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Thaumatophyllum calcicola a new deciduous species of Araceae from limestone outcrops in Brazilian Cerrado

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Abstract

Thaumatophyllum calcicola, a new species of Araceae restricted to limestone outcrop vegetation within the Brazilian Cerrado (savanna) in the western region of the state of Bahia, is described and illustrated, and compared with the morphologically similar species *Thaumatophyllum speciosum*.

Key words: Central Brazilian Savanna, Karst habitat, Western Bahia, *Philodendron* subg. *Meconostigma*

Introduction

Thaumatophyllum Schott (1859: 31) is a Neotropical genus comprising 21 species (Sakuragui *et al.* 2018). It was recently segregated from *Philodendron* based on molecular and morphological evidence, having previously been classified within the *Philodendron* subgen. *Meconostigma* (Schott in Schott & Endlicher 1832: 20) Engler (1899: 554) (Mayo 1991, Calazans *et al.* 2014, Sakuragui *et al.* 2018). Recent phylogenetic studies of the Homalomena clade have consistently recovered *Thaumatophyllum* (≡ *Philodendron* subg. *Meconostigma*) as a well-supported monophyletic lineage. The main divergence among authors concerns its taxonomic rank rather than its phylogenetic integrity. While Sakuragui *et al.* (2018), based on an integrative framework including molecular, morphological, anatomical, and cytogenetic evidence, recognized *Thaumatophyllum* at generic level, other analyses (e.g. Canal *et al.* 2018, 2019, Cedeño-Fonseca *et al.* 2025) have interpreted the same lineage as better maintained within *Philodendron*. We acknowledge these alternative viewpoints, which reflect differences in taxonomic interpretation rather than conflicting phylogenetic signals. In the present study, we follow the generic circumscription proposed by Sakuragui *et al.* (2018), recognizing *Thaumatophyllum* as a distinct Neotropical genus within Philodendreae. The genus is characterized by its arborescent habit, thickened spathe, well developed sterile intermediate zone in the inflorescence equal or longer than the staminate zone, the gynoecium always having stylar lobes and an axial vascular system independent of the funicle supply (Sakuragui *et al.* 2018). Among the key characteristics for recognizing species within the group are differences in leaf morphology and size, internode spacing, the presence of persistent or deciduous squamules, variable in texture among species, generally firm to coriaceous, peduncle length, and details of the female flowers' morphology (Mayo 1991, Calazans *et al.* 2014, Sakuragui *et al.* 2018). In addition to morphology, the geographical distribution of the taxa and their habitat specificities also seem to be well defined within the genus (Mayo 1991).

During a floristic survey conducted in limestone outcrop areas in the municipality of São Desidério, state of Bahia, we identified a species distinct from the other members of the genus. These specific outcrops are characterized by exposures of carbonate rocks from the Bambuí Group, within the São Desidério Formation, which is entirely surrounded

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by the sandstones of the Urucuia Group (Godinho 2020), the latter of which underpins the phytogeographical domain of the Cerrado in Bahia. Although this region is located within the Cerrado domain, the limestone outcrops support a unique and distinctive flora shaped by harsh environmental conditions, such as shallow and highly draining soils, elevated temperatures, intense solar radiation, and a well-defined climatic seasonality marked by distinct dry and rain periods (Aguiar-Campos *et al.* 2020). The combination of these factors acts as a strong environmental filter, selecting for highly specialized species that often become restricted to this specific habitat type (Felfili *et al.* 2007, Dryflor *et al.* 2016). Despite their ecological importance, the limestone outcrops in the region remain botanically under-sampled and are increasingly threatened by anthropogenic pressures, particularly agricultural expansion and mineral extraction activities (Brinkmann & Parise 2012, Aguiar-Campos *et al.* 2020, Rocha & Pinto 2021). These threats, combined with the restricted spatial distribution of these environments, highlight the urgency of documenting and conserving their biological richness.

The new species of *Thaumatophyllum* described here can be recognized by its thick stem, large leaves that are shed at the end of the dry season, and deciduous elongated intravaginal squamules. It also exhibits a distinctive spathe coloration—dull purple-brown with a pink margin on the outer surface and white-cream on the inner surface. Thus far, this species is known only from a small area of limestone outcrops within the Cerrado of Bahia, Brazil.

