



## Original Paper

# *Ruehssia quirinopolensis* (Apocynaceae), a new species from the Cerrado Domain, Brazil

Isa Lucia de Moraes<sup>1,5</sup>, Fábio da Silva do Espírito Santo<sup>2</sup>, Alessandro Rapini<sup>3</sup> & J. Francisco Morales<sup>4</sup>

### Abstract

A new species of Apocynaceae, *Ruehssia quirinopolensis*, endemic to Serra da Confusão do Rio Preto and Serra da Igreja, Quirinópolis, state of Goiás, Brazil, is described and illustrated. It resembles *R. rupestris*, differing by the white corolla, adaxially villose and with a longer tube, and by its corona lobes with the upper portion lanceolate. Besides a distribution map for the new species, we provide a key to identify the nine species of *Ruehssia* that occur in Goiás. *Ruehssia quirinopolensis* is assessed here as Critically Endangered (CR).

**Key words:** Asclepiadoideae, *Marsdenia*, Neotropics, taxonomy.

### Resumo

Uma nova espécie de Apocynaceae, *Ruehssia quirinopolensis*, endêmica da Serra da Confusão do Rio Preto e Serra da Igreja, Quirinópolis, estado de Goiás, Brasil, é descrita e ilustrada. Ela se assemelha a *R. rupestris*, diferindo, pela corola branca, adaxialmente vilosa e com tubo mais longo, e pelos lobos da corola com a porção superior lanceolada. Além de um mapa de distribuição para a nova espécie, apresentamos uma chave para identificar as nove espécies de *Ruehssia* que ocorrem em Goiás. *Ruehssia quirinopolensis* é avaliada aqui como Criticamente em Perigo (CR).

**Palavras-chave:** Asclepiadoideae, *Marsdenia*, Região Neotropical, taxonomia.

## Introduction

The Apocynaceae comprise around 5,350 species and more than 370 genera (Endress *et al.* 2018). They are represented by nearly 70 genera and approximately 780 species in Brazil; more than half of these species are endemic (Apocynaceae in Flora do Brasil 2020). In Gentianales, the family is easily recognized by the presence of latex, a gynoeceum with two carpels free at the ovary level but fused towards the apex to form a style-head, and a remarkable gradual synorganization of floral structures, culminating with the gynostegium (absent in the basal rauvolfioid grade) and the pollinaria (absent in the basal 'rauolfioid-

apocynoid' grade): the gynostegium arises from the post-genital fusion of the androeceum to the style-head and pollinaria are the pollen units of Periplocoideae, Secamonoideae and Asclepiadoideae (Rapini 2012). Counterintuitively, the most specialized groups of Apocynaceae, in particular the Asclepiadoideae, show wider ranges of pollinators (Ollerton *et al.* 2019)

With about 3,375 species (Endress *et al.* 2018), Asclepiadoideae is the largest subfamily of Apocynaceae. The group is characterized by bisporangiate stamens and pollen in monads, gathered in pollinia coated by a pellicle from the tapetum cells; pollinia of adjacent stamens are then

<sup>1</sup> Universidade Estadual de Goiás, Biological Sciences Course and Herbarium José Ângelo Rizzo (JAR), Conjunto Hélio Leão, Quirinópolis, GO, Brazil. ORCID: <<https://orcid.org/0000-0001-8748-9723>>.

<sup>2</sup> Universidade Federal do Sul da Bahia, Centro de Formação em Tecnociências e Inovação, Ferradas, Itabuna, BA, Brazil. ORCID: <<https://orcid.org/0000-0002-2661-4081>>.

<sup>3</sup> Universidade Estadual de Feira de Santana, Depto. Ciências Biológicas, Prog. Pós-graduação em Botânica, Novo Horizonte, Feira de Santana, BA, Brazil. ORCID: <<https://orcid.org/0000-0002-8758-9326>>.

<sup>4</sup> Research Associate, Missouri Botanical Garden, St. Louis, USA; University of Bayreuth, Bayreuth Center of Ecology and Environmental Research (BayCEER), Bayreuth, Germany. ORCID: <<https://orcid.org/0000-0003-3984-7009>>.

