



A new species of *Eremitis* Döll (Poaceae, Bambusoideae) from the Baixo Jequitinhonha region, an area of extreme importance for the conservation of the flora of Minas Gerais, Brazil

Fabício Moreira Ferreira^{1*} , Pedro L. Viana² , Cassiano A. Dorneles Welker¹ , Lynn G. Clark³ 
and Reyjane P. Oliveira⁴ 

Received: January 27, 2021
Accepted: September 2, 2021

ABSTRACT

Eremitis is one of the three genera of the subtribe Parianinae (Poaceae, Bambusoideae, Olyreae) and is restricted to the Atlantic Forest in eastern Brazil. *Eremitis aemula*, herein described and illustrated, is microendemic to the Alto Cariri State Park, located in the Baixo Jequitinhonha region, an area considered to be extremely important for conservation of the flora in the state of Minas Gerais. This new species is morphologically similar to *Eremitis jardimii* and *E. robusta*. However, *E. aemula* is differentiated from both species mainly by its longer decumbent culms (47–50 cm long vs. 22–25 cm and (15–)25–28 cm, respectively) with shorter inflorescences (4.5–5 cm long vs. 5.5–6 cm and 6–6.5 cm, respectively), and by its leaf blades with rounded base (vs. attenuate in *E. jardimii* and *E. robusta*). The total number of bamboos in Minas Gerais thereby rises to 79 species with 16 endemic to the state, reinforcing the fact that the Baixo Jequitinhonha is of extreme importance to the conservation of the Minas Gerais flora.

Keywords: Alto Cariri State Park, conservation, herbaceous bamboos, Parianinae, taxonomy

Introduction

The Brazilian state of Minas Gerais occupies an area of 588,528 km², partitioned into 853 municipalities (IBGE 2020). Minas Gerais is characterized by a set of extremely variable abiotic factors such as relief, climate, soil, and water resources (Drummond *et al.* 2005). Such different geomorphological conditions contribute to the presence of

several distinct vegetation types and an extraordinary floristic richness (Drummond *et al.* 2005). According to Flora do Brasil 2020 (2020), Minas Gerais is the richest Brazilian state in angiosperm diversity, with 12,153 species. This diversity is also observed in the bamboo group (Poaceae, Bambusoideae). With 78 species, of which 15 are endemic, Minas Gerais is the second most diverse Brazilian state in bamboo species, in addition to Bahia (91 species, 37 endemic) and Espírito Santo (51 species, eight endemic) (Flora do Brasil 2020 2020).

¹ Programa de Pós-Graduação em Biologia Vegetal, Instituto de Biologia, Universidade Federal de Uberlândia, 38400-902, Uberlândia, MG, Brazil

² Coordenação de Botânica, Museu Paraense Emílio Goeldi, 66040-170, Belém, PA, Brazil

³ Department of Ecology, Evolution, and Organismal Biology, Iowa State University, 50011-4009, Ames, Iowa, USA

⁴ Programa de Pós-Graduação em Botânica, Departamento de Ciências Biológicas, Universidade Estadual de Feira de Santana, 44036-900, Feira de Santana, BA, Brazil

* Corresponding author: fmoreiraf@yahoo.com.br



Eremitis is one of the three monophyletic lineages of herbaceous bamboos that compose the subtribe Parianinae (Ferreira *et al.* 2019). Along with *Parianella*, the genus has a distribution restricted to the Atlantic Forest of eastern Brazil (Ferreira *et al.* 2013a; 2019). The other recognized genus of this subtribe, *Pariana*, is more widely distributed throughout the Amazon Basin and into Central America (Hollowell 1987; Judziewicz *et al.* 1999; Clark & Oliveira 2018; Ferreira *et al.* 2019). In addition to molecular data, four morphological synapomorphies define Parianinae: spiciform inflorescences, spikelets in whorls, articulated inflorescence axes, and staminate spikelets with glumes (Ferreira *et al.* 2019). The monophyly of *Eremitis* is supported by molecular data and five morphological synapomorphies: truly underground culms, sympodial inflorescences on leafy culms, gynecandrous and staminate spikelet whorls in the same inflorescence, staminate spikelet pedicels elongated and laminar only in the terminal whorl, and pubescent styles (Ferreira *et al.* 2019).