Material and methods

Fieldwork was conducted on limestone outcrops in São Desidério, Bahia, Brazil, where this *Thaumatophyllum* species occurs (Fig. 1). In the area of occurrence, there are three overlapping Conservation Units: Lagoa Azul Municipal Park, São Desidério Environmental Protection Area and São Desidério Caves Natural Monument, which ensure the protection of the region's geological and hydrological formations. Morphological analyses were based on literature review, analysis of digitized images and collections from BRBA and RB (acronyms according to Thiers 2025, continuously updated). The terminology of morphological characters follows Mayo (1989, 1991) and Calazans *et al.* (2014). The species concepts adopted in this manuscript are based on morphology, following the Phylogenetic Species Concept (PSC) (Wheeler & Platnick 2000). Nomenclatural practices follow the International Code of Nomenclature for algae, fungi, and plants (Turland *et al.* 2025). For the preliminary conservation status of the species, we followed the IUCN criteria and guidelines (2012, 2022) in conjunction with the GeoCAT tool (Bachman *et al.* 2011). The map was created using QGIS, version 3.16.7 (2025). The illustrations were based on exsiccates, photographs and cultivated specimens; the reproductive structures were rehydrated for measurements.

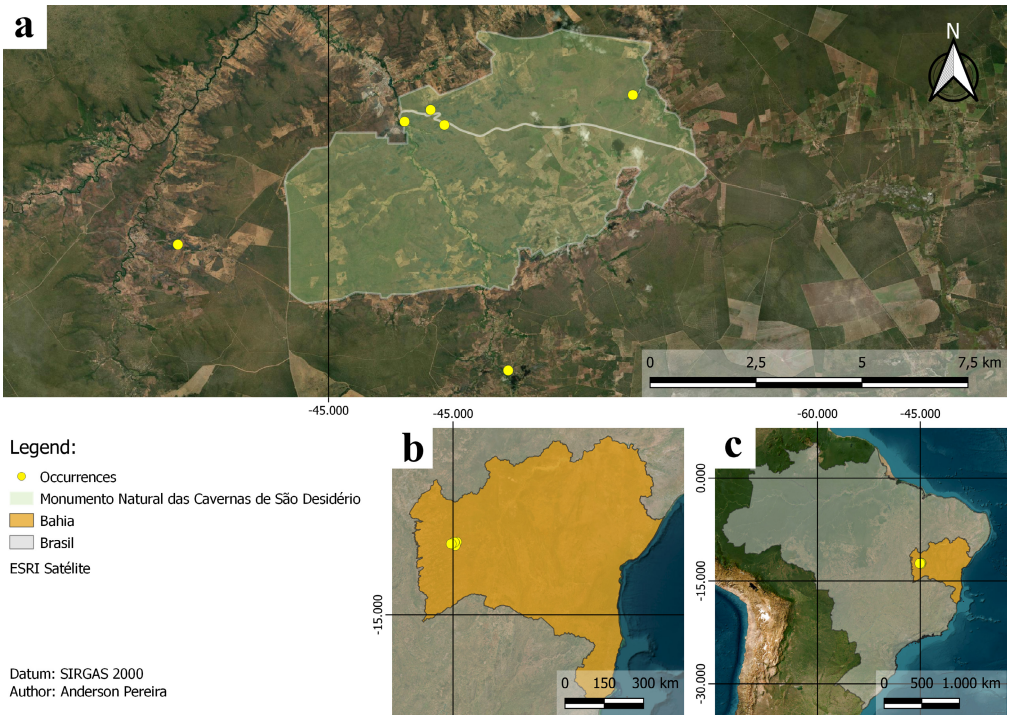

FIGURE 1. Distribution map of *Thaumatophyllum calcicola.* A. Conservation Unit Monumento Natural das Cavernas de São Desidério and collection points. B. State of Bahia. C. Brazil.

