Pterolepis xaxa (Melastomateae, Melastomataceae), a new haplostemonous species from Bahia, Brazil

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Abstract: We describe *Pterolepis xaxa* (Melastomateae, Melastomataceae), a new species collected in "caatinga rupestre" at Licínio de Almeida, Bahia, Brazil. *Pterolepis xaxa* resembles the recently described *Pterolepis haplostemona*, both representing the only two species in the genus that are haplostemonous (i.e., with the stamens equal in number to the petals). Apart from flowers with a single whorl of stamens, *P. xaxa* can also be recognized by intercalycine projections consisting of a very short central axis topped with 2–3 trichomes, and white petals (vs. intercalycine projections lacking trichomes at the apex and magenta or lilac petals in *P. haplostemona*).

Keywords: Biodiversity, Caatinga Rupestre, haplostemony, Licínio de Almeida, taxonomy.

Pterolepis (DC.) Miq. is a genus of 16 species of herbs and small shrubs from open areas in the Savannas, Cerrado and Campos Rupestres of southern Mexico, Central and South America, with two widespread species, each found respectively in the Lesser Antilles and Mesoamerica (Renner, 1994; Ulloa Ulloa et al., 2022). Due to the presence of flowers with a superior ovary having an apical crown and which develops into a capsular fruit, seeds that are cochleate, and anthers with a pedoconnective, *Pterolepis* clearly belongs in the tribe Melastomateae (Renner, 1994), which has been confirmed by molecular data (Michelangeli et al., 2013; Penneys et al., 2022). Among the Neotropical genera of Melastomateae, *Pterolepis* is easily distinguished by the presence of branched emergences (sensu Renner, 1994; Veranso-Libalah et al., 2020, 2022) in the sinuses of the calyx and often also on the surface of the hypanthium. These emergences have been alternatively described as "penicellate emergences" (Romero, 2009), "vascularized projections" (Goldenberg et al., 2020), "pterolepoid hairs" or "pterolepoid appendages" (Wurdack, 1986), and they are not regarded as trichomes or indumentum, since they are multicellular and vascularized. While among neotropical Melastomateae this character is only found in *Pterolepis*, it is widespread across several genera of paleotropical Melastomateae, and may have evolved more than once (Veranso-Libalah et al., 2020, 2022).

The taxonomy of *Pterolepis* is very complex given what seems to be a high degree of variability. This is reflected in the fact that its 16 currently recognized species include over 80 described taxa (Renner, 1994). Additionally, herbarium specimens very often have few, if any, complete anthers, as these are commonly damaged by *Trigona* bees (Renner, 1993).

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Flowers in most species of *Pterolepis* are diplostemonous with dimorphic stamens, although some species have isomorphic stamens (Renner, 1994). However, the most recently described species, *P. haplostemona* Almeda & A.B.Martins, is haplostemonous (Almeda & Martins, 2015). Haplostemony, the presence of stamens equal in number to the petals, is uncommon in Melastomataceae; it is present in all species of the tribe Cyphostyleae Gleason and the genus *Sonerila* Roxb. (Sonerileae Triana), and it is also found in a few species of *Blakea* P.Browne, *Cambessedesia* DC., *Creochiton* Blume, *Dissochaeta* Blume, *Miconia* Ruiz & Pav., *Monochaetum* (DC.) Naudin, *Poteranthera* Bong., and *Siphanthera* Pohl, obviously having evolved multiple times (Almeda & Robinson 2011; Almeda & Martins 2015; Almeda & Pacifico 2018; Michelangeli et al., 2022; Judd et al., 2022).

Field work in the state of Bahia, Brazil, yielded a specimen that clearly belongs to *Pterolepis* (given the characters described above) with haplostemonous flowers but that did not correspond to the previously described *P. haplostemona*. After careful analysis, this species is here described as new.

