New records of Aristolochia bahiensis F.Gonzalez for the State of Maranhão, Brazil

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Artigo recebido em 24/07/2020 e aceito em 01/12/2020

**A B S T R A C T**

This study aimed to record the occurrence of the species *Aristolochia bahiensis* F. González in an area of the territory of the State of Maranhão, Brazil. The species was collected in the city of Timon, in an area of tension that brings together characteristics of the Cerrado, adjacent to Mata Ciliar. The study provides a brief characterization of the botanical family and descriptions of the genus and species, as well as data on its distribution. The species had already been found in the states of Alagoas, Bahia and Espírito Santo. In addition to portraying the geographic occurrence of the plant, a morphological characterization of the species was made, with the assembly of a board with images of the most relevant aspects of its morphology in addition to maps with its location.

**Keywords:** Aristolochiaceae, *Aristolochia*, *Aristolochia bahiensis*, Ecological Stress Area, Cerrado, Riparian Forest, Paráiba River Basin, Northeast Brazil.

**Novo registro de Aristolochia bahiensis F.Gonzalez para o Estado do Maranhão, Brasil**

**R E S U M O**

Este trabalho teve como objetivo registrar a ocorrência da espécie *Aristolochia bahiensis* F. González em área do território do Estado do Maranhão, Brasil. A espécie foi coletada na cidade de Timon, em área de tensão que reúne características de Cerrado, em adjacência com Mata Ciliar. O estudo traz uma breve caracterização da família botânica e descrições sobre o gênero e a espécie, além de dados sobre sua distribuição. A espécie já tinha sido encontrada nos estados de Alagoas, Bahia e Espírito Santo. Além de retratar ocorrência geográfica da planta foi feita uma caracterização morfológica da espécie, com a montagem de uma prancha com imagens dos aspectos mais relevantes da sua morfologia além de mapas com sua localização.

**Palavras-chave:** Aristolochiaceae, *Aristolochia*, *Aristolochia bahiensis*, Área de Tensão Ecológica, Cerrado, Mata Ciliar, Bacia do Rio Paráiba, Nordeste Brasil.

**Introdução**

The state of Maranhão in northeastern Brazil covers an area of 331,983 km\(^2\) (IBGE, 2020), which includes parts of five domains: i) the Amazon occupying the northwestern portion on the border with Pará; ii) the Cerrado occupying most of the State's area (about 60% of the territory) to the south, bordering the states of Tocantins and Piauí; iii) the coastal vegetation, to the north with formations of Mangroves and “Restingas”, constituting the second largest coast in the Northeast region of Brazil; iv) Mixed subcaduciferous forest areas forming babassu forests, in the eastern region on the border with Piauí and; v) small enclaves of Caatinga vegetation, along the Paráiba River basin (Santos-Filho et al. 2013).

The city of Timon is located to the east of Maranhão, whose territory is configured as...
belonging to the Mesoregion of the East of Maranhão. The city is 69 m above sea level and is characterized as a place of flat relief where there are also residual reliefs on hills, ridges, pontoons and hills that can reach altitudes ranging from 120 to 155 meters (Correia Filho, 2011). The vegetation is influenced by the climatic transition, relief and soil conditions, which is represented by the Open Evergreen Seasonal Forest, interspersed with babassu, Cerrado with its various phytogeographical formations, interspersed with buritizais, and the discreet presence of caumaual patches (Conceição et al., 2015). The main types of soils found in Timon (MA) are Yellow Latosols, Plintosols, Red-Yellow Argisols and Fluvic Neosols, according to EMBRAPA (2006) and Cardoso and Aquino (2014). It’s classified as a tropical climate according to the Köppen classification (Aw), with nine dry months and three rainy months. The mean annual temperature is relatively high, reaching around 20,1 – 36,2°C and with an annual mean temperature of 2,7°C with no significant oscillations. The total annual precipitation varies around to 1383 mm, with the wettest period in February and April (CLIMATEMPO, 2020).

Aristolochiaceae is a family of Magnoliids positional in Piperales (APG IV, 2016). The family Aristolochiaceae Juss. is represented by four genera, Aristolochia L., Asarum L., Saruma Oliv. and Thotthea Rottb., which together have approximately 600 species with a cosmopolitan distribution (González, 1990, 1998, 2012), with Aristolochia being the most diverse, with 450 recognized species and with tropical and temperate distribution (Wanke et al., 2006a; Wanke et al., 2006b; González, 2011, 2012). In South America, Aristolochia is the only genus of Aristolochiaceae, and Brazil is configured as the main center of diversity of the genus with 93 described species, of these 38 endemic to the Brazilian territory and 40 to the Cerrado (Freitas, Alvez-Araújo, 2017; Aristolochiaceae, 2020). In addition, in the country, the species of this family occur in all regions, distributed in all the phytogeographic domains and their phytogeographical formations, as well as in the different vegetation formations, being the Cerrado (40 spp.), the Amazon (39) and the Atlantic Forest (39), the richest in number of species, followed by the Caatinga (8) and two in the Pampas (Aristolochiaceae, 2020). The family is formed by low, annual herbs, branched from the bae, with tuberous roots, decumbent or supportive herbs and robust vines, with 62 spp. in Brazil (Barroso et al., 2002).

