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Research article

Taxonomic revision of the *Paepalanthus trichophyllus* complex (Poales, Eriocaulaceae) with the description of two new species

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Abstract. We revise the *Paepalanthus trichophyllus* species complex using multivariate morphological analyses, leading to a redefinition of species boundaries, clarification of nomenclature and taxonomy, and the description of two new species: *P. linearilaminatus* L.E.F.Silva sp. nov. and *P. rollimae* L.E.F.Silva sp. nov. *Paepalanthus trichophyllus* is now circumscribed as occurring in south-western Minas Gerais and south-eastern Goiás. Despite this narrower range, the species continues to exhibit substantial morphological variability, particularly in floral structures and stem morphology. For *P. trichophyllus*, we provide a second-step lectotype and a new synonym (*P. canescens* f. *angustifolia*). The new species *P. linearilaminatus* occurs in the center to south of Bahia and is mainly distinguished by its linear leaves and oblanceolate floral bracts, while *P. rollimae* occurs in Chapada dos Veadeiros National Park and its surroundings in Goiás, being mostly characterized by its elliptical or elliptical-lanceolate leaf blades, rounded spathe apices, and discoid capitula. The geographical isolation and consistent morphological traits of *P. linearilaminatus* and *P. rollimae* support their recognition as distinct species. This study contributes to the taxonomic understanding of *Paepalanthus* diversity in Brazil and highlights the rich biodiversity of the Cerrado domain.

Keywords. Brazilian Cerrado, morphological variation, multivariate analyses, Paepalanthoideae, species delimitation.

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Introduction

Paepalanthus Mart. nom. cons. is the largest genus of Eriocaulaceae Martinov in the Neotropics, comprising approximately 485 species (Giulietti *et al.* 2012; Bánki *et al.* 2024; Stützel *et al.* 2024). In Brazil, the genus is particularly diverse in the Cerrado domain, with about 400 species recorded

(Giulietti & Hensold 1990; Trovó *et al.* 2013a, 2013b). This phytogeographic domain, recognized as the largest Neotropical savanna and a global biodiversity hotspot, has already lost nearly 46% of its original native vegetation (Myers *et al.* 2000; Strassburg *et al.* 2017), and is characterized by a mosaic of savannas, grasslands, and forests, providing unique habitats for diverse flora (Ribeiro & Walter 2008).

Within the Cerrado domain in central Brazil, *Paepalanthus* sect. *Diphyomene* Ruhland represents a taxonomically challenging group. Ruhland (1903) defined the section by the presence of elongated stems, terminal umbelliform or fasciculate inflorescences, dimerous flowers, and bifid stigmas. Its distribution is predominantly associated with rocky outcrops in tropical South American savannas, with a center of diversity in central Brazil, particularly in the state of Goiás (Trovó *et al.* 2013b). Based on the inflorescence architecture, Trovó *et al.* (2010) proposed an informal division of the section into groups A and B, while Trovó & Sano (2010) provided taxonomic and nomenclatural adjustments for group A, excluding the species of group B from the treatment. The species in group B comprise two morphological complexes related to the names *Paepalanthus flaccidus* (Bong.) Kunth and *P. trichophyllus* (Bong.) Körn., as well as other species that are more clearly delimited: *P. atratus* (Moldenke) L.E.F.Silva & Trovó, *P. babyloniensis* Silveira, *P. rectifolius* Trovó, Echtern. & Sano, and *P. strictus* Körn. They are characterized by a gracile habit and elongated stems without a reproductive axis. Recent studies have emphasized the underestimated diversity within this group, leading to the discovery and description of new and neglected taxa, such as *P. atratus* recently described as having dimerous flowers, elongated ramified stems, and gracile habit (Silva & Trovó 2020). Silva & Trovó (2021) revised *P. decorus* Abbiatti, which had been previously overlooked in the revision of *P.* sect. *Diphyomene*, and had been synonymized with *P. flaccidus* by Silva & Trovó (2021). Silva *et al.* (2025) reestablished *P. babyloniensis* to species rank using morphological, anatomical, and chemical evidence. Those studies highlight the difficulty of establishing the species boundaries in this group, especially because the circumscription of *Paepalanthus trichophyllus*, a highly variable species complex, still needs clarification.

Originally described briefly by Bongard (1831) based on a single specimen, *Riedel 292*, from São João del-Rei, Minas Gerais, *Paepalanthus trichophyllus* was later more thoroughly treated by Körnicke (1863) in his *Flora brasiliensis* and further expanded upon in Ruhland (1903) in Engler's *Das Pflanzenreich*. While botanical collections grew, the species circumscription was expanded to encompass specimens distributed in Minas Gerais, Goiás, and Bahia. The current species circumscription represents a morphologically variable species complex with poorly understood species boundaries among other species in *P.* sect. *Diphyomene*, primarily characterized by recurved leaves on an elongated stem, brown involucral bracts, and dimerous flowers. The morphological variation observed in the specimens includes differences in plant size and structures such as stems, leaves, involucral bracts, petals, and sepals. Despite its broad distribution and morphological diversity, not a single population-level study has been conducted.

Integrative analyses have proven to be a valuable tool for species delimitation within Eriocaulaceae. Watanabe (2009) demonstrated the importance of morphological variability in populations for understanding species boundaries in *Syngonanthus nitens* (Bong.) Ruhland. Picanço (2018) showed how morphometric and palynological analyses help resolve taxonomic ambiguities within the *Paepalanthus aequalis* (Vell.) J.F.Macbr. complex. Echternacht *et al.* (2020), through a comprehensive morphological analysis of *P. elatus* (Bong.) Körn., reestablished this taxon as a distinct species within *P.* subgen. *Xeractis* Körn., based on detailed field and herbarium observations. More recently, Cabrini *et al.* (2024) combined genome-wide analyses and morphological data to clarify taxonomic uncertainties in *P. calvus* Körn., recognizing a new species, *P. salimenae* Cabrini & Trovó. These studies underscore the value of modern analytical approaches in addressing taxonomic challenges in the family.

In this study, we assess the morphological variation and discontinuities in this variation within the *Paepalanthus trichophyllus* complex using a morphometric approach to clarify its taxonomy. To this end,

we conducted an exploratory multivariate analysis of vegetative and inflorescence traits, complemented by observations of qualitative characters. We present an updated taxonomic treatment for the complex, including the description of two new species. Additionally, we provide detailed morphological descriptions, illustrations, a distribution map, preliminary conservation assessments, and notes on taxonomy, nomenclature, and ecology.

Material and methods

Sampling

To encompass the full range of morphological variation and geographic distribution of the *Paepalanthus trichophyllus* complex, seven subpopulations were sampled, including the type localities: one from Itutinga (MG), one from the Piatã (BA), three from the Chapada dos Veadeiros (GO), and one from the Serra do Lenheiro in São João del-Rei (MG). An additional subpopulation from the Serra da Canastra National Park (MG) was analyzed exclusively from herbarium specimens. Populations from southeast Goiás were neither collected nor observed in herbarium materials at the subpopulation level and, therefore, were not included in the morphometrical analyses.

Standard methods for botanical collection, pressing, drying, and storage followed Mori *et al.* (2011). All specimens were georeferenced using GPS and deposited in the R herbarium, with duplicates distributed to additional institutions. In-person consultations were conducted with specimens in the following herbaria: HRCB, R, RB, and SPF, while online resources were consulted for the collections: ALCB, B, BHCB, BHZB, BM, BOTU, BR, CEN, CEPEC, CGMS, CNMT, COR, CPAP, E, ESA, ESAL, F, FLOR, G, HCF, HDJF, HEPH, HFC, HJ, HRB, HTO, HUEFS, HUEG, HUEM, HUFSJ, HUFU, HVC, IAN, IBGE, IPA, INPA, K, L, LAG, LE, LL, LP, MBM, MBML, MO, NY, OUPR, P, PACA-AGP (Herbarium Anchiete), PAMG, RFFP, RON, SORO, SP, U, UB, UEC, UESC, UFG, UFP, UPCB, US, and VIC. Acronyms of herbaria follow Index Herbariorum (Thiers 2025).

Morphometrical analysis

The subpopulations were categorized and assigned to their respective localities. The number of individuals analyzed along with voucher specimens are summarized in Table 1. A ruler and caliper were used to measure the following quantitative traits: plant height, stem length, scape length, and spathe length. Millimeter paper was used to measure internode length, leaf length and width, capitulum diameter and height, involucral bract length, floral bract length, sepals and petals of staminate and pistillate flowers, androecium and gynoecium. When an individual lacked a structure, the subpopulation average was used. Leaf measurements included six leaves per individual: three from the apical region (Leaf 1) and three from the median region (Leaf 2). For each leaf, four measurements were recorded: length, width at the apical portion (Width 1), width at the median portion (Width 2), and width at the basal portion (Width 3). These were treated as distinct traits in the statistical analysis. For the Serra da Canastra National Park population, where stems were short, only three leaves per individual were analyzed, with their data duplicated for consistency in comparisons.

An input matrix was constructed with the values for each measurement per individual. The input matrix was logarithmically transformed to avoid size distortions regarding different structures. This step also ensured compatibility with the assumptions of multivariate analyses, which require normally distributed data. Statistical analyses were conducted using Past ver. 4.07 software. Two ordination methods were applied: Principal Component Analysis (PCA), where no prior groups were assumed, and Discriminant Analysis (DA), which assumed each subpopulation as an independent group as detailed in Table 1. The jackknife statistical method was employed to estimate confidence in the discriminant analysis. Both analyses were based on a variance-covariance matrix

Table 1. Populations of the *Paepalanthus trichophyllus* complex used in this study, including acronyms, locality information, number of specimens and vouchers or barcodes. Vouchers were deposited in the R herbarium. Abbreviations: BA = Bahia; GO = Goiás; MG = Minas Gerais. * = holotype voucher.

Acronym	Locality/coordinates (lat, long)	N° of specimens	Vouchers
CANAS	MG, Serra da Canastra National Park (20°15′18″ S, 46°26′58″ W)	7	SPF 106131 SPF 109761 SPF 109764 SPF 227046
CHAVEfaz	GO, Chapada dos Veadeiros National Park, Fazenda Água Fria (14°05′39″ S, 47°30′19″ W)	16	*L.E.F. Silva et al. 141* *
CHAVEcru	GO, Chapada dos Veadeiros National Park, Cruzeiro (14°05′8″ S, 47°32′33″ W)	16	*L.E.F. Silva et al. 145*
CHAVEest	GO, Chapada dos Veadeiros National Park, road Alto Paraíso to Teresina (13°59′15″ S, 47°30′32″ W)	15	*L.E.F. Silva et al. 155*
PIA	BA, Piatã (13°03′44″ S, 41°53′02″ W)	15	*W.L. Picanço 561* *
ITU	MG, Itutinga (21°17′47″ S, 44°42′42″ W)	16	*L.E.F. Silva & I.M. Rollim 178*
SÃO	MG, São João del-Rei (21°7′31″ S, 44°16′28″ W)	9	*L.E.F. Silva & I.M. Rollim 180*

Taxonomic treatment, distribution and conservation

The broad concept of *Paepalanthus* s. lat., as outlined by Christenhusz *et al.* (2020) and Stützel *et al.* (2024) was adopted. Therefore, all names (including the new species) are treated within *Paepalanthus*, alternatively to the proposal of Andrino *et al.* (2023), that would consider those taxa as belonging to *Floralia* Andrino & F.N.Costa. To ensure accurate nomenclatural assignment, groups identified through morphometric analyses were compared against the type specimens and original descriptions. Beyond quantitative data, qualitative traits were meticulously examined to identify diagnostic features and morphological variations essential for a robust taxonomic treatment. Specimen groups consistently supported by multivariate analysis were recognized as a distinct species, with geographic patterns further helping to establish their circumscription.

