Check List the journal of biodiversity data
NOTES ON GEOGRAPHIC DISTRIBUTION

Expansion of the distribution range of angiosperm species for the states of Maranhão and Tocantins, Brazil, through a territorial action plan

Lucas C. Marinho[1,3,4], André V. Scatigna[2], Amanda L. Garcia[3], Ellen Thamara S. Castro[4], Gabriela Amorim[5], Fabio A. Silva[6], Jone Clebson R. Mendes[7], Karena M. Pimenta[8], Natércia Camille V. Feitosa[9], Alessandro W.C. Ferreira[1,3]

1 *Universidade Federal do Maranhão, Centro de Ciências Biológicas e da Saúde, Departamento de Biologia, São Luís, MA, Brazil*
2 *Universidade Estadual da Região Tocantina do Maranhão, Centro de Ciências Agrárias, Naturais e Letras, Estreito, MA, Brazil*
3 *Universidade Federal do Maranhão, Programa de Pós-graduação em Biodiversidade e Conservação, São Luís, MA, Brazil*
4 *Universidade Federal Rural da Amazônia/Museu Paraense Emílio Goeldi, Programa de Pós-graduação em Ciências Biológicas – Botânica Tropical, Belém, PA, Brazil*
5 *Universidade Federal de Pernambuco, Programa de Pós-graduação em Biologia Vegetal, Recife, PE, Brazil*
6 *Instituto Federal de Rondônia, Herbário COOE, Colorado do Oeste, RO, Brazil*
7 *Universidade Federal Rural de Pernambuco, Recife, PE, Brazil*
8 *Empresa Brasileira de Pesquisa Agropecuária – Cocais, São Luís, MA, Brazil*
9 *Secretaria Municipal de Meio Ambiente e Recursos Hídricos, Imperatriz, MA, Brazil*

Corresponding author: *Lucas C. Marinho (lc.marinho@ufma.br)*

Abstract. We expand the geographical distribution of 10 angiosperm species in Maranhão and Tocantins states. The species were collected during two field expeditions carried out by the Territorial Action Plan for the conservation of endangered species of the Meio Norte Territory between September 20 and 30, 2022 and between July 24 and 30, 2023, in both states. Photographs, comments on morphology and distributional data are provided for species of Acanthaceae, Aristolochiaceae, Euphorbiaceae, Myrtaceae, Orchidaceae, Plantaginaceae, Pontederiaceae and Turneraceae.

Key words. Cerrado, new records, Pró-espécies, seed plants, taxonomy

Marinho LC, Scatigna AV, Garcia AL, Castro ETS, Amorim G, Silva FA, Mendes JCR, Pimenta KM, Feitosa NCV, Ferreira AWC (2024) Expansion of the distribution range of angiosperm species for the states of Maranhão and Tocantins, Brazil, through a territorial action plan. Check List 20 (5): 1067–1075. https://doi.org/10.15560/20.5.1067

INTRODUCTION

Field expeditions to sample specimens, collect ecological data and take images are the first step toward understanding the diversity of a given location (Ríos-Saldaña et al. 2018). With this information, estimating population rates and threats suffered to preserve and conserve organisms is possible. In view of this, efforts have been made by various civil society groups together with research institutes that have the mission of understanding and protecting global diversity through territorial action plans that are based on field expeditions and data collection (Saif et al. 2024).

Territorial Action Plans (PAT, acronym in Portuguese) for the conservation of endangered species are Brazilian instruments aimed at the conservation of critically endangered species that occur in the national territory. This initiative is part of the Projeto Estratégia Nacional para a Conservação de Espécies Ameaçadas de Extinção – Pró-Espécies, coordinated by the Ministério do Meio Ambiente of Brazil. The Meio Norte Territorial Action Plan (PAT Meio Norte, henceforward) covers ca. 80,000 km^2 in the states of Pará, Tocantins and Maranhão (Pró-Espécies 2022). In this plan, in addition to animal species, three species of angiosperms were prioritized as the main target, among which only two occur in Maranhão and Tocantins: *Erythroxylum ayrtonianum* Loiola & M.F.Sales (Erythroxylaceae) and *Rinorea villosiflora* Hekking (Violaceae). Therefore, two field expeditions were carried out in the project area, focusing on both states aiming to recollect these species. These expeditions were conducted in ecotonal areas between the Amazon Forest domain and the Cerrado. Both states, Tocantins and Maranhão, have this peculiar characteristic with typically Amazonian species advancing over the savannah and the opposite also occurs (IMESC 2008).

OPEN ACCESS

Academic editor: Ana Carolina Mezzonato-Pires
Received: 15 May 2024
Accepted: 30 August 2024
Published: 24 September 2024

During field expeditions, specimens from different angiosperm families were collected, constituting new records for the states of Maranhão and Tocantins and demonstrating the importance of broad sampling. Here we present the extent of the geographic distribution of 10 species of angiosperms from different lineages based on these expeditions carried out by the Territorial Action Plan for the conservation of endangered species of the Meio Norte Territory.