In Brazil, the states of Minas Gerais (32), Amazonas (27), Mato Grosso (24), Rio de Janeiro (23), Pará (23), São Paulo (22) and Bahia (21) are the most representative in terms of number of species in the family. The other states have one to 18 species (Aristolochiaceae, 2020). For the Northeast region, 29 species are cataloged, of these 18 are endemic, and the richest states are Bahia (21 spp.), followed by Maranhão with eight known species, which represents the second state in the region that is richest in number. In terms of the number of species of the Aristolochiaceae family, the eight registered for the state represent 1.45% of the world flora (550 spp.), 8.6% (93 spp.) in Brazil and 20% (40 spp.) for the Cerrado.

Aristolochia plants have alternate leaves, petiolate, with or without pseudostipules, considered undeveloped leaves. They have solitary flowers, axillary or rarely arranged in short flowering branches. Zygomorphic perigone of varying dimensions with three main parts: utricle, the perigone tube and the limb or lip, as an expanded part of the perigone. The limb or lip can have different shapes, from peltate to uni or bilabiate. The inner surface of the lip or lip may be smooth or warty and still have marginal fimbriae. In the utricle are the sexual organs that form a column (gynostemium). The gynostemium can be campanulate or cylindrical, presenting six erect stigmatiferous lobes with hairy edges. They have sessile, oblong or linear anthers inserted in the back of the spine. The ovary is located as inferior, formed by six carpels. The fruit is a hexagonal seplicidal capsule (Barroso et al., 2002; Souza and Lorenzi, 2012).

Among the registered species listed for the state of Maranhão, are: Aristolochia cordigera Willd. ex Klotzsch, A. holostylis F. González, A. doratissima L., A. papilaris Mast., A. rugosa Lam., A. setosa Duch., A. stomachoides Hoehne and A. warinningii Mast (Aristolochiaceae, 2020). It should also be noted that in the literature consulted, none of the eight species cited in the online (Barros et al. 2015) for the state were sampled in studies.
with a floristic listing bias from samples from various locations carried out in the Amazon region of Maranhão, Cerrado, on the coast and sandbank (Cabral-Freire and Monteiro, 1993; Muniz et al., 1994; Medeiros et al., 2008; Silva et al., 2008; Conceição and Castro, 2009; Neres and Conceição, 2010; Amorim et al., 2016; Loch and Muniz, 2016; Serra et al., 2016; Almeida Jr. et al., 2017; Cameo Jr. et al., 2017; Lima and Almeida Jr., 2018; Rodrigues et al., 2019).

The present study records the first occurrence of the species *Aristolochia bahiensis*, collected in the county of Timon, Maranhão, Northeast Brazil, in a preserved area adjacent to the riparian forest of the Parnaíba River, characterized as belonging to the Cerrado phytophysiognomy. The study provides a brief morphological description and illustrations of the species, as well as their location.

**Methods**

Our study was based on field collections, a literature review (Flora of Brazil 2020), and of digital collections in Reflora databases (http://reflora.jbrj.gov.br; accessed on: 2020-7-6) and SpeciesLink (http://www.splink.org.br/; accessed on: 2020-7-6) reviews.

For identification and confirmation of the species, specialized literature was used, being (Harris and Harris, 2001) for the descriptions of general morphological characters, and the unique characters in the flowers were described according to Freitas, Lírio and González (2013a), Abreu , Giulietti (2016); Freitas, Alves-Araújo (2017); Freitas et al., (2019). Supplemented with information on the analysis of the typus material, exclusive characteristics of the group, geographical distribution, flowering and fruiting periods and the species terminology, obtained from Flora do Brasil's online data networks (www.floradobrasil.jbrj.gov.br), NYBG (http://sweetgum.nybg.org/science/vh/), Mobot /

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For the analysis of the Brazilian geographic distribution of the species, the information on the collection locations and coordinates were obtained based on Freitas, Lírio and González (2013), Abreu, Giulietti (2016); Freitas; Alves-Araújo (2017); Freitas et al., (2019); Spinelli-Araújo et al., (2016), in addition to information from the SpeciesLink database (www.splink.org.br). After that, the data were grouped and the map was constructed using the QGIS software (QGIS Development Team 2015; http://www.qgis.org/en/site/). The exsiccate of the new records were incorporated into Federal University of Maranhão Herbarium (MAR).

