



Passiflora purii (Passifloraceae), a new species in honor of the originating peoples of Serra da Mantiqueira, Southeastern Brazil

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ABSTRACT

During fieldwork in Serra Negra da Mantiqueira, Minas Gerais state, southeastern Brazil, a new taxon of *Passiflora*, subgenus *Astrophea*, was collected in cloud forest areas. *Passiflora purii*, the new species, is characterized by the conical trochlea and the totally vinaceous corona, and was named in honor of the Puri ethnic group that inhabited the mountain range where its population was located. Detailed data on the distribution, habitat, reproductive phenology, and conservation status of the new species, as well as a key to closely related taxa of subgenus *Astrophea* are provided.

Keywords: *Astrophea*, Atlantic Forest, cloud forest, Passifloraceae, Serra da Mantiqueira, passionflower, taxonomy.

Introduction

Passiflora is the largest and most representative genus of the Passifloraceae family. It contains about 500 species occurring mainly in the Americas (Bernacci *et al.* 2022), with only 20 distributed in India, China, southeast Asia, Australia, and Oceania islands (Bernacci 2003). The majority of *Passiflora* are herbaceous or woody climbers, but there are also shrubs and trees among this genus (Ulmer & McDougal 2004). In addition to the ornamental potential of its exuberant flowers, the genus stands out for its medicinal and economic importance, with several species presenting phytotherapeutic properties or producing fruit for consumption *in natura* (Moraes *et al.* 2020).

Passiflora is recognized by possessing six subgenera, distributed mainly in the Americas (Feuillet & MacDougal 2003; Kronisck *et al.* 2013; Buitrago *et al.* 2018). *Passiflora* subgenus *Astrophea* (DC.) Mast. contains about 60 species with a Neotropical distribution. However, recent studies have shown an increase in this group, especially in Brazilian territory (Mezzonato-Pires *et al.* 2020). Most species of the subgenus *Astrophea* occur in unexplored areas of the Amazonian domain, which makes specimen collection very difficult.

Recent taxonomic studies on the *Astrophea* subgenus have indicated seven new occurrences in Brazil (Mezzonato-Pires *et al.* 2018), expanding the distribution of some species, such as *P. plumosa* Feuillet & Cremers, until then

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known only by the *typus* collected in French Guiana. In addition, four new species were described: *P. lorenziana* Mezzonato & Bernacci (Mezzonato-Pires *et al.* 2016), *P. bernaccii* Mezzonato (Mezzonato-Pires 2018), *P. jorgeana* Mezzonato (Mezzonato-Pires *et al.* 2021a), and *P. bacabensis* Mezzonato, Silva & Oliveira (Mezzonato-Pires *et al.* 2021b). Among these new species, the first two were described for the Amazonian region and the last two for the cerrado, totaling 33 species for Brazil.

The Atlantic domain comprises only four species from this group: *P. elliptica* Gardner, *P. haematostigma* Mart. ex Mast., *P. pentagona* Mast., and *P. rhamnifolia* Mast. All of these are characterized by two glands located laterally at the petiole apex, white-greenish flowers, and a beige or yellow-greenish corona with vinaceous spots.

Serra da Mantiqueira (SM) is a Brazilian mountain range that extends through the Atlantic domain between the limits of Minas Gerais, Espírito Santo, Rio de Janeiro, and São Paulo states. SM is an area of special biological importance with priority for conservation, and it presents a great species richness of the flora and fauna, many of which are rare, endemic, and threatened (Drummond *et al.* 2005; Furtado & Menini Neto 2018; Gonzaga *et al.* 2018; Santiago *et al.* 2018; Pereira *et al.* 2020). According to Moraes *et al.* (2020), recent descriptions of new Passifloraceae taxa for SM reinforce the importance of this area for *Passiflora* studies.

After a thorough analysis of specimens collected in the Serra Negra region, which is part of the SM complex, we proposed a new species for *Passiflora* subgenus *Astrophea*. In this paper, we provide a full description, illustration, and conservation assessment, as well as comments on the etymology and morphological relationship of the new species with similar taxa.

Materials and methods

Study area

The Serra Negra da Mantiqueira region is in the Zona da Mata of Minas Gerais state, southeastern Brazil, and it integrates the central portion of the SM (Fig. 1A). The local climate is Cwb (Köppen), characterized by dry and cold winters and wet and mild summers. The annual averages of temperature and precipitation are 20.6°C and 1376 mm, respectively (Oliveira-Filho *et al.* 2013).

The new species was found in the rural area of the municipality of Rio Preto (21°58'456" S, 43°41'424" W) at 1179 m a.s.l. and a few meters from the limits of the newly established Serra Negra da Mantiqueira State Park. This Conservation Unit and its surroundings are inserted into a vegetation mosaic of the Atlantic Forest, where cloud forests, dwarf cloud forests, cloud shrubs, and cloud shrubby savannahs are the predominant phytophysognomies in most preserved areas (Oliveira-Filho *et al.* 2013). In the

areas impacted by anthropic actions, grasslands intended to raise dairy cattle are the predominant vegetation.