METHODS

The area of the PAT Meio Norte, with approximately 80,000 km^2, is located on the border between the states of Pará, Tocantins and Maranhão, Brazil (Figure 1). The region is covered by Amazon (~80%) and Cerrado (~20%) domains, thus being characterized as an ecotone region between these two domains. Two expeditions were carried out in this area focusing on the states of Maranhão and Tocantins, between September 20 and 30, 2022 (see Marinho et al. 2023 for more) and July 24 and 30, 2023 along the highways BR-010 and BR-222. We also included records made within the PAT Meio Norte area on individual expeditions carried out by the authors.

The sampling sites were chosen with the support of Google Earth images, looking for larger fragments with a more preserved appearance. Collections were also carried out in the Ciriaco Extractive Reserve and Florestal Arara-Azul Municipal Natural Park, both in Maranhão, and around the Apinayé Indigenous Land, in Tocantins, under the licenses 84289-1 and 84288-1 provided by Sistema de Autorização e Informação em Biodiversidade – SISBIO. Botanical samples were collected and herborized according to Mori et al. (2011). Species identification was performed confronting specimens with available descriptions in specialized literature. Descriptions and figures were made from specimens collected on field expeditions. Collected specimens were deposited on MAR, SLUI and PEUFR herbaria (acronyms according to Thiers 2024).

In this work, we considered as new records 1) species that are not identified in Flora e Funga do Brasil (2024) as occurring in the states of Maranhão and/or Tocantins; 2) species collected for the first time by the authors of this work or that, even if collected and available in collections, have not been reviewed by experts. The distribution map was produced using the online tool SimpleMappr (Shorthouse 2010) based on data downloaded from speciesLink (speciesLink 2024) that were in line with Flora and Funga do Brasil (2024).

RESULTS

We identified 10 new species records of angiosperms distributed in eight families. Six of them are new records for Maranhão state: *Aristolochia claussenii* Duch. (Aristolochiaceae), *Dalechampia burchellii* Müll. Arg., *Euphorbia dioeca* Kunth (Euphorbiaceae), *Habenaria gourlieana* Gill. ex Lindl. (Orchidaceae), *Mecardonia procumbens* (Mill.) Small var. *procumbens* and *Scoparia montevidensis* (Spreng.) R.E.Fr. (Plantaginaceae); and four new records for Tocantins: *Ruellia verbasciformis* (Nees) C.Ezcurra & Zappi, (Acanthaceae), *Eugenia caipora* A.R.Lourenço & Costa-Lima (Myrtaceae), *Pontederia reflexa* D.J.Sousa (Pontederiaceae) and *Turnera stipularis* Urb. (Turneraceae).

Acanthaceae

***Ruellia verbasciformis* (Nees) C.Ezcurra & Zappi**, Kew Bull. 51(4): 819. 1996.
Figures 1B, 2A

New records. BRAZIL – TOCANTINS • Aguiarnópolis, ramal em direção à Chácara Paraíso; 06°29′54″S, 047°31′26″W; 27.VII.2023; L.C. Marinho 2010, E.T.S Castro, A.L. Garcia & A.W.C. Ferreira, leg.; MAR 14435.

Identification. *Ruellia verbasciformis* is characterized by the erect subshrub habit, leaf blades hairy, tomentose, velutinous, pubescent with tectorial and glandular trichomes. The inflorescences are terminal thyrsus with bracts and bracteoles present. The calyx has subequal, oblong to lanceolate segments. The corolla is yellow, cream to greenish ventricose and the fruits are elliptical capsules, with up to four seeds and hygroscopic trichomes on the entire surface (Ezcura and Zappi 1996). *Ruellia verbasciformis* is similar to *R. exserta* Wassh. & J.R.I.Wood by the greenish ventricose corolla and oblong leaf blades; however, the striking differences between them are in the subshrub habit with erect branches and tectorial and glandular trichomes (vs. lianescent habit and glabrous branches in *Ruellia exserta*), and due to the up to four seeds per capsule (vs. 6–8 seeds).

Previous distribution, habitat and status conservation. *Ruellia verbasciformis* is endemic to Brazil, with occurrence previously recorded in the states of Goiás and Mato Grosso (Flora e Funga do Brasil 2024). Here the species is recorded for the first time in the state of Tocantins, where it was collected on the side of the highway in a severely deforested area of the Amazonian domain. Despite its distribution being restricted to just three states and the apparent threat to its habitat, *R. verbasciformis* has not yet been formally assessed regarding its conservation status.

