KEW BULLETIN (2024) 79:233–241
DOI 10.1007/S12225-023-10159-Z

ISSN 1874-933X (print)
ISSN 0075-5974 (electronic)

Eugenia guapiassuana (Myrtaceae), a remarkable new tree species from the Brazilian Atlantic Forest

Thiago Fernandes[1], Pablo Viany Prieto[2], Marco Túlio Côrtes de Lacerda[3], Mariana Bünger[4] & João Marcelo Alvarenga Braga[1]

Summary. This study proposes a new species of *Eugenia* sect. *Phyllocalyx* from Atlantic Forest remnants in the Brazilian state of Rio de Janeiro. The new taxon, *Eugenia guapiassuana,* is proposed based on literature survey, examination of herbarium material and field work. We herein provide a morphological description, including comments on fruit taste, along with information on distribution, habitat, phenology, vernacular name, taxonomy and conservation status. Figures showing fresh and dry material and a map of the occurrence records are also presented. *Eugenia guapiassuana* is morphologically similar to *E. involucrata* and *E. superba*, and these species are contrasted in the discussion. Following an assessment, the conservation status of *Eugenia guapiassuana* is provisionally determined as Critically Endangered [CR B2ab(iii)].

Key Words. Cereja-de-guapiaçu, *Eugenia* sect. *Phyllocalyx*, fruit tree, Reserva Ecológica de Guapiaçu, threatened species

Introduction

Currently comprising 414 species, *Eugenia* P.Micheli ex L. (Linnaeus 1753: 470) is the most species-rich Myrtaceae genus occurring in Brazil (Mazine *et al.* 2020), and in the Brazilian Atlantic Forest, *Eugenia* is remarkable for its species richness, often topping lists of species in floristic surveys (e.g., Oliveira-Filho & Fontes 2000; Barros 2008; Urbanetz *et al.* 2010; Giaretta *et al.* 2013). *Eugenia* species produce fleshy fruits that contribute significantly as food sources for frugivores in the Atlantic Forest (Pizo 2000; Nic Lughadha & Proença 1996; Gressler *et al.* 2006; Staggemeier *et al.* 2017).

Eugenia sect. *Phyllocalyx* Nied. (Niedenzu 1893: 82) is one of 11 currently accepted sections within *Eugenia* and is placed in subg. *Eugenia* (Mazine *et al.* 2018). It comprises 17 species, occurring mainly in the Brazilian Atlantic Forest, and can be recognised by auxotelic inflorescences combined with relatively large flowers with foliaceous bracteoles and sepals (Bünger *et al.* 2020). The morphology of *Eugenia* sect. *Phyllocalyx* is also partly shared with its sister group, *Eugenia* sect. *Speciosae* Bünger & Mazine (in Bünger *et al.* 2016: 75), but bracteoles in *Speciosae* are filiform and deciduous (see Bünger *et al.* 2016, 2020).

In 2022, a tall, remarkable tree with a distinctively smooth trunk, whitish-pink flowers and red fruits was found by Mr Messias Gomes da Silva, a local resident and forest ranger of Reserva Ecológica de Guapiaçu (REGUA). His discovery was the foundation of this study, as it made us aware of this tree and prompted us to collect samples for herbaria. REGUA is a private, protected area, totalling 8000 hectares of Atlantic Forest, in southeastern Brazil (see https://www.regua.org.br/).

Herein we propose the aforementioned species as a new taxon of *Eugenia* sect. *Phyllocalyx*. We provide a morphological description, including comments on the taste of its fruit, and information about its distribution, habitat, phenology and conservation status. We include a vernacular name and some additional taxonomic notes. Figures showing fresh and dry material and a map with occurrence records of the new taxa are presented.

Material and Methods

A literature survey and examination of virtual and physical herbarium specimens confirmed the recognition of the taxon as a new species. The following herbaria were visited: BHCB, BM, BR, C, CEPEC, ESA, G, HB, HPL, HRCB, HUENF, HUFU, HUFSJ, K, LE, M, MBM, MBML, NIT, OUPR, OXF, P, R, RB, RBR, RFA, RFFP, S, SP, SPF, UEC, UPCB, and W (acronyms follow Thiers 2023, continuously updated; HUENF follows Nascimento *et al.* 2023). In addition, high-resolution images of specimens of Atlantic Forest *Eugenia* were

Accepted for publication 17 November 2023. Published online 19 March 2024

[1] Instituto de Pesquisas, Jardim do Botânico do Rio de Janeiro, Rua Pacheco Leão, 915, Rio de Janeiro 22460-030, Brazil. e-mail: thiagofernandes@id.uff.br
[2] Universidade do Estado do Rio de Janeiro, Programa de Pós-graduação em Ecologia e Evolução, Rua São Francisco Xavier, 524, Rio de Janeiro, RJ 20550–013, Brazil
[3] Coleção Botânica Sítio E-jardim, Estr. do Aviário s.n., Xerém, Duque de Caxias, RJ 25250–597, Brazil
[4] Departamento de Biologia, Universidade Federal do Ceará, Campus do Pici Prof. Prisco Bezerra, bl. 906, 60440-900, Fortaleza, CE, Brazil

examined through REFLORA (2022), CRIA (2022), and JSTOR Global Plants (2022). We examined all the types of names assigned to *Eugenia* sect. *Phyllocalyx* and *E.* sect. *Speciosae*, and recent taxonomic studies on these sections (Bünger *et al.* 2016, 2020) were consulted throughout.

All measurements presented in the description were taken from dried material. Colours were obtained from freshly collected material. Terminology on indumentum is according to Hewson (1988); leaf features according to Hickey (1973); general shapes according to Radford *et al.* (1974); and general morphology according to Beentje (2010). The terms "auxotelic" and "anauxotelic" are applied in the sense of Briggs & Johnson (1979).