Diagnostic and taxonomically significant characters were documented with photographs captured under a stereo microscope (Zeiss-Stemi 508). Terminology for the morphological description of vegetative structures follows Radford *et al.* (1974), while reproductive structures were described in accordance with Weberling (1989) and family-specific study (Stützel & Trovó 2013). Distribution and ecological data were compiled from herbarium specimens and field observations. The species concept adopted follows Stuessy (1990), and all nomenclatural changes are in line with the latest International Code of Nomenclature (Turland *et al.* 2025) and clarifications by McNeill (2014).

The distribution map was developed using the QGIS ver. 3.36.1 software (QGIS Development Team 2024). For the specimens lacking geographic coordinates on the herbarium labels but containing detailed locality descriptions, coordinates were inferred using Google Earth. The Extent of Occurrence (EOO) and Area of Occupancy (AOO) were calculated in GeoCAT (Bachmann *et al.* 2011), with grid cells set at 2 km^2. A preliminary conservation assessment was conducted according to the IUCN (2012) categories and criteria, following the updated IUCN guidelines (IUCN Standards and Petitions Committee 2024).

Abbreviations

BA = Bahia
GO = Goiás
MG = Minas Gerais

Results

Morphometrical analysis

The first four components of PCA analysis explain 90.6821% of the observed morphological variation: PC1 accounted for 51.704%, PC2 for 30.507%, PC3 for 5.0894%, and PC4 for 3.3817%. When plotting the first two components (Fig. 1A), component 2 separates PIA from CANAS, CHAVEest and SÃO, component 1 separates CANAS and PIA from the group of ITU, CHAVE subpopulations, and SÃO. When PC1 and PC3 were plotted (Fig. 1B), component 3 separates CANAS from ITU and SÃO. Meanwhile, component 1 separates CANAS from PIA and those two from ITU, CHAVE subpopulations, and SÃO. When PC1 was plotted with components from PC4 (Fig. 1C), only component 1 separates CANAS from PIA and those two from the group of CHAVE subgroups, ITU and SÃO clustered together. Morphological characteristics contributing to these separations varied across components. For PC1, nearly all characteristics except capitulum length were relevant. PC2 showed contributions from eleven of the fifteen studied traits, particularly leaf lengths and widths. PC3 emphasized seven characteristics, while PC4 highlighted nine. Notably, Serra da Canastra National Park (CANAS) and Piatã (PIA) are consistently distinct in all analyses.

The Discriminant Analysis generated four main axes accounting for the morphological variation: axis 1 (45.57%), axis 2 (31.37%), axis 3 (11.02%), and axis 4 (8.884%). When plotting the first two axes (Fig. 2A), axis 2 separates CANAS and PIA from CHAVE subgroups, ITU and SÃO. When axes 1 and 3 were plotted (Fig. 2B), axis 3 separates ITU from CANAS and CHAVE subgroups. When axis 1 was plotted with axis 4 (Fig. 2C), axis 4 separates CANAS and CHAVEfaz from SÃO, and also separates CANAS from CHAVEcru, CHAVEest and PIA. Meanwhile, axis 1 separates CANAS from SÃO and those two from a grouping formed by CHAVE subgroups, PIA and ITU, and separate ITU from CHAVEcru and CHAVEfaz. The confusion matrix for the DA correctly classified 97.87% of individuals into their predefined groups, and when subjected to the Jackknifed analysis, this value decreased to 92.55%.

The results obtained from both PCA and DA demonstrated a clear separation of the Serra da Canastra National Park subpopulation. The subpopulations from the Chapada dos Veadeiros National Park exhibited morphological cohesion, being related to the Itutinga and São João del-Rei in the PCA, whereas in the DA, they were closer to Piatã and Itutinga. This variability, combined with the data presented in Table 2, highlights a high degree of morphological variation within the Chapada dos Veadeiros National Park subpopulations. This group exhibits unique qualitative morphological traits, which, despite their considerable variation in dimensions, are shared across all individuals of the subpopulation. These traits, along with the multivariate analysis results and the group's isolated geographical distribution (Fig. 3), provide strong support for its classification as a distinct species.

The Piatã subpopulation consistently separated from the other subpopulations in PCA, while in DA, it either formed a distinct group or was placed near Chapada dos Veadeiros National Park subpopulations. This consistent distinction, along with its unique morphological characteristics and geographic isolation, supports its recognition as a separate species. These results provide robust evidence to support the redefinition of the *Paepalanthus trichophyllus* complex into three distinct species based on morphological and geographical data. Descriptions of these species, along with the necessary nomenclatural and taxonomic changes are provided. These are based on both quantitative and qualitative data obtained from herbarium specimens and field collections. Comments, illustrations, and a distribution map are presented to facilitate the species recognition.

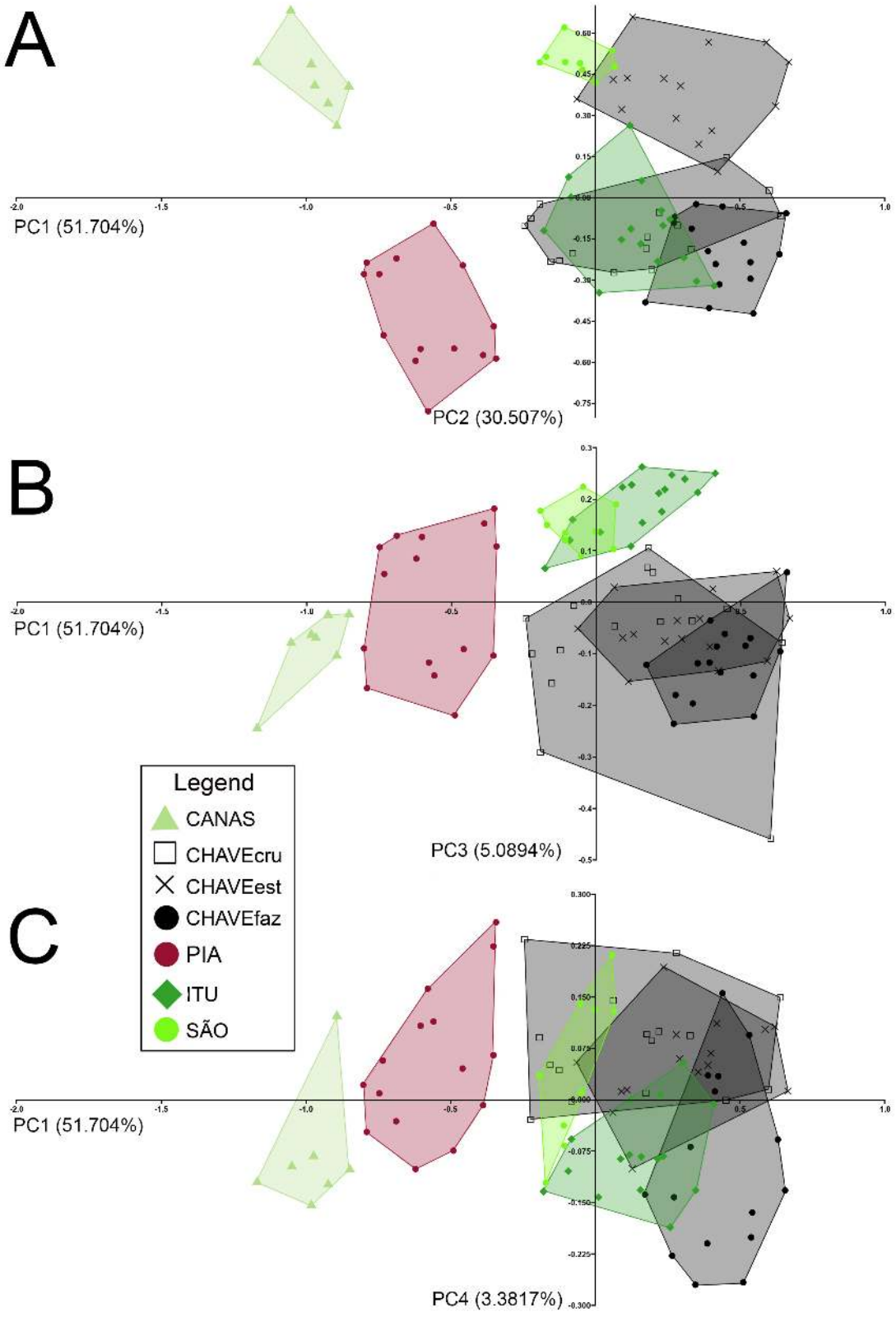


Fig. 1. Scatterplots derived from Principal Component Analysis of seven populations of the *Paepalanthus trichophyllus* complex. **A**. Plot of principal component (PC) 1 vs PC2. **B**. Plot of PC1 vs PC3. **C**. Plot of PC1 vs PC4. For explanation of the acronyms see Table 1.

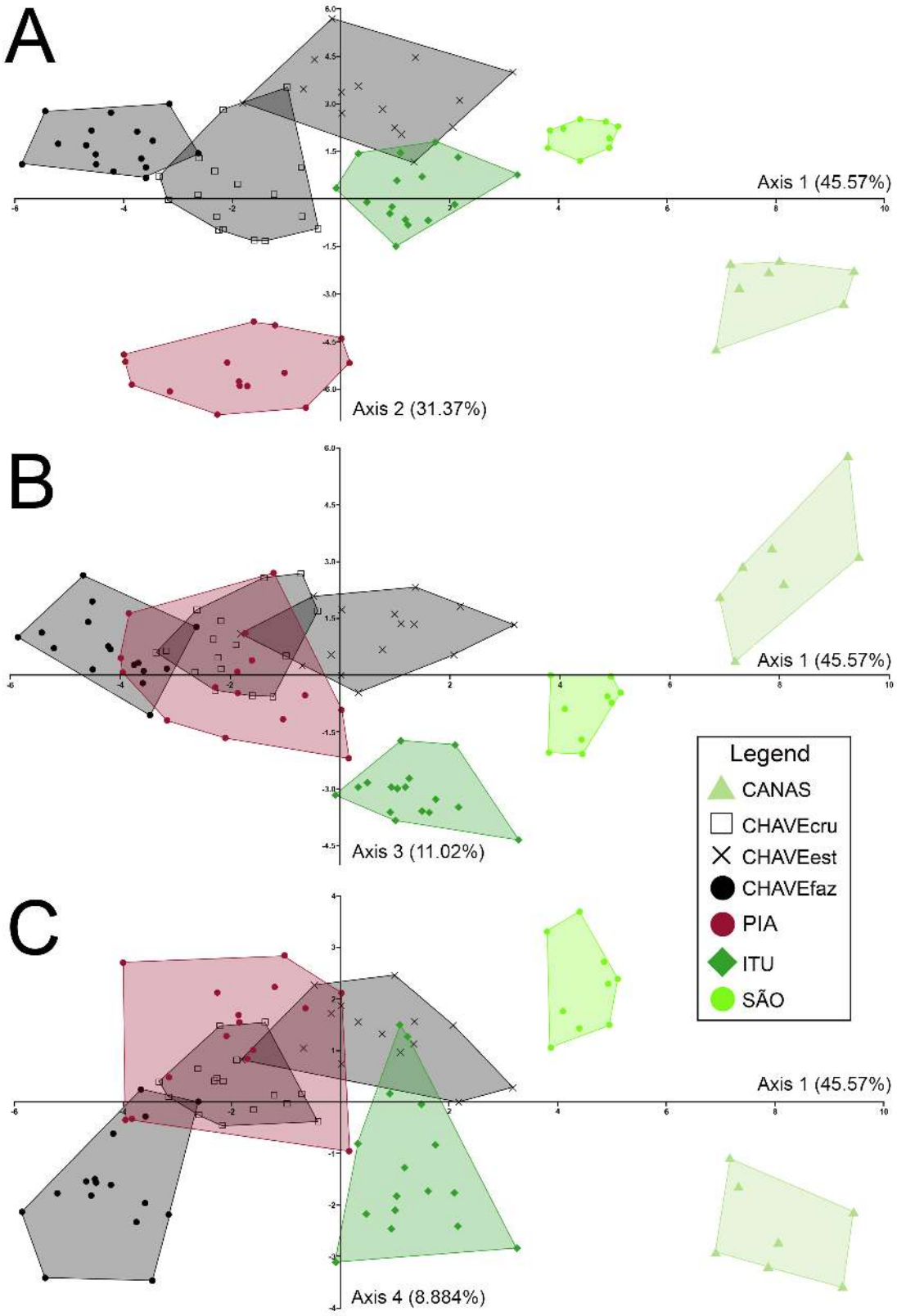


Fig. 2. Scatterplots derived from Discriminant Analysis of seven populations of the *Paepalanthus trichophyllus* complex. **A**. Plot of Axis 1 vs Axis 2. **B**. Plot of Axis 1 vs Axis 3. **C**. Plot of Axis 1 vs Axis 4. For explanation of the acronyms see Table 1.