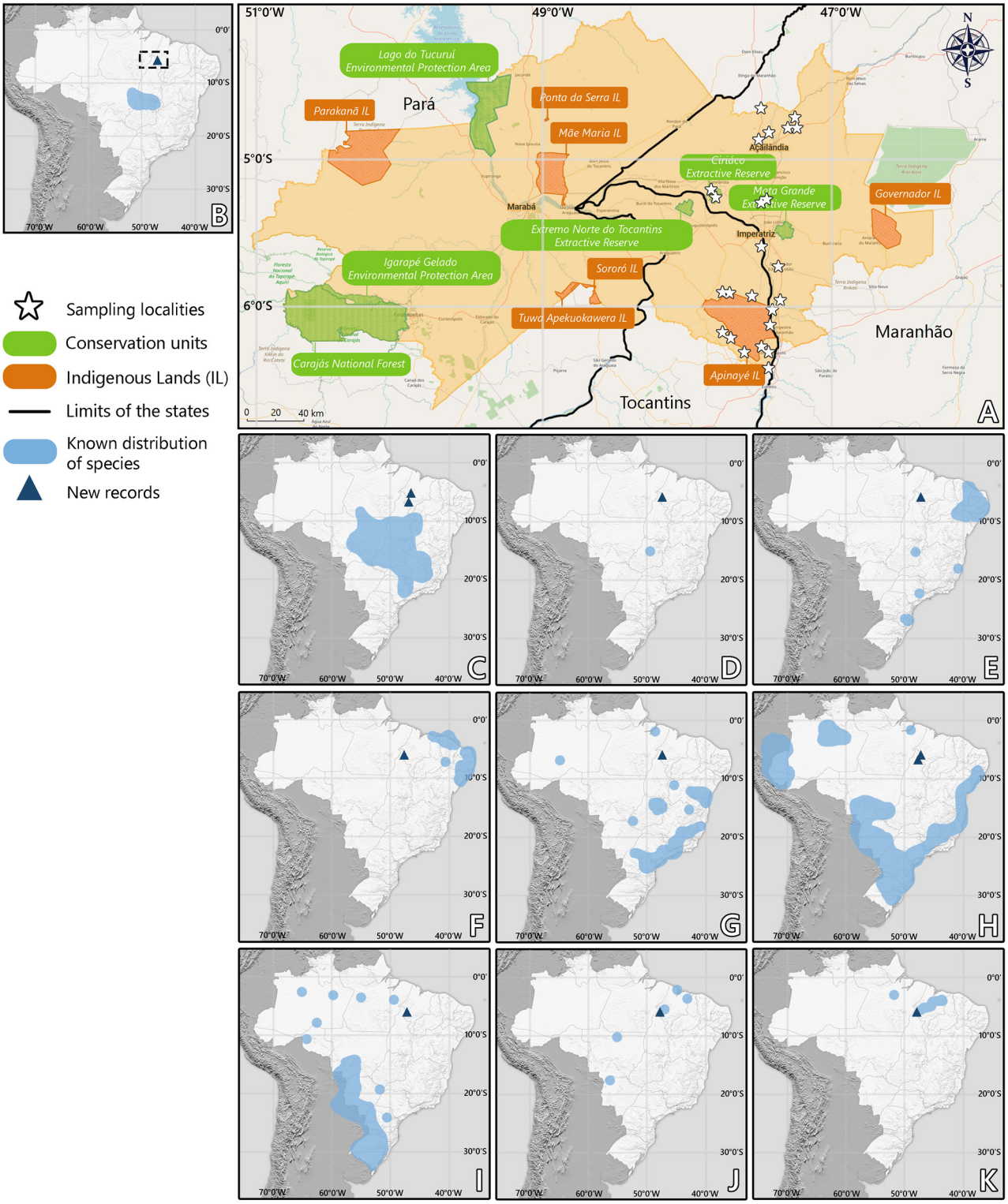

Figure 1. A. Map of the Meio Norte Territorial Action Plan, Brazil (orange shading). White stars indicate collection areas along the border of Maranhão and Tocantins states. Modified from Pró-Espécies (2022). **B–K.** Known distribution (blue shade) and new record of the species. **B.** *Ruellia verbasciformis* (Acanthaceae), the dotted area refers to Map 1A. **C.** *Aristolochia claussenii* (Aristolochiaceae). **D.** *Dalechampia burchellii* (Euphorbiaceae). **E.** *Euphorbia dioeca* (Euphorbiaceae). **F.** *Eugenia caipora* (Myrtaceae). **G.** *Habenaria gourlieana* (Orchidaceae). **H.** *Mecardonia procumbens* (Plantaginaceae). **I.** *Scoparia montevidensis* (Plantaginaceae). **J.** *Pontederia reflexa* (Pontederiaceae). **K.** *Turnera stipularis* (Turneraceae).

Figure 2. Species recorded for the first time in Maranhão and Tocantins states. **A.** *Ruellia verbasciformis* (Acanthaceae). **B.** *Aristolochia claussenii* (Aristolochiaceae). **C.** *Dalechampia burchellii* (Euphorbiaceae). **D.** *Euphorbia dioeca* (Euphorbiaceae). **E.** *Eugenia caipora* (Myrtaceae). **F.** *Habenaria gourlieana* (Orchidaceae). **G.** *Mecardonia procumbens* (Plantaginaceae). **H.** *Scoparia montevidensis* (Plantaginaceae). **I.** *Pontederia reflexa* (Pontederiaceae). **J.** *Turnera stipularis* (Turneraceae). **K.** Deforestation for eucalyptus plantations. Photos: A, D–G, J–K by L.C. Marinho; B by **K.**M. Pimenta; C, H–I by **A.**V. Scatigna.

Aristolochiaceae

***Aristolochia claussenii* Duch.**, Ann. Sci. Nat., Bot., sér. 4, 2: 57. 1854.
Figures 1C, 2B

New records. BRAZIL – MARANHÃO • Carolina, estrada de acesso à cachoeira São Romão, 07°06′04″S, 047°25′22″W, 15.I.2008; G. Pereira-Silva & G.A. Moreira, obs.; CEN 68233, MAC 69244 • Governador Edson Lobão, área inventariada para futura construção de um aterro sanitário; 15.XII.2021; K.M. Pimenta 1009 & A. Machado, leg.; MAR.