The Area of Occupancy (AOO) was calculated using GeoCAT (Bachman *et al.* 2011), and the map of occurrence records was built using QGis Desktop version 2.16.3 (QGIS Development Team 2022). Conservation assessments follow the IUCN Red List categories, criteria and guidelines (IUCN 2012, 2022).

Taxonomic Treatment

Eugenia guapiassuana *T.Fern., M.T.C.Lacerda & J.M.A.Braga* **sp. nov.** Type: Brazil, Rio de Janeiro, Cachoeiras de Macacu, 1 Sept. 2022, fl., *T. Fernandes, M. G. da Silva & P. V. Prieto* 1218 (holotype RB; isotypes NIT, K, R). Figs 1, 2 and 3.

http://www.ipni.org//urn:lsid:ipni.org:names:77331883-1

Deciduous tree up to 20 m tall. *Trunk* smooth, light brown when flowering and fruiting; bark thick, sometimes detaching in irregular plates. *Leafy shoots* adaxially sericeous and glabrescent, trichomes golden, 0.5 – 0.8 mm long; in fresh state adaxially cinereous, abaxially vinaceous. *Young twigs* flattened, trichomes similar to those on leafy shoots, glabrescent; epidermal surface beneath trichomes densely glandular. *Mature branches* straight, terete, brownish, smooth, not exfoliating. *Leaves:* petioles 10 – 17 × 1.8 – 3.5 mm, adaxially sulcate, trichomes similar to those on leafy shoots, glabrescent; blades 80 – 120 × 40 – 70 mm, usually obovate, base cuneate, apex usually mucronate or sometimes rounded or rarely slightly emarginate, coriaceous, essentially concolorous, drying brown, mostly glabrous or sometimes puberulent on both surfaces, with trichomes visibly concentrated at the midvein; midvein canaliculate adaxially and strongly raised abaxially, venation slightly raised and barely conspicuous, secondary veins 12 – 15 on each side, leaving the midvein at angles of 50 – 60°; marginal veins two, the inner one 2 – 3 mm from the margin, conspicuous, the outer one 0.5 – 1 mm from the margin, barely conspicuous; glands up to 0.2 mm in diam., conspicuous on both surfaces, adaxially black and foveolate, abaxially dark-brown and raised. *Inflorescences* in auxotelic racemes, 1 – 3 pairs of decussate flowers, flower internodes c. 1 mm long; Bracts at the inflorescence base 3.5 – 4.5 × 1 – 2 mm, linear, base truncate, apex obtuse, tomentose, with rusty or brownish simple trichomes c. 0.5 mm, falling at anthesis or occasionally persisting, although marcescent in fruiting material; bracts at the axis nodes not seen, probably deciduous before anthesis. Pedicels 15 – 30 mm long, flattened; when flowering 1 – 1.8 mm wide, densely sericeous, trichomes similar to those on young twigs; when fruiting 2.5 – 3 mm wide, puberulent to glabrous; verrucose and swollen at base and apex in fresh state. Bracteoles 8.5 – 10 × 7.2 – 9.8 mm, cordiform; apex obtuse or with an obtuse acumen; free from each other, partially or completely concealing the ovary, foliaceous; persistent after anthesis, deciduous in fruit; vinaceous; densely punctate, puberulent to glabrous, except for the densely sericeous midvein, ciliate; trichomes similar to those on young twigs. *Flowers:* buds 12 – 14 × 12 – 14 mm, globose; completely concealed by bracteoles when immature; when mature bracteoles only concealing the ovary. Floral disk subquadrate, 6 – 8 mm between the edges. Sepals 8.5 – 11.3 × 6 – 7.5 mm, widely-deltoid; apex obtuse or with a short, obtuse acumen; externally mostly puberulent, except moderately sericeous at base, internally moderately to densely sericeous; margins with golden cilia up to 0.2 mm long; opening perpendicularly to the ovary axis at anthesis; pinkish to vinaceous when fresh. Petals 20 – 22.5 × 12 – 19 mm, obovate, base truncate, apex obtuse or rounded, puberulent or glabrous, except for golden cilia up to 0.2 mm long at margins, concave, whitish-pink when fresh. *Staminal ring* 2.5 – 3 mm thick, rounded, densely covered with erect, golden trichomes c. 0.5 mm long; stamens 205 – 235 (counted in bud), filaments 5 – 10 mm long; anthers c. 1 × 1 mm, bilocular, with a visible septum. Ovary c. 0.3 × 0.2 mm; externally densely sericeous, trichomes golden, c. 0.5 mm long, markedly distinct from the calyx; internally with two, glabrous locules, each with 42 – 46 ovules. *Fruits* 28 – 46 × 14 – 20 mm, ellipsoid, green when immature, passing through yellow then red to vinaceous when mature; pulp orange, juicy and abundant, firmly adhering to the seed; surface lustrous, puberulent but with trichomes concentrated at the transition with the calyx; calyx in fruit persistent, accrescent, usually erect, red to vinaceous. *Seeds* one per fruit, c. 25 × 15 mm, ellipsoid; cotyledons fused, hypocotyl lighter and conspicuous.

