

New distribution record and implications for conservation of the endangered *Wunderlichia azulensis* Maguire & G.M. Barroso (Asteraceae: Wunderlichieae)

Luana Paula Mauad^{1*}, Fátima Otavina de Souza Buturi², Tatiane Pereira de Souza³, Marcelo Trindade Nascimento⁴ and João Marcelo Alvarenga Braga¹

¹ Instituto de Pesquisas Jardim Botânico do Rio de Janeiro. Rua Pacheco Leão, 915, Jardim Botânico. CEP 22460-030. Rio de Janeiro, RJ, Brasil.

² Universidade Estadual de Campinas, Instituto de Biologia, Programa de Pós Graduação em Biologia Vegetal. Rua Monteiro Lobato, 255, Barão Geraldo. CEP 13083-862. Campinas, SP, Brasil.

³ Universidade do Estado do Rio de Janeiro, Instituto de Biologia Roberto Alcântara Gomes, Programa de Pós-graduação em Biologia Vegetal. Rua São Francisco Xavier, 524, Maracanã. CEP 20550-013. Rio de Janeiro, RJ, Brasil.

⁴ Universidade Estadual do Norte Fluminense Darcy Ribeiro, Centro de Biociências e Biotecnologia, Laboratório de Ciências Ambientais. Avenida Alberto Lamego, 2000, Parque Califórnia. CEP 28013-602. Campos dos Goytacazes, RJ, Brasil.

* Corresponding author. E-mail: luamaud@gmail.com

ABSTRACT: The endemic Brazilian genus *Wunderlichia* is one of the smallest in Asteraceae. Among its species is found the rare *Wunderlichia azulensis*, only known to grow in rocky outcrops in Bahia, Minas Gerais, and Espírito Santo states. This work shows the first record of *W. azulensis* in Rio de Janeiro state and categorizes its conservation status based on the IUCN Red List Categories and Criteria. It is also presented a distribution map showing its relationship to places with low annual rainfall, and its occurrence in three Brazilian biomes

DOI: 10.15560/10.3.706

The genus *Wunderlichia* Riedel ex Benth. & Hook.f. (Asteraceae: Wunderlichieae), which comprises five species, is endemic to some states of Central Plateau and southeastern Brazil (Souza-Buturi 2013a). The species are found on rocky outcrops, such as inselbergs, in regions with a long annual dry season. Species of *Wunderlichia* are deciduous shrubs or small trees that lose their leaves in flowering (Barroso and Maguire 1973; Feres *et al.* 2009). The loss of leaves is an important adaptation to prevent excessive loss of water through evapotranspiration, as a result of the xerophytic environmental conditions to which these plants are exposed in their rocky habitat.

The studied species, *Wunderlichia azulensis* Maguire & G.M. Barroso (Figure 1), was first collected by J.G. Kuhlmann (collection number 6616, 05/12/1943, RB), and described by Barroso and Maguire (1973), with few records thereafter. In fact, it has only been recorded in ten rocky outcrops in Bahia, Minas Gerais and Espírito Santo states (Souza-Buturi 2013b). Size of capitula, number of series of involucre bracts, and type of indumentum and color (incano to glabrous indument, cream-colored, ochre or blackish), are features that distinguish it from *W. mirabilis*, the morphologically closest species and the one with which it is most confused in herbarium collections.

Wunderlichia azulensis is found in small patch communities of rocky outcrops, mostly sharing their habitat with some species of Velloziaceae, Cactaceae, and Bromeliaceae. It can sometimes be found isolated in some clefts with shallow substrate. Its distribution pattern seems to be associated with places having an annual rainfall below 1200 mm (Figure 2). It is commonly found

in places which have a clear seasonal climate with a short rainy season, and up to eight dry months each year. All such locations are characterized by rocky outcrops surrounded by semideciduous or deciduous forests within the Atlantic Forest domain, with rare records in the Brazilian savanna (*Cerrado*) and *Caatinga* biomes.

In 2009, research was launched to survey the flora of the Itaoca massif (21°47'31" S, 41°27'25" W, with altitudinal range between 8 and 420m.a.s.l.) at Campos dos Goytacazes City, northern Rio de Janeiro state, and some individuals of *W. azulensis* were identified. Thus, the first recorded occurrence of this species in Rio de Janeiro state is based on specimens collected in the years of 2010 and 2011. Herbarium material collected in 2007 at the same massif was also identified. All specimen vouchers are deposited at the herbarium of the Rio de Janeiro Botanical Garden (RB).

