

Research article

The Paepalanthoideae (Eriocaulaceae) of the Chapada dos Veadeiros National Park, Brazil: taxonomic novelties, identification key, and illustrated list of species

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Abstract. The Chapada dos Veadeiros National Park is a conservation unit established to preserve the highest savannahs of Central Brazil and their unique biodiversity. Eriocaulaceae are a relevant and conspicuous family in such high savannahs, but its diversity is poorly known, documented solely in general lists or in isolated efforts aimed at small groups. After a structured series of field expeditions and analysis of specimens from the relevant herbaria, we provide nomenclatural novelties, a first identification key, and an illustrated checklist for the species of Paepalanthoideae (Eriocaulaceae) in the area. We recorded 42 species of Paepalanthoideae from the Chapada dos Veadeiros National Park: *Actinocephalus* (Körn.) Sano (2 spp.), *Comanthera* L.B.Sm. (1 sp.), *Paepalanthus* Mart. (24 spp.), and *Syngonanthus* Ruhland (15 spp.). *Actinocephalus brevifolius* Trovó & Echtern. sp. nov. and *P. irwinii* Trovó & Echtern. sp. nov. are newly described species and *P. politus* Trovó stat. et nom. nov. is a variety of *P. elongatus* (Bong.) Körn. raised to the species status with a new name. The generic and specific composition shows predominance of *Paepalanthus* and *Syngonanthus*, and with a low representation of *Actinocephalus* and *Comanthera*, as expected, outside of the Espinhaço Range. More than 50% of the species (22 spp.) are endemic to the area and 25 species are endemic to Central Brazil, the area being the main center of diversity for dimerous-flowered groups. The non-endemic diversity is a combination of widespread species and marginal distribution of species typical from the Amazon and southeastern savannahs. The species are unevenly distributed in the area, with their occurrence correlated to altitude, water availability, and lithology. We reinforce that the savannahs from Central Brazil are a secondary center of diversity for Eriocaulaceae, playing a central role in the conservation of an unique and irreplaceable piece of its diversity and the Cerrado biome as well.

Keywords. Biodiversity, Cerrado, flora, nomenclature, new species.

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Introduction

The Brazilian Cerrado is a global biodiversity hotspot, hosting thousands of endemic and endangered species (Strassburg *et al.* 2017; Gomes-da-Silva & Forzza 2020; Myers *et al.* 2000). According to the Brazilian Flora 2020 project (Flora do Brasil 2020), at least 12 433 angiosperm species occur in the Cerrado domain, of which 5036 are restricted to the area. The biome suffers, however, from high deforestation rates, while less than 10% of its area is protected (Strassburg *et al.* 2017; Gomes-da-Silva & Forzza 2020; Myers *et al.* 2000). The Chapada dos Veadeiros National Park is a conservation unit established in 1961 to preserve the highest savannahs in Central Brazil, their hydrological resources, and unique biodiversity (ICMBIO 2021).

Botanical inventories in the Chapada dos Veadeiros Region date back to the time of the first naturalists traveling across the country (Urban 1906). In the middle of the 20th century, a major project to explore the flora of the Central Brazilian Plateau, known as the “Planalto Expeditions”, was carried out through a series of botanical expeditions led by Howard S. Irwin and William R. Anderson from the New York Botanical Garden (NYBG) along with their collaborators, especially from the Universidade de Brasília (NYBG 2021). As one of the results, many specimens were collected in the Chapada dos Veadeiros Region. Complete sets of these specimens are housed at the NY and UB herbaria, and smaller sets of duplicates were distributed among the plant specialists (NYBG 2021). Most of the earlier specimens of Eriocaulaceae Martinov gathered in the Chapada dos Veadeiros Region were analyzed by Wilhelm Ruhland in the European herbaria, and Harold Moldenke studied the specimens from the Planalto Expeditions in the North American Herbaria.

Eriocaulaceae encompasses ca 1400 species and 10 genera sorted in two subfamilies (Körnigke 1863; Ruhland 1903; Giulietti *et al.* 2012). Eriocauloideae comprises two genera, being characterized by its diplostemonous flowers, petals usually with nectariferous glands, and gynoecium with dorsal stigmas, while Paepalanthoideae Ruhland comprises eight genera and is characterized by its isostemonous flowers, petals without nectariferous glands, and gynoecium with dorsal nectariferous branches and commissural stigmatic branches (Körnigke 1863; Ruhland 1903; Stützel 1998; Giulietti *et al.* 2012). In South America, the diversity of the family is concentrated in Paepalanthoideae, with ca 800 species occurring mostly in the Campos Rupestres and in the Tepuis (Körnigke 1863; Ruhland 1903; Giulietti *et al.* 2012).

The floristic treatments for the group are focused on the Campos Rupestres from Minas Gerais and Bahia, such as the floras of Serra do Cipó (Hensold 1998; Parra 1998; Sano 1998), Grão-Mogol (Sano *et al.* 2010), Pico das Almas (Giulietti & Parra 1995), and Chapada Diamantina (Miranda & Giulietti 2001). The diversity of Eriocaulaceae in Central Brazil is also relevant as the family is a frequent floristic element in the high rocky savannahs in this region. The diversity is, however, poorly known, being documented in general lists or isolated efforts focused on small groups (Munhoz & Felfili 2006; Trovó *et al.* 2013; Trovó 2018). New taxa published in the last decade point to the high potential of the area for taxonomic novelties (e.g., Echternacht *et al.* 2015; Trovó *et al.* 2015a, 2017; Trovó 2018; Watanabe *et al.* 2015a, 2015b, 2016).

Checklists are useful tools for the botanical community interested in knowing plant names and the information attached to such names, also serving as starting points for future taxonomic and ecological research projects. They may contribute to the enrichment of botanical collections, to specimen identification, and to taxonomic updating, enhancing representativeness and reliability of herbarium data. They are also relevant for governmental and non-governmental agencies in establishing conservation actions and practices (Ulloa *et al.* 2017; Fernandes *et al.* 2020). As a result of a series of botanical expeditions to the Chapada dos Veadeiros Region and visits to the relevant herbaria, we present an illustrated checklist of the Paepalanthoideae (Eriocaulaceae) for the Chapada dos Veadeiros Region, comprising also two new species, one new status accompanying a new name, and a first identification key.

Material and methods

Study Area

Located in the northeast of the state of Goiás, the Chapada dos Veadeiros National Park (Fig. 1) was established in 1961 and originally covered an area of 625 000 ha. After being severely reduced to ca 10% of its original area, a recent extension was enacted and the current park area is of ca 240 000 ha, encompassing the municipalities of Alto Paraíso de Goiás, Cavalcante, Colinas do Sul, São João D’Aliança, Teresina de Goiás, Nova Roma, Monte Alegre de Goiás, and Campos Belos (Brazilian Ministry of the Environment 2017; ICMBio 2021). The park hosts the highest savannahs in Central Brazil, ranging in altitude from 500–1650 m a.s.l. and comprising different Cerrado phytophysiognomies (Munhoz & Felfili 2006; Felfili *et al.* 2007). Climatic conditions include rainy summers and dry winters, with mean annual rainfall ranging from 1500 to 1750 mm and mean temperatures from 20 to 25°C (Felfili *et al.* 2007).

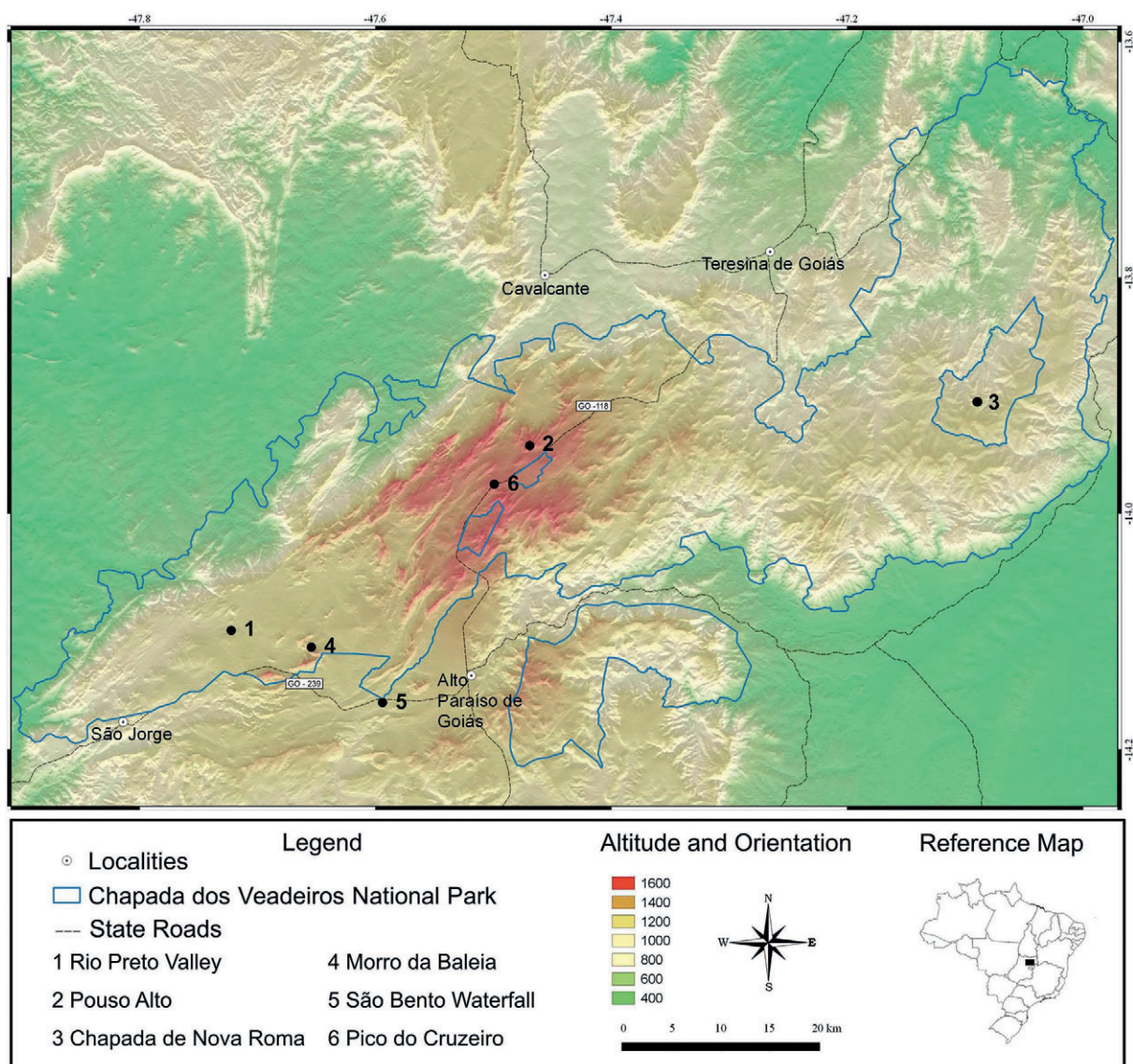


Fig. 1. The Chapada dos Veadeiros National Park: boundaries, topography, and relevant locations according to delimitation provided by Brazilian Ministry of the Environment (2017). The small blue areas enclosed in the Chapada dos Veadeiros National Park boundaries are two conservation units prior to the recent park expansion and one area designated to host a transmission antenna.

In order to evaluate species distribution within the conservation unit, the park was roughly divided into three areas according to the combination of their respective geomorphologies, lithotypes, and altitude: the Rio Preto Valley (between latitudes 47.9 and 47.6° S, and altitudes from 800–1150 m), belonging to the geomorphological unit SRA I, an old formation comprising mostly quartzitic feldspathic rocks; the Pouso Alto (between latitudes 47.6 and 47.3°S, and altitudes from 1150–1650 m), also belonging to the geomorphological unit SRA I; and the Chapada de Nova Roma (between latitudes 47.3 and 47.0° S, and altitudes from 800–1000 m), belonging to the SRA IIa geomorphological unit, comprising mostly quartzitic arcosean rocks (Latrubesse & Carvalho 2006; Silva & Cherem 2016; SIEG 2021).