Materials and methods

The description and measurements of vegetative parts was based on dried herbarium specimens, whereas the flowers were described and measured from rehydrated material. Terminology follows Renner (1994), Almeda and Martins (2015), and Goldenberg et al. (2020). The description of *Pterolepis haplostemona* (Almeda & Martins, 2015) was used as a proxy for the morphological description of the new species. The two numbered collections on which *P. xaxa* is based are deposited at ALCB; the type and paratype have respectively four and one duplicates that will be distributed after the publication of the new species.

Results and discussion

Pterolepis xaxa Michelang. & R.Goldenb., **sp. nov.**—Type: Brazil, Bahia: Licínio de Almeida, xaxá, 14°39′09″S, 42°33′05″W. Alt. 969 m., 21 March 2017 (fl,fr), *J. Coelho, M. Silva, A. Stadnik, A. Tuler 159* (holotype: ALCB barcode 48012 [!]; isotypes: HUEFS [!], RB [!], UPCB [!]). (Figs. 1, 2).

Diagnosis.— A species of *Pterolepis* similar to *P. haplostemona* in having only one whorl of stamens but differing by the intercalycine projections consisting of a very short central axis topped with 2–3 trichomes (vs. intercalycine projections lacking trichomes at the apex), shorter sepals (2.2–2.8 mm vs. 3–4 mm, the measurements in both species including an apical seta), glandular-ciliate and white petals (vs. petals entire with 1–3 apical to subapical gland-tipped trichomes and magenta or lilac), and oblong anthers with an apical pore almost as wide as the thecae (vs. subulate-rostrate anthers with an apical pore much narrower than the widest point of the thecae).

Delicate, annual herbs, 4–16 cm tall, unbranched or with 1–4 pairs of lateral branches, these always shorter than the overall plant height. Cauline internodes quadrangular and ridged or shortly winged along the angles, moderately to sparsely covered with trichomes 0.3–0.55 mm long, simple (unbranched), erect, glandular, interpetiolar ridge distinct and slightly raised, crowned with a line of trichomes 0.6–1.3 mm long, simple, ascending, eglandular. Leaves opposite, isomorphic in each pair, sometimes with smaller leaves on short, axillary brachyblasts and then appearing verticillate; mature leaves sessile or with short petioles up to 1 mm long, compressed, glabrous or with a few trichomes similar to the ones on the leaf blade, blades (including an apical, eglandular trichome 0.4–0.5 mm long) 4–12 × 0.6–2 mm (distal leaves shorter than the proximal ones), membranaceous, oblong to elliptic, 1–nerved, apex acute, base attenuate, margins undulate-ciliolate, both surfaces moderately to sparsely covered with erect or curved glandular (but sometimes with glandular heads absent) trichomes 0.5–1 mm long on both surfaces; brachyblast leaves essentially the same as the regular ones but smaller, petioles up to 0.4 mm long, blades 2–3.5 × 0.4–0.6 mm. Flowers solitary and initially apical, early overtopped by the growth of another module (stem + one pair of leaves + one apical flower) from one or seldom the two axillary buds (each in one of the two opposite leaves axils); bracts and bracteoles absent, such that each pair of leaves associated with the initially apical