The Itaoca massif is situated in an extensive plain with annual rainfall that does not exceed 1000 mm (Aguiar and Gaglianone 2011). Despite having a clear seasonal climate with less humidity than the rest of the state, this area is important for the floristic diversity of Rio de Janeiro (Werneck *et al.* 2011; Pessanha *et al.* 2014), which is considered a hotspot within the Atlantic Forest (Myers *et al.* 2000; Murray-Smith *et al.* 2008). In view of the local environmental conditions of Itaoca Massif, compared to the rest of the state, it might be the southern boundary for *W. azulensis* distribution in the state, and very likely the country, because farther south, the trend is toward lower temperatures, higher rainfall and more differentiated geological formations.

The conservation status of *Wunderlichia azulensis* differs in all red lists of the Brazilian flora (Nakajima *et al.* 2012). Based on the scarcity of records and general lack of information about its distribution, *W. azulensis* is considered “Data Deficient” by the Brazilian Official List of Flora Threatened Species (MMA 2008). Recently, it has been considered “Endangered (EN) - EN B1ab(i,ii,iii,v) + 2ab(i,ii,iii,v)” by the Red Book of Brazilian Flora (Martinelli and Moraes 2013), and had already been considered “Critically Endangered (CR) - B2ab (ii, iii)” by the non-official Brazilian List of Flora Threatened Species of *Fundação Biodiversitas* (2005). These lists mainly followed IUCN criteria of restricted distribution area and small population (IUCN 2012), and did not consider records from the states of Rio de Janeiro and Bahia. The present work has confirmed that *W. azulensis* is under a threat category. Although, taking into account all records about occupancy area (SpeciesLink 2013) and habitat quality, and using GeoCat (Bachman *et al.* 2011) recommendations, with area of occupancy estimated at 68 km², we have classified *W. azulensis* as “Endangered (EN) - B2ab (ii, iii, iv)”. This classification is primarily based

on the very few areas of its occurrence and the visible loss of habitat quality over the years since its first collection. Specifically, most of its present habitat suffers from intense mining activities and fires that directly affect the patch vegetation where it is found.

In spite of being recorded in four Brazilian states, it should be noted that its occurrence is still very limited to isolated rocky outcrops with equally limited climatic conditions. In addition, its occurrence habitat in Rio de Janeiro state is not a conservation area, and other likely occurrence habitats in the northern part of this state may well be on private, unprotected land. Therefore, based on the findings in the present study, a reassessment of its conservation status per the Brazilian Official List of Flora Threatened Species and the Red Book of Brazilian Flora is recommended. It is also recommended that *W. azulensis* be included on a possible upcoming red list of Rio de Janeiro state, since its occurrence is now recorded for one isolated rocky outcrop in that state (21°47'31" S, 41°27'25" W), thus making it possible to take action toward its conservation.