RECOGNITION. Morphologically closely related to *Eugenia involucrata* DC. (de Candolle 1828: 264), *E. guapiassuana* differs in having petioles 10 – 17 mm long (vs 3 – 7 mm long); bracteoles and sepals ciliate (vs glabrous); bracteoles deciduous in fruit (vs

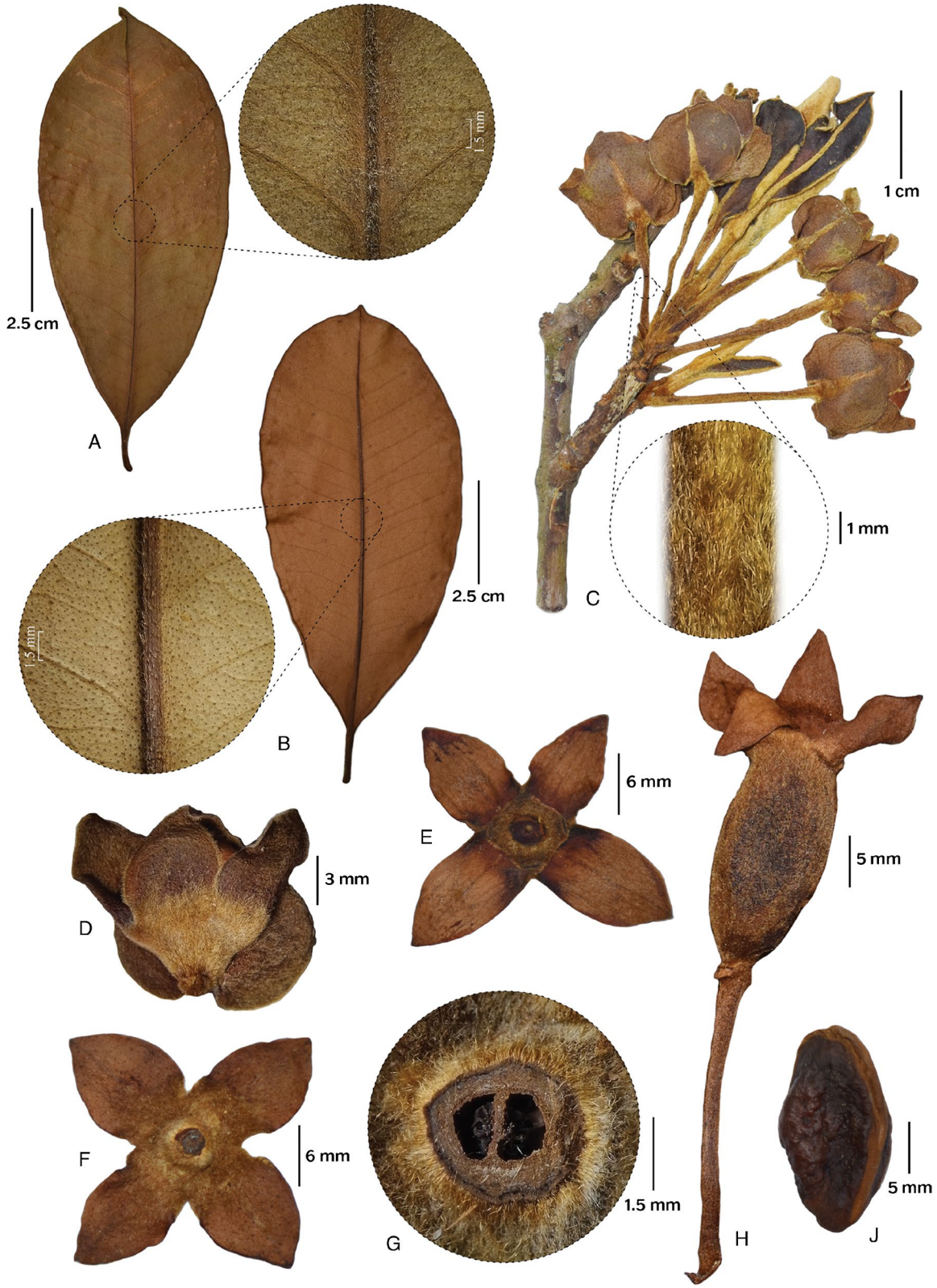


Fig. 1. Morphology of *Eugenia guapiassuana* from dried specimens. **A** & inset, leaf adaxial surface; **B** & inset, leaf abaxial surface; **C** & inset, inflorescence with flower buds, mostly concealed by the bracteoles, developing along with leaf shoots; **D** flower bud, frontal bracteole detached; **E** open flower, from above; **F** open flower, from below; **G** ovary with two locules; **H** fruit; **J** embryo; **A – G** from *Fernandes* 1218; **H – J** from *Fernandes* 1268.

