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EUGENIA STENOCARPA (MYRTACEAE), A NEW SPECIES FROM THE ATLANTIC FOREST OF SÃO PAULO, BRAZIL, WITH A REMARKABLE FRUIT

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The new species *Eugenia stenocarpa* Valdemarin & A.Maruy. is described and illustrated. It is nested within *Eugenia* sect. *Speciosae* but is distinguished from other species in the section by the combination of its sparsely puberulent and glabrescent young twigs, revolute leaf margin with a thickened yellow edge, flowers with pubescent hypanthium, and remarkable cylindrical fruits. Images of a specimen *in situ* and of dried material are provided, as is a provisional conservation assessment and discussion of morphological similarities between *Eugenia stenocarpa* and other *Eugenia* species.

Keywords. *Eugenia* sect. *Speciosae*, fleshy fruit, Neotropics, taxonomy.
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Introduction

The family Myrtaceae Juss. is predominantly distributed in tropical and subtropical regions, with some gatherings in the Mediterranean (Biffin *et al.*, 2010; Thornhill *et al.*, 2015). It comprises 127 genera and c.6000 species (POWO, 2024). In the Brazilian Flora, Myrtaceae is one of the most speciose angiosperm families, with 29 genera and 1203 species, 796 of which are endemic to Brazil. Of these endemics, 77% occur in the Atlantic Forest (BFG, 2018, 2021; Proença *et al.*, 2024). The Neotropical species of Myrtaceae are notable for their fleshy fruits, which are an important food source for animals (Gressler *et al.*, 2006; Gomes *et al.*, 2017).

Eugenia L. is represented by c.1100 tree and shrub species worldwide and is the most species-rich Neotropical genus of Myrtaceae. It is morphologically characterised by solitary flowers or inflorescences with up to two levels of branching, generally tetramerous flowers with free calyx lobes, stamens straight in the bud, ovary with two locules, seeds attached at a single point on the septum, and embryo with fused or partially fused cotyledons (Mazine *et al.*, 2016, 2018a; Lucas *et al.*, 2019). Morphological variation can be observed in the fusion

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of calyx lobes, particularly among species of *Eugenia* sect. *Pseudeugenia* Mazine & Faria, *Eugenia* sect. *Schizocalomyrtus* (Kausel) Mattos and *Eugenia* sect. *Umbellatae* O.Berg. The number of calyx lobes in the genus is usually four but varies from four to six in *Eugenia* sect. *Hexachlamys* (O.Berg) Mazine. A higher number of branching in inflorescences (e.g. thyrse) can be observed in *Eugenia* sect. *Pilothecium* (Kiaersk.) D.Legrand. Molecular studies support the monophyly of *Eugenia*, and 11 sections are currently recognised (Mazine *et al.*, 2014, 2018a; Flickinger *et al.*, 2020).

Eugenia is the largest genus in the Brazilian flora, comprising 414 species (Mazine *et al.*, 2020), and is especially rich in the Atlantic Forest domain, where it plays an important ecological role (BFG, 2015; Lucas & Bünger, 2015; BFG, 2018; Oliveira-Filho & Fontes, 2000). Indeed, the Atlantic Forest has the highest number of *Eugenia* species among all Brazilian domains, with 262 species recorded thus far (Mazine *et al.*, 2020), and several new species described from the southern region in recent years (Faria *et al.*, 2015; Mazine *et al.*, 2017; Proença *et al.*, 2017; Mazine *et al.*, 2018b; Sobral & Souza, 2018; Valdemarin *et al.*, 2022). Here, we describe and illustrate a new species from the Atlantic Forest of the municipality of Cunha, São Paulo state, at the boundary with Rio de Janeiro state.

Materials and methods

Fieldwork was carried out between 2018 and 2023, covering all seasons, in the Atlantic Forest surrounding the Serra do Mar State Park (SMSP) in the states of São Paulo and Rio de Janeiro. Measurements were based on dried specimens from the following herbaria: ESA, RB, SORO, SP and SPSF (herbarium codes follow Thiers, continuously updated). Morphological terminology follows Hickey (1973) for leaf shape, Payne (1978) for hairs, Briggs & Johnson (1979) for inflorescences, and Harris & Harris (2001) for the remaining characters. Morphological characters of related species are determined from original descriptions and observations of specimens in the herbaria cited above. The size and density of the oil glands were determined from images under magnification, using the ImageJ2 software and following Rueden *et al.* (2017).

