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PTEROLEPIS ARENACEA (MELASTOMATACEAE, MELASTOMATEAE), A NEW SPECIES FROM THE BRAZILIAN CERRADO

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Pterolepis arenacea is described and illustrated as a new species to the Estação Ecológica Serra Geral do Tocantins and its surroundings, in the Brazilian states of Bahia and Tocantins. This species is restricted to microhabitats of sandstone outcrops surrounded by savanna vegetation. *Pterolepis arenacea* is the first known species of the genus exhibiting a dorsal appendage on the stamens. Morphologically, *Pterolepis arenacea* is most similar to species of the *P. polygonoides* complex, composed of *P. polygonoides*, *P. saturejiformis* and *P. trimera*. Furthermore, *Pterolepis arenacea* shares vegetative similarities with the haplostemonous species *P. haplostemona* and *P. xaxa*. Detailed line drawings, field photographs, and scanning electron microscopy images are provided. The conservation status of *Pterolepis arenacea* is preliminarily assessed as Data Deficient (DD) under the IUCN criteria.

Keywords. Estação Ecológica Serra Geral do Tocantins, Jalapão, Matopiba, *Pterolepis polygonoides*, sandstone outcrops
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Introduction

The Brazilian Cerrado is recognised as the most biodiverse savanna in the world (Murphy *et al.*, 2016), particularly due to its flora, which comprises more than 12,000 species of angiosperms (BFG, 2022). Despite its ecological importance, the biodiversity of the Cerrado is increasingly threatened by agriculture, infrastructure development, weak legal protection, and limited conservation incentives, leading to extensive habitat loss and severe ecosystem fragmentation (Klink & Machado, 2005; Strassburg *et al.*, 2017). One of the most critically affected regions is the Matopiba (an acronym based on the Brazilian states of Maranhão, Tocantins, Piauí and Bahia), which has experienced rapid agricultural expansion and, consequently, some of the highest deforestation rates in the Cerrado (Araújo *et al.*, 2019). In this context, protected areas play a vital role in safeguarding the remaining natural ecosystems within the Matopiba, acting as biodiversity refuges and important barriers

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against agricultural expansion (Françoso *et al.*, 2015; Santana & Simon, 2022). Nevertheless, the floristic knowledge of this region remains limited and disproportionately focused on the Jalapão area (Silva *et al.*, 2018; Antar & Sano, 2019; Schindler *et al.*, 2023).

The Estação Ecológica Serra Geral do Tocantins (EESGT), a protected area covering approximately 716,000 ha, located in northeastern Tocantins and western Bahia, represents a key stronghold for flora conservation (ICMBio/MMA, 2014). Recent botanical surveys in EESGT have led to the first floristic inventory of ferns and lycophytes (Schindler *et al.*, 2023), as well as the rediscoveries of a rare stonebreaker, *Phyllanthus allemii* G.L.Webster (Mendes *et al.*, 2022), and a gesneriad, *Goyazia villosa* (Gardner) R.A.Howard (Figueira *et al.*, 2024). Sampling efforts in the Jalapão region (Antar & Sano, 2019) have also led to the discovery of new species based on collections from the EESGT (e.g. Araújo *et al.*, 2016; Borges & Antar, 2016; Pastore & Antar, 2021), as well as other species described from collections in surrounding regions (see references in Figueira *et al.*, 2024).

Pterolepis (DC.) Miq. is a Neotropical genus of Melastomataceae, comprising 17 herbaceous or subshrubby species (Renner, 1994; Goldenberg *et al.*, 2023). The genus is easily recognisable among members of the tribe Melastomateae Bartl. by the presence of branched emergences on the outer surface of the hypanthium, or restricted to the area between the sepals, as well as by its superior ovary apically setose (Renner, 1994; Veranso-Libalah *et al.*, 2022).

As a result of extensive fieldwork conducted between 2018 and 2022 in the EESGT and surrounding areas (see Schindler *et al.*, 2023), specimens from two populations of an unknown species of *Pterolepis* were collected in the states of Bahia and Tocantins. In this paper, we formally describe this new species, providing detailed line drawings, photographs of living specimens, and scanning electron microscopy images to illustrate its micromorphology. In addition to the morphological description, we discuss its morphological affinities with other *Pterolepis* species and present data on its geographical distribution, phenology and conservation status.