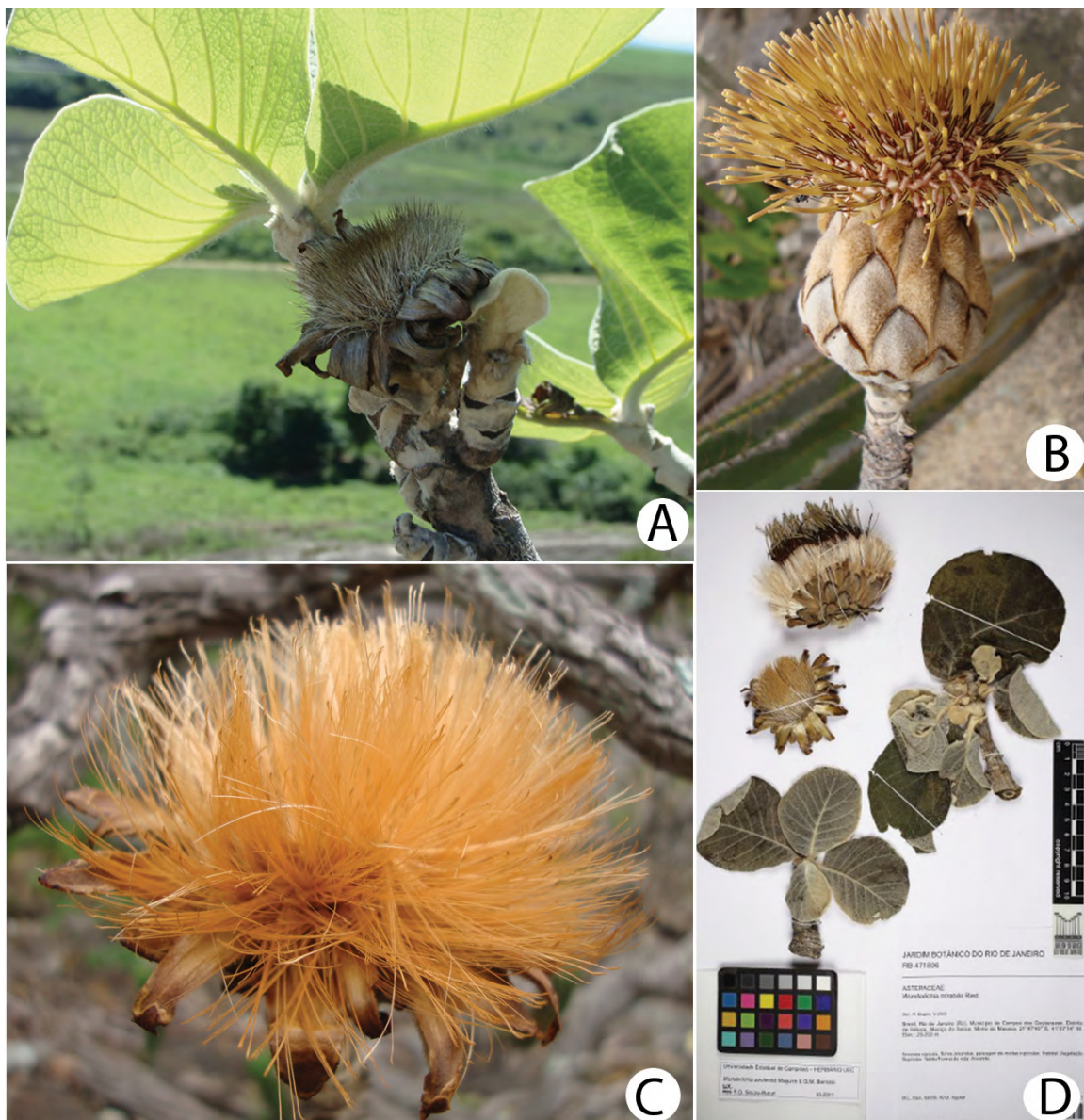


FIGURE 1. *Wunderlichia azulensis* Maguire & G.M. Barroso (Asteraceae) at Itaoca Massif, Campos dos Goytacazes, Rio de Janeiro, Brazil. A) Branches with old capitula (bracts and paleas); B) Flowering capitula; C) Fruiting capitula; D) Specimen of *W. azulensis* from the Itaoca Massif (M. L. Dan 39 (RB)).