Taxonomy

Thaumatophyllum calcicola A.Pereira, Rando & Sakur. *sp. nov.* (Figs. 2, 3)

Thaumatophyllum calcicola mostly resembles Thaumatophyllum speciosum (Schott ex Endlicher) Sakur., Calazans & Mayo (2018: 63) but differs in stem, leaf and intravaginal squamules size: T. calcicola has a thicker stem (15–20 cm versus 6–9 cm), smaller leaves (32–62 cm versus 62–96 cm) and longer intravaginal squamules (1 cm versus 1–2 mm). The spathe of T. speciosum is longer (21–32 cm long versus 19–20 cm), but the diameter of the peduncle apex is smaller (1.7–3.4 cm diam. versus 8.0 cm). Additionally, the spathe coloration differs between the species: in T. calcicola the outer surface ranges from yellowish green to dull purple-brown, with a pink margin, while the inner surface is white-cream. In contrast, T. speciosum has an outer surface that is dull darkish green with red-maroon margin and the inner surface transitions from carmine-magenta apically becoming green at the very base. The gynoecium of T. calcicola has a shallow compitum and long stylar canals, while in T. speciosum the compitum is deep and the stylar canals are short. The habitat also differs between the species: T. calcicola occurs in limestone outcrops of Bahia's Cerrado, while T. speciosum can be found in granite outcrops of Espírito Santo, Minas Gerais and Rio de Janeiro.

Type:—BRAZIL. Bahia: São Desidério, Parque Municipal da Lagoa Azul, 12°22'06.2"S–44°52'04.3"W, 459m, 23 November 2024, *Rando JG et al. 1419* (holotype BRBA-9205, isotype RB)

Stem decumbent to erect, up to 2 m tall, stout, trunk-like, 15–20 cm thick, presenting different shades of brown; *adventitious roots* many on the aerial part of stem, extending in all directions to 8 m or more; *internodes* short, 0.1–0.3 cm between foliage leaf scars, brown; *prophyll scars* 0.2 cm width, dark brown; *intravaginal squamules* up to 1 cm, 0.1–0.2 cm wide, falcate, sharply-pointed, in rows of 3–6 either below and side of foliage leaf scars, deciduous at maturity; *foliage leaf scars* 3–4.5 cm wide, elliptic, light brown to beige. **Leaf** *prophyll* up to 35 cm long, green as the petiole and leaf blade, deciduous; *petiole* 40–65 cm long x 9–10 cm of diameter at base, 3–4 cm of diameter at apex, sulcate adaxially with sharply angled margins, rounded adaxially, sheath 3.5–8 cm long; *leaf blade* sagittate, margin repand, overall length 32–62 cm, overall width 32–62 cm, adaxial and abaxial surface mid green with paler green primary lateral veins; *anterior division* 23–49 cm long x 30–45 cm wide, widest at base, apex obtuse, primary lateral veins 5–7 per side, arising at an angle of 100º to midrib; *posterior division* 9–13 cm long x 30–45 cm wide, 0.4–0.5x overall blade length, basal ribs denuded for 2–6.5 cm, tip rounded, *primary acroscopic* veins 3–4, *primary basiscopic* veins 4–6. **Inflorescence** one per leaf-sheath, *peduncle* shorter than spathe 5–8 cm long, 8 cm of diameter at apex, not tapering to base, not exerted from leaf sheath; *spathe* coriaceous, 19–20 cm long, 4–5 cm diam. at middle, slightly cylindric with an apiculate apex, decurrent along 10 cm, entirely dull purple-brown on outer surface with the margin pink, inner surface white-cream presenting gold colored resin in abundance and citrus scent; *spadix* 16–20 cm long, fertile male zone 8–11 cm long, 2 cm diam., cylindric, sterile male zone 5.5–9 cm long, thicker basally, female zone 3–5 cm long, 2.5–3 cm diam. **Flowers** *stamens* 0.5 cm long x 0.1 cm diam., orange pollen; *staminodes* 0.4 cm long, 0.1 cm diam. at apex, tapered toward the base; *gynoecium* 0.5 cm long x 0.2–0.3 cm diam., ovary as broad as stigma, subcylindric, 0.3 cm long, style crown strongly lobed, raphide cells common in septa, upper ovary walls and ovary axis, *locules* 7–11 per ovary, ovules 2–3 per locule, inserted on basal half of axis, undeveloped stylar body present with long stylar canals, central stylar dome absent, compitum shallow, not penetrating ovary. **Infructescence** one per leaf-sheath, 22–24 cm long, 5–6 cm diam. at the base, 3–4 diam. at the middle, spathe entirely closed, emitting a rotten scent when opened. **Fruit** mature berry, 1 cm long, 0.5 cm diam. at apex, cylindric, yellow–beige, base rhomboid; *seeds* compressed ovoid-ellipsoid, 12–16 per fruit, 0.3 cm long, 0.2 cm diam.