Identification. *Aristolochia claussenii* is characterized by the lianescent habit, glabrous branches and absence of pseudostipules. The leaf blades are small and cordiform with sparse trichomes on the abaxial surface. The flowers have suborbicular utricles and just one purplish-brown lip (Freitas et al. 2024). *Aristolochia claussenii* is similar to *A. smilacina* (Klotzsch) Duch., especially due to its herbaceous size and

internally glabrous lip. Species can be differentiated by the broadly oval leaf blade in *A. claussenii* vs. lanceolate in *A. smilacina* (Abreu and Giulietti 2016).

Previous distribution, habitat and status conservation. *Aristolochia claussenii* is native to Brazil, but not endemic, also occurring in Colombia and Venezuela (POWO 2024). In Brazil, the species is known from the states of Rio de Janeiro, Minas Gerais, Bahia, Goiás, Mato Grosso do Sul and Tocantins (Freitas et al. 2024), being recorded here for the first time in Maranhão, where it was collected in a typical Amazonian-Cerrado transition area. The area near the road and pastures had signs of continued deforestation. Until now, *A. claussenii* has not been assessed for its conservation status.

Euphorbiaceae

***Dalechampia burchellii* Müll. Arg.**, Fl. Bras. 2: 649. 1874.
Figures 1D, 2C

New records. BRAZIL – Maranhão • Cidelândia, estrada para RESEX Ciríaco, próx. à Faz. Sta. Maria, 05°12′02″S, 047°46′55″W, 154 m elev.; 20.IX.2022; J.C.R. Mendes 297, L.C. Marinho & A.V. Scatigna, leg.; PEUFR 57036.

Identification. *Dalechampia burchellii* is characterized by being the only Brazilian species that has a compound leaf, unlobed to 2–3-foliolate mixed in the same individual, besides the inflorescence axillary with involucral bracts triangular-ovate, greenish, apex acute. The staminate pleiochasium has 5–8 flowers with four sepals each, pistillate cumulus with three flowers bearing 8–12 pinnatisect sepals, and the stylar column apex frequently crateriform.

Previous distribution, habitat and status conservation. In Brazil, according to Flora e Funga do Brasil (2024), the species is little known, with records only in the state of Goiás in a Cerrado environment. Mendes et al. (2024) expanded its distribution to Acre. In this work we recorded its occurrence for the first time in the state of Maranhão in the transition area from the Cerrado to the Amazon Forest, specifically in anthropic areas. Regarding conservation status, the species has not yet been formally assessed.

***Euphorbia dioeca* Kunth**, Nov. Gen. Sp. 2: 53. 1817.
Figures 1E, 2D

New records. BRAZIL – Maranhão • Imperatriz, Entrada do Horto da Arara Azul; 05°34′58″S 047°26′28″W; 23.IX.2022; J.C.R. Mendes 307, L.C. Marinho, A.V. Scatigna & N.C.V. Feitosa, leg.; PEUFR 57029.

Identification. *Euphorbia dioeca* is a prostrate herb with vinaceous to greenish and pubescent branches. The leaf blades are elliptical with an obtuse to rounded apex and an asymmetrical base, as well as serrated to inconspicuously serrated margins and villous abaxial and adaxial surfaces. On the abaxial surface, *E. dioeca* present a notorious purplish coloration. *Euphorbia dioeca* is similar to *E. adenoptera* Bertol, especially due to the presence of trichomes covering its vegetative and reproductive structures, zygomorphic cyathia with well-developed and unequal glands (a pair bigger than the other one). Both can be distinguished by the villous indument and purplish coloration on the adaxial surface of leaves (vs. leaves completely green and glabrous or puberulous to sparsely hairy indument in *E. adenoptera*). Additionally, the appendages of the cyathia in *E. dioeca* are generally white to slightly pink (vs. generally pink to reddish).

Previous distribution, habitat and status conservation. *Euphorbia dioeca* is widely distributed throughout Tropical America, in Brazil it occurs in the states of Bahia, Espírito Santo, Goiás, Santa Catarina and São Paulo (Carneiro-Torres et al. 2017). Here, we recorded the species in the municipality of Imperatriz in Maranhão, this being its northern limit in the country. *Euphorbia dioeca* was collected growing in disturbed areas and sidewalk gaps. The species has not yet been formally assessed for conservation status.

Myrtaceae

***Eugenia caipora* A.R.Lourenço & Costa-Lima**, Phytotaxa 408: 130. 2019.
Figures 1F, 2E

New records. BRAZIL – Tocantins • Tocantinópolis, ramal em direção à Chácara Paraíso; 06°29′36″S, 047°28′24″W; 26.VII.2023; E.T.S. Castro 41, L.C. Marinho, A.L. Garcia & A.W.C. Ferreira, leg.; MAR 14778; • ibid., L.C. Marinho 1994, E.T.S. Castro, A.L. Garcia & A.W.C. Ferreira, leg.; MAR 14421.