Currently, *Eremitis* encompasses 16 species (Ferreira *et al.* 2013b; 2016; 2019; 2020a; b; c; d; 2021a; b). During the taxonomic revision of the genus, a new species from Minas Gerais was found, which is morphologically similar to *Eremitis jardimii* and *E. robusta* (both from Bahia state). The new species described here increases the number of bamboo species in Minas Gerais to 79 species (16 endemic). This reinforces the fact that this state is a critical area for bamboo diversity (Ferreira *et al.* 2020a). In the present study, we provide a morphological description, illustrations, a distribution map, and notes on habitat and conservation status of the new species, as well as a morphological comparison with similar *Eremitis* species.

Materials and methods

Morphological investigation of the studied species was based on herbarium specimens (from ALCB, BHCB, CEPEC, CVRD, ESA, GUA, HUEFS, HUFU, IAN, INPA, ISC, K, LE, MBM, MBML, MG, MO, NY, P, PEUFR, R, RB, RBR, SP, SPF, UEC, UESC, US, and VIC herbaria; acronyms according to Thiers 2020, continuously updated), type collections, and fieldwork throughout the geographical distribution of the genus. The morphological terminology follows Hollowell (1987) and Ferreira *et al.* (2013b). In addition, web-based resources such as Tropicos (<https://www.tropicos.org/>), SpeciesLink system (<https://specieslink.net/>), and Reflora – Virtual Herbarium (<https://floradobrasil.jbrj.gov.br/reflora>) were accessed in order to check additional specimens, and update the geographical distribution of the genus. The conservation status was proposed following the recommendations of IUCN Red List categories and criteria, version 14 (IUCN Standards and Petitions Committee 2019). The area of occupancy (AOO) was calculated using the GeoCAT tool (Bachman *et al.* 2011), with 2 × 2 km

grid cells. Since the new species is only known from one locality so far, it was not possible to calculate its extent of occurrence (EOO). Maps were elaborated using the website SimpleMappr (Shorthouse 2010) and the software ArcMap (ESRI 2008). Geographical coordinates were obtained during the fieldwork and from collection details indicated in the labels of herbarium specimens.

Result and discussion

Taxonomy

Eremitis aemula F.M. Ferreira & R.P. Oliveira sp. nov. (Fig. 1)

Etymology: The specific epithet “aemula”, from the Latin, means “what imitates, who seeks to match” (Faria 1956), a reference to the morphological complexity of the new species, overlapping other congeneric species in various morphological characters.

Diagnosis: *Eremitis aemula* is similar to *E. jardimii* and *E. robusta* in leafy culm length and leaf blade width, but can be differentiated by its longer decumbent culms (47–50 cm long *vs.* 22–25 cm and (15–)25–28 cm, respectively) with shorter inflorescences (4.5–5 cm long *vs.* 5.5–6 cm and 6–6.5 cm, respectively), and by its leaf blades with rounded base (*vs.* attenuate in *Eremitis jardimii* and *E. robusta*).

Type: BRAZIL, Minas Gerais: Santa Maria do Salto, Alto Cariri State Park (16°24'14" S 41°21'22" W), 08 Jul. 2009, F.M. Ferreira, P.L. Viana, M.O.D. Pivari 2152 (Holotype: HUEFS; isotypes: BHCB, CEN, CEPEC, CESJ, CVRD, HUFU, ICN, ISC, K, MBM, MO, P, R, RB, SP, US).

