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Eplingiella sanoi sp. nov. (Hyptidinae-Lamiaceae): supports the urgent need for *campos rupestres* conservation in the Serra do Espinhaço Septentrional, Minas Gerais state, Brazil

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Abstract. A new species of Lamiaceae, *Eplingiella sanoi*, from the *campo rupestre* of an ecotone zone between the Cerrado and the Caatinga domains is described and illustrated. The new species expands the distribution of the genus to Southeast Brazil, previously restricted to Northeast Brazil. *Eplingiella sanoi* is compared to the three other species of the genus, especially *E. cuniloides*, the morphologically closest related species. We present an identification key for all the species of the genus, an occurrence map for *Eplingiella sanoi*, *E. cuniloides* and *E. brightoniae* and a formal conservation assessment for the new species. *Eplingiella sanoi* is endemic to the region between Pico da Formosa and Pico do Sucuruiú (Minas Gerais state, Serra do Espinhaço), an area under threat due to a planned wind farm installation. Recognizing this species emphasizes the imperative for more taxonomic studies and conservation of Serra do Espinhaço.

Keywords: Espinhaço Range, Labiatae, *Hyptis*, Ocimeae, protected areas.

INTRODUCTION

Eplingiella Harley & J.F.B.Pastore (Lamiaceae, tribe Ocimeae, subtribe Hyptidinae) is a genus from Tropical America named in honour of

Carl Epling (1894–1968), one of the major specialists in tropical American Lamiaceae, especially Hyptidinae (Harley and Pastore 2012). The genus is characterized as shrubs with fasciculate or much branched stems, bearing reduced leaves adapted to xeromorphic climates, which are borne on brachyblasts, short pedunculate and subumbellate cymes subtended by foliaceous bracts and containing 2 to 18 flowers, blue or violet-blue corollas spreading lobes with lips unmarked, and gynoecium without a stylopodium (Harley 2014; Harley et al. 2017). Additionally, *Eplingiella* is unique within the subtribe in displaying resupinate dimorphy and the style opposing the stamens and not lying alongside them (Harley 2014; Harley et al. 2017).

The genus is mainly distributed in the semi-arid region of Northeast Brazil (Harley 2014; Antar et al. 2024) and is represented by three species: *Eplingiella brightoniae* Harley, from the further North portion of Chapada Diamantina region, in the municipalities of Umburanas and Sento Sé, Northern Bahia state; *E. cuniloides* (Epling) Harley & J.F.B.Pastore, known from a small locality in Morro do Chapéu municipality, also in Bahia state; and *E. fruticosa* (Salzm. ex Benth.) Harley & J.F.B.Pastore, with a much wider distribution, occurring in both semi-arid and the coastal *restinga* areas of Northeastern Brazil, from Bahia to Rio Grande Norte states (Harley 2014; Soares et al. 2019). The latter species, which is the type species of the genus, was firstly described by Bentham (1833) as *Hyptis fruticosa* Salzm. ex Benth. a member of *Hyptis* sect. *Mesosphaeria* Benth., one of the 19 sections that this author divided *Hyptis* into. With further morphological studies (e.g. Epling 1949; Harley 1988), the species was withdrawn from *H.* sect. *Mesosphaeria* and its taxonomic position remained uncertain, until molecular data revealed the paraphyletic nature of *Hyptis* s.lat. (Pastore et al. 2011, 2021). Finally, the phylogenetic study of Pastore et al. (2011) led to a new generic classification of Hyptidinae (Harley and Pastore 2012), in which the genus *Eplingiella* was delimited for *E. fruticosa* and allied species (Harley 2014).

The Espinhaço Range is an important centre of plant diversity in eastern Brazil (Giulietti et al. 1997), with a high number of endemic, rare and endangered species (Rapini et al. 2021). Beyond its biological importance, the Espinhaço Range stands out in the geological and geographical context as an extensive watershed, stretching longitudinally for over 1,000 km, from the Jacobina region (Bahia state, northern limit) to the Quadrilátero Ferrífero (Minas Gerais state, southern limit; Derby 1906; Saadi 1995). Based on geology, it can be divided into Chapada Diamantina, Espinhaço Meridional and Espinhaço Septentrional (Saadi 1995; Knauer 2007). Historically, a significant number of studies on the flora in eastern Brazil has been focussed on the Chapada Diamantina (e.g., Harley & Simmons, 1986; Stannard, 1995; Zappi et al. 2003) and, particularly, on the Serra do Espinhaço Meridional (e.g., Giulietti et al. 1987 [including the Flora da Serra do Cipó Collection]; Zappi et al. 2014). Apart from floristic studies in the Grão Mogol region (Pirani et al. 2003, including the Flora de Grão Mogol Collection), the flora of the Serra do Espinhaço Septentrional is still poorly known (Almeida et al. 2023).