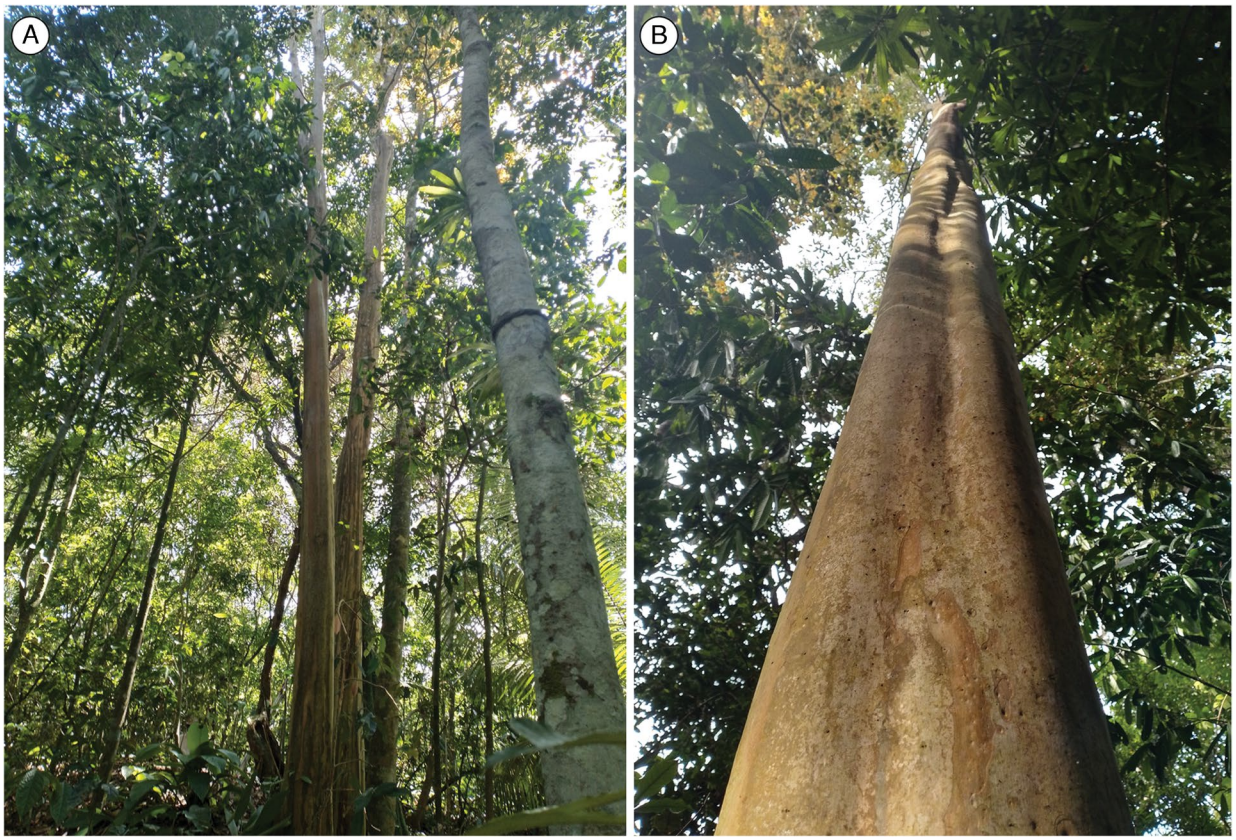


Fig. 2. *Eugenia guapiassuana* in its natural habitat at the type locality. **A** two individuals; **B** detail of trunk bark. PHOTOS: THIAGO FERNANDES.

persistent); pedicels verrucose in fruit (vs smooth); ovaries with golden indumentum (vs rusty); mature fruits with persistent indumentum, at least on the transition with the calyx (vs glabrous); and in pulp firmly adhering to the seeds when fresh (vs pulp almost entirely free from the seeds, so that the fruit display a hollow cavity between the endocarp and the seed coat). Also remarkable are the whitish-pink flowers of *Eugenia guapiassuana*, which contrasts with all other species of *E.* sect. *Phyllocalyx*, which have flowers with green sepals and white petals and stamens. Other differences are described in Table 1.

Eugenia guapiassuana is also similar to *E. superba* T.Fern., M.C.Souza & J.M.A.Braga (Fernandes *et al.* 2023: 100), another tall, deciduous tree with smooth trunk bark from the Atlantic Forest, which is also assigned to *E.* sect. *Phyllocalyx*. It differs, however, as the trunk detaches as thick plates (vs exfoliates as papyraceous plates in *E. superba*), mature branches are brownish and not exfoliating (vs reddish and exfoliating), leaf blades are essentially concolorous when dry (vs markedly discolorous), the indumentum on flowers is golden (vs whitish), the fruits are markedly ellipsoid and red when ripe (vs suglobose to slightly ellipsoid and yellow to orange); and the bracteoles are usually deciduous (vs persistent and accrescent).

DISTRIBUTION. Restricted to the municipality of Cachoeiras de Macacu, in Rio de Janeiro State, southeastern Brazil (Map 1). There it occurs in Atlantic rainforests at the base and on the slopes of the Serra do Mar mountain range, up to 500 m, close to watercourses.

SPECIMENS EXAMINED. BRAZIL. Rio de Janeiro: Cachoeiras de Macacu, Fragmento de floresta aluvial próximo à Reserva Ecológica de Guapiaçu (REGUA), 22°27'1.7"S, 42°48'42.2"W, 80 m a.s.l., 16 Oct. 2022, fr., *T. Fernandes, M. G. da Silva & P. V. Prieto* 1268 (BHCB, K, MBML, NIT, NY, RB, R, RBR, RFFP, SPF).

HABITAT AND ECOLOGY. We collected samples of *Eugenia guapiassuana* from two adult trees only, found at a single locality in the Guapiaçu river watershed. The site is within an 194 ha fragment of early to mid-secondary forest, on an alluvial plain, adjacent to a small creek. It is supposed that *Eugenia guapiassuana* is a late-successional species, so these two trees are probably reminiscent of old-growth forests that covered the area in the past. Another two trees could be reliably identified from photographs as the same species, so were included on the distribution map. They are together,