<sup>5</sup> Author for correspondence: [isamorais1@gmail.com](mailto:isamorais1@gmail.com)

connected one another by a translator, secreted by the style-head before the anthesis and formed by a corpusculum and two caudicles (Rapini *et al.* 2001). Apart from Fockeeae, a nine-species tribe from the Old World in which pollinia are attached directly to the corpusculum (*i.e.*, the translators lack caudicles), Asclepiadoideae is divided into two clades, one with pendent pollinia (Asclepiadeae) and other with erect pollinia (Ceropegieae-Marsdenieae) (*e.g.*, Rapini *et al.* 2003, 2007; Fishbein *et al.* 2018). This latter clade comprises only one American lineage, treated until recently in a Pantropical genus, *Marsdenia* R. Br.

A phylogenetic study based on plastid and nuclear data (Espírito Santo *et al.* 2019) showed that *Marsdenia s.l.* is not monophyletic, with species scattered across the whole Marsdenieae. The American species of *Marsdenia*, however, form a clade, but not closely related to *M. tinctoria* R. Br., the type of *Marsdenia*. Thus, *Ruehssia* H. Karst., until then treated in the synonymy of *Marsdenia*, was reinstated to accommodate the neotropical species of Marsdenieae. The genus comprises ca. 110 species, with centers of diversity in southeastern Mexico, northwestern South America, and northeastern Brazil, each with approximately 20 species. It shows a large range of ecological tolerance, occurring in environments as distinct as wet forests, savannas and seasonally dry forests. Although morphologically heterogeneous, *Ruehssia* can be easily recognized among the neotropical Asclepiadoideae by the erect pollinia, as it represents the only American lineage of the clade Ceropegieae-Marsdenieae (Espírito Santo *et al.* 2019).

Espírito Santo *et al.* (2019) recognized 42 species of Marsdenieae in Brazil and formally transferred 41 from *Marsdenia* to *Ruehssia* (except *R. macrophylla* H. Karst., the type of *Ruehssia*); since then, species from the rest of South America, Puerto Rico and Cuba have also been transferred to or described in *Ruehssia* (Bárrios *et al.* 2020; Keller & Liede-Schumann 2020; Keller *et al.* 2020; Reuss *et al.* 2020). Roughly one fifth of the Brazilian species in the genus (9 species) was described in the last three years (Espírito Santo *et al.* 2018a, b, c) and most of them (6 species) are endemic to the Cerrado Domain. Among these findings, we had an equivocal plant with fruits from Quirinópolis, state of Goiás, vegetatively very similar to *R. rupestris* (F. Esp. Santo) F. Esp. Santo & Rapini, a species known only from an area of 100 m<sup>2</sup> in the Diamantina Plateau, state of Minas Gerais (Espírito Santo *et al.* 2018a). In November 2018,

we found plants of this population in Quirinópolis with flowers; this allowed us to recognize another undescribed species from the Cerrado domain. Therefore, our aim here is to describe and illustrate this new species of *Ruehssia*.

The state of Goiás is nested in the Cerrado domain; it is dominated by savannas and shelters a high diversity of angiosperms (Santos *et al.* 2012; Soares *et al.* 2015). Rocky outcrop *cerrados* cover around 7% of the state (Santos *et al.* 2012) and occur throughout the state, on small and large mountain ranges (Lima 2008). In southern Goiás, only ranges near Caldas Novas have been floristically investigated, whereas important formations around Cachoeira Alta, Itarumã, and Quirinópolis remains poorly explored. The few floristic studies in these regions focused mainly on trees and shrubs (*e.g.*, Amaral *et al.* 2006; Miranda *et al.* 2007; Lima *et al.* 2010) and vegetation on cliffs and gallery forests around small creeks remains poorly known; besides, many of these areas have been destroyed, resting only small remnants of natural vegetation today. The present study resulted from a botanical survey of unexplored forests in Serra da Confusão do Rio Preto and Serra da Igreja, Quirinópolis, and an inventory of the Apocynaceae in these areas. The vascular flora of Quirinópolis has been surveyed since 2017 and focused mainly on the cliffs around the city. As a result, rare and endangered species as well as taxonomic novelties have been found (*e.g.*, Bueno *et al.* 2019), and this distinctive erect species of *Ruehssia* described for the first time here.