The northernmost mountains of Minas Gerais state, situated near the border with the state of Bahia, including the complex formed by Serra Montevidéu, Pico da Formosa, and Pico do Sucuruiú, are part of the Serra do Espinhaço Septentrional. This region is characterized by an ecotone zone between the Cerrado and the Caatinga domains, including extensive areas of *campos rupestres* (herbaceous and shrubby vegetation inhabiting quartzite and ironstone soils and outcrops in elevations above 900 m asl). It remains floristically underexplored, partly due to its challenging accessibility, despite being designated as a conservation priority area (MMA, 2018). Recent efforts have been made to catalogue the plant diversity in this portion of the Serra do Espinhaço Septentrional, with notable contributions from researchers at the Rio de Janeiro Botanical Garden Research Institute and the Brazilian Agricultural Research Corporation, which made first floristic surveys. Following these initial efforts, the region has caught the attention of other botanical researchers who are now getting involved in cataloguing the local flora. In the past years, a significant number of new species to science have been described (e.g., Cardoso et al. 2022; Almeda & Pacifico, 2023; Pacifico et al. 2023; Silva et al. 2023; Zavatin et al. 2023), and at least six new species are currently under study by taxonomists (Verdi, pers. comm.). To document the local flora and support the creation of a Protected Area, over 50 taxonomists are collaborating on a checklist led by researchers from the Rio de Janeiro Botanical Garden Research Institute. These studies are expanding floristic knowledge and highlighting an elevated diversity of plants in the *campos rupestres* of this mountain complex in the Serra do Espinhaço Septentrional.

Here, we propose a new species of *Eplingiella* from the *campos rupestres* of Minas Gerais, an ecotone zone between the Cerrado and Caatinga domains, expanding the genus distribution and assessing the species' conservation status. Our results contribute to the understanding of biodiversity within a botanically poorly explored yet highly threatened region of *campos rupestres* in Serra do Espinhaço Septentrional. Therefore, this study pro-

vides further support for decision-making regarding the adoption of effective conservation strategies in the region.

MATERIAL AND METHODS

The taxonomic treatment was made from field observations and studying specimens housed on the following herbaria: ALCB, BHCB, BM, CEN, CEPEC, CTBS, HST, HUEFS, IBGE, IPA, JPB, K, MOSS, P, RN, SAMES, SPF, UB, UFRN and W (acronyms according to Thiers, continuously updated), as well as the examination of digital images of samples available at JABOT (http://rb.jbrj.gov.br/v2/consulta.php), REFLORA (http://reflora.jbrj.gov.br/) and speciesLink (http://specieslink.net) databases. The terminology of morphological description follows Hickey (1973) for leaf shape, Harris and Harris (2001) for general morphology and Harley and Pastore (2012) and Harley (2014) for specific nomenclature.

We assessed the conservation status of the *Eplingiella* species according to version 3.1 of the IUCN Red List Categories and Criteria for Threatened Species (IUCN 2001, IUCN Standards & Petitions Committee 2022). Available data and information on distribution, occurrence, population, habitat and ecology, uses and trade, and threats were included in the National System for the Conservation of Flora (ProFlora) of the Brazilian National Center for Plant Conservation (CNCFlora), Rio de Janeiro Botanical Garden Research Institute (JBRJ), which serves as the IUCN SSC Brazil Plant Red List Authority (IUCN SSC BP-RLA), to document the assessment. The assessment will undergo technical review by the IUCN Red List Unit and may subsequently be added to the Species Information System (SIS) of the IUCN for publication on its portal. Therefore, the complete assessment of the conservation status of the *Eplingiella* species herein described will be accessible through both the official global and national Red Lists.