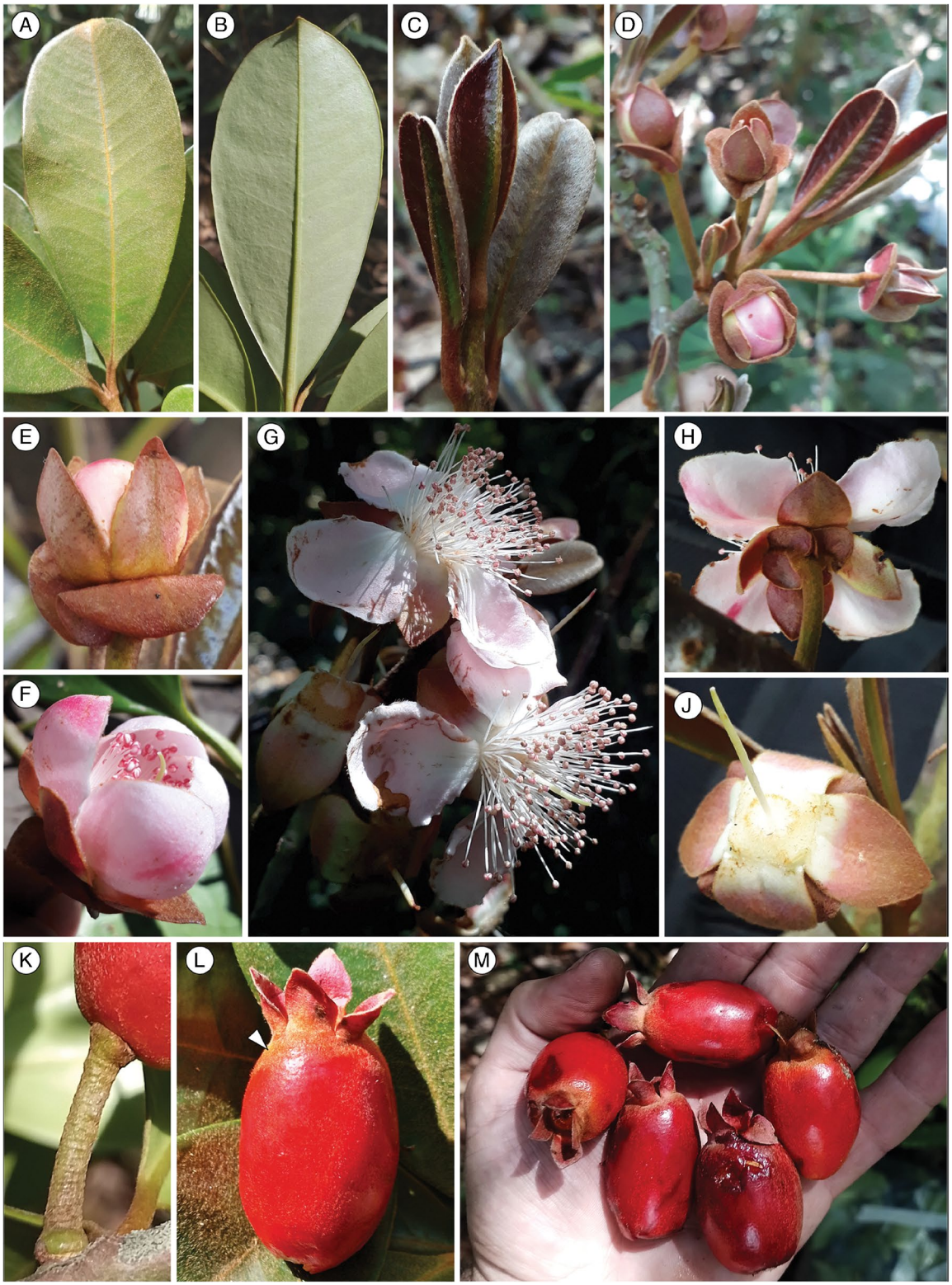


Fig. 3. Morphology of *Eugenia guapiassuana*. **A** leaf adaxial surfaces with puberulent indument; **B** leaf abaxial surface; **C** leafy shoots, adaxially cinereous, sericeous, abaxially glabrous and vinaceous; **D** inflorescences developing along with leafy shoots; **E** flower bud at early stages of development; **F** pre-anthetic flower; **G** flowers at anthesis; **H** flower from below, showing the cordiform bracteoles; **J** post-anthetic flower, after stamens fall; **K** detail of the thick, verrucose pedicel in fruit, swollen at base and apex; **L** mature fruit with persistent trichomes concentrated on the transition with the calyx (arrowed); **M** mature fruits. **A – J** from *Fernandes* 1218; **K – M** from *Fernandes* 1268. PHOTOS: THIAGO FERNANDES.