Materials and methods

The morphological description of *Pterolepis haplostemona* Almeda & A.B.Martins (Almeda & Martins, 2015) was used as a template for the description of the new species. We adopted the morphological terminology of Beentje (2016). The terms *hairs* and *emergences* follow Renner (1994). To quantify the relative size difference between antesepalous and antepetalous stamens, we used the stamen dimetrism index (SDI; Melo *et al.*, 2021). Scanning electron microscopy (SEM) images of leaf blades, hypanthium and seeds were obtained using a Zeiss EVO40 microscope (Zeiss, Oberkochen, Germany) with the extra high tension set to 15 kV. The morphological comparison is based on data from the protologues of each taxonomic entity mentioned, as well as their respective type specimens and later collections (see **Appendix**), and the information provided by Renner (1994). In addition, other

flowering specimens belonging to the *Pterolepis polygonoides* (DC.) Triana complex were examined (see **Appendix**).

Herbarium codes follow the Index Herbariorum (updated continuously). The distribution map was generated using QGIS v.3.42.0 (QGIS Development Team, 2024). The preliminary conservation status assessment of the new species followed the IUCN criteria and guidelines (IUCN, 2012; IUCN Standards and Petitions Committee, 2024). All figures were edited using GIMP v.3.0.2 (Kimball *et al.*, 1995–2025).

Species description

Pterolepis arenacea D.Nunes & P.J.F.Guim., **sp. nov.**

Pterolepis arenacea resembles *P. polygonoides* s.str. but can be distinguished by its sparsely hirtellous indumentum on the cauline internodes (vs densely strigose in *P. polygonoides*), glabrous pedicels (vs with hairs), outer surface of the hypanthium bearing sparse unbranched emergences and branched emergences (vs densely covered with unbranched emergences), sepals c.2 × 0.8–1 mm, triangular (vs 3–5.5 × 1.5–2 mm, narrowly triangular), petals 4.8–5 × 4.5–5 mm, ovate (vs 7–8 × 6–7 mm, obovate), antesepalous stamens with filaments 1.8–2 mm long (vs 5.5–6.1 mm), triangular dorsal appendage (vs absent), anthers 1–1.2 mm long, oblong (vs 4.8–5.5 mm, subulate), and seeds with irregular cells on the testa (vs with ovate cells). – Type: Brazil, Tocantins, Rio da Conceição, ESEC Serra Geral do Tocantins, 11 km nordeste de Rio da Conceição, 11°21'44"S, 46°47'30"W, 578 m, 16 iii 2022, fl., fr., *R.R. Souza* et al. 269 (holotype CEN barcode CEN00123095; isotypes RB, UB number 226272). **Figures 1, 2 and 3.**

Delicate wiry herb 4.5–23.5 cm tall, erect, branched from the base, or unbranched. *Cauline internodes* 2–3.5 cm long, subquadrangular, light green or light green and reddish, obscurely winged, sparsely hirtellous, glandular hairs 0.5–1 mm long, unbranched. *Nodal hairs* 1–1.5 mm long, glandular and eglandular, unbranched, erect. *Leaves* decussate, isophyllous in each pair, membranaceous, hypostomatic (visible on SEM, **Figure 3C**); sessile or short-petiolate 0.7–1.2 mm long, petiole flat, ill-defined, sparsely hirtellous, glandular hairs 0.5–1 mm long, unbranched; leaf blades 1-nerved, sulcate adaxially, plus one pair of inconspicuous submarginal veins that do not reach the apex, abaxial surface light green or grey-green, adaxial surface dark green; margin sparsely serrate, with sparsely distributed glandular hairs 0.5–1 mm, unbranched. *Basal leaves* typically early deciduous, rarely persistent on fertile plants, leaf blades 1.1–1.8 × 0.5–0.6 cm, ovate, base obtuse or rounded, apex obtuse, glandular hairs c.0.8 mm long, unbranched; sparsely distributed glandular hairs on the abaxial and adaxial surfaces 0.5–0.8 mm long, unbranched. *Cauline leaves* persistent, leaf blades 2–2.7 × 0.4–0.7 cm, elliptic or lanceolate, base attenuate or cuneate, apex acute or obtuse, glandular hairs c.1 mm long, unbranched; sparsely distributed glandular hairs on the abaxial surface 0.5–1 mm long, unbranched; sparsely distributed glandular hairs on the

