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Flora of Maranhão, Northeastern Brazil: Droseraceae

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ABSTRACT

Drosera is a cosmopolitan genus of carnivorous plants with around 250 species and centers of diversity in Australia, Brazil and South Africa. It is characteristic of open, sunny landscapes and seasonally moist oligotrophic soils. In Brazil, 32 species occur, and in the state of Maranhão, until now, only *Drosera sessilifolia* had been recorded. Despite the richness of Maranhão's flora, the state remains undersampled regarding its botanical diversity. The aim of this study was to investigate the diversity of the genus *Drosera* in Maranhão through field sampling, literature review, and consultation of online databases with exsiccates from Maranhão. Studies carried out between 2016 and 2023 made it possible to expand the list of *Drosera* species from Maranhão from one to four. In addition to the species previously recorded for the Maranhão flora (*D. sessilifolia*), three more were added (a 300% increase): *D. cayennensis*, *D. communis* and *D. intermedia*. Of these, *D. intermedia* had its first record for the Brazilian Cerrado and also its first record as a floating aquatic life form in Brazil (without any contact with the ground throughout the year). Taxonomic descriptions, identification keys, geographical distribution maps and photographic plates of these species are presented.

Keywords: Carnivorous plants, floristic, geographic distribution, new occurrences, taxonomy.

Flora do Maranhão, Nordeste do Brasil: Droseraceae

RESUMO

Drosera é um gênero cosmopolita de plantas carnívoras com cerca de 250 espécies e centros de diversidade na Austrália, Brasil e África do Sul. É característico de paisagens abertas, ensolaradas e solos oligotróficos sazonalmente úmidos. No Brasil, ocorrem 32 espécies, sendo que no estado do Maranhão, até o momento, apenas *Drosera sessilifolia* havia sido registrada. Apesar da riqueza da flora maranhense, o estado continua carente de diversidade botânica. O objetivo deste estudo foi investigar a diversidade do gênero *Drosera* no Maranhão através de amostragem de campo, revisão de literatura e consulta a bancos de dados online com exsicatas do Maranhão. Estudos realizados entre 2016 e 2023 possibilitaram a ampliação da lista de espécies de *Drosera* do Maranhão de uma para quatro. Além da espécie já registrada anteriormente para a flora maranhense (*D. sessilifolia*), foram acrescentadas mais três (um aumento de 300%): *D. cayennensis*, *D. communis* e *D. intermedia*. Destas, *D. intermedia* teve seu primeiro registro para o Cerrado brasileiro e também seu primeiro registro como forma de vida aquática flutuante no Brasil (sem nenhum contato com o solo durante todo o ano). São apresentadas descrições taxonômicas, chaves de identificação, mapas de distribuição geográfica e placas fotográficas destas espécies.

Palavras-chave: Plantas carnívoras, florística, distribuição geográfica, novas ocorrências, taxonomia.

Introduction

The carnivorous or insectivorous plants are so called due to the set of morphological and physiological adaptations for capturing prey, mainly invertebrates and, rarely, some smaller vertebrate species (Juniper et al., 1989). In the different lineages of carnivorous plants, animals are captured by leaves modified into traps, the most common type being that formed by trichomes or adhesive glandular emergences, although there is a great diversity of forms and types of traps (Fleischmann et al., 2018a, Heubl et al., 2006). These plants generally grow in sunny, humid and oligotrophic environments, so carnivory plays a part in supplementing the mineral nutrition of these species. The digestion of captured animals is carried out through digestive enzymes produced by the glands of carnivorous plants but there is also evidence that this digestion is aided by microorganisms and even invertebrates in some species (Adamec, 1997; Fleischmann et al., 2018b; Givnish et al., 1984; Juniper et al., 1989).

Carnivorous plants are Angiosperms and comprise around 860 species, divided into 20 genera, 13 families and six orders, forming a polyphyletic group with at least 11 independent origins among eudicots and monocots (Fleischmann et al., 2018b; Lin et al., 2021). Among the carnivorous plant families, Droseraceae Salisb. (order Caryophyllales) comprises three genera: *Aldrovanda* L., *Dionaea* Sol. ex J.Ellis (which are monotypic and do not occur naturally in Brazil) and *Drosera* L., the only genus that occurs in Brazil (Fleischmann et al., 2018b; Gonella et al., 2022a).

Drosera is a cosmopolitan genus with around 250 species and centres of diversity in Australia, Brazil and South Africa (Fleischmann et al., 2018b). Although around 65 per cent of the species are restricted to south-western Australia, the genus is distributed across all continents except Antarctica (Juniper et al., 1989). The genus is characteristic of open, sunny landscapes and is associated with seasonally moist oligotrophic soils (Fleischmann et al., 2018b). In Brazil, the genus has 32 species distributed throughout the country, occurring in all phytogeographic domains and with the greatest diversity of species in the Cerrado, with 20 species, the Atlantic Forest, with 13 species, and the Amazon, with 10 species (Flora e Funga do Brasil, 2024). The campos rupestres of eastern Brazil are recognized as the main center of diversity of the genus in the Neotropics, with 23 species, 13 of which are endemic, with Minas Gerais and Bahia being the

most representative states, with 21 and 10 species, respectively (Gonella et al., 2022b). According to Flora e Funga do Brasil (2024), the northeastern states have little diversity of species of the genus *Drosera*, usually one or two, with the exception of the state of Bahia. Only one species has been recorded for the state of Maranhão, *Drosera sessilifolia* A.St.-Hil. (Gonella, 2024).

Despite the richness of Maranhão's vegetation, due to the ecotones formed by the presence of three Phytogeographic Domains in its territory, its flora is still poorly known, as indicated by the many new species recently described (e.g. Silva et al., 2023; Costa da Silva et al., 2023; Guarçoni et al., 2020a; Scatigna et al., 2019, 2020) and the various records of new occurrences published recently (e.g. Ferreira et al., 2022; Guarçoni et al., 2020b, 2022; Guarçoni & Marinho, 2023; Lima et al., 2022; Oliveira et al., 2022a; Oliveira et al., 2022b; Pestana et al., 2022; Salazar-Ferreira et al., 2022; Silva et al., 2022).

The aim of this study was therefore to record how many species of the genus *Drosera* occur in the state of Maranhão.

In this work, we carry out a taxonomic treatment of the Droseraceae species from Maranhão, increasing the number of *Drosera* species recorded from one to four. We provide an identification key, photographs, morphological descriptions, distribution maps, and comments on taxonomy, ecology, conservation status and distribution for the species that occur in the state.