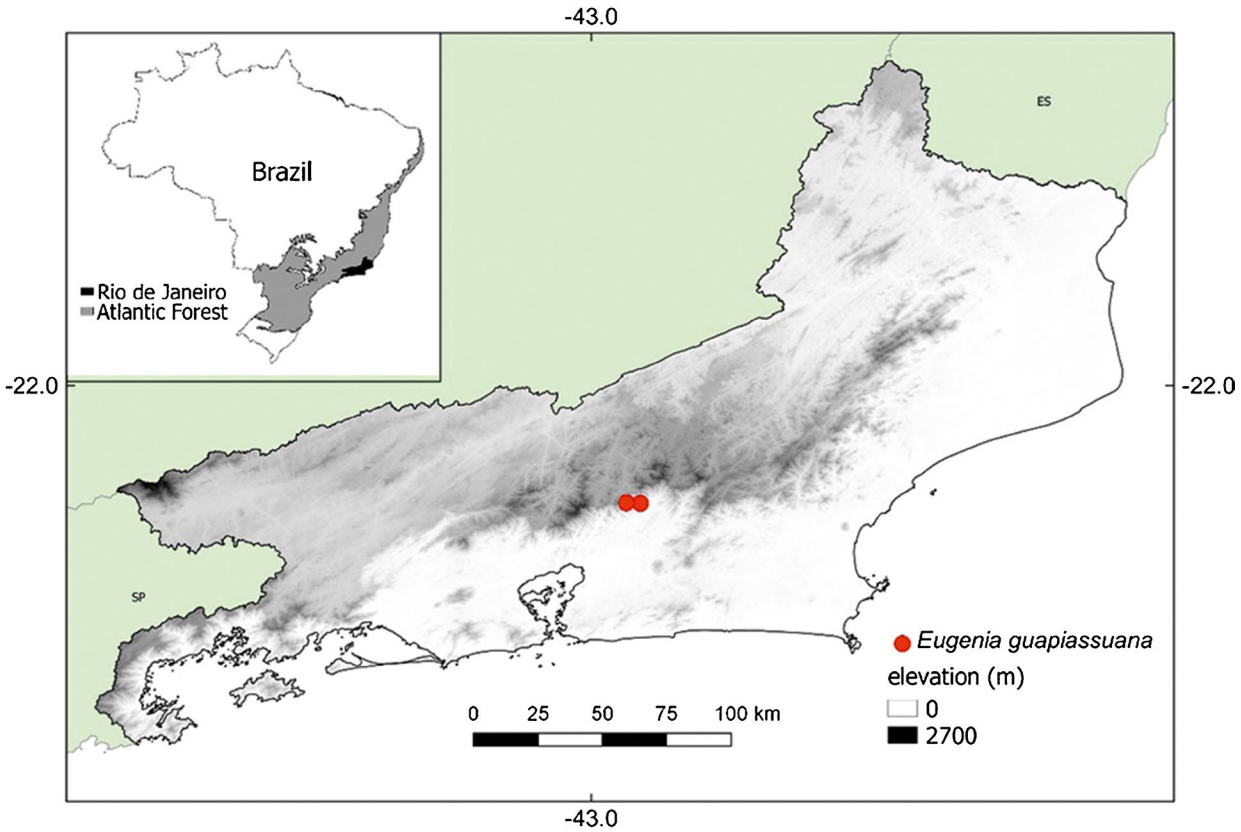
Table 1. Morphological comparison between *Eugenia guapiassuana* and its relatives, *E. involucrata* and *E. superba*.

	E. guapiassuana	*E. involucrata*	*E. superba*
Seasonality	deciduous	mostly evergreen	deciduous
Petioles length (mm)	10 – 17	3 – 7	7.7 – 18.5
Bracteoles	vinaceous, ciliate, deciduous in fruit	green, not ciliate, accrescent in fruit	green, ciliate, accrescent in fruit
Pedicel in fruit	verrucose, swollen at base and apex	smooth, not swollen	smooth, not swollen
Sepals in fresh state	pinkish or vinaceous	green, sometimes with red spots	green
Petals in fresh state	whitish-pink	white, sometimes with green spots	white
Ovary indumentum	golden	rusty	cream to golden
Fruits	ellipsoid, red when mature, pulp firmly adhering to the seed	ellipsoid, red when mature, pulp almost entirely free from the seed	subglobose, orange, pulp firmly adhering to the seed

at a hard to access site, five kilometres away from the type locality, in the same watershed, in old-growth forest, growing on a rocky slope.

Wood density is highly conserved at the genus level among neotropical trees (Chave *et al.* 2006), so *Eugenia guapiassuana* is likely to have dense wood, comparable to that of the closely related *E. involucrata* (0.9 g/cm^3; Carvalho 2008). The species also has a large maximum size and large seed, which, along with dense wood, are typically associated with slow-growing, shade-tolerant, late-successional tree species (Lohbeck *et al.* 2015; Rüger *et al.* 2018).

CONSERVATION STATUS. *Eugenia guapiassuana* is only known from four mature individuals that occur in a very small area. The AOO is 8 km^2 and the species is restricted to two sites about 5 km apart, but likely to be prone to a single threat event, as described below, so considered a single locality sensu IUCN (2022). The type locality is within a forest fragment, surrounded by pastures and agricultural fields, which may lead



Map 1. Geographic distribution of *Eugenia guapiassuana*.

to a loss of habitat quality due to edge effects. Urban expansion is taking place rapidly in the adjacent landscape and also constitutes a direct threat. Therefore, *Eugenia guapiassuana* is provisionally assessed as Critically Endangered [CR B2ab(iii)]. Legal protection for the type locality is urgently required, as is propagation of the species for both ex-situ conservation and enrichment of restoration plantations. Cultivation of *E. guapiassuana* as an ornamental and fruit tree is also highly recommended, as this may help to reduce its chances of extinction.

PHENOLOGY. Flowers in August – September and fruits in October.

ETYMOLOGY. The epithet is a tribute to Reserva Ecológica de Guapiaçu (REGUA), an outstandingly important area for the conservation of Atlantic Forest biodiversity, close to which the new species was found. Guapiaçu (latinised Guapiassu) is treated as an institutional name and adjectivised as guapiassuana. The Tupi indigenous word Guapiaçu (= large headwaters) is the name of the main river crossing the Reserve.

VERNACULAR NAME. The popular name 'cereja-de-guapiaçu' ('cherry of Guapiaçu') is given to *Eugenia guapiassuana*. The word 'cereja' ('cherry') is widely used for fruits of *Eugenia* sect. *Phyllocalyx*, especially those of the closely related *E. involucrata* (Lorenzi *et al.* 2015).

NOTES. *Eugenia guapiassuana* can be recognised in its habitat by its distinctively smooth, light-brown trunk (when flowering and fruiting); leaf shoots adaxially cinereous, abaxially vinaceous; bracteoles and sepals pinkish or vinaceous; petals whitish-pink; and by its large, ellipsoid fruits that are red to vinaceous and orange-fleshed when ripe. The fruits are edible and present a nice sweet-acid balance, resembling other *Eugenia* sect. *Phyllocalyx* species. The edible skin is very thin and red when fully ripe, enwrapping the orange, juicy and abundant pulp, which firmly adheres to the seed.