Data collection

The checklist is based on both field efforts and visits to relevant herbaria. Field trips to the Chapada dos Veadeiros National Park began sporadically in 2005. From 2015 to 2020, structured field efforts comprising 11 fieldtrips were conducted to maximize the sampled area within the park and to cover the flowering period of the species. A few species growing explicitly in the vicinity of the park are also included in the checklist. The photos of the illustrated checklist were made directly in the field. The following herbaria were analyzed (acronyms according to Thiers, continuously updated): B, BHCB, BOCH, BR, C, CEN, CEPEC, CESJ, ESA, G, HB, HBG, HEPH, HRCB, HUEG, HUEFS, IBGE, INPA, K, LE, LL, M, MBM, MO, NY, OUPR, P, R, RB, RFA, S, SP, SPF, UB, UEC, UFG, UPS, VIES, W and WU. One voucher per species is cited. The specimens marked with an asterisk are type specimens. Additional records can be consulted using online platforms of virtual herbaria (www.splink.org.br/; jabot.jbrj.gov.br/; www.sibbr.gov.br). Numbers between square brackets in the species protocols correspond to herbarium barcodes. Herbarium specimens were analyzed under a Leica EZ4 stereoscopic microscope with camera, and identified using Ruhland (1903), the series of Moldenke manuscripts usually published in *Phytologia*, and recent revisions of specific groups. The subfamily Eriocauloideae in Brazil is represented only by *Eriocaulon* L., a genus currently under review and pending many nomenclatural adjustments (Chagas 2017); it is therefore not included in this treatment. The measurements concerning *Actinocephalus phaeocephalus* (Ruhland) F.N.Costa and *Paepalanthus acanthophyllus* Ruhland follow the protocols, Costa (2005), Trovó (2010), and additional field observations.

Results

Taxonomic treatment

During our survey of the Paepalanthoideae from the Chapada dos Veadeiros National Park, we detected a new species of *Actinocephalus* (Körn.) Sano and a new species of *Paepalanthus* Mart. nom. cons., here described and illustrated. We also propose a new status accompanying a new name for one of the *Paepalanthus elongatus* (Bong.) Körn. varieties described by Moldenke (1979).

Class Embryopsida Engler ex Pirani & J.Prado
Order Poales Small
Family Eriocaulaceae Martinov
Genus *Actinocephalus* (Körn.) Sano

Actinocephalus brevifolius Trovó & Echtern. sp. nov.
urn:lsid:ipni.org:names:77302846-1
Figs 2–3, 6A

Diagnosis

Differs from *Actinocephalus phaeocephalus* by having rhizomes, narrower rosettes of linear and shorter leaves, more numerous paraclades with linear and shorter bracts, and also by the pilosity of the floral organs.

Etymology

The epithet “*brevifolius*” is related to the species’ small leaf size both when compared to the morphologically similar species and also in relation to the size of its paraclades.

Material examined

Type

BRAZIL • Goiás, Alto Paraíso de Goiás, Parque Nacional da Chapada dos Veadeiros, Beira da estrada de terra para a Vereda do Mulungu; 14°06'26" S, 47°39'10" W; 9 May 2018; *M.L.O. Trovó et al.* 774; holotype: RB[RB1405306]; isotypes: B, CEN, NY, P, SPF.

Paratypes

BRAZIL • Goiás, Alto Paraíso de Goiás; 13 Nov. 2017; *M.L.O Trovó & L.M Borges* 688; CEN, RB, SPF • *ibid.*; 21 Aug. 2018; *M.F. Simon et al.* 3379; CEN, RB • *sibid.*; 14 Mar. 2020; *L. Echternacht, M. Pignal & P.H. Cardoso* 2830; OUPR. • *ibid.*; 14 Mar. 2020; *L. Echternacht, M. Pignal & P.H. Cardoso* 2833; OUPR.

Description

Herbs perennial, solitary, 20.0–50.0 cm tall; rhizome short, sometimes sprouting; aerial stem restricted to the rosette, ca 0.5–2.5 cm long. Leaves persistent, membranaceous to chartaceous, linear, greenish, flat, patent to recurved, 0.5–2.0 × 0.05–0.1 cm, with short hairs on both surfaces, margins with short and rarely long hairs, apex acute. Paraclades arising from the leaf axil, ca (1)5–35 per plant, 5.5–15.0 cm long, incurved; paraclade bracts usually persistent, membranaceous to chartaceous, linear, greenish, flat to navicular, patent to rarely recurved, 0.5–1.5 × 0.05–0.2 cm, with short hairs on both surfaces, margins with short hairs, apex acute. Spathes 3.5–5.5 cm long, with short, long, and t-shaped trichomes on the external surface, apex acute. Scapes 1–15 per paraclade, arranged at the paraclade apex, 20.0–45.0 cm long, with short t-shaped trichomes and long hairs, glabrescent. Capitula 0.6–1.2 cm diam., obconic to hemispherical, whitish; involucre bracts in 4–5 series, the internal series surpassing the floral disc, castaneous, elliptical, ca 3.5 mm long, with short hairs on the abaxial surface, densely ciliate, apex long acuminate. Flowers trimerous, ca 40 per capitulum, disposed in concentric rings; floral bracts linear to narrowly oblong, whitish, flat, ca 4.0 mm long, sparsely pilose distally, margin ciliate toward the acute apex. Staminate flowers ca 4.0 mm long; pedicel ca 0.8 mm long; sepals free, linear to narrowly oblong, navicular, whitish to light castaneous, ca 2.5 mm long, pilose distally on the abaxial surface, densely ciliate toward the acute apex; anthophore fleshy, ca 1.0 mm long; petals fused into a tube, whitish, membranaceous, ca 2.0 mm long; stamens ca 2.5 mm long, cream-colored; carpellodes 3, papillose. Pistillate flowers ca 3.5 mm long, pedicel ca 0.05 mm long; sepals free, oblong to obovate, navicular, castaneous, ca 3.5 mm long, pilose distally on the abaxial surface, densely ciliate toward the acute apex; petals free, oblong, flat, whitish, ca 2.5 mm long, pilose distally on the abaxial surface, ciliate toward the acute to obtuse apex; gynoecium 3.5 mm long, stigmatic branches simple, slightly longer than the nectariferous branches, staminodes scale-like. Fruit a loculicidal capsule. Seeds ellipsoid, reddish.

Distribution, habitat, and conservation

A few populations with ca 15–50 flowering individuals of *Actinocephalus brevifolius* sp. nov. were observed along the margins of unpaved roads in the Chapada dos Veadeiros National Park. All known populations are restricted to the same area in the Rio Preto Valley in the vicinity of the Morro da Baleia Region. Some of these populations are at risk of disappearing, as they occur along roads frequently used by tourists and locals, but at least one population occurs in a less exposed area, close to the Vereda do Mulungu. The individuals were found growing in dry to humid soil along the border of moist grasslands.

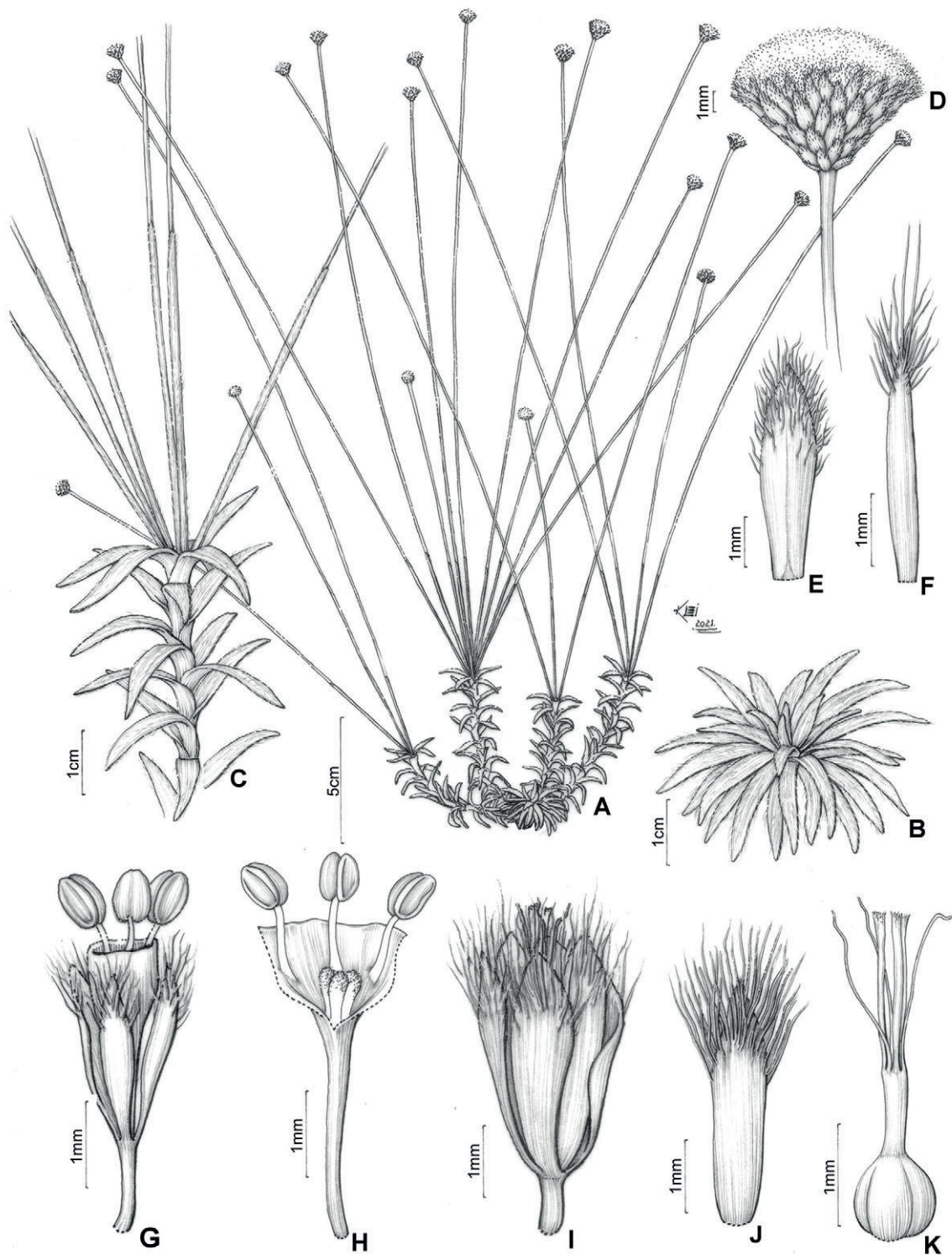


Fig. 2. *Actinocephalus brevifolius* Trovó & Echter. sp. nov.. A. Habit. B. Rosette detail. C. Paraclade apex detail. D. Capitulum detail. E. Involucral bract, abaxial surface. F. Floral bract, abaxial surface. G. Staminate flower. H. Staminate flower with sepals removed and corolla opened. I. Pistillate flower. J. Petal of the pistillate flower, abaxial surface. K. Gynoecium. (M.L.O. Trovó et al. 774 – RB).

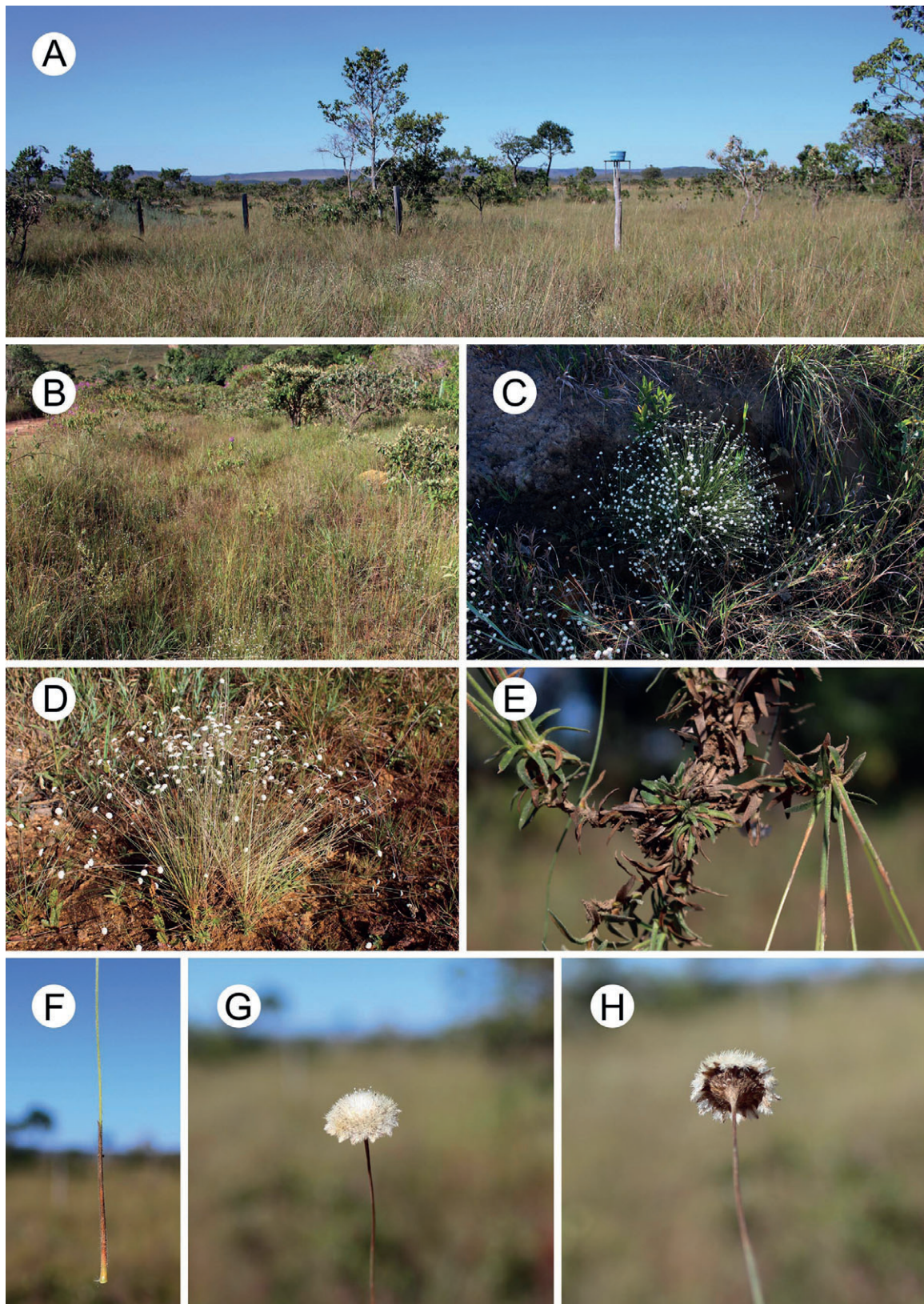


Fig. 3. *Actinocephalus brevifolius* Trovó & Echtertn. sp. nov. **A.** Habitat. **B.** Habitat detail. **C.** Habit. **D.** Habit detail. **E.** Rosette and paraclade detail. **F.** Spathe detail. **G.** Capitulum detail, view from above. **H.** Capitulum detail, view from below.