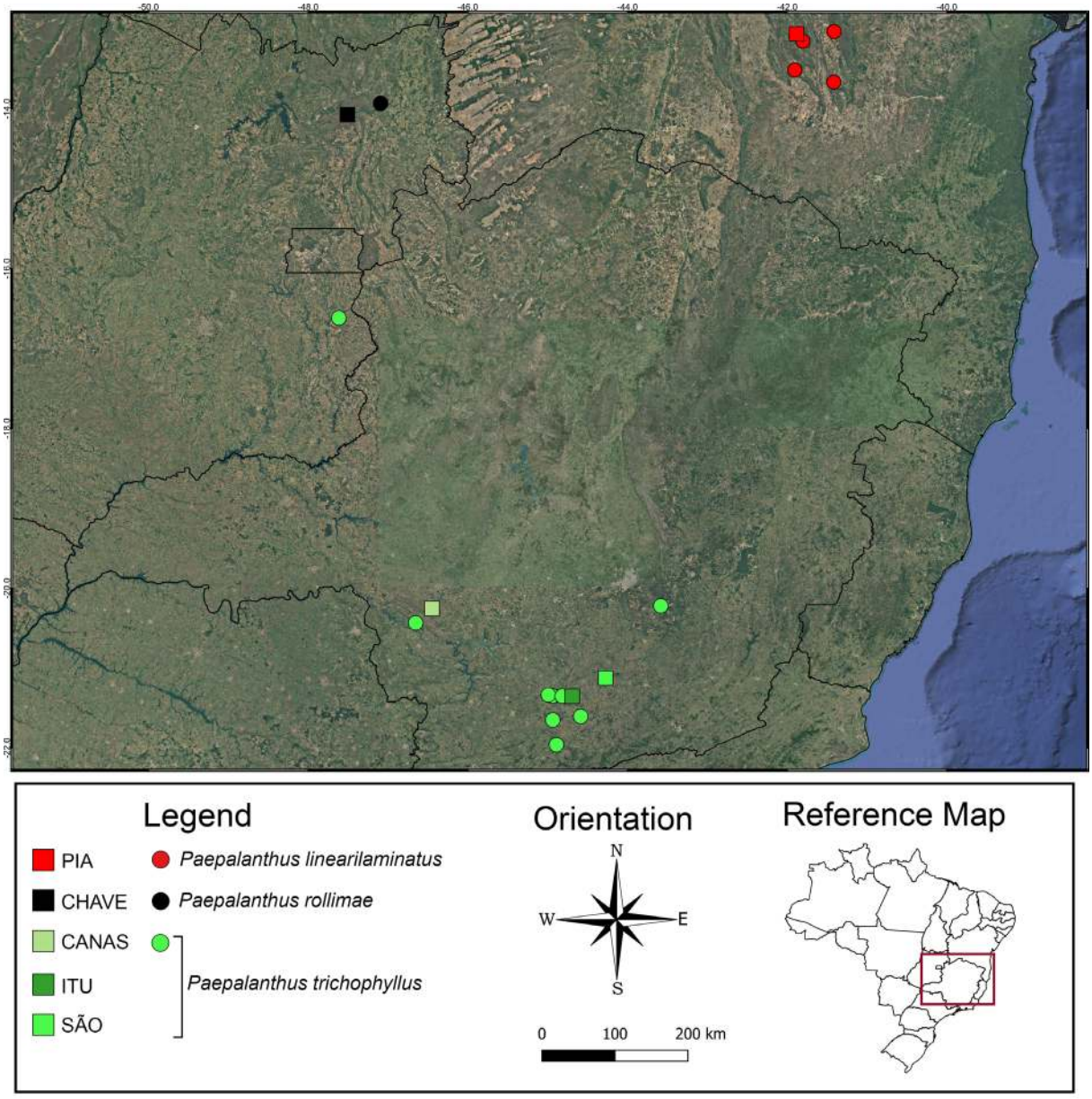


Fig. 3. Distribution map of *Paepalanthus linearilaminatus* L.E.F.Silva sp. nov., *P. rollimae* L.E.F.Silva sp. nov. and the three morphotypes in the *Paepalanthus trichophyllus* complex.

Table 2. Comparison of the main vegetative characters used in morphometric analysis for the seven populations of the *Paepalanthus trichophyllus* complex.

Characters (cm) / populations (acronyms)		CANAS	CHAVEest	CHAVEcruz	CHAVEfaz	ITU	PIA	SÃO
Plant length	min.	10.35	24.40	30.30	41.30	26.50	18.80	16.65
	max.	20.10	50.00	70.70	65.20	56.35	40.70	28.90
	average	14.87	36.38	44.22	54.00	38.56	28.21	23.94
Stem length	min.	0.80	4.10	6.40	12.30	8.70	5.00	4.00
	max.	2.00	17.00	24.20	30.50	32.60	19.20	6.00
	average	1.51	8.56	14.32	21.52	17.79	10.69	4.85
Leaf of the apical portion length	min.	7.00	12.00	8.30	9.00	12.60	5.00	15.70
	max.	14.00	23.00	19.00	16.00	19	11.00	23.00
	average	12.26	16.91	11.72	12.00	16.15	7.50	19.78
width of the median portion	min.	1.00	1.80	0.90	1.50	1.20	0.90	1.90
	max.	2.00	5.10	3.80	3.50	3.00	1.80	3.00
	average	1.54	3.28	2.02	2.61	2.06	1.16	2.42
Leaf of the median portion length	min.	7.00	10.50	8.50	9.00	9.50	5.00	16.50
	max.	14.00	19.50	18.00	17.00	20.5	9.50	23.00
	average	12.26	16.03	12.39	11.79	14.94	7.11	18.83
width of the median portion	min.	1.00	2.10	1.00	1.50	1.30	0.80	2.50
	max.	2.00	5.00	3.20	4.50	3.20	1.90	3.20
	average	1.54	3.14	2.19	2.41	2.19	1.35	2.84

Taxonomic treatment

Class Liliopsida Batsch
Order Poales Small
Family Eriocaulaceae Martinov
Genus *Paepalanthus* Mart.

Paepalanthus trichophyllus (Bong.) Körn. in Martius & Eichler
Figs 4–5

Paepalanthus trichophyllus (Bong.) Körn. in Martius & Eichler (Martius & Eichler 1863). – *Eriocaulon trichophyllum* Bong. (Bongard 1831). – *Dupatya trichophylla* (Bong.) Kuntze (Kuntze 1891). – *Floralia trichophylla* (Bong.) Andrino (Andrino 2023).

Paepalanthus canescens f. *angustifolia* Ruhland (Ruhland 1903). – **Type:** BRAZIL − **Minas Gerais** • an schattigen Stellen der Serra do Lenheiro; May 1896; *Álvaro da Silveira 1036*; holotype: B [B 10 0247833]; isotype: LL [LL 00374678]). **Syn. nov.**

Etymology

The term '*trichophyllus*' originates from the Greek, with '*tricho*' meaning 'hair' and '*phyllus*' meaning 'leaf', a reference to the species characteristic of leaves covered by trichomes.

Type material examined

BRAZIL − **Minas Gerais** • "Brasilia, In siccis arenosis mont. St. Juno d' El Ray" [São João del-Rei]; Jun. 1824; fl.; *Riedel 292* (first-step lectotype designated by Moldenke 1977: 252); second-step lectotype: LE [LE 00002858], designated here; isolectotypes: LE [LE 00002857], B [B 10 0247642].