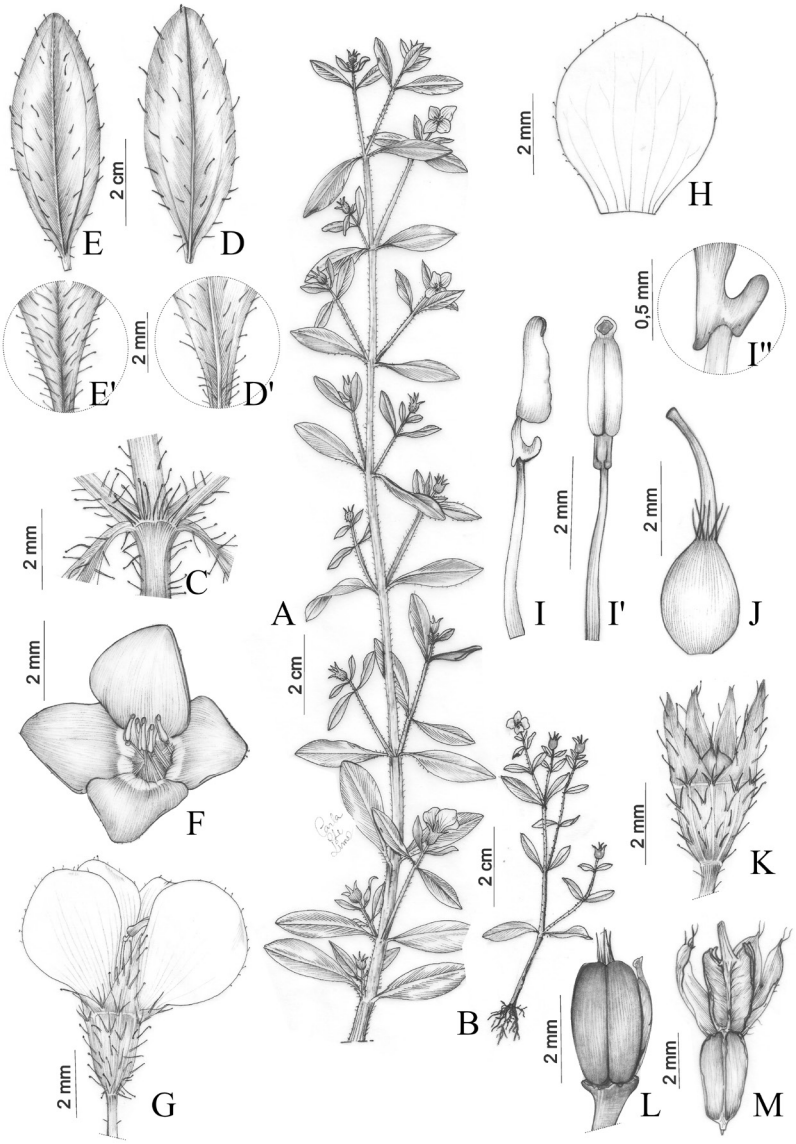

Figure 1. *Pterolepis arenacea* D.Nunes & P.J.F.Guim., sp. nov. A, Flowering branch; B, a small branched specimen; C, branch node; D, abaxial surface of the leaf blade; D', detail of the abaxial surface of the leaf blade base; E, adaxial surface of the leaf blade; E', detail of the adaxial surface of the leaf blade base; F, front view of the flower, exposing the inner surfaces of the petals and the androecium; G, lateral view of the flower, showing the outer surfaces of the hypanthium and perianth; H, inner surface of the petal, highlighting the venation; I–I", antesepalous stamens (I, lateral view of the stamen; I', front view of the stamen; I", detail of the dorsal and ventral appendages); J, gynoecium; K, capsule covered by the hypanthium and persistent sepals; L, exposed capsule; M, open capsule exposing persistent placenta. Drawn by Carla de Lima from *R.R. Souza* et al. 269 (A and C–M) and *M. Figueira* et al. 1773 (B).