Description: Leafy culms erect, 39–79 cm long, 1.3–2.7 mm diam. near the base; internodes slightly striate, glabrous to slightly pilose; nodes thickened, pilose; leaves 7–11 per leafy culm; leaf sheaths slightly keeled, not inflated, glabrous at the base, pilose towards the apex, margins ciliate, fimbriae at the apex present, persistent; ligules entire, 0.8–1.5 mm long; pseudopetioles 1.6–3(–3.3) × 1.2–1.8 mm, green or brown, adaxially and abaxially pilose; leaf blades (7.8–)8.4–10.3 × 2.4–3.4 cm, lanceolate, base rounded, symmetric, apex acute, concolor, glabrous to slightly scabrous, margins scabrous. Decumbent culms 47–50 cm long; leaves 3–4, reduced to the leaf sheaths; leaf sheaths not inflated, slightly scabrous, green, margins ciliate. Subterranean culms (10–)22–65 cm long. Leafy culm inflorescences 1(–2) per culm, (4–)5–6.5 cm long. Decumbent culm inflorescences 1 per culm, 4.5–5 cm long. Subterranean culm inflorescences 1 per culm, (1.6–)2–3.2 cm long. Gynecandrous whorls 16.3–18.5 × 4–4.7 mm, 1 per inflorescence; rachis prolongation 13–15(–16) mm long, glabrous; pistillate spikelets 1 per whorl; staminate spikelets 5 per whorl. Pistillate spikelets (13.4–)14–15 × 3–3.5 mm, lanceolate or oblong, stramineous to slightly spotted; glumes 10–12.3 × 1.4–2.5 mm, membranous, hyaline, linear to



A new species of *Eremitis* Döll (Poaceae, Bambusoideae) from the Baixo Jequitinhonha region, an area of extreme importance for the conservation of the flora of Minas Gerais, Brazil

