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# First record of *Ipomoea spruceana* (Convolvulaceae) in the Brazilian Cerrado with anatomical and palynological notes

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**Abstract:** *Ipomoea spruceana* is a Brazilian endemic species previously considered restricted to the Amazon phytogeographical domain and poorly represented in botanical collections since its original description in 1869. Examination of herbarium specimens revealed a new occurrence of the species in the state of Mato Grosso do Sul, Brazil, representing the first confirmed record for the Cerrado domain and extending its known distribution by approximately 832 km from the nearest previously documented locality. This study also provides the first anatomical and palynological data for the species. Anatomical analyses revealed epidermal cells with sinuous anticlinal walls, anisocytic and paracytic stomata, and sessile peltate glandular trichomes. Pollen grains are large, pantoporate, spheroidal, and echinate, corresponding to the pollen pattern commonly observed in *Ipomoea*. The occurrence of *I. spruceana* in the Cerrado expands its known ecological range and highlights the importance of herbarium revisions and taxonomic studies for improving knowledge of species distributions in Brazil. A preliminary conservation assessment based on IUCN criteria classified the species as Endangered (EN). These findings contribute to the taxonomic knowledge of *I. spruceana* and emphasize the need for continued botanical exploration and collection efforts in under-sampled areas of the Amazon and Cerrado domains.

**Keywords:** Brazilian flora, Jitirana, leaf anatomy, micromorphology, pollen grains.

**Resumo: (Novo registro de *Ipomoea spruceana* (Convolvulaceae) no Cerrado brasileiro com notas anatômicas e palinológicas).** *Ipomoea spruceana* é uma espécie endêmica do Brasil, anteriormente considerada restrita ao domínio fitogeográfico Amazônico e pouco representada em coleções botânicas desde sua descrição original, em 1869. A análise de espécimes de herbário revelou uma nova ocorrência da espécie no estado de Mato Grosso do Sul, constituindo o primeiro registro confirmado para o domínio do Cerrado e ampliando sua distribuição conhecida em aproximadamente 832 km em relação à localidade previamente documentada mais próxima. Este estudo também apresenta os primeiros dados anatômicos e palinológicos para a espécie. As análises anatômicas evidenciaram células epidérmicas com paredes anticlinais sinuosas, estômatos anisocíticos e paracíticos, além da presença de tricomas glandulares peltados sésseis. Os grãos de pólen são grandes, pantoporados, esferoidais e equinados, correspondendo ao padrão polínico amplamente registrado para espécies de *Ipomoea*. O registro de *I. spruceana* no Cerrado amplia sua amplitude ecológica conhecida e reforça a importância de revisões de herbário e estudos taxonômicos para o aprimoramento do conhecimento sobre a distribuição das espécies no Brasil. Com base nos critérios da IUCN, uma avaliação preliminar classificou a espécie como Em Perigo (EN). Os resultados contribuem para o conhecimento taxonômico de *I. spruceana* e destacam a necessidade de intensificar os esforços de coleta e exploração botânica em áreas ainda subamostradas dos domínios Amazônico e do Cerrado.

**Palavras-chave:** Flora brasileira, Jiritana, anatomia foliar, micromorfologia, grãos de pólen.

## Introduction

Convolvulaceae Juss. comprises approximately 60 genera and about 1,900 species, distributed mainly throughout tropical and subtropical regions of the world (Staples & Brummitt, 2007; POWO, 2026). Among its largest genera, *Ipomoea* L. stands out with approximately 800 species and exhibits remarkable morphological, ecological and biogeographical diversity (Wood et al., 2020). In Brazil, the genus comprises more than 160 species, of which approximately 70 are endemic (D. Santos et al., 2021; Belo, Santos, & Gasparino, 2026; Belo, Gasparino, & Buril, 2024; Simao-Bianchini et al., 2026). Species of *Ipomoea* occur across a wide range of phytogeographical domains, from humid forests to savannas and other open vegetation formations (Simao-Bianchini et al., 2026).