Materials and Methods

The state of Maranhão is located in the Northeast region of Brazil (7°02'39.6''S; 47°26'28.0''W), bordering the states of Pará to the west, Piauí to the east, Tocantins to the south, and the Atlantic Ocean to the north, covering an area of approximately 332,000 km² (Batistella et al., 2014). The state has three distinct phytogeographic domains: the Cerrado, with 64.1 per cent of the territory, the Amazon, with 34.8 per cent, and the Caatinga, with 1.1 per cent. When these domains meet, they form ecotonal areas, constituting transition zones, climates and vegetation, with a wide variety of phytophysognomies (Fig. 1) (Spinelli-Araújo et al., 2016; Stella, 2011). Maranhão has a tropical rainy climate - AW (humid with moderate water deficit) (Köppen, 1948), with an average annual temperature of between 25° and 26° C and average annual rainfall of between 1,400-1,800 mm, making it one of the Northeastern states with the lowest water deficit (Martins & Oliveira, 2011). Its dry season usually occurs between July and December, while the rainy

season is between January and June (Spinelli-Araújo et al., 2016).

Field collections took place between January 2016 and June 2023, throughout the state. Specimens available in digital herbaria accessible through the speciesLink (2024) and REFLORA Virtual Herbarium (2024) platforms were examined. The description of the species was based

on fieldwork, material from the physical (BMA, HUNI, MBM, SLUI) and virtual (IAN, TEPB) herbaria (acronyms according to Thiers, 2024) and complemented by information from the literature on Drosera (Correa & Silva, 2005; Fleischmann et al, 2018b; Fleischmann & Gonella, 2020; Gonella et al, 2022a, b; Gonella, 2024).

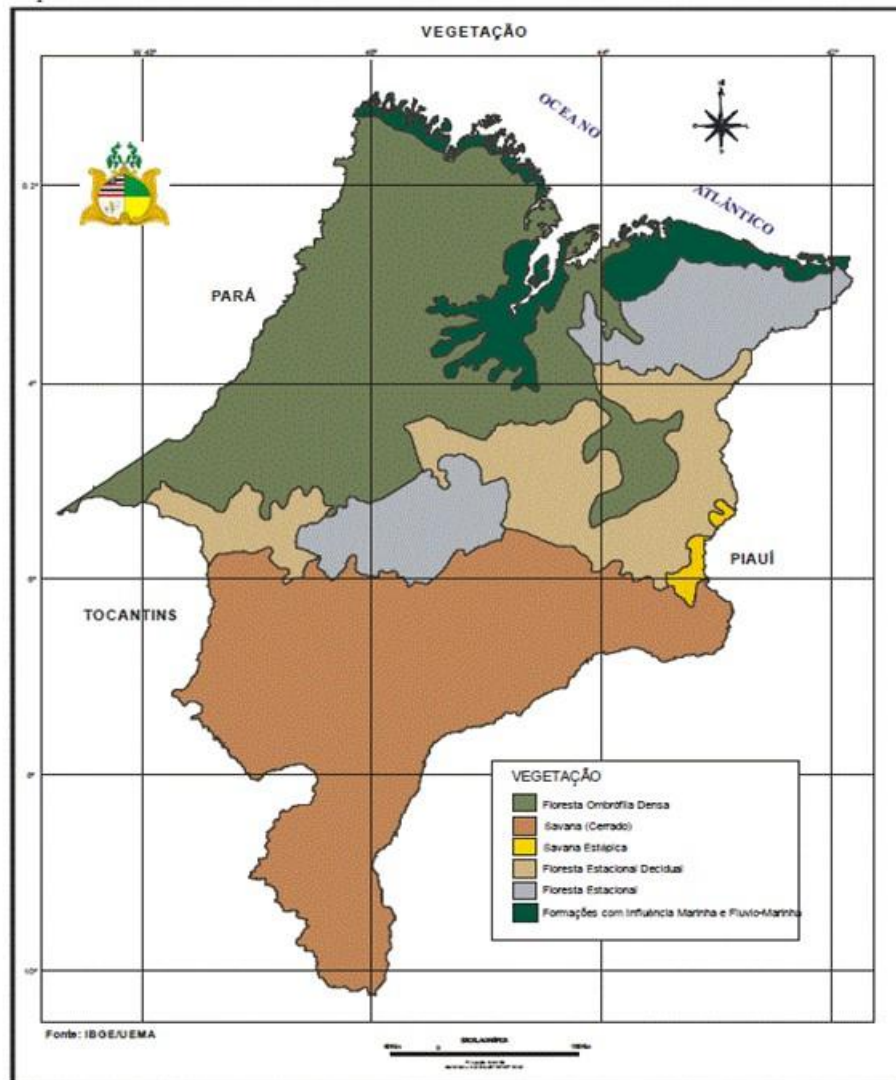


Figure 1: Map of the state of Maranhão showing its location and phytogeographical regions (Fonte: IBGE/UEMA).

The morphological terminology used follows specialized literature on the family (Gonella et al., 2022b).

All the material collected was herborized following the standard methods described in Fidalgo and Bononi (1984) and incorporated into the BMA herbarium. Observations about the populations, their habitats and flowering times were recorded.

The material with photographic documentation was collected in the field,

photographed and registered in the BMA and SLUI herbaria (acronyms according to Thiers, 2024).

The geographical distribution followed the information available in the Flora e Funga do Brasil (2024) and SpeciesLink (2024) databases. Geographical distribution maps in Maranhão were created in QGIS 3.30.1 software (QGIS Development Team, 2023), using the SIRGAS 2000 datum. The conservation status followed Cross et al. (2020) at a global level and Gonella et al. (2022b) at a national level.

In this paper we analyse the conservation

status of the species for the state of Maranhão. The criteria used to analyse the status of the species were based on their registration within Conservation Units and their distribution range.

Results and Discussion

The field work and study of specimens deposited in herbaria revealed the occurrence of four species of *Drosera* in the state of Maranhão, all in humid environments: *Drosera cayennensis* Sagot ex Diels, in meadow areas; *D. communis* A.St.- Hil. Hil. in sandy soils, near gallery forest or veredas; *D. intermedia* Hayne, in areas between dunes or near veredas in sandy soil; and *D. sessilifolia*, in the restinga, in areas between dunes that form temporary lagoons, and in humid sandy areas of the Cerrado (Fig. 2).

Of these four species, *D. intermedia* had its first record for Brazil's Cerrado and also its first record with the aquatic life form in Brazil, on the surface of the water, developing on clumps of chlorophycean algae, without any contact with the ground throughout the year.

Until now, only *D. sessilifolia* had been recorded for the flora of Maranhão (Flora e Funga do Brasil, 2024; Gonella, 2024).

Based on this study, the number of species of the genus *Drosera* species in Maranhão increased from one to four (an increase of 300%), highlighting the lack of botanical studies in this Brazilian state.