According to the IUCN (2019) distribution criteria, EN: B1ab (i,ii,iii,iv), and its occurrence inside a National Conservation Unit, the species should be considered Endangered.

Notes

Actinocephalus brevifolius sp. nov. is one of the few species of *Actinocephalus* occurring in Goiás State (Sano 2004; Costa & Sano 2013; Andrino *et al.* 2021). The most similar species to *A. brevifolius* is *Actinocephalus phaeocephalus*, the only congeneric and sympatric species in the Chapada dos Veadeiros Region. Although Andrino *et al.* (2021) refers *Actinocephalus phaeocephalus* as endemic to the Chapada dos Veadeiros, it is worth mentioning that the species is also distributed southwards, as the type of *Actinocephalus phaeocephalus* var. *foliosus* (Moldenke) F.N.Costa & Andrino was collected in the vicinities of Brasília.

Both *Actinocephalus brevifolius* sp. nov. and *A. phaeocephalus* are perennial and share the relatively long paraclades bearing very similar obconic to hemispherical capitula surrounded by a series of castaneous involucre bracts with densely ciliate apex surpassing the floral disc. *Actinocephalus brevifolius* is distinguished by its rhizome (vs rhizome absent); shorter and narrower, linear leaves, 0.5–2.0 × 0.05–0.1 cm (vs lanceolate, 4.0–8.5 × 0.5–0.9 cm); ca 5–35 paraclades per rosette (vs ca 4–8), covered by shorter and narrower, linear bracts, 0.5–1.5 × 0.05–0.2 cm (vs lanceolate, 2.0–5.5 × 0.3–0.5 cm). The flowers are similar, as in most *Actinocephalus*-related species, but slight differences in pilosity were observed in the floral organs, especially in the petals of the pistillate flower.

Genus *Paepalanthus* Mart.

Paepalanthus irwinii Trovó & Echter. sp. nov.

urn:lsid:ipni.org:names:77302849-1

Figs 4–5, 7A

Diagnosis

Differs from *Paepalanthus acanthophyllus* by being a more gracile plant with shorter, linear leaves, shorter and narrower reproductive axis, shorter, linear to narrowly lanceolate axis bracts, fewer scapes per plant, capitula usually narrower, and petals of the pistillate flower with obtuse to mucronate apex.

Etymology

The epithet “*irwinii*” honors Howard Samuel Irwin, the coordinator of the Planalto Expeditions Program, which collected over 225 000 specimens and over 30 000 numbers in Central Brazil by 1972 (NYBG 2021). The Eriocaulaceae set of specimens from the “Planalto Expeditions” is precious, encompassing many type specimens.

Material examined

Type

BRAZIL • Goiás, Alto Paraíso de Goiás, Parque Nacional da Chapada dos Veadeiros, GO 239, entre Alto Paraíso de Goiás e São Jorge; 14°0'5"S, 47°43'48"W; 14 Nov. 2017; *M.L.O. Trovó et al.* 706; holotype: RB[RB1405241]; isotypes: CEN[CEN112954], OUPR.

Paratypes

BRAZIL • Goiás, Alto Paraíso de Goiás; 9 May 1987; *N.L. Menezes 1217*; RB, SPF • same locality as for preceding; 20 May 1994; *M. Aparecida-da-Silva et al. 1921*; RB, SPF • same locality as for

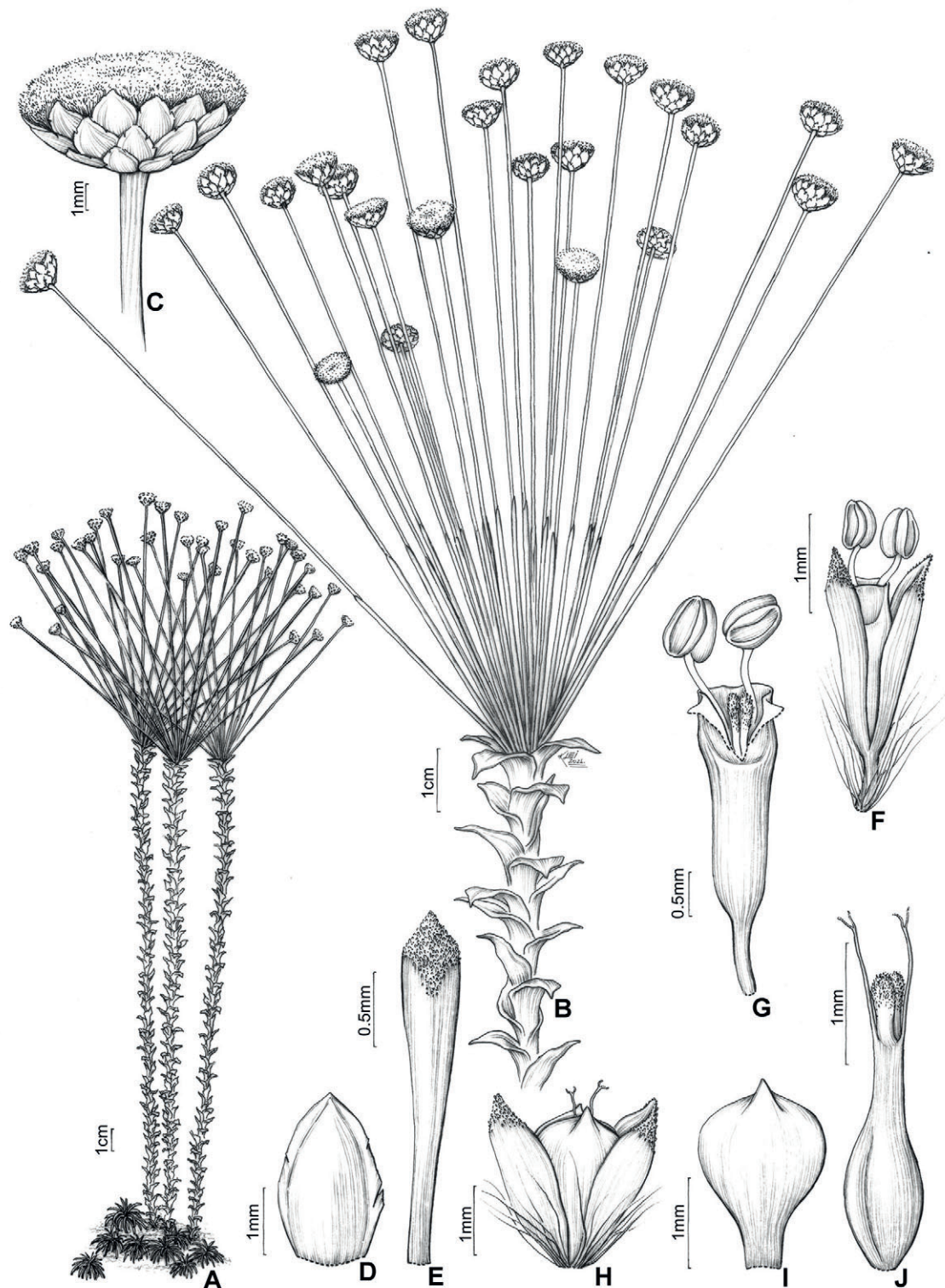


Fig. 4. *Paepalanthus irwinii* Trovó & Echter. sp. nov. **A.** Habit. **B.** Inflorescence and reproductive apex detail. **C.** Capitulum detail. **D.** Involucral bract, abaxial surface. **E.** Floral bract, abaxial surface. **F.** Staminate flower. **G.** Staminate flower with sepals removed and corolla opened. **H.** Pistillate flower. **I.** Petal of the pistillate flower, abaxial surface. **J.** Gynoecium. (*M.L.O. Trovó et al. 706 – RB*).

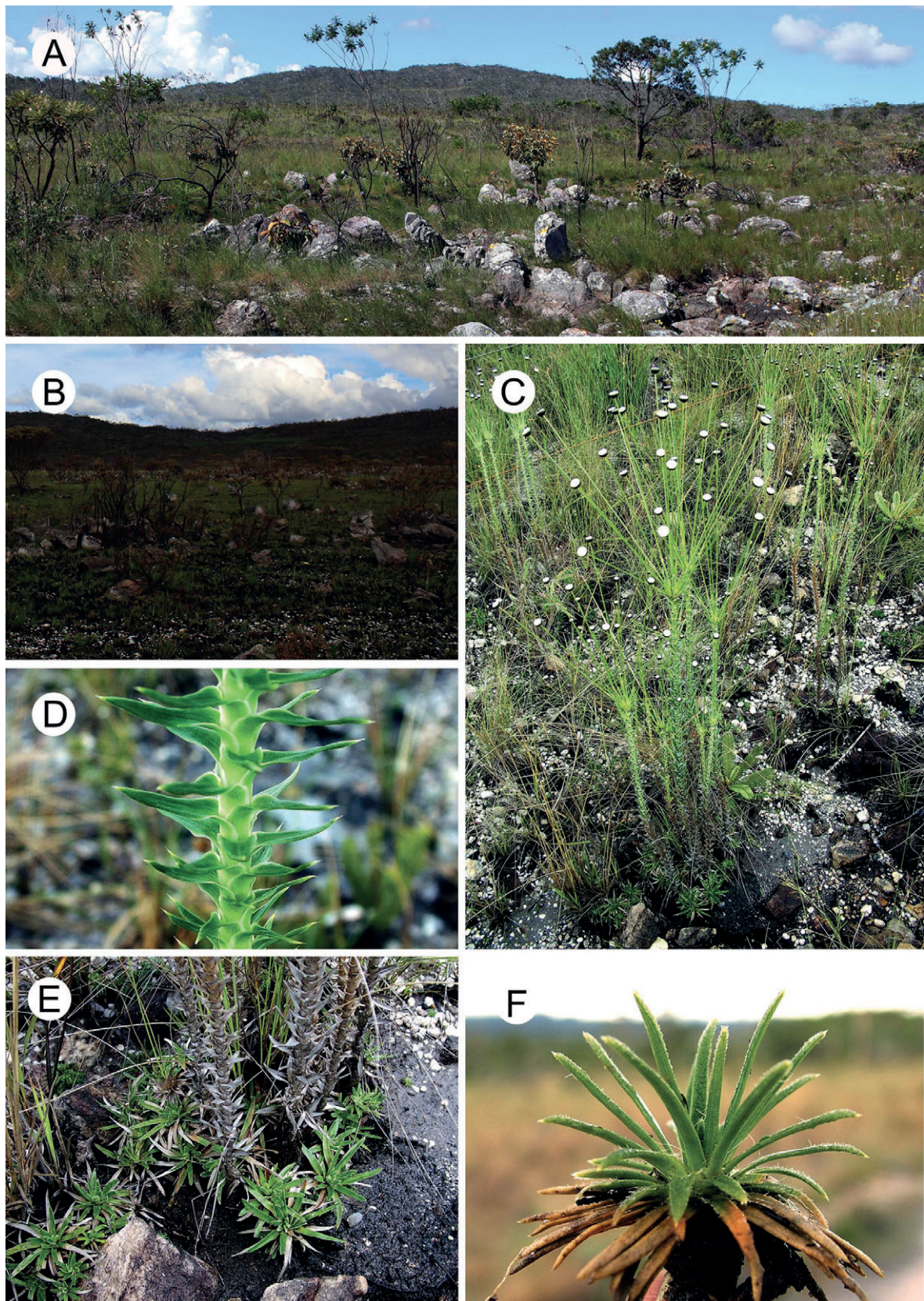


Fig. 5. *Paepalanthus irwinii* Trovó & Echtern. sp. nov. **A.** Habitat. **B.** Habitat detail. **C.** Habit. **D.** Reproductive axis detail. **E.** Sprouting rosettes. **F.** Rosette detail.

preceding; 27 Apr. 2009; *D. Cardoso et al.* 2600; HUEFS, RB • same locality as for preceding; 22 Mar. 2012; *M. Watanabe et al.* 227; RB, SPF.