Results

Aristolochia bahiensis F.González, Brittonia 50 (1): 8.1998.
Type: BRAZIL. Bahia: Una, Mico-Leão Biological Reserve (IBAMA), 46 km from the entrance of Highway BA-001 Ilhéus / Una, road that leads to Jaqueiral Farm, ca. 8 km from the entrance, 15º09’S, 39º05’W, 01.V.1996 (fl.), J. Jardim, S. C. Santana & J. L. Paixão 809 (Holotype: CEPEC; Isotype: NY).

New Records. Brazil: Maranhão – Timon, Lat. 5º16’44,16” S; Long. 42º51’03,12”W, alt.59m asl, 01.1.2019, L.A. Moraes 832 (MAR).

Identification.

Voluble creeper; glabrous branches and cylinders, with suber; absent intrapeciolar profiles (Fig. 2A). Petiolated leaves; blade broad-oval to lanceolate, cardiac, apex attenuated to acuminate, base subcorded to truncated, adaxially glabrous, abaxially pubescent (Fig. 2B); 4 ribs from the dichotomization of the main lateral ribs at the base of the leaf. Intrapeciolar ripples; deltoid bracts, sessile, pubers. Glabrous perianth externally, beige with streaks and vinaceous macules (Fig. 2C), internally slightly vinaceous and pale yellow closest to the upper tube, with white trichomes (Fig. 2D); obovoid lower tube; cylindrical upper tube; inconspicuous or absent lower lip, revolute margin, obtuse apex; upper lip oval to elliptical, margin revolute, obtuse apex; gynostemium with pedicel and ovary puberules. Capsules and seeds not observed.
Figure 2. Leaf and flower morphology of *Aristolochia bahiensis*. A. General aspect of the branch (including phyllotaxis) with flower in terminal position. B. Detail of leaf blade variation: abaxial face (H) and adaxial face (B). H=higher; B=bottom. C. Side view of *A. bahiensis* flower. D. Details: glabrous perianth externally, beige with streaks and vinaceous macules, internally slightly vinaceous and pale yellow closest to the upper tube, with white trichomes.
Discussion and Conclusion

Aristolochia bahiensis is endemic to Brazil. According to Flora do Brasil (2020), the species occurs in the species occurs in the Atlantic Forest Domain in an Ombrophilous Forest environment, having already been registered in the States of Alagoas, Bahia and Espírito Santo.

There is no record of any species in the Aristolochiaceae family for areas studied most strongly in Maranhão (Almeida Jr. et al., 2017), but it is noticed that given the diversity of environments and the low number of studies that new occurrences have been relatively frequent to be registered for different regions of Maranhão (Diniz et al., 2017; Ferreira et al., 2017; Ferreira et al., 2018; Ferreira et al., 2019a; Ferreira et al., 2019b; Guarçoni et al., 2018a; Guarçoni et al., 2018b; Guarçoni et al., 2020; Koch and Araújo-Silva, 2014; Nascimento et al., 2018a; Nascimento et al., 2018b; Nascimento et al., 2019; Nascimento et al., 2020; Oliveira et al., 2018; Salazar-Ferreira et al., 2020; Silva et al., 2016; Silva et al., 2018a; Silva et al., 2018b; Silva-Moraes et al., 2019).

The discovery and registration of A. bahiensis in the Parnaíba River basin, but precisely in a forest with characteristics of the Cerrado adjacent to its riparian forest, in the territory of Maranhão, reinforces the discussion raised by several authors that the region is home to a large ecotonal area, because it brings together species that occur in very diverse areas, from areas of more humid seasonal forests, passing through Cerrado areas, to drier areas, such as the Caatinga, reinforcing the dispersing role of water bodies in the dissemination of seeds and propagules.

It is believed, therefore, that there is still an exceptionally large gap in relation to the Aristolochia species that actually occur in Maranhão and that further studies on the state's flora are needed. This is the first record of the species Aristolochia bahiensis in a forest area strongly influenced by the presence of plants from the Cerrado, in addition to its first occurrence in the state of Maranhão, which expands its area of distribution in the Brazilian territory, and in another biome in the country (Cerrado).

The new occurrence of A. bahiensis calls attention to the need for floristic surveys in areas not yet sampled in Maranhão, as well as in neighboring states, especially in places of forest remnants with many species typical of the Cerrado, before these habitats destroyed by anthropic action. It is believed that one of the possible reasons for the lack of registration in the state is due to the scarcity of collections of species of the Aristolochiaceae Juss. family, this may be due to the great difficulty of finding them during collects, or even their identification in the field, because in the area only one individual of the species was found, therefore, of rare occurrence.

Finally, it is important to know the regional flora, as it contributes to indicate the degree of richness and diversity of plants in the region, in the case of the occurrence of the species A. bahiensis in a Cerrado fragment, it can enable projects of conservation, management and recovery of areas belonging to this phyto physiognomy. In addition, it extends the area of geographic distribution of the taxon, in addition to providing knowledge related to ecology and taxonomic data of the species.

Acknowledgements

The authors are grateful for the resources coming from CNPq (Universal Project Nº 422747/2016-5) for funding.

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