Conservation status was assessed based on *IUCN Red List Categories and Criteria* (IUCN, 2012). Extent of occurrence (EOO) and area of occupancy (AOO) were estimated using the Geospatial Conservation Assessment Tool, GeoCAT (Bachman *et al.*, 2011). A distribution map was made in QGIS (QGIS Development Team, 2022), using geographical coordinates extracted from herbarium specimen labels.

Taxonomic treatment

Eugenia stenocarpa Valdemarin & A.Maruy., **sp. nov.**

Eugenia stenocarpa is morphologically distinguished from all other species of *Eugenia* sect. *Speciosae* Bünger & Mazine by its cylindrical (vs globose) fruits. Additionally, it

can be distinguished from the most similar species, *Eugenia speciosa* Cambess., by its leaf blades with inconspicuous oil glands above and slightly raised below (vs raised on both surfaces in *E. speciosa*), pedicels 25–39 mm long (vs 5–24 mm long), flowers with calyx lobes 4–5 mm long (vs 5–8 mm long) and pubescent hypanthium (vs glabrous). – Type: Brazil, São Paulo, municipality of Cunha, Zona de amortecimento do PESM, Núcleo Cunha, Sítio Vivenda das Meninas, próximo à Estrada do Paraibuna, 23°13'45"S, 45°00'50"W, 1102 m, 2 viii 2020 [fl. and imm. fr.], *K.S. Valdemarin, A. Maruyama & A. Gibau* 1496 (holotype SORO, isotype ESA). **Figures 1, 2.**

Tree 3–5 m tall. *Twigs* slightly applanate when young, terete when mature, the distal internodes 15–55 mm long, 1–2 mm in diameter, longitudinally striate exfoliating in membranaceous irregular sheets, sparsely puberulent when young, trichomes whitish, glabrescent. *Young leaves* sparsely puberulent above, strigose below, trichomes adpressed and brownish. *Leaves* opposite, petiole (4)7–12 × 0.8–1.1 mm, terete, sparsely puberulent, trichomes glabrescent; blade (2.9)8–10 × 2.9–4.1 cm, elliptic or narrowly obovate, chartaceous, markedly discolorous when dry, upper surface dark green, sparsely puberulent or glabrous, lower surface olive green, sparsely strigose, base acute, attenuate or cuneate, apex obtuse or short-acuminate, sometimes rounded, sometimes falcate when dry, midvein sulcate in the proximal region becoming prominent on the upper third of the blade above, prominent below, sparsely puberulent above and strigose below, secondary veins (8)12–15 pairs, leaving the midvein at angles of 64–70°, slightly raised above and raised below, sparsely puberulent above and puberulent below, marginal veins 2, innermost 1–4 mm from the margin, outermost up to 1 mm from margin. Margin revolute with a thickened and yellow edge, and oil glands 0.1–1.5 mm in diameter, 5–10 per mm^2, inconspicuous above and slightly raised below. *Inflorescences* terminal or axillary auxotelic racemes with late vegetative proliferation and 1 or 2 pairs of flowers; rachis up to 12 mm long, terete, puberulent, glabrescent; bracts 2–3 × 0.5–0.8 mm, lanceolate or oblong, tomentose, glabrescent, persistent until fruiting, sometimes deciduous in the flowers; pedicels 25–39 × c.0.7 mm, terete, puberulent; bracteoles 1.5–2.1 × c.0.5 mm, narrow-lanceolate or linear, free, apex acute, puberulent, deciduous in bud, flower and mature fruit, trichomes whitish or brownish. *Flower buds* c.6 × 4 mm, obovate. *Flowers* with smooth, pubescent hypanthium; calyx lobes 4, fused by 1 mm at the base in bud, in two unequal pairs, the outermost 4–5 × 2.5–3.8 mm, ovate, apices acute, the innermost 4–4.5 × 3–3.5 mm, ovate, sparsely puberulent on both surfaces, oil glands prominent; petals 4, c.8 × 4.5 mm, obovate, glabrous and ciliate; staminal ring c.3 mm in diameter, rounded, glabrous; stamens straight in the bud, filaments 4–7 mm long, glabrous, anthers 0.5–0.8 × 0.5 mm, oblong or globose, dehiscing longitudinally; style c.5.5 mm, glabrous, stigma punctiform and papilose, ovary 2-locular, ovules 12–14 per locule, locule glabrous inside. *Fruits* 8–10.3 × 3.5–5.9 mm, cylindrical, smooth, glabrous. *Seeds* 1 per fruit, c.1.8 × 1.2 mm, globose; testa smooth; cotyledons fused with no visible hypocotyl.