Floristic and taxonomic studies, as well as revisions of biological collections, play a fundamental role in expanding knowledge of species distributions, frequently revealing new occurrence records, collection gaps and previously unrecognized biogeographical patterns (Falcão, 1971; Buril et al., 2013; Nepomuceno et al., 2016; Simão-Bianchini et al., 2016; Belo et al., 2020; Wood et al., 2020). Such studies are particularly important for some genera of Convolvulaceae, including *Ipomoea* L. and *Jacquemontia* Choisy, for which the geographic distribution of many species remains incompletely understood (Buril et al., 2015; Pastore & Simao-Bianchini, 2017; Delgado-Junior et al., 2023; Belo, Buril, et al., 2023; Belo, Gasparino, & Buril, 2024; Belo, Santos, et al., 2026; Marinho et al., 2023).

Some species of Convolvulaceae exhibit distributions restricted to specific Brazilian phytogeographical regions, as is the case for *Dicranostyles yrypoana* M.Pastore, *Ipomoea cavalcantei* D.F. Austin, *Jacquemontia barbieri* Belo and *J. ferricola* Belo, Buril & Louzadawhich are primarily associated with Amazonian environments (Wood et al., 2020; Belo, Buril, et al., 2023; Belo, Santos, et al., 2026; Pastore et al., 2023; Simao-Bianchini et al., 2026). Similarly, *Ipomoea spruceana* Benth. ex Meisn. is a Brazilian endemic species whose known distribution is restricted to the Amazon domain, with records from the states of Amazonas, Maranhão, Mato Grosso and Pará (Meisner, 1869; Wood et al., 2020; Simao-Bianchini et al., 2026). Despite its potentially broad geographic range, the species remains poorly represented in scientific collections, with relatively few specimens known since its original description in *Flora Brasiliensis* (Meisner, 1869).

The Cerrado is recognized as one of the world's major biodiversity hotspots and harbors an exceptionally rich flora, including numerous endemic taxa (Simon et al., 2009). Despite its outstanding biological diversity, this phytogeographical domain has undergone extensive habitat loss in recent decades due to agricultural expansion and cattle farming (Klink & Machado, 2005; Cunha et al., 2008). In recent years, taxonomic studies conducted in the Cerrado have greatly improved our understanding of Convolvulaceae diversity, leading to the description of new species and a more accurate assessment of the geographic distribution of several taxa (D. Santos et al., 2020; D. Santos & Buril, 2024; Belo, Gasparino, & Buril, 2024; Pastore et al., 2025).

Anatomical and palynological studies have made significant contributions to the taxonomic understanding of Convolvulaceae, providing important diagnostic characters for species delimitation, the interpretation of morphological relationships, and the recognition of taxonomic groups (Vital et al., 2008; Ketjarun et al., 2016; Alencar et al., 2022; Romeiro et al., 2023; Belo, Louzada, & Buril, 2024; Belo, Gasparino, & Buril, 2024). Anatomical traits such as the shape of ordinary epidermal cells, stomatal types, petiole outline and the number of vascular bundles have proven useful for species delimitation. The taxonomic value of these characters has been demonstrated in studies of *Argyreia* Lour. (Traiperm et al., 2017), *Camonea* Raf. (E. A. V. Santos et al., 2024), *Daustinia* Buril & A.R. Simões (Alencar et al., 2024), *Evolvulus* L. (Ketjarun et al., 2016; D. Santos & Buril, 2024), *Ipomoea* (Belo, Santos, & Gasparino, 2026; Belo, Gasparino, & Buril, 2024) and *Jacquemontia* (e.g., Belo et al., 2023, 2026). Despite these advances, micromorphological data remain scarce or entirely lacking for many species of the genus, including *I. spruceana*.

Examination of herbarium specimens from several scientific collections revealed the occurrence of *I. spruceana* in the state of Mato Grosso do Sul, within areas of the Cerrado domain, thereby extending its previously known geographic range. In light of this finding, the present study aims to expand the taxonomic knowledge of the species through a detailed morphological description, provide its first anatomical and palynological data, document its novel occurrence in the Cerrado domain, and present a preliminary assessment of its conservation status.