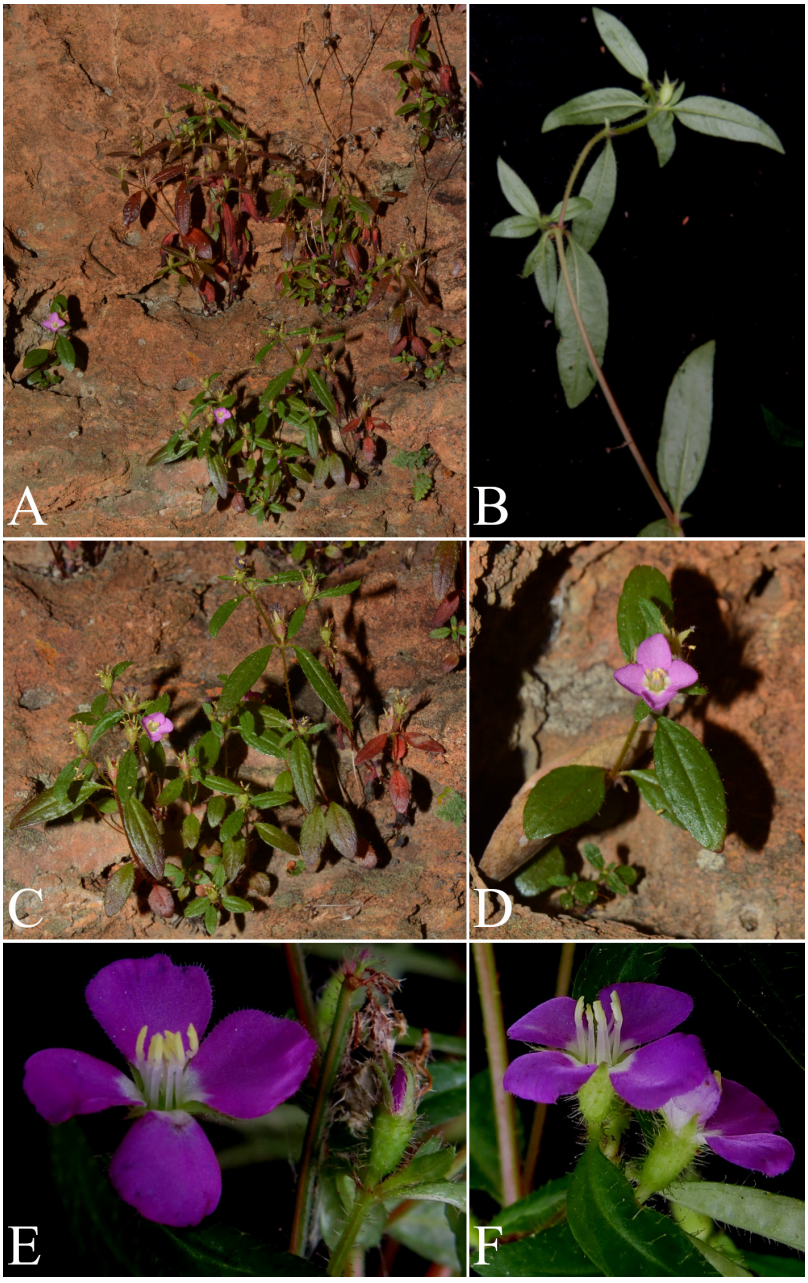

Figure 2. Field images of *Pterolepis arenacea* D.Nunes & P.J.F.Guim., sp. nov. A, Individuals growing in sandstone outcrop cavities; B, detail of a stem, showing the grey-green abaxial surface leaf blades; C, individuals with both flowers and fruits; D, flowering individual; E and F, details of the flowers and floral bud. Photographs by M. Figueira (A, C and D; all from *M. Figueira* et al. 1773) and M. F. Simon (B, E and F; all from *R.R. Souza* et al. 269).

