

Expansion of the geographic distribution and conservation status of *Paullinia cearensis* Somner & Ferrucci (Sapindaceae)

Janilde de Melo Nascimento^a, Guilherme Sousa Silva^{b*}, Gonçalo Mendes da Conceição^c

^a Universidade Estadual do Piauí, São Raimundo Nonato, 64770-000, Piauí, Brasil. *guilhermecx.cx@hotmail.com

^b Programa de Pós-Graduação em Biologia Vegetal, Universidade Estadual de Campinas, Campinas, 13083-876, São Paulo, Brasil. *guilhermecx.cx@hotmail.com

^c Programa de Pós-Graduação em Biodiversidade Ambiente e Saúde, Universidade Estadual do Maranhão, Caxias, 65.604-380, Maranhão, Brasil

Received: 7 March 2022 / Accepted: 23 May 2022 / Published online: 31 May 2022

Abstract

Paullinia cearensis Somner & Ferrucci (Sapindaceae) is an endemic species of Northeastern Brazil, hitherto known from the states of Ceará and Piauí, in areas of Caatinga and Atlantic Forest. The species is being recorded for the first time in the state of Maranhão and in the Brazilian Cerrado. It was collected in Morro do Alecrim, a remnant of Cerrado, in Caxias-Maranhão, during a botanical expedition in January 2021, where the species was found with fruits. A morphological description, taxonomic comments, data on geographic distribution, detailed images of the species, and an assessment of its conservation status, categorized as endangered, are presented. This data will contribute to the knowledge and conservation of this species for the northeastern flora.

Keywords: Cerrado; Maranhão flora; new occurrence; Sapindales.

Ampliação da distribuição geográfica e status de conservação de *Paullinia cearensis* Somner & Ferrucci (Sapindaceae)

Resumo

Paullinia cearensis Somner & Ferrucci (Sapindaceae) é uma espécie endêmica do Nordeste brasileiro até então reconhecida para os estados do Ceará e Piauí, em áreas de Caatinga e Mata Atlântica. A espécie está sendo registrada pela primeira vez no estado do Maranhão e para o Cerrado do Brasil. A espécie foi coletada em remanescente de cerrado do Morro do Alecrim, Caxias-Maranhão durante expedição botânica em janeiro de 2021, onde a espécie encontrava-se frutificada. Apresenta-se descrição morfológica, comentários taxonômicos, dados de distribuição geográfica, imagens detalhadas para a espécie e avaliação do estado de conservação, categorizando-a como em perigo de extinção. Esses dados contribuirão com o conhecimento e conservação dessa espécie para a flora nordestina.

Palavras-chave: Cerrado, Flora do Maranhão, nova ocorrência, Sapindales

Sapindaceae is the largest and most important family of the order Sapindales (APG IV, 2016), with about 140 genera and 1,900 species mainly distributed in tropical regions (Acevedo-Rodríguez, Welzen, Adema, & Ham, 2011). In Brazil, the family is represented by 32 genera and 436 species, of which 191 are endemic, and in the Northeast, the third region with the highest biodiversity in Brazil, there are 165 species (Flora do Brasil 2020). Among the phytogeographic domains, a greater diversity of Sapindaceae is found in areas of Atlantic Forest (204 spp.) and Amazon Forest (241 spp.) (Acevedo-Rodríguez, 1993; Flora do Brasil 2020), both biomes known for their high richness and endemism of angiosperms (Daly, & Mitchell, 2000).

Among the lineages of Sapindaceae, the genus *Paullinia* L. is one of the most diverse, with approximately 200 species

widely distributed in Central and South America (Ferrucci, 1991). In Brazil, 102 species are recorded, including 39 endemic to the country (Somner, & Medeiros, 2021). *Paullinia* representatives are recognized as woody vines with imparipinnate leaves; inflorescences in thyrses with more than three branches; flowers tetramerous, zygomorphic with aposepalous calyx, 2 external and 2 or 3 internal sepals, appendage adnate to the base of the petal and cucullate with a yellowish crest at the apex; ovate nectaries; villous stamen filaments; pubescent or glabrous gynoeceum, trifid stigma; and septifragal capsule. (Pereira, Amorim, Alves, Somner, & Barbosa, 2016).

