

New occurrence of *Mitracarpus frigidus* (Willd. ex Roem. & Schult.) K.Schum. (Rubiaceae, Spermaceae) in the State of Ceará, Brazil

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ABSTRACT – (New occurrence of *Mitracarpus frigidus* (Willd. ex Roem. & Schult.) K.Schum. (Rubiaceae, Spermaceae) in the State of Ceará, Brazil). We report a new occurrence of *Mitracarpus frigidus* (Willd. ex Roem. & Schult.) K.Schum. in the Brazilian State of Ceará, collected at the Serra das Matas residual massif. We present data on its morphological relationship to a similar species, ecological preferences, photographs, illustration, map and updated information on its distribution. This finding increases our knowledge on the distribution of this species and about the flora of Ceará State, as well as aiding in future biogeographic research.

Keywords: new records, residual massif, rocky outcrop, serra das matas

RESUMO – (Nova ocorrência de *Mitracarpus frigidus* (Willd. ex Roem. & Schult.) K.Schum. (Rubiaceae, Spermaceae) no Estado do Ceará, Brasil). Relatamos a nova ocorrência de *Mitracarpus frigidus* (Willd. ex Roem. & Schult.) K.Schum. para o Estado do Ceará, coletada no Maciço Residual Serra das Matas. Apresentamos dados sobre relações morfológicas com espécie afim, preferências ecológicas, fotografias, ilustração, mapa e informações atualizados sobre sua distribuição. Esse achado amplia o conhecimento sobre a distribuição dessa espécie e da flora do Estado do Ceará, além de auxiliar futuros estudos biogeográficos.

Palavras-chave: novo registro, maciço residual, afloramento rochoso, serra das matas

Introduction

Rubiaceae Juss. is comprises of approximately 13.765 species distributed among 611 genera and is the fourth richest Angiosperm family (Delprete & Jardim 2012, Govaerts *et al.* 2016). It presents a cosmopolitan distribution, predominantly occurring in tropical and subtropical regions (Govaerts *et al.* 2016). In Brazil, the taxon has approximately 1.406 species distributed over 126 genera and occurs in all the phytogeographic domains. In the Northeast region of Brazil, the group is represented by 83 genera and 411 species, of which 42 genera and 103 species occur in the State of Ceará (Souza *et al.* 2020).

Among its genera, *Mitracarpus* Zucc. ex Schult. & Schult.f. has ca. 50 species distributed in the tropical and

subtropical regions of the New World (Verdcourt 1975, Andersson 1992, Souza *et al.* 2010). In Brazil, 28 species are recognized, occurring mainly in the Cerrado and Caatinga domains (Souza *et al.* 2020). In the Northeast region of Brazil, the genus is represented by 18 species, of these six occur in Ceará State, so far. This genus is characterized by its calyx having four lobes, two small and two large, a capsular fruit with transverse dehiscence and by presence of a depression in the ventral region of the seeds. (Souza *et al.* 2010). Among the species, *Mitracarpus frigidus* (Willd. ex Roem. & Schult.) K.Schum. has a wide distribution in South America. Field expeditions revealed a new occurrence of this species in the State of Ceará, increasing our knowledge on its distribution and the diversity of the flora of Ceará State. We provide a morphological description, taxonomic

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comments, ecological preferences, illustrations, a map of its distribution, as well as photographs of the species and its habitat taken on site.

Material and methods

This work was based on field trips carried out between 2020 and 2022, in the Serra das Matas residual massif, located in the municipality of Catunda, Ceará State, consultations to the herbarium collections EAC, HCDAL and HUVA (acronym based on Thiers 2023- continuously updated) in order to find other specimens collected in the study area, digital images available online provided by online platforms (Tropicos 2020, *SpeciesLink* 2020, Souza *et al.* 2020), digital images available online provided by JSTOR, specialized literature (Souza *et al.* 2010), and morphological analysis of specimens collected in the field. The specimens were collected and herborized according to usual techniques for vascular plants (Mori *et al.* 1989) and incorporated into the HUVA herbarium. Identification was carried out with aid of specialized bibliography, consultation with specialists and confirmed by comparison with a digital image of the type specimen. Data on geographic distribution were obtained from the exsiccate labels and from specialized literature (Souza *et al.* 2010). Distribution map was made using QGIS v. 3.16.10.