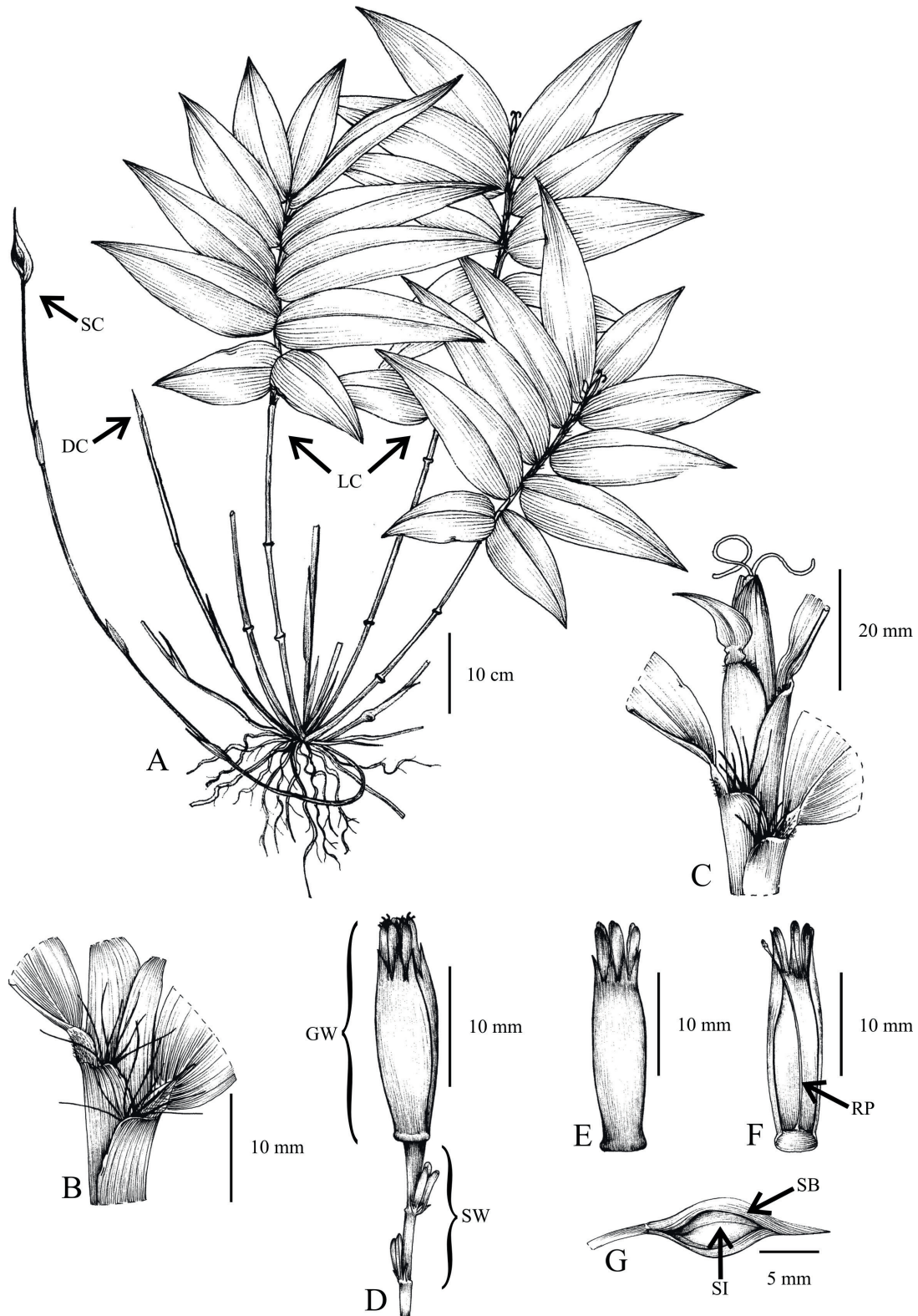


Figure 1. *Eremitis aemula*. **A.** Habit (DC = decumbent culm; LC = leafy culms; SC = subterranean culm). **B.** Detail of the leafy culm showing the fimbriae at the apex of the leaf sheaths. **C.** Leafy culm inflorescence enclosed by spathaceous bracts with style branches protruding. **D.** Decumbent culm inflorescence with spathaceous bracts removed, showing a gynecandrous whorl (GW) above and two staminate whorls (SW) below. **E-F.** Gynecandrous whorl. **E.** Abaxial view of the staminate spikelets. **F.** Adaxial view of the staminate spikelets showing the rachis prolongation (RP), pistillate spikelet removed. **G.** Subterranean culm inflorescence (SI) enclosed by spathaceous bracts (SB) (Drawn from the holotype by Carla Lima).

lanceolate, apex acute, glabrous to slightly pilose, 1–3-nerved; lemmas cartilaginous, oblong to lanceolate, apex acuminate, glabrous, 9–13-nerved; paleas cartilaginous, lanceolate, apex acuminate, glabrous, 10-nerved. Caryopsis not seen. Staminate spikelets (4.8–)5.5–6 × 1.3–1.5 mm, elliptic to oblong; pedicels (10.5–)11–14 mm long, laterally adnate in two groups, pilose; glumes (3–)3.5–4 × (0.9–)1–1.7 mm, linear to triangular, apex acute, pilose to slightly scabrous, 1–2-nerved; lemmas (3.5–)4.5–5.5 × 1–1.2 mm, oblong, apex obtuse to rounded, glabrous at the base and slightly villous at the margins and apex, 3-nerved; paleas 4.5–5(–5.5) × 0.8–1.5 mm, oblong, apex obtuse to rounded, glabrous at the base and villous towards the apex, 2-nerved; anthers 1–1.5 mm long. Staminate whorls 1–2(–3) per inflorescence; staminate spikelets (3–)4.5–5.5(–6) × 0.9–1 mm, oblong; pedicels 0.7–1.3 mm long, laterally adnate or free, glabrous to slightly pilose; glumes 2–3.2 × 0.3–0.5 mm, linear to narrowly triangular, apex acute to setaceous, glabrous, 0–1-nerved; lemmas (3.3–)3.5–4.7 × 0.8–1 mm, lanceolate to oblong, apex obtuse to rounded, glabrous at the base and villous towards the apex, 1–3-nerved; paleas (3–)3.3–4.3 × 0.8–1 mm, oblong, apex obtuse, glabrous at the base and villous at the margins and apex, 2-nerved; anthers ca. 1.5 mm long.