All four species of *Drosera* recorded for Maranhão are assessed in the Least Concern (LC) category, both globally (Cross et al., 2020) and nationally (Gonella et al., 2022b). However, all four species are subject to various threats due to human activities in Maranhão, especially habitat conversion for agriculture, livestock and urban expansion (Spinelli-Araújo et al., 2016). Only *D. cayennensis* was not recorded in a protected area in Maranhão; *D. communis* was recorded in the Chapada das Mesas National Park (PARNA) and Mirador State Park; *D. sessilifolia* was recorded in the PARNA Chapada das Mesas and PARNA Lençóis Maranhenses; and *D. intermedia* only in the PARNA Lençóis Maranhenses.

In this way, we consider that *D. communis*, *D. sessilifolia* and *D. intermedia* are assessed in the Least Concern (LC) category for the state of Maranhão because they are within the boundaries of conservation units and are therefore protected. *D. cayennensis*, on the other hand, was classified as Data Deficient (DD) because it didn't have enough information about its level of threat. More studies are therefore needed before it can be evaluated.

All four species were found flowering in both the dry and rainy seasons, with the tendency for most of the individuals in these populations to flower during the rainy season. *Drosera cayennensis* may have a longer flowering period compared with the other species, as the records in Maranhão present a broad range, with flowering specimens collected in the months of April (09.IV.2023, M.S. da Silva 70 (SLUI!)) and 11.IV.2023, M.S. da Silva 156 (SLUI!)) and August (15.VIII.1958, R.L. Froés 34539 (IAN!)). However, new collections at other times of the year will be necessary to help establish more precisely the range of its flowering period.

Taxonomic treatment

Droseraceae Salisb. - Annual or perennial carnivorous herbs. Stem inconspicuous or elongated. Leaves simple, stipules present or absent, vascularized glandular emergences present on the adaxial lamina surface, or lamina modified into a bilobed snap trap with sensitive trichomes over the adaxial surface. Inflorescence cymose, multi-flowered (rarely uniflorous). Flowers 5-merous (rarely 4-merous), actinomorphic; stamens 5(-many), anthers longitudinally dehiscent; ovary superior, 3-5-carpellar; styles 1-5 (usually 3), usually bifurcated at the base (rarely entire); ovary with parietal placentation (rarely basal), pluriovulated. Fruit a loculicidal capsule; seeds numerous.

Drosera L. (description based solely on the species occurring in Maranhão) - Terrestrial herbs. Leaves rosetted or spirally arranged, stipulate, petiolate, red or greenish, sessile glands always present; stipules intrapetiolate, membranaceous, with lacinate apex; petiole linear, glabrous or with eglandular or glandular trichomes; blade oblong, lanceolate or spatulate, with glandular emergences (tentacles) on adaxial surface, abaxial surface glabrous or pilose. Inflorescence a scorpioid cyme, multiflorous; scape glabrous or eglandular-pilose. Flowers ephemeral, anthesis lasting a few hours; sepals fused at base, glabrous or glandular-pilose or eglandular-pilose; petals white or pink; stamens 5; ovary 1-locular; styles forked at the base or entire. Petals, sepals and stamens persistent in fruit. Fruit a dry capsule, loculicidal.

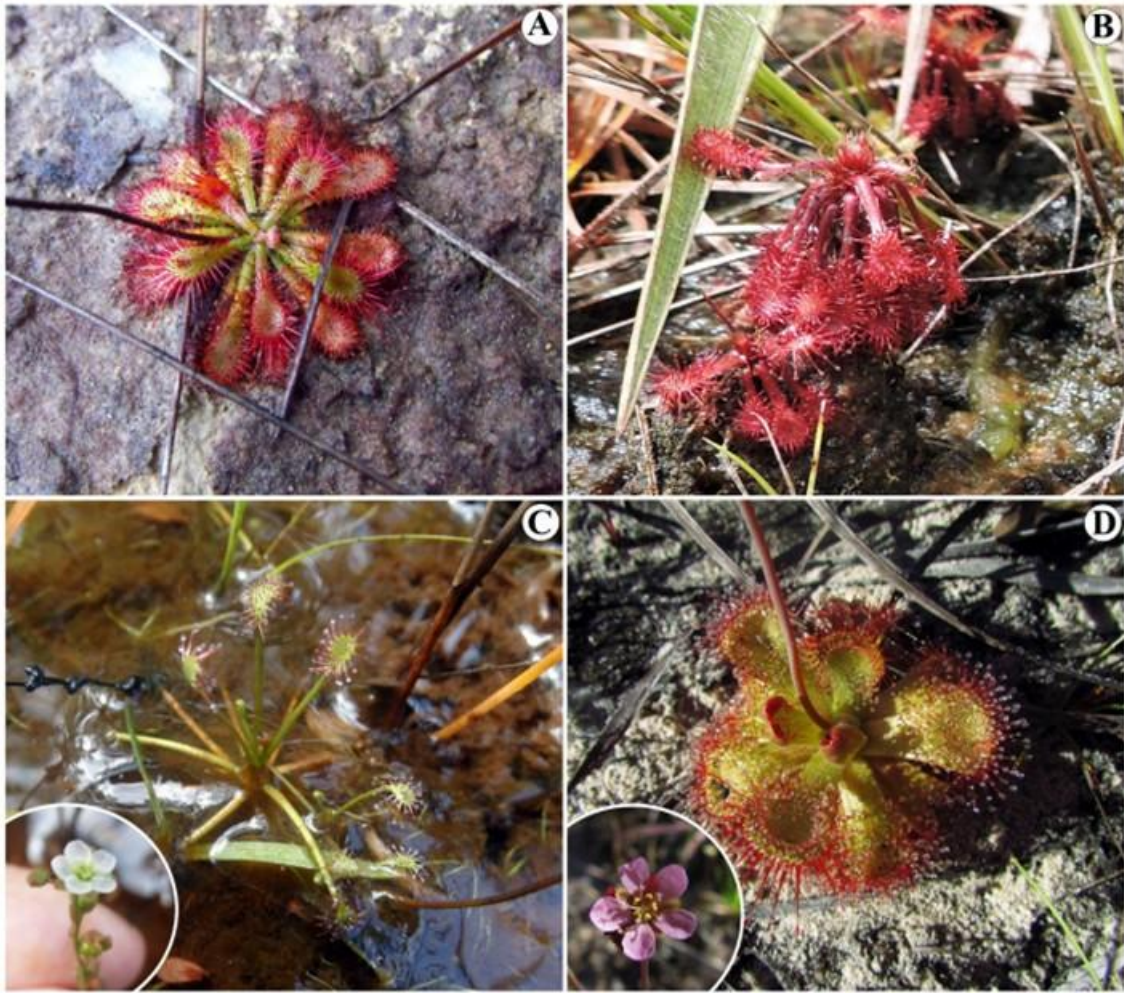


Figure 2. Species of the Droseraceae family that occur in Maranhão. A. *Drosera cayennensis*. B. *D. communis*. C. *D. intermedia*. D. *D. sessilifolia*. (Photos: A and D. Paulo M. Gonella; B. Elidio Guarçoni, C. Alessandro W.C. Ferreira).