Taxonomic study

The taxonomic treatment and comparison with other closely related species from *Passiflora* subgenus *Astrophea* were based on specimens collected in the field, herbaria collections deposited at CESJ, acronyms following Thiers (2022, continuously updated), and online databases, such as SpeciesLink (<http://splink.cria.org.br/>) and JABOT (<http://rb.jbrj.gov.br/v2/consulta.ph>).

The species description follows the morphological concepts of Mezzonato-Pires *et al.* (2020) and Radford *et al.* (1974). The pollen terminology adopted here follows Presting (1965) and Punt *et al.* (2007). For scanning electron microscopy (SEM) analysis, the anthers were macerated, and the pollen grains (non-acetolyzed) were sprayed on supports covered with carbon tape (Melhem *et al.* 2003). The grains were analyzed using a Quanta 250 SEM (FEI, Ltd., Hillsboro, Oregon, USA) in the Laboratório de Microscopia Eletrônica (UFJF). The distribution map (Fig. 1) was prepared using the geographic information system (GIS) software QGIS 3.8 (QGIS Development Team 2021). The illustrations and photographs were made from materials deposited at the CESJ. The conservation status was informally evaluated based on IUCN Red List Categories and Criteria, Version 15 (IUCN 2022).

Results and discussion

Taxonomic treatment

Passiflora purii Mezzonato, Lima & A.P.Gelli, **sp. nov.**

Type: BRAZIL, Minas Gerais: município de Rio Preto, 21°45'13.2" S, 43°21'36.4" W, 25 Jan. 2021, fl, A.P.G. de Faria & L.M.C. Lima 239 (holotype: CESJ!, isotype: RB!). (Figs. 2, 3).

Passiflora purii is characterized by the presence of two laterally glands in the petiole apex, ca. 1.0–2.1 mm from the leaf base; leaf blades elliptic or obovate; corona in 2 series of filaments, filaments of the first series 13–16 mm long, apical portion 3–4.5 mm long, base 0.4–0.6 mm wide, dolabriform, apex verrucose gradually attenuate, totally vinaceous; trochlea conical.

Scandent lianas or **subshrubs**; **tendrils** slender to robust, tomentose; spines present. **Branches** 0.2–0.5 cm in diameter, younger branches greenish brown, older branches brown, cylindrical, striate, slightly velutinous, trichomes yellow. **Stipules** 0.2–0.5 mm or deciduous. **Petiole** 1.0–2.5 cm long, slightly velutinous; **2 glands** 1.0–2 × 0.5–0.7 mm, laterally of the petiole apex, ca. 1.0–2.1 mm from the leaf base, elliptic, margins and center nigrescent or yellowish. **Leaf blades** 5.0–8.0 × 1.8–4.5 cm, chartaceous, elliptic or obovate, apex acute or acuminate, base acute or