Distribution and habitat: *Eremitis aemula* occurs in a Dense Tropical Submontane Rainforest in the Santa Maria do Salto municipality, Minas Gerais state, at about 776 m elevation (Fig. 2). The forest fragment where *E. aemula* was found is part of the Alto Cariri State Park, a protected area of about 6,151 ha, created in 2008 by the law decree 44.726, located in the Baixo Jequitinhonha region (IEF-MG 2008). The Alto Cariri State Park harbors an important remnant of the Atlantic Forest that extends across southern Bahia (IEF-MG 2008), an area that encompasses a great diversity

and endemism of bamboos (Soderstrom *et al.* 1988; Clark 1990; Judziewicz *et al.* 1999). The Baixo Jequitinhonha region includes areas considered to be of extreme biological importance to the conservation of the Minas Gerais flora (Drummond *et al.* 2005).

Conservation status: The new species is only known from one small population occurring in the Alto Cariri State Park, in northeastern Minas Gerais. Júlio A. Lombardi cited, on the herbarium label (Lombardi *et al.* 5992), the locality as Duas Barras Farm, near to the Minas Gerais/Bahia border (see paratype section below). However, at that time, the Alto Cariri State Park had not been created yet. Therefore, both collections were made at the same locality, and there is a single population of *E. aemula* known so far.

This species is microendemic to this region. About 50 individuals were observed in the field. According to the IUCN Standards and Petitions Committee (2019), criteria B2ab(ii, iii), *Eremitis aemula* should be considered Critically Endangered (CR). We suggest this category because the species has a very restricted geographic distribution and area of occupancy (AOO = 4 km²). Although the species occurs in a Conservation Unit, throughout the Baixo Jequitinhonha region, there is significant conversion of native vegetation for areas of pasture, agriculture, and mining activities (Mascarenhas *et al.* 1989; Ribeiro & Galizoni 2003), which puts the preservation of this species at risk.

Taxonomic notes: *Eremitis aemula* presents a great morphological overlap with both *E. jardimii* and *E. robusta*. However, its longer decumbent culms (47–50 cm long *vs.* 22–25 cm and (15–)25–28 cm, respectively) with shorter inflorescences (4.5–5 cm long *vs.* 5.5–6 cm and 6–6.5 cm, respectively) help to differentiate it from *E. jardimii* and *E. robusta* (both endemic to southern Bahia) (Tab. 1).