The genus *Drosera* comprises about 250 species concentrated mainly in the Southern Hemisphere. The genus is identified by the presence of vascularized emergences each topped with a gland (tentacles) on the adaxial surface of the leaf blade. The main center of diversity of the genus is located in southwestern Australia, followed by northern Australia, the Cape Province of South Africa and the mountains of central-eastern Brazil (Fleischmann et al., 2018b).

Identification key to the species of Drosera from the Maranhão state

1. Leaves glabrous; petiole at least 3 times longer than the lamina..... *D. intermedia*
1'. Leaves densely covered with minute glandular trichomes or with eglandular trichomes mainly along the petiole abaxial surface and margins; petiole equaling to about twice as long as the lamina 2

2. Leaves with glandular trichomes only; scape base straight and glabrous; gynoecium 5-merous, styles 5, entire *D. sessilifolia*
2'. Leaves with eglandular trichomes only; scape curved at the base or, if straight, then eglandular-pilose; gynoecium 3-merous, styles 3, bifurcated at the base (6 stigmatic tips) 3
3. Leaves semi-erect; scape curved at the base, glabrous; seeds fusiform, testa reticulate *D. communis*
3'. Leaves patent; scape straight at the base, eglandular-pilose; seeds ovoid, testa foveolate *D. cayennensis*

1. *Drosera cayennensis* Sagot ex Diels in Das Pflanzenreich, IV.112 (Heft 26): 86, 1906.
Figure 2A and 3

Perennial herb, terrestrial, 3.9-7 cm tall in bloom. Leaves in rosettes, vinaceous, adpressed to

the ground, abaxial surface with filamentous trichomes, adaxial side of the petiole glabrous; petiole 5-6 mm long; lamina 2.5-4 mm long, obovate, obtuse apex, with glandular emergences on the adaxial surface; stipules 2-3 mm long. Inflorescence vinaceous, sericeous, with filamentous trichomes, 1-3 flowers, sericeous pedicels; sepals 3-5 mm long, reddish, abaxial surface sericeous, filamentous trichomes, lanceolate, acute apex; petals rose, unguiculate, obovate. Ovary tricarpetal; stipes bifurcate from the base. Fruits 3-valvate, seeds ovoid, testa foveolate.

Material examined: BRAZIL, Maranhão: rio Gurupi, 15.VIII.1958, *R.L. Froés* 34539 (IAN!). Carutapera, Campina da Passagem, 10.IV.2023, *M.S. da Silva* 88 (SLUI!); Carananduiua, 09.IV.2023, *M.S. da Silva* 70 (SLUI!). Boa Vista do Gurupi, direção do rio Gurupi, ramal próximo ao povoado Vilela, 11.IV.2023, *M.S. da Silva* 156 (SLUI!).

Comments: *Drosera cayennensis* can be recognized by its patent leaves with only

filamentous trichomes, erect scape at the base, scape and sepals covered with filamentous trichomes and seeds with a foveolate testa. The species occurs from Central America (Costa Rica, Panama) to South America (Bolivia, Brazil, Colombia, French Guiana, Guyana, Peru, Suriname and Venezuela) (Gonella et al., 2022b). In Brazil, the species has been recorded in the states of Acre, Amazonas, Amapá, Distrito Federal, Goiás, Mato Grosso, Pará, Rondônia, Roraima, Tocantins, in the Amazon and Cerrado domains (Gonella, 2024). This is the first record of the species for Maranhão, where it was recorded in the municipalities of Carutapera and Boa Vista do Gurupi, in the Amazon domain. In Maranhão, the species was recorded in a campinarana area, on sandy and seasonally humid soils.

Phenology: The species was collected with flowers in April and August.