Our estimates of Area of Occupancy (AOO) and Extent of Occurrence (EOO) followed the default definitions (Bachman et al. 2011). These estimates were provided by the ProFlora system, based on the inclusion of occurrence records validated by the botanical specialists in Lamiaceae (GMA, JFBP, RMH and ASS). We generated the species distribution maps using the open-source software QGIS version 3.24.3 (QGIS Development Team 2018). The data for historical land use data from the period 1985–2020 was provided by MapBiomas (MapBiomas 2021). The data for *Eplingiella cuniloides* and *E. brightoniae* distribution was obtained by gatherings available at JABOT, REFLORA and speciesLink databases that have been checked by the authors.

TAXONOMIC TREATMENT

Eplingiella sanoi Antar, A.Soares & Harley, **sp. nov.** (Figures 1, 2)

Type: Brazil, Minas Gerais, Mun. Santo Antônio do Retiro: sítio 10, ponto 6, 15°22'49"S 42°45'34"W, 17 Mar 2017, *A. C. Sevilha et al. 6525* (holotype, CEN [barcode CEN00103452]; isotype, SAMES [barcode SAMES14610]).

Diagnosis

The new species differs from *Eplingiella cuniloides,* its morphologically closest related species, by the leaves narrowly elliptic or linear (vs. obovate in *E. cuniloides*), 0.5–1 mm wide (vs. 1–3.8 mm wide in *E. cuniloides*), with sessile glandular trichomes on the adaxial surface and sometimes pubescent with hairs mostly in the nerves (vs. silvery-grey-green tomentose in *E. cuniloides*), and calyx slightly curved in fruit (calyx straight in fruit in *E. cuniloides*).

Description

Subshrub, ca. 30 cm tall, citric aromatic, often forming thickets, with several stems arising from a woody subterranean structure. Stems 1–3 mm diam., slender, straight and sub-erect, younger stems quadrangular, slightly canaliculate, glabrous except by scattered glandular sessile trichomes, sometimes pubescent with scattered small white tector hairs mostly in the nodes, older stems ± terete, glabrous, peeling in small plates. Leaves, slightly coriaceous, mostly in fascicles from very short and poorly developed brachyblasts along the stem; lamina 6–14 × 0.5–1 mm, linear of very narrow elliptic, longer than internodes in secondary branches and mostly shorter than the internodes in principal stems, apex rounded, base attenuate and imperceptibly merging into the petiole, margin thickened, entire, revolute, sometimes deeply so and with replicate margins obscuring the abaxial surface, adaxial surface with sessile glandular trichomes and sometimes pubescent with small tector hairs mostly in the nerves, primary vein impressed, secondary venation inconspicuous, abaxial surface with similar indumentum, venation prominent, conspicuous; petiole absent to 2 mm long, jointed, with the basal part persistent after leaf-fall, indumentum as on lamina. Inflorescence cymose, sub-umbellate, along the upper portion of the stem, with similar indumentum as on stems and leaves, but more dense, cymes 3–6-flowered, borne on peduncle 1.4–4.1(–5.3) cm long. Flowers with inconspicuous, linear bracteoles 1–1.9 × 0.1–0.2 mm, on pedicels 0.5–1 mm long; calyx at anthesis 2.1–3.1 mm long, tube 1.3–1.8 mm long, infundibuliform, with glan-