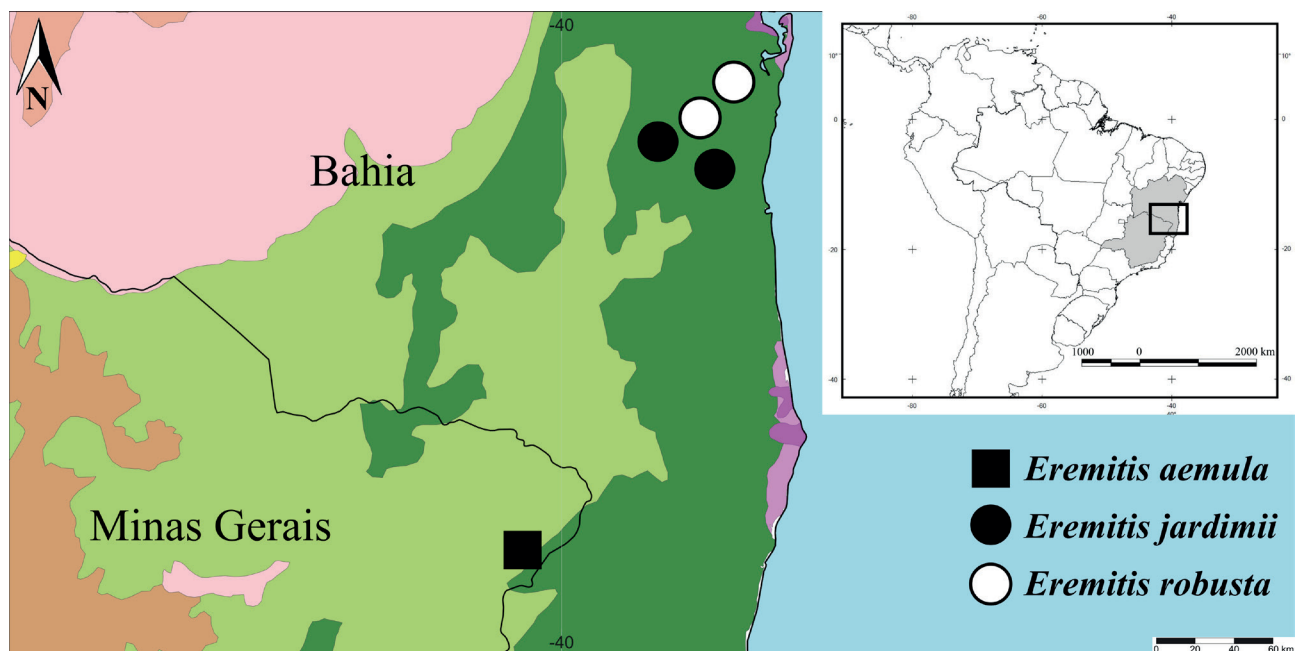


Figure 2. Geographical distribution of *Eremitis aemula*, *E. jardimii*, and *E. robusta*.

A new species of *Eremitis* Döll (Poaceae, Bambusoideae) from the Baixo Jequitinhonha region, an area of extreme importance for the conservation of the flora of Minas Gerais, Brazil

Table 1. Morphological and geographical distribution comparisons among the new species *Eremitis aemula* with *E. jardimii* and *E. robusta*.

Characters	<i>Eremitis aemula</i>	<i>Eremitis jardimii</i>	<i>Eremitis robusta</i>
Leafy culm			
Length (cm)	39–79	(27–)30–62(–67)	(51–)53–108(–127)
Node	pubescent	pubescent	glabrous
Leaf blade base	rounded and symmetric	attenuate and asymmetric	attenuate, symmetric to slightly asymmetric
Leaf blade length (cm)	(7.8–)8.4–10.3	10–13.6	(12.3–)13.5–18.2(–19)
Leaf blade width (cm)	2.4–3.4	2.5–3.2(–3.7)	(3–)3.4–4.8(–5)
Decumbent culm			
Length (cm)	47–50	22–25	(15–)25–28
Inflorescence length (cm)	4.5–5	5.5–6	6–6.5
Subterranean culm			
Inflorescence length (cm)	(1.6–)2–3.2	3.5–4.5	3
Gynecandrous whorl			
Pistillate spikelet: palea nerve number	10	8	8–10
Staminate spikelet: lemma width (mm)	1–1.2	1.3–1.5	1.5–2
Staminate whorl			
Staminate spikelet width (mm)	0.9–1	1–1.3	1.5–1.8
Staminate spikelet: glume length (mm)	2–3.2	1–1.7	(2–)2.5–3
Staminate spikelet: lemma width (mm)	0.8–1	1–1.3	1.5–1.8
Staminate spikelet: palea width (mm)	0.8–1	0.8–1	1.4–1.6
Geographical distribution (Brazilian state)	Minas Gerais	Bahia	Bahia

In addition, the new species can be distinguished from *E. jardimii* by its leaf blades with the base rounded and symmetric (*vs.* attenuate and asymmetric), shorter subterranean culm inflorescences ((1.6–)2–3.2 cm long *vs.* 3.5–4.5 cm), palea of the pistillate spikelets 10-nerved (*vs.* 8-nerved), staminate spikelets of the gynecandrous whorls with narrower lemmas (1–1.2 mm wide *vs.* 1.3–1.5 mm), and staminate spikelets of the staminate whorls with longer glumes (2–3.2 mm long *vs.* 1–1.7 mm) (Tab. 1).

Eremitis aemula differs from *E. robusta* mainly by its pubescent nodes (*vs.* glabrous), shorter leaf blades ((7.8–)8.4–10.3 cm long *vs.* (12.3–)13.5–18.2(–19) cm), narrower staminate spikelets of the staminate whorls (0.9–1 mm wide *vs.* 1.5–1.8 mm), and narrower lemmas and paleas of the staminate spikelets of the staminate whorls (0.8–1 mm wide *vs.* 1.5–1.8 mm, 0.8–1 mm wide *vs.* 1.4–1.6 mm, respectively) (Tab. 1).