Description

Herbs perennial, solitary or forming small clumps of ramets, 45.0–60.0 cm tall; rhizome short, erect, usually sprouting; rosette stem short, ca 0.5–1.5 cm long. Leaves usually deciduous in fertile specimens, membranaceous to chartaceous, linear, greenish, flat, patent to recurved, $1.0\text{--}3.0 \times 0.1\text{--}0.2$ cm, glabrescent on both surfaces, margins with long, sparse trichomes, apex acute. Reproductive axis erect, 30.0–45.0 cm long, ca 0.3 cm diameter, glabrous; all axis bracts with similar shape, amplexicaul, chartaceous, linear to narrowly lanceolate, patent to recurved, $0.5\text{--}1.5 \times 0.1\text{--}0.3$ cm, apex acute, usually entirely glabrous, the younger with long trichomes towards the margin. Spathes 3.5–4.5 mm long, glabrous, apex acute. Scapes 5–25, arranged at the reproductive axis apex, 12.0–28.0 cm long, glabrous or rarely with sparse trichomes. Capitula 0.5–0.9 mm diam., hemispherical to spherical, whitish; involucre bracts in 2–4 series, dark castaneous, deltate, ca 2.5 mm long, glabrous or rarely with sparse trichomes abaxially, sparsely ciliate, apex obtuse. Flowers dimerous, ca 80 per capitulum, disposed in concentric rings; floral bracts linear to narrowly oblanceolate, castaneous with central whitish stripe, flat, 1.5–2.0 mm long, mostly glabrous or sparsely pilose distally on the abaxial surface, margin ciliate toward the acute apex, glabrescent. Staminate flowers ca 3.5 mm long; pedicel with ca 0.5 mm long; sepals free, narrowly obovate, castaneous with central whitish stripe, ca 2.5 mm long, mostly glabrous or sparsely pilose distally on the abaxial surface, densely ciliate toward the acute apex, glabrescent; anthophore fleshy, elongated, ca 1.5 mm long; petals fused into a tube, whitish, membranaceous, ca 0.5 mm long; stamens ca 0.8 mm long, cream-colored; carpellodes 3, papillose. Pistillate flowers ca 2.5 mm long, sessile or subsessile; sepals free, dolabriform, whitish, ca 2.0 mm long, densely pilose abaxially, densely ciliate toward the obtuse apex, glabrescent; petals free, dolabriform, whitish, ca 1.5 mm long, sparsely pilose abaxially, ciliate toward the obtuse to mucronate apex, glabrescent; gynoecium 2.5 mm long, stigmatic branches bifid at the apex, twice as long as the nectariferous branches, staminodes not seen. Fruit a loculicidal capsule. Seeds ellipsoid, reddish.

Distribution, habitat, and conservation

Populations of *Paepalanthus irwinii* sp. nov. with ca 10–75 flowering individuals were frequently found in the Chapada dos Veadeiros National Park. Different from most of the endemic species of Eriocaulaceae to the area, which are locally restricted, the species is distributed from the Rio Preto Valley in the vicinity of São Jorge village to the Pouso Alto Region. Populations occur in different phytophysiognomies, from open fields to rupestrian savannahs, but the individuals grow only over shallow, usually wet, rocky soils. It is also worth mentioning that many individuals were seen in flower after a severe fire event in 2017. Based on the IUCN (2019) distribution criteria, EN: B1ab (i,ii,iii,iv), and its occurrence inside a National Conservation Unit, the species should be considered Vulnerable.

Notes

Paepalanthus irwinii sp. nov. belongs to *Paepalanthus* sect. *Diphyomene* Ruhland, one of the few categories of *Paepalanthus* mostly diversified in the Chapada dos Veadeiros Region (Trovó & Sano 2010; Trovó *et al.* 2013). The species is morphologically most similar to *P. acanthophyllus* due to its general habit, deciduous leaves, patent and spiny axis bracts, and the shape and color of the capitula and involucre bracts. *Paepalanthus irwinii* is distinguished by being a more gracile plant up to 60 cm tall (vs up to 120 cm); with shorter and narrower, linear leaves, $1.0\text{--}3.0 \times 0.1\text{--}0.2$ cm (vs lanceolate, $3.5\text{--}8.0 \times 0.3\text{--}0.7$ cm); shorter and narrower reproductive axis, ca 45.0 cm tall and 0.3 cm diam. (vs longer and wider, ca 100.0 cm tall and 0.6 cm diam.); linear to narrowly lanceolate axis bracts, $0.5\text{--}1.5 \times 0.1\text{--}0.3$ cm (vs lanceolate, $1.0\text{--}5.5 \times 0.8\text{--}1.2$ cm); up to 25 scapes per plant (vs up to 80 scapes per plant); narrower capitula, ca 0.9 cm diam. (vs wider, ca 1.5 cm diam.); and the petals of the pistillate flower with obtuse

to mucronate apex (vs petals of the pistillate flower with obtuse to rounded apex). Although sympatric, these species grow in different habitats and flower at different times. While *P. irwinii* occurs over shallow, rocky soils, *P. acanthophyllus* occurs over a more consolidated argillaceous soil. Individuals of the new species are usually seen in flower and fruit from November to May, while *P. acanthophyllus* is usually fertile from April to August.

Paepalanthus politus Trovó stat. et nom. nov.

Fig. 8D

Paepalanthus elongatus var. *glabrescens* Moldenke. *Phytologia* 43: 196 (Moldenke 1979).

Material examined

Type

BRAZIL • Goiás, Campo arenoso úmido; rodovia GO-12, Km 5–10 ao sul de Alto Paraíso – Goiás; 24 May 1975; *G. Hatschbach* 36772; holotype: US[US00088344]; isotypes: MO[MO1430138], UPCB.

Notes

Moldenke (1979) briefly described *Paepalanthus elongatus* var. *glabrescens* based on a single collection (*G. Hatschbach* 36772), distinguished from the typical variety solely by its narrow leaves and glabrous or subglabrous spathes. Trovó (2018) considered such character states as within the morphological variation of *Paepalanthus elongatus* var. *elongatus* and proposed its synonymization. Trovó (2018) also commented that two isotypes (*G. Hatschbach* 36772 MO, UPCB) were annotated by Moldenke himself in 1975 as *Paepalanthus elongatus* var. *angustifolius* Silveira, enhancing the fragile delimitation of such taxa. Herbarized specimens of *P. politus* are indeed tricky to distinguish from the bulk of the *P. elongatus* species complex and may explain such nomenclatural instability.

During our field trips, we located a single population in the Rio Preto Valley of what we first thought to be a new species. When analyzing the dried specimens for this manuscript, it became clear that such specimens belong to the taxon described by Moldenke (1979) as *Paepalanthus elongatus* var. *glabrescens*. It is, however, much different from *Paepalanthus elongatus* var. *elongatus* due not only to the characters pointed out by Moldenke (1979), but mainly by its bright and completely glabrous involucre bracts slightly surpassing the floral disc (vs opaque and pilose, densely ciliated involucre bracts largely surpassing the floral disc). The position, the apex, and the color of the involucre bracts are also noteworthy and different. In *P. politus*, the bracts of all series are patent; with an acute apex; and with a paleaceous central stripe, while in *P. elongatus* var. *elongatus* the inner bracts are recurved; all bracts have a long acuminate apex; with a dark castaneous central stripe. The taxon deserves thus the species status with a new name, as the epithet “*glabrescens*” is already taken (Hensold 2017). The epithet “*politus*” is related to the shiny involucre bracts, with a polished aspect. A complete description of the species will be available in a forthcoming revision of *Paepalanthus* ser. *Dimeri* (Ruhland) Giul.

Key to the species of Eriocaulaceae from the Chapada dos Veadeiros National Park

1. Flowers diplostemonous; petals with glands *Eriocaulon* L. (not treated here)
- Flowers isostemonous; petals without glands 2 (*Paepalanthoideae* Ruhland)
2. Lateral branches subtending the scapes (paraclades) entirely covered by bracts 3 (*Actinocephalus* (Körn.) Sano)
- Lateral branches subtending the scapes usually absent, when present, not covered by bracts 4
3. Rhizome present; leaves linear, 0.5–2.0 × 0.05–0.1 cm.; paraclades ca 8–35 per rosette, covered by linear bracts, 0.5–1.5 × 0.05–0.1 cm *Actinocephalus brevifolius* Trovó & Echterm. sp. nov.

- Rhizome absent; leaves lanceolate, 4.0–8.5 × 0.5–0.9 cm.; paraclades ca 4–8 per rosette, covered by lanceolate bracts, 2.0–5.5 × 0.3–0.5 cm *Actinocephalus phaeocephalus* (Ruhland) F.N.Costa
- 4. Petals of the pistillate flower completely free 5 (*Paepalanthus* Mart.)
 - Petals of the pistillate flowers fused at the middle 28
- 5. Flowers trimerous 6
 - Flowers dimerous 10
- 6. Stem conspicuously elongated, > 15 cm long, ramified *Paepalanthus scandens* Ruhland
 - Stem shortly elongated, < 15 cm long, not ramified 7
- 7. Involucral bracts of the external series linear, green *Paepalanthus bifidus* (Schrad.) Kunth
 - Involucral bracts of the external series elliptical, ovate or lanceolate, hyaline or castaneous 8
- 8. Involucral bracts castaneous, ovate, densely ciliate *Paepalanthus polytrichoides* Kunth
 - Involucral bracts hyaline, elliptical or lanceolate, mostly glabrous at the margin 9
- 9. Scapes sparsely pilose to usually glabrescent; capitula campanulate, glabrous; involucral bracts elliptical; stigmatic branches bifid at the apex *Paepalanthus campanulatus* Trovó
 - Scapes pilose with persistent trichomes; capitula hemispherical, pilose; involucral bracts lanceolate; stigmatic branches simple *Paepalanthus subtilis* Miq.
- 10. Stem restricted to the rosette, < 10 cm long 11
 - Stem conspicuously elongated, > 10 cm long 18
- 11. Capitula spherical, rarely hemispherical; receptacle hemispherical 12
 - Capitula discoid, rarely hemispherical; receptacle flat 14
- 12. Amphibious; leaves patent; scapes with long, loose trichomes *Paepalanthus amphibius* Trovó
 - Terrestrial; leaves recurved; scapes glabrous or with hirsute or adpressed trichomes 13
- 13. Spathes < 1 cm long, dark brown; scapes 35–160, < 10 cm long, glabrous or rarely covered by adpressed trichomes; capitula ca 2 mm diam. *Paepalanthus echinoides* Trovó
 - Spathes > 1.2 cm long, green; scapes 1–5, > 10 cm long, with hirsute trichomes; capitula ca 0.5 mm diam. *Paepalanthus sphaerocephalus* Ruhland
- 14. Leaf sheath castaneous; involucral bracts of the external series golden to pale straw-colored, twice the length of the floral disc *Paepalanthus cassiae* Trovó
 - Leaf sheath pale straw-colored or yellowish to golden; involucral bracts of the external series golden, varying from grayish to blackish, slightly or 1× surpassing the floral disc 15
- 15. Leaf sheath yellowish to golden; involucral bracts of the external series linear, greyish to dark castaneous with a central whitish stripe, 1× surpassing the floral disc
 - *Paepalanthus longibracteatus* (Moldenke) Trovó
 - Leaf sheath pale straw-colored; involucral bracts of the external series lanceolate to oblong, light castaneous to blackish without a central whitish stripe, slightly surpassing the floral disc 16
- 16. Gracile herbs; leaves < 1 mm wide; capitula < 1 cm diam., discoid to hemispherical
 - *Paepalanthus modestus* Trovó
 - Robust herbs; leaves > 1.5 cm wide; capitula > 1.5 cm diam., discoid 17