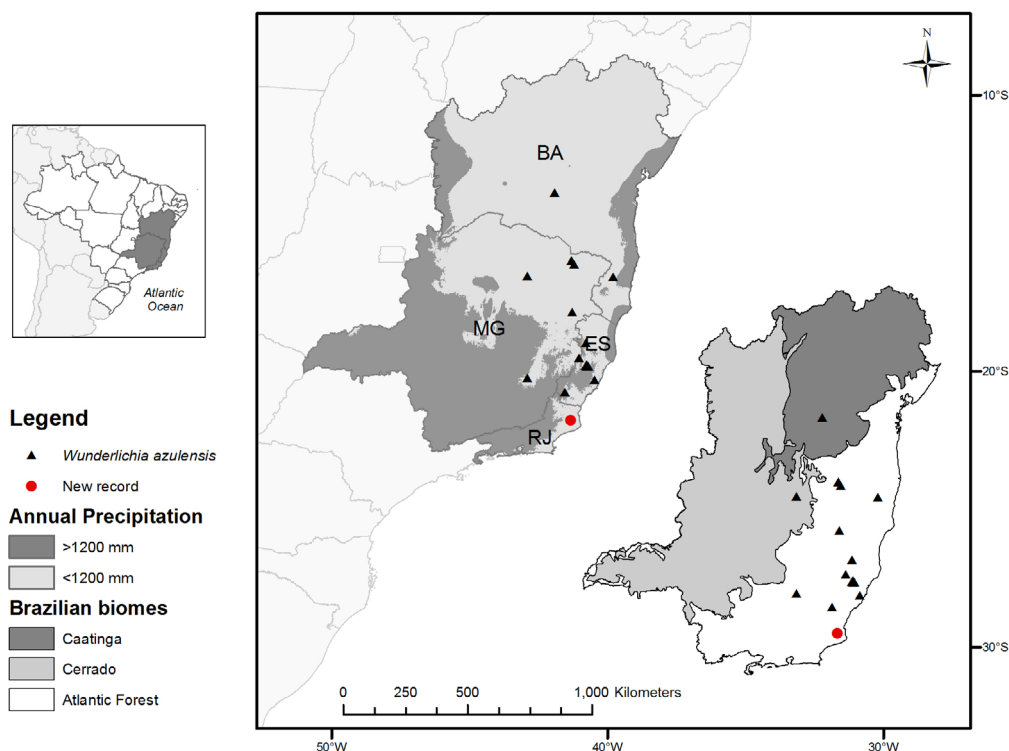


FIGURE 2. Distribution map of *Wunderlichia azulensis* Maguire & G.M. Barroso (Asteraceae) regarding annual rainfall (Hijmans et al. 2005) and Brazilian biomes (IBGE 2012).

ACKNOWLEDGMENTS: We thank Dr. Roberto Lourenço Esteves and Pablo Viany Prieto for conversations about the studied species and its conservation status, respectively, and Leandro Jorge Telles Cardoso for the insight about this subject. The *Conselho Nacional de Desenvolvimento Científico e Tecnológico* (CNPq) provided financial support and a productivity grant to Marcelo T. Nascimento.

LITERATURE CITED

- Aguiar, W.M. and M.C. Gaglianone. 2011. Euglossine bees (Hymenoptera Apidae Euglossina) on an inselberg in the Atlantic Forest domain of southeastern Brazil. *Tropical Zoology* 24(2): 107–125 (<http://www.fupress.net/index.php/tropicalzoology/article/view/10455>).
- Bachman, S., J. Moat, A. Hill, J. de la Torre and B. Scott. 2011. Supporting Red List threat assessments with GeoCAT: Geospatial Conservation Assessment Tool. *Zookeys* 150: 117–126 (doi: 10.3897/zookeys.150.2109).
- Barroso, G.M. and B. Maguire. 1973. A review of the genus *Wunderlichia* (Mutisiae, Compositae). *Revista Brasileira de Biologia* 33: 379–406.
- COPAM. 2008. *Lista das Espécies Ameaçadas de Extinção da Flora do Estado de Minas Gerais*. Deliberação Conselho Estadual de Política Ambiental nº 367, de 15 de dezembro de 2008. Belo Horizonte: Diário do Executivo. 48 pp.
- Feres, F., M.I. Zucchi, A.P. Souza, M.C.E. Amaral and W. Bittrich. 2009. Phylogeographic studies of Brazilian “campo-rupestre” species: *Wunderlichia mirabilis* Riedel ex Baker (Asteraceae). *Biotemas* 22(1): 17–26 (doi: 10.5007/2175-7925.2009v22n1p17).
- Fundação Biodiversitas. 2005. *Lista da Flora Brasileira Ameaçada de Extinção*. Electronic Database accessible at <http://www.biodiversitas.org.br/folraBr/>. Captured on 24 September 2013.
- Hijmans, R.J., S.E. Cameron, J.L. Parra, P.G. Jones and A. Jarvis. 2005. Very high resolution interpolated climate surfaces for global land areas. *International Journal of Climatology* 25(15): 1965–1978 (doi: 10.1002/joc.1276).
- IBGE. 2012. *Manual Técnico da Vegetação Brasileira*. Rio de Janeiro: Instituto Brasileiro de Geografia e Estatística. 274 pp.
- IUCN. 2012. *IUCN Red List of Threatened Species. Version 4.0*. Electronic Database accessible at <http://www.iucnredlist.org/>. Captured on 23 September 2013.
- MMA. 2008. *Instrução Normativa 6, de 23 de setembro de 2008*. Ministério do Meio Ambiente. Diário Oficial da União 185: 75–83.
- Murray-Smith, C., N.A. Brummitt, A.T. Oliveira-Filho, S. Bachman, S., J. Moat, E.M.N. Lughadha, and E.J. Lucas. 2008. Plant Diversity Hotspots in the Atlantic Coastal Forests of Brazil. *Conservation Biology* 23(1): 151–163 (doi: 10.1111/j.1523-1739.2008.01075.x).
- Myers, N., R.A. Mittermeier, C.G. Mittermeier, G.A.B. Fonseca and J. Kent. 2000. Biodiversity hotspots for conservation priorities. *Nature* 403(6772): 853–858 (doi: 10.1038/35002501).