Most of the diversity of *Paullinia* species in Brazil is concentrated in the North region, where Amazon Forest predominates (83 spp.). Although the other regions have less

than half of the species cited for the North, they harbor endemic species that still need studies and, especially, a basis for conservation. *Paullinia cearensis* Somner and Ferrucci is an endemic species occurring in Caatinga and Atlantic Forest, exclusive to the Northeast region, with few collection points and several knowledge gaps. The objective of this work was to expand the geographic distribution of *P. cearensis* in Brazil through the report of the first record for the state of Maranhão and the Brazilian Cerrado. We evaluate the conservation status of the species and discuss possible conservation measures.

The analyzed material was collected in Morro do Alecrim, a remnant of Cerrado, in the municipality of Caxias/Maranhão, during a botanical expedition in January 2021. The collection followed the procedures suggested by Rotta, Beltrami and Zonta (2008). Specialized literature was used for identification and confirmation of the species, according to Somner and Ferrucci (1997) and Perdiz, Ferrucci and Amorim (2014). Comparisons were made with exsiccates by consulting image banks of the EAC, HUEFS and R herbaria (acronyms according to Thiers, 2021), with visualization and comparison with type material. Identifications were confirmed by a specialist in the group. After identifying the botanical material, the samples were incorporated into the Prof. Aluizio Bittencourt Herbarium (HABIT), from the Center for Higher Studies of Caxias/CESC of the State University of Maranhão/UEMA.

The scientific names and authors of the species were checked in the List of Species of the Brazilian Flora (Somner, & Medeiros, 2021). The terminology used to describe the species is in agreement with Somner and Ferrucci (1997). In addition to descriptions, data on the geographic distribution of the species in the Brazilian states and phytogeographic domains are provided. A distribution map was created in the QGIS software version 3.6.2.0 (Quantum GIS Development Team 2015). Information on the phenology and occurrence in phytogeographies according to the Flora do Brasil 2020 (floradobrasil.jbrj.gov.br), Tropicos (www.tropicos.org), and SpeciesLink (inct.splink.org.br) databases is also provided along with comments on the biology of the species.

The conservation status was assessed using the GeoCAT tool (Bachman, Moat, Hill, Torre, & Scott, 2011). The analysis of the Area of Occupancy (AOO) was performed with a grid cell size of 2 km² as recommended by the IUCN. AOO and Extent of Occurrence (EOO) values are provided. Maps showing the AOO and EOO were created using the QGIS software version 3.6.2.0, and the species was classified according to the categories established by the IUCN (2013).

Paullinia cearensis Somner and Ferrucci, Bonplandia (Corrientes) 9(3–4): 241, f. 1997. (Fig. 1). Holotype: BRASIL. Ceará. Na entrada de Piçarra para Viçosa do Ceará, fruto vermelho, carrasco, 22-II-1979 (fr), Fernandes, A. et A. J. Castro s.n. (EAC 5639).

Liana. Stem with an indument of curly hairs, yellowish to ferruginous in young branches, leaf axes and inflorescences. Flowering branches dark brown, 3-5 mm diam. Stipules subulate, deciduous, 4-8 mm long, sericeous; petiole ventrally canaliculate, 1.3-9 cm long, blade pinnate compound, 5-foliolate; rachis bicanaliculate, generally shorter than the petiole, 14-32 mm long, pubescent; leaflets petiolate to

subsessile, subcoriaceous, elliptical, oblong or narrowly ovate, 5-13 × 1.5-5.5 cm, base of the terminal leaflet acute, obtuse in the others, apex acute, sometimes retuse, margin serrate-dentate, 7-16 teeth. Inflorescence a double terminal or axillary spike-like thyrse, peduncle quadrangular in cross-section, 0.5-9 cm long, with 2 tendrils at the base of the rachis, the latter angular, 24-103 mm long, cincinni sessile, 3-6-flowered; floral pedicel 1.5- 3.5 mm long, in the fruit up to 3.5 mm long. Flowers not seen. Capsules reddish, septifragal, ellipsoidal, 6-costate, coriaceous, uniseminate, apiculate, 12.5-14.5 × 8-10 mm, including the stipe which is 1.3-8 mm long; epicarp rugose, puberulent; endocarp woolly, long greyish hairs. Seeds ellipsoid, 8-9.5 × 5.5-6.7 mm; sarcotesta ± ½ the length of the seed, divided into two lobules.

Material examined: Brazil, Maranhão: Caxias, Morro do Alecrim, Lat: 4°51'32" S, Long: 43°21'22" W, 08/1/2021, fr., Nascimento, JM 284 (HABIT 00002).