## Materials and Methods

### Data Collection

The present study is based on the examination of herbarium specimens deposited in the herbaria CEN, CGMS, IAN, MG, MSF, and SP (*Index Herbariorum* (updated continuously), 2026). Species identification was conducted using relevant taxonomic literature (Meisner, 1869; Simao-Bianchini et al., 2026), comparison with specimens identified by specialists and examination of type material available online at JSTOR (https://plants.jstor.org/). Morphological descriptions follows the terminology of Harris and Harris (2001). Distributional information was obtained from the label data of the examined specimens and complemented with records from the SpeciesLink database (https://specieslink.net/).

### Anatomical analyses

Samples obtained from herbarium specimens were rehydrated and stored in 70% ethanol following Smith and Smith (1942). Hand-made transverse and paradermal sections were prepared from the median region of

the leaf blade, petiole and stem using a razor blade and polystyrene support (Kraus & Arduin, 1997). The sections were cleared with 20% sodium hypochlorite (NaClO), neutralized in 2% acetic acid, washed in distilled water, and stained with safranin and Astra blue (Kraus & Arduin, 1997). Prepared sections were mounted in 50% glycerin on semipermanent slides and analyzed using a LEICA DM500 light microscope equipped with a digital camera. Anatomical features were documented through photomicrographs.

### Palynological analysis

Unopened floral buds were sampled from the examined specimen, with at least two flowers analyzed. Mature pollen grains were subjected to acetolysis following Erdtman (1960), as modified by Melhem *et al.* (2003). Pollen grain size was evaluated from measurements of 25 grains (Salgado-Labouriau et al., 1965), whereas measurements of apertures and exine thickness were based on ten grains. Permanent slides were prepared and incorporated into the herbaria PEUFR/UFRPE pollen collection. Quantitative data were summarized using means and standard deviations (Zar, 2009). The variables analyzed included pollen diameter, aperture dimensions, spine size, distance between spines and thickness of the exine layers. Morphological characterization followed the terminology adopted by Punt *et al.* (2007) and Halbritter *et al.* (2018). The number of apertures was estimated according to Hoen & Punt (1989) and spine density was assessed following Hanks & Fryxell (1979).

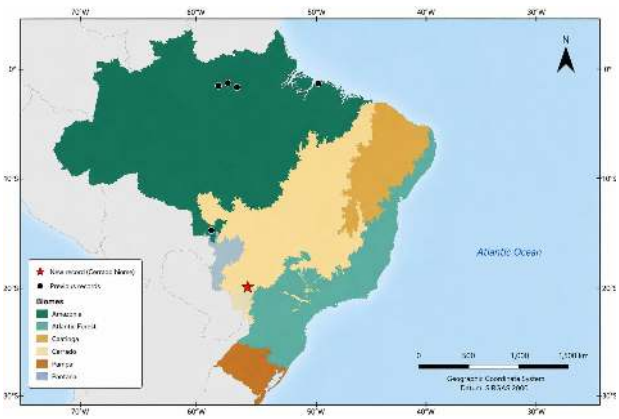



**Figure 1:** Geographic distribution of *I. spruceana*. Black circles indicate previously known records of the species, whereas the red star represents the first record for the Brazilian Cerrado, located in the state of Mato Grosso do Sul, Brazil.

### Preliminary conservation status and distribution of the species

A preliminary conservation status assessment was conducted using the IUCN Red List Categories and Criteria (IUCN – International Union for Conservation of Nature, 2012; IUCN Standards and Petitions Committee, 2024). A geographic distribution map was generated in QGIS software (2026) based on the georeferenced records of the examined herbarium vouchers and additional occurrence records retrieved from the SpeciesLink database (Figure 1).

## Results and discussion

Here we present a taxonomic treatment and a complete description of *I. spruceana*, clarifying its morphological limits and presenting an anatomical and palynological description, as well as its initial preliminary conservation status.

