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First records of *Utricularia breviscapa* C. Wright ex Griseb. (Lentibulariaceae) for Maranhão state, northeastern Brazil

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Abstract

We report the first record of *Utricularia breviscapa* from the state of Maranhão, northeastern Brazil. We collected this species in the municipality of Chapadinha, eastern Maranhão, within the Cerrado domain. This work adds new information on the flora of Maranhão and on the distribution of *U. breviscapa*. Illustrations and descriptions are also provided.

Keywords

Aquatic macrophytes, carnivorous plant, Cerrado, lower Parnaiba

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Introduction

Maranhão is the westernmost state of northeastern Brazil, bordering Piauí on the east, Tocantins on the south and southeast, and Pará on the west (IMESC 2011; Rebêllo et al. 2003). It covers an area of about 330 thousand km^2, occupying approximately 3.9% of the national territory (Rebêllo et al. 2003). Within its territory are three of the main Brazilian phytogeographic domains: the Amazon, in its western portion; the Cerrado, in the south, central and east regions; and the Caatinga, at its eastern end (Spinelli-Araújo et al. 2016). Where the boundaries of these domains meet, they form areas of transition that contribute to an extremely rich biodiversity (Vieira and Oliveira

2020). The state has a large number of aquatic ecosystems (rivers, streams, lakes, lagoons, and swamps) which together further contribute to a highly diverse, specialized, and unique aquatic biota.

Lentibulariaceae Rich. is a monophyletic family composed of three carnivorous genera: *Pinguicula* L., *Genlisea* A. St.-Hil., and *Utricularia* L. With approximately 360 species, they are the most diverse carnivorous family of angiosperms (Taylor 1989; Veleba et al. 2014; Fleischmann and Roccia 2018). The family is cosmopolitan, with the Cerrado domain and the Guiana Shield in the American continent as the centers of diversity due to the abundance of grassland formations in nutrient-poor soils (Taylor 1989).

Utricularia is the largest genus within the family, with more than 230 species (Jobson et al. 2018). The greatest species richness of the genus occurs in the Neotropics, and studies using morphological and molecular data point to this region as the probable center of its origin (Guisande et al. 2007). The characteristics that distinguish *Utricularia* from other genera are its very complex leaf modifications consisting of suction vesicles called utricles that work as traps for invertebrates (Rutishauser and Sattler 1989).

The genus has a wide distribution in Brazil, occurring in all domains and there are 71 species in total (Guedes et al. 2020). Forty species are recorded in the Northeast region, and 16 of these occur in Maranhão state (Guedes et al. 2020; Salazar-Ferreira et al. 2020).

Here, we report the first known occurrence of *Utricularia breviscapa* C. Wright ex Griseb. in Maranhão, increasing to 17 the number of *Utricularia* species reported from the state.

Methods

Utricularia breviscapa was collected in the Centro Água Branca village, municipality of Chapadinha, eastern Maranhão (Fig. 1). Centro Água Branca village is located within the Cerrado domain, and the region is characterized by the several streams crossing the landscape. There is marked seasonality, with two well-defined seasons: rainy from January to May, and dry from June to December; the average rainfall is 1613.2 mm (Passos et al. 2016).

Our study was based on field collections. The collected material was herborized according to the usual methods used for aquatic phanerogams (Fidalgo and Bononi 1989) and deposited in the CCAA herbarium (acronyms according to Thiers 2020) of the Center for Agricultural and Environmental Sciences at Federal University of Maranhão (UFMA - Chapadinha), with duplicates sent to the Maranhão Continental Herbarium (BMA, UFMA - Bacabal).

We identified the species using the work of Taylor (1989) and made comparisons with specimens in virtual