Additional material examined (paratypes):—BRAZIL. Bahia: São Desidério, Parque Municipal da Lagoa Azul, 19 October 2024, *Pereira A et al. 359* (BRBA); Baixa do Coqueiro, 03 August 2024, *Pereira A 334 & Sá Telis EA* (BRBA); Sítio do Rio Grande, Camping Rock Base, 16 March 2025, *Rando JG* 1420 (BRBA); Parque Municipal da Lagoa Azul, 19 December 2024, *Pereira A et al. 389* (BRBA, SPF).

Habitat:—Terrestrial, rupicolous, or hemi-epiphytic (Fig. 1A); dry deciduous forest on limestone outcrops; full to partial sun; approx. 490 m alt.

Etymology:—The etymology of the specific epithet is related to the limestone rocks in which the species inhabits.

Phenology and interactions:—*T. calcicola* is a deciduous species, found leafless in September at the end of the dry season (Fig. 1F). When the first rains fall, in October, the leaves begin to grow and the plant starts flowering. In November we observed the inflorescence open, with the presence of *Cyclocephala* beetles (Fig. 1C), fruits can also be found in November. In December, we collected the infructescence. In the rest of the year, this plant can be found in vegetative stage.

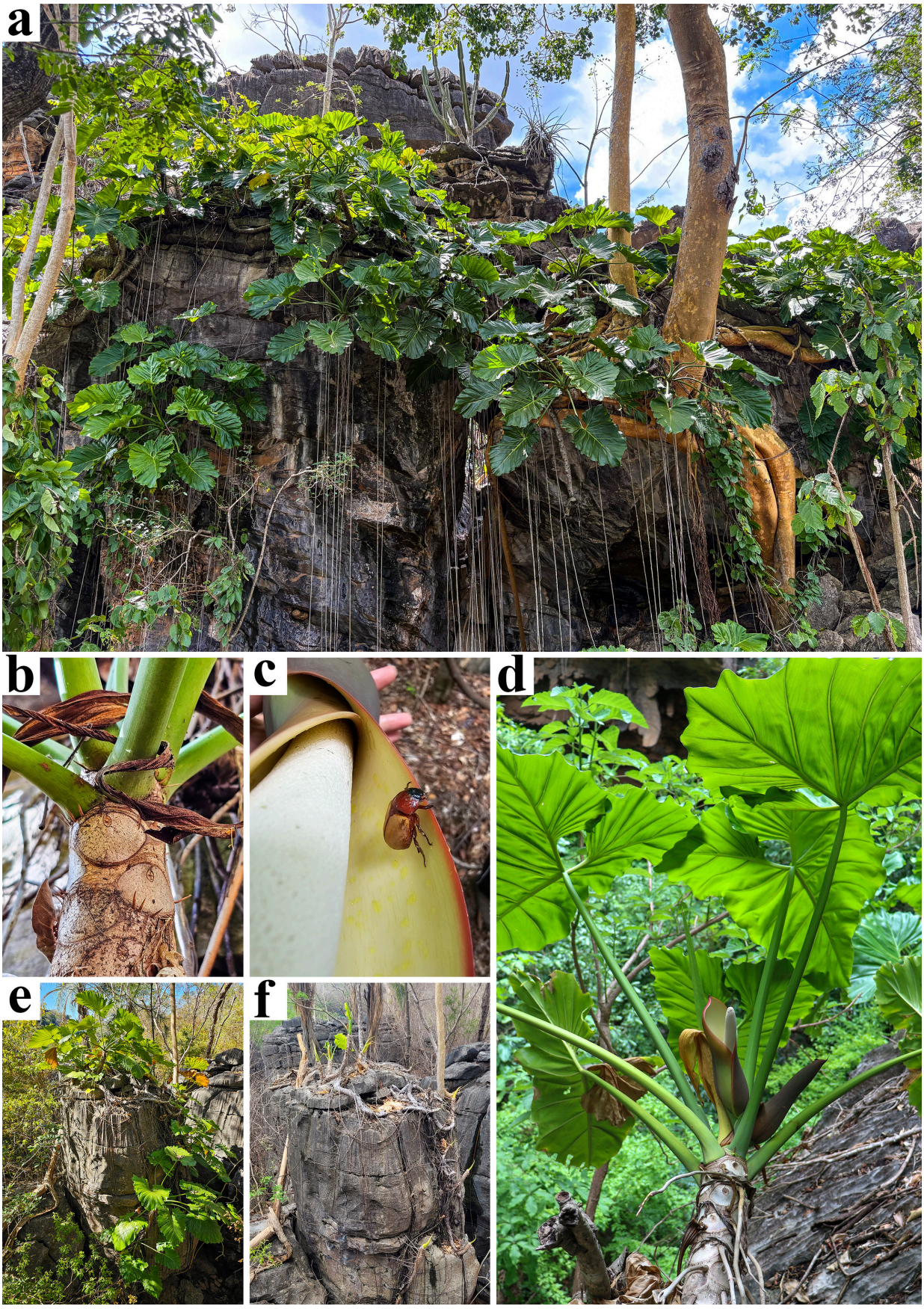

FIGURE 2. *Thaumatophyllum calcicola.* A. Habit and habitat. B. Stem. C. *Cyclocephala* beetle interaction. D. Flowering type. E, F. The same individual in different seasons. E. Rainy season. F. Deciduous period in the dry season. Photos by Anderson Pereira, Iago B.F.S. Silva & Juliana G. Rando.