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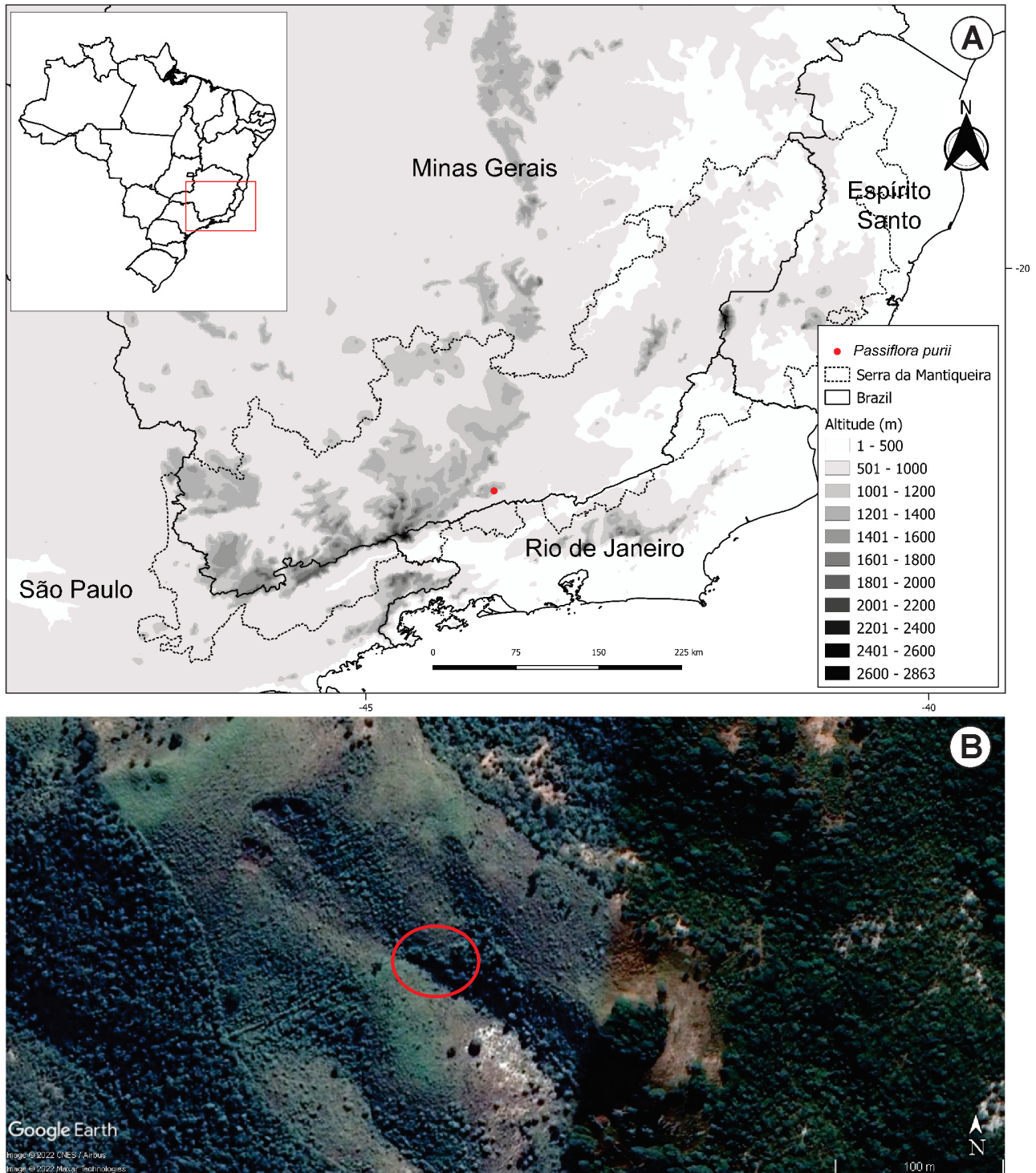


Figure 1. Location of the study area. A. Distribution of *P. purii* in the Serra Negra da Mantiqueira, southeastern Brazil (red dot). B. Location of the *P. purii* population (red circle). Source of image B: Google Earth. Map data ©2022 Google. Images courtesy of ©2022 CNES Airbus via Google Earth.