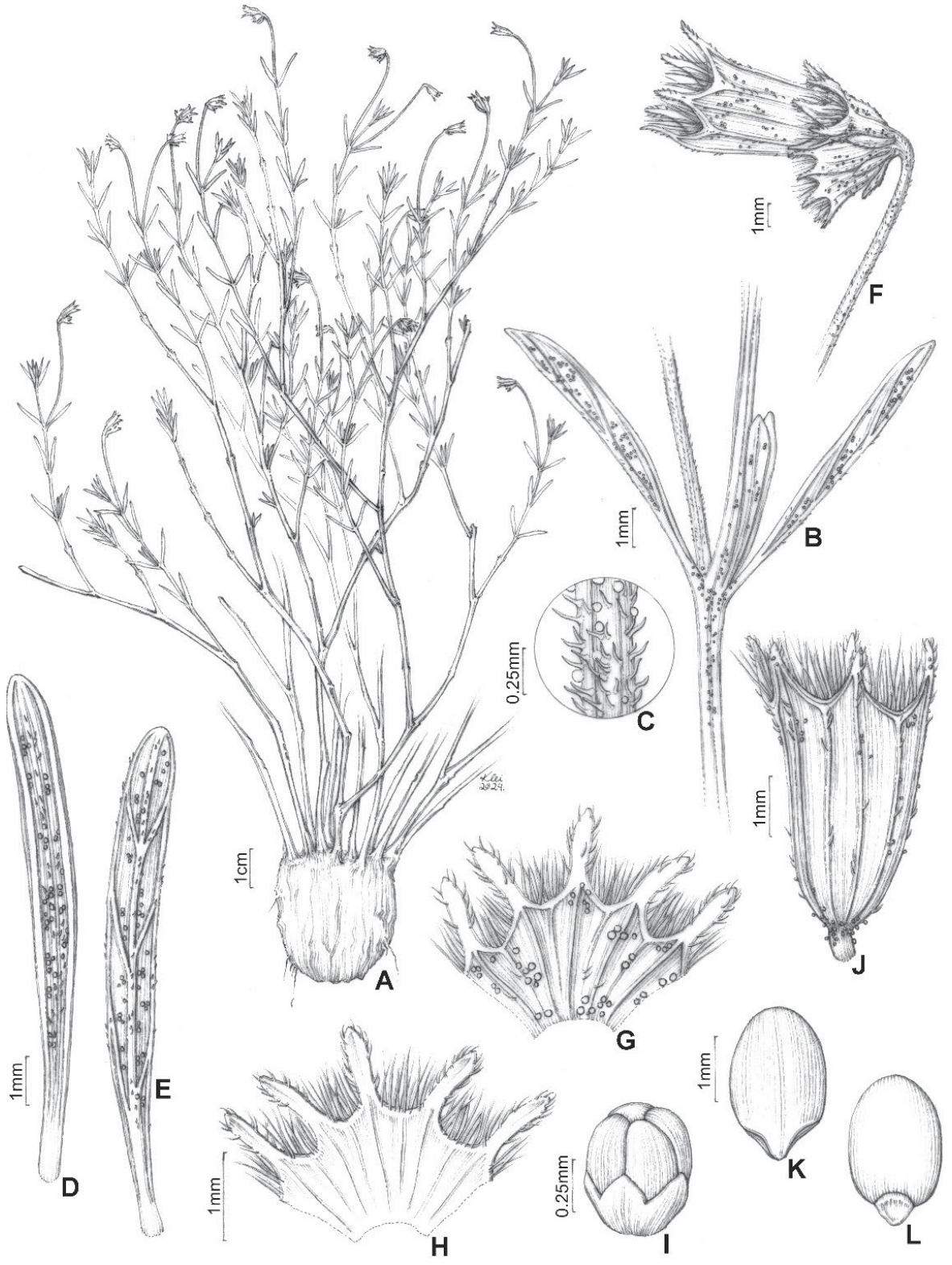

Figure 1. *Eplingiella sanoi* Antar, A.Soares & Harley: A. Habit. B. Branch detail, evidencing the leaves in fascicles on short lateral brachyblasts. C. Branch in detail evidencing the indumentum. D. Leaf, adaxial surface. E. Leaf, abaxial surface. F. Cyme. G. Opened calyx, outer surface. H. Opened calyx, inner surface. I. Ovary. J. Fruiting calyx. K. Nutlet, ventral view. L. Nutlet, dorsal view. Illustration by Klei Souza based on *A.C. Sevilha et al.* 6525 (SAMES).