Results and Discussion

Mitracarpus frigidus (Willd. ex Roem. & Schult.) K. Schum., Fl. Bras. 6(6): 81. 1888.

Spermacoce frigida Willd. ex Roem. & Schult., Syst. Veg. 3: 531. 1818.

Type: Venezuela. Silla de Caracas, *Humboldt & Bonpland s.n.* (holotypus: *B-Willd 2623* [photo!]).

Ascending or erect subshrub, 30-70 (-100) cm high. Stems strongly tetragonal, winged, glabrous or puberulous on each surface, hispid or pubescent on the wings, trichomes retrorse, denser in the stipule region. Stipule leathery, glabrous or puberulous, 2-3 mm long, 4-8(-12) spines, 2-7(-12) mm long, thinly triangular, acute, glabrous, apical colleter. Leaves pseudovercillate, axillary brachyblasts, sessile, leaf blade 9-11 x (2-)5-20 mm, lanceolate or linear-lanceolate, rarely linear, acute mucronate apex, attenuate or cuneate base, the edges are ciliate, scabrous or (rarely) glabrous, upper surface scabrous, strigous or glabrous, lower surface scabrous to glabrous, glabrous or pilose on the veins, 2-3 secondary veins on each side, conspicuous or inconspicuous. Flowers in globular fascicle, terminal or axillary, 2-4 leafy bracts, usually reflexed. Flowers subsessile, inconspicuous pedicel, hypanthium is obconic, glabrous or puberulous on the apex. Calyx has unequal pairs of lobes, larger lobes linear-lanceolate or lanceolate, lengthily acuminate,

3-5 mm long, ciliate along the edges, maller lobes narrowly triangular, hyaline, lengthily acuminate (1.2-)2-3 mm long, ciliated along the edges. Corolla (3.5-)5-9 mm long, tube (3-)4-7 mm long, papillous or puberulous-papillous externally, ring of trichomes on its internal lower third, lobes highly oval or ovoid, subobtuse to acute, 1.5-2 mm long, papillous or puberulous externally, sparsely or densely puberulous internally. Filaments 0.5-1 mm long, anthers 1-1.5 x 0.3 mm, linear. Style (3-)6-9 mm long, filiform, stigmatic lobules 0.5-1 mm long. Capsules obconical, 1.5-2 x 0.5-1.5 mm, glabrous or puberulous on the upper part. Seeds oblong or globular, 1-1.2 x 0.8 mm, brown or dark brown, dorsal surface with deep cruciform depression, foveolate-reticulate exotest, ventral surface fit with an "X" pattern.

Material examined: BRAZIL. Ceará, Serra Branca, Catunda, 07.6161°S, 072.6872°W, 1000 m, 6-VII-2020, L.S. Rodrigues 90 (HUVA).

Geographical distribution: The species presents a wide distribution in South America, occurring in Colombia, Venezuela, French Guiana, Guiana, Peru, and Brazil (Souza *et al.* 2010). Its geographic distribution in the countries to the North and the Northeast of South America mainly comprise mountain ranges (Souza *et al.* 2010). In Brazil, it occurs in the States of Roraima, Amazonas, Piauí, Paraíba, Pernambuco, Bahia, Minas Gerais, Espírito Santo, and Rio de Janeiro (figure 1). It occurs in sandy soils, usually in humid areas, on rocky outcrops and *inselbergs*, *capoeiras*, secondary vegetation, along the fringes of paths, as well as occurring near to rivers (Souza *et al.* 2020).