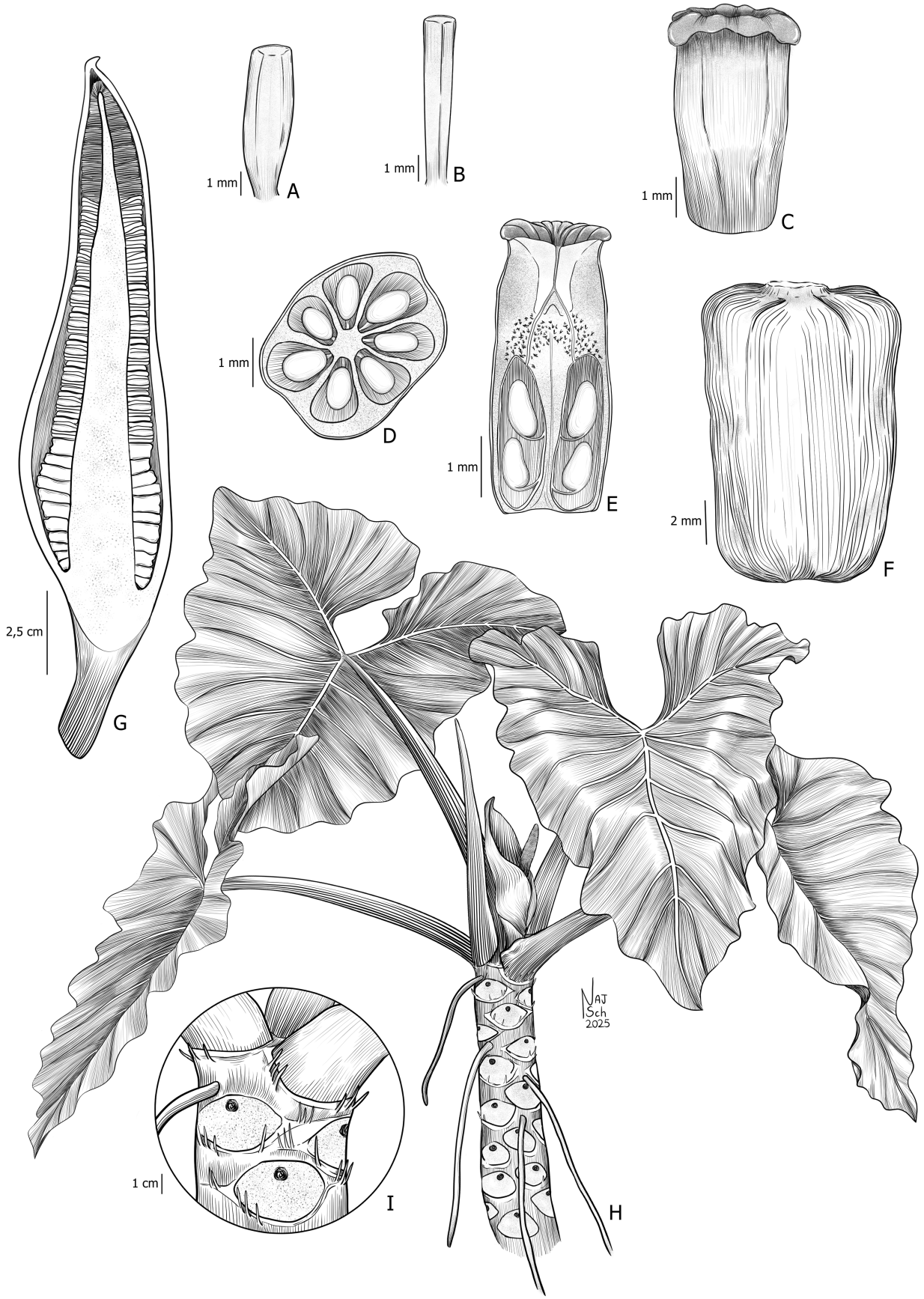

FIGURE 3. *Thaumatophyllum calcicola*. A. Staminode. B. Stamen. C. Gynoecium. D. Cross section of the gynoecium. E. Longitudinal section of the gynoecium. F. Berry. G. Inflorescence. H. Habit. I. Details of stem and intravaginal squamules. Drawn by Najla Mara Bastos Scheidegger (Naj Formiga).

Preliminary conservation status:—Following the recommendations of IUCN (2025), we assigned the category Data Deficient (DD). Apparently, this species is restricted to the karst of São Desidério, but further survey efforts in the limestone outcrops of western Bahia are needed to assign it to a threat category. Additionally, this species occurs within Conservation Units and is widely cultivated by the local population, who call it *imbé*. It has easy vegetative propagation and is commonly found in the backyards of communities that highly appreciate the plant for its beauty and resistance to the region's climate. Although it naturally appears to be restricted to rock outcrops, *T. calcicola* thrives when cultivated in the region's soil.