17. Spathes and scapes densely pilose, sericeous, involucre bracts dark castaneous to blackish, capitula > 2.5 cm wide *Paepalanthus niger* (Moldenke) Trovó
 – Spathes and scapes usually glabrous to sparsely pilose, involucre bracts light castaneous, capitula < 2.5 cm wide *Paepalanthus politus* Trovó stat. et nom. nov.
18. Gracile herbs; basal rosette absent, stem ramified 19
 – Robust herbs; basal rosette present, stem not ramified 21
19. Involucre bracts golden to paleaceous when old *Paepalanthus flaccidus* (Bong.) Kunth
 – Involucre bracts castaneous 20
20. Leaves usually glabrous, apex acute; spathes > 3.5 cm long, mostly glabrous; scapes glabrous; capitula ca 3 mm wide; floral bracts linear
 *Paepalanthus atratus* (Moldenke) L.E.F.Silva & Trovó
 – Leaves densely pilose and ciliate, apex mucronate to acuminate; spathes < 3.0 cm long, hirsute; scapes hirsute; capitula ca 6 mm wide, floral bracts oblong
 *Paepalanthus trichophyllus* (Bong.) Körn.
21. Leaves oblong, apex cuspidate; bracts of the inflorescence axis strongly recurved, cordate
 *Paepalanthus cordatus* Ruhland
 – Leaves lanceolate or linear, apex acute to mucronate; bracts of the inflorescence axis patent to erect, lanceolate or linear 22
22. Bracts of the inflorescence axis strongly appressed; capitula sulfurous
 *Paepalanthus macer* Trovó
 – Bracts of the inflorescence axis usually patent or ascending, but then lax; capitula whitish 23
23. Bracts of the inflorescence axis ascending, membranaceous *Paepalanthus stellatus* Trovó
 – Bracts of the inflorescence axis patent, chartaceous 24
24. Leaves of the uppermost series contort, apex mucronate; scapes mostly with the same size of the inflorescence axis *Paepalanthus urbanianus* Ruhland
 – Leaves of the uppermost series straight, apex acute; scapes much shorter than the inflorescence axis 25
25. Plants < 120 cm tall; leaves deciduous, < 8.0 cm long; reproductive axis < 80.0 cm long; scapes < 100 26
 – Plants > 130 cm tall; leaves persistent, > 9.0 cm long; reproductive axis > 100.0 cm long; scapes > 100 27
26. Plant up to 60 cm tall; leaves linear, 1.0–3.0 × 0.1–0.2 cm.; reproductive axis ca 45.0 cm tall and 0.3 cm diam.; axis bracts linear to narrowly lanceolate, 0.5–1.5 × 0.1–0.3 cm.; up to 25 scapes per plant; capitula ca 0.9 cm diam. *Paepalanthus irwinii* Trovó & Echter. sp. nov.
 – Plant up to 120 cm tall; leaves lanceolate, 3.5–8.0 × 0.3–0.7 cm.; reproductive axis ca 100.0 cm tall and 0.6 cm diam.; axis bracts lanceolate, 1.0–5.5 × 0.8–1.2 cm.; up to 80 scapes per plant; capitula ca 1.5 cm diam. *Paepalanthus acanthophyllus* Ruhland
27. Bracts of the inflorescence axis varying in shape along the axis, becoming smaller from the base to the apex *Paepalanthus chiquitensis* Herzog
 – Bracts of the inflorescence axis with similar shape along the axis, with the same size from the base to the apex *Paepalanthus koernickei* (Ruhland) Trovó

28. Flowers dimerous; sepals of the pistillate flowers shorter than petals, petals with erect, spatulate lobes. *Comanthera dimera* Echterm.
 – Flower trimerous; sepals of the pistillate flowers longer than petals, petals with often involute, triangular lobes 29 (*Syngonanthus* Ruhland)
29. Simple inflorescences, scapes arising from the stem, axillary to the leaves 30
 – Compound inflorescences (synflorescences), scapes arising from the synflorescence axis, axillary to the axis bracts 37
30. Stem subterranean or restricted to the basal rosette of leaves 31
 – Stem aerial, basal rosette absent, leaves spirulate along the stem 35
31. Involucral bracts brown 32
 – Involucral bracts cream-colored to golden 33
32. Roots orangish, leaves semi-terete *Syngonanthus cabralensis* Silveira
 – Roots cream-colored, leaves flat to canaliculate
 *Syngonanthus hensoldiae* M.T.C.Watanabe & Sano
33. Pistillate flowers twice the length of staminate flowers; petals of pistillate flower hairy
 *Syngonanthus heteropeplus* (Körn.) Ruhland
 – Pistillate flowers similar in length to the staminate flowers; petals of pistillate flower glabrous 34
34. Roots spongy, orangish; gynoecium with nectariferous appendices; involucral bracts appressed, progressively longer toward the internal series; scape golden
 *Syngonanthus nitens* (Bong.) Ruhland
 – Roots fibrous, cream-colored; gynoecium without nectariferous appendices; involucral bracts lax, medium and internal series similar in height; scape stramineous *Syngonanthus davidsei* Huft
35. Flowers bisexual; spathes and scapes with capitate hairs; petals membranaceous
 *Syngonanthus androgynous* M.T.C.Watan.
 – Flowers unisexual; spathes and scapes without capitate hairs; petals spongy 36
36. Scapes shorter than or equal to the leaf length; involucral bracts cream-colored, with stramineous to greenish longitudinal band; floral bracts present; petals of pistillate flowers glabrous
 *Syngonanthus cuyabensis* (Bong.) Giul., Hensold & L.R.Parra
 – Scapes longer than the leaf length; involucral bracts completely cream-colored; floral bracts absent; petals of pistillate flowers hairy *Syngonanthus caulescens* (Poir.) Ruhland
37. Stem aerial or aquatic; synflorescence axis shorter than leaves, hidden
 *Syngonanthus widgrenianus* (Körn.) Ruhland
 – Stem subterranean; synflorescence axis longer than leaves, conspicuous 38
38. Synflorescence with whorls of bracts along the axis and at the apex; involucral bracts cream-colored, stramineous to golden; leaves with capitate hairs *Syngonanthus humboldtii* (Kunth) Ruhland
 – Synflorescence with one whorl of bracts at apex; involucral bracts brown; leaves without capitate hairs 39
39. Involucral bracts abaxially glabrous, discolorous, the external brown, the internal cream-colored; floral bracts present *Syngonanthus decorus* Moldenke
 – Involucral bracts abaxially hairy, similar or gradual in color, all series brown; floral bracts absent 40

40. Pistillate flowers glabrous; involucre bracts narrow-lanceolate
*Syngonanthus vittatus* M.T.C.Watan. & Echtertn.
 – Pistillate flowers hairy; involucre bracts triangular, ovate, oblanceolate to obovate 41
41. Leaves cespitose, erect to flexuous; involucre bracts with a lighter central band
*Syngonanthus densifolius* var. *majus* Moldenke
 – Leaves in distinct basal rosettes, ascending, recurved or incurved; involucre bracts mostly
 homogeneously brown or margins lighter than the center 42
42. Leaves distally incurved, 0.7–1.2 mm wide
*Syngonanthus incurvifolius* M.T.C.Watan. & Echtertn.
 – Leaves ascending to recurved, 2–5 mm wide
*Syngonanthus densifolius* var. *brachyphyllus* Moldenke

Illustrated list of Paepalanthoideae species from the Chapada dos Veadeiros

Actinocephalus brevifolius Trovó & Echtertn. sp. nov.

Fig. 6A

Voucher

M.L.O. Trovó 774 (RB)*.

Distribution

Endemic to the Chapada dos Veadeiros. Occurs in the Rio Preto Valley in the vicinity of the Morro da Baleia Region on dry to humid, usually sandy-argillaceous soils.

Actinocephalus phaeocephalus (Ruhland) F.N.Costa

Fig. 6B

Voucher

M.L.O. Trovó 459 (RB).

Distribution

Distributed southwards in the savannahs surrounding the municipality of Brasília (Federal District) to northwards in the Chapada dos Veadeiros National Park. Widely distributed in the park from the Rio Preto Valley to the Chapada de Nova Roma, being scarcer in the Pouso Alto region. Grows on moist, argillaceous soils.

Comanthera dimera Echtertn.

Fig. 6C

Voucher

L. Echtertnacht 1963 (SPF)*.

Distribution

Endemic to the Chapada dos Veadeiros. Widely distributed from the Rio Preto Valley to the Pouso Alto Region, growing on moist soils.

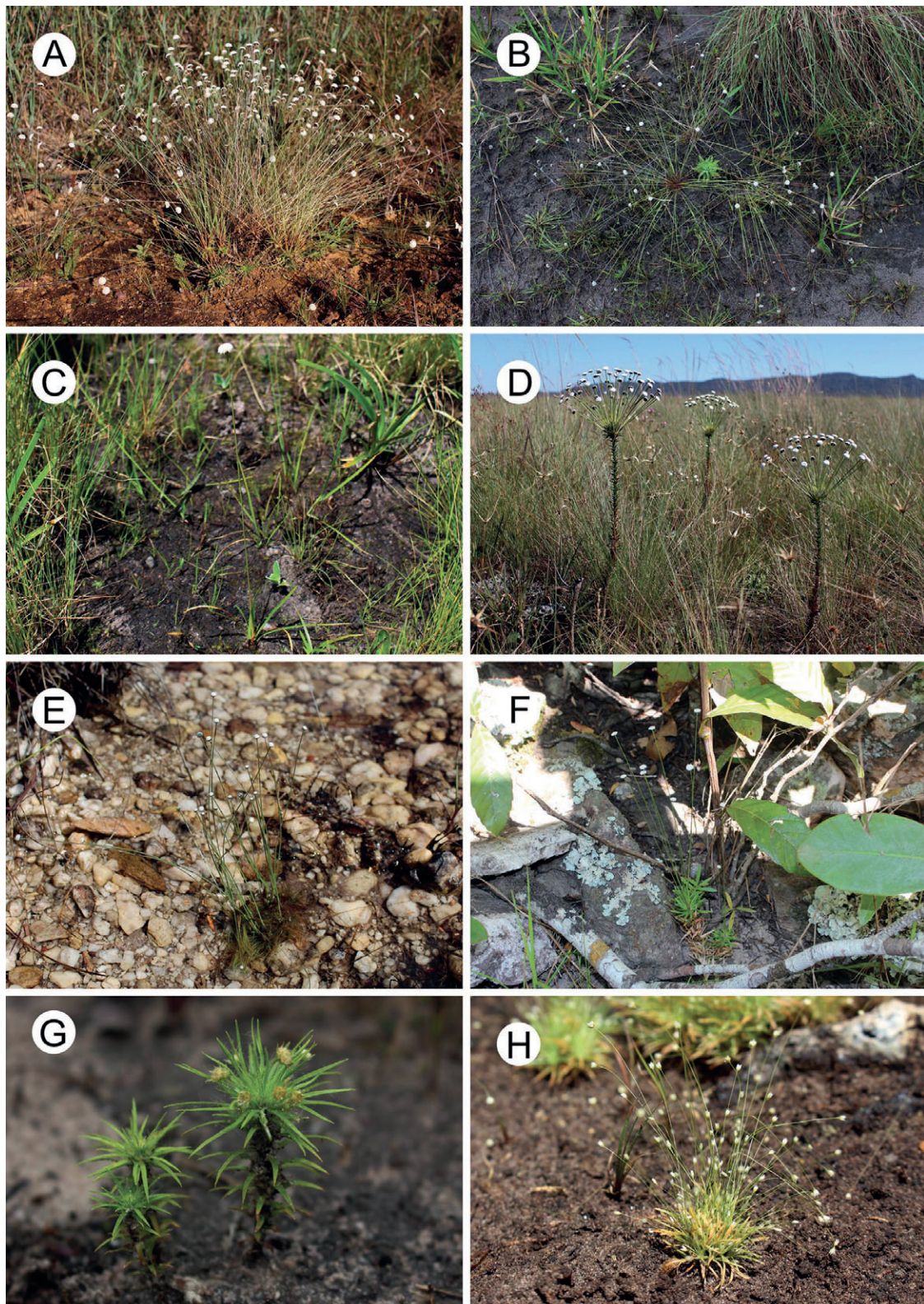


Fig. 6. Species of Paepalanthoideae (Eriocaulaceae) from the Chapada dos Veadeiros National Park. **A.** *Actinocephalus brevifolius* Trovó & Echter. sp. nov. **B.** *A. phaeocephalus* (Ruhland) F.N.Costa. **C.** *Comanthera dimera* Echter.. **D.** *Paepalanthus acanthophyllus* Ruhland. **E.** *P. amphibius* Trovó. **F.** *P. atratus* (Moldenke) L.E.F.Silva & Trovó. **G.** *P. bifidus* (Schrad.) Kunth. **H.** *P. campanulatus* Trovó.