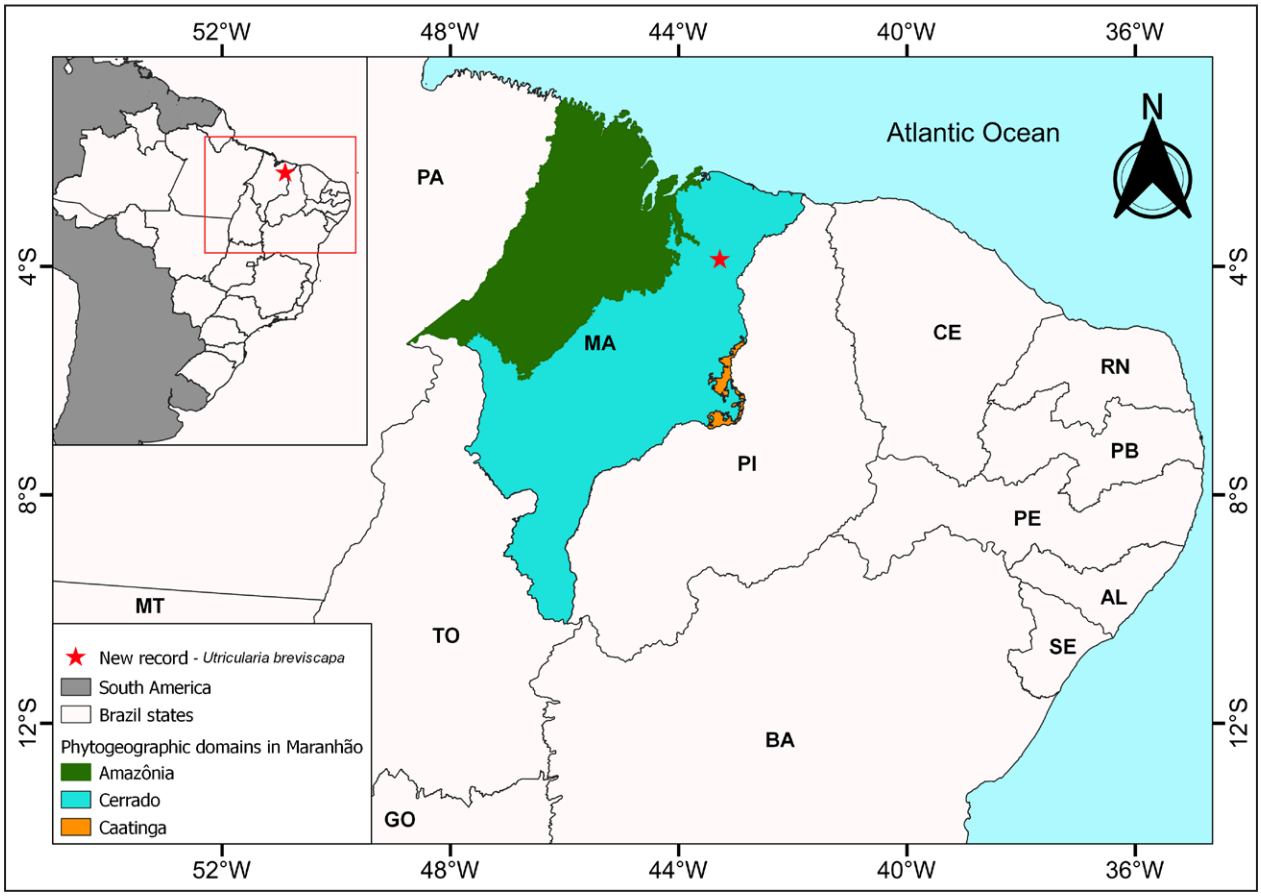

Figure 1. Location of the new record of *Utricularia breviscapa* in Maranhão, Brazil.

herbarium (SpeciesLink 2022), as well as consultations with specialists.

The distribution of the species in Brazil was obtained by consulting the records in online databases (SpeciesLink; GBIF; Flora e Funga do Brasil 2022). We mapped records using QGIS v. 3.24.2 (QGIS Development Team 2021).

The water parameters were taken with an AK87 multiparameter meter measuring dissolved oxygen, temperature, and pH. The measurements and photos of floral structures were taken using the Opticam Microscopy OPTHD v. 4.7 software coupled to a stereomicroscope with a 14-megapixel camera. For measurements of the branches, we used digital calipers with a precision of 0.01 mm.

Results

***Utricularia breviscapa* C.Wright ex Griseb.**
Figures 1–4

New records. BRAZIL – **Maranhão** • Município de Chapadinha, Povoado Centro Água Branca; 03°52′54″S, 043°16′51″W; 23 m alt.; 18.XII.2021; M.C.A. Pestana, M.C.C. Bastos, A.M. Barroso, N.A. Mendonça, M.I. Silva & R.F. Oliveira leg.; CCAA 2849 • same locality; 22.XII.2021; M.C.A. Pestana, M.C.C. Bastos, R.F. Oliveira, N.A. Mendonça, R.C. Hora & M.I. Silva leg.; CCAA 2850.