Recent phylogenetic analyses combining nuclear and plastid DNA sequences (Ferreira *et al.* 2019) did not recover a close relationship among *Eremitis aemula*, *E. jardimii*, and *E. robusta* (the first two species treated as *Eremitis* sp.8 and *Eremitis* sp.11, respectively), reinforcing that these taxa correspond to different species.

Paratype: BRAZIL, Minas Gerais: Santa Maria do Salto, Duas Barras Farm, trail from the farm's headquarters to the border between MG and BA, 09 Feb. 2004, J.A. Lombardi, A. Salino, R.C. Mota, T.E. Almeida, P.L. Viana 5992 (BHCB, HUEFS).

Acknowledgements

The authors are grateful to Dr. Marco Otávio Dias Pivari and Mr. Batista for their help with the fieldwork, to Carla Lima for the illustrations, and to the Conselho Nacional de Desenvolvimento Científico e Tecnológico, Brazil (CNPq, grants 401526/2014-3 and 426334/2018-3) for financial support. We also thank the CNPq and the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior, Brazil (CAPES) for fellowships given to FMF (PDJ/CAPES and PNP/CAPES), CADW (PQ-2/CNPq), and RPO (PQ-1C/CNPq).

References

- Bachman S, Moat J, Hill AW, de la Torre J, Scott B. 2011. Supporting Red List threat assessments with GeoCAT: geospatial conservation assessment tool. *ZooKeys* 150: 117–126.
- Clark LG. 1990. Diversity and biogeography of Neotropical bamboos (Poaceae: Bambusoideae). *Acta Botanica Brasiliica* 4: 125–132.
- Clark LG, Oliveira RP. 2018. Diversity and evolution of the New World bamboos (Poaceae: Bambusoideae: Bambuseae, Olyreae). In: Lucas S, Abadie M, Santos HA, *et al.* (eds.) Proceedings of the 11th World Bamboo Congress, Xalapa, Mexico. Xalapa, Mexico, Plymouth: The World Bamboo Organization. p. 35–47.
- Drummond GM, Martins CS, Machado ABM, Sebaio FA, Antonini Y. 2005. Biodiversidade em Minas Gerais: um atlas para sua conservação. 2nd edn. Belo Horizonte, Fundação Biodiversitas.