Paepalanthus acanthophyllus Ruhland

Fig. 6D

Voucher

M.L.O. Trovó 287 (RB).

Distribution

Distributed southwards in the savannahs surrounding the municipality of Cristalina (Goiás State) to northwards in the Chapada dos Veadeiros National Park. Widely distributed in the three areas of the park, growing mostly on the dry, argillaceous soils of the more elevated areas.

Paepalanthus amphibius Trovó

Fig. 6E

Voucher

G. Hatschbach 36832 (LL)*.

Distribution

Endemic to the Chapada dos Veadeiros. Known only from a few beds of seasonal streams (full or empty) in the Pouso Alto Region.

Paepalanthus atratus (Moldenke) L.E.F.Silva & Trovó

Fig. 6F

Voucher

W.R. Anderson 6636 (NY)*.

Distribution

Endemic to the Chapada dos Veadeiros. Known only from the Rio Preto Valley along the margins of Rio dos Couros and its tributaries, sometimes growing in the shade of riverine forests.

Paepalanthus bifidus (Schrad.) Kunth

Fig. 6G

Voucher

M.L.O. Trovó 749 (RB).

Distribution

Widely distributed in South America. It is known from a few collections in the Rio Preto Valley in the vicinity of the São Bento waterfall and in the Chapada de Nova Roma inside the Ecological station, growing on dry and sandy soils.

Paepalanthus campanulatus Trovó

Fig. 6H

Voucher

M.L.O. Trovó 785 (RB)*.

Distribution

Endemic to the Chapada dos Veadeiros. Known from the RPPN (Reserva Particular do Patrimônio Natural) Cara Preta in the Pouso Alto Region, growing in the shade of large rock blocks.

Paepalanthus cassiae Trovó

Fig. 7A

Voucher

C. Munhoz 1392 (RB)*.

Distribution

Endemic to the Chapada dos Veadeiros. Mostly distributed in the vicinity of the Água Fria Farm in the RPPN Cara Preta Region in the lower slopes of the Pouso Alto, growing on dry, argillaceous soils.

Paepalanthus chiquitensis Herzog

Fig. 7B

Voucher

M.L.O. Trovó 749 (RB).

Distribution

Widely distributed in South America. Occurs in the Rio Preto Valley between Alto Paraíso de Goiás and São Jorge, growing on dry, argillaceous soils.

Paepalanthus cordatus Ruhland

Fig. 7C

Voucher

M.L.O. Trovó 478 (RB).

Distribution

Endemic to the Chapada dos Veadeiros. Form dense populations over dry argillaceous soils, mostly in the Rio Preto Valley between Alto Paraíso de Goiás and São Jorge, with a few populations known from the Cruzeiro area in the Pouso Alto.

Paepalanthus echinoides Trovó

Fig. 7D

Voucher

M.L.O. Trovó 647 (RB)*.

Distribution

Endemic to the Chapada dos Veadeiros. Forms small populations on dry, sandy soils, mostly in the Rio Preto Valley between Alto Paraíso de Goiás and São Jorge, with a few populations known from the Pouso Alto Region.

Paepalanthus flaccidus (Bong.) Kunth

Fig. 7E

Voucher

S. Romaniuc Neto 295 (RB).

Distribution

Widely distributed in Brazil. Known from a few sparse populations growing on moist soils of the Rio Preto Valley and Pouso Alto Region.

Paepalanthus irwinii Trovó & Echtern. sp. nov.

Fig. 7F

Voucher

M.L.O. Trovó 706 (RB)*.

Distribution

Endemic to the Chapada dos Veadeiros. Widely distributed from the Rio Preto Valley to the Pouso Alto Region, growing only on shallow, usually wet, rocky soils.

Paepalanthus koernickei (Ruhland) Trovó

Fig. 7G

Voucher

M.L.O. Trovó 461 (SPF).

Distribution

Distributed southwards in the savannahs surrounding the municipality of Catalão (Goiás State) to northwards in the Chapada dos Veadeiros National Park. Known mostly from the Pouso Alto Region, forming small populations growing on dry, rocky soils.

Paepalanthus longibracteatus (Moldenke) Trovó

Fig. 7H

Voucher

H.S. Irwin 12374 (LL)*.

Distribution

Endemic to the Chapada dos Veadeiros. Widely distributed from the Rio Preto Valley to the Pouso Alto Region, growing usually on wet, rocky soils.

Paepalanthus macer Trovó

Fig. 8A

Voucher

M.L.O. Trovó 446 (SPF)*.

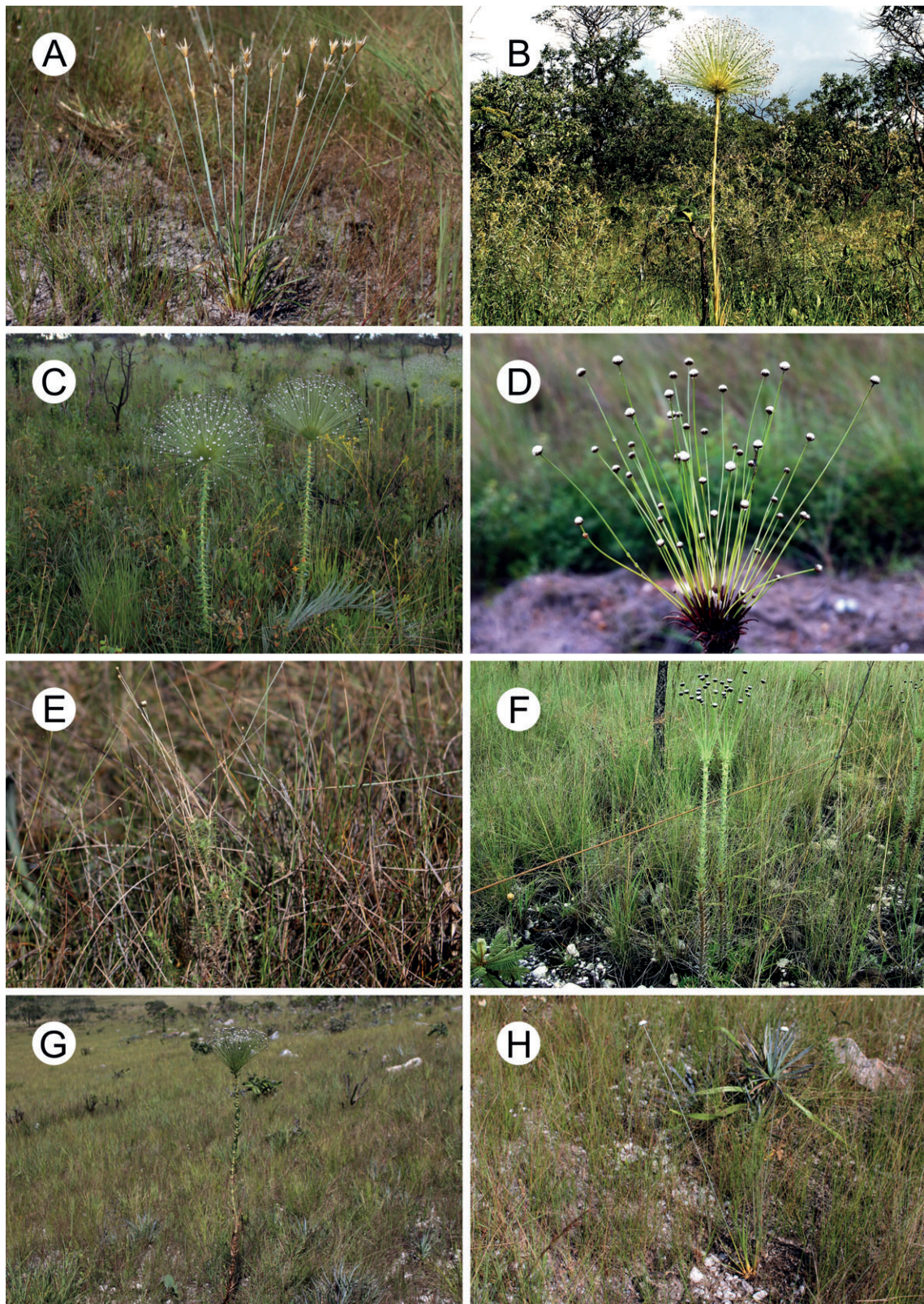


Fig. 7. Species of Paepalanthoideae (Eriocaulaceae) from the Chapada dos Veadeiros National Park. **A.** *Paepalanthus cassiae* Trovó. **B.** *P. chiquitensis* Herzog. **C.** *P. cordatus* Ruhland. **D.** *P. echinoides* Trovó. **E.** *P. flaccidus* (Bong.) Kunth. **F.** *P. irwinii* Trovó & Echtertn. sp. nov. **G.** *P. koernickei* (Ruhland) Trovó. **H.** *P. longibracteatus* (Moldenke) Trovó.

Distribution

Endemic to the Chapada dos Veadeiros. Restricted to the Rio Preto Valley, occurring on rocky soils and forming large populations in the vicinities of the Morro da Baleia.

Paepalanthus modestus Trovó

Fig. 8B

Voucher

M.L.O. Trovó 646 (RB)*.

Distribution

Endemic to the Chapada dos Veadeiros. The species forms large populations on the Chapada de Nova Roma, being less frequent in the Pouso Alto Region. Grows on dry, rocky to sandy soils.

Paepalanthus niger (Moldenke) Trovó

Fig. 8C

Voucher

H.S. Irwin 32187 (LL)*.

Distribution

Endemic to the Chapada dos Veadeiros. It is probably the most frequent species of Eriocaulaceae in the area, distributed from the Rio Preto Valley to the Chapada de Nova Roma, forming large populations in the Pouso Alto Region. Grows mostly on argillaceous soils.

Paepalanthus politus Trovó stat. et nom. nov.

Fig. 8D

Voucher

G. Hatschbach 36772 (US)*.

Distribution

Endemic to the Chapada dos Veadeiros. A rare species probably restricted to the lower parts of the park on dry, rocky soils in the Rio Preto Valley.

Paepalanthus polytrichoides Kunth

Fig. 8E

Voucher

H.S. Irwin 33091 (NY).

Distribution

Distributed in the sandy savannahs of North and Central-West Brazil. Widely distributed from the Rio Preto Valley to the Pouso Alto Region, growing usually on dry, sandy soils.

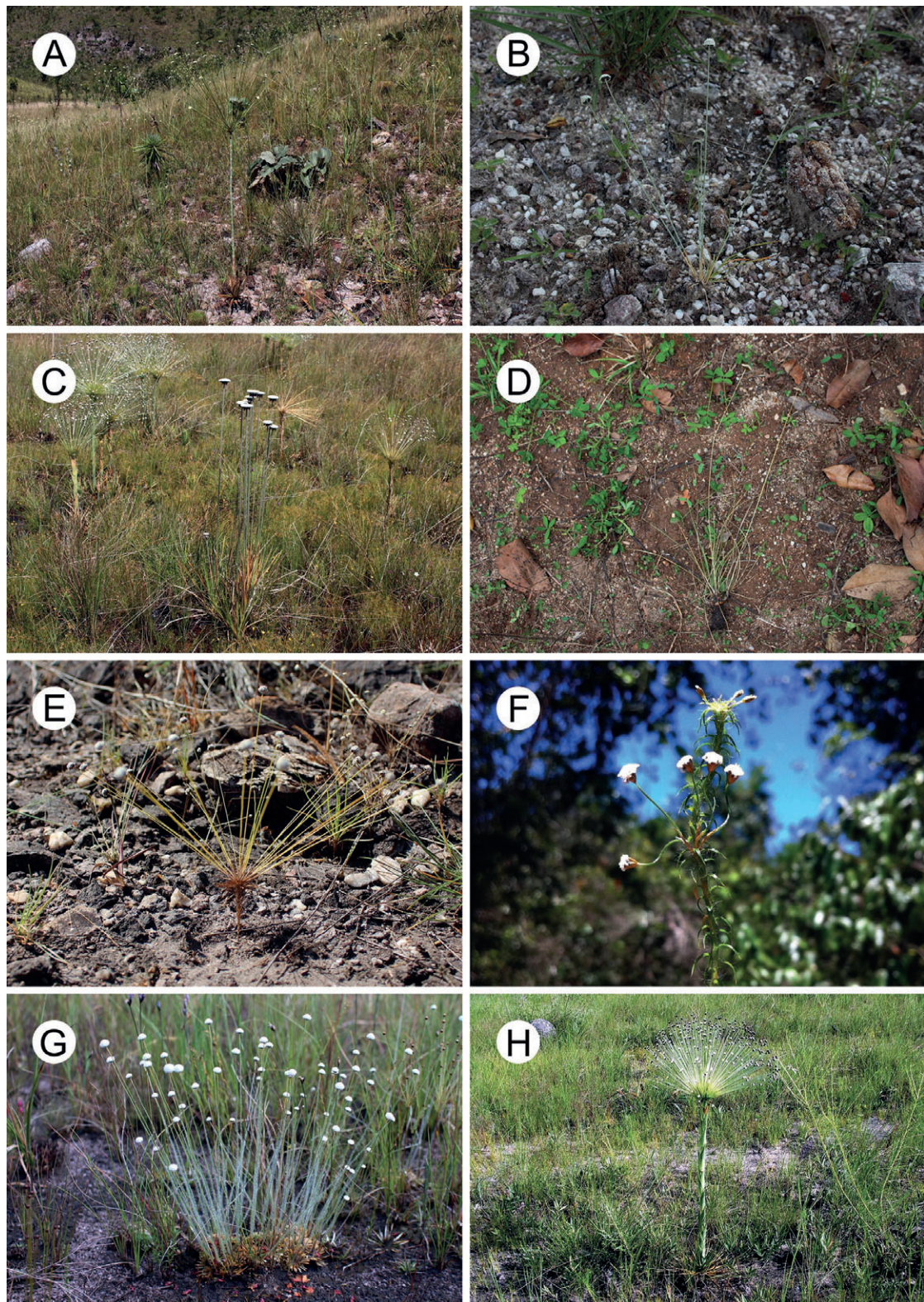


Fig. 8. Species of Paepalanthoideae (Eriocaulaceae) from the Chapada dos Veadeiros National Park. **A.** *Paepalanthus macer* Trovó. **B.** *P. modestus* Trovó. **C.** *P. niger* (Moldenke) Trovó. **D.** *P. politus* Trovó stat. et nom. nov. **E.** *P. polytrichoides* Kunth. **F.** *P. scandens* Ruhland. **G.** *P. sphaerocephalus* Ruhland. **H.** *P. stellatus* Trovó.