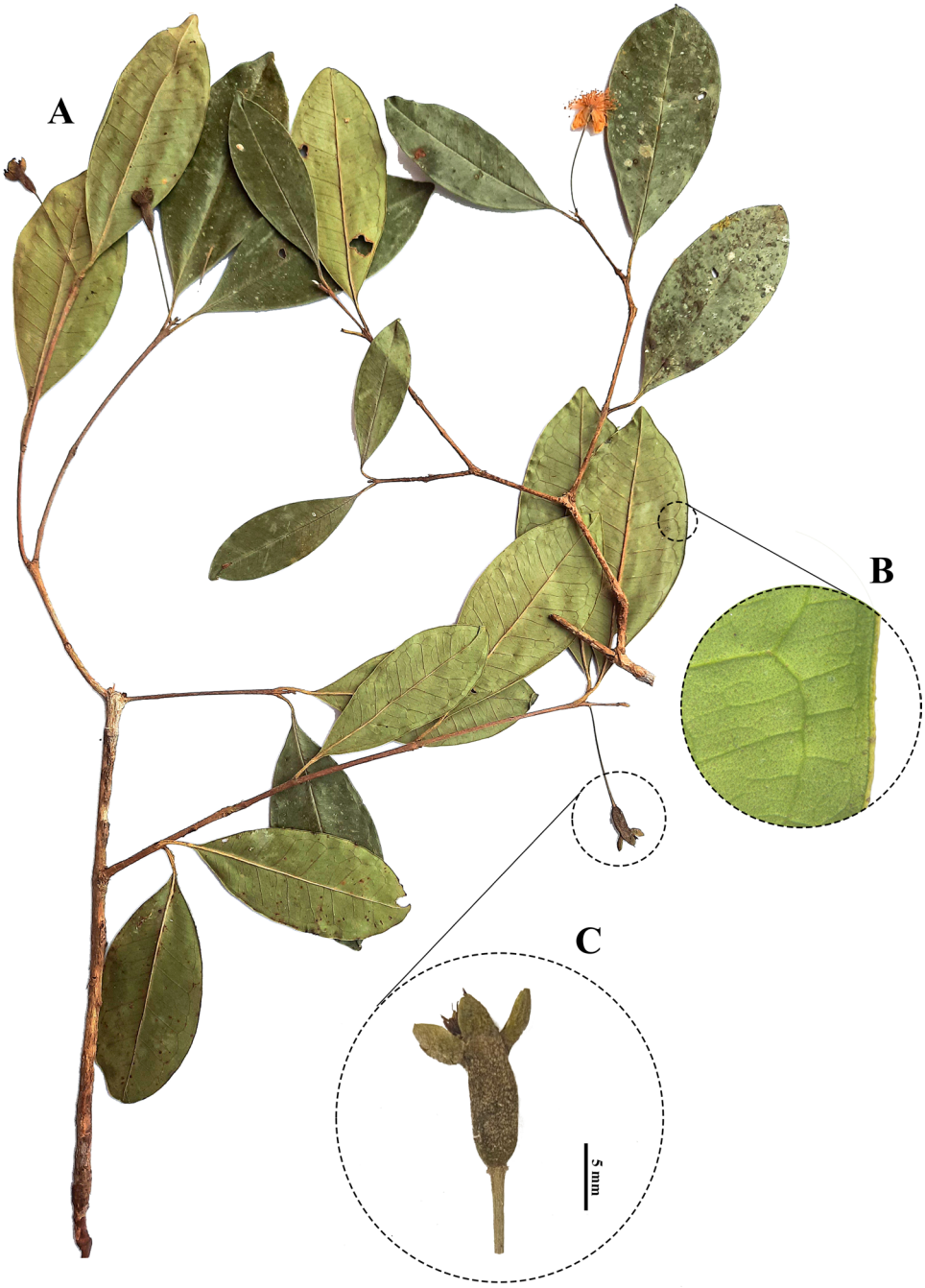

Figure 1. *Eugenia stenocarpa* Valdemarin & A.Maruy., sp. nov. A, Twigs with flower and immature fruits; B, detail of the leaf margin, with yellow thickening; C, immature cylindrical fruit. Photograph of the holotype (*K.S. Valdemarin* et al. 1496), taken by K. S. Valdemarin.