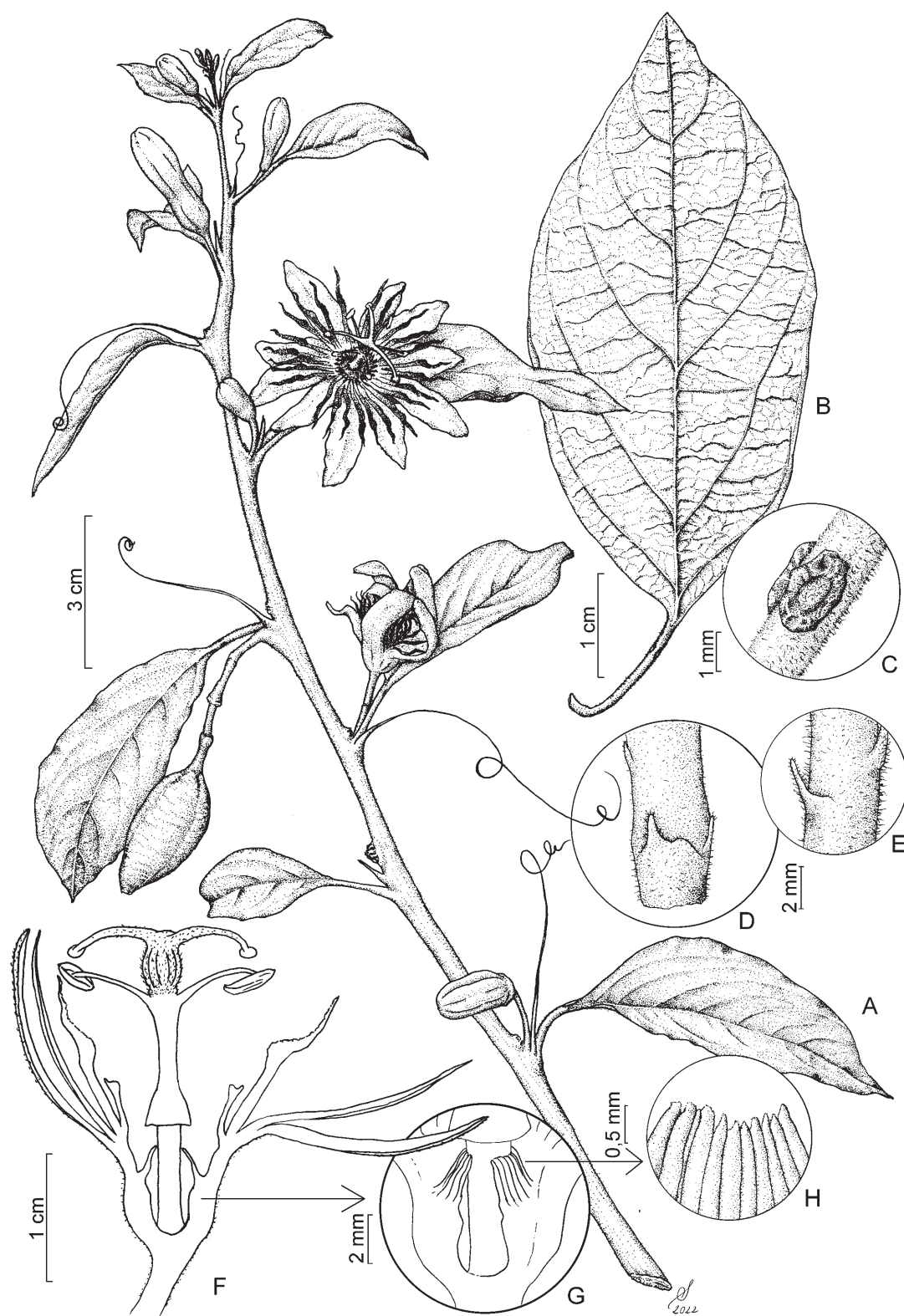


Figure 2. Illustrations of *Passiflora purii* sp. nov. A. flowering branch. B. leaf adaxial. C. detail glands on petiole. D and E. bracts, showing variation in the shape. F. longitudinal section of flower. G. operculum insertion. H. operculum apex detail.

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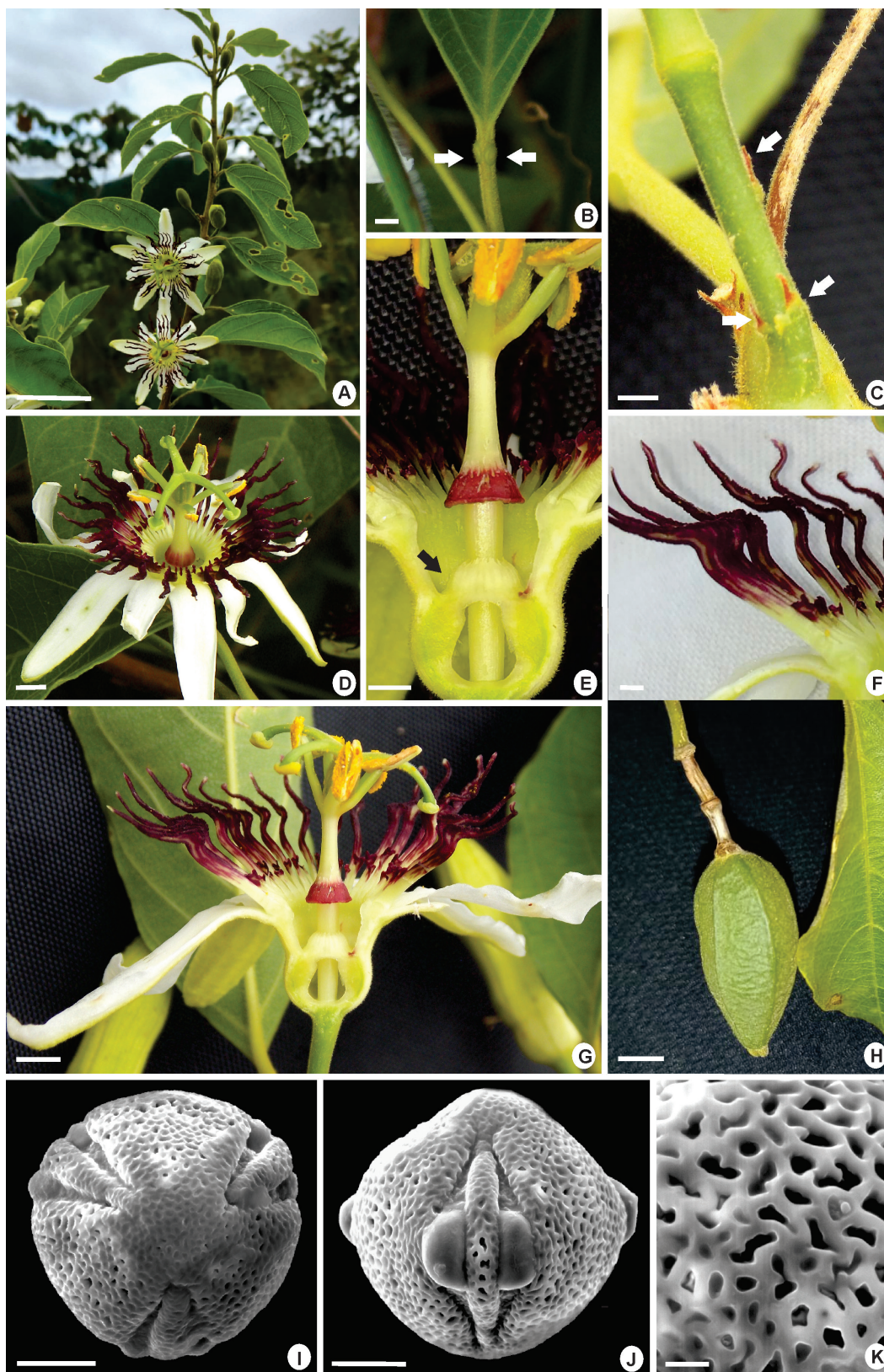