Other material examined

BRAZIL − **Minas Gerais** • Baependi; 20 Jun. 1962; fl.; *J. Mattos & H. Bicalho 10346*; SP, SPF • Carrancas; 28 Nov. 2002; fl.; *A.A.M. de Barros 1772*; RFFP • Delfinópolis; 11 Mar. 2003; fl.; *R. Romero et al. 6724*; HUFU, UB • Ingaí; s.d.; *M.L. Gavilanes 831*; ESAL • Itumirim; 24 Jul. 1987; fl.; *D.A. Carvalho s.n.*; SPF [SPF61218] • Itumirim; 20 May 2010; fl.; *M.E. Mansanares et al. 1448*; ESAL • Itumirim; 17 Jun. 2012; fl.; *M.E. Mansanares et al. 2711*; ESAL • Itumirim; 22 Mar. 2016; fl.; *C.P.V. Martins et al. 379*; ESAL • Itumirim; 22 Mar. 2016; fl.; *C.P.V. Martins et al. 381*; ESAL • Itumirim; s.d.; fl.; *Alunos da terceira turma da pós-graduação em botânica 265*; ESAL • Itumirim; s.d.; fl.; *E.A. Andrade s.n.*; ESAL [ESAL27042] • Itumirim; s.d.; fl.; *D.A. Carvalho s.n.*; ESAL [ESAL6456, ESAL8305] • Itumirim; s.d.; fl.; *M.L. Gavilanes 366*; ESAL • Itutinga; 7 Mar. 1995; fl.; *V.C. Souza et al. 7843*; ESA • Itutinga; 20 May 2010; fl.; *M.E. Mansanares et al. 1415*; ESAL • Itutinga; 16 Feb. 2012; fl.; *M. Sobral & D.G. Castro 14755*; HUFSJ, RB • Itutinga; 26 Apr. 2016; fl.; *I.AC. Arruda & C.P.V. Martins 669*; ESAL • Itutinga; 13 Feb. 2017; fl.; *D.Q. Domingos et al. 838*; ESAL • Itutinga; 3 Mar. 2021; fl.; *L.E.F. Silva & I.M. Rollim 178*; R • Lavras; 29 Jun. 1987; fl.; *H.F. Leitão Filho et al. 19296*; UEC • Lavras; 10 Apr. 2001; fl.; *J. Chaddad Jr. 46*; ESA • Lavras; 25 Mar. 2011; fl.; *M.E. Mansanares et al. 2131*; ESAL • Lavras; s.d.; fl.; *D.A. Carvalho s.n.*; ESAL [ESAL6738] • Lavras; s.d.; fl.; *M.L. Gavilanes 558*; ESAL • Minduri; 31 Mar. 2011; fl.; *M.E. Mansanares et al. 2158*; ESAL • Ouro Preto; 19 Sep. 2018; fl.; *J.A.M. Paiva et al. 1876*; BHCB, OUPR • São João del-Rei; 4 Jan. 2006; fl.; *A. Rapini 1284*; HUEFS • São João del-Rei; 25 Jan. 2018; fl.; *M.T.R. Costa et al. 1336*; HUFSJ, R • São João del-Rei; 4 Mar. 2021; fl.; *L.E.F. Silva & I.M. Rollim 180*; R • São João del-Rei; s.d.; fl.; *A. Silveira s.n.*; BHCB [BHCB63188] • São Roque de Minas; 7 Dec. 1994; fl.; *J.N. Nakajima & R. Romero 652*; HUFU, SPF • São Roque de Minas; 10 Jan. 1995; fl.; *R. Romero et al. 1682*; HUFU, SPF • São Roque de Minas; 10 Jan. 1995; fl.; *R. Romero et al. 1698*; HUFU, SPF [SPF106131] • São Roque de Minas; 17 Mar. 1995; fl.; *R. Romero et al. 1983*; HUFU, SPF • São Roque de Minas; 17 Mar. 1995; fl.; *R. Romero et al. 1986*; HUFU • São Roque de Minas; 20 Mar. 1995; fl.; *J.N. Nakajima et al. 938*; HUFU • São Roque de Minas; 21 Nov. 1995; fl.; *J.N. Nakajima et al. 1533*; HUFU, SPF [SPF109764, SPF227046] • São Roque de Minas; 23 Nov. 1995; fl.; *J.N. Nakajima et al. 1614*; HUFU, SPF [SPF109761] • São Roque de Minas; 10 Dec. 1996; fl.; *J.N. Nakajima & E.F. André 2475*; UEC • São Roque de Minas; 10 Dec. 1996; fl.; *J.N. Nakajima & E.F. André 2477*; UEC • São Roque de Minas; 11 Jan. 1998; fl.; *R. Romero et al. 5021*; HUFU, SPF. • São Roque de Minas; 31 May 2014; fl.; *L. Echternacht et al. 2496*; HUFU • São Roque de Minas; 31 May 2014; fl.; *M.S. Freitas et al. 34*; HUFU • São Thomé das Letras; 30 Oct. 1984; fl.; *Cordeiro s.n.*; SPF [SPF35521] • São Thomé das Letras; 20 Apr. 1986; fl.; *C.R.A. de Moraes & L.R. Ávila s.n.*; HRCB [HRCB6497] • São Thomé das Letras; 28 Oct. 1989; fl.; *C.L.M. Rocha s.n.*; BHCB [BHCB27983], SPF [SPF100035]. – **Goiás** • Cristalina; 23 Jun. 1983; fl.; *G. Hatschbach & R. Kummrow 46601*; FLOR, INPA, MBM, US • Cristalina; 17 Jul. 2007; fl.; *M.M. Saavedra 403*; HUEFS, RB, SPF • Cristalina; 30 Jul. 2011; fl.; *J.E.Q. Faria et al. 1488*; HUEFS, UB • Cristalina; 19 Mar. 2013; fl.; *R.G. Chacon et al. 1019*; HEPH • Cristalina; 15 May 2015; fl.; *R.G. Chacon et al. 1290*; HEPH • Cristalina; 12 Jun. 2024; fl.; *T.M. de Lima 12*; OUPR

Description

Perennial herbs, usually solitary or forming clumps, with an erect habit and self-supporting individuals, 10.35–56.5 cm tall; rhizome present, usually conspicuous, aerial stem 0.8–32.6 cm long, sparsely pilose, solitary or branched, internodes 0.5–3.5 mm long. Leaves persistent, arranged in a rosette or along the stem, chartaceous, flexible, lanceolate, light green to brownish when old, patent when the stem is short and restricted to the rosette or usually recurved when the stem is elongated and not restricted to the rosette, sessile when the stem is short and restricted to the rosette or usually amplexicaul when the stem is elongated and not restricted to the rosette, 0.7–2.3 × 0.1–0.32 cm, pilose or sparsely pilose, margin straight when the stem is short and restricted to the rosette or involute when the stem is elongated and not restricted to the rosette, margin hirsute at the base and pilose distally, apex acute. Spathes ca 2 × as long as the leaves, pilose or glabrous, apex pilose or glabrous and acute or lacerated. Scapes 1−10 per

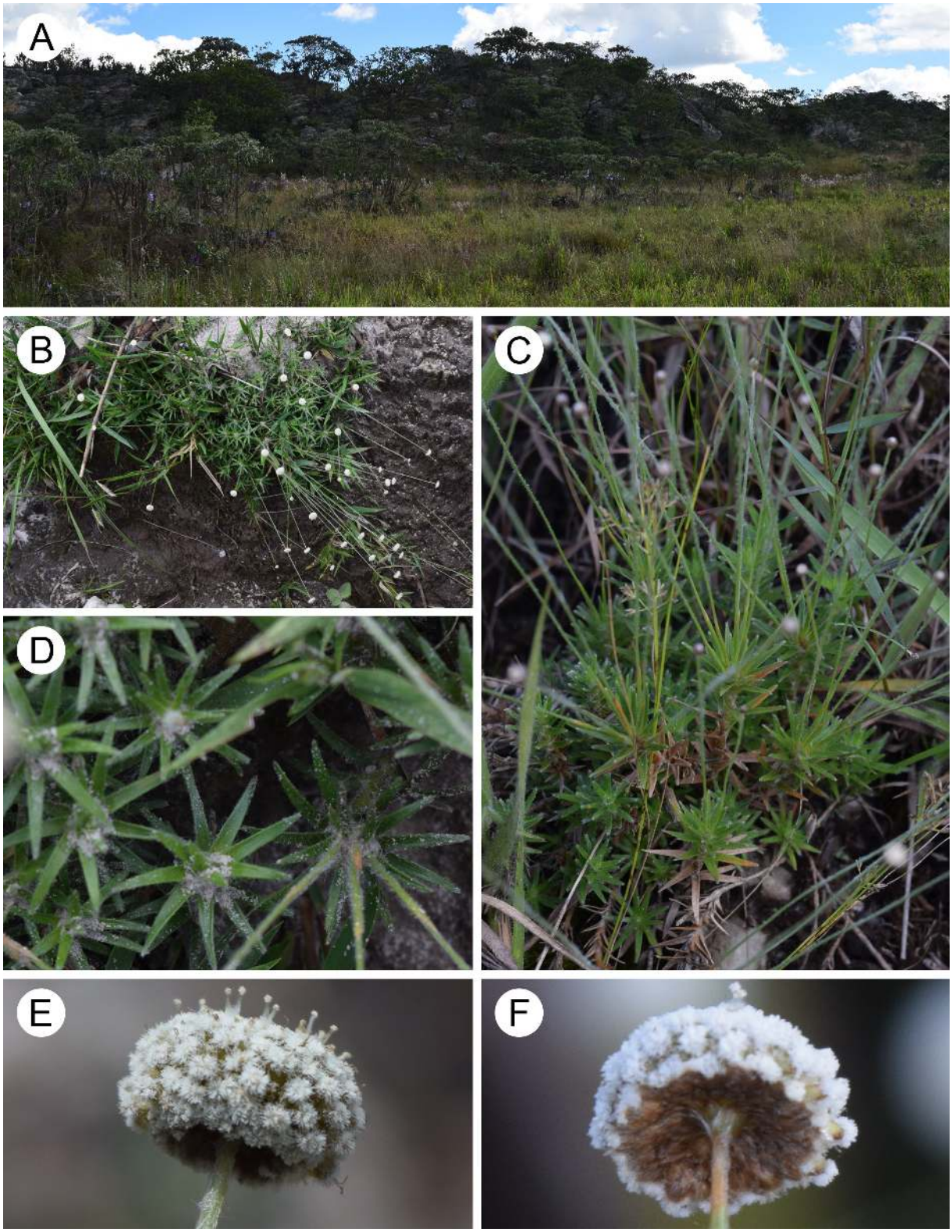


Fig. 4. *Paepalanthus trichophyllus* (Bong.) Körn. **A**. Overview of the habitat in Itutinga (MG). **B**. Habitat and habit. **C**–**D**. Habit. **E**. Capitulum, view from the side. **F**. Capitulum, view from below. Photos by Isis Rollim.

branch, arranged in a terminal umbelliform inflorescence or solitary scapes, 9.1–28.6 cm long, densely pilose or glabrous. Capitula hemispherical to globose, white-villous, 4–9 mm in diam.; involucral bracts in 3−5 series, obovate or wide-elliptic, castaneous, concave-convex, 2–2.5 mm long, pilose to glabrescent distally, margin ciliate, apex obtuse to rounded; receptacle hemispherical, pilose. Flowers dimerous; floral bracts linear, castaneous, concave-convex, 1.5–2 mm long, pilose distally, margin ciliate, apex obtuse or rounded. Staminate flowers 2–2.5 mm long; sessile or with pedicel 0.2–1 mm long, pilose; sepals 2, free, obovate, castaneous, 1.5–2 mm long, pilose to glabrescent distally, ciliate to glabrescent toward the obtuse apex; anthophore fleshy, elongate; corolla fused into a tube, hyaline, membranaceous, 1.5–2 mm long, glabrous; stamens 2–2.5 mm long; anthers 2, exerted, ca 0.5 mm long. Pistillate flowers 2–3 mm long, sessile or with pedicel 0.5 mm long; sepals 2, fused at the base, oblong-obovate, castaneous, 2–3 mm long, pilose to glabrescent distally, margin ciliate to glabrescent toward the obtuse or rounded apex; petals 2, free, elliptic or obovate, hyaline-castaneous, hyaline or cream to golden, 1.5–2.5 mm long, pilose distally on the abaxial surface, margin ciliate toward the obtuse or rounded apex; gynoecium 1.5–3 mm long, stigmatic branches 2, bifid at the apex, slightly or 0.5–1 mm longer than the nectariferous branches, staminodes 2, scale-like. Fruit a loculicidal capsule. Seeds not seen.

Distribution, habitat and ecology

The species is distributed in the states of Minas Gerais and Goiás (Fig. 3), occurring in both protected areas and isolated remnants of native vegetation. In Minas Gerais, it has been recorded in several municipalities, including Baependi, Carrancas, Delfinópolis, Itumirim, Itutinga, Lavras, Minduri, Ouro Preto, as well as in the Serra do Campestre in Ingaí, and the Serra de São Thomé das Letras, within the municipality of São Thomé das Letras. In Goiás, the species is also found in native vegetation remnants within the Serra dos Cristais in Cristalina. It typically inhabits rupestrian grasslands, usually in sandy soils that are often waterlogged in areas with full sunlight exposure. Flowering specimens have been recorded in every month of the year, except in August.

Preliminary conservation assessment

The species occurs within the Quedas do Rio Bonito Ecological Park, the Capanema Private Natural Heritage Reserve, the Serra do Lenheiro Municipal Ecological Park, and the Serra da Canastra National Park, all located in Minas Gerais. With an EOO of 98 828.131 km^2 and an AOO of 52 000 km^2, the species should be treated as Least Concern (LC). Its wide distribution, occurrence in multiple protected areas, and numerous populations of mature individuals support its assessment in this category.

Taxonomic remarks

Paepalanthus trichophyllus was described by Bongard (1831), who provided only a brief description and did not specify the holotype nor the locality. Most of the species described by Bongard (1831) were based on collections by Riedel, deposited at the LE herbarium. During this study, we identified four specimens of particular interest: two under *Riedel 292*, deposited at the LE herbarium with a duplicate at the B herbarium, and *Riedel s.n*. also at LE. Although Trovó & Sano (2010) indicated the *Riedel s.n*. specimen as the holotype of the species, there is no clear indication, which material was used by Bongard in the original description. Moldenke (1977) cited that the species was described based on the specimens at LE, with isotypes at B, which may be considered a first-step lectotype according to the current ICN (Turland 2025: Art. 9.17.). Therefore, we designate the specimen *Riedel 292* [LE 00002858] at the LE herbarium as the second-step lectotype and the duplicate specimens at LE [LE 00002858] and B herbarium [B 10 0247642] are regarded as isolectotypes. Those specimens at LE bear an original label with Bongard's handwriting and are similar to the description protologue of the species.