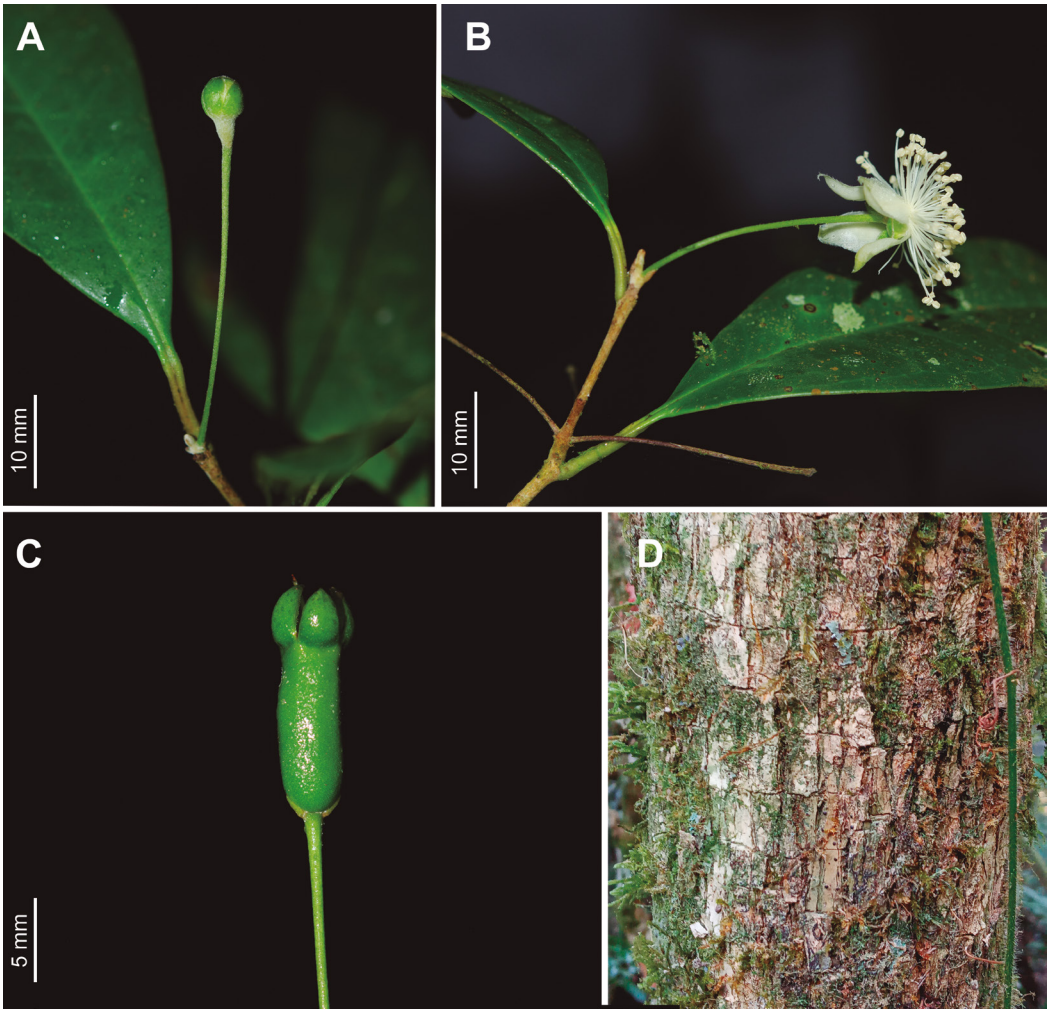

Figure 2. *Eugenia stenocarpa* Valdemarin & A.Maruy., sp. nov. A, Flower bud; B, flower after anthesis; C, immature cylindrical fruit; D, bark. All photographs of the holotype (*K.S. Valdemarin* et al. 1496), taken by K. S. Valdemarin.

Distribution. *Eugenia stenocarpa* is found only in the Serra do Mar mountain range, in northeastern São Paulo state, at the boundary with Rio de Janeiro state. The new species was recorded in three localities in the municipality of Cunha. Two of them come from a private property (Sítio vivenda das meninas) located in the SMSP's