## Material and Methods

Samples were collected and processed following techniques described by Fidalgo & Bononi (1984) and Mori *et al.* (1989). Descriptions were made based on fresh material, herbarium specimens, and preserved flowers (alcohol 70%). The terminology for the morphological description follows Radford *et al.* (1974) and Stearn (2004). Herbarium acronyms are cited according to Thiers (continuously updated). Data on distribution, habitat, and phenology were obtained from herbarium specimens and field notes. The conservation status was assessed by calculating the extent of occurrence (EOO) and the area of occupancy (AOO) with GeoCAT (Bachman *et al.* 2011) and applying the IUCN Red List Categories and Criteria (IUCN 2012). The AOO was calculated based on a user defined grid cell of 2 km.

## Results and Discussion

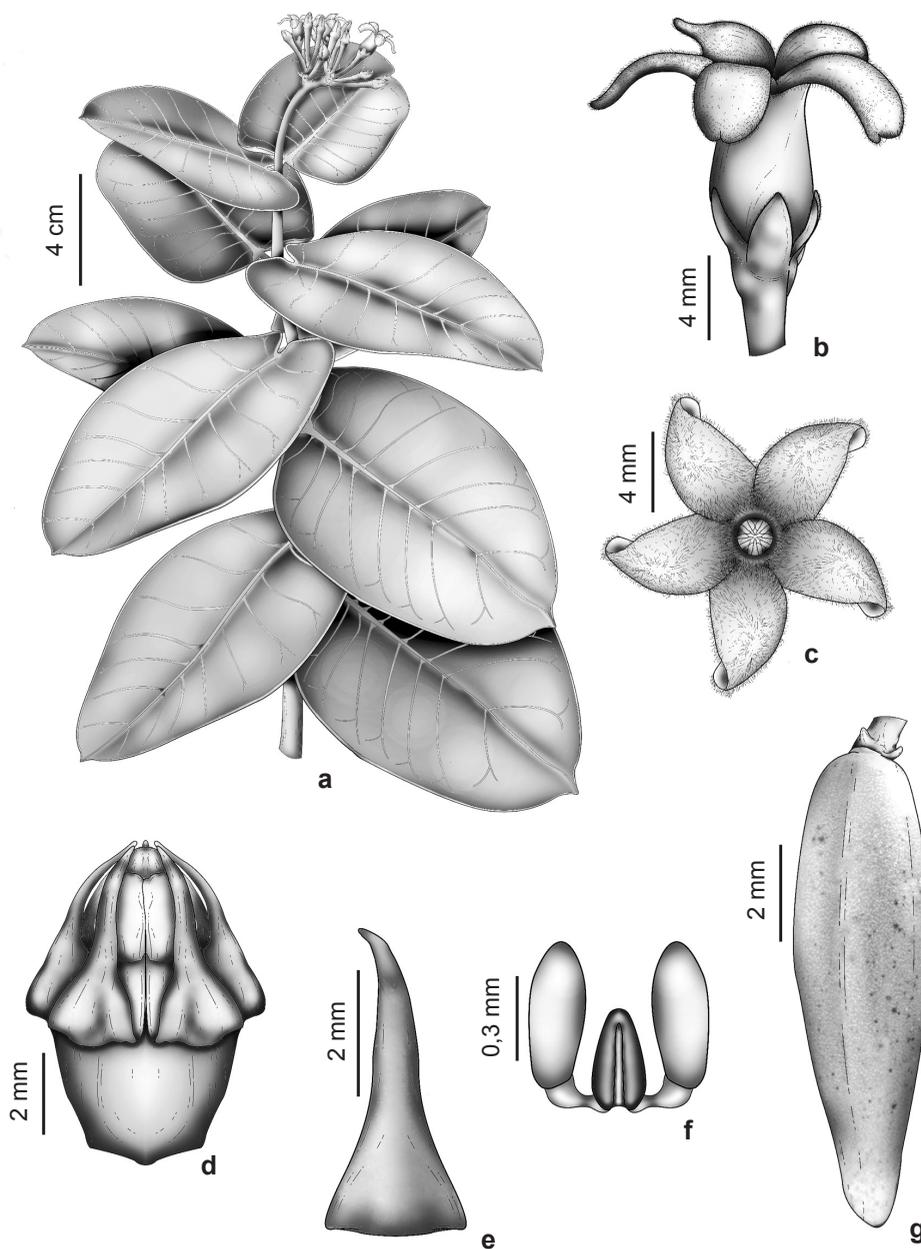
### Taxonomic treatment

*Ruehssia quirinopolensis* I. L. Morais & F. Esp. Santo, *sp. nov.*

Tipo: BRAZIL. GOIÁS: Quirinópolis, Serra da Confusão do Rio Preto, 18°30'48"S, 50°22'29"W,

680-700 m, 16.XI.2018, fl., *I.L.Morais 5122* (holotype: JAR!, isotype: HUEFS!). Figs. 1-3

*Ruehssia quirinopolensis* is morphologically similar to *R. rupestris* (F. Esp. Santo) F. Esp. Santo & Rapini, differing by the white corolla (vs. greenish-vinaceous), adaxially villose, forming five rows of trichomes at the base of the tube (vs.



**Figure 1** – a-g. *Ruehssia quirinopolensis* – a. branch with inflorescence; b. flower, lateral view; c. flower, seen from above; d. flower, perianth removed to show the corona in front of gynostegium; e. corona lobe, frontal view; f. pollinarium. g. fruit. (a-f. *Morais 5122*; g. *Morais & Morales 4818*). Illustrated by Lucas Menezes Silva.

adaxially pubescent only on the middle portion of the tube), with longer tube ( $> 9$  mm *vs.*  $< 5.4$  mm long) and lobes ( $> 5.8$  mm *vs.*  $< 3.8$  mm long), and corona lobes with the upper portion lanceolate (*vs.* ovate).