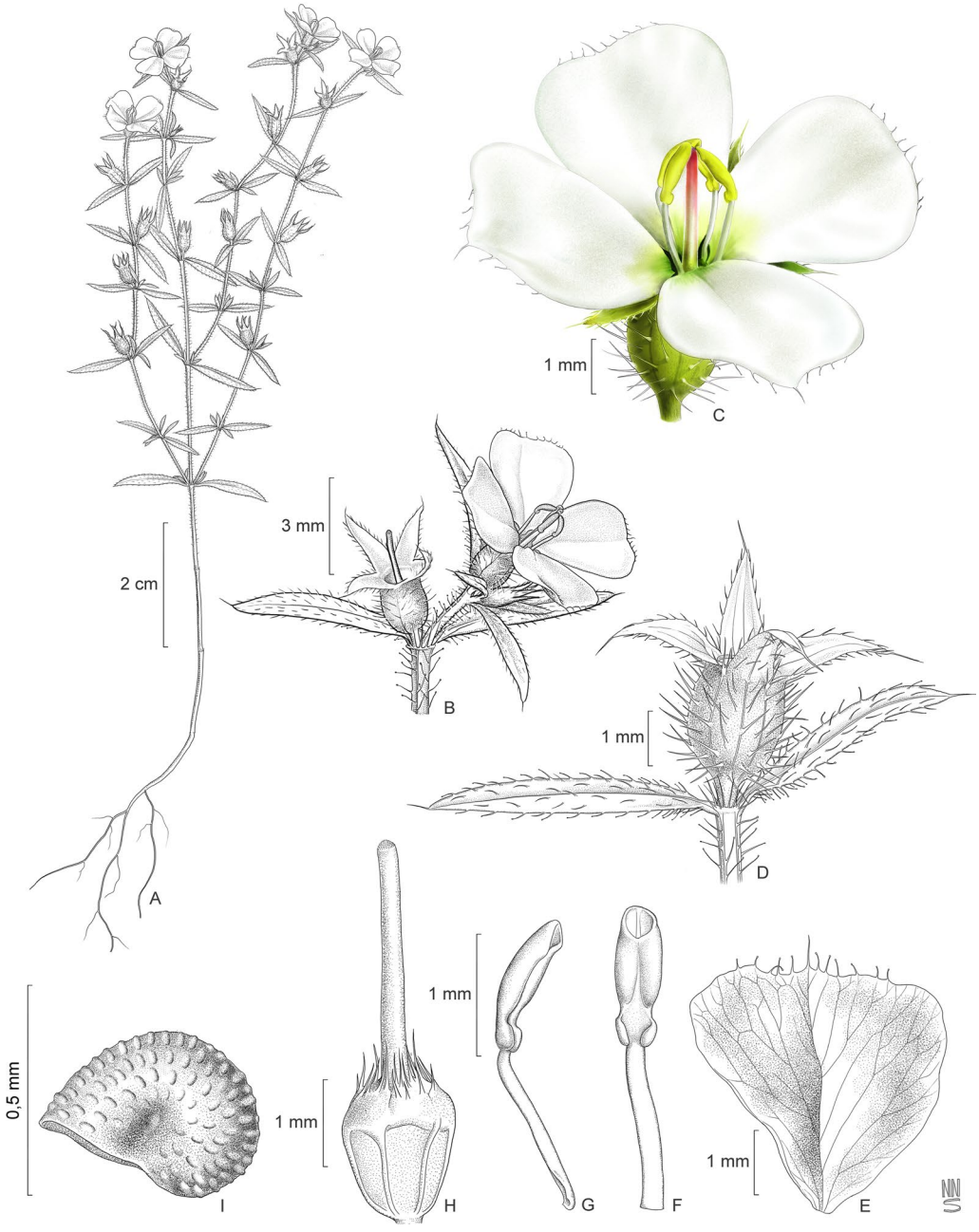

FIG. 1. *Pterolepis xaxa.* **A.** Whole plant. **B.** Tip of one branch, with one flower bud, one flower and a young fruit. **C.** Flower. **D.** Young fruit. **E.** Petal, adaxial view. **F.** Stamen, adaxial view. **G.** Stamen, lateral view. **H.** Ovary and style. **I.** Seed, lateral view. [Drawings by Natanael N. Santos, from the holotype, *J. Coelho 159* et al., ALCB].