Identification. *Eugenia caipora* has pubescent branches with simple and whitish trichomes in the mature branches, while young branches are densely pubescent giving a silvery appearance. The leaf blades are elliptical to ovate, glabescent to puberulous on both surfaces, but densely pubescent in young leaves. This species has auxotelic inflorescence, with one to three pairs of flowers, long pedicels, bracts and bracteoles deciduous after anthesis, hypanthium and staminiferous disc densely pubescent. The fruits are ellipsoid to

pyriform and velutine. *Eugenia caipora* is morphologically similar to *E. caatingicola* K.Cout. & M.Ibrahim, a species from the states of Piauí and Bahia (Mazine et al. 2024), but it can be distinguished by the elliptical to obovate leaves (vs. lanceolate in *E. caatingicola*), the lobes of the calyx elliptical to obovate (vs. oblong), and fruits elliptical to pyriform (vs. globose).

Previous distribution, habitat and status conservation. *Eugenia caipora* was presumably endemic to northeastern Brazil, in the states of Ceará, Rio Grande do Norte, Paraíba, Pernambuco and Alagoas (Mazine et al. 2024). Besides the Cerrado domain, this species occurs in vegetation along the Atlantic coast (Lourenço et al. 2019). Here, *E. caipora* is recorded for the first time in the North Brazil. *Eugenia caipora* has not yet been formally assessed for conservation status.

Orchidaceae

***Habenaria gourlieana* Gill. ex Lindl.**, Gen. Sp. Orchid. Pl., 309. 1835.
Figures 1G, 2F

New records. BRAZIL – Maranhão • Cidelândia, Reserva Extrativista do Ciriáco, estrada principal; 05°14′49″S, 047°48′43″W; 21.IX.2022; L.C. Marinho 1849, A.V. Scatigna, J.C.R. Mendes & N. Vasconcelos, leg.; MAR 13785.

Identification. *Habenaria gourlieana* has a cylindrical and long stem (between 60 and 180 cm), lanceolate leaves, greenish flowers with a whitish spur at the base and greenish at the apex, pendulous and linear. The petals are bipartite and labellum tripartite (Batista et al. 2006). *Habenaria gourlieana* has morphological affinity with *H. longicauda* Hook., which presents the segments of the labellum, lateral sepals and anterior petals reflexed (vs. not reflexed in *H. gourlieana*) and spur between 13 and 20 cm long (vs. 11–14.5 cm long in *H. gourlieana*) (Batista et al. 2006; Batista et al. 2008).

Previous distribution, habitat and status conservation. *Habenaria gourlieana* was previously known to occur in all states of the Southern Brazil, in addition to Espírito Santo, Minas Gerais, São Paulo, Goiás, Mato Grosso, Amazonas, Rondônia, Tocantins and Bahia (Flora e Funga do Brasil 2024); this is the first record of the species in Maranhão. In Maranhão, *H. gourlieana* was observed as terricolous, in swampy and sunny environments, as generally occurs with this species in other locations in Brazil (Batista et al. 2006). According to IUCN criteria (2012), *Habenaria gourlieana* is considered of Least Concern, although this region suffers with fires, deforestation and other agricultural activities (IPAM 2024).

Plantaginaceae

***Mecardonia procumbens* (Mill.) Small var. *procumbens*, Fl. S.E. U.S. [Small]**. 1065: 1338. 1903.
Figures 1H, 2G

New records. BRAZIL – Maranhão • Imperatriz, rio Itaueiras, na altura da ponte da BR 010. Margem degradada do rio; 06°30′51″S, 047°23′16″W; 24.IX.2022; A.V. Scatigna 2158, J.C.R. Mendes, L.C. Marinho & N.C.V. Feitosa, leg.; SLUI 9282 • Porto Franco, Balsa Pipes, margem do rio Tocantins; 06°20′07″S, 047°24′30″W; 26.IX.2022; A.V. Scatigna 2202, J.C.R. Mendes & N.C.V. Feitosa, leg.; SLUI 9283.

Identification. *Mecardonia procumbens* is characterized by being a glabrous herb, usually crawling, with distinctly pedicellate flowers, calyx with strongly unequal sepals, corolla entirely yellow and anthers with thecae separated by arms of the connective (Souza and Giulietti 2009; Scatigna et al. 2022). *Mecardonia procumbens* var. *procumbens* is similar to *M. procumbens* var. *tenella* (Cham. & Schltdl.) V.C.Souza due to the leaf margin distinctly serrate (vs. entire to subserrate in the remnant varieties sensu Souza and Giulietti 2009) but differs in the pedicel of the same length of the subtending leaf (= bract) (vs. twice as long). Nevertheless, it is usually hard to differentiate among the varieties because diagnostic characters may overlap among taxa (Souza and Giulietti 2009).

Previous distribution, habitat and conservation status. *Mecardonia procumbens* var. *procumbens* is the most widely distributed taxon in its genus, with records from southern USA to southern Brazil, besides a few records in the African continent (Souza and Giulietti 2009). In Northeast Brazil, *M. procumben*s had been previously recorded in the state of Bahia. Here we cite the first specimens of this species collected in Maranhão. It usually occurs in open, wet habitats, including disturbed areas such as the riverbanks where the new records were found. The conservation status of the species was not formally assessed.

***Scoparia montevidensis* (Spreng.) R.E.Fr.**, Ark. Bot. 6(9): 18. 1907.
Figures 1I, 2H

New records. BRAZIL – Maranhão • Imperatriz, praia do Cacau, foz do rio Cacau, margem do rio Tocantins; 05°33′55″S, 047°28′48″W; 23.IX.2022; A.V. Scatigna 2136, J.C.R. Mendes & L.C. Marinho, leg.;

SLUI 9284. Tocantins • Tocantinópolis, praia da Gil, margem do arenosa do rio Tocantins; 06°18′19″S, 047°23′59″W; 27.IX.2022; A.V. Scatigna 2206, J.C.R. Mendes & N.C.V. Feitosa, leg.; SLUI 9285.