Figure 3. *Passiflora purii*. A. habit. B. detail gland (arrow). C. detail bracts (arrows). D. flower. E. detail hypanthium, highlight for the operculum (arrow). F. detail corona. G. longitudinal section of flower. H. fruit. I. pollen grains in polar view. J. pollen grains in equatorial view. K. ornamentation detail of the pollen grains. Scale bars: A, D, G = 3 mm, B, E, F = 2 mm, C = 1 mm, H = 7 mm., I, J = 10 μ m, K = 2 μ m. Photos from A. C. Mezzonato-Pires (A-G) e L.M.C. Lima (H).



attenuate, adaxial surface slightly velutinous in the midrib, abaxial surface velutinous; margins undulate; marginal glands present, < 0.2 mm; **veins** 10–13, straight to arched. **Inflorescences** uniflorous or biflorous; **peduncle** 5.4–8.8 mm long; **bracts** 1–1.2 × 0.4–0.6 mm, triangular with lobes at the base or linear; **pedicel** 6.7–11.3 mm long; **flowers** 2.6–3 cm long, 4.3–4.6 cm diameter; **hypanthium** 4.8–7 mm long, green, cylindrical-campanulate; **sepals** 1.6–2.2 × 0.3–0.6 cm, linear-oblong, apex obtuse, adaxial surface glabrous, white, abaxial surface velutinous, green; **petals** 1.8–1.9 × 0.3–0.5 cm, linear-oblong, apex obtuse, glabrous, white; **corona** in 2 series of filaments, 5–9 mm from the base of the hypanthium, vinaceous, non-plumose; **filaments of the first series** 13–16 mm long, apical portion 3–4.5 mm long, widest portion 0.7–2 mm, base 0.4–0.6 mm wide, laterally compressed and inserted, dolabriform, apex verrucose gradually attenuate, totally vinaceous; **filaments of the second series** 1.5–4.8 × 0.1–0.3 mm, bifid, apex vinaceous, base yellowish; **operculum** 1.1–2.2 mm long, apical portion 0.4–0.6 mm long, free, inserted at 2.5–4.5 mm from the base of the hypanthium, erect, apex fimbriate, papillose; **androgynophore** 0.8–1.7 cm long, **trochlea** 1.5–2.4 × 2.9–3.2 mm, 7.4–8.7 mm from the base, conical, vinaceous, **filaments** 3.5–5.4 mm long, glabrous; **anthers** 4–4.6 × 1.3–1.5 mm; **pollen** 6-colporate, with 3 pontopercula, exine semitectate, sexine reticulate, homobrochate; **ovary** 0.2–0.3 × 0.15–0.2 cm, oblong too vate, velutinous; **style** 3.5–5.5 mm long, 0.5–0.8 cm in diameter, bottom half portion velutinous. **Fruits** 3–3.5 × 2 cm, obovoid, velutinous, **seeds** 4.4–5.4 × 2.7–3.6 mm, ca. 1.1 mm thick, reticulate.

Habitat and distribution – To the best of our knowledge, *P. purii* has been registered in only one location in the southern part of the Serra Negra da Mantiqueira, at an elevation of 1179 m a.s.l., in a dwarf cloud forest remnant surrounded by pasture and unprotected by the Conservation Unit (Fig. 1B). The individuals grow in typical soils of the region (sandy quartzite soils), characterized by the exposure of colluvial material resulting from the process of quartzite erosion (Oliveira & Marques 2014).

Phenology – *Passiflora purii* can be seen collected with flowers in January and February and observed with fruits in August.

Etymology – The new taxon described here received this specific epithet in honor of the Puri ethnicity, which, before the arrival of the Portuguese, inhabited the regions of SM located in the basins of the Paraíba do Sul River and the upper Rio Doce (Nimuendaju 2002). Contact with the colonizers, especially in the 18th and 19th centuries, was catastrophic for the individuals of this ethnic group, who, in addition to being killed, enslaved, and kidnapped (especially women), do not own, to this day, their lands recognized by the National Indian Foundation (Ramos 2017).