Erect shrubs, up to 1.7 m tall; stems cylindrical, glabrous. Leaves with petiole 0.3–1.0 cm long, glabrous; lamina 6–15  $\times$  4.4–9(–11) cm, elliptic, base cordate or rounded, apex cuspidate, margins not revolute, with 2–4 colleters adaxially at the base of the midvein, fleshy and glabrous. Inflorescences umbelliform cymes, 7–32 flowers; peduncle 3–5.5 cm long, glabrous; bracts 1.12–1.82  $\times$  0.81–1.1 mm, deltoid to ovate, scarious, margins ciliate; pedicels 1.2–1.6 cm long, glabrous; sepals 3–5  $\times$  2.8–3.8 mm, ovate, greenish, apex acute, margins ciliate, abaxially glabrous, adaxially with five axilar alternisepalous colleters. Corolla tubular, basally swollen, white, with purple spots at the end of the anthesis, abaxially glabrous, adaxially villose, forming five rows of trichomes at the base of the tube; tube 9.1–10.1  $\times$  4.6–6 mm; lobes 5.9–8.4  $\times$  3.6–4.2 mm, ovate to ovate-oblong,

apex rounded or irregularly emarginate, recurved, margins not ciliate, adaxially villose, glabrescent toward the apex. Corona lobes 4.2–5  $\times$  1.8–2 mm, lower portion triangular, fused to the anther, the upper portion lanceolate, free, apex acute, incurved over the style-head. Gynostegium c. 7.8 mm long, stipitate (stipe c. 3.5 mm long), inserted within the corolla tube; style-head c. 1.6  $\times$  1.7 mm, ovate; anthers c. 0.49  $\times$  0.3 mm, the apical membranous appendix c. 1.65  $\times$  1.3 mm, ovate-oblong; corpusculum 0.44–0.5  $\times$  0.22–0.25 mm, ovoid, apex rounded, erect; caudicles c. 0.25–0.32 mm long; pollinia 0.48–0.65  $\times$  0.25–0.31 mm, oblong. Fruits c. 10–12  $\times$  2.9–3.2 cm, fusiform, glabrous; seeds c. 9  $\times$  7 mm, brown, comose at the microphylar end, c. 200 seeds/fruit.

