

New insights into morphology and distribution of the asymmetrical genus *Croasdalea* (Desmidiaceae, Streptophyta)

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Abstract

The genus *Croasdalea* is currently known only from two countries of South America: Brazil and Colombia. In this paper we report a new record, expanding the distribution of this genus to northeastern Brazil, in addition to provide for the first time detailed photos in light microscopy and scanning electron microscopy for this genus. Some observations about ecology and morphology were provided.

Introduction

The monospecific genus *Croasdalea* was proposed by Bicudo & Mercante (1993) based on *Staurostrum marthae*, a species described by Grönblad (1945) from Pará State, northern Brazil. It is one of the asymmetrical genera of desmids occurring in the tropics together with *Allorgeia* Gauthier-Lievre, *Amscottia* Grönblad, and *Prescotiella* C.E.M.Bicudo, and it is currently considered endemic to South America, with records from Brazil and Colombia.

Before the proposition of this genus, this taxon also was considered a member of the genus *Staurodesmus* by Teiling (1967) at variety level: *Staurodesmus calyxoides* var. *marthae* (Grönblad) Teiling. The last records of *Croasdalea* were performed in 1990s in São Paulo State (Bicudo & Mercante, 1993; Marinho & Sophia, 1997) and in 1985 in Colombia (Coesel et al., 1988). Since then, the records of this genus in Brazil were known only to States of Pará and São Paulo, northern and southeastern regions, respectively.

Recently, we have collected samples in Cerrado areas from western Bahia State, northeastern Brazil, and we found rare and interesting desmids, including *Croasdalea marthae*.

Herein we report a new record of this genus showing an updated distribution and new insights about morphology, besides presenting photos in different views in light microscopy and SEM.

Material & Methods

Five samples were collected during February 2026 in a pond in the municipality of São Desidério, Bahia State, northeastern Brazil (photo 1). Some physico-chemical water parameters were measured *in situ* including Dissolved Oxygen (DO; mg/l), temperature (°C), Electrical Conductivity (EC; $\mu\text{S}/\text{cm}$), Total Dissolved Solids (TDS; mg/l) and pH. Measurements were performed using portable multimeter probes (Hanna HI98130 and Instrutherm MO-910). The samples were fixed with Transeau solution. The Light Microscopy (LM) analysis was carried out with a Leica Microscope, and the Scanning Electron Microscopy (SEM) studies were conducted based on Moura et al. (2021).



Photo 1. Map and sampling site (*) in municipality of São Desidério, Bahia State, Brazil. Photo © Geraldo Ramos.

Results and discussion

Croasdalea marthae (Grönblad) C.E.M.Bicudo & Mercante 1993, 271 (figs. 2–3).

Basionym: *Staurostrum marthae* Grönblad (1945: 27)
Synonym: *Staurodesmus calyxoides* var. *marthae* (Grönblad) Teiling (1967: 492).

Cell solitary, as long as wide, deeply constricted, median sinus open, acute-angled; semicells trapeziform, all angles somewhat projected and tipped with a single, solid, long spine; spines of both upwardly curved; chloroplast axial, stelloid, with one pyrenoid per semicell. Zygospores not observed.

Cell dimensions: cell length (without spines) 25–39 μm ; cell width (without spines) 24–38 μm ; width of isthmus 17–25 μm ; spines: 19–29 μm .

Distribution: Brazil: Pará (Grönblad 1945, Scott et al. 1965: as *Staurostrum marthae*, Förster 1969: as *Staurodesmus calyxoides* var. *marthae*), São Paulo (Bicudo & Mercante, 1993; Marinho & Sophia, 1997; Mercante & Bicudo, 1998; Ramírez & Mercante, 1998; Bicudo et al., 2018); Bahia (present study); Colombia (Coesel et al., 1988: as *Staurodesmus calyxoides* var. *marthae*).

We have analyzed five samples from western Bahia, collected in areas of Cerrado, the World's most biodiverse Tropical Savannah (Cardoso et al., 2026), covering

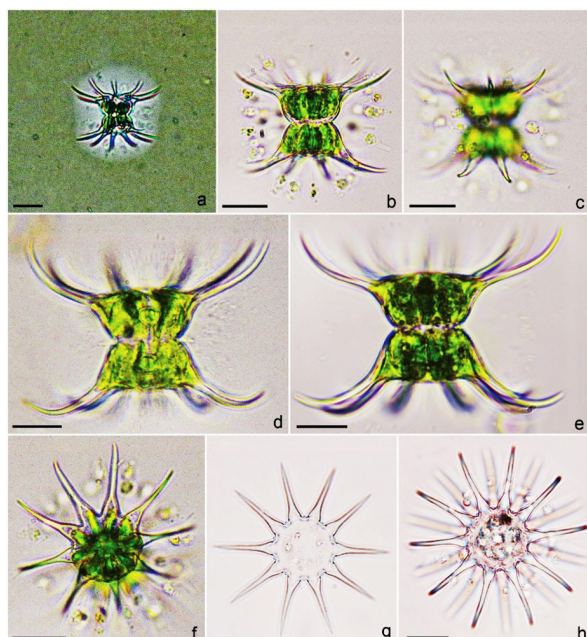
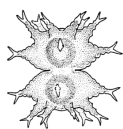