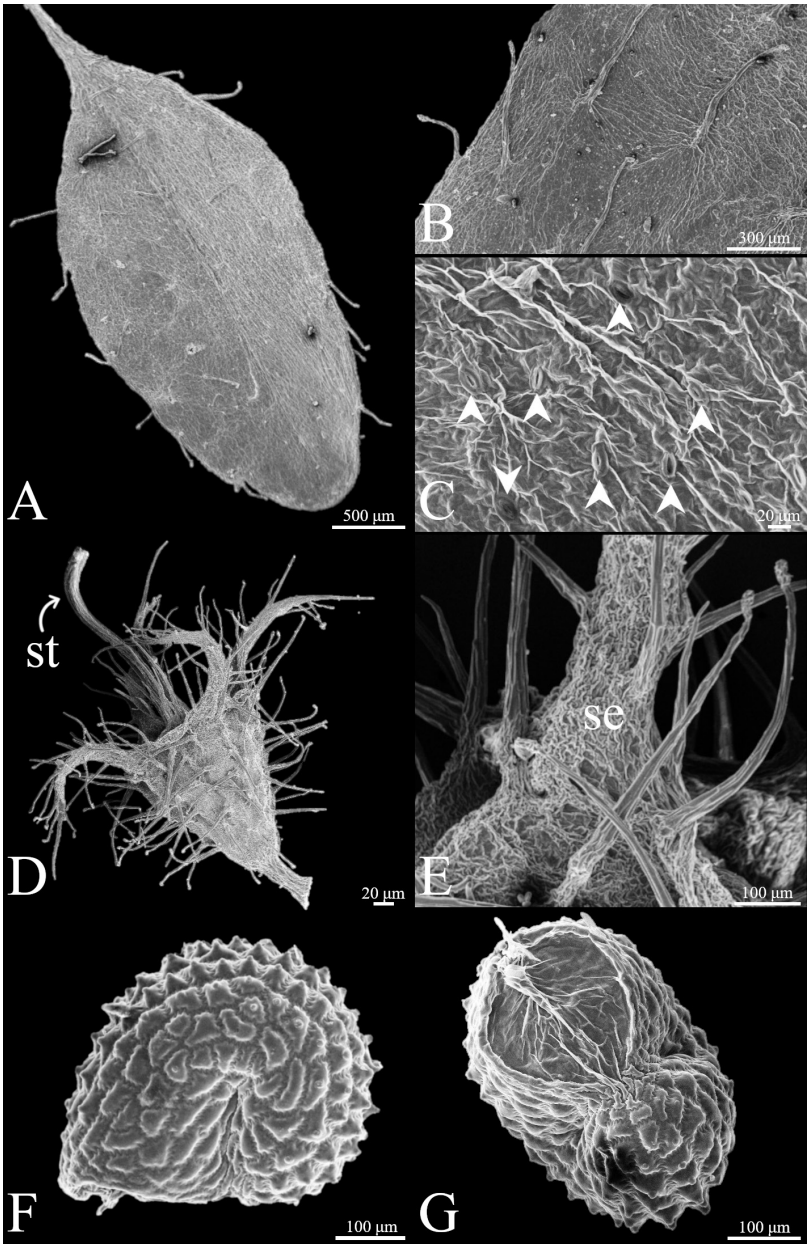

Figure 3. Scanning electron microscopy images of *Pterolepis arenacea* D.Nunes & P.J.F.Guim., sp. nov. A, Adaxial surface of the leaf blade; B, detail of the adaxial surface of the leaf blade; C, stomata (white arrowheads) on the abaxial surface of the leaf blade; D, hypanthium, sepals and style (st); E, detail of the intercalycine region and sepal (se) base, showing the glandular emergences; F, seed, showing lateral surface details; G, seed, showing the raphal zone. Micrographs by D. N. Silva from *M. Figueira* et al. 1773 (RB).

adaxial surface 0.5–1 mm long (free portion), unbranched, base adnate to the epidermis for 0.3–0.5 mm. *Inflorescence* a modified dichasium with widely spaced flowers, or flowers solitary; pedicel 1–1.5 mm long, terete, light green, glabrous; bracts and bracteoles absent. *Flowers* 4-merous, diplostemonous. *Hypanthium* 2.5–3 × 1.8–2 mm, obconical, outer surface weakly 8-striate, light green, sparsely hirtellous, unbranched emergences 0.8–1.3 mm long, branched emergences c.1 mm long, glandular or eglandular; intercalycine emergences, one per sinus, rarely two, branched emergences, c.1 mm long, glandular or eglandular, or unbranched emergences, 1–1.3 mm long, glandular; branched emergences have a thickened base 0.2–0.3 mm long, bearing 2 or 3 setae, glandular or eglandular. *Sepals* c.2 × 0.8–1 mm, triangular, light green, unbranched emergences 0.5–1 mm long, glandular, on the outer surface, margins, and the apex; apex acute; margin entire; inner surface glabrous. *Petals* 4.8–5 × 4.5–5 mm, ovate, pink or purple, white at the base, margin distally glandular-ciliate, 0.2–0.3 mm long. *Stamens* subdimetric (SDI = 0.11–0.13), subisomorphic, glabrous, filaments straight, whitish, ventral appendages bilobate, ovoid, yellow, dorsal appendage single, triangular, yellow, pedoconnectives straight or curved, yellow, anthers oblong, erostrate, yellow, pore slightly ventrally arched; antesepalous stamens 4: filaments 1.8–2 mm long, pedoconnectives c.0.3 mm long, ventral appendages c.0.2 × 0.2 mm, dorsal appendage c.0.2 × 0.2 mm, anthers 1–1.2 × c.0.4 mm, pore c.0.3 mm in diameter; antepetalous stamens 4: filaments 1.5–1.7 mm long, pedoconnectives c.0.2 mm long, ventral appendages bilobate, c.0.2 × 0.1 mm, dorsal appendage c.0.2 × 0.2 mm, or absent, anthers c.0.8 × 0.4 mm, pore c.0.2 mm in diameter. Ovary c.2 × 1.2 mm, ovoid, light green, 4-locular, superior, apical crown of eglandular hairs, 1–1.1 mm long, unbranched, persistent in the capsule. *Style* 3.5–4 mm long, arched at the apex, glabrous; stigma truncate. *Capsules* enclosed by the hypanthium, sepals and placenta persistent; capsules 3–3.5 × 2.5–3 mm, ovoid, brown, surpassing the apex of the hypanthium, dehiscence apical-basal. *Seeds* c.0.3 × 0.2–0.3 mm, cochleate, orange, testa tuberculate, cells irregular.