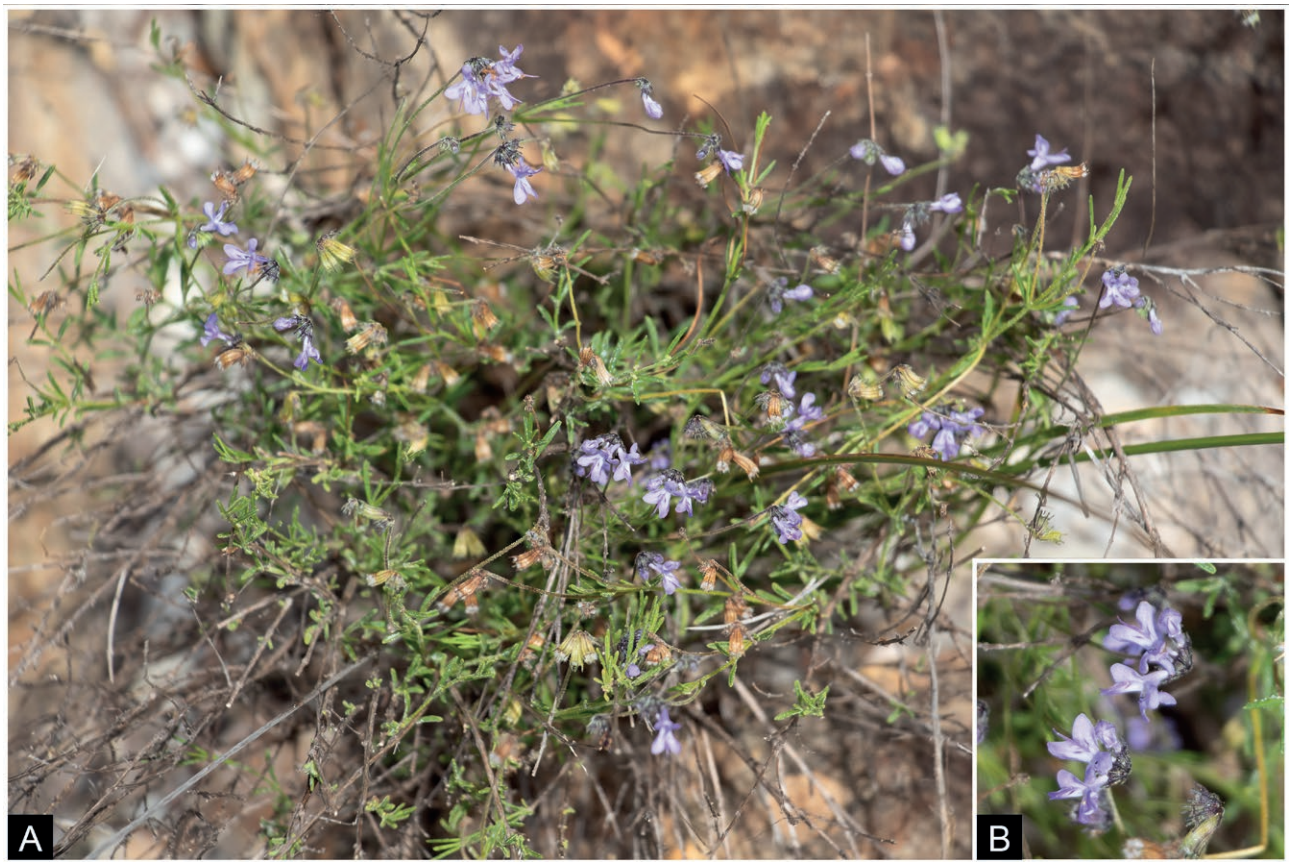

Figure 2. *Eplingiella sanoi* Antar, A.Soares & Harley: A. Habit. B. Inflorescence detail. Photos by Anderson C. Sevilha.

dular sessile trichomes and small tector hairs on outer surface, glabrous internally, with oblique mouth, lobes 5, slightly unequal, 1–1.6 mm long, subulate, with broadly truncate sinus between them, and a ring of erect, conspicuous white hairs at throat; calyx in fruit 5–5.9 mm long, tube 3.9–4.6 mm long, ± cylindrical, slightly curved, thin between the thickened, prominent nerves, lobes 1.1–1.3 mm long, weakly spreading to erect, the ring of white hairs in throat conspicuous; corolla purple, 3.5–5.1 mm long, tube pale, c. 4 mm long, infundibuliform, pubescent externally, especially on distal portion, glabrous internally, lobes spreading, the posterior lip 2-lobed, anterior lip concave, boat-shaped; stamens glabrous; style without a stylopodium, elongate and exserted parallel with the posterior lip at early anthesis, with a very short bluntly bi-lobed stigma. Nutlets c. 1.9–2.1 × 1.0–1.2 mm, ellipsoid, glabrous, minutely tuberculate, strongly mucilaginous when wet (Fig. 1).

Etymology

The epithet honors Dr. Paulo Takeo Sano, Brazilian professor and researcher at the *Universidade de São Paulo*. Paulo made significant contributions to the systematics of Neotropical angiosperms, in particular in Eriocaulaceae and Myrtaceae, as well as to the flora of the *campos rupestres* in the mountains of the Espinhaço Range, actively participating in several floristic studies, especially the Flora de Grão-Mogol and Flora da Serra do Cipó projects. He has also supervised numerous students engaged in the study of *campo rupestre* flora and worked with traditional knowledge from local communities and the teaching of botany and biology in schools.