Photo 2. Cells of *Croasdalea marthae* in LM. a. Detail of the mucilage sheath. b-c. detail of the chytrids parasitizing the cell. d-e. cell in front view, with detail of the chloroplast. f-g. cell in apical view showing the variation in the number of spines. Scale bars: 20 µm.

the most part of Central Brazil. This biome is known for high endemism and rare species of desmids (Ramos et al., 2024). Despite of little is known about the distribution of *Croasdalea*; the ecology of the genus is well known from studies performed mainly in São Paulo State. As highlighted by Mercante & Bicudo (1998) *Croasdalea marthae* is surely a species morphologically well adapted for flotation, due to its perfectly smooth cell wall and long, strong spines, which occur at regular intervals on the angular projections of the semicells. According to these authors, the concentration of the cells of this species in a pond from São Paulo State is approximately three times more in the surface than in at the bottom. This pattern together with the mucilage sheath (photo 2a) contributes to planktonic life of this species. In our samples we found *Croasdalea* cells from different communities (phytoplankton, periphyton, and metaphyton). Ramirez & Mercante (1998) referred this species mainly as “pseudo-periphyton”. During our analysis we also realized most individuals were parasitized by chytrids photos 2a-b).

Apparently, this species is well adapted to wide variation of pH. Bicudo & Mercante (1993) reported specimens occurring between pH 5.44–8.90 in a pond. However, in Bahia, we found *Croasdalea* cells only under acidic conditions (pH 5.4). Other parameters measured were water temperature (28.9 °C), EC 1 µS/cm, dissolved oxygen (DO) 4.5 mg/L and TDS 0 ppm.

Regarding bipolar asymmetry of the cell, we did not observe symmetrical forms, so the asymmetrical pattern of the genus was strongly constant in all the specimens examined. On other hand, the number of spines was variable, as reported in the literature. The most

common pattern is cells with 9 spines, but specimens 7 or 8 radiate also could occur (Bicudo & Mercante, 1993). In our samples from Bahia, we observe two populations: one with minor cells (approximately 30 µm in length) bearing up to 9 spines (photos 2b-c, f-g), and another with larger cells (approximately 40 µm in length) with 10 spines (photos 2d-e,h). Some cells with 8 spines were also observed, especially in individuals measuring around 30 µm. Overall, we observed that larger cells tend to have a greater number of spines. According to Bicudo & Mercante (1993), the spines of the upper semicell are all upwardly curved, whereas those of the lower one are less curved than and somewhat parallel to those of the upper semicell. Scott et al. (1965) reported different specimens (as *Staurostrum marthae*) with spines more erect. However, in the specimens which we analyzed from Bahia, both semicells have spines upwardly curved. We also noticed that in apical view the spines of the upper semicell are generally alternate with those of the lower semicell (photo 2h), which probably contributes to a better stability in the flotation.

Although bipolar asymmetry is commonly used to separate desmid genera, this criterion is not unanimity beyond the desmidiologists. Coesel & van Geest (2014), for example, do not recognize the genus *Prescotttiella*, and consider it a member of *Micrasterias*. The same to *Croasdalea*, which is still referred to as *Staurostrum marthae*. The exception for these authors is the genus *Allorgeia*. All the asymmetrical desmid genera still lack molecular studies to a better taxonomic understanding and placement within Desmidiaceae.

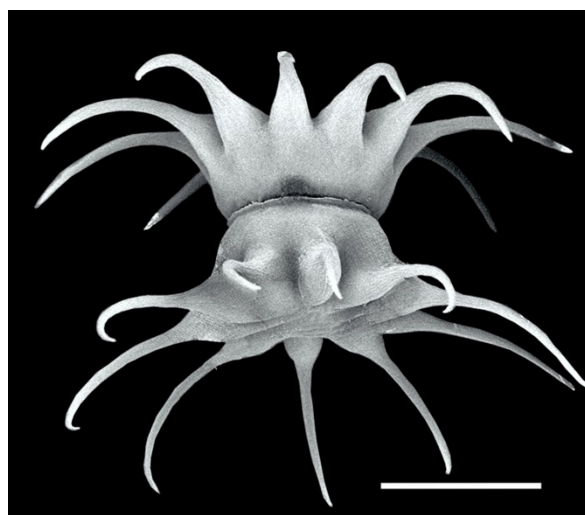
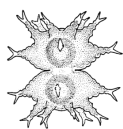


Photo 3. Cell of *Croasdalea marthae* in SEM. Front view. Scale bar: 20 µm.

The SEM analysis revealed that the cell wall is characterized by tiny pores concentrated in the midregion and apices of semicells (photo 5), whereas the spines exhibit a striated pattern with few pores. In addition, the extremities of some spines were strongly curved forming hooks (photo 3, 4), which were not clearly observed in LM analysis. This latter pattern probably



contributes to cell fixing in some substrates, especially aquatic macrophytes.

Finally, further studies are yet necessary to the genus *Croasdalea*, especially regarding its phylogenetic position and the reproductive aspects, as its zygospore still is unknown.

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