The morphology of *Eugenia guapiassuana* fits well with the morphological concept of *Eugenia* sect. *Phyllocalyx*, although the fruits lack the accrescent bracteoles that are so typical of the section. Within *Eugenia* sect. *Phyllocalyx*, mature fruits without bracteoles appear consistently only in *E. selloi* B.D.Jacks. (Jackson 1893: 911).

Eugenia guapiassuana is morphologically closely related to the widespread *E. involucrata*, the type species of *E.* sect. *Phyllocalyx*. *E. involucrata* is commonly cultivated as a fruit tree in southern and southeastern Brazil, usually under the vernacular name "cereja-do-rio-grande" (Lorenzi *et al.* 2015; Mazine *et al.* 2020). It is also cultivated in other tropical to subtropical countries, e.g., Florida, USA, where it has been grown since 1938 under the popular designation of 'Cherry of the Rio Grande' (Menninger 1959). Indeed, fruits of the two species have a similar taste (see description above). *E. guapiassuana* differs from *E. involucrata*, however, by the characters given in the Recognition section above and described in Table 1.

Acknowledgements

TF thanks Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) for a scholarship (Process nº. 141327/2020-0) and Universidade Federal Fluminense (UFF) and NIT herbarium for laboratory support. PVP benefits from a post-doc grant from CNPq (Process nº. 152888/2022-5). The authors are especially grateful to the REGUA team, especially managers Nicholas Locke and Raquel Locke, and forest ranger Messias Gomes da Silva, whose support was fundamental for the preparation of this study.

Declarations

Conflict of Interest The authors declare they have no conflict of interest.

References

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. https://doi.org/10.3897/zookeys.150.2109.

Barros, A. A. M. (2008). *Análise florística e estrutural do Parque Estadual da Serra da Tiririca, Niterói e Maricá, RJ, Brasil*. PhD thesis, Instituto de Pesquisas Jardim Botânico do Rio de Janeiro, Rio de Janeiro.

Beentje, H. (2010). *The Kew Plant Glossary*. Royal Botanic Gardens, Kew.

Briggs, B. G. & Johnson, L. A. S. (1979). Evolution in the Myrtaceae — Evidence from inflorescence structure. *Proc. Linn. Soc. New South Wales* 102: 157 – 254.

Bünger, M. O., Mazine, F. F., Lucas, E. J. & Stehmann, J. R. (2016). Circumscription and synopsis of *Eugenia* section *Speciosae* Bünger & Mazine (Myrtaceae). *PhytoKeys* 61: 73 – 80. https://doi.org/10.3897/phytokeys.61.7904.

Bünger, M. O., Mazine, F. F. & Stehmann, J. R. (2020). Revision of *Eugenia* section *Phyllocalyx* (Myrtaceae). *Phytotaxa* 474: 99 – 118. https://doi.org/10.11646/phytotaxa.474.2.1.

Carvalho, P. E. R. (2008). *Espécies arbóreas brasileiras*. Vol. 3. Embrapa Informação tecnológica, Brasília.

Chave, J., Muller-Landau, H. C., Baker, T. R., Easdale, T. A., ter Steege, H. & Webb, C. O. (2006). Regional and phylogenetic variation of wood density across 2456 neotropical tree species. *Ecol. Applic.* 16: 2356

– 2367. https://doi.org/10.1890/1051-0761(2006)016[2356:RAPVOW]2.0.CO;2.

CRIA (Centro de Referência em Informação Ambiental) (2022). *Herbário Virtual da Flora e dos Fungos*. Available from: http://inct.splink.org.br/ [Accessed 19 May 2023].

de Candolle, A. P. (1828). *Myrtacées*. In: A. P. de Candolle (ed.), *Prodromus systematis naturalis regni vegetabilis* 3: 207 – 296. Treuttel & Würtz, Paris. https://www.biodiversitylibrary.org/item/7152#page/218/mode/1up.

Fernandes, T., da Silva Machado, D. N., da Costa Souza, M., Bünger, M., de Barros, A. A. M., Prieto, P. V. & Braga, J. M. A. (2023). Two new species of *Eugenia* (Myrtaceae) from the Brazilian Atlantic Forest. *Kew Bull.* 78: 95 – 105. https://doi.org/10.1007/s12225-022-10070-z.

Giaretta, A., Menezes, L. F. T. & Pereira, O. J. (2013). Structure and floristic pattern of a coastal dunes in southeastern Brazil. *Acta Bot. Bras.* 27: 87 – 107. https://doi.org/10.1590/S0102-33062013000100011.

Gressler, E., Pizo, M. A. & Morellato, P. C. (2006). Polination and seed dispersal of Brazilian Myrtaceae. *Brazil. J. Bot.* 29: 509 – 530. https://doi.org/10.1590/S0100-84042006000400002.

Hewson, H. J. (1988). *Plant Indumentum, a handbook of terminology*. Australian Government Publishing Service, Canberra.

Hickey, L. J. (1973). Classification of the architecture of Dicotyledonous leaves. *Amer. J. Bot.* 60: 17 – 33. https://doi.org/10.1002/j.1537-2197.1973.tb10192.x.

IUCN (2012). *IUCN Red List Categories and Criteria, Version 3.1*. 2nd edition. Prepared by the Species Survival Commission. International Union for Conservation of Nature, Gland and Cambridge. Available from: https://portals.iucn.org/library/sites/library/files/documents/RL-2001-001-2nd.pdf. [Accessed 19 May 2023].

IUCN (2022). *Guidelines for Using the IUCN Red List Categories and Criteria. Version 15.1*. Prepared by the Standards and Petitions Subcommittee. International Union for Conservation of Nature, Gland and Cambridge. Available from: http://www.iucnredlist.org/documents/RedListGuidelines.pdf. [Accessed 19 May 2023].