**Additional specimens examined:** BRAZIL. GOIÁS: Quirinópolis, Serra da Confusão do Rio Preto, 18°30'8"S, 50°52'29"W, 25.II.2017, fr., *I.L. Morais & J.F. Morales* 4818 (HUEFS, JAR); 18°24'29.94"S, 50°26'28.11"W, 2.V.2019, fr., *D.A.R.B. Ventura* 564 (JAR); Serra da Igrejinha, 18°07'34.24"S, 50°28'43.88"W, 6.I.2020, fl., *I.L. Morais & J.F. Morales* 5875 (JAR).



**Figure 2** – a-e. *Ruehssia quirinopolensis* – a-b. habit; c. inflorescence; d. flower, seen from above; e. fruit.

The species is endemic to Serra da Confusão do Rio Preto and to Serra da Igrejinha, Quirinópolis, state of Goiás, Brazil, growing on cliffs and surrounding areas, at 680–700 m. (Fig. 3). These formations shelter small fragments of rocky savannas that remained almost unexplored floristically until recently.

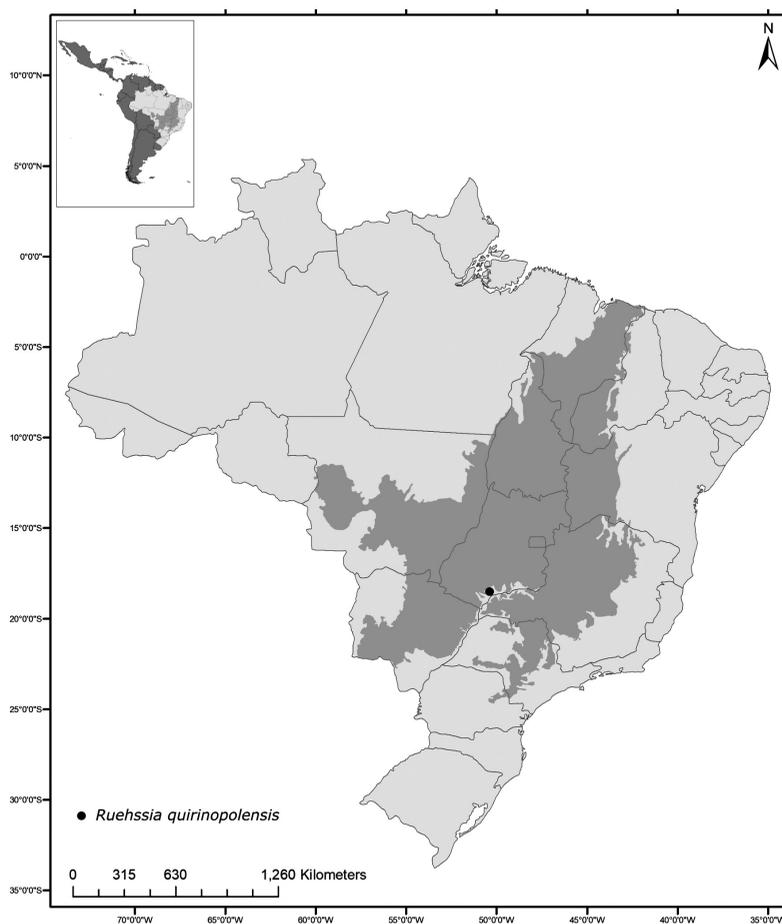
The epithet refers to Quirinópolis, a small city located at the southern base of the Serra da Confusão do Rio Preto, Goiás, Brazil.

*Ruehssia quirinopolensis* was collected with flowers from November to February, and with fruits from January to July.

The species is restricted to cliffs and surrounding areas, which are fire-prone during the dry season; most of the vegetation in the site was destroyed by a fire in September 2019 and is still regenerating. Due to the narrow distribution (extent of occurrence 12,5 km<sup>2</sup> and area of occupancy 16 km<sup>2</sup>), current habitat decreasing, and risk of

fire, *Ruehssia quirinopolensis* is assessed here as Critically Endangered (CR), following criteria B1ab(i ii iii) + 2ab(i ii iii).