Distribution. *Pterolepis arenacea* occurs within the EESGT and its surroundings, with known populations in the Brazilian states of Bahia and Tocantins, at elevations between 578 and 745 m above sea level (**Figure 4A**).

Habitat and ecology. Occurs in savannas (**Figure 4B–D**), specifically inhabiting cavities and rounded depressions in sandstone outcrops, where organic matter accumulates and partially shaded microenvironmental conditions persist (**Figure 2A**). The species was recorded growing alongside other plants adapted to sandstone outcrops, including ferns such as *Anemia humilis* (Cav.) Sw. (*Schindler* et al. 205), *A. trichorhiza* Gardner (*Schindler* et al. 207, 382) and *Mineirella eriophora* (Fée) Ponce & Scataglini (*Schindler* et al. 206), as well as bromeliads such as *Billbergia* sp. (*Figueira* et al. 1895) and *Pitcairnia* cf. *ensifolia* Mez. (*Figueira* et al. 1821). *Pterolepis arenacea* has been collected in flower and fruit in March and June.

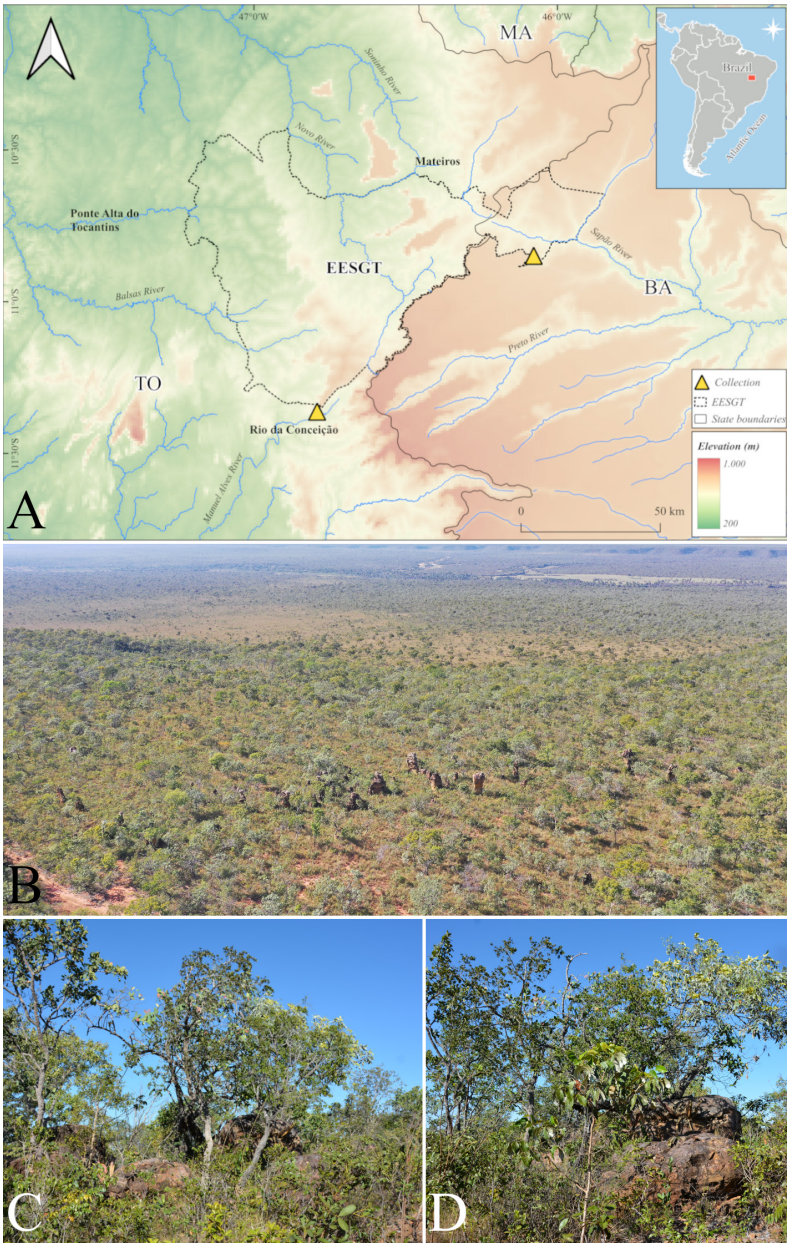

Figure 4. Distribution and habitat of *Pterolepis arenacea*. A, Distribution map for *Pterolepis arenacea* (yellow triangles) (Brazilian states: BA, Bahia; MA, Maranhão; TO, Tocantins). B, Aerial view of the vegetation in the Estação Ecológica Serra Geral do Tocantins (EESGT), showing a predominance of savannas and grasslands interspersed with rocky outcrops. C and D, Habitat where *Pterolepis arenacea* was found in the municipality of Formosa do Rio Preto, Bahia. Photographs: Sérgio E. Noronha (B) and M. Figueira (C and D).

Etymology. The specific epithet *arenacea* is a reference to the species' habit of growing on sandstone outcrops (Stearn, 1983).

Proposed IUCN conservation category. To date, only two populations of *Pterolepis arenacea* are recorded from the EESGT protected area and its surroundings (**Figure 4A**). Each population is confined to a microhabitat with highly specific conditions (**Figure 2A**). Based on current knowledge, *Pterolepis arenacea* should be preliminarily assessed as Data Deficient (DD) under the IUCN criteria. The Area of Occupancy is 4 km^2, but Extent of Occurrence cannot be calculated due to the existence of only two known collection sites, which are insufficient to define a minimum convex polygon. Future conservation efforts in the region where this species occurs are expected to generate additional data that may support a more accurate and formal assessment of its conservation status.