### Taxonomic treatment

***Ipomoea spruceana*** Benth. ex Meisn., Fl. Brasil. 7: 223. 1869. (Figure 2).

Type: BRAZIL. Pará, Santarém, May 1850, R. Spruce 703 (holotype M0184963, isotypes BM, MG, K).

*Climbing plants*, herbaceous; branches glabrous; internodes 25–80 mm long. *Leaf* blades 45–100 × 30–90 mm, 3–5-lobed, margin entire, base shallowly cordate to hastate, central lobe lanceolate 45–100 × 10–25 mm, apex acuminate, adaxial surface glabrous and sessile peltate glandular trichomes visualized by light and scanning electron microscopy, abaxial surface glabrous and sessile peltate glandular trichomes visualized by light and scanning electron microscopy, venation penninervous, brochidodromous type, with five to seven pairs of secondary veins; petiole 10–25 mm long, glabrous. *Inflorescence* cymose 1–4-flowers; peduncle 12–60 mm long, sparsely hispid-pilose; bracteoles 4.5–18 mm long, lanceolate to ovate, base rounded, apex acuminate, hirsute; pedicels 4.5–15 mm long, pilose. *Sepals* 5, unequal, the 2 outer ones 13–20 × 5–7 mm, ovate, base rounded, apex acuminate, densely pilose, the intermediate one 12–17 × 5–6 mm, ovate, base rounded, apex acuminate, pilose, the 2 inner ones 12–17 × 5 mm, ovate, base rounded, apex acuminate, pilose with scarious. *Corolla* 19–52 mm long, infundibuliform, pink, glabrous. *Filaments* 5, emerging from the base of the corolla, 6–13 mm long, glabrous; anthers usually narrowly oblong, 3 mm long, glabrous. *Ovary* 1–1.5 × 1.5–2 mm, globose; style entire, 5–6 mm long, stigmatic lobes 2, 0.5 mm long, oval. *Seeds* not observed.

**Anatomical description:** In the paradermal section and frontal view, the ordinary epidermal cells have sinuous anticlinal walls on the adaxial and abaxial surfaces, with sessile peltate glandular trichomes (Figure 3A–B). The leaf is amphihypostomatic. The adaxial surface has anisocytic and paracytic stomata (Figure 3A–E), while the abaxial surface has only paracytic stomata. In cross-section, the petiole has a concave-convex outline with a uniseriate epidermis and absence of trichomes (Figure 3F–G). The collenchyma is of the angular type with 2–3 layers of cells, arranged continuously along the petiole, followed by the fundamental parenchyma, composed of parenchyma cells of varying sizes and shapes (Figure 3G). The vascular system is bicollateral, comprising three bundles, the main

bundle being arch-shaped, located in the central region of the petiole and two smaller ones positioned on the adaxial surface. The stem has a circular shape with a uniseriate epidermis (Figure 3H). The cortical region of the stem is attached to the epidermis and is composed of 2–3 layers of angular collenchyma, followed by 3–4 layers of parenchyma (Figure 3I). Sclerenchyma fibers were observed around the phloem. In the vascular system, in a single growth ring, the xylem forms a continuous ring with xylem elements. The central region of the stem presents a pith composed of fundamental parenchyma with circular cells, the largest in the central region and the smallest near the xylem (Figure 3I).




**Figure 2:** Morphological features of *I. spruceana*. A. Voucher specimen of the new record deposited in the CGMS Herbarium. B. Flower showing the calyx densely covered with pilose indumentum. C. Detail of the leaf lobes.

**Pollen description:** The pollen grains of *I. spruceana* are monads, apolar, large (x = 95 × 92 µm) (Figure 3J–K), spheroidal, pantoporate, with wide circular pores (Figure 3L), about 100 circular pores (x = 4 µm), without a ring; exine tectate, echinate, and perforate. Spines bulbous (x = 16 µm) (Figure 3M), about 300, with acute apex and wide, polygonal base. The nexine is thicker than the sexine (total exine x = 10 µm; sexine x = 4 µm; nexine x = 6 µm).