Distribution, habitat & phenology

Eplingiella sanoi is a terrestrial heliophilic subshrub, approximately 30 cm in height, occurring in *campos rupestres* above 950 m asl within an ecotone zone between the Cerrado and Caatinga domains. The new species has been recorded from a single gathering in Santo Antônio do Retiro municipality, Minas Gerais state, south of the border with Bahia state (Fig. 3). The new species has been collected flowering and fruiting in March, which agrees with the most common flowering \\

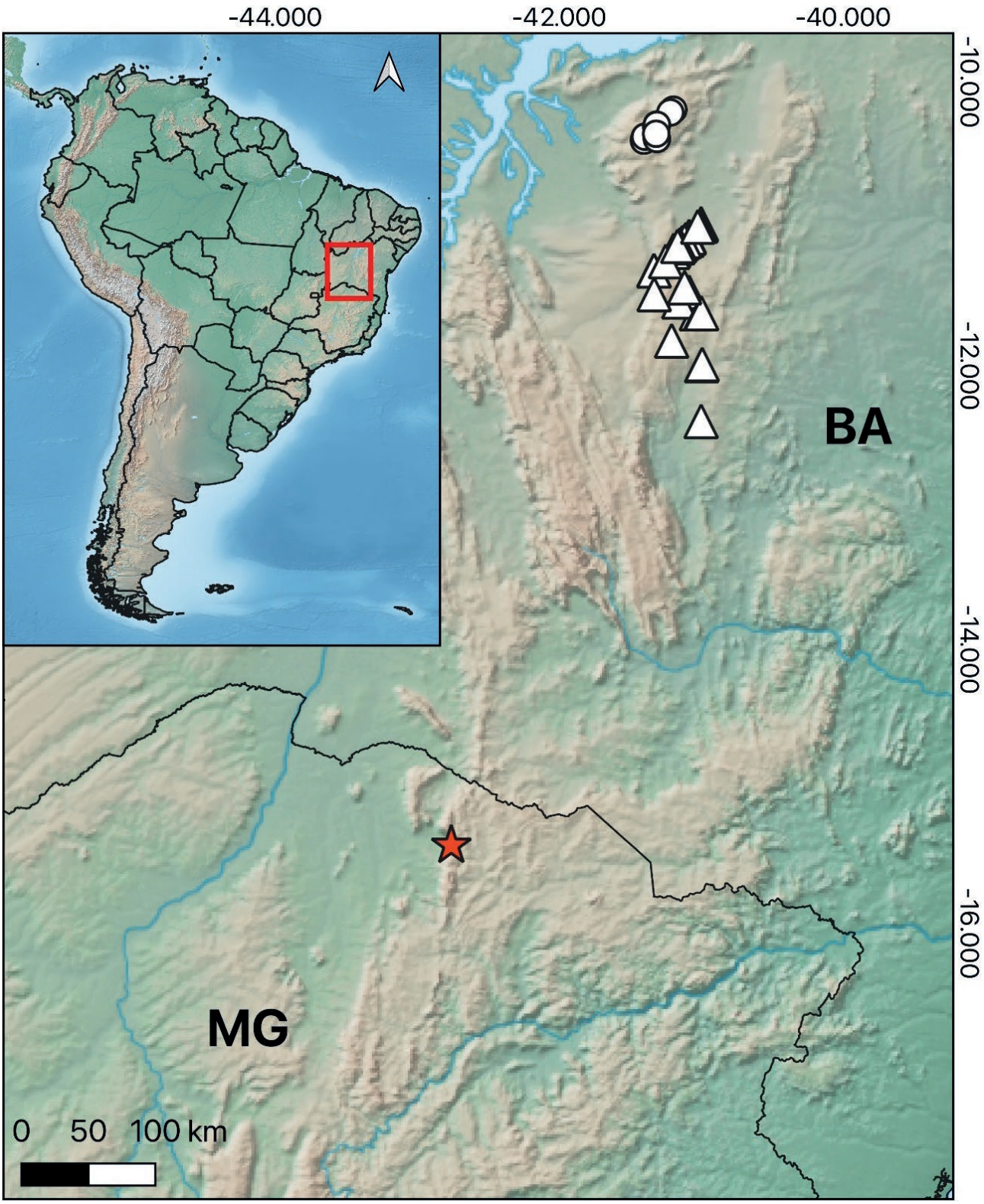

Figure 3. Map showing the distribution of *Eplingiella sanoi* Antar, A.Soares & Harley (red star) and the related species *E. cuniloides* (Epling) Harley & J.F.B.Pastore (white triangles) and *E. brightoniae* Harley (white circles). Abbreviation for Brazilian states: BA: Bahia; MG: Minas Gerais.

pattern observed in Hyptidinae, which concentrates its flowering and fruiting in March, April and May.