Geographic distribution and habitat: *P. cearensis* is recorded only in the Northeast region of Brazil, in the states of Ceará and Piauí, in the phytogeographic domains of Caatinga and Atlantic Forest. Regarding the type of vegetation, the species occurs in Caatinga (*sensu stricto*), Riparian Forest, and Ombrophilous Forest (Rainforest) (Somner, & Medeiros, 2021). With the new record reported in this study, the species has its distribution extended to the state of Maranhão, in the Cerrado phytogeographic domain, specifically in Cerrado vegetation (*sensu lato*) (Fig. 2). According to data from the Flora do Brasil 2020, the species is being reported for the first time for Maranhão, but in the Specieslink platform, the species had been collected once in Maranhão, recorded as a Voucher from Nunes, E. s.n. (EAC 5788), in a collection carried out on 16/04/1979 and determined by Ferrucci in 1997. This collection was also made in the municipality of Caxias, in a rural area in the village of Criminosa. It is noteworthy that the species was collected only twice in the few floristic studies conducted in the area, and it is, thus, possible that the area of occurrence of the species in the state of Maranhão is larger.

Phenology: The flowering of the species occurs from October to February and the fruiting from December to April, corresponding to the end of the dry season and beginning of the rainy season in Maranhão, Piauí and Ceará.

Notes: The species is known by the popular name “Mata fome” (Somner, & Ferrucci, 1997). According to Radlkofer (1931-1932), the genus *Paullinia* has 13 sections, and the species *P. cearensis* belongs to the section *Pleurotoechus* Radlk., whose diagnostic characters are fruits with thickened pericarp, with 3 or 6 longitudinal strands, dialysepalous calyx with the two anterior sepals welded at the base. Considering the Brazilian species of *Paullinia*, the species most closely related to *P. cearensis* is *P. capreolata* (Aubl.) Radlk., mainly due to shared characteristics such as subcylindrical central vascular cylinder, apterous capsule, petiole and rachis. They differ by the sarcotesta that is absent in the seeds of *P. capreolata* and present and covering half of the seeds of *P. cearensis*, and the capsules without crests in *P. capreolata* and with crests in *P. cearensis* (Somner, & Medeiros, 2021).

According to Somner and Medeiros (2021), there are six species of *Paullinia* in the state of Maranhão: *Paullinia clavigera* Schldl., *Paullinia elegans* Cambess., *Paullinia imberbis* Radlk., *Paullinia pinnata* L., *Paullinia rubiginosa* Cambess., and *Paullinia venosa* Radlk. Of these, *P. clavigera*, *P. venosa* and *P. rubiginosa* are the most related to *P.*

cearensis, but they are easily distinguished by vegetative characters such as trigonal stems in *P. clavigera* vs. subcylindrical in *P. cearensis*; domatia absent in secondary vein axils of *P. venosa* vs. domatia present in secondary vein axils of *P. cearensis*; winged or marginate rachis in *P. rubiginosa* vs. apterous rachis in *P. cearensis*.