Ruhland (1903) described *Paepalanthus canescens* f. *angustifolia* as differing from *P. canescens* Körnicke by its slenderer habit and smaller leaves. This form does not fit the concept of *P. canescens,* a species

with trimerous flowers, because the type specimens of the new form has dimerous flowers. Furthermore, its distribution in the Serra do Lenheiro, São João del-Rei, overlaps with the distribution of the type of *P. trichophyllus*. The form described does not exhibit morphological features that differentiate it from *P. trichophyllus*, possessing lanceolate, pilose leaves with a hirsute margin at the base and pilose distally, castaneous capitula, castaneous obovate or wide-elliptic involucral bracts, and dimerous flowers. Therefore, we propose the synonymy of *P. canescens* f. *angustifolia* under *P. trichophyllus*.

Prior to this study, the broad concept of *Paepalanthus trichophyllus* encompassed a poorly understood assemblage of dimerous plants with variable morphology distributed across the states of Minas Gerais, Goiás, and Bahia. This work provides a narrower, more tight circumscription of *P. trichophyllus*, restricting its occurrence to the southern regions of Minas Gerais and Goiás, including the populations from Itutinga, Serra da Canastra National Park, and São João del-Rei, where the type of the species was originally collected. These morphotypes of *Paepalanthus trichophyllus* share both quantitative and qualitative characteristics that define them as a single species. The species is characterized by its sparsely pilose stem; lanceolate leaves with margins hirsute at the base and pilose distally and an acute apex, white-villous, hemispherical to globose capitula, obovate or wide-elliptic involucral bracts, linear floral bracts; and the sepals of pistillate flowers oblong-obovate and petals elliptic or obovate.

While the morphotypes exhibit some variation in size and shape of certain structures compared to the type population from São João del-Rei, these differences are not sufficient to designate them as separate entities. The morphotype found in Itutinga, an area adjacent to São João del-Rei, shows distinct floral features such as floral bracts ca 1.5 mm long (vs 2 mm long in the type population), pistillate flowers ca 2 mm long (vs 3 mm long), sepals ca 2 mm long (vs 3 mm long), petals obovate, hyaline, ca 1.5 mm long (vs elliptic, cream-colored to golden, 2.5 mm long), gynoecium ca 1.5 mm long (vs 3 mm long), and stigmatic branches slightly longer than the nectariferous branches (vs ca 1 mm longer than the nectariferous branches).

The morphotype found in the Serra da Canastra National Park also differs from the São João del-Rei morphotype, with some individuals exhibiting a short stem and sessile, patent leaves with straight margins. However, these features occur in only a few individuals, as the majority maintain characteristics of elongated stems that are not restricted to the rosette, and recurved, amplexicaul leaves with involute margins, like individuals from other populations of *P. trichophyllus*. It was also observed that in this population, some individuals with short stems and their associated characteristics were found in clumps alongside individuals with elongated stems and their respective characteristics.

In the Serra da Canastra National Park population, while the pubescence of vegetative and reproductive structures is similar to other morphotypes, the pubescence of the leaves, spathes, and scapes tends to be more deciduous. Some vegetative and floral traits show variability, such as glabrous spathes (vs pilose) with glabrous apex (vs pilose), glabrous scapes (vs densely pilose), floral bracts ca 1.5 mm long (vs

Fig. 5 (on next page). *Paepalanthus trichophyllus* (Bong.) Körn.; B, D, G, J, P from *L.E.F. Silva & I.M. Rollim 178*; A, C, E–F, H–I, K–O, Q–S from *L.E.F. Silva & I.M. Rollim 180*. **A**. Capitulum, view from the side. **B**. Stem and leaf detail. **C**. Stem and leaf base detail. **D**. Leaf apex detail. **E**. Leaf, view from side. **F**. Spathe and scape detail. **G**. Scape detail. **H–J**. Involucral bract, abaxial surface. **K**. Floral bract, abaxial surface. **L**. Staminate flower with sepals opened. **M**. Staminate flower with one sepal removed. **N**. Staminate flower with sepals removed. **O**. Pistillate flower with sepals and petals opened. **P**. Pistillate flower with one sepal removed. **Q**. Sepal of pistillate flower. **R**. Petal of pistillate flower. **S**. Gynoecium with bifid stigmatic branches. Scale bars: A–C, G = 2 mm; D, H–I, K, P = 1 mm; E = 5 mm; F, O, Q, S = 1.5 mm; J, L–N, R = 1.25 mm. Photos by L.E.F. Silva.


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2 mm long), staminate flowers with sepals and petals ca 1.5 mm long (vs 2 mm long), pistillate flowers ca 2 mm long (vs 3 mm long) with sepals ca 2 mm long (vs 3 mm long) and petals ca 1.5 mm long (vs 2.5 mm long), gynoecium ca 1.5 mm long (vs 3 mm long), and stigmatic branches ca 0.5 mm longer than the nectariferous branches (vs 1 mm longer than the nectariferous branches).

Paepalanthus linearilaminatus L.E.F.Silva sp. nov.
urn:lsid:ipni.org:names:77371912-1
Figs 6–7

Diagnosis

Paepalanthus linearilaminatus sp. nov. may be segregated from the *P. trichophyllus* complex by its linear leaves, which are small, recurved to deflexed and also by its oblanceolate floral bracts.

Etymology

The specific epithet '*linearilaminatus*' is derived from the Latin words '*linearis*' ('linear') and '*lamina*' ('blade' or thin 'sheet'), referring to the distinct morphology of the leaves, which are narrow, elongated, and linear in shape, a characteristic that differentiates the species from other within the group.

Type material

BRAZIL – **Bahia** • Piatã "Estrada para Três Morros, acessada pela BA-560. Estrada de terra na primeira bifurcação às esquerda, sentido Três Morros, campo ca 2 km a partir da estrada principal, próximo a uma fazenda"; 13°03′44″ S, 41°53′02″ W; 1431 m; 8 Jul. 2021; fl; *W.L. Picanço 561*; holotype: R [R253469]!; isotypes: HUEFS!, NY!, P!, RB!, SPF!.

Other material examined

BRAZIL – **Bahia** • Barra da Estiva; 23 Mar. 1980; fl.; *R.M. Harley 20814*; CEPEC, K, SPF • Barra da Estiva; 19 Jul. 1981; fl.; *A.M. Giulietti et al. 1356*; K, SPF • Mucugê; 6 Feb. 1974; fl.; *R.M. Harley et al. 16066*; CEPEC, IPA, K, MO, U, US • Piatã; 20 Aug. 1981; fl.; *L. Coradin et al. 4369*; CEN • Piatã; 15 Feb. 1987; fl.; *R.M. Harley et al. 24316*; HUEFS, K • Piatã; 14 May 1992; fl; *W. Ganev* 287; HUEFS • Piatã; 5 Nov. 1996; fl.; *H.P. Bautista et al. 4074*; ALCB, CEPEC, HUEFS, K, SPF • Piatã; 21 May 1999; fl.; *V.C. Souza 22996*; ESA • Piatã; 29 Jul. 2017; fl.; *N. Roque et al. 4966*; ALCB, HVC • Rio de Contas; 21 Mar. 1977; fl.; *R.M. Harley et al. 19790*; CEPEC, IPA, K, MBM, P, SP, SPF, UEC, US • Rio de Contas; 15 May 1983; fl.; *G. Hatschbach 46408*; INPA, US • Rio de Contas; 20 Feb. 1987; fl.; *R.M. Harley et al. 24516*; K, SPF • Rio de Contas; 6 Nov.1988; fl.; *R.M. Harley et al. 25929*; HUEFS, K, SPF • Rio de Contas; Mar. 1997; fl.; *A.M. Giulietti & R.M. Harley 4013*; BOTU, HCF, HUEFS, K, LAG, R, SORO, UB • Rio de Contas; Mar. 1997; fl.; *A.M. Giulietti & R.M. Harley 4015*; HUEFS, K, R • Rio de Contas; 4 Jan. 2003; fl.; *R.M. Harley et al. 54552*; HUEFS • Rio de Contas; 27 Mar. 2021; fl.; *D.C. Zappi et al. 5169*; HUEFS • Rio de Contas; 10 Sep. 2021; fl.; *R.M. Harley et al. 58809*; HUEFS.

Description

Perennial herbs, solitary, with an erect and self-supporting habit, 18.8–40.7 cm tall; rhizome present, usually conspicuous, aerial stem 5–19.2 cm long, sparsely pilose, unbranched or branched, internodes 1–2 mm long. Leaves persistent, arranged along the stem, chartaceous, rigid, linear, light green to brownish when old, recurved to deflexed, amplexicaul, 0.5–1.1 × 0.08–0.19 cm, pilose, margins involute and hirsute at the base and pilose distally, apex acute. Spathes ca 3 × as long as the leaves, glabrous, apex glabrous and acute. Scapes 1−10 per branch, arranged in a terminal umbelliform inflorescence or solitary, 11.9–28.2 cm long, glabrous. Capitula hemispherical to globose, white-villous, 3.5–7 mm in diam.; involucral bracts in 3−5 series, obovate, castaneous, concave-convex, ca 2 mm long, pilose to glabrescent distally,

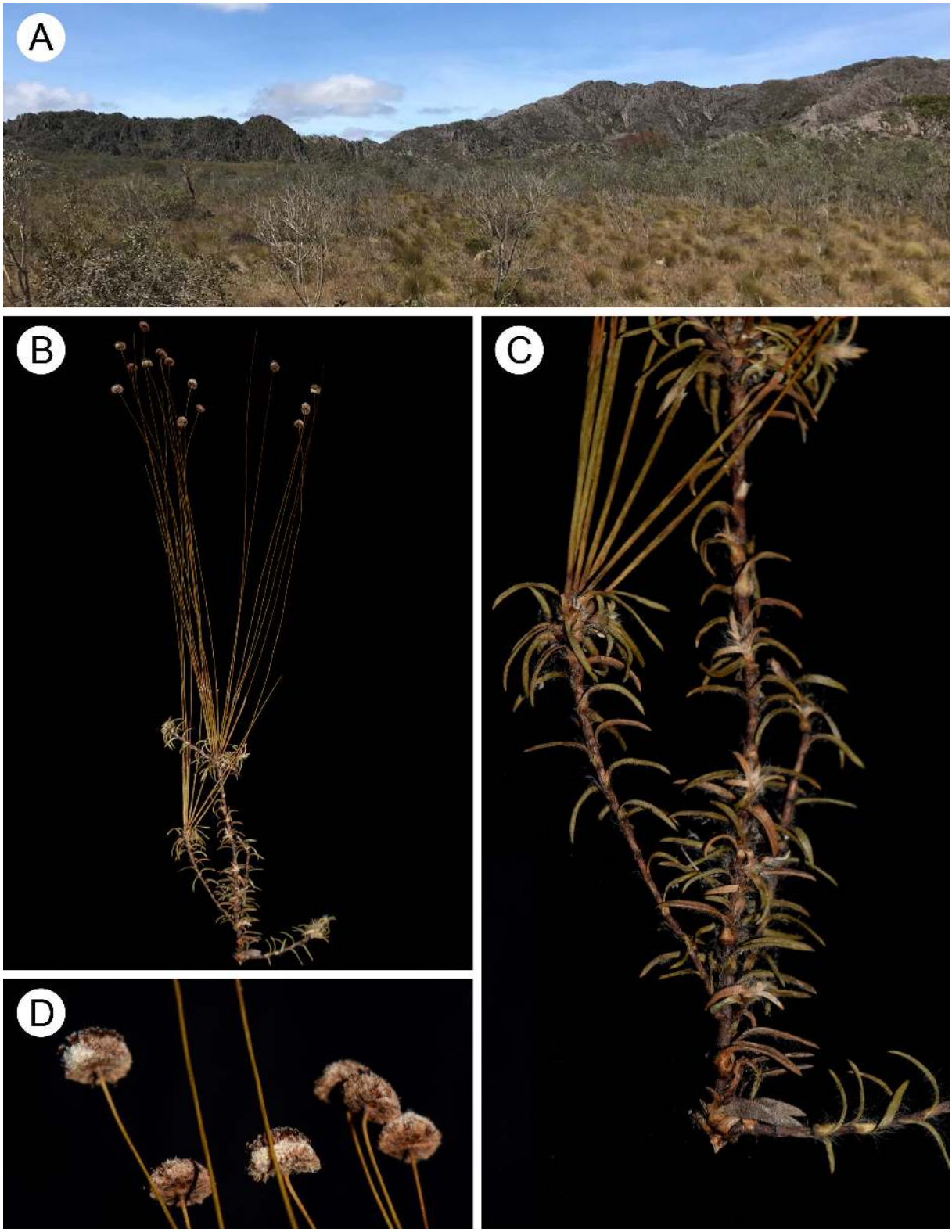


Fig. 6. *Paepalanthus linearilaminatus* L.E.F.Silva sp. nov. **A**. Overview of the habitat in Piatã (BA). **B**. Habit. **C**. Stem and leaves. **D**. Capitulum, view from side. Photos: A by Wellerson Picanço; B–D by Isis Rollim.