TABLE 1. Morphological differences that distinguish *T. calcicola* from similar species.

Character	*T. calcicola*	*T. speciosum*
Stem thickness	15–20 cm thick	6–9 cm thick
Length of leaf blade / anterior division length / posterior division length	32–62 cm / 23–49 cm / 09–13 cm	62–96 cm / 45–60 cm / 22–36 cm
Petiole length and diameter at apex	40–65 cm long / 3–4 cm of diam. at apex	68–100 cm long / 0.8–1 cm diam. at apex
Intravaginal squamules	Long, 1 cm	Short, 1–2 mm
Peduncle diameter	8 cm of diam. at apex	1.7–3.4 cm diam. at apex
Spathe length	19–20 cm long	21–32 cm long
Spathe colors	Outer surface dull purple-brown with the margin pink, inner surface white-cream	Outer surface dull darkish green with red-maroon margin, inner surface carmine-magenta apically becoming green at very base
Gynoecium	Locules 7–11 per ovary, compitum shallow, stylar canals long	Locules 9–11 per ovary, compitum deep, stylar canals short
Habitat	Limestone outcrops	Granite outcrops
Occurrence and distribution	Western Bahia, Cerrado Domains	Espírito Santo, Minas Gerais and Rio de Janeiro, Atlantic Forest Domains

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