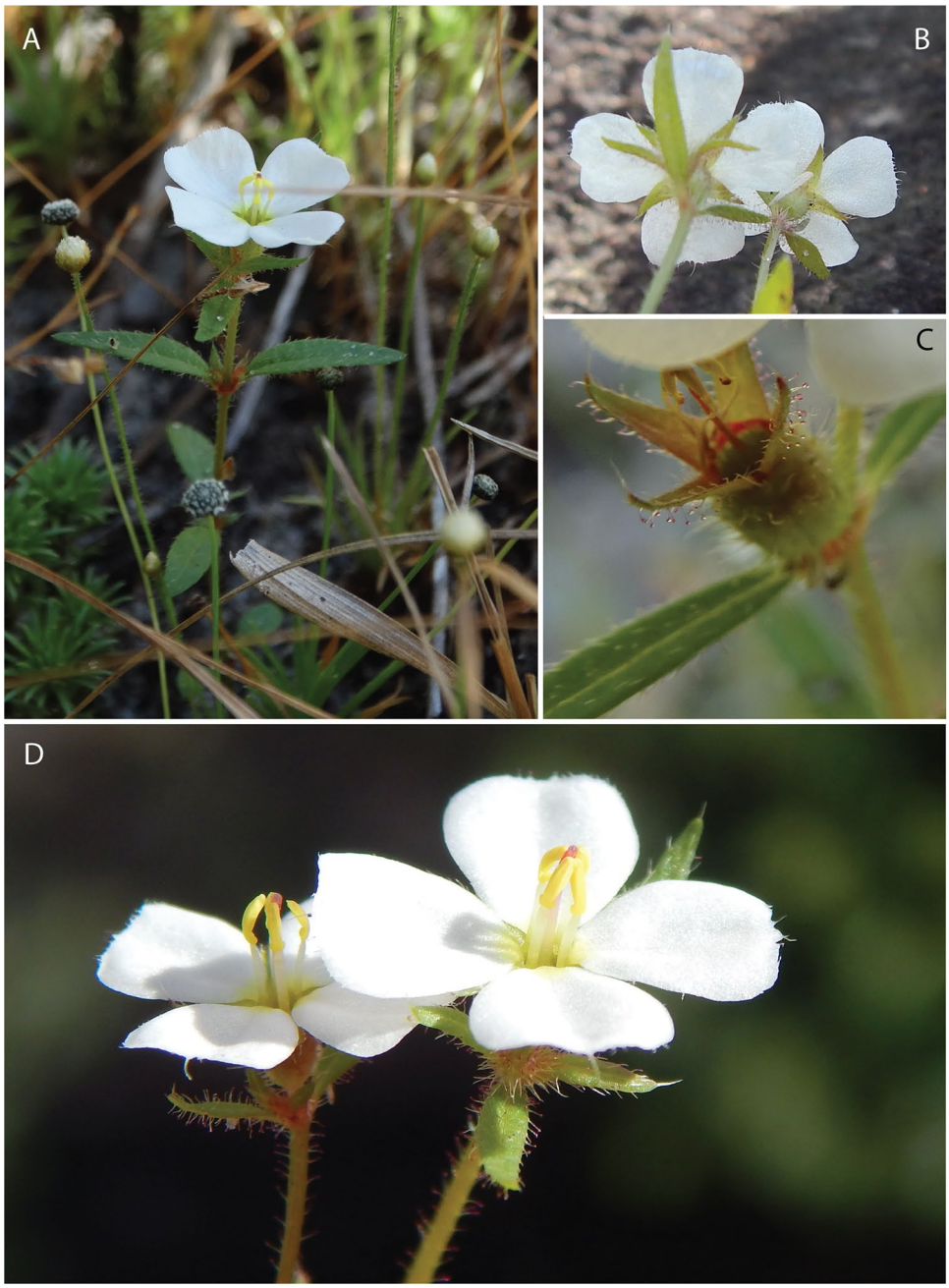

FIG. 2. *Pterolepis xaxa* in the field. **A.** Upper portion of a plant, with one flower. **B.** Flowers, abaxial view. **C.** Old flower, lacking petals and stamens. **D.** Flowers, lateral view. [All photos by J.C. de Jesus].