margin ciliate, apex obtuse to rounded; receptacle hemispherical, pilose. Flowers dimerous; floral bracts oblanceolate, castaneous, concave-convex, ca 1.5 mm long, pilose distally, margin ciliate, apex obtuse or rounded. Staminate flowers 1–1.8 mm long; sessile or with pedicel ca 0.2 mm long, pilose; sepals 2, free, obovate, castaneous, ca 1.5 mm long, pilose distally to glabrescent, ciliate to glabrescent towards the obtuse apex; anthophore fleshy, elongate; corolla fused into a tube, hyaline, membranaceous, ca 1.5 mm long, glabrous; stamens ca 1.8 mm; anthers 2, exerted, ca 0.5 mm long. Pistillate flowers ca 2.5 mm long, sessile or with pedicel 0.3 mm long; sepals 2, fused at the base, oblong-obovate, castaneous, ca 2.5 mm long, sparsely pilose to glabrescent distally, margin ciliate to glabrescent toward the rounded apex; petals 2, free, elliptic, light castaneous to hyaline, ca 2 mm long, pilose distally on the abaxial surface, margin ciliate toward the obtuse or rounded apex; gynoecium 2 mm long, stigmatic branches 2, bifid at the apex, slightly longer than the nectariferous branches, staminodes 2, scale-like. Fruit a loculicidal capsule. Seeds not seen.

Distribution, habitat and ecology

Paepalanthus linearilaminatus sp. nov. is restricted to the state of Bahia (Fig. 3). The species is found in the Serra das Almas Municipal Park in the municipality of Rio de Contas, which hosts the largest population of individuals. It is also found within in Chapada Diamantina National Park. Additional records have been documented in remnants of native vegetation in the Serra da Tromba, Abaíra, Piatã, and the Serra do Sincorá in Mucugê. The species is found in rupestrian fields, predominantly in sandy soils, frequently waterlogged, and directly exposed to sunlight. Flowering specimens have been recorded in most months of the year: January, February, March, May, July, August, September, and November.

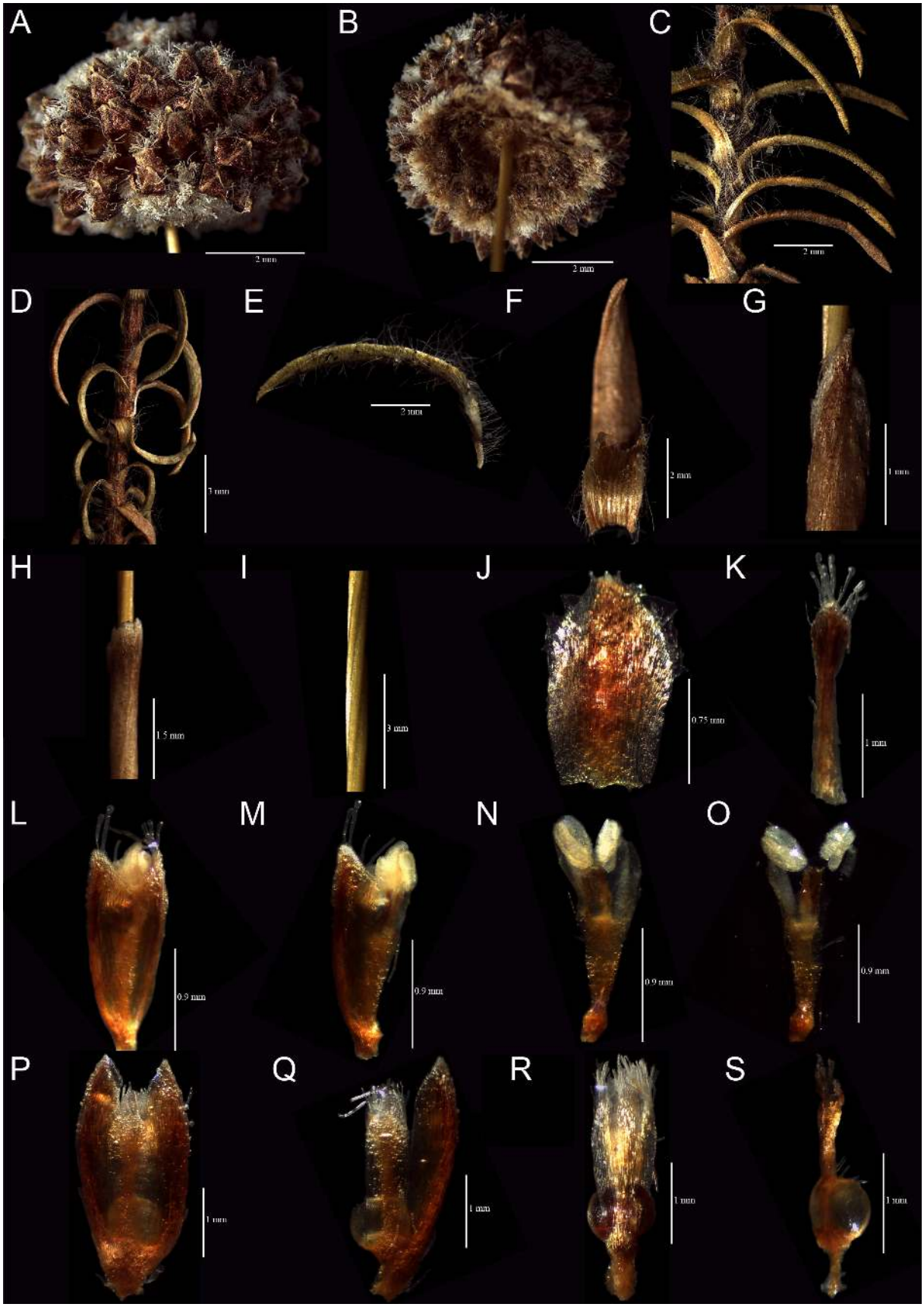
Preliminary conservation assessment

The species is protected within the Serra das Almas Municipal Park (BA) and the Chapada Diamantina National Park (BA). With an EOO of 3 138.849 km^2 and an AOO of 20 000 km^2, the species is suggested as Endangered: EN B1ab(iii). Its distribution is highly fragmented and restricted to the Chapada Diamantina, where typical Caatinga and Cerrado rupestrian fields formations predominate, one of the most threatened domains, exposed to severe pressures such as recurrent fires and widespread replacement of native vegetation by pastures and monocultures. Although it occurs in protected areas, these regions do not provide complete protection against frequent wildfires, which are often intensified by agricultural activities. Such threats may compromise its viability in the medium to long term.

Taxonomic remarks

Specimens belonging to the new species were previously misidentified as *Paepalanthus trichophyllus* due to shared traits, such as elongated stems, leaves arranged along the stem, hemispherical to globose capitula and castaneous involucral bracts, and dimerous flowers. Comparative analysis reveals diagnostic traits when populations of both species are compared. From the specimens of *P. trichophyllus* occurring in the type locality in São João del-Rei, *P. linearilaminatus* sp. nov. can be distinguished by having leaves 0.5–1.1 × 0.08–0.19 cm (vs 1.57–2.3 × 0.19–0.32 cm); glabrous spathes (vs pilose) with glabrous apex

Fig. 7 (on next page). *Paepalanthus linearilaminatus* L.E.F.Silva sp. nov.; *W.L. Picanço 561*. **A**. Capitulum detail, view from the side. **B**. Capitulum detail, view from below. **C–D**. Stem and leaf detail. **E**. Leaf, view from the side. **F**. Leaf, view from below. **G–H**. Spathe detail. **I**. Scape detail. **J**. Involucral bract, abaxial surface. **K**. Floral bract, abaxial surface. **L**. Staminate flower. **M**. Staminate flower with one sepal removed. **N**. Staminate flower with sepals removed. **O**. Staminate flower with sepals and petals removed. **P**. Pistillate flower. **Q**. Pistillate flower with one sepal removed. **R**. Pistillate flower with sepals removed. **S**. Gynoecium in fruit with seeds dispersed. Scale bars: A–C, E–F = 2 mm; D, I = 3 mm; G, K, P–S = 1 mm; H = 1.5 mm; J = 0.75 mm; L–O = 0.9 mm. Photos by L.E.F. Silva.


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1 mm

(vs pilose), glabrous scapes (vs densely pilose), floral bracts ca 1.5 mm long (vs 2 mm long), sepals and petals of staminate flowers ca 1.5 mm long (vs 2 mm long), pistillate flowers ca 2.5 mm long (vs 3 mm long) with sepals ca 2.5 mm long (vs 3 mm long) and light castaneous to hyaline petals ca 2 mm long (vs cream-colored to golden, 2.5 mm long), gynoecium ca 2 mm long (vs 3 mm long), and stigmatic branches slightly longer than the nectariferous branches (vs ca 1 mm longer than the nectariferous branches).

When compared to the morphotype of *Paepalanthus trichophyllus* found in Itutinga, *P. linearilaminatus* sp. nov. is distinguished by its glabrous spathe (vs pilose) with glabrous apex (vs pilose), glabrous scapes (vs densely pilose), sepals and petals of staminete flowers ca 1.5 mm long (vs 2 mm long), pistillate flowers ca 2.5 mm long (vs 2 mm long) with sepals ca 2.5 mm long (vs 2 mm long) and elliptic petals ca 2 mm long (vs obovate, 1.5 mm long), and gynoecium ca 2 mm long (vs 1.5 mm long). Compared to the morphotype from Serra da Canastra National Park, *P. linearilaminatus* exhibits stems 5–19.2 cm long (vs 0.8–2 cm long), amplexicaul, recurved to deflected leaves with involute margin (vs patent, sessile, margin straight when the stem is short and restricted to rosette), pistillate flowers ca 2.5 mm long (vs 2 mm long) with sepals ca 2.5 mm long (vs 2 mm long) and petals ca 2 mm long (vs 1.5 mm long), gynoecium ca 2 mm long (vs 1.5 mm long), and stigmatic branches slightly longer than the nectariferous branches (vs ca 0.5 mm longer than the nectariferous branches).