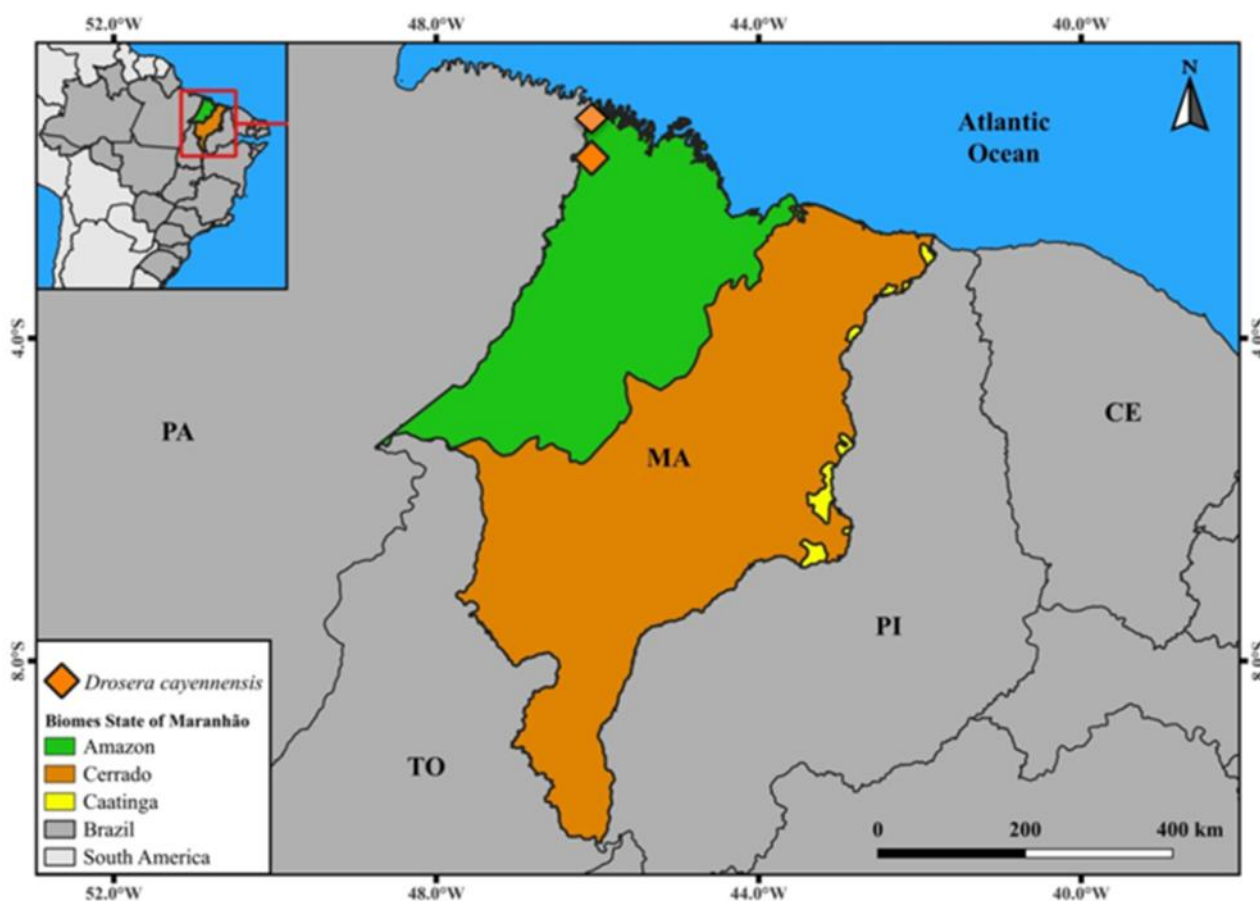


Figure 3. Geographical distribution of *Drosera cayennensis* in the state Maranhão.

2. *Drosera communis* A.St.-Hil. in Pl. Usuel. Bras. I (3): 1-5, 1824.
Figure 2B and 4

Perennial herb, terrestrial, 7-14 cm tall in bloom. Leaves in rosettes, vinaceous, semi-erect, adaxial side of petiole and entire abaxial surface with sparse filamentous trichomes; petiole 1.6-3.6 mm long; lamina 1.2-1.9 mm long, obovate, obtuse apex, with glandular emergences on the adaxial surface; stipules 1-4 mm long. Inflorescence vinaceous, papillose, with glandular trichomes at the apex, 3-8 flowers, pedicels 1-3 mm long, with glandular trichomes; sepals 3-4 mm long, vinaceous, joined near the base, abaxial surface with glandular trichomes, oblong-ovate, acute apexes; petals 6-7 mm long, pink, unguiculate, obovate; filament 2-3 mm long, anthers ca. 0,5 mm long. Ovary tricarpeal, 1-2 mm long; styles 3, 2-3 mm long, bifurcate from the base. Fruits 3-valvate, fusiform seeds, reticulate testa.

Material examined: BRAZIL, Maranhão: Balsas, rio Caracol, Gerais de Balsas, 08°41'39"S, 46°32'21"W, 26.VII.2021, *Engels, M.E. 9027 & Engels, R.W.* (MBM 443517!). Carolina, PARNA Chapada das Mesas, est. Fazenda Monte Alegre, região da Serra Vermelha, 209 m elev., 07°06'55"S, 47°17'06"W, 27.I.2021, *Guarçoni, E.A.E. 2597 & Lucas C. Marinho* (BMA 2477!). Mirador, Parque Estadual do Mirador, Posto da Geraldina, Brejo do Papa Fogo, 06°43'58"S, 45°41'20"W, 20.VIII.2021, *A.V. Scatigna 1330, R.M. Machado, M.S. Silva & D.R. Costa* (BMA 2946!). São Raimundo das Mangabeiras, Serra de Itapecuru, 451 m elev., 06°43'00"S, 45°44'03"W, 07.II.2016, *Guarçoni, E.A.E. 2426, Alessandro W.C. Ferreira & Eduardo Oliveira Silva* (BMA 1420!).

Comments: *Drosera communis* can be recognized by its semi-erect leaves with filamentous trichomes, a scape that is curved at the base and glabrous, sepals with glandular trichomes and fusiform seeds with a reticulated testa. It is widely distributed in South America, from Colombia to

southern Brazil (Gonella et al., 2022b). In Brazil, the species occurs in the Amazon, Caatinga, Cerrado, Atlantic Forest and Pantanal, with records for the states of Bahia, Distrito Federal, Goiás, Mato Grosso do Sul, Mato Grosso Paraíba, Minas Gerais, Paraná, Pernambuco, Rio de Janeiro, Rio Grande do Norte, Rio Grande do Sul, Roraima, Santa Catarina, São Paulo, and Tocantins (Gonella, 2024). The species was recently recorded for Maranhão, in the municipality of Carolina (Guarçoni & Marinho, 2023) and, in this work, new records are added in the municipalities of Balsas, Mirador and São Raimundo das Mangabeiras. The species has been recorded in moist, sandy soils of veredas and gallery forests.

Phenology: Collected with flowers in January, February, July and August.

3. *Drosera intermedia* Hayne in Dreves & Hayne, Bot. Bilderb. 3: 18, t. 3B. 1798.
Figure 2C, 5 and 6A-D

Perennial herb, terrestrial or floating aquatic, 7-14 cm tall in bloom. Leaves in rosettes, green to reddish, semi-erect; petiole 14-24 mm long, glabrous on both sides, with only sessile glands; lamina 7-12 mm long, spatulate, rounded apex, with glandular emergences on the adaxial face; stipules ca. 2,5 mm long. Inflorescence 2-3 per plant, slightly curved at the base, red, 7-14 flowers, 8-14 cm long (including the floriferous part); sepals 3.5-4.5 mm long, green, minute sessile glands, lanceolate, acute apex; petals 4-5 mm long, whitish, unguiculate, obovate; filaments 3-4 mm long, anthers ca. 0.4 mm long; gynoecium tricarpeal; ovary ca. 3 mm long, globose; stipes 3, forked from the base. Fruit not seen.

Material examined: BRAZIL, Maranhão: Morros, margem da MA 402, nascente afluenta do rio Una, pequena vereda com palmeira buriti, 02°51'19"S, 44°01'03"W, 14.V.2022, fl., *A.W.C. Ferreira 614* (SLUI!). *Ibid.*, 14.V.2022, fl., *A.W.C. Ferreira*