flower is here considered as consisting of two vegetative leaves, not bracts. Pedicel ca. 0.5 mm long, terete. Hypanthium 1.8–2 × 1.5–0.7 mm, campanulate, weakly 10-costate (5 ridges opposite to the sepals and the other 5 opposite to the sinuses), plus a faint transversal ridge right below the sepals, moderately covered with trichomes 0.4–8 mm long, erect or slightly arched, basally thickened, mostly eglandular but seldom glandular, the hypanthial emergences always intercalycine (one per sinus) and also with one or two additional units in a downwards sequence on the same ridge (sinusial), sometimes also with one or two units on the distal portion of calycine ridges, seldom distally on the hypanthium and not associated with any longitudinal ridge/costa, consisting of a very short central axis up to 1.5 mm topped with usually 3 (seldom 2) trichomes 0.3–0.6 mm long, erect, eglandular. Sepals (including an apical, eglandular trichome 0.45–0.7 mm long) 2.2–2.8 × 0.7–0.9 mm, triangular, spreading at a ca. 45° angle with the hypanthial axis, abaxial surface moderately to sparsely covered with trichomes 0.2–0.4 mm long, glandular, adaxial surface glabrous. Petals 4, white, ca 4 × 4–4.5 mm, broadly obovate to obdeltoid, with a minute basal claw, entire, but with the margin distally glandular-ciliate, 0.2–0.3 mm long, the apex truncate or abruptly and shortly acuminate, with a single trichome ca. 0.5 mm long (longer than the neighboring, glandular cilia on the margins). Stamens 4 (antesepalous); filaments 1.3–1.4 mm long, white; anthers 0.8–1 × 0.3–0.4 mm, yellow, oblong and slightly ventrally arched, apex rounded to obtuse, the apical pore ventrally inclined; connective yellow, prolonged 0.2–0.3 mm below the thecae and expanded laterally into inwardly (ventrally) oriented bilobed appendages 0.5 mm long, each lobe ca. 0.1 × 0.2 mm, rounded; staminodia absent. Ovary 4-locular, ca. 1.6 × 1.3 mm (at anthesis), superior, rounded to shortly elliptic, the apex covered with trichomes 0.2–0.6 mm long, erect, eglandular. Style ca. 2.8 mm long, straight, glabrous; stigma punctiform, slightly convex, papillose. Fruits 5.5–7.1 × 2–2.6 mm (including pedicels and sepals), persistent sepals erect, fruits and sepals with remnants of the same trichomes as the hypanthium at anthesis, the capsule shorter than the enveloping hypanthium. Seeds 0.5 × 0.4 mm, cochleate, brown; testa regularly tuberculate.

Distribution, habitat and phenology.—To date, *Pterolepis xaxa* has been collected only in the municipality of Licínio de Almeida, in the state of Bahia, Brazil. The habitat where it was found has been described as a "caatinga rupestre" ("rocky caatinga", according to Jesus et al. 2018), which means a transitional area between "Cerrado" and "Caatinga" domains; the vegetation is xeromorphic, with a predominance of herbs and shrubs (rarely trees) and growing on shallow soils among outcrops, at 750 to 1000 m elevation (Campos et al., 2017). Three species have been recently described from the same "caatinga rupestre" in Licínio de Almeida: *Microlicia caatingae* J.Coelho & R.Romero (Melastomataceae; Jesus et al., 2018), *Anteremanthus piranii* Roque & F.A.Santana (Asteraceae; Roque & Santana, 2014), and *Maschalostachys mellosilvae* Loeuille & Roque (Asteraceae, Loeuille & Roque, 2017). *Pterolepis xaxa* was collected with flowers and fruits in March and May, at the end of the rainy season.

Preliminary conservation status.— *Pterolepis xaxa* is known only from two collections from the same population. The area is not protected and the entire Serra Geral de Licínio de Almeida is under threat by illegal amethyst mining and the expansion of wind farms (Jesus et al. 2018). Given the paucity of collections, and the possibility that these plants are ephemeral, and thus undercollected, we recommend that *P. xaxa* is considered as Data Deficient (DD), although we would not be surprised if a detailed study found it to be under the thresholds to be considered Critically Endangered (CR) (IUCN, 2012, 2019).