- ESRI. 2008. Arcmap. Version 9.3. Environmental Systems Research Institute.
- Faria E. 1956. Dicionário Escolar Latino-Português. 2nd. edn. Rio de Janeiro, Ministério da Educação e Cultura.
- Ferreira FM, van den Berg C, Hollowell VC, Oliveira RP. 2013a. *Parianella* (Poaceae, Bambusoideae): morphological and biogeographical information reveals a new genus of herbaceous bamboos from Brazil. *Phytotaxa* 77: 27-32.
- Ferreira FM, Dórea MC, Leite KRB, Oliveira RP. 2013b. *Eremitis afimbriata* and *E. magnifica* (Poaceae, Bambusoideae, Olyreae): two remarkable new species from Brazil and a first record of blue iridescence in bamboo leaves. *Phytotaxa* 84: 31-45.
- Ferreira FM, Hollowell VC, Oliveira RP. 2016. *Eremitis linearifolia* and *E. robusta* (Poaceae, Bambusoideae, Olyreae): two new species of herbaceous bamboos from Brazil first collected over 30 years ago. *Phytotaxa* 280: 179-189.
- Ferreira FM, Oliveira RP, Welker CAD, et al. 2019. Phylogenetic relationships within Parianinae (Poaceae: Bambusoideae: Olyreae) with emphasis on *Eremitis*: evidence from nuclear and plastid DNA sequences, macromorphology, and pollen ectexine patterns. *Molecular Phylogenetics and Evolution* 139: 106541.
- Ferreira FM, Welker CAD, Santos-Gonçalves AP, Clark LG, Oliveira RP. 2020a. A new species of *Eremitis* (Poaceae, Bambusoideae) from Rio Doce State Park, Minas Gerais, Brazil, marks the furthest inland distribution of the genus. *Brittonia* 72: 133-140.
- Ferreira FM, Welker CAD, Clark LG, Oliveira RP. 2020b. *Eremitis limae* (Poaceae, Bambusoideae), a new species of herbaceous bamboo endemic to the Atlantic Forest of Bahia, Brazil. *Phytotaxa* 454: 277-284.
- Ferreira FM, Silva C, Welker CAD, et al. 2020c. *Eremitis berbertii* and *E. fluminensis* (Poaceae, Bambusoideae): new species from the Brazilian Atlantic Forest and updates on leaf microcharacters in the genus. *Novon: A Journal for Botanical Nomenclature* 28: 240-252.
- Ferreira FM, Welker CAD, Clark LG, Oliveira RP. 2020d. *Eremitis jardimii* (Poaceae, Bambusoideae), a new species from Bahia, Brazil. *Kew Bulletin* 75: 25.
- Ferreira FM, Welker CAD, Clark LG, Oliveira RP. 2021a. Reinterpretation of vegetative and reproductive characters validates three new species in the endangered herbaceous bamboo genus *Eremitis* (Poaceae, Bambusoideae, Olyreae) from the Atlantic Forest, Brazil. *Systematic Botany* 46: 321-332.
- Ferreira FM, Welker CAD, Oliveira RP. 2021b. *Eremitis clarkiae* and *E. vinacea* (Poaceae, Bambusoideae): two new species of herbaceous bamboos endemic to the Atlantic Forest of southern Bahia, Brazil increase the diversity of the genus in this hotspot. *Plant Ecology and Evolution* 154: 470-482.
- Flora do Brasil 2020. 2020. Jardim Botânico do Rio de Janeiro. <http://floradobrasil.jbrj.gov.br/> 23 Nov. 2020.
- Hollowell VC. 1987. Systematics of the subtribe Parianinae (Poaceae: Bambusoideae: Olyreae). PhD thesis, University of South Carolina, South Carolina.
- IBGE – Instituto Brasileiro de Geografia e Estatística. 2020. Área territorial do Estado de Minas Gerais. <https://www.ibge.gov.br/cidades-e-estados/mg.html> 23 Nov. 2020.
- IEF-MG – Instituto Estadual de Florestas de Minas Gerais. 2008. Parque Estadual do Alto Cariri. <http://www.ief.mg.gov.br/unidades-de-conservacao/573> 23 Nov. 2020.
- IUCN Standards and Petitions Committee. 2019. Guidelines for using the IUCN Red List categories and criteria. Version 14. <http://www.iucnredlist.org/documents/RedListGuidelines.pdf>.
- Judziwicz EJ, Clark LG, Londoño X, Stern M. 1999. American bamboos. Washington D.C., Smithsonian Institution Press.
- Mascarenhas GR, Teixeira CAS, Vilela JMC, Martinez JEA, Féres MC. 1989. Levantamento de áreas críticas de mineração do Rio Jequitinhonha. Relatório Técnico não publicado. Departamento Nacional de Produção Mineral (DNPM), 3º distrito, Fundação Estadual de Meio Ambiente (FEAM). Belo Horizonte, Fundação Centro Tecnológico de Minas – CETEC.
- Ribeiro EM, Galizoni FM. 2003. Água, população rural e políticas de gestão: o caso do vale do Jequitinhonha, Minas Gerais. *Ambiente & Sociedade* 6: 129-146.
- Shorthouse DP. 2010. SimpleMappr, an online tool to produce publication-quality point maps. <http://www.simplemappr.net>. 23 Nov. 2020.
- Soderstrom TR, Judziwicz EJ, Clark LG. 1988. Distribution patterns of Neotropical bamboos. In: Vanzolini PE, Heyer WR. (eds.) Proceedings of a workshop on Neotropical distribution patterns. Rio de Janeiro, Brazil, Academia Brasileira de Ciências. p. 121-157.
- Thiers B. 2020, continuously updated. *Index Herbariorum*: a global directory of public herbaria and associated staff. New York Garden's Virtual Herbarium. <http://sweetgum.nybg.org/ih/herbarium.php?irn=174420>. 23 Nov. 2020.