**Distribution and habitat:** *Ipomoea spruceana* is endemic to Brazil and was previously considered restricted to the Amazon phytogeographical domain, where it has been recorded in the states of Amazonas, Maranhão, Mato Grosso, and Pará (Wood et al., 2020; Simao-Bianchini et al., 2026). The record from Mato Grosso do Sul presented here represents the first confirmed occurrence of the species in the Cerrado domain. Although Mato Grosso do Sul also encompasses the Pantanal phytogeographical domain, no confirmed records of *I. spruceana* are currently available for this region. Nevertheless, given the proximity of the new record to the Pantanal and the species' apparent association with humid environments, targeted botanical surveys may help clarify whether its distribution extends into this domain. Available herbarium data indicates that *I. spruceana* occurs between 506 and

600 m elevation and is consistently associated with humid environments near rivers and waterfalls. Although based on a limited number of collections, these records provide additional information on the species' habitat preferences. Flowering specimens have been collected between February and March.

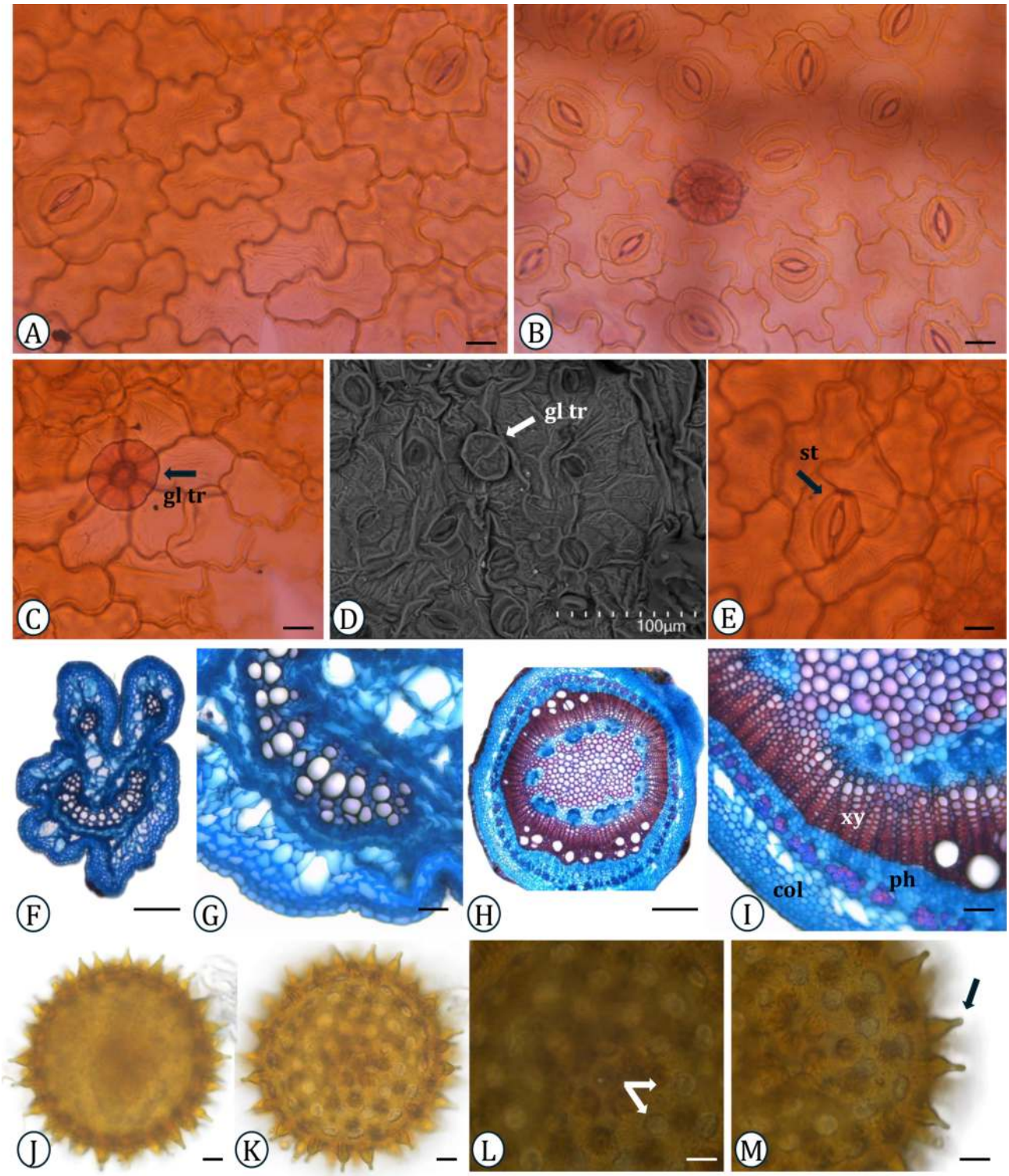



**Figure 3:** Anatomical and palynological characters of *I. spruceana*. A–I. Anatomical characters. A. Adaxial epidermis showing ordinary cells with sinuous anticlinal walls and paracytic stomata. B. Abaxial epidermis showing ordinary cells with sinuous anticlinal walls and paracytic stomata. C. Glandular trichome on the adaxial surface. D. Sessile peltate glandular trichome on the adaxial surface under scanning electron microscopy (SEM). E. Anisocytic stoma on the adaxial surface. F. General view of the petiole in cross-section. G. Detail of collenchyma cells and vascular bundles in the petiole. H. General view of the stem in cross-section. I. Detail of the stem showing collenchyma, phloem, and xylem. J–M. Palynological characters. J–K. General view of pollen grains. L. Detail of the pores. M. Detail of the spines.