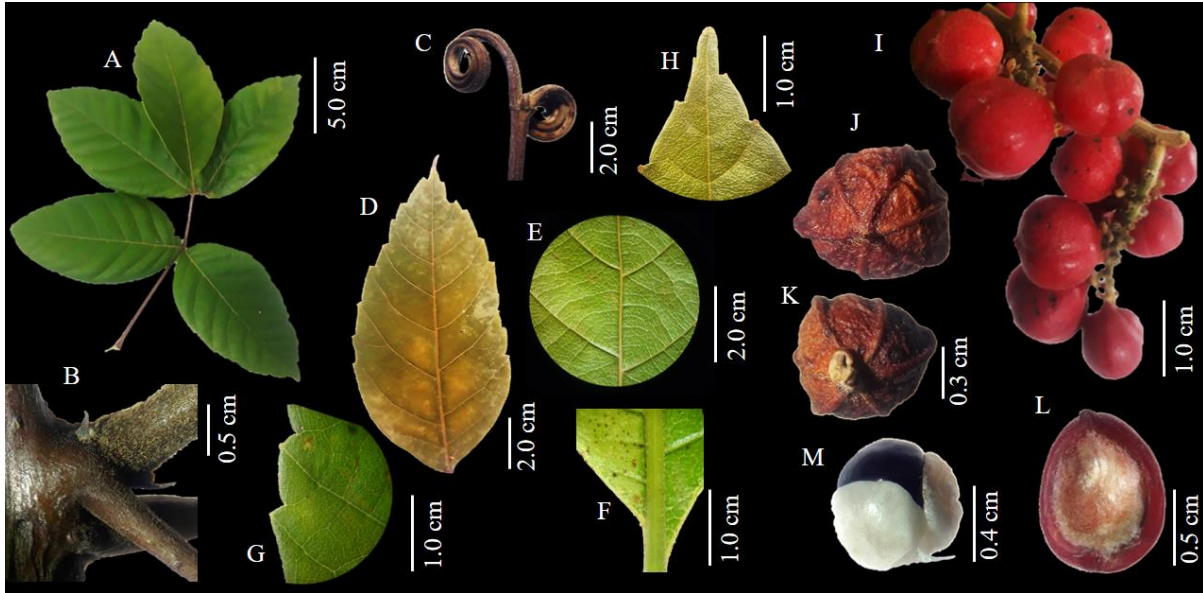


Figure 1. *Paullinia cearensis*: A. Leaves; B. Stipules on both sides of the leaf; C. Tendrils; D. Leaflet; E. Veins; F. Leaflet base; G. Leaflet margin; H. Leaflet apex; I. Fruits; J. Inferior view of the capsule; K. Top view of the capsule; L. Woolly endocarp; M. Seed. (HABIT 00002).

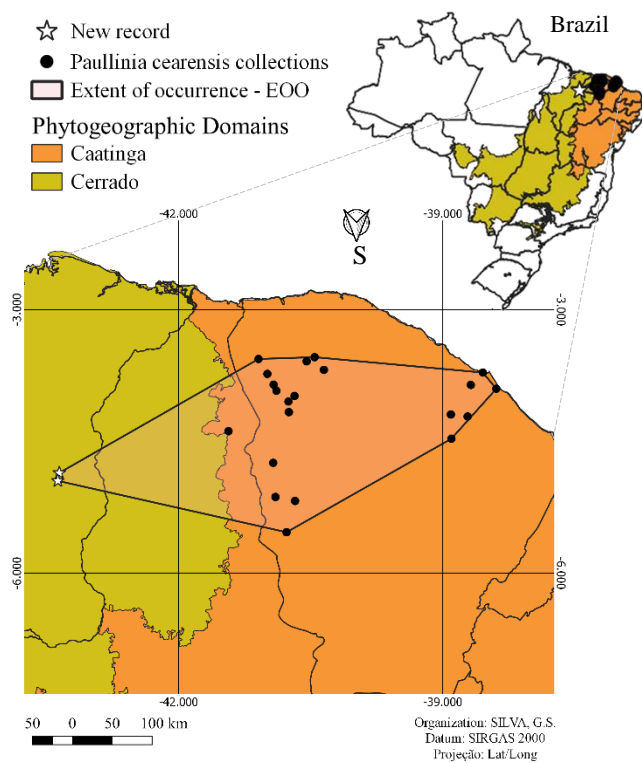


Figure 2. Points of occurrence of *Paullinia cearensis*, highlighting new records cataloged in the State of Maranhão and Brazilian Cerrado.

Conservation status: The species *P. cearensis* is known from 32 collections of populations in 23 localities, of which eight occur within or near conservation areas. GeoCAT analyses indicated an EOO of 70,801.741 km², placing the species in the category of Least Concern (LC), and an AOO of 92,000 km², placing it in the category Endangered (EN). When the result suggested by the EOO differs from that indicated by the AOO, the IUCN recommends the adoption of the highest threat category, according to the precautionary principle (PP). Thus, *P. cearensis* is categorized as Endangered (EN) under IUCN (2013) criteria. The species is endemic to the Brazilian Northeast, occurring in vegetation remnants with severely fragmented forest remnants, many of which are being destroyed and/or replaced by human activities, which are phenomena particularly common in tropical regions (Ranga et al., 2012).

Studies on new records of plant species are necessary to computerize the information on their occurrence in plant biodiversity data networks, so as to expand and facilitate the access to the knowledge about the biodiversity of the areas and phylogeographic domains in which the species occur. As many areas in the state of Maranhão lack floristic surveys or are poorly sampled, new records of species are frequent, such as those published by Santos-Silva, Silva, Oliveira and Conceição (2018), Diniz, Silva and Conceição (2017), Nascimento et al. (2019), and Nascimento et al. (2020). The expansion of the distribution of *P. cearensis* to the state of Maranhão and the Brazilian Cerrado contributes

significantly to the floristic knowledge of the state and of the phytogeographic domain, especially so because this is an endemic species. It also encourages further studies in the area so that the richness and the diversity can be known before being devastated by human activities.

Acknowledgment

The authors thank researcher Herison Medeiros for confirming the identification of the species. To the Laboratory of Plant Biology/LABIVE of CESC/UEMA for the infrastructure provided.

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