Assessment of conservation status

Data Deficient - DD. The species is known only from the type specimen collected in the municipality of Santo Antônio do Retiro, located in the northern region of the Minas Gerais state, Brazil (Fig. 4). The estimated area of occupancy for the species is AOO = 4 km², while it was not possible to estimate the extent of occurrence (EOO) due to a single-point limitation. There is no available information regarding population size and trends, as well as its occurrence within Protected Areas. Nevertheless, the region where *Eplingiella sanoi* occurs has been exposed to human-induced threats, including fire, quartzite mining, and road construction for the installation of wind turbine generators. If these threats continue to advance within its potential range, it could negatively impact the species in the near future, leading to habitat degradation and decline. Considering the species' restricted distribution, potential threats, and AOO, the *Eplingiella sanoi* could be assessed as Critically Endangered under the criterion B2ab. Given the general lack of data and insufficient floristic inventories in the region where the species was recorded, this taxon is assessed as Data Deficient (DD). Research efforts aiming to find the species at its known location and in nearby areas are crucial to enhance our understanding of its distribution and population dynamics, ultimately enabling a robust assessment of its conservation status.

Key to species of Eplingiella (adapted from Harley 2014)

1. Leaves not in fascicles, brachyblasts absent, at least some leaves with lamina >15 mm long and >5 mm broad, with distinct petiole. Calyx tube strongly curved in fruit, with throat not conspicuously hairy ..... ***E. fruticosa***

1′. Leaves in fascicles on short lateral brachyblasts, lamina 4 – 14 × 0.5 – 3.8 mm, with petiole indistinct. Calyx tube straight or slightly curved in fruit, with conspicuous white hairs in throat 2