Identification. *Scoparia montevidensis* is characterized by being a usually erect, branched herb or subshrub, with leaves entire to pinnatisect, calyx with five sepals and corolla rotaceous, with four lobes, entirely yellow. Although vegetative features are variable and may overlap with other species of *Scoparia* L., only *S. montevidensis* has yellow corolla (Souza and Giulietti 2009).

Previous distribution, habitat and conservation status. *Scoparia montevidensis* occurs from Mexico to Argentina (Souza and Giulietti 2009). The most records were made on wetlands of the Central-West Brazil, but it also occurs in the Amazon and part of the South region. Here we report the first record in the state of Tocantins and from the state of Maranhão, which represents an expansion of the known distribution to the Northeast region. The conservation status of *S. montevidensis* was not formally assessed, but it is likely to be Least Concern according to IUCN (2012), because of the several specimens recorded and its wide distribution.

Pontederiaceae

***Pontederia reflexa* D.J.Sousa**, Phytotaxa 432(3): 257. 2020.
Figures 1J, 2I

New record. BRAZIL – Tocantins • Tocantinópolis, Lagoa do Lampedor, lagoa perene; 06°16′17″S, 047°23′58″W; 27.IX.2022; A.V. Scatigna 2231, J.C.R. Mendes & N.C.V. Feitosa, leg.; SLUI 9286.

Identification. *Pontederia reflexa* is characterized by being an erect emergent aquatic herb, rhizomatous, with a markedly reflexed and revolute spathe (= bract) and white flowers arranged in a dense inflorescence. *Pontederia reflexa* may be confused with *P. ovalis* Mart. in the overall aspect, especially the white flowers, but is readily distinguished by the markedly reflexed spathe (vs. upright) and the evident midvein on the abaxial surface of leaf blades (vs. inconspicuous).

Previous distribution, habitat and conservation status. *Pontederia reflexa* has a disjunct distribution, with records from Northeast Brazil and from Bolivia, Paraguay, and the Brazilian Pantanal (Sousa et al. 2020). Here we present the first record of this species in North Brazil, in the state of Tocantins, in a transition area between the Cerrado and Amazon domains. The new record was made in the margins of a perennial pond near the Tocantins River.

Turneraceae

***Turnera stipularis* Urb.**, Bot. Gart. Berlin, 2: 131. 1883.
Figures 1K, 2J

New records. BRAZIL – Tocantins • Tocantinópolis, estrada de terra para a chácara Paraíso; 06°00′19″S, 047°20′38″W; 26.VII.2023; A.W.C. Ferreira 1241, L.C. Marinho, A.L. Garcia & E.T.S. Castro, leg.; MAR • ibid, 26.VII.2023; A.W.C. Ferreira 1242, L.C. Marinho, A.L. Garcia & E.T.S. Castro, leg.; MAR • ibid, 26.VII.2023; A.W.C. Ferreira 1243, L.C. Marinho, A.L. Garcia & E.T.S. Castro, leg.; MAR.

Additional examined materials. BRAZIL – Maranhão • Aldeias Altas, povoado Jatobá; 04°38'S, 43°44'W; 05.II.2022; F.C. Sousa 51, obs.; MAR • Barra do Corda, povoado Cachoeirinha; 05°08'S, 045°37'W; 2.III.1983; Rosário et al. 821, obs.; US • Carolina, PARNA Chapada das Mesas; 06°09'S, 046°39'W; 19.IV.2018; R.V.C. Saraiva 276, obs.; HUEFS, SLUI.

Identification. *Turnera stipularis* can be characterized as a shrub with height varying between 50 and 200 cm. The absence of petiolar nectaries, the presence of an indument with simple trichomes and the well-developed stipules are also characteristics of this species. The flowers are yellow, sessile and arranged in axillary captulum (Rocha and Arbo 2024), which have anthesis around seven o'clock and begin to close around noon (A.W.C. Ferreira pers. obs.). *Turnera stipularis* is similar to *T. kuhlmanniana* Arbo, a species endemic to Rondônia state, from which it is distinguished by its flowers with a glabrous calyx and yellow corolla (vs. tomentose calyx and white corolla in *T. kuhlmanniana*) and fruits with smooth epicarp (vs. granulose) (Rocha and Arbo 2024).

Previous distribution, habitat and status conservation. *Turnera stipularis* is endemic to Brazil with records only in Maranhão and Pará states (Silva et al. 2023). Here, we recorded it for the first time in the state of Tocantins, close to the Tocantins River. *Turnera stipularis* was observed growing in clayey soil in the understory of a seasonal forest. This species does not have a formal conservation status assessment based on the IUCN (2012). However, Silva et al. (2023) assessed the species as Endangered, since the species occurs near conflicts involving illegal mining and environmental degradation.