The species also shares morphological similarities with the sympatric *Paepalanthus strictus*, particularly in having leaves arranged along the stem, hemispherical to globose capitula and castaneous involucral bracts, and dimerous flowers. However, *P. linearilaminatus* sp. nov. can be distinguished by its linear and pilose leaves (vs lanceolate or subulate, hirsute to lanuginous) with hirsute margin at the base and pilose distally (vs hirsute to lanuginous all over the margin), obovate involucral bracts (vs spatulate) with obtuse or rounded apex (vs acuminate), oblanceolate floral bracts ca 1.5 mm long (vs linear, 2 mm long), sepals and petals of staminate flowers ca 1.5 mm long (vs 2 mm long), pistillate flowers ca 2.5 mm long (vs 3 mm long) with sepals ca 2.5 mm long (vs 3 mm long).

Paepalanthus rollimae L.E.F.Silva sp. nov.
urn:lsid:ipni.org:names:77371913-1
Figs 8–9

Diagnosis

The new species is primarily distinguished by its recurved leaves, which are broader at the median portion, elliptical or elliptical-lanceolate in shape, pubescent, and have a rounded apex. These leaves are thick, with margins hirsute at the base and pubescent distally, while the acuminate to rounded apex further enhances its distinctiveness. Additionally, the species is characterized by a pubescent stem, discoid and white-villous capitula sharply contrasting with a dark brown involucral bracts at the basal portion, oblong or oblong-ovate involucral bracts, and oblong sepals in pistillate flowers.

Etymology

The new species is named in honor of the botanical researcher Isis Rollim, for her longstanding support of my Eriocaulaceae studies, article reviews, and species photographs.

Type material

BRAZIL − **Goiás** • Alto Paraíso de Goiás, "trilha para a Fazenda Água Fria"; 14°05′39″ S, 47°30′19″ W; 7 Apr. 2019; fl.; *L.E.F. Silva et al. 141*; holotype: R [R255104]!; isotypes: CEN!, NY!, P!, RB!, SPF!.

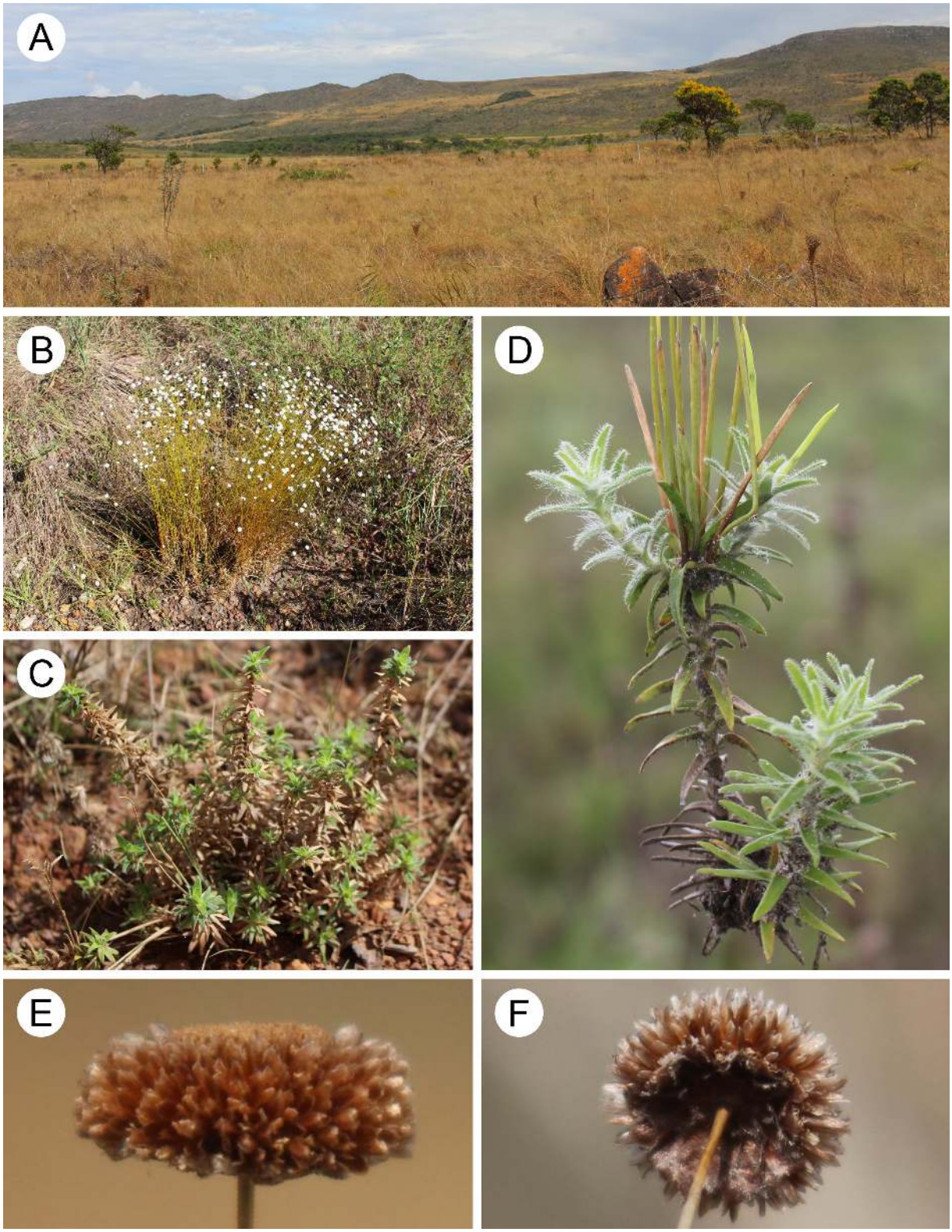


Fig. 8. *Paepalanthus rollimae* L.E.F.Silva sp. nov. **A**. Overview of the habitat in Chapada dos Veadeiros National Park (GO). **B**. Habitat and habit. **C–D**. Habit. **E**. Capitulum, view from side. **F**. Capitulum, view from below. Photos by Marcelo Trovó.

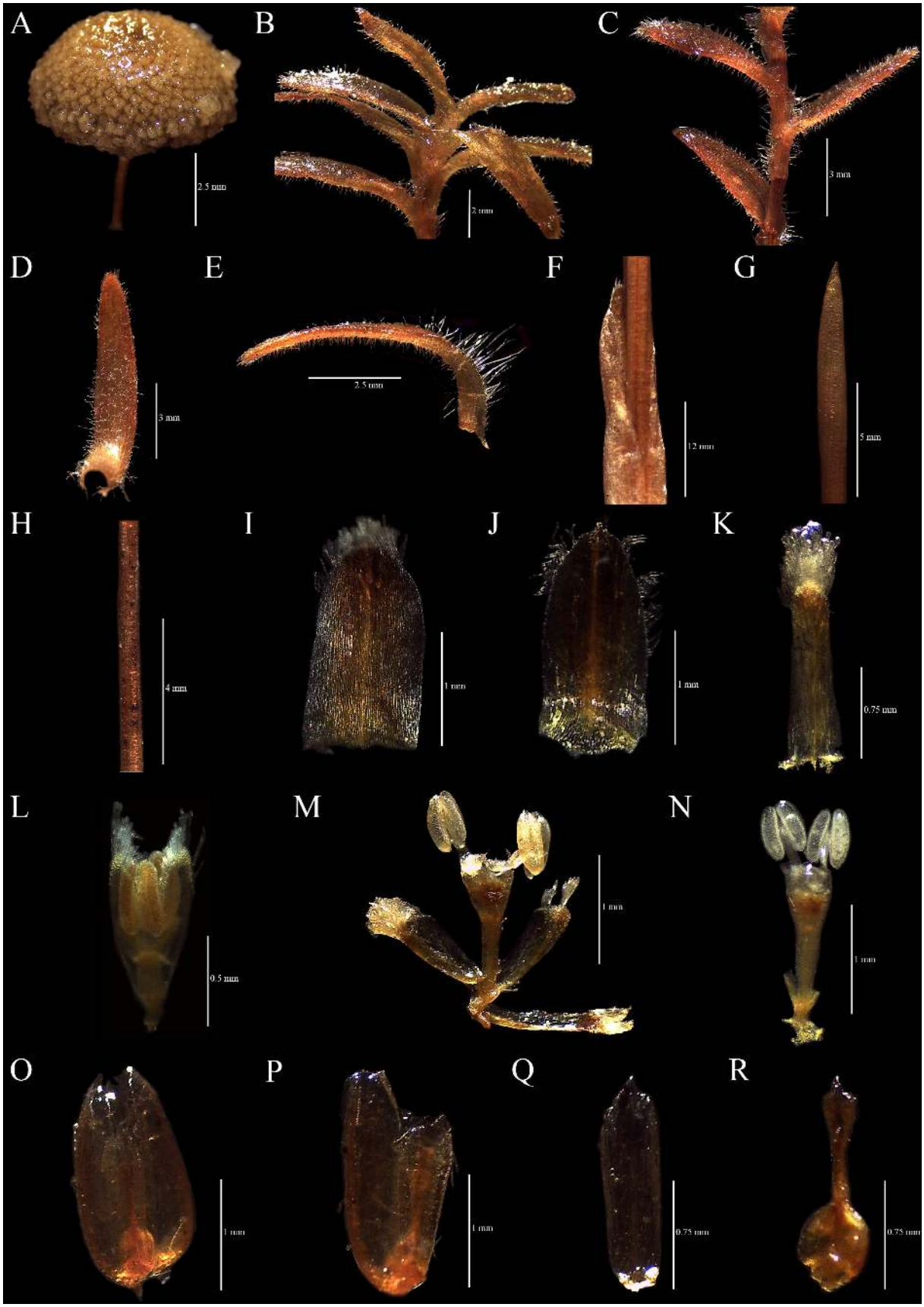
Other material examined

BRAZIL − **Goiás** • Alto Paraíso de Goiás; 4 Feb. 1990; fl.; *M.M. Arbo et al. 3592*; HRCB, K, MBM • Alto Paraíso de Goiás; 24 May 1993; fl.; *I.V. Lima 107*; HEPH • Alto Paraíso de Goiás; 20 Jul. 1994; fl.; *M. Aparecida da Silva et al. 2184*; IBGE, SPF • Alto Paraíso de Goiás; 7 Sep. 1994; fl.; *M. Aparecida da Silva 2283*; SPF • Alto Paraíso de Goiás; 26 Apr. 1998; fl.; *C.B.R. Munhoz et al. 715*; HEPH, HUEFS • Alto Paraíso de Goiás; 26 Apr. 1998; fl.; *C.B.R. Munhoz et al. 724*; HEPH • Alto Paraíso de Goiás; 8 May 2000; fl.; *G. Hatschbach 70681*; BHCB, COR, HEPH, MBM, PACA-AGP • Alto Paraíso de Goiás; May 2002; fl.; *V.L.C.R. Uliana et al. 648*; CEN, ESA, HTO, IBGE, RB, SP, SPF, UB, UEC, UFG • Alto Paraíso de Goiás; 22 May 2008; fl.; *J.M. Silva et al. 6652*; MBM • Alto Paraíso de Goiás; 19 Mar. 2009; fl.; *M. Trovó et al. 456*; B, HRCB, R, RB, SPF, UB • Alto Paraíso de Goiás; 22 Mar. 2012; fl.; *M.T.C. Watanabe et al. 238*; SPF • Alto Paraíso de Goiás; 5 Apr. 2012; fl.; *A.G. Amaral et al. 2741*; HUEFS, UB • Alto Paraíso de Goiás; 13 Mar. 2015; fl.; *A.L. Silva 7*; HRCB • Alto Paraíso de Goiás; 11 Apr. 2017; fl.; *J.F. Carrión 1812*; HUEFS • Alto Paraíso de Goiás; 14 Nov. 2017; fl.; *M.L.O. Trovó & L.M. Borges 695*; CEN, OUPR • Alto Paraíso de Goiás; 9 May 2018; fl.; *M.L.O. Trovó et al. 777*; CEN, OUPR • Alto Paraíso de Goiás; 7 Apr. 2019; fl.; *L.E.F. Silva et al. 145*; R • Alto Paraíso de Goiás; 7 Apr. 2019; fl.; *L.E.F. Silva et al. 147*; R • Alto Paraíso de Goiás; 8 Apr. 2019; fl.; *L.E.F. Silva et al. 155*; R • Alto Paraíso de Goiás; 15 Mar. 2020; fl.; *L. Echternacht et al. 2840*; OUPR • Nova Roma; 21 Feb. 2018; *M.L.O. Trovó et al. 753*; CEN, OUPR, RB.