Paepalanthus scandens Ruhland

Fig. 8F

Voucher

M.L.O. Trovó 653 (RB).

Distribution

Distributed in the savannahs of Central-West Brazil, with a single collection in the Serra do Cabral in the Espinhaço Range. Distributed from the Rio Preto Valley to the Pouso Alto Region, forming small populations on wet soils, sometimes in shaded habitats.

Paepalanthus sphaerocephalus Ruhland

Fig. 8G

Voucher

M.L.O. Trovó 769 (RB).

Distribution

Widely distributed in Brazil. Occurs from the Rio Preto Valley to the Pouso Alto Region, forming small populations on usually dry, sandy soils.

Paepalanthus stellatus Trovó

Fig. 8H

Voucher

M.L.O. Trovó 465 (SPF)*.

Distribution

Endemic to the Chapada dos Veadeiros. The species is restricted to the Pouso Alto Region, growing on dry, argillaceous soils. A few photographs from the species in the Rio Preto Valley are pending confirmation and a voucher.

Paepalanthus subtilis Miq.

Fig. 9A

Voucher

J.F.B. Pastore 1795 (HUEFS).

Distribution

Widely distributed in Brazil. Distributed from the Rio Preto Valley to the Pouso Alto Region, frequently forming small populations on dry, sandy soils.

Paepalanthus trichophyllus (Bong.) Körn.

Fig. 9B

Voucher

M.L.O. Trovó 456 (RB).

Distribution

Widely distributed in Brazil. Widely distributed in the three areas of the park, forming dense populations on argillaceous soils.

Paepalanthus urbanianus Ruhland

Fig. 9C

Voucher

M.L.O. Trovó 447 (RB).

Distribution

Endemic to the Chapada dos Veadeiros. Restricted to the Rio Preto Valley, the species forms very large populations on dry, rocky soils, especially in the vicinity of the Morro da Baleia.

Syngonanthus androgynous M.T.C.Watan.

Voucher

M. Fonseca & T. Filgueiras 115 (RB)*.

Distribution

With a disjunct distribution in the Amazon and Cerrado biomes. Known from a single collection in the Rio Preto Valley in the vicinity of the São Bento waterfall, growing on wet, sandy soils.

Syngonanthus cabralensis Silveira

Fig. 9D

Voucher

M.L.O. Trovó & L.M. Borges 690 (RB).

Distribution

With a disjunct distribution in the Chapada dos Veadeiros and the Serra do Cabral in the Espinhaço Range. Widely distributed from the Rio Preto Valley to the Pouso Alto Region, forming small populations on wet, argillaceous soils.

Syngonanthus caulescens (Poir.) Ruhland

Fig. 9E

Voucher

M.L.O. Trovó et al. 784 (RB).

Distribution

Widely distributed in South and Central Americas. Widely distributed from the Rio Preto Valley to the Pouso Alto Region, especially in the wet lowlands.

Syngonanthus cuyabensis (Bong.) Giul., Hensold & L.R.Parra

Fig. 9F

Voucher

M.L.O. Trovó et al. 771 (RB).

Distribution

Widely distributed in the Cerrado Biome in South America. Known from a single population in a wet, argillaceous area in the Pouso Alto Region, close to the Cruzeiro entrance.

Syngonanthus davidsei Huft

Fig. 9G

Voucher

M.L.O. Trovó et al. 778 (RB).

Distribution

Widely distributed from Mexico to Central Brazil. Widely distributed in the three areas of Park, forming small populations on wet to dry, sandy soils.

Syngonanthus decorus Moldenke

Fig. 9H

Voucher

M.F. Simon & L. Jordão 3266 (RB).

Distribution

Endemic from Chapada dos Veadeiros. Widely distributed from the Rio Preto Valley to the Pouso Alto Region, forming small populations or occurring as isolated individuals, usually on dry, sandy soils.

Syngonanthus densifolius var. *brachyphyllus* Moldenke

Fig. 10A

Voucher

S.M. Sano 61 (NY)*.

Distribution

Endemic to Chapada dos Veadeiros. Distributed from the Rio Preto Valley to the Pouso Alto Region, known from a few specimens collected in dry, sandy soils.

Syngonanthus densifolius var. *majus* Moldenke

Fig. 10B

Voucher

M.L.O. Trovó et al. 783 (RB).

Distribution

Endemic from Chapada dos Veadeiros. Distributed from the Rio Preto Valley to the Pouso Alto Region, growing on dry, sandy to argillaceous soils.

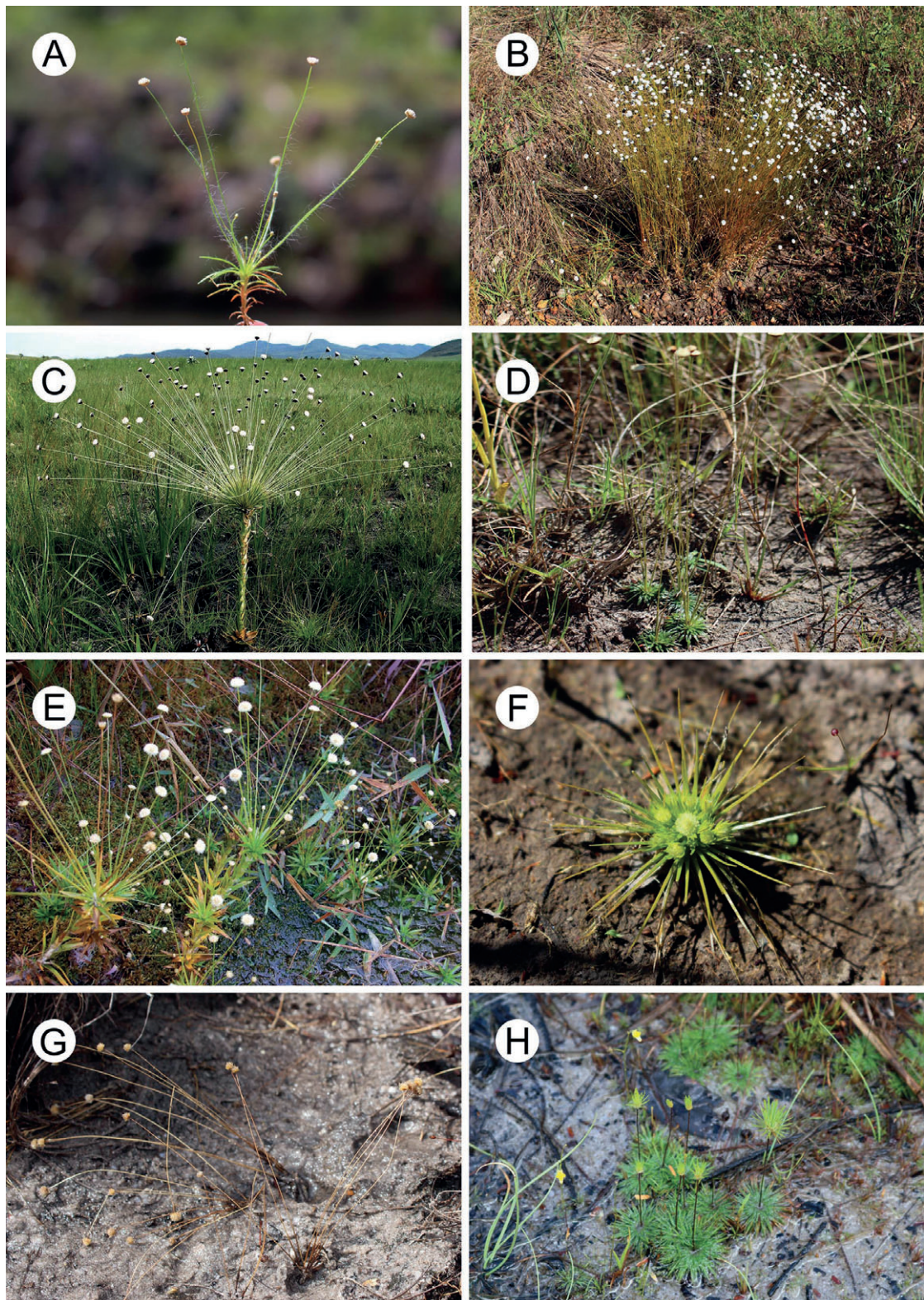


Fig. 9. Species of Paepalanthoideae (Eriocaulaceae) from the Chapada dos Veadeiros National Park. **A.** *Paepalanthus subtilis* Miq. **B.** *P. trichophyllus* (Bong.) Körn.. **C.** *P. urbanianus* Ruhland. **D.** *Syngonanthus cabralensis* Silveira. **E.** *S. caulescens* (Poir.) Ruhland. **F.** *S. cuyabensis* (Bong.) Giul., Hensold & L.R.Parra. **G.** *S. davidsei* Huft. **H.** *S. decorus* Moldenke.

Syngonanthus hensoldiae M.T.C.Watan. & Sano

Fig. 10C

Voucher

M.T.C. Watanabe & W. Watanabe 375 (SPF).*

Distribution

Endemic to Chapada dos Veadeiros. Restricted to the Rio Preto Valley, the species is known from a few populations growing on moist soils around Rio dos Couros.

Syngonanthus heteropeplus (Körn.) Ruhland

Fig. 10D

Voucher

M.L.O. Trovó & L.M. Borges 697 (RB).

Distribution

Widely distributed in northern South America, occurring in Brazil throughout the Amazonian and Cerrado domains. Distributed from the Rio Preto Valley to the Pouso Alto Region, growing mostly on wet, sandy soils.

Syngonanthus humboldtii (Kunth) Ruhland

Fig. 10E

Voucher

M.L. Fonseca & T.S. Filgueiras 114 (RB).

Distribution

Widely distributed in northern South America, occurring in Brazil throughout the Amazonian and Cerrado domains. Distributed from the Rio Preto Valley to the Pouso Alto Region, growing mostly on wet, rocky to sandy soils.

Syngonanthus incurvifolius M.T.C.Watan. & Echtertn.

Voucher

H.S. Irwin et al. 24648 (RB).*

Distribution

Endemic to Chapada dos Veadeiros. The species is known from a few old specimens collected along the GO-118 road, a few km south of the Chapada dos Veadeiros. This species grows on wet, sandy soils in an area nowadays suffering from high levels of anthropic activity.

Syngonanthus nitens (Bong.) Ruhland

Fig. 10F

Voucher

M.L.O. Trovó & L.M. Borges 722 (RB).