The colonization process also severely impacted Brazilian ecosystems and caused large-scale suppression and

fragmentation of highly diverse biomes, such as the Atlantic Forest. However, the adaptations to the colonizers' way of life were not enough to transfigure several characteristics inherited from their ancestors, and the Puri resisted due to the efforts of their descendants, who sought to rescue the history of their people. Likewise, the anthropic impacts observed in the location where *P. purii* was found were not sufficient to prevent the survival of this species. Precisely where the Puri lived a few centuries ago, they are honored not only with the epithet of a new species but also, indirectly, with the creation of a State Park and other Conservation Units in the Serra Negra da Mantiqueira destined for the preservation of the home of our native peoples, the forest.

IUCN conservation assessment – We estimate that the population of *P. purii* has less than 50 mature individuals. The individuals inhabit an isolated fragment of a dwarf cloud forest surrounded by pasture (Figs. 1B, 4), established alongside a tenuous watercourse. The place of occurrence of *P. purii* is private property unprotected by Conservation Units.

In recent years, the flora of Serra Negra da Mantiqueira has been intensively studied (Abreu *et al.* 2011; Mezzonato-Pires *et al.* 2013; Monteiro 2013; Salimena *et al.* 2013; Gonzaga *et al.* 2014; Cabral *et al.* 2016; Justino *et al.* 2016; Miloski *et al.* 2017; Mota *et al.* 2017; Cardoso *et al.* 2018). Nevertheless, at present, we are not aware of any other locality in the region where this new species may occur. Even recent studies of *Passiflora* in other locations of the SM (Moraes *et al.* 2020) and a recent taxonomic review performed in *Passiflora* subg. *Astrophea* (Mezzonato-Pires *et al.* 2020) did not record any specimens that could be the new taxon described herein. Therefore, we suggest its inclusion in the Critically Endangered (CR) category of threat under criterion D, which considers very small or restricted populations with less than 50 mature individuals (IUCN 2022).

Comments – *Passiflora purii* is described in *Passiflora* subg. *Astrophea* sect. *Pseudoastrophea* (Harms) Killip for presenting a cylindrical-campanulate hypanthium smaller than its sepals and non-plumose corona. This species is closely related to *P. elliptica*, *P. haematostigma*, *P. pentagona*, and *P. rhamnifolia* (Fig. 5), all of which present two petiolate glands, a corona with two series of filaments, and a trochlea. However, *P. purii* can be distinguished from *P. elliptica* by the first series of dolabriform filaments (vs. liguliform filaments). The presence of a conical trochlea in *P. purii* brings it closer to *P. rhamnifolia* and distances it from *P. haematostigma* and *P. pentagona*, which present a fusiform trochlea. However, the presence of an operculum with a fimbriate apex, observed in *P. purii*, is also present in *P. haematostigma* and *P. pentagona*, although the length of the apical portion differs between them (*P. purii*: 0.4–0.6 mm; *P. haematostigma*: 1.27–1.7 mm; and *P. pentagona*: 0.73–1.32 mm). *Passiflora purii* differs from *P. rhamnifolia* mainly by the larger corona first series of filaments (13–16 mm vs.