Etymology.—The epithet refers to the name of the locality ("xaxá"), in Licínio de Almeida, where these plants have been found.

***Additional specimens examined.*—BRAZIL. Bahia:** Licínio de Almeida, xaxá, "início da trilha de cima". 14°39′11″ S, 42°33′03″ W, 944 m, 12 May 2015 (fl, fr), *J. Coelho* et al. *43* (ALCB045168).

Pterolepis xaxa can be easily grouped with the other haplostemonous species in the genus, *P. haplostemona* (Almeda & Martins, 2015). However, they differ not only by the intercalycine projections, calyx size and petal color (see diagnosis) but also by *P. haplostemona* having eciliate petals with 1–3- subapical trichomes (vs. ciliate in *P. xaxa*) and anthers 0.8–1 mm long, subulate-rostrate, (vs. anthers 1.25–2 mm, oblong, with a rounded to obtuse apex). This related species is apparently endemic to

ultramafic outcrops in the state of Goiás, also in Brazil.

Pterolepis xaxa is also morphologically similar to the complex of species that includes *Pterolepis polygonoides* (DC.) Triana and other names synonymized under it by Renner (1994), such as *Pterolepis gracilis* Wurdack, *P. hatschbachii* Wurdack, *P. saturejiformis* Cogn., *P. trianae* Cogn., and *P. trimera* Ule. As defined by Renner (1994: 96), 1885; Ule, 19811983; Renner 19941908*P. polygonoides* should be recognized by its "relatively sparse hypanthium pubescence with only a few, short, branched emergences in the sinus areas, stamens with basally barely prolonged connectives, and solitary axillary flowers" and also "petals pale magenta or lilac" and "anthers (excluding filaments) 1.6–2.6 or 4.8–5.5 mm long, subulate or truncate". This concept includes specimens encompassing a huge variation in leaf shape and width, and stamen shape and length, as well as petal number; Renner's decision to synonymize all these species seemed to rely strongly on leaf shape and the geographical distribution, rather than in anther length or number of petals.

It is not our purpose here to review all species of *Pterolepis*, but considering the color of the petals and anthers size and shape, it seems reasonable to propose that the specimens described as *P. saturejiformis* and *P. trimera*, with white petals and oblong anthers, ca. 1 mm long or less (Cogniaux,), are actually different from the specimens of *P. polygonoides* with pink petals and subulate anthers, these more than 2.6 mm long (Wurdack). Whether this difference could result in the recognition of one or two distinct species is a matter for future studies; Renner (1994) mentioned that she found 3- and 4-merous flowers in a single specimen. *Pterolepis xaxa* has the same white petals and short, oblong stamens as the types of *P. saturejiformis* and *P. trimera* mentioned above, and is surely close to them, but not to *P. polygonoides* in a strict sense (i.e., apart from *P. saturejiformis* and *P. trimera*). *Pterolepis xaxa* differs from these species by the haplostemonous flowers, with 4 stamens, while *P. saturejiformis* and *P. trimera* have diplostemonous flowers with 6 or 8 stamens, depending on whether the flower is 3- or 4-merous. *Pterolepis polygonoides* s.s. (i.e., excluding *P. saturejiformis* and *P. trimera*) has been collected near *P. xaxa*, also in Licínio de Almeida, but in a different locality ("Brejo das Ametistas", *Coelho 166* and *174* in ALCB). These specimens have distinct pink petals and 8 stamens with subulate anthers.

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Author's Contributions

RG, NR and FAM conceived the study, provided the morphological description and taxonomic analyses, and contributed to writing; JCJ collected the plants, took the photos and helped preparing the illustration.

Declarations

Competing Interests The authors have no competing interests to declare that are relevant to the content of this article.

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