**Preliminary IUCN conservation assessment:** We categorized this species as Endangered (criteria EN) according to B1 (EOO < 5000 km2) and B2ab (ii, iii) (AOO < 500 km2) from IUCN (2012, 2024).

**Specimens examined:** Mato Grosso. Comodoro, Balneário do Rio Juina, 19.03.2013. Alt 506m. fl., *A. Francener et al. 1337* (SP 446989!). Mato Grosso do Sul. Corguinho, Fazenda Salto do Taboco, Cachoeira do Rio Taboco, 08.02.2006, fl., *A. Pott et al. 13956* (CEN 105700!, CGMS 52768!).

**Taxonomic notes:** *Ipomoea spruceana* may be confused with some species characterized by lobed leaves, particularly when only vegetative material is available, a condition frequently encountered in specimens from northern Brazil. However, it can be readily distinguished from *I. rosea* Choisy by its densely villous sepals, whereas *I. rosea* has glabrous, ovate to oblong, rostrate outer sepals. It also differs from *I. mauritiana* Jacq., which possesses glabrous, elliptic to orbicular sepals lacking a rostrum (Wood et al., 2020; Simao-Bianchini et al., 2026). These differences in sepal indumentum and morphology provide reliable diagnostic characters for the identification of *I. spruceana*.

The occurrence of *I. spruceana* in the Cerrado broadens the known ecological and geographic amplitude of the species, previously regarded as restricted to Amazonian environments (Simao-Bianchini et al., 2026). The new record from Mato Grosso do Sul represents the first confirmed occurrence of the species in the Cerrado domain and extends its known distribution by 832 km from the nearest previously documented locality in Comodoro, Mato Grosso. Although the mechanisms underlying this distribution pattern remain unclear, the presence of *I. spruceana* in both Amazonian and Cerrado regions may reflect historical and ecological connections between these phytogeographical domains, which have long been recognized as important drivers of species distribution patterns in central Brazil (Brown & Lomolino, 1998; Lomolino, 2004; Simon et al., 2009). The present record reinforces the importance of taxonomic studies and herbarium revisions for improving our understanding of species distributions across these phytogeographical domains.