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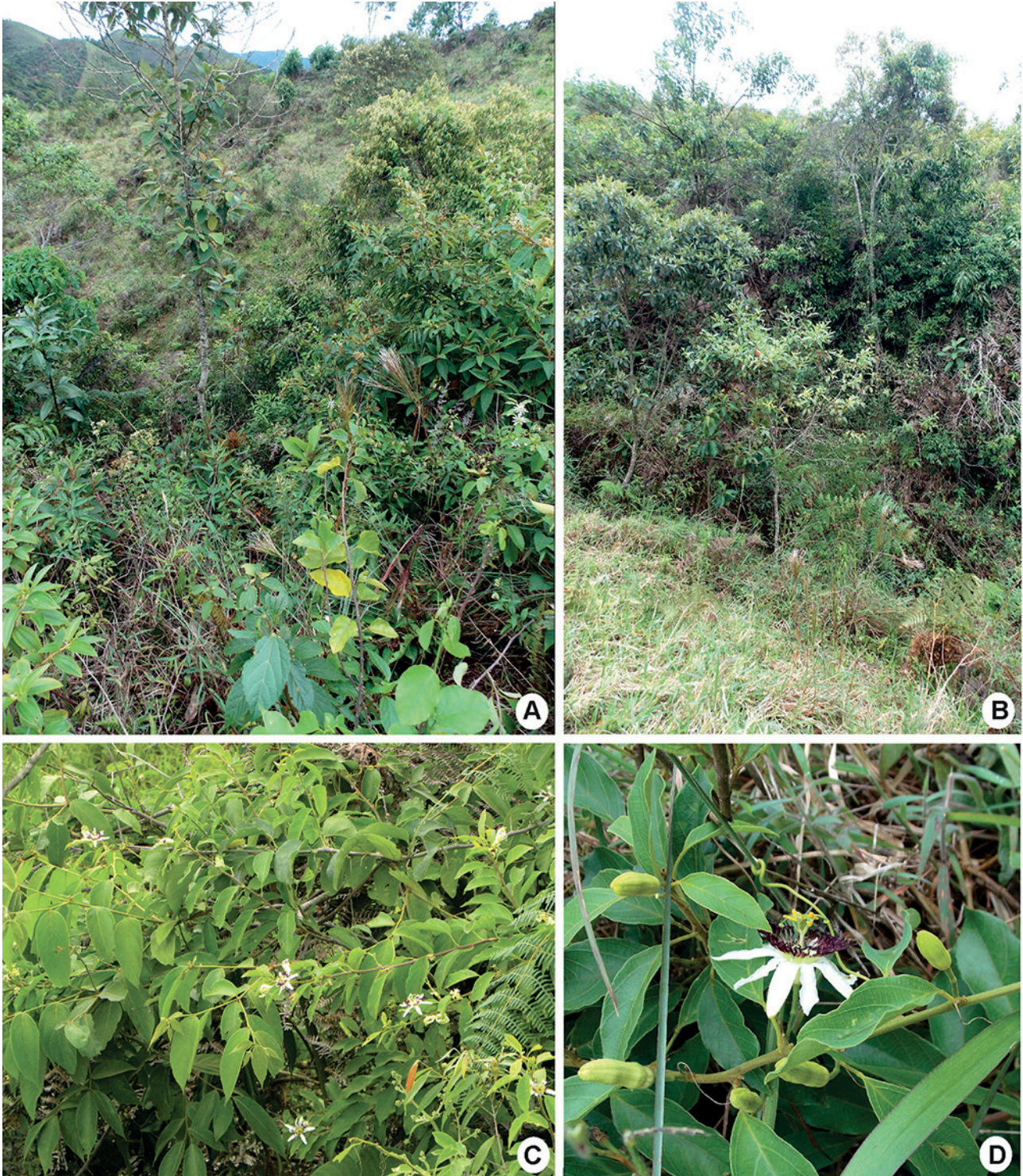


Figure 4. Habitat of *Passiflora purii*. A. General view from the top. B. General view of from under. C. View *P. purii* climbing. D. Detail of one climbing branch of *P. purii*.