Mitracarpus frigidus is a species with a distribution intimately linked to rocky grasslands at high altitudes. It grows on granite or sandstone outcrops, or even on grassy fields, in the *Cerrado* and *Campo Rupestre* vegetation. In the region where this study was conducted, we collected a specimen growing on the crowning strata of the massif, at altitudes of over 1000 meters (figure 2). The area exhibits an herbaceous layer associated with the granite outcrops under the influence of orographic rains and highly humid winds. In this environment, *M. frigidus* shares the same habitat as that occupied by Begoniaceae, Bromeliaceae, Cactaceae, Euphorbiaceae, Orchidaceae and other succulent species. As reported by other high altitude field collectors in the State of Bahia, especially from Chapada Diamantina, each individual of *M. frigidus* from the Serra das Matas form clumps among the rocks' crevices, where they appear as little bushes.

Conservation status: This species is categorized as Least Concern.

Comments: *Mitracarpus frigidus* is an erect subshrub or ascending and generally forms clumps, occasionally with decumbent stems (figure 3). Leaves and stems vary from glabrous to strongly indumented. Its defining characteristics are its leaves, which are lanceolate or linear-lanceolate,

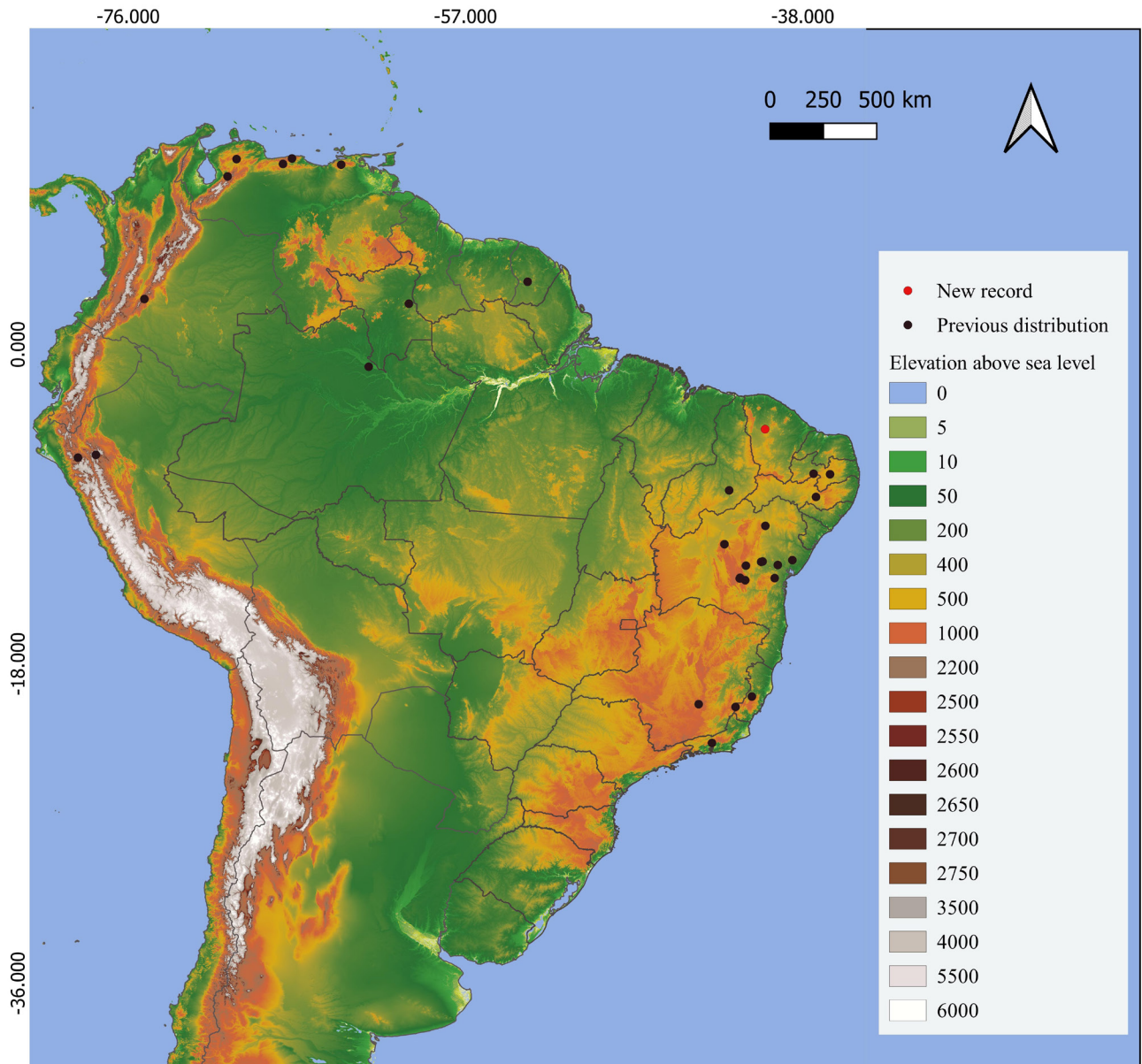


Figure 1. Distribution of *Mitracarpus frigidus* (Willd. ex Roem. & Schult.) K.Schum. The new record is shown by a red dot.