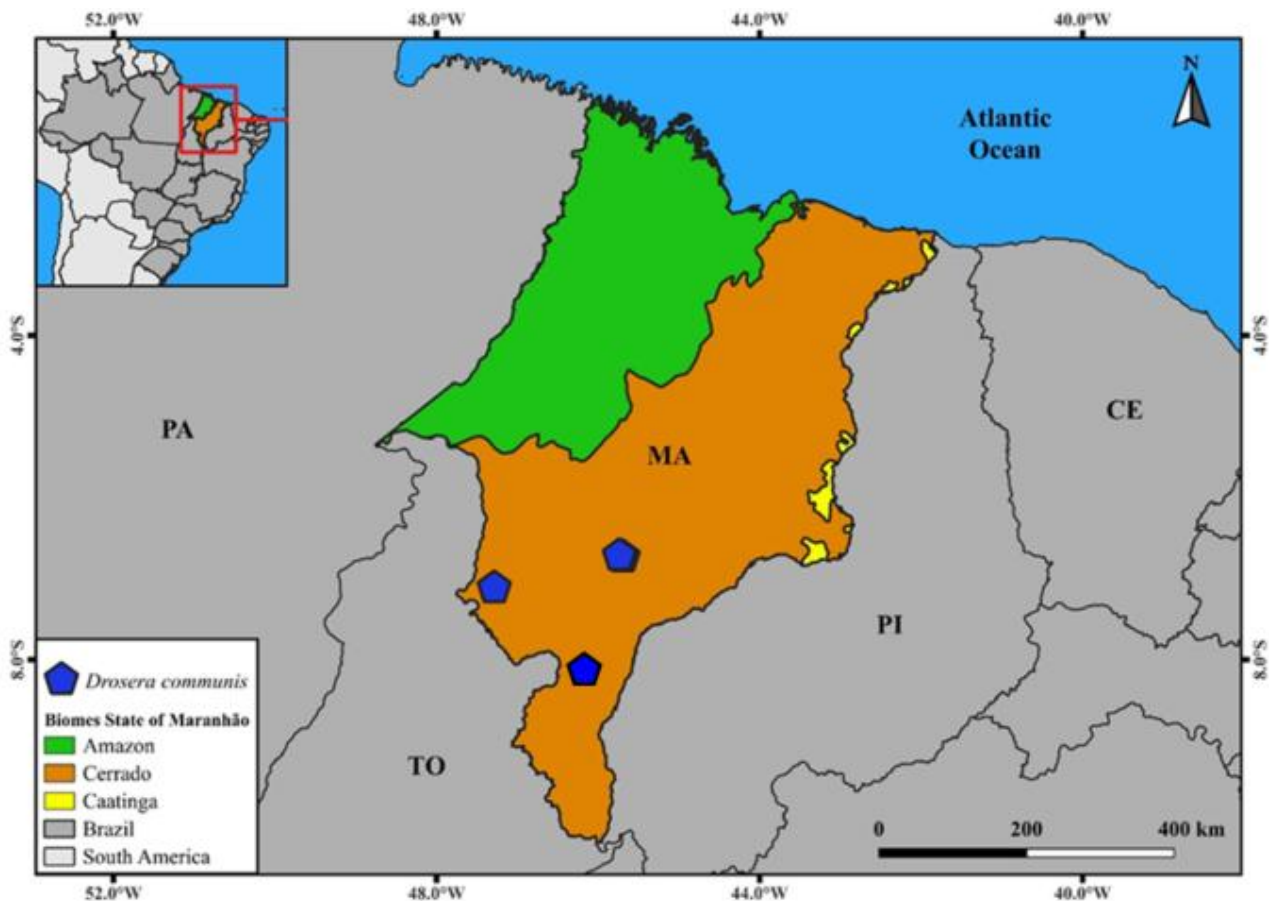


Figure 4. Geographical distribution of *Drosera communis* in the state of Maranhão.

615 (SLUI!). *Ibid.*, 01.V.2023, fl., A.W.C. Ferreira 1205 (SLUI!). Santo Amaro, Parque Nacional dos Lençóis Maranhenses, próximo a lagoa Passarela; 02°30'04"S, 43°11'34"W, 06.X.2022, E.A.E. Guarçoni 2694 & J.D.S. Sousa (BMA 2821!).

Additional Material Examined: BRAZIL, Bahia: Caravelas, estrada para o aeroporto de Caravelas, após 3 Km, 24.XII.1998, C.P. Bove 373, W. Costa & B.B. Costa (HUNI 127!). Rio de Janeiro: Carapebus, Lagoa Blau, 01.X.1999, C.P. Bove 476, G. Malva & C.B. Moreira (HUNI 6182!).

Comments: *Drosera intermedia* can be easily recognized by its semi-erect, glabrous leaves with only sessile glands, glabrous scape and sepals, and seeds with a papillose testa. It occurs in tropical South America, the Caribbean, eastern North America, Europe and Asia Minor (Fleischmann & Gonella, 2020). In Brazil, the species has been recorded in the states of Amapá, Bahia, Espírito Santo, Rio de Janeiro and Roraima (Gonella, 2024; Gonella et al., 2022a, 2022b), in the Amazon and Atlantic Rainforest domains. This paper presents the first record of the species for Maranhão and the Cerrado in Brazil. In Maranhão, *D. intermedia* has so far been found in the municipality of Santo

Amaro, within the area of the Lençóis Maranhenses National Park (PNLM), and in the municipality of Morros.

In the PNLM, it occurs between dunes hats during the rainy season and can be seen during the dry season, usually from September onwards. The species is seen in the lagoon edge areas associated with *D. sessilifolia*. In Morros, *D. intermedia* was observed in the region of the flooded spring of a stream tributary to the Una River, in a small vereda with buriti palms (*Mauritia flexuosa* L.f., Arecaceae), where it does not coexist with *D. sessilifolia*. In this location, *D. intermedia* grows both as a terrestrial plant (in sandy soil, on the moist banks of the stream) and as an aquatic plant, on the surface of a swampy spot in the watercourse. Throughout the year, individuals of *D. intermedia* were observed developing in two ways: terrestrial individuals (sandy soil) and aquatic individuals (on the surface of the water, without any contact with the ground). In the terrestrial life form, the individuals of *D. intermedia* settle in waterlogged soil (from July to December, the dry season in this study region) or partially covered by water in the rainy season (from January to June) (Figure 1C). In other words, the individuals that grow on the ground spend part of

the year (around six months) without direct contact with the water and around six months partially submerged. In the aquatic condition (Figure 6A-D), the individuals of *D. intermedia* were observed throughout the year (dry and rainy seasons) always in contact with the water, resting on clusters of chlorophycean algae intertwined with the aquatic macrophytes *Nymphaea pulchella* DC. (Nymphaeaceae) and *Urospatha sagitifolia* (Rudge) Schott. (Araceae). Therefore, throughout the year, only the roots are always submerged. The leaves are not partially submerged because the chlorophycean algae float and support the individuals of *D. intermedia*. During the rainy season, the water current does not usually carry the banks of algae closest to the shore. Eventually, it

carries some individuals whose entanglement in chlorophycean algae becomes disconnected from their anchorage in the aquatic macrophytes. This may contribute to the dispersal of *D. intermedia* individuals to other parts of the watercourse. Specimens of *D. intermedia* usually remain on the surface of the water all year round, in full sunlight or temporarily shaded by some shrub near the banks. In the literature, there is information that *D. intermedia* is only found as a terrestrial in Brazil (Gonella et al., 2022a, 2022b; Gonella, 2024), while its habit as a floating and submerged aquatic is common in populations in Europe (Banás et al., 2024). Therefore, this is its first record with a totally aquatic life form in Brazil (Figure 6A-D).