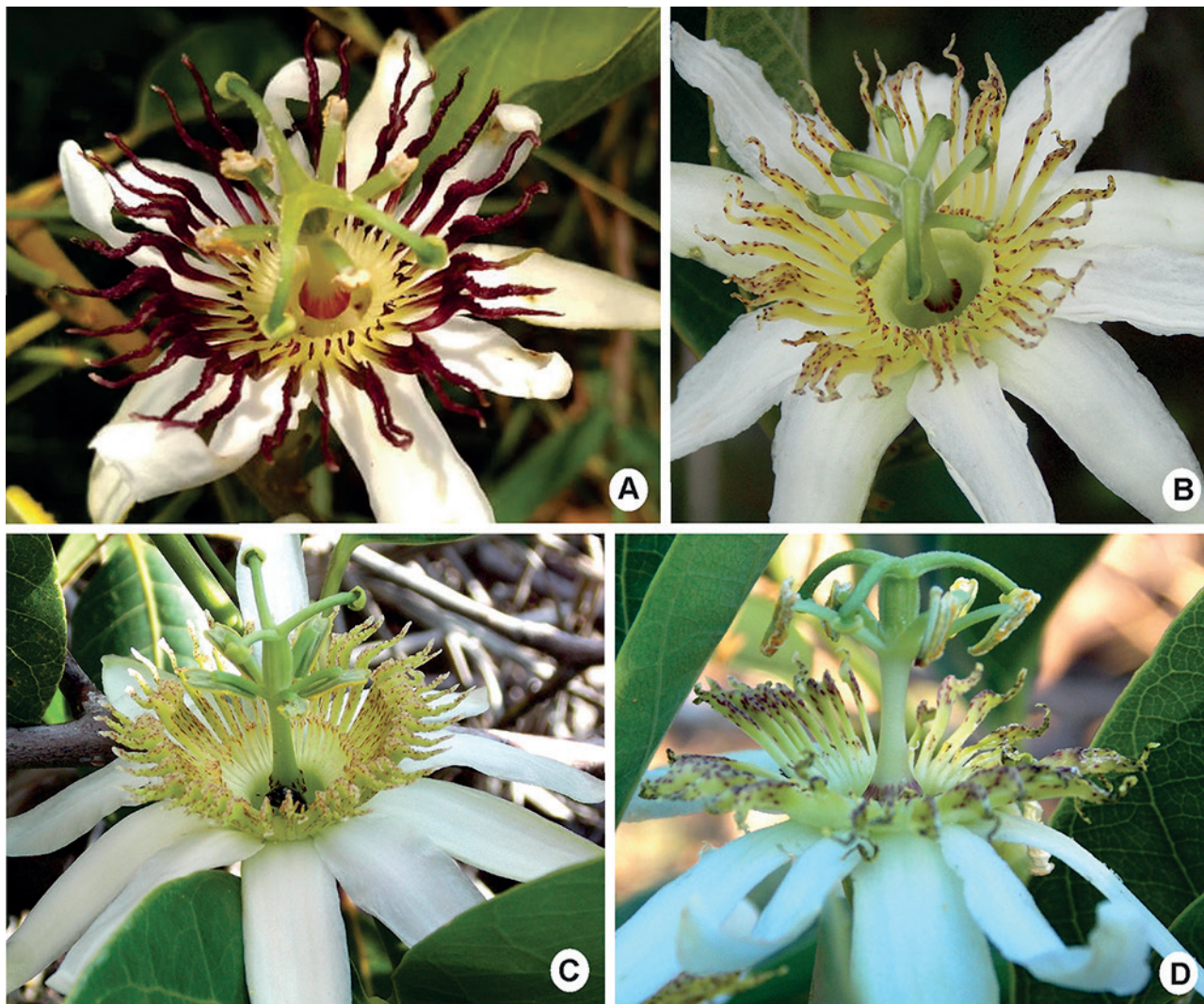


Figure 5. Comparison to morphologically similar species. A. *Passiflora purii*. B. *Passiflora haematostigma* Mart. ex Mast. C. *Passiflora pentagona* Mast. D. *Passiflora rhamnifolia* Mast. Photos from L.M.C. Lima (A), A.C. Mezzonato-Pires (B-D).

8.94–9.22 mm), totally vinaceous (vs. yellow greenish with vinaceous spots), with the apical portion gradually larger and attenuated (3–4.5 mm vs. 2.66–3.72 mm), wider filaments of the second series (0.1–0.3 mm vs. 0.04–0.12 mm), and a wider conical trochlea (2.9–3.2 mm vs. 0.8–2.9 mm).

According to pollen studies already carried out for *P.* subg. *Astrophea* (Mezzonato-Pires *et al.* 2015; 2017), *P. purii* is inserted in pollen type IV, characterized by pollen grains with semitectate exine; continuous muri; sexine simplicolumellate; formation of small lumina. The pollen morphology affirms the similarity between the species *P. elliptica*, *P. haematostigma*, *P. pentagona*, and *P. rhamnifolia*, which were also inserted in the same pollen type (Mezzonato-Pires *et al.* 2015; 2017).

With the description of *P. purii*, Minas Gerais contains 53 species of *Passiflora*, the largest and most important genus

of Passifloraceae. Under *Passiflora* subg. *Astrophea*, Minas Gerais is now represented by four species. The three already known species are *P. chlorina* L.K. Escobar, *P. haematostigma*, and *P. rhamnifolia*. *Passiflora chlorina* is the most different and can be easily distinguished from *P. purii* by the crypts and puberulous indumentum on the abaxial veins of the leaf blade, dolabriform filaments of the first series with apex attenuate not gradually attenuate, and absent trochlea. *Passiflora chlorina* is the only species that occurs in the Cerrado, the other species (*P. elliptica*, *P. haematostigma*, *P. pentagona* and *P. rhamnifolia*) occur in Atlantic Forest.

Additional material examined (paratype). BRAZIL, Minas Gerais: Rio Preto, zona rural, 21°45'13.2" S, 043°21'36.4" W, 06 Feb 2022, fl., A.C. Mezzonato, Y. Tavares & L.M.C. Lima 250 (CESJ, R); Rio Preto, zona rural, 21°45'13.2" S, 043°21'36.4" W, 05 Aug 2021, fr., L.M.C. Lima 06 (CESJ).



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Key to the species of *P.* subgenus *Astrophea* section *Pseudoastrophea* similar to *P. purii* (sensu Mezzonato-Pires et al. 2020)

1. Corona filaments of the first series liguliform *P. elliptica*
1. Corona filaments of the first series dolabriform, long attenuate, gradually attenuate, margins verrucose, undulate or slightly undulate 2
2. Operculum apex entire or irregularly with short incisions *P. rhamnifolia*
2. Operculum apex fimbriate 3
3. Trochlea conical, corona totally vinaceous *P. purii*
3. Trochlea fusiform; corona beige or yellow greenish with vinaceous spots 4
4. Abaxial surface velutinous; bracts linear-setaceous *P. haematostigma*
4. Abaxial surface puberulous; bracts deltate to narrowly triangular *P. pentagona*

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