chartaceous, 2-5 mm long, with ciliate leaf margins, scabrous or (rarely) glabrous, the stipule has 4-18 spines around 2-12 mm in length and the seeds have a dorsal cruciform depression (Souza *et al.* 2010). It is a heliophyte, inhabiting sandy soils, generally with a preference for more humid areas, on rocky outcrops and *inselbergs*, at elevations ranging from 268-2970 m.

Due to its variation, it has had its delimitation mistaken with that of other species because they don't exhibit a morphological discontinuity regarding their stipules, stem, and leaves, which has led to the proposition of distinct definitions for these entities. The habit and the stem of

M. frigidus are similar to those of *M. polygonifolius*; however, the former can be distinguished from the latter especially because it exhibits pseudoverticillate (instead of opposite) leaves, each flowering branch bearing 1-3 glomerules (instead of with 2-14 glomerules for each flowering stem), the terminal flower is subtended by 4 bracts (instead of by 2 bracts) and its seeds have a dorsal cruciform depression (instead of no dorsal depressions). *Mitracarpus frigidus* is also similar to *M. semirianus*, but differs by the puberulent to glabrous stems (vs. glabrous in *M. semirianus*), ribbed at each angle (vs. winged at each angle) and rib margin hirsute, strigose or glabrous (vs. wing margin hirsute).



Figure 2. *Mitracarpus frigidus* (Willd. ex Roem. & Schult.) K.Schum. a. Serra das Matas massif overview. b. Habit. c. Leaf details. d-e. glomerule details. f. Flowers. Photos: L. S. Rodrigues.