Phenology: Flowers are seen from May to October.

4. *Drosera sessilifolia* A. St.-Hil. in Hist. Pl. Remarq. Bresil 1: 259, 1826.
Figure 2D and 7

Perennial herb, terrestrial, 9.7-21.2 cm tall in bloom. Leaves in rosettes, green to vinaceous, patent to semi-erect, spatulate, adaxial side of the petiole and the entire abaxial surface densely covered with short glandular trichomes; petiole 4.3-20 mm long; lamina 1-2.9 mm long, rounded apex, with glandular emergences on the adaxial surface; stipules 0.3-0.5 mm long. Inflorescence vinaceous, glabrous, 4-6 flowers, red pedicels, with glandular trichomes; sepals 3-4 mm long, vinaceous, papillose abaxial surface with glandular trichomes, lanceolate, acute apex; petals 4-5.5 mm long, rosaceous, obovate; filaments 2-3 mm long, anthers ca. 0.4 mm long. Ovary pentacarpellate, ca. 3 mm long, globose; styles 5, entire. Fruit not seen. 27.I.2021, *Elidio Guarçoni* 2596, *Lucas C. Marinho* (BMA 2401!); Parque Nacional da Chapada das Mesas, Cachoeira da Prata, margem arenosa do rio Farinha; 06°59'36"S, 47°09'57"W; 24.VIII.2021; A.V. *Scatigna* 1395, R.M. *Machado*, M.S. *Silva* & A. *Barros* (BMA 2911!); Canto da Rosa; 07°07'06"S, 47°04'30"W; 24.VIII.2021; A.V. *Scatigna* 1411, R.M. *Machado*, M.S. *Silva* & A. *Barros* (BMA 2952!); Vereda do Ribeirão Serra Vermelha; 07°06'57"S, 47°17'08"W,

Material examined: BRAZIL, Maranhão: Aldeias Altas, Poção, 04°36'56"S, 43°30'24"W, 22.VIII.2015, *Elidio Guarçoni* 2360, *Eduardo O. Silva* & *Miguel Sena* (BMA 1085!). Araisos, Ilha do Caju, 17.VI.1981, A.J. *Castro s.n.* (TEPB 1843!). Barreirinhas, PARNA Lençóis Maranhenses, Baixa Grande, 02°32'10"S, 42°59'20"W, 26.VIII.2017, *Elidio Guarçoni* 2597 (BMA 1864!); Circuito da Lagoa Azul, 02°39'32"S, 42°50'23"W, 14.VIII.2018, *Milena Salazar Ferreira* 5, *Elidio Guarçoni* & *Jordana Martins* (BMA 2074!); região do rio Negro, Baixa Grande, 04°31'45"S, 43°00'28"W, *Milena Salazar Ferreira* 19, *Elidio Guarçoni* & *Jordana Martins* (BMA 2072!); Mata Fome, 02°37'47"S, 42°48'30"W, 15.VIII.2018, *Milena Salazar Ferreira* 29, *Elidio Guarçoni* & *Jordana Martins* (BMA 2073!); Carolina, PARNA Chapada das Mesas, estr. Fazenda Monte Alegre, região da Serra Vermelha, 07°06'55"S, 47°17'06"W,

24.VIII.2021; A.V. *Scatigna* 1419, R.M. *Machado*, M.S. *Silva* & A. *Barros* (BMA 2901!). Icatu, próximo à lagoa, 16.VII.2022, L.C. *Marinho et al.* 1815 (MAR 13760!). Santo Amaro, PARNA Lençóis Maranhenses, próximo a lagoa da Passarela, 02°30'04"S, 43°11'34"W, 06.X.2022, *Guarçoni*, E. 2693 & *Sousa*, J.D.S. (BMA 2810!).

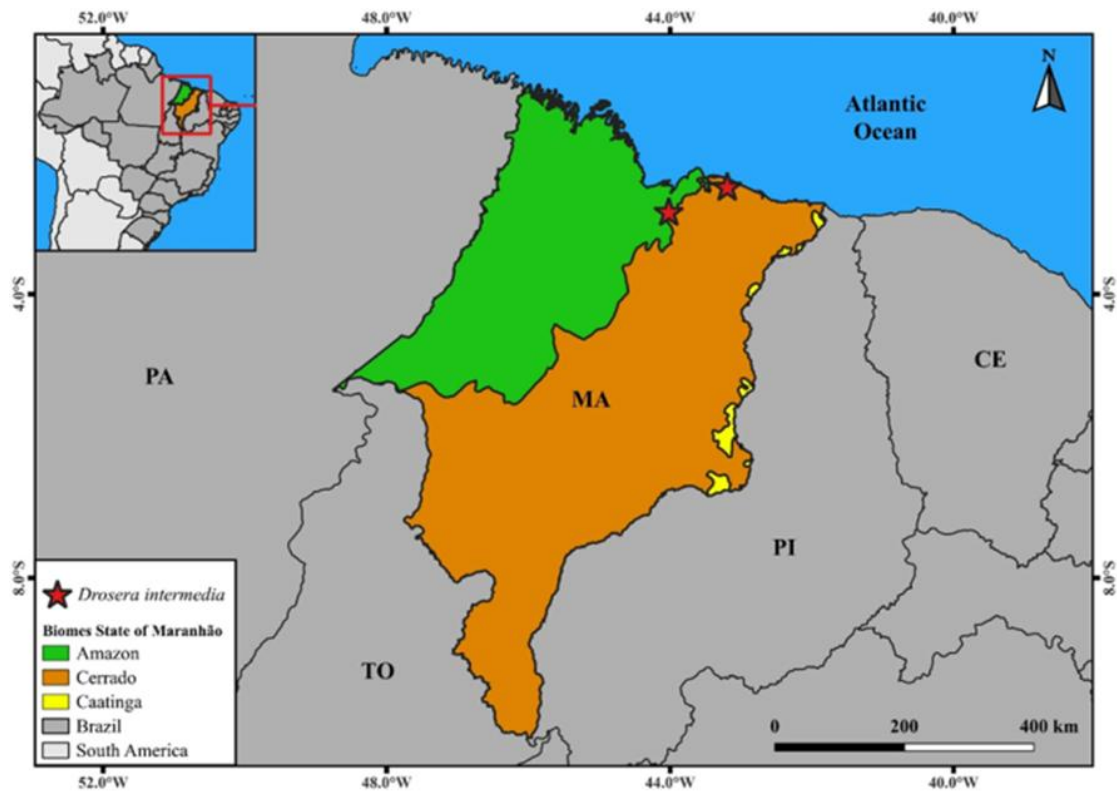


Figure 5. Geographical distribution of *Drosera intermedia* in the state of Maranhão.