buffer zone in Paraibuna road, and the third from the waterfall trail within the SMSP area (Figure 3).

Habitat and ecology. This species grows on clay soils in dense ombrophilous forest above 1000 m a.s.l. (see Figure 3) with an average annual precipitation of 1421 mm. It was

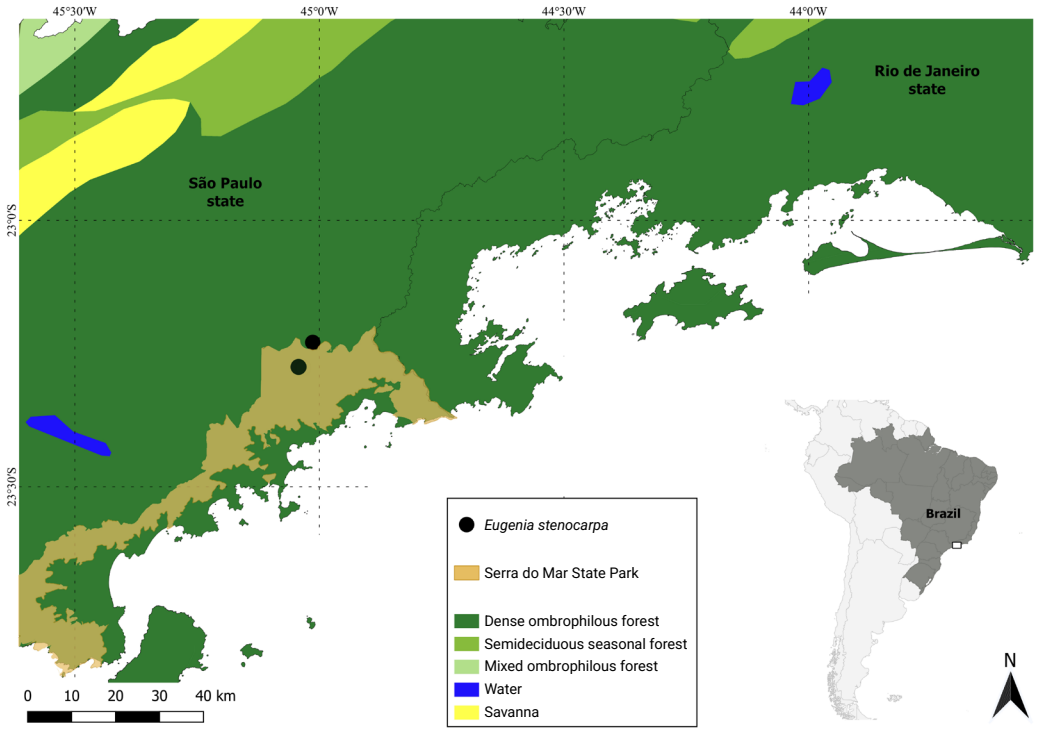

Figure 3. Distribution of *Eugenia stenocarpa* in the Atlantic Forest of São Paulo, Brazil.

collected from riverine environments and tropical montane cloud forest with a history of degradation (Neves *et al.*, 2017). Flowering in June through August; fruiting in August through September.