Jackson, B. D. (1893). *Index Kewensis: an enumeration of the genera and species of flowering plants from the time of Linnaeus to the year 1885 inclusive together with their authors' names, the works in which they were first published, their native countries and their synonyms*. Vol. 1 (fasc. 2) – A-Cran. Clarendon Press, Oxford.

JSTOR Global Plants (2022). https://plants.jstor.org/. [Accessed 19 May 2023].

Linnaeus, C. (1753). *Species Plantarum*. Vol. 1. Impensis Laurentii Salvii, Stockholm. https://www.biodiversitylibrary.org/page/358012#page/482/mode/1up.

Lohbeck, M., Lebrija-Trejos, E., Martínez-Ramos, M., Meave, J. A., Poorter, L. & Bongers, F. (2015). Functional trait strategies of trees in dry and wet tropical forests are similar but differ in their consequences for succession. *PLoS ONE* 10: e0123741. https://doi.org/10.1371/journal.pone.0123741.

Lorenzi, H., Lacerda, M. T. C. & Bacher, L. B. (2015). *Frutas no Brasil: nativas e exóticas (de consumo in natura)*. Instituto Plantarum de Estudos da Flora, São Paulo.

Mazine, F. F., Faria, J. E. Q., Giaretta, A., Vasconcelos, T., Forest, F. & Lucas, E. (2018). Phylogeny and biogeography of the hyper-diverse genus *Eugenia* (Myrtaceae: Myrteae), with emphasis on *E.* sect. *Umbellatae*, the most unmanageable clade. *Taxon* 67: 752 – 769. https://doi.org/10.12705/674.5.

Mazine, F. F., Valdemarin, K. S., Bünger, M. O., Faria, J. E. Q., Fernandes, T., Giaretta, A., Santana, K. C., Sobral, M. & Souza, M. A. D. (2020). *Eugenia* in Flora do Brasil 2020. Jardim Botânico do Rio de Janeiro. Available from: http://floradobrasil.jbrj.gov.br/reflora/floradobrasil/FB10338. [Accessed 19 May 2023].

Menninger, E. A. (1959). The cultivated Eugenias in American gardens, part 2. *Natl. Hort. Mag.* 38: 145 – 163.

Nascimento, M., da Cunha, M. & Vieira, T. (2023). HUENF herbarium - *Universidade Estadual do Norte Fluminense — Herbário Virtual REFLORA*. Version 1.142. Instituto de Pesquisas Jardim Botanico do Rio de Janeiro. Occurrence dataset. Available from: https://ipt.jbrj.gov.br/reflora/resource?r=huenf&v=1.142.

Nic Lughadha, E. N. & Proença, C. (1996). A survey of the reproductive biology of the Myrtoideae (Myrtaceae). *Ann. Missouri Bot. Gard.* 83: 480 – 503. https://doi.org/10.2307/2399990.

Niedenzu, F. (1893). Myrtaceae. In: A. Engler & K. Prantl (eds), *Die Natürlichen Pflanzenfamilien* 3 (7): 57 – 105. Engelmann, Leipzig.

Oliveira-Filho, A. T. & Fontes, M. A. L. (2000). Patterns of floristic differentiation among Atlantic forests in southeastern Brazil and the influence of climate. *Biotropica* 32 (4b): 793 – 810. https://doi.org/10.1111/j.1744-7429.2000.tb00619.x.

Pizo, M. A. (2000). The seed-dispersers and fruit syndromes of Myrtaceae in the Brazilian Atlantic Forest, pp. 129 – 143. In: D. J. Levey, W. R. Silva & M. Galetti (eds), *Seed Dispersal and Frugivory: Ecology, Evolution and Conservation*. CABI Publishing, Oxon. https://doi.org/10.1079/9780851995250.0129.

QGIS Development Team (2022). QGIS Geographic Information System. Open Source Geospatial Foundation Project. Available from: http://qgis.osgeo.org/. [Accessed 19 May 2023].

Radford, A. E., Dickson, W. C., Massey, J. R. & Bell, C. R. (1974). *Vascular Plant Systematics*. Harper & Row Publisher, New York.

REFLORA (2022). *Herbário*. Available online from: http://floradobrasil.jbrj.gov.br/reflora/herbarioVirtual. [Accessed 19 May 2023].

Rüger, N., Comita, L. S., Condit, R., Purves, D., Rosenbaum, B., Visser, M. D., Wright, S. J. & Wirth, C. (2018). Beyond the fast-slow continuum: demographic dimensions structuring a tropical tree community. *Ecol. Letters* 21: 1075 – 1084. https://doi.org/10.1111/ele.12974.

Staggemeier, V. G., Cazetta, E. & Morellato, L. P. C. (2017). Hyperdominance in fruit production in the Brazilian Atlantic rain forest: the functional role of plants in sustaining frugivores. *Biotropica* 49: 71 – 82. https://doi.org/10.1111/btp.12358.

Thiers, B. (2023, continuously updated). *Index Herbariorum: A Global Directory of Public Herbaria and Associated Staff. New York Botanical Garden's Virtual Herbarium*. http://sweetgum.nybg.org/science/ih/. [Accessed 19 May 2023].

Urbanetz, C., Tamashiro, J. Y. & Kinoshita, L. S. (2010). Floristic composition and similarity analysis of an Atlantic rain forest fragment in Cananéia, São Paulo State, Brazil. *Brazil. J. Bot.* 33: 639 – 651. https://doi.org/10.1590/S0100-84042010000400012.

Publisher's Note

Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.