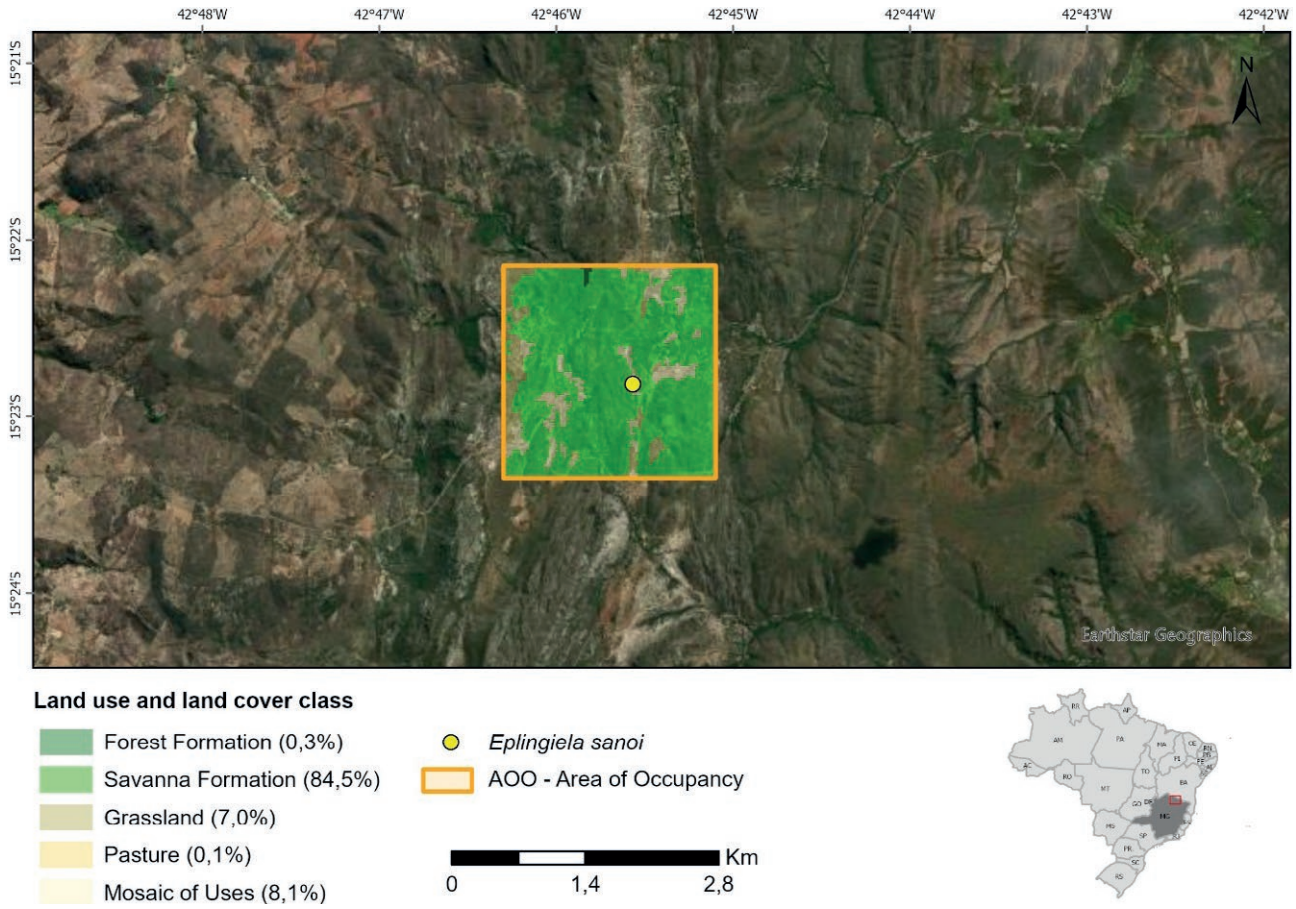

Figure 4. Distribution map of *Eplingiella sanoi* Antar, A.Soares & Harley indicating its Area of Occupancy, land use and land cover class.

2. Leaf margin entire 3

2′. Leaf margin with small teeth in upper half. . ***E. brightoniae***

3. Leaves obovate, silvery-grey-green tomentose ..... ***E. cuniloides***

3′.Leaves narrowly elliptic or linear, with glandular sessile trichomes and sometimes pubescent with hairs mostly in the nerves..... ***E. sanoi***

Comments and affinities

With leaves arranged in fascicles (brachyblasts), *Eplingiella sanoi* joins *E. brightoniae* and *E. cuniloides* that have this feature. It differs from *Eplingiella brightoniae* by the entire leaf margin (vs. distinctly toothed in the upper half of the leaf in *E. brightoniae*), lamina linear of very narrow elliptic, 0.5–1 mm wide (vs. lamina narrowly obovate to spathulate, 2.5–3.8 mm wide in *E. brightoniae*) and calyx lobes at anthesis 1 – 1.6 mm long (vs. 1.7–2 mm long in E. *brightoniae*). From *Eplingiella fruticosa*, the new species immediately differs by the leaves in fascicles (vs. leaves not in fascicles in *E. fruticosa*), which are narrowly elliptic or linear 6–14 × 0.5–1 mm (vs. leaves ovate to elliptic 4–29 × 2–30 mm) and calyx slightly curved with conspicuous white hairs in throat (vs. curved calyx with throat not conspicuously hairy).

Eplingiella sanoi is surprisingly known from just a single and very recent gathering. This supports the outstanding pattern that Brazil (and, likely true for other world's tropical areas) still harbours areas of biological richness, which have only rarely, or have never been, botanically explored (BFG 2015). The genus has now had its distribution extended due to this new gathering, as seen in other neotropical genera such as *Dinizia* Ducke (Leguminosae - Lewis *et al.* 2017), *Freziera* Willd. (Penthaphyllacaceae – Zorzanelli et al. 2015), *Markea* Rich. (Solanaceae – Stehmann and Giacomin 2012) and *Bahiana* J.F.Carrión (Euphorbiaceae – Wurdack 2023). These findings can change significantly our understanding of the distribution and evolution of many neotropical lineages. Despite the lack of recognition and funding (Engel et al. 2021), basic taxonomy is still much needed for flora description in most of the neotropics, especially in the threatened Serra do Espinhaço Septentrional.

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