Identification. Aquatic herb, free submerged, stolons filiform, 10–32 cm long. **Traps** 0.9–13.0 × 1.3–1.7 mm, ovoid, dark, with mouth lateral, 2 dorsal branched filiform appendages and a few lateral and ventral simple setae, with the internal glands armed. **Leaves** numerous, 1.3–4.1 cm long, dichotomously branched, divided from the base in capillary segments. **Inflorescence** erect, 1.3–2.9 cm long. **Peduncle** glabrous, 2–7 cm long, with a whorl of 4 or 5 spongy floats in the base. **Floats** connate at the base, with 3 filamentous or claw-like terminal projections on each float. **Scales** absent. **Bracts** basifixed, ovate. **Bracteoles** absent. **Calyx** lobes subequal, glandular, 1.0–2.5 mm long, with evident ribs. **Corolla** 0.7–1.5 cm long, yellow with reddish marks at the base of the lower lip; upper lip rounded; lower lip elliptical.

Figure 2. *Utricularia breviscapa* in the municipality of Chapadinha, Maranhão. **A.** Flowering individual **B**. Detail of the utricles with black coloring. **C.** Habitat. Photos: M.C.A. Pestana and R.F. Oliveira

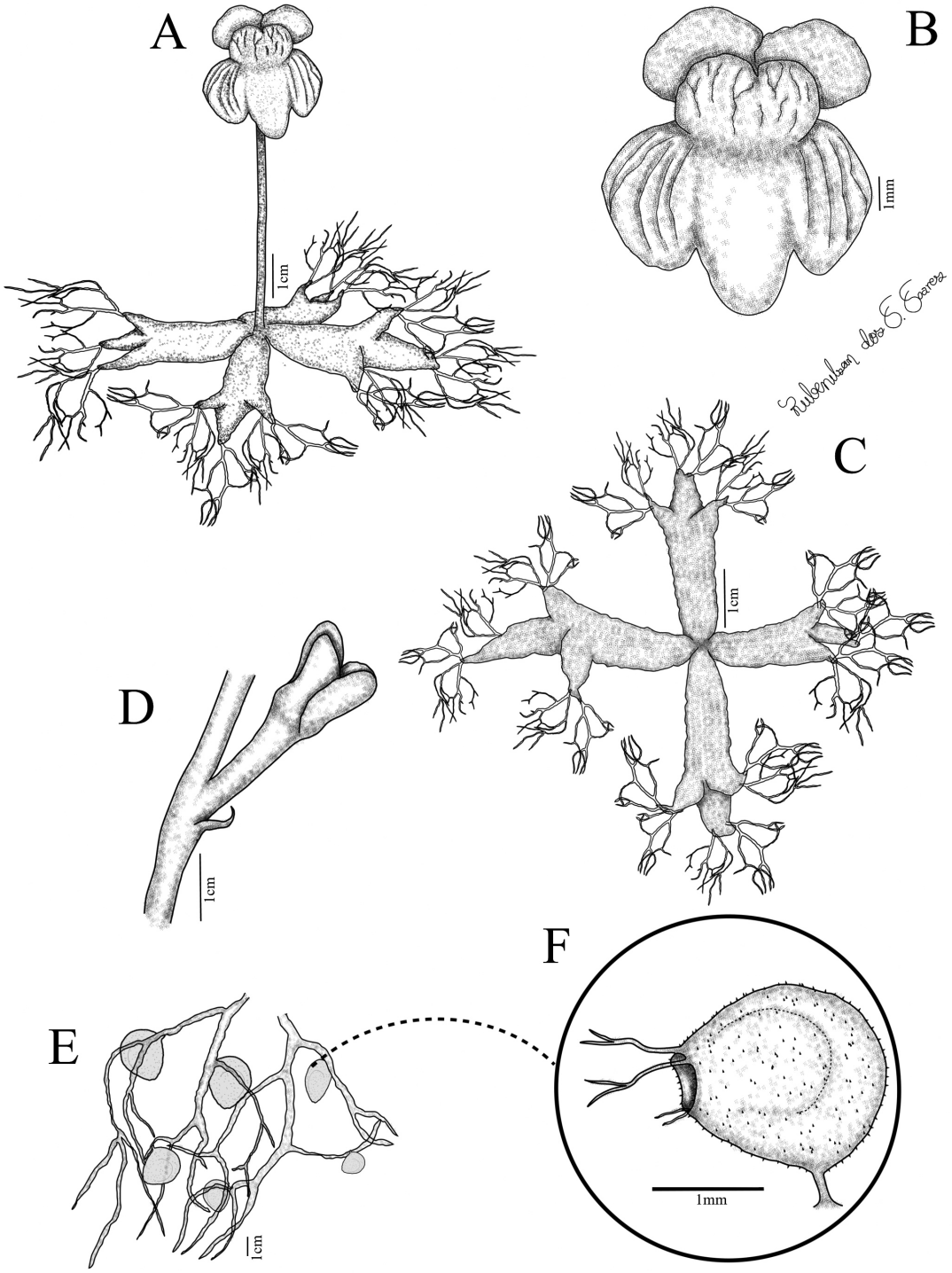

Figure 3. *Utricularia breviscapa*. **A.** Habit. **B**. Flower. **C**. Details of floats. **D**. Bracts. **E**. Utricles attached to leaves. **F**. Detail of utricle.

Utricularia breviscapa belongs to the subgenus *Utricularia* section *Utricularia* because of its two-lobed calyx, elliptical traps, basifixed bracts, and absence of bracteoles (Taylor 1989). Within the section it can be distinguished from other species due to the trichotomy of the primary and secondary leaf segments (Taylor 1989).

Dry specimens of *U. breviscapa* can be confused with *Utricularia benjaminiana* Oliv. and *Utricularia platensis* Speg. by presenting a whorl of floats at the base of the inflorescence. However, it differs from the former by the glabrous vegetative parts, inflated scape, and yellow corolla (vs. villous vegetative parts, narrow scape, and lilac to white corolla), and from the latter by the primary and secondary leaf segments in groups of three and a smaller corolla, with a circular upper lip (vs. primary and secondary leaf segments in groups of two and larger corolla, with transversely elliptical upper lip) (Taylor 1989).