Etymology. The specific epithet refers to the species' narrowly cylindrical fruits, an unusual characteristic in *Eugenia* sect. *Speciosae*.

Proposed IUCN conservation category. This species has a restricted distribution and is known from only three closely situated localities within the SMSP and its buffer zone. The estimated EOO of 0.045 km^2 and AOO of 8 km^2 fall within the thresholds for the Critically Endangered (CE) category under criterion B. However, *Eugenia stenocarpa* occurs in a protected area, and the presence of a buffer zone suggests that it is not under any major threats or undergoing continuing decline. Therefore, the new species is classified at present as Least Concern (LC).

Notes. Based on morphology, the new species is assigned to *Eugenia* sect. *Speciosae* due to its auxotelic raceme inflorescences with late vegetative proliferation, foliaceous calyx lobes 4–5 mm long, and narrowly lanceolate to linear bracteoles that are sometimes deciduous in the bud or in flower but always in the mature fruits (Bünger *et al.*, 2016).

Currently, 10 species are nested in *Eugenia* sect. *Speciosae* (Bünger *et al.*, 2016; Mazine *et al.*, 2020). Two occur in the Amazon region (*Eugenia tovomita* Sobral & M.A.D.Souza and *E. wentii* Amshoff, neither restricted to Brazil), one in dry areas of the Brazilian Cerrado (*E. macedoi* Mattos & D.Legrand), and seven recorded from Brazilian Atlantic Forest (*E. anthropophaga* Costa-Lima & E.C.O.Chagas, *E. bunchosiifolia* Nied., *E. hermesiana* Mattos, *E. jussara* Costa-Lima & E.C.O.Chagas, *E. longipetiolata* Mattos, *E. speciosa* and *E. tumescens* B.S.Amorim & M.Alves). The key encompassing these 10 species can be found in the monograph by Mazine *et al.* (2020), for the group named 'Chave E'. Following this key, *Eugenia stenocarpa* is similar to *E. bunchosiifolia* because both have smooth hypanthium covered by trichomes, and leaf blades with obtuse or short-acuminate apex, sometimes rounded, with a thickened yellow revolute margin and without floccose dark indument. However, the new species is distinguished by its 25–39 mm long pedicels (vs 5–20 mm long), leaf blades with innermost marginal vein 1–4 mm from the blade edge (vs 4–6 mm), and oil glands inconspicuous above (vs raised). The key to *Eugenia* sect. *Speciosae* by Mazine *et al.* (2020) is updated to include *E. stenocarpa* and is provided below.

As already mentioned in the diagnosis, the remarkable cylindrical fruits of *Eugenia stenocarpa* make it clearly different from all other species in the section. Additionally, of the species that occur in the Atlantic Forest of Southeast Brazil (i.e. *Eugenia bunchosiifolia*, *E. hermesiana*, *E. longipetiolata* and *E. speciosa*), the new species is distinguished by a set of further features, including young twigs that are sparsely puberulent and glabrescent, and flowers with pubescent hypanthium (**Table**).

Additional specimens examined. Brazil. **São Paulo**: Cunha, Parque Estadual da Serra do Mar, núcleo Cunha, próximo a Estrada do Paraibuna, sentido rodovia 171 (Cunha, Paraty), 23°13'44"S, 45°00'49"W, 1088 m alt., 3 xi 2019 [fl], *A. Maruyama & L. Cicco* 2045 (ESA, SORO); ibid., no km 4 da Trilha das Cachoeiras, 23°16'36"S, 45°01'59"W, 1039 m alt., 1 x 2019 [fl], *A. Maruyama & L. Cicco* 1587 (SORO); Zona de amortecimento do PESM, Núcleo Cunha, Sítio Vivenda das Meninas, próximo à Estrada do Paraibuna, 23°13'45"S, 45°00'50"W, 1102 m alt., 30 iii 2018 [fr], *A. Maruyama & L. Cicco* 1086 (ESA, RB, SORO, SPSF).