Notes. *Pterolepis arenacea* is readily recognised by a combination of vegetative and floral characters. In this species, the cauline leaves have internodes that bear a sparse and hirtellous indumentum composed of glandular hairs; ill-defined or absent petioles; elliptic or lanceolate leaf blades 2–2.7 × 0.4–0.7 cm; and adaxial surface bearing sparse glandular hairs 0.5–1 mm long (free portion) with broader base adnate to the epidermis for 0.3–0.5 mm. Flowers are consistently tetramerous and diplostemonous, solitary or arranged in a modified dichasium with widely spaced flowers. The hypanthium is obconical, and its outer surface is sparsely hirtellous, with unbranched glandular emergences and branched emergences that are either glandular or eglandular. Branched emergences are also found between the sepals (one per sinus, rarely two), although in the sinuses, also only unbranched emergences may be present. The staminal whorls are subisomorphic, without staminodes, with the antesepalous stamens bearing a triangular dorsal appendage, and the anthers are oblong and yellow. The ovary is tetralocular and has an apical crown of eglandular hairs. Finally, *Pterolepis arenacea* is the only species of the genus with a dorsal appendage on the antesepalous stamens.

Pterolepis arenacea is most similar to *P. polygonoides*, a taxon with considerable variation in both leaf and floral morphology (Renner, 1994). *Pterolepis polygonoides* is clearly a species complex comprising two main groups: specimens with lilac or pink petals and subulate anthers, which represent *P. polygonoides* s. str., and a second group with white petals and oblong anthers (Renner, 1994; Goldenberg *et al.*, 2023). It is likely that seed testa surface morphology is also correlated with the morphological tendencies of these two groups (see figure 2E,F and figure 4E,F, both in Renner, 1994). The group here considered *Pterolepis polygonoides* s. str. includes the heterotypic synonyms listed by Renner (1994), except for *P. saturejiformis* Cogn. and *P. trimera* Ule (**Table**). The morphological differences in petals and anthers within the *Pterolepis polygonoides* complex have been reassessed by Goldenberg *et al.* (2023) and need further investigation to enable better understanding of the morphological circumscription of this complex. With a more precise delimitation of

Table. Morphological comparison between *Pterolepis arenacea* and the *P. polygonoides* complex