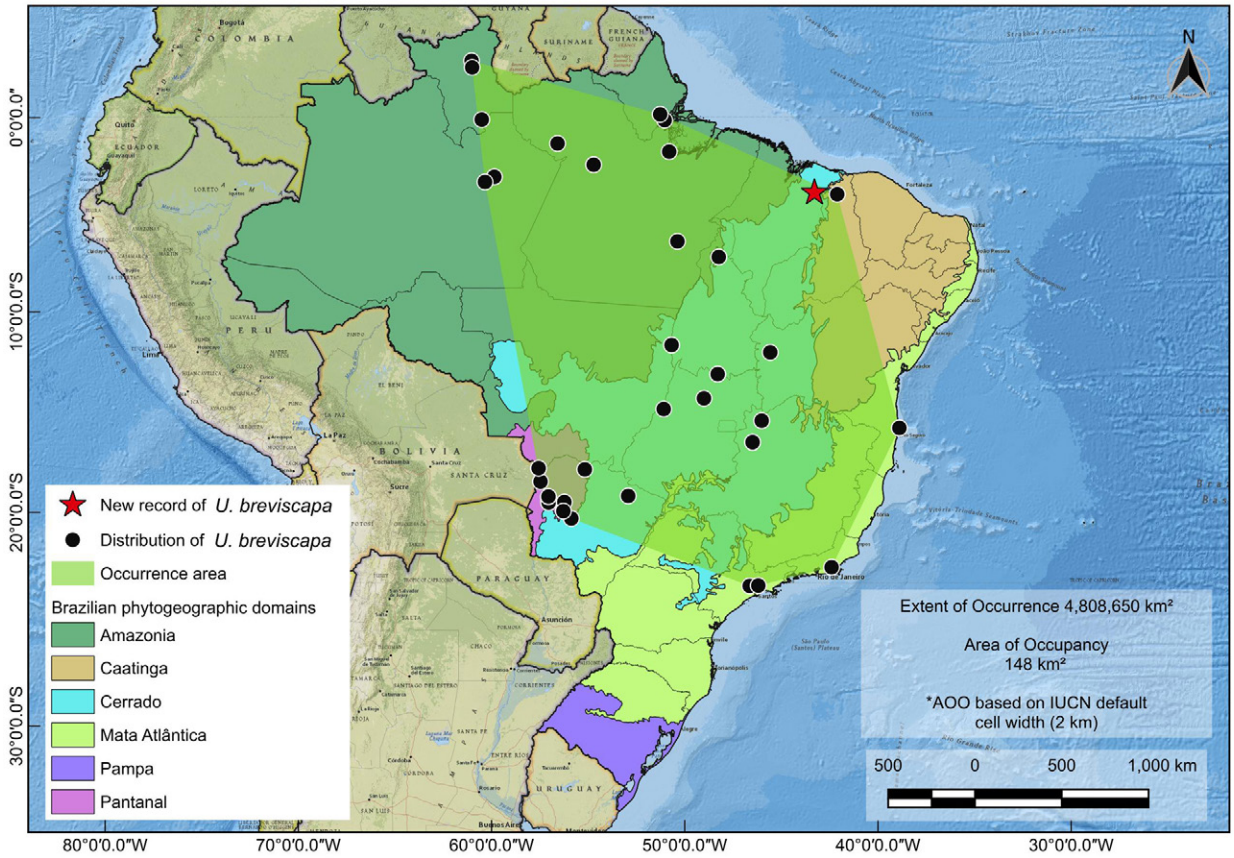

Figure 4. Map showing the distribution of *Utricularia breviscapa* throughout the Brazilian phytogeographic domains and extent of occurrence.

Discussion

Utricularia breviscapa is widely distributed in the Neotropical region (Guedes and Alves 2020) and occurs in several Brazilian states. In this country, it is distributed in all phytogeographic domains, except the Pampa, with records in the states of Amapá, Amazonas, Bahia, Goiás, Mato Grosso do Sul, Mato Grosso, Minas Gerais, Pará, Piauí, Rio de Janeiro, Roraima, São Paulo, and Tocantins (Flora e Funga do Brasil 2022).

Utricularia breviscapa can be easily recognized as a floating aquatic herb, with floats at the base of the scape and yellow flowers.

We found the species in Maranhão at Centro Água Branca village in a partially lentic environment, in stretches of first-order flow waters with a bottom composed of sand and a predominance of decomposing organic matter. Water parameters were 68.4–79.3 mg/L for dissolved oxygen; 28.2–33.5 °C for temperature; 4.2–5.1 for pH at the time of collection. The high concentration of dissolved oxygen may be due to the great abundance of macrophytes, since studies show that some species can release oxygen through their roots, such as species of the genus *Eichhornia* (Moorhead and Reddy 1988; Jedicke et al. 1989).

These water parameters are favorable for the dispersion and colonization of aquatic invertebrates that are tolerant to the presence of large amounts of organic matter and variations in pH (Restello et al. 2020). Thus, *U. breviscapa* might benefit from the resources of the environment, since the species has structures that capture and digest small organisms (Taylor 1989).