Nakajima, J.N., T.V. Junqueira, F.S. Freitas and A.M. Teles. 2012. Comparative analysis of red lists of the Brazilian flora: Asteraceae. *Rodriguésia* 63(1): 039–054 (doi: 10.1590/S2175-78602012000100004).

Pessanha, A.S., L. Menini Neto, R.C. Forzza and M.T. Nascimento. 2014. Composition and conservation of Orchidaceae on an inselberg in the Brazilian Atlantic Forest and floristic relationships with areas of Eastern Brazil. *Revista de Biologia Tropical* 62(2): 829–841 (<http://revistas.ufr.br/index.php/rbt/article/view/10719>).

Souza-Buturi, F.O. 2013a. *Wunderlichia* in Lista de Espécies da Flora do Brasil. Jardim Botânico do Rio de Janeiro. Electronic Database accessible at <http://floradobrasil.jbrj.gov.br/jabot/floradobrasil/FB5541>. Captured on 17 July 2013.

Souza-Buturi, F.O. 2013b. *Taxonomia, palinologia e anatomia de Wunderlichia, Asteraceae*. PhD. Thesis. Campinas: Universidade Estadual de Campinas. 156 pp.

SpeciesLink. 2013. *Wunderlichia azulensis* in Centro de Referência em Informação Ambiental, CRIA. Electronic Database accessible at <http://www.splink.cria.org.br>. Captured on 22 October 2013.

Werneck, M.S., M.E.G. Sobral, C.T.V. Rocha, E.C. Landau and J.R. Stehmann. 2011. Distribution and Endemism of Angiosperms in the Atlantic Forest. *Natureza & Conservação* 9(2): 188–193 (doi: 10.4322/natcon.2011.024).

RECEIVED: November 2013

ACCEPTED: April 2014

PUBLISHED ONLINE: July 2014

EDITORIAL RESPONSIBILITY: Angelo Gilberto Manzatto

APPENDIX. Material examined.

- BRAZIL. Bahia: Guaratinga, Pedra do Oratório, G.M. Carvalho *et al.* 399 (CEPEC, UEC), 26.08.2010. Espírito Santo: Água Branca, Pedra redonda, Vervloet *et al.* 3229 (MBML), 16.08.2007. Cariacica, Parque Municipal do Mochuara, A.G. Christo 646 (RB), 30.07.2008. Santa Teresa, São João de Petrópolis, (Cachoeira do Strut), L. Kollmann 8339 (MBML) 23.09.2005; *ib.*, Pedra do Rudio, R.C. Forzza 5729 (RB) 18.11.2009. São Roque de Canaã: Alto Misterioso, C. Esgario 76 (MBML), 26.08.2006. Minas Gerais: Pedra Azul, G.M. Magalhães 12039 (RB), 10.09.1958; *ib.*, F.O. Souza-Buturi 296 (SP, UEC), 17.09.2009. Rio Doce, Fazenda Santa Adelaide, Kuhlmann 6616 (RB), 05.12.1943. Teófilo Otoni, L.F.A. Paula 293 (RB) 16.04.2011. Grao Mogol, T.S.M. Grandi *s.n.* (UFMG) 27.08.1988. Rio de Janeiro: Campos dos Goytacazes, Maciço do Itaoca, L. P. Mauad 187 (RB, HUENF), 20.04.2010; *ib.*, M. L. Dan 39 (RB), 18.10.2007; *ib.*, T.P.Souza 85 (HUENF), 22.09.2011.