DISCUSSION

The region covered by the Territorial Action Plan for the conservation of endangered species of the Meio Norte territory is an ecotonal area with influences from both the Amazon Forest and the Cerrado. This can be seen by the species listed here, which are almost uniformly distributed between these two domains. The number of new records may be greater, since during the expeditions all specimens of plants with flowers and fruits were collected, but they have not yet been identified at a specific level. Among the target species of PAT Meio Norte, we recollected only *Erythroxylum ayrtonianum* in two locations in Maranhão and Tocantins. We visited the type locality of *Rinorea villosiflora*, but found it completely devastated, thus, this species can be locally extinct. More information on the two target species can be seen in Marinho et al. (2023).

The PAT Meio Norte area coincides with the well-known "Arc of Deforestation" (Nepstad et al. 1995), a region where intense activity of livestock grazing and plantation advances towards the forest and promotes the highest rates of deforestation of the Amazon. Most of the records in this work were made outside environmental protection areas and close to highways, areas under threat of deforestation for grazing, fires and, especially, deforestation for eucalyptus plantations (Figure 2K), which are the main factor of pressure detected by us during the two expeditions. Data such as those presented here, although focused on the taxonomy, reinforces the need for broad-spectrum field expeditions, where all taxa are collected, given the importance of distribution data for understanding the real conservation status of species.

ADDITIONAL INFORMATION

Conflict of interest

The authors declare that no competing interests exist.

Ethical statement

No ethical statement is reported.

Funding

The expeditions that led to this publication were financed with resources from the Global Environment Facility (GEF) through the Project 029840 – Estratégia Nacional para a Conservação de Espécies Ameaçadas – Pró-Espécies: Todos contra a extinção, coordinated by Ministério do Meio Ambiente of Brazil, implemented by the Fundo Brasileiro para a Biodiversidade (Funbio) and executed by WWF-Brasil. The expeditions also received support from Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq; Edital Universal, 402943/2021-0; 404619/2023-1). JCRM also thanks the CNPq (01300.008711/2022-24) and the Fundação de Amparo à Ciência e Tecnologia de Pernambuco (FACEPE) for the post-doctoral fellowship (BCT-0715-2.03/22). AVS thanks Fundação de Amparo à Pesquisa e ao Desenvolvimento Científico e Tecnológico do Maranhão (FAPEMA; PDCRT -00123/20) and CNPq (301691/2021-5).

Author contributions

Conceptualization: LCM. Data curation: LCM, AVS, ETSC, JCRM, KMP, AWCF. Investigation: LCM, AVS, ALG, ETSC, JCRM, AWCF. Methodology: LCM, AVS, ALG, ETSC, JCRM, NCVF, AWCF. Supervision: LCM. Visualization: LCM, AVS, AWCF. Validation: LCM, AVS, GA, FAS, JCRM, AWCF. Writing – original draft: LCM, AVS, GA, FAS, JCRM, KMP, AWCF. Writing – review and editing: LCM, AVS, AWCF, GS. Supervision: LCM. Project administration: LCM.

Author ORCIDs

Lucas C. Marinho https://orcid.org/0000-0003-1263-3414
André V. Scatigna https://orcid.org/0000-0002-8874-2206
Amanda L. Garcia https://orcid.org/0000-0003-2720-7418
Ellen Thamara S. Castro https://orcid.org/0000-0003-3143-0612
Gabriela Amorim https://orcid.org/0000-0002-9375-4033
Fabio A. Silva https://orcid.org/0000-0002-1944-7246
Jone Clebson R. Mendes https://orcid.org/0000-0002-9696-1978
Karena M. Pimenta https://orcid.org/0000-0003-3058-4142
Alessandro W.C. Ferreira https://orcid.org/0000-0002-0961-5189

Data availability

All data that support the findings of this study are available in the main text.

REFERENCES

Abreu I, Giulietti AM (2016) Flora da Bahia: Aristolochiaceae. Sitientibus série Ciências Biológicas 16: 1–25. https://doi.org/10.13102/scb1059

Batista JAN, Bianchetti LB, Miranda, ZJG (2006) A revision of *Habenaria* section *Macroceratitae* (Orchidaceae) in Brazil. Brittonia 58: 10–41. https://doi.org/10.1663/0007-196x(2006)58[10:arohsm]2.0.co;2

Batista JAN, Silva JBF, Bianchetti LB (2008) The genus *Habenaria* (Orchidaceae) in the Brazilian Amazon. Revista Brasileira de Botânica 31: 105–134. https://doi.org/10.1590/S0100-84042008000100011

Carneiro-Torres DS, Silva OLM, Cordeiro I (2017) Flora da Bahia: *Euphorbia* (Euphorbiaceae). Sitientibus Série Ciências Biológicas 17: 1–28. https://doi.org/10.13102/scb2676

Ezcurra C, Zappi D (1996) *Ruellia verbasciformis*, a new combination in the genus *Ruellia* (Acanthaceae). Kew Bulletin 51: 819–820. https://doi.org/10.2307/4119741

Flora e Funga do Brasil (2022) Jardim Botânico do Rio de Janeiro. https://reflora.jbrj.gov.br/reflora/. Accessed on: 2024–05–01.

Freitas J, Lirio EJ, Barros F, González, F (2024) Aristolochiaceae. In: Flora e Funga do Brasil. Jardim Botânico do Rio de Janeiro. https://floradobrasil.jbrj.gov.br/FB15753. Accessed on: 2024-05-02.