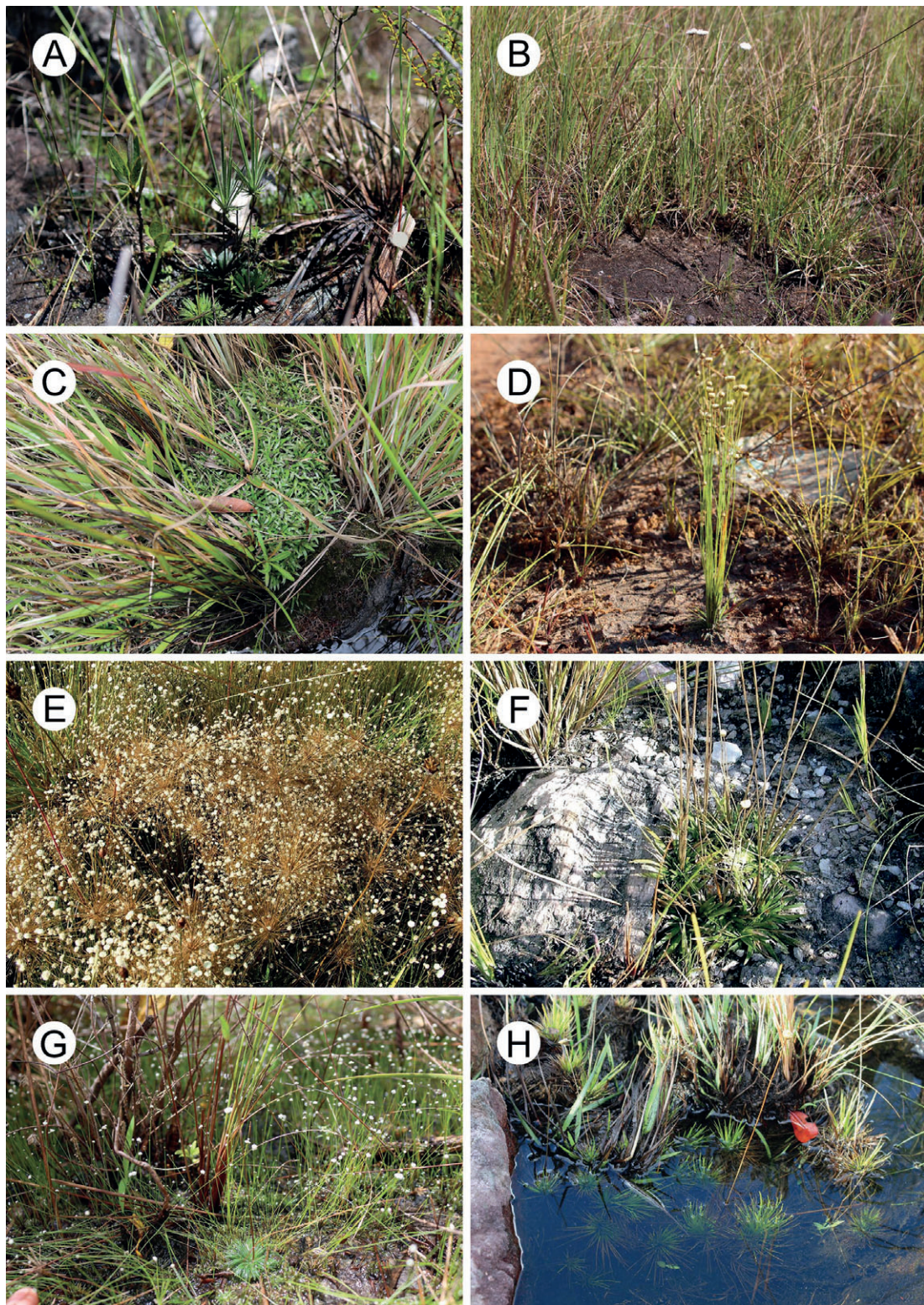


Fig. 10. Species of Paepalanthoideae (Eriocaulaceae) from the Chapada dos Veadeiros National Park. **A.** *Syngonanthus densifolius* var. *brachyphyllus* Moldenke. **B.** *S. densifolius* var. *majus* Moldenke. **C.** *S. hensoldiae* M.T.C.Watan. & Sano. **D.** *S. heteropeplus* (Körn.) Ruhland. **E.** *S. humboldtii* (Kunth) Ruhland. **F.** *S. nitens* (Bong.) Ruhland. **G.** *S. vittatus* M.T.C.Watan. & Echtertn. **H.** *S. widgrenianus* (Körn.) Ruhland.

Distribution

Widely distributed in South America. Distributed in the Rio Preto Valley, growing on wet, sandy to argillaceous soils.

Syngonanthus vittatus M.T.C.Watan. & Echtertn.

Fig. 10G

Voucher

M.T.C. Watanabe & W. Watanabe 377 (RB).*

Distribution

Endemic to Chapada dos Veadeiros. Distributed in the Rio Preto Valley, growing on wet, sandy to argillaceous soils.

Syngonanthus widgrenianus (Körn.) Ruhland

Fig. 10H

Voucher

M.L.O. Trovó & L.M. Borges 723 (RB).

Distribution

Widely distributed in eastern Brazil, from Piauí to São Paulo. Known only from perennial streams and rivers in the Pouso Alto Region.

Discussion

Species list and geographical distribution

We recorded a total of 42 species of Paepalanthoideae from the Chapada dos Veadeiros National Park, belonging to the following genera: *Actinocephalus* (2 spp.), *Comanthera* (1 sp.), *Paepalanthus* (24 spp.), and *Syngonanthus* (15 spp.). The generic and specific composition is as expected from the Cerrado vegetation outside of the Espinhaço Range, with a predominance of *Paepalanthus* and *Syngonanthus*, and with a low representation of *Actinocephalus* and *Comanthera* (Giulietti & Hensold 1990; Stützel 1998; Giulietti *et al.* 2012). *Leiostrix* Ruhland was not recorded from the area, not even *Leiostrix flavescens* (Bong.) Ruhland, a widely distributed species in South America. The area is especially significant for the species of Paepalanthoideae with dimerous flowers, being the main center of diversity for groups such as *Paepalanthus* sect. *Conodiscus* Ruhland, *Paepalanthus* sect. *Diphyomene*, and *P. ser. Dimeri* (Trovó *et al.* 2013, 2015a, 2017, 2020; Trovó 2018; Silva & Trovó 2020; Silva *et al.* 2020). Interestingly, the only recorded *Comanthera* is dimerous and endemic to Chapada dos Veadeiros (Echternacht *et al.* 2015).

The diversity of Paepalanthoideae in the Chapada dos Veadeiros National Park encompasses high levels of endemism, with more than half of the recorded species being endemic to the area (22 spp.), or at least endemic to Central Brazil (25 spp.). The remaining species diversity is a combination of widespread species in Brazil, such as *Paepalanthus bifidus* and *Syngonanthus caulescens*, while others may represent a marginal distribution of species typical from the Amazon savannahs, such as *P. polytrichoides* and *S. heteroepplus*, and from the southeastern rocky savannahs, such as *P. flaccidus*. Interestingly, some of the widespread species in Central Brazil do not occur in the Chapada dos Veadeiros National Park, such as *Actinocephalus bongardii* (A.St.-Hil.) Sano and *Syngonanthus densiflorus* (Körn.) Ruhland.

The species of Paepalanthoideae of the Chapada dos Veadeiros are therefore a distinctive combination of species.

The species are unevenly distributed within the park, with only five species recorded throughout the three predetermined areas. Most of the species are shared between the Rio Preto Valley and the Pouso Alto Region (17 spp.), while only one species is shared between the Pouso Alto and the Chapada de Nova Roma, and another between the Rio Preto Valley and the Chapada de Nova Roma. The Rio Preto Valley hosts the majority of the exclusive species (10 spp.), while the Pouso Alto Region has seven exclusive species and the Chapada de Nova Roma has none. Such distribution may be explained by the differences in the geomorphology, especially regarding lithology, altitude, and water availability.

The shared diversity between the Rio Preto Valley and the Pouso Alto Region may be explained by the similar lithology and occurrence of moist grasslands, an abundant vegetation in the Rio Preto Valley and occurring as patches in the Pouso Alto Region (Latrubesse & Carvalho 2006; ICMBIO 2009; Silva & Cherem 2016). The differences, however, may be explained again by the differences in altitude, substrate and soil humidity. The Chapada de Nova Roma belongs to a different geomorphological unit (Latrubesse & Carvalho 2006; Silva & Cherem 2016). The open grassland areas are much less frequent in this region and we may suggest that the combination of lithology and vegetation types makes the establishment of the Paepalanthoideae species more difficult, as only the more widespread species occur in the region.

According to Chagas (2017), at least 11 species of *Eriocaulon* occur in the Chapada dos Veadeiros National Region, most of them endemic and yet to be described. The whole species of Eriocaulaceae richness is thus not only significant by itself, but even more so when compared to other areas already surveyed. The Chapada dos Veadeiros National Park is richer in species of Eriocaulaceae than other areas of Cerrado and Mata Atlântica vegetation, as for example in the states of São Paulo (49 spp.) and Rio de Janeiro (36 spp.), the core Mantiqueira Range (24 spp.), and the Ibitipoca State Park (22 spp.) (Ferreira *et al.* 2011; Sano & Giuliatti 2012; Trovó *et al.* 2015b; Baumgratz *et al.* 2021). It is also richer than areas within the main center of diversity in the Espinhaço Range, such as the Grão-Mogol Region (33 spp.) (Sano *et al.* 2010). The results reinforce the highest savannahs from Central Brazil as a secondary center of diversity for Eriocaulaceae in Brazil and may be even more representative when considering the remaining areas beyond the Chapada dos Veadeiros National Park (Giuliatti & Hensold 1990; Stützel 1998). Efforts to expand the herbarium collections and checklists of Eriocaulaceae in the Central Brazilian Plateau are urgent and may play a critical role in the conservation of a unique and irreplaceable piece of the Eriocaulaceae diversity and the Cerrado biome as well.

Dubious taxa and specimens

Some specimens previously described and identified with dubious names or yet to receive a proper identification were kept out from the checklist. Such specimens were usually maintained at the generic level or re-identified. We would like, however, to provide comments on such specimens and names for further investigations.

Regarding *Paepalanthus*, the name *Paepalanthus fasciculifer* var. *capillifolius* Moldenke described from the Chapada dos Veadeiros indeed belongs to *Syngonanthus* Ruhland, according to Echternacht (2012) and its proper synonymization under a species of *Syngonanthus* is yet to be published. Many specimens were identified as *P. microcaulon* Ruhland in the herbaria visited. We assume these specimens as corresponding to *P. polytrichoides* and further investigations should elucidate the circumscription of these two taxa, as we did not find enough differences to maintain both names as corresponding to distinct entities.

The specimens of *C.B.R. Munhoz 7844* (RB, UB) were previously identified as *P. scholiophyllus* Ruhland. This species is recorded from other areas in Central Brazil, but the two specimens from the study area correspond to vegetative rosettes of difficult identification. In addition, these specimens represent a single collection gathered in an intensively surveyed area of the park, though the species has never been recollected. The specimen *J.P Souza 8657* (SPF) resembles *P. lycopodioides* Silveira, a rare species from the Espinhaço Range. Intense efforts to recollect this material have failed and we leave the specimen at the generic level rather than assume such geographic disjunction until further specimens are available. Finally, the specimens *M.L Fonseca 6932b* (IBGE, RB) may represent a new species from the park or a variation of similar species, such as *P. echinoides* and *P. sphaerocephalus*. We, however, failed to recollect the taxon and decided to wait for additional specimens or further revisionary studies.

Regarding *Comanthera* L.B.Smith, the specimen *H.S. Irwin 32664* (LL, NY, US) represents the type of *Syngonanthus ulei* var. *goyasensis* Moldenke collected in the Chapada dos Veadeiros Region, synonymized under *Comanthera kegeliana* (Körn.) Moldenke by Parra *et al.* (2010). The specimen, however, differs from *C. kegeliana* by the golden external series of involucre bracts (vs cream-colored) and the internal series surpassing the flower disc (vs not surpassing). In addition, its flowers are mostly immature and remain undescribed. It would represent an unlikely disjunction between the Amazon and the Cerrado Domain. In this treatment we do not recognize *S. ulei* var. *goyasensis* as synonymous with *C. kegeliana*. Additional analyses of the specimen, especially of the flowers, are needed to confirm its identity.

Regarding *Syngonanthus*, the taxon *S. appressus* var. *chapidensis* Moldenke is known only from a few specimens in the vicinities of the Chapada dos Veadeiros National Park. According to Echternacht (2012) and Watanabe (2015), an analysis of the type specimen, *H.S. Irwin 32149* (LL), suggests that the species should be transferred to *Paepalanthus*. However, such analysis and nomenclatural adjustments are yet to be published. Finally, *Syngonanthus davidsei* belongs to the *Syngonanthus gracilis* (Bong.) Ruhland species complex. Indeed, many specimens were previously identified as *S. gracilis* in different herbaria. Based on the morphology of the stem and gynoecium of the specimens, besides the species distribution, we follow Nancy Hensold's concepts according to Echternacht (2012) and consider all specimens from the Chapada dos Veadeiros Region as belonging to *S. davidsei*.

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