*Ruehssia quirinopolensis* is characterized by the erect shrubby habit, leaves with the lamina basally cordate or rounded, umbelliform inflorescences, flowers with white corolla, adaxially villose, forming five rows of trichomes at the base of the tube, stipitate gynostegium, and corona lobes with the lower part triangular and the upper part lanceolate. Vegetatively, it can be confused with *R. rupestris*, because of the habit, leaves, and inflorescence architecture, but *R. quirinopolensis* can be easily distinguished by the features included in the diagnosis. Other eight species of *Ruehssia* occur in Goiás: a key to separate them is given below. However, only one other species is found in Quirinópolis, *R. altissima* (Jacq.) F.Esp.Santo & Rapini, which is a woody vine (vs. shrub) with leaves densely pubescent (vs. glabrous).



**Figure 3** – Distribution map of *Ruehssia quirinopolensis* with the Brazilian Cerrado in darker gray.

### Key to the species of *Ruehssia* from Goiás, Brazil

1. Shrubs.
  2. Leaves with elliptic lamina, > 3.14 mm wide, cuspidate at the apex; corolla white, cream or reddish (not on limestone outcrops).
    3. Sepals > 2.9 × 2.7 mm; corolla white, tubular, basally swollen, tube > 9 × 4.5 mm, lobes ovate to ovate-oblong, > 5.8 × 3.5 mm; corona lobes > 4.1 × 1.8 mm.....*Ruehssia quirinopolensis*
    - 3'. Sepals < 2.7 × 1.7 mm; corolla cream or reddish, campanulate, tube < 3 × 3.1 mm, lobes elliptic, < 4 × 2.9 mm; corona lobes < 2.9 × 1.4 mm.....*Ruehssia serpentina*
  - 2'. Leaves with lanceolate, narrowly elliptic or linear lamina, < 3.15 mm wide, attenuate to acute at the apex; corolla greenish to greenish-cream (only on limestone outcrops).
    4. Sepals < 2.7 mm long; corolla throat pilose, tube < 2.3 × 4.1 mm, lobes < 5.1 mm long; corona lobes < 3.1 × 1.3 mm; corpusculum < 0.28 × 0.16 mm .....*Ruehssia phallica*
    - 4'. Sepals > 3.2 mm long; corolla throat glabrous, tube > 4.9 × 5.9 mm, lobes > 5.9 mm long; corona lobes > 6.7 × 2.4 mm; corpusculum > 0.4 × 0.22 mm .....*Ruehssia zehntneri*
- 1'. Twiners.
  5. Stems tomentose to villous; corolla abaxially pubescent; corpusculum < 0.16 × 0.06 mm; pollinia > 0.79 × 0.29 mm .....*Ruehssia altissima*
  - 5'. Stems glabrous or pubescent; corolla abaxially glabrous; corpusculum > 0.16 × 0.07 mm; pollinia < 0.76 × 0.27 mm.
    6. Corolla white.
      7. Stems pubescent to glabrescent; leaves with ovate or cordiform (rarely elliptic) lamina; inflorescences formed by a set of umbelliform cymes; corolla tube < 1.6 mm long, lobes suberect; corona lobes inverted V-shaped (Λ), completely fused to the anther, < 0.8 × 0.9 mm.....*Ruehssia brasiliensis*
      - 7'. Stems glabrous; leaves with elliptic or oblong-elliptic lamina; inflorescences umbelliform; corolla tube > 3 mm long, lobes recurved; corona lobes with a lower portion with concave auricles, fused to the anther and an upper portion narrowly triangular, caudate, free, > 2.9 × 1.3 mm .....*Ruehssia weddellii*
    - 6'. Corolla vinaceous or greenish-yellow to brownish-yellow.
      8. Sepals abaxially puberulent; corolla campanulate, vinaceous, tube > 3.9 mm wide, lobes > 2.3 mm wide; corpusculum > 0.34 mm long .....*Ruehssia avacanoeira*
      - 8'. Sepals abaxially glabrous; corolla urceolate, greenish-yellow to brownish-yellow, tube < 3.1 mm wide, lobes < 1.7 mm wide; corpusculum < 0.2 mm long .....*Ruehssia neomanarae*

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