IMESC (2008) Instituto Maranhense de Estudos Socioeconômicos e Cartográficos. Perfil do Maranhão 2006/2007. São Luís: editora do Instituto Maranhense de Estudos socioeconômicos e Cartográficos. http://imesc.ma.gov.br/src/upload/publicacoes/ab4f63fb911f92ef-718e3049c8dd2890.pdf. Accessed on: 2024-08-02

IPAM (2024) Instituto de Pesquisa da Amazônia. https://ipam.org.br/cerrado-perde-area-equivalente-a-palmas-puxado-por-aumento-do-desmatamento-no-matopiba/. Accessed on: 2024-04-06.

IUCN (2012) IUCN Red List Categories and Criteria: Version 3.1. Second edition. International Union for the Conservation of Nature, Gland, Switzerland and Cambridge, UK, iv + 32 pp.

Lourenço AR, Costa-Lima JL, Chagas EC (2019) *Eugenia caipora*, a new species of *Eugenia* sect. *Pseudeugenia* (Myrtaceae) from northeastern Brazil. Phytotaxa 408: 129–35. https://doi.org/10.11646/phytotaxa.408.2.6

Marinho LC, Scatigna AV, Mendes JCR, Feitosa NCV (2023) Expedição flora do PAT Meio Norte: em busca das espécies ameaçadas *Erythroxylum ayrtonianum* (Erythroxylaceae) e *Rinorea villosiflora* (Violaceae). Botânica Pública 4: 1–9.

Mazine FF, Bünger M, Faria JEQ, Fernandes T, Giaretta A, Valdemarin KS, Santana KC, Souza MAD, Sobral M (2024) *Eugenia.* In: Flora e Funga do Brasil. Jardim Botânico do Rio de Janeiro. https://floradobrasil.jbrj.gov.br/FB603819. Accessed on: 2024-03-24.

Mendes JCR, Pereira-Silva RA, Oliveira MH, Bigio NC, Secco RS, Silveira M (2024) *Dalechampia burchellii* (Euphorbiaceae): rediscovered, new synonyms and update on geographical distribution area. Hoehne 51: e802023. https://doi.org/10.1590/2236-8906e802023

Mori SA, Berkovi A, Gracie CA, Hecklau EF (2011) Tropical plant collecting: from the field to the internet. Tecc, Florianópolis, Brazil, 332 pp.

Nepstad DC, Jipp P, Moutinho P, Negreiros G, Vieira S (1995) Forest recovery following pasture abandonment in Amazonia: canopy seasonality, fire resistance and ants. In: Evaluating and monitoring the health of large-scale ecosystems. Springer, Berlin & Heidelberg, Germany, 333–349.

POWO (2024) Plants of the World Online. Facilitated by the Royal Botanic Gardens, Kew, UK. http://www.plantsoftheworldonline.org/. Accessed on: 2024-05-03.

Pró-Espécies (2022) Sumário Executivo Plano de Ação Territorial para a Conservação de Espécies Ameaçadas de Extinção do Território Meio Norte. https://proespecies.eco.br/publications/plano-deacao-territorial-meio-norte/. Accessed on: 2024-05-03.

Ríos-Saldaña CA, Delibes-Mateos M, Ferreira CC (2018) Are fieldwork studies being relegated to second place in conservation science? Global Ecology and Conservation 14: e00389. https://doi.org/10.1016/j.gecco.2018.e00389

Rocha L, Arbo MM (2024) *Turnera*. In: Flora e Funga do Brasil. Jardim Botânico do Rio de Janeiro. https://floradobrasil.jbrj.gov.br/FB21353. Accessed on: 2024–04–06.

Saif O, Staddon S, Keane A (2024) Fieldwork in conservation organisations—a review of methodological challenges, opportunities and ethics. Methods in Ecology and Evolution 15: 248–265. https://doi.org/10.1111/2041-210X.14273

Scatigna AV, Souza VC, Sosa MLM, Colleta DG, Machado MR, Simões AO (2022) Phylogenetics of Gratioleae (Plantaginaceae): paraphyly of *Stemodia* and its implications for generic circumscriptions, with insights from floral evolution. Botanical Journal of the Linnean Society 200 (2): 194–217. https://doi.org/10.1093/botlinnean/boac013

Shorthouse DP (2010) SimpleMappr, an online tool to produce publication-quality point maps. https://www.simplemappr.net. Accessed on: 2024-05-24.

Silva MJC, Rocha L, Marinho LC (2023) A new record of *Turnera stipularis* in Amazonia could lead to a misinterpretation of its conservation status. Oryx 57: 286–286. https://doi.org/10.1017/S0030605323000285

Sousa DJ, Siqueira GB, Giulietti AM (2020) Two new species of *Pontederia* L. (Pontederiaceae Kunth) to South America. Phytotaxa 432: 252–262. https://doi.org/10.11646/phytotaxa.432.3.2

Souza VC, Giulietti AM (2009) Levantamento das espécies de Scrophulariaceae sensu lato nativas do Brasil. Pesquisas, Botânica 60: 7–288. https://repositorio.usp.br/item/001805791

SpeciesLink (2024) speciesLink network. http://specieslink.net/search. Accessed on: 2024-05-24.

Thiers B (2024) New York Botanical Garden's Virtual Herbarium. http://sweetgum.nybg.rg/science/ih. Accessed on: 2024-04-28.