Description

Perennial herbs, usually solitary, with an erect and self-supporting habit, 24.4–70.7 cm tall; rhizome present, usually conspicuous, aerial stem 4.1–30.5 cm long, sparsely pubescent, usually branched or solitary, internode 1–6 mm. Leaves persistent, arranged along the stem, chartaceous, flexible, elliptical or elliptical-lanceolate, light green to brownish when old, recurved, amplexicaul, 0.83–2.3 × 0.09–0.51 cm, pubescent, margins straight and hirsute at the base and pubescent distally, apex acuminate to rounded. Spathes ca 2 × as long as the leaves, glabrous, apex glabrous and rounded. Scapes 1−10 per branch, arranged in a terminal umbelliform inflorescence or solitary, 18.3–46.2 cm long, glabrous. Capitula discoid, white-villous, 4–9 mm in diam.; involucral bracts in 3−5 series, oblong or oblong-ovate, castaneous, concave-convex, ca 2 mm long, glabrous, margin ciliate, apex rounded; receptacle hemispherical, pilose. Flowers dimerous; floral bracts linear, castaneous, concave-convex, ca 1.5 mm long, pilose distally, margin ciliate, apex obtuse or rounded. Staminate flowers 2–2.5 mm long; sessile or with pedicel ca 0.2 mm long, pilose; sepals 2, free, obovate, castaneous, ca 1.5 mm long, pilose distally to glabrescent, ciliate to glabrescent toward the obtuse apex; anthophore fleshy, elongate; corolla fused into a tube, hyaline, membranaceous, ca 1.5 mm long, glabrous; stamens 2–2.5 mm; anthers 2, exerted, ca 0.5 mm long. Pistillate flowers ca 2 mm long, sessile or with pedicel 0.3 mm long; sepals 2, fused at the base, oblong, castaneous-hyaline, ca 2 mm long, pilose distally, margin ciliate to glabrescent toward the obtuse or rounded apex; petals 2, free, oblong, hyaline, ca 1.5 mm long, pilose distally on the abaxial

Fig. 9 (on next page). *Paepalanthus rollimae* L.E.F.Silva sp. nov.; A–F, I, K, M–R from *L.E.F. Silva et al. 141*; G, L from *L.E.F. Silva et al. 145*; J from *L.E.F. Silva et al. 147*; H from *L.E.F. Silva et al. 155*. **A**. Capitulum detail, view from the above. **B**. Apical rosette detail. **C**. Stem and leaf detail. **D**. Leaf, adaxial surface. **E**. Leaf, view from the side. **F**. Spathe and scape detail. **G**. Spathe apex. **H**. Scape detail. **I–J**. Involucral bract, abaxial surface. **K**. Floral bract, abaxial surface. **L**. Staminate flower (pre-anthesis). **M**. Staminate flower with floral bract and sepals opened. **N**. Staminate flower with sepals removed. **O**. Pistillate flower. **P**. Pistillate flower with one sepal removed. **Q**. Petal of pistillate flower. **R**. Gynoecium with bifid early developing stigmatic branches. Scale bars: A, E = 2.5 mm; B = 2 mm; C–D = 3 mm; F = 12 mm; G = 5 mm; H = 4 mm; I–J, M–P = 1 mm; K, Q–R = 0.75 mm; L = 0.5 mm. Photos by L.E.F. Silva.


A
2.5 mm
B
2 mm
C
3 mm
D
3 mm
E
2.5 mm
F
12 mm
G
5 mm
H
4 mm
I
1 mm
J
1 mm
K
0.75 mm
L
0.5 mm
M
1 mm
N
1 mm
O
1 mm
P
1 mm
Q
0.75 mm
R
0.75 mm

surface, margin ciliate toward the obtuse or rounded apex; gynoecium 1.5 mm long, stigmatic branches 2, bifid at the apex, slightly longer than the nectariferous branches, staminodes 2, scale-like. Fruit a loculicidal capsule. Seeds not seen.

Distribution, habitat and ecology

Paepalanthus rollimae sp. nov. is restricted to the state of Goiás (Fig. 3). It has been recorded in the Chapada dos Veadeiros National Park and adjacent remnants of native vegetation. The species is also found within the Chapada de Nova Roma Ecological Station, a conservation unit now enclosed within the Chapada dos Veadeiros National Park. It typically inhabits rocky fields, over sandy and often waterlogged soils in areas with full sunlight exposure. Flowering specimens have been recorded in the following months of the year: February, March, April, May, July, September, and November.

Preliminary conservation assessment

The species is recorded in the protected areas of the Chapada de Nova Roma Ecological Station and the Chapada dos Veadeiros National Park. With an AOO of 8000 km^2, the species is classified as Critically Endangered: CR B2ab(iii). Its distribution is restricted and severely fragmented, with populations composed of few mature individuals. Although it occurs in protected areas, the species is endemic to the Cerrado, a domain under significant pressure from recurrent fires and the conversion of native vegetation into monocultures and pastures.

Taxonomic remarks

The specimens of *Paepalanthus rollimae* sp. nov. were previously identified as *P. trichophyllus*, as the two species share traits such as elongated stem, leaves arranged along the stem, castaneous involucral bracts, and dimerous flowers. A comparative analysis revealed additional distinguishing features. When compared to populations from the type locality of *P. trichophyllus* in São João del-Rei, *P. rollimae* differs in having leaves with straight margin (vs involute), glabrous spathe (vs pilose) with rounded apex (vs acute or lacerate), glabrous scape (vs densely pilose), oblong or oblong-ovate involucral bracts (vs obovate or wide-elliptic), floral bracts ca 1.5 mm long (vs 2 mm long), sepals and petals of staminate flowers ca 1.5 mm long (vs 2 mm long), pistillate flowers ca 2 mm long (vs 3 mm long) with sepals ca 2 mm long (vs 3 mm long) and oblong, hyaline petals ca 1.5 mm long (vs elliptic, cream-colored to golden, 2.5 mm long), gynoecium ca 1.5 mm long (vs 3 mm long), and stigmatic branches slightly longer than the nectariferous branches (vs ca 1 mm longer than the nectariferous branches).

In comparison to the morphotype of *Paepalanthus trichophyllus* found in Itutinga, *P. rollimae* sp. nov. has differences such as leaves with straight margin (vs involute), glabrous spathe (vs pilose) with rounded apex (vs acute or lacerate), glabrous scape (vs densely pilose), oblong or oblong-ovate involucral bracts (vs obovate), sepals and petals of staminate flowers ca 1.5 mm long (vs 1.8 mm long), and oblong petals of pistillate flowers (vs obovate). In contrast to the morphotype of *P. trichophyllus* found in Serra da Canastra National Park, *P. rollimae* can be distinguished by its plants being 24.4–70.7 cm tall (vs 10.35–20.1 cm tall), stem 4.1–30.5 cm long (vs 0.8–2 cm long), leaves recurved, amplexicaul (vs patent, sessile, when the stem is short) with straight margin (vs involute when the stem is elongated and not restricted to rosette), apex of the spathe rounded (vs acute), scape 18.3–46.2 cm long (vs 9.1–17.5 cm long), oblong or oblong-ovate involucral bracts (vs obovate), oblong petals of pistillate flowers (vs elliptic), and stigmatic branches slightly longer than the nectariferous branches (vs ca 0.5 mm longer than the nectariferous branches).

The species also resembles the geographically close *Paepalanthus atratus* (Moldenke) L.E.F.Silva & Trovó but differs ecologically and morphologically. While *P. rollimae* sp. nov. inhabits grasslands with full sunlight exposure, *P. atratus* is found in the shade of gallery forests. Morphologically, *P. rollimae* can be distinguished by its sparsely pubescent stem (vs glabrous); elliptical or elliptical-lanceolate, pubescent

leaves (vs lanceolate, glabrous) with margin hirsute at the base and pubescent distally (vs glabrous) and rounded or acuminate apex (vs acute), spathe with rounded apex (vs acuminate or acute), staminate flowers 2–2.5 mm long (vs 1.1 mm long) with obovate sepals (vs obovate-oblong), petals ca 1.5 mm long (vs ca 0.5 mm long), and pistillate flowers ca 2 mm long (vs 1.5 mm long) with oblong sepals ca 2 mm long, pilose distally (vs obovate-oblong, 1.5 mm long, glabrous) and oblong petals (vs elliptic to obovate).

Paepalanthus rollimae sp. nov. can be distinguished from *P. flaccidus*, another morphologically similar and sympatric species, by its sparsely pubescent stem (vs glabrous). elliptical or elliptical-lanceolate, pubescent leaves (vs linear or linear-acicular, glabrous) with straight margin hirsute at the base and pubescent distally (vs involute, hirsute at base and glabrous distally) with acuminate or rounded apex (vs acute), spathe with rounded apex (vs acute), discoid, white-villous capitula (vs hemispherical, white to cream-colored), oblong or oblong-ovate, castaneous involucral bracts (vs elliptic, obovate or ovate, hyaline to golden), staminate flowers 2–2.5 mm long (vs 1.5 mm long), and pistillate flowers ca 2 mm long (vs 1.5 mm long) with oblong sepals ca 2 mm long (vs oblong-obovate, 1.5 mm long) and oblong petals (vs elliptic).

Discussion

This research integrated morphometric and qualitative morphological data to refine the circumscription of the *Paepalanthus trichophyllus* complex, underscoring the importance of integrating historical taxonomic treatments and collections with modern analytical approaches to uncover hidden diversity. The historical ambiguity in the delimitation of *P. trichophyllus* has often led to frequent misidentifications, grouping distinct taxa under a single name and hindering a comprehensive understanding of the group's biological diversity. Although *P. trichophyllus* remains a morphologically variable species, the presence of consistent qualitative traits, together with analyses of its variation patterns, enabled a more narrowly defined circumscription, now primarily encompassing populations from Minas Gerais and a few from south-eastern Goiás.

In contrast, *Paepalanthus linearilaminatus* sp. nov., from Piatã, Bahia, exhibits well-defined diagnostic features, such as linear leaves and oblanceolate floral bracts, and forms a distinct cluster in multivariate analyses. These traits, along with its geographic isolation, support its recognition as a new species. Similarly, *P. rollimae* sp. nov., from Chapada dos Veadeiros, Goiás, while quantitatively variable, maintains a consistent set of qualitative characters and is geographically isolated, further reinforcing its recognition as a distinct taxon.

The recircumscription of *Paepalanthus trichophyllus* and the descriptions of *P. linearilaminatus* sp. nov. and *P. rollimae* sp. nov. significantly contribute to clarifying the taxonomy of this complex and highlight its diversity. Furthermore, this study emphasizes the value of integrative approaches in modern taxonomy and reaffirms its essential role in advancing our understanding and conservation of biodiversity, especially in megadiverse and threatened biomes such as the Cerrado.

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