Character	*P. arenacea*	*P. polygonoides* complex		
		P. polygonoides s. str.	*P. saturejiformis*	*P. trimera*
Indumentum on the branches	Sparsely hirtellous	Strigose	Strigose	Strigose
Floral merosity	4-merous	4-merous, rarely 3-merous	4-merous	3-merous
Hypanthium shape	Obconical	Campanulate	Campanulate	Campanulate
Outer surface of the hypanthium	Sparsely unbranched and branched emergences	Densely covered by unbranched emergences	Densely covered by unbranched emergences	Densely covered by unbranched emergences
Relative length of sepals and hypanthium	Sepals < hypanthium	Sepals ≥ hypanthium	Sepals > hypanthium	Sepals > hypanthium
Predominant petal colour	Pink or purple	Lilac or pink	Unknown	White
Anther shape	Oblong	Subulate	Oblong	Oblong
Dorsal appendage on the antesepalous stamens	Present	Absent	Absent	Absent

Pterolepis polygonoides, other entities with morphology more similar to that of *P. arenacea* should emerge, such as *P. saturejiformis* and/or *P. trimera*.

Nevertheless, *Pterolepis arenacea* differs from *P. saturejiformis* by having branches with sparsely hirtellous indumentum (vs strigose in *P. saturejiformis*), an obconical hypanthium (vs campanulate), and sepals smaller than the hypanthium (vs larger than the hypanthium) (Cogniaux, 1885). If *Pterolepis trimera* is eventually recognised as distinct from *P. saturejiformis* and *P. polygonoides*, it can also be distinguished from *P. arenacea* by its floral merosity, with *P. arenacea* having tetramerous flowers (vs trimerous in *P. trimera*), eight stamens (vs six), and a tetralocular ovary (vs trilocular). Other distinguishing characters include branches with sparsely hirtellous indumentum in *Pterolepis arenacea* (vs strigose in *P. trimera*), pink or purple petals (vs white), an obconical hypanthium (vs campanulate), and sepals smaller than the hypanthium (vs larger than the hypanthium) (Ule, 1908). In addition to the morphological differences discussed here and those highlighted in the diagnosis, the **Table** includes additional characters that distinguish *Pterolepis arenacea* from all closely related species.

Pterolepis arenacea is vegetatively similar to *P. haplostemona* and *P. xaxa* Michelang. & R.Goldenb. but can be readily distinguished by its diplostemonous flowers (vs haplostemonous flowers) (Almeda & Martins, 2015; Goldenberg *et al.*, 2023). Additionally, *P. arenacea* does not occur in sympatry with *P. haplostemona*, which is endemic to the ultramafic outcrops of Niquelândia in the Brazilian state of Goiás (Almeda & Martins, 2015), nor with *P. xaxa*, which is endemic to a transitional zone between the Caatinga and Cerrado domains, occurring in *caatinga rupestre* (rocky caatinga), known only from Licínio de Almeida in the state of Bahia (Goldenberg *et al.*, 2023).

Additional specimen examined. Brazil. Bahia, Formosa do Rio Preto, ESEC Serra Geral do Tocantins, área de amortecimento da UC, 10°50'56"S, 46°04'41"W, 745 m, 20 vi 2021, fl., fr., *Figueira* et al. 1773 (CEN barcode CEN00120464, RB).

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Appendix

Specimens of the *Pterolepis polygonoides* complex examined in the present study

***P. polygonoides* (DC.) Triana s. str.**
Gardner 2855 (BR0000005209552) – type of *P. trianae* Cogn.
Harley, R.M. et al. 21403 (RB00241446) – type of *P. gracilis* Wurdack
Hatschbach, G. & Guimarães, O. 42363 (RB01449920) – type of *P. hatschbachii* Wurdack
Leite, K.R.B. et al. 12 (HUEFS000143091)
Martius *s.n.* (G00353875, M0165785) – type of *P. polygonoides* (DC.) Triana
Mendes, M.R.A. et al. 671 (RB00654619)
Mendes, M.R.A. et al. 5671 (RB00654633)
Queiroz, L.P. de et al. 10897 (HUEFS000149818)
Scheidegger, N.M.B. et al. 13 (BRBA007395)

Souza, E.B. et al. 1564 (HUEFS000143055)
Souza, E.B. et al. 1577 (HUEFS000149188)

P. saturejiformis **Cogn.**
Gardner 2590 (BR0000005209224) – type of *P. saturejiformis*

P. trimera **Ule**
Ule, E. 6981 (K000293970) – type of *P. trimera*