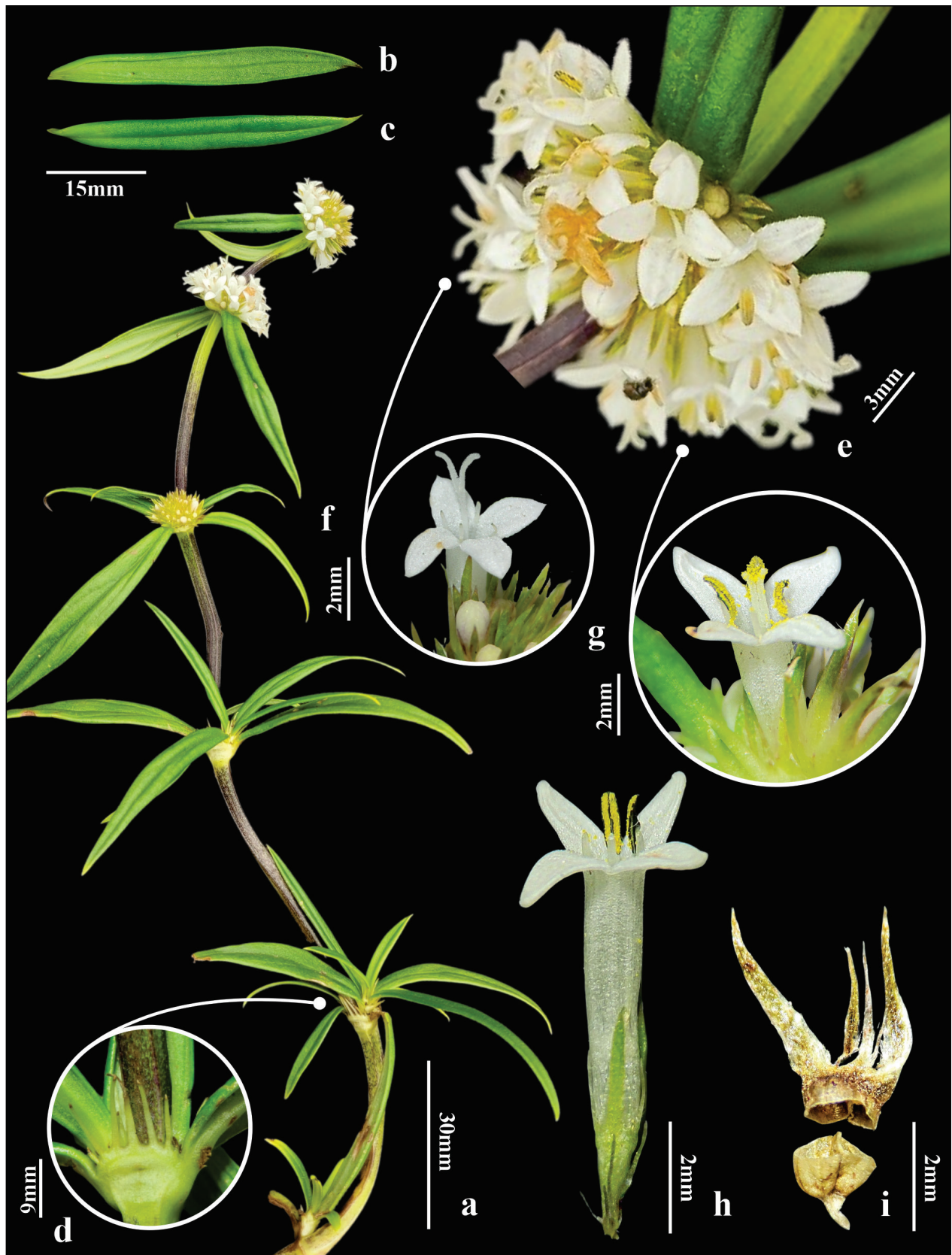


Figure 3. *Mitracarpus frigidus* (Willd. ex Roem. & Schult.) K.Schum. a. Habit. b-c. Leaf. b. Abaxial face. c. Adaxial face. d. Stipule. e. Fascicle detail. f. Flower with evident pistil. g. Mature anthers, showing pollen grains. h. Flower. highlighting the hypanthium. i. Open fruit. Photos: L.S. Rodrigues.

The first record of *M. frigidus* in the State of Ceará indicates the necessity for a greater collection effort on the massifs present in the central regions of the State, as they are poorly researched areas and have few recorded collections. This finding will support conservation efforts, improve our knowledge of the local flora, contributing to a better understanding of the biogeographical patterns and morphological characteristics of *M. frigidus*. These data are essential to accurately document biodiversity and to advance knowledge of the species present in the Caatinga domain.

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Conflict of interests

There are no conflicts of interest.

Author contributions

Leonardo de Sousa Rodrigues: Development of the study; specimen collection, species identification and manuscript writing.

Izaias Carvalho de Sousa: Identification of the species, production and preparation of the photograph board, writing of the manuscript and revision of the manuscript.

Francisco Diego Sousa Santos: Development of the manuscript, intellectual contribution in critically reviewing the writing, contribution of technical knowledge about taxonomy.

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