Key to Brazilian species of *Eugenia* sect. *Speciosae* (adapted from Mazine *et al.*, 2020)

1a. Hypanthium and fruits costate _____ 2
1b. Hypanthium and fruits with non-costate surface _____ 3

2a. Fruits slightly 8-ribbed and pedicels swollen at the apex _____ *E. jussara*
2b. Fruits deeply 8-ribbed and pedicels not swollen at the apex _____ *E. anthropophaga*

3a. Hypanthium glabrous _____ 4
3b. Hypanthium with trichomes _____ 5

4a. Leaf blades with a thickened and yellow edge, pedicel not swollen at the apex *E. speciosa*

4b. Leaf blades without a thickened and yellow edge, pedicel swollen at the apex *E. tumescens*

5a. Leaf blades with caudate apex and black-floccose indumentum on mature leaves *E. longipetiolata*

5b. Leaf blades with acuminate, acute, obtuse or rostrate apex, glabrous or with other than black-floccose indumentum 6

6a. Leaf blades with a thickened and yellow edge 7

6b. Leaf blades without a thickened and yellow edge 8

7a. Pedicels 25–39 mm long, fruit cylindrical **E. stenocarpa**

7b. Pedicels 5–20 mm long, fruit globose *E. bunchosiifolia*

8a. Leaf blades with acuminate or rostrate apex 9

8b. Leaf blades with acute or obtuse apex 10

9a. Leaf blades with irregularly distributed punctuations, calyx lobes up to 3 mm long and not recovering the petals when in bud *E. tovomita*

9b. Leaf blades with evenly distributed punctuations, calyx lobes longer than 6 mm and recovering the petals when in bud *E. wentii*

10a. Calyx lobes with acuminate apex, 50–70 mm long *E. hermesiana*

10b. Calyx lobes with acute apex, 3.9–7 mm long *E. macedoi*

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Table. Morphological features of *Eugenia stenocarpa* Valdemarin & A.Maruy., sp. nov., and related species in the Atlantic Forest of Southeast Brazil.

Character	*E. stenocarpa*	*E. bunchosiifolia*	*E. hermesiana*	*E. longipetiolata*	*E. speciosa*
Young twigs	Sparsely puberulent and glabrescent	Puberulent	Pubescent	Pubescent	Glabrous
Leaf blades					
Form	Elliptic or narrow-obovate	Elliptic	Wide-elliptic or ovate	Wide-elliptic	Elliptic or narrow-obovate
Base	Acute, attenuate or cuneate	Obtuse or rounded	Obtuse or rounded	Obtuse or rounded	Acute to attenuate
Apex	Obtuse or short acuminate	Obtuse or short acuminate	Obtuse or rounded	Acuminate	Obtuse or short acuminate
Distance from innermost marginal vein to margin	1–4 mm	4–6 mm	1.5–3.5 mm	2–4.5 mm	1–3 mm
Margin	Revolute with a thickened and yellow edge	Revolute with a thickened and yellow edge	Revolute without a thickened and yellow edge	Plane without a thickened and yellow edge	Revolute with a thickened and yellow edge
Oil glands	Inconspicuous adaxially and slightly raised abaxially	Inconspicuous adaxially and slightly raised abaxially	Inconspicuous adaxially and raised and dark abaxially	Inconspicuous on both surfaces	Raised on both surfaces
Pedicel length	25–39 mm	5–11.5 mm	12–58 mm	10–25 mm	5–24 mm
Hypanthium surface	Pubescent	Puberulent	Pubescent	Pubescent	Glabrous
Calyx lobe length	4–5 mm	3–6 mm	9–13.5 mm	5–11 mm	5–8 mm
Fruits	Cylindrical and dark purple when ripe	Ellipsoid or globose, and orange when ripe	Unknown	Unknown	Ellipsoid or globose, and orange when ripe
Habit	Tree	Tree	Shrub	Tree	Shrub or tree

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