We found this species associated with *Cabomba aquatica* Aubl. (Cabombaceae), *Egeria densa* Planch. (Hydrocharitaceae), *Eichhornia heterosperma* Alexander (Pontederiaceae), *Nymphaea amazonum* Mart. & Zucc., *Nymphaea rudgeana* G.Mey. (Nymphaeaceae), *Nymphoides humboldtiana* (Kunth) Kuntze (Menyanthaceae) *Cyperus* spp., *Eleocharis* spp. (Cyperaceae), *Salvinia auriculata* Aubl. (Salviniaceae), and *Ludwigia* spp. (Onagraceae) close to the stream bank, with arboreal-shrubby vegetation typical of the Cerrado domain.

In the Northeast region of Brazil, *U. breviscapa* was known only from the states of Bahia and Piauí (Guedes et al. 2020). Our new occurrence in Maranhão expands the species' geographic distribution in Brazil (Fig. 1). Based on our research, the species has the EOO (Extent of occurrence) = 4,808,650 km^2 and AOO (Area of occupancy) = 148 km^2 (Fig. 4).

In recent years, Maranhão state lost habitat due to unrestrained intensification of human activities, mainly real estate speculation, the expansion of agribusiness, and increased fires (Almeida et al. 2019; Silva et al. 2020; Guarçoni et al. 2022). We highlight that there is little knowledge about aquatic vegetation in the state of Maranhão and suggest the need for further studies,

especially in aquatic ecosystems in priority and underexplored areas (Arouche et al. 2021). New studies should be developed to help fill gaps in our knowledge of *Utricularia* species in Maranhão and northeastern Brazil.

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Authors' Contributions

Conceptualization: AMB, EAEG, MCAP, MCCB, MIS, RCH, RFO. Data curation: EAEG, MCAP, RFO. Investigation: AMB, EAEG, MCAP, MCCB, MIS, NAM, RCH, RFO. Methodology: EAEG, MCAP, RFO. Resources: AMB, EAEG, MCAP, MCCB, MIS, RCH, RFO. Supervision: EAEG. Writing – original draft: EAEG, MCAP, NAM, RFO.

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