Figure 6. First record of the aquatic life form of *Drosera intermedia* in a marshy area of a tributary of the Una River, municipality of Morros, Maranhão. **A.** Submerged aquatic habit of *D. intermedia*. **B.** Note the aquatic development of *D. intermedia* individuals on chlorophyceous algae intertwined with aquatic macrophytes. **C** and **D.** Emergent aquatic habit of *D. intermedia* (Photos: Alessandro W.C. Ferreira).

Comments: *Drosera sessilifolia* can be recognized by its leaves densely covered in short glandular trichomes, erect scape at the base and glabrous sepals with glandular trichomes. It is also the only species recorded in Maranhão and Brazil with a pentacarpellate ovary and entire styles. It occurs in Brazil, Bolivia, Colombia, Guyana and Venezuela (Gonella et al., 2022b). In Brazil, it occurs in the Amazon, Caatinga, Cerrado, Atlantic Forest, and Pantanal, in the states of Alagoas, Amazonas, Bahia, Ceará, Goiás, Mato Grosso do Sul, Mato Grosso, Maranhão, Minas Gerais, Pará, Paraíba, Pernambuco, Piauí, Rio Grande do Norte,

Roraima, Sergipe, and Tocantins (Gonella, 2024). In Maranhão, the species is extremely common and can be seen all over the state. It is the most widely distributed species, occurring in the municipalities of Aldeias Altas, Araisos, Barreirinhas, Carolina, Icatu and Santo Amaro, always in sandy and humid soils, in campinarana and vereda vegetation. In the Lençóis Maranhenses National Park, the species is extremely common, being seen throughout its entire length.

Phenology: the species flowers from January to October, with peaks in July and August.

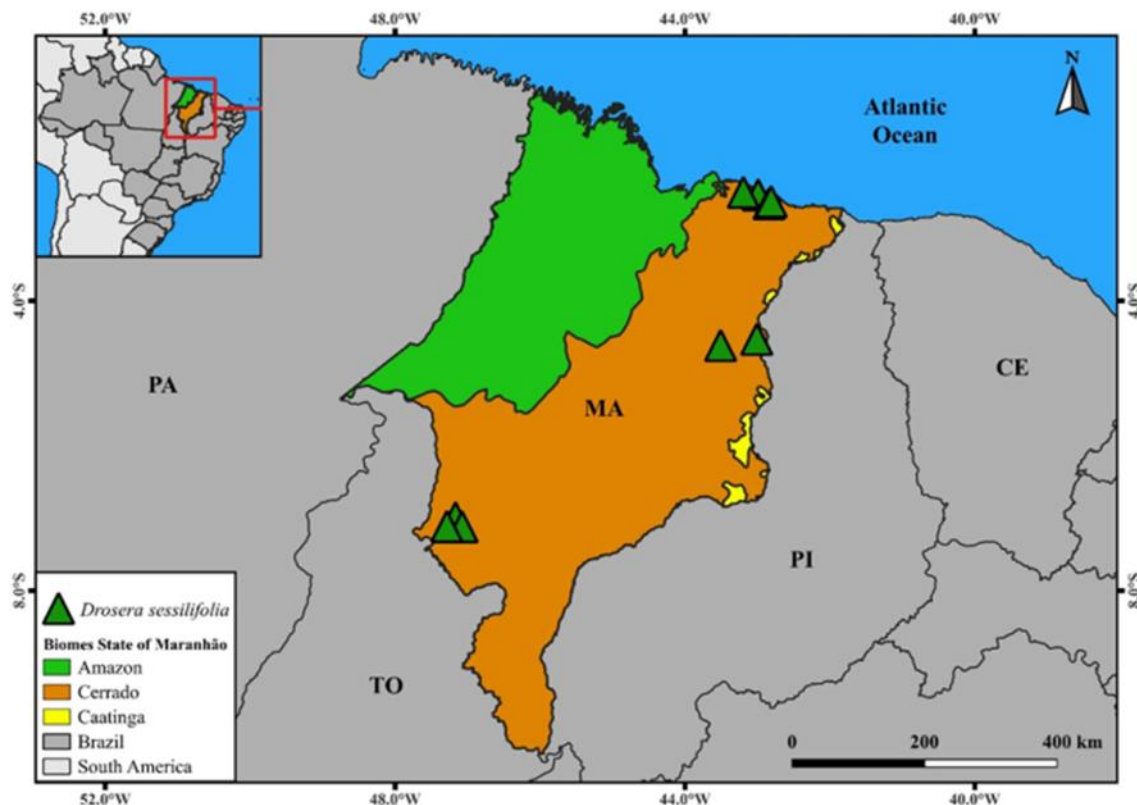


Figure 7. Geographical distribution of *Drosera sessilifolia* in the state of Maranhão.

Conclusion

This study increases the number of *Drosera* species in Maranhão from one to four (*D. sessilifolia*, *D. cayennensis*, *D. communis* and *D. intermedia*), highlighting the lack of botanical studies in this Brazilian state.

In this paper we record for the first time the occurrence of *Drosera intermedia* in Maranhão and also in the Cerrado of Brazil. Its record in the Lençóis Maranhenses National Park, one of the most researched areas in the state, shows the importance of training taxonomists in the state due to the lack of professionals in the state. It also justifies its importance for preservation. The first record of *Drosera cayennensis* in Maranhão can also be related to the low number of

taxonomists specializing in Droseraceae carrying out taxonomic revisions on carnivorous plants for the flora of this state, as a preexisting record was already available in herbaria, but remained unidentified until the present work. The existing gaps in Maranhão are the same as those cited by Amazon: low government investment in research, logistical difficulties in collecting in the state, the insipid number of taxonomists working in the region, as well as the challenges imposed by the biology of some peculiar plant groups.

In addition, despite the floristic potential derived from the presence of three Phytogeographic Domains and their ecotones, Maranhão suffers from intense deforestation and high real estate speculation (Spinelli-Araújo et al.,

2026; Guarçoni et al., 2022). It is therefore necessary to step up botanical collection efforts in order to learn more about the biodiversity of this region.

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Authors' Contribution

EAEG took part in fieldwork, species identification, writing the academic text and revising it; PMG took part in species identification, writing the academic text and revising it; AWCF took part in fieldwork, species identification, writing the academic text and revising it; JDSS took part in fieldwork.

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