Despite having been described more than 150 years ago (Meisner, 1869), *I. spruceana* remains poorly represented in herbaria and biodiversity databases. The apparent scarcity of records may indicate genuine rarity, but it may also result from insufficient collecting effort in remote areas of northern and central Brazil. Collection shortfalls remain a major challenge for understanding plant diversity and species distributions, particularly in tropical regions (Hortal et al., 2015; Ondo et al., 2024). Similar situations have been reported for several species of Convolvulaceae whose known distributions were substantially expanded following herbarium revisions and targeted taxonomic studies (D. Santos et al., 2020; Belo et al., 2020; Belo, Buril, et al., 2023; Belo, Gasparino, & Buril, 2024; D. Santos & Buril, 2024). Therefore, the apparent distribution gap between the Amazonian records and the new occurrence in the Cerrado may represent, at least in part, a knowledge gap resulting from uneven botanical sampling rather than a true biogeographical discontinuity. Although Mato Grosso do Sul also encompasses the Pantanal phytogeographical domain, no confirmed records of *I. spruceana* are currently available from this region. Consequently, its occurrence in the Pantanal cannot be confirmed based on the available evidence, highlighting the need for additional botanical inventories, herbarium revisions, and taxonomic studies in central-western Brazil to better delimit the species' distribution and determine whether its apparent rarity reflects a truly restricted distribution or the consequences of historical under-sampling.

The anatomical characters observed in *I. spruceana* are largely consistent with those reported for other species of the genus, including *I. bahiensis* Willd. (Vital et al., 2008), *I. buriliae* Belo (Belo, Santos, & Gasparino, 2026), *I. cryptocarpa* Belo & Buril (Belo, Gasparino, & Buril, 2024), and *I. maranhensis* D.Santos & Buril (D. Santos et al., 2020). Features such as sinuous anticlinal walls, paracytic and anisocytic stomata, bicollateral vascular bundles and the presence of glandular trichomes have been repeatedly documented in *Ipomoea* and are considered characteristic for the genus (Belo, Santos, & Gasparino, 2026; Belo, Gasparino, & Buril, 2024). The presence of sessile peltate glandular trichomes further corroborates previous anatomical studies in Convolvulaceae, in which these structures have been reported as recurrent micromorphological features with potential taxonomic relevance (Belo, Louzada, & Buril, 2024; Belo, Gasparino, & Buril, 2024). Although these traits do not appear to provide exclusive diagnostic features for *I. spruceana*, they contribute to a broader understanding of anatomical variation within the genus and reinforce the taxonomic value of micromorphological studies in Convolvulaceae.

Palynologically, *I. spruceana* conforms to the pollen pattern commonly reported for species of the genus, characterized by large pantoporate grains with echinate ornamentation. Similar pollen morphology has been documented in several species of *Ipomoea* and is regarded as one of the most distinctive features of the genus within Convolvulaceae (Vital et al., 2008; Vasconcelos et al., 2015; Romeiro et al., 2023; Belo, Louzada, & Buril, 2024; Belo, Gasparino, & Buril, 2024). Although pollen morphology alone is generally insufficient for species delimitation in *Ipomoea* due to the high degree of similarity among species (Vital et al., 2008; Vasconcelos et al., 2015), quantitative variation in pollen size, pore number, spine dimensions and exine thickness may provide useful complementary evidence in integrative taxonomic studies.

Although the species is currently known from a few collections, the available occurrence data allowed a preliminary conservation assessment. Based on the calculated EOO and AOO values, *I. spruceana* meets the thresholds for Endangered under Criterion B (IUCN 2012, 2024). This assessment should be regarded as preliminary, since future surveys may reveal new populations and further enlarge the currently known distribution of the species. Additional fieldwork is therefore necessary to determine whether the restricted distribution currently observed reflects true rarity or is primarily a consequence

of collection gaps across Amazonian and Cerrado regions.

## Conclusion

The first record of *I. spruceana* in the Brazilian Cerrado significantly expands the known distribution of the species and provides new information on its habitat preferences, taxonomy and conservation. The anatomical and palynological data presented here establish a baseline for future comparative studies within *Ipomoea* and contribute to a better understanding of micromorphological variation in Convolvulaceae. Given the limited number of known collections and the preliminary conservation assessment as Endangered, further botanical inventories, herbarium revisions and field surveys are essential to clarify the species' distribution, population status, and conservation needs.

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