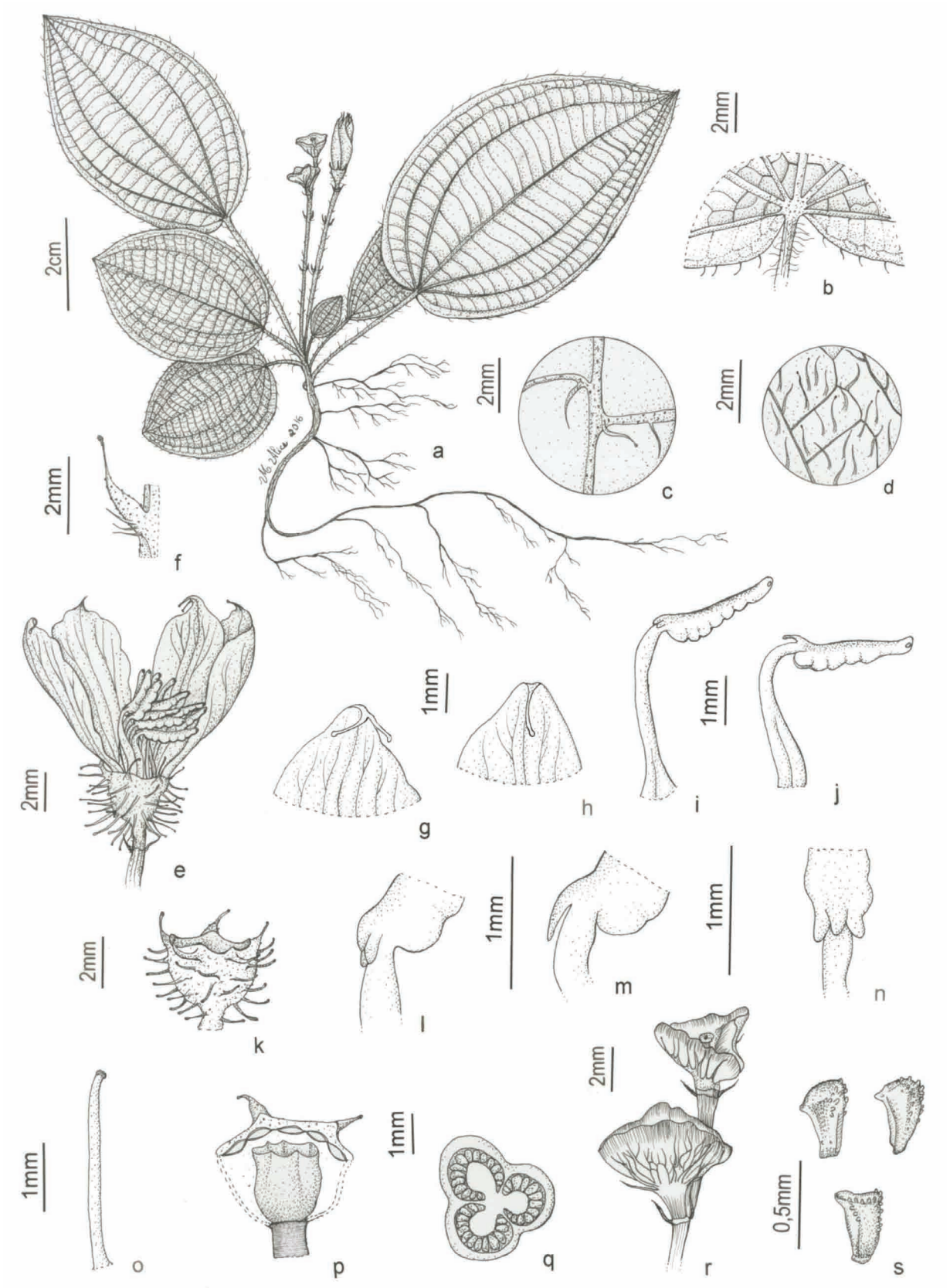

FIGURE 2. ***Bertolonia organensis*** Baumgratz, Gonçalves-Silva & Nunes-Freitas: a. habit; b. details of the petiole and acrodromous veins on the abaxial leaf surface; c–d. details of abaxial and adaxial surfaces of the leaf, respectively; e. flower; f. bracteole; g–h. details of the petal apex with two and one glandular trichomes, respectively; i. antesepalous stamen; j. antepetalous stamen; k. hypanthium and calyx; l. detail of the trilobate connective appendage of the antesepalous stamen, lateral view; m. detail of the calcar on the connective of the antepetalous stamen, lateral view; n. detail of the trilobate connective appendage of the antesepalous stamen, dorsal view; o. style; p. ovary free inside the hypanthium; q. ovary in transversal section; r. fruits and bracteoles; s. seeds (*Baumgratz* 1187-A).

Comments:—*Bertolonia organensis* is distinguished by the glandulose-punctate, sparsely setulose and setulose-glandulose indumentum, and the leaves with 7 acrodromous veins, bullate on adaxial surface. The hypanthium is shortly tubulose, and the external calyx lobes are erect, thick, narrow-triangular, with an acuminate-glandulose apex and an entire, not ciliate margin. The anthers connective is dorsally appendaged, trilobed or with an acute calcar. The stem is usually unbranched, but sometimes a branch may occur at its distal portion.

The new species is closely similar to *B. carmoi*, *B. maculata* and *B. marmorata*, which share the setulose and setulose-glandulose indumentum, variegated elliptic to ovate leaves with similar size and cordate base, and also with the connective with a short dorsal appendage. All these three species differ from *B. organensis* mainly by the leaves with 3-5 acrodromous veins, the membranaceous, oblong, obovate or ovate calyx lobes with a rounded, obtuse or truncate apex and ciliate-glandulose margins. *Bertolonia carmoi* and *B. marmorata* are restricted to northeastern Brazil: the former is endemic to Bahia state and the latter occurs in Bahia and Pernambuco states. These three species can also be distinguished from *B. organensis* by other characteristics: *Bertolonia carmoi* has longer stamens (8.2–9.5 mm), linear-falciform anthers, plane, sometimes lightly undulate thecae, and rounded to truncate connective appendages; *Bertolonia maculata* has anthers with a truncate-emarginated apex and a terminal pore, and unappendaged connectives, sometimes slightly gibbose at the base; and *Bertolonia marmorata* has shorter flowers (8–13 mm) and petals (6.5–8 mm), anthers that are clearly undulate, gibbose and calloused on the base, sometimes with an inconspicuous calcar, and the pore with convolute and thickened margins forming evident protrusions.

Bertolonia organensis also resembles *B. hoehneana* Brade (1956: 225), *B. nymphaeifolia* Raddi (1820: 384), *B. sanguinea* Saldanha ex Cogn. var. *sanguinea* (1886: 51) and *B. sanguinea* var. *santos-limae* (Brade 1956: 223) Baumgrtaz (1990: 109) in the shape and cordate base of the leaves. While *B. hoehneana* is endemic to the state of São Paulo and *B. sanguinea* var. *sanguinea* and *B. sanguinea* var. *santos-limae* endemic to Rio de Janeiro state, *B. nymphaeifolia* occurs in Minas Gerais, Rio de Janeiro and São Paulo. These taxa are distinguished from *B. organensis* by different sets of characteristics: *B. hoehneana* has leaves with 3-5 acrodromous veins, shorter flowers (10–13 mm) and petals (6.3–7.1 mm) and fleshy, widely ovate, calyx lobes with acute, not glandulose apex; *B. nymphaeifolia* has leaves with 7-9 acrodromous veins, widely campanulate hypanthia, a cupuliform corolla, external calyx lobes reduced to a membrane forming a shallow pocket-like cavity and rounded at the apex; *B. sanguinea* var. *sanguinea* and *B. sanguinea* var. *santos-limae* have widely elliptic or ovate to orbicular leaves, glandulose-punctate and hirsute petioles, cupuliform corollas, patent to reflex, widely ovate, external calyx lobes with an acute apex, and longer floral parts: hypanthium (4–6.5 mm), filaments (8–9 mm), anthers (9–10 mm) and style (12–13 mm).

Bertolonia alternifolia Baumgratz, Amorim & A.B. Jardim (2011: 273) and *Bertolonia bullata* Baumgratz, Amorim & A.B. Jardim (2011: 276) share with *B. organensis* the setose- or setulose-glandulose indumentum and leaves with a cordate base. The former species can be distinguished mainly by the alternate leaves along the stem and the latter by the leaves bullate on the adaxial surface and foveolate on abaxial surface, the exclusively glandulose-punctate indumentum of the pedicel, hypanthium and calyx, oblong bracts and bracteoles with an acute to acuminate, not glandulose apex, and shorter and wider external lobes. Furthermore, both species are endemic to southeastern Bahia state.

Three additional species, *B. formosa* Brade (1956: 224), *B. foveolata* Brade (1956: 226) and *B. wurdackiana* Baumgratz (1990: 125), all endemic to Espírito Santo state, also have leaves with a cordate base and the last two species have leaves bullate on the adaxial surface and foveolate on the abaxial surface. *Bertolonia formosa* differs from *B. organensis* by the leaves that are not bullate nor foveolate, the widely campanulate and densely villose hypanthium, and costate calyx lobes on the abaxial surface with shortly laciniate margins. *Bertolonia foveolata* can be distinguished by the villose stem, petioles and leaf adaxial surface; and *B. wurdackiana* by the tomentose stems and petioles, leaves adaxial surfaces sparsely strigose and calyx lobes with laciniate margins.

Identification key to the taxa of Bertolonia in Rio de Janeiro state

1. Leaf base cordate or cordate-lobate, sometimes subcordate ..... 2.
- Leaf base cuneate, acute, acute-decurrent, obtuse, rounded or truncate ..... 5.
2. Leaf with 7-9 acrodromous veins; hypanthium widely campanulate; calyx external lobes reduced to a membrane, forming a shallow pocket-like cavity, rounded at the apex ..... *B. nymphaeifolia*
- Leaf with 5-7 acrodromous veins; hypanthium tubulose or shortly tubulose; calyx external lobes narrow-triangular or widely ovate, thick, acute or acuminate-glandulose at the apex ..... 3.
3. Leaf adaxial surface bullate, petiole glandulose-punctate, setulose and setulose-glandulose; calyx external lobes erect, narrow-triangular, acuminate-glandulose at the apex; hypanthium ca. 2.5 mm long; filaments 3–4.5 mm long; anthers 2.5–3 mm long; style ca. 6 mm long ..... *B. organensis*
- Leaf adaxial surface flat, petiole glandulose-punctate and hirsute; calyx external lobes patent to reflex, widely ovate, acute at the

apex; hypanthium 4–6.5 mm long; filaments 8–9 mm long; anthers 9–10 mm long; style 12–13 mm long.....4.
4. Leaf with the petiole adaxial surface hirsute along 1/3-1/2 of its length, the abaxial surface of the lamina only glandulose-punctate ..... *B. sanguinea var. sanguinea*
- Leaf with the petiole adaxial surface hirsute along its entire length, the abaxial surface of the lamina glandulose-punctate and pilose on the acrodromous veins ..... *B. sanguinea var. santos-limae*
5. Stem and petiole glabrous or only glandulose-punctate.....6.
- Stem and petiole glandulose-punctate and setulose or setulose-glandulose .....7.
6. Hypanthium only glandulose-punctate, sometimes also setulose on the ribs; calyx lobes with irregularly serrate sometimes crenulate or entire margins; petals with both surfaces glabrous.....*B. leuzeana*
- Hypanthium glandulose-punctate and villose-glandulose; calyx lobes with distinctly laciniate margins; petals with both surfaces with glandular trichomes at the base ..... *B. grazielae*
7. Leaf ovate or widely elliptic, sometimes suborbicular or obovate; hypanthium campanulate; petals with both surfaces with glandular trichomes at the base; anthers apex split in two rounded lobes, biporose; style glandulose.....*B. mosenii*
- Leaf elliptic or lanceolate; hypanthium tubulose; petals with both surfaces glabrous; anthers apex entire, uniporose; style glabrous .....8.
8. Leaf with serrate and ciliate margins, and basal acrodromous veins; calyx lobes with entire margins; seeds rostrate .... *B. acuminata*
- Leaf with entire margins at its base, or these crenulate and serrate at the apex, not ciliate, and slightly suprabasal acrodromous veins; calyx lobes with serrulate margins, sometimes with teeth only at the base and entire or crenulate to the apex; seeds not rostrate .....*B. valenteana*

Conservation Status:—Critically Endangered (CR B2 ab (ii, iii) + D). *Bertolonia organensis* is endemic to one locality and has restricted distribution (AOO < 10 km²). There is one small population with less than 50 mature individuals. The main threats to conservation of the species are the historical impacts of urban and industrial development and open trails near the place of occurrence. Around 1937, the district of Santo Aleixo got the first South American fabric industry, named Fábrica Imperial. Consequently, the deforestation, the expansion of the city and pollution also arrived to this region (ICMBio, 2008). Today, the ecological tourism also represents a threat to *B. organensis*. Field expeditions exploring adjacent areas to find other subpopulations were fruitless until now. Considering the incidents threats, we estimate a continuous decline of AOO and the quality of the habitat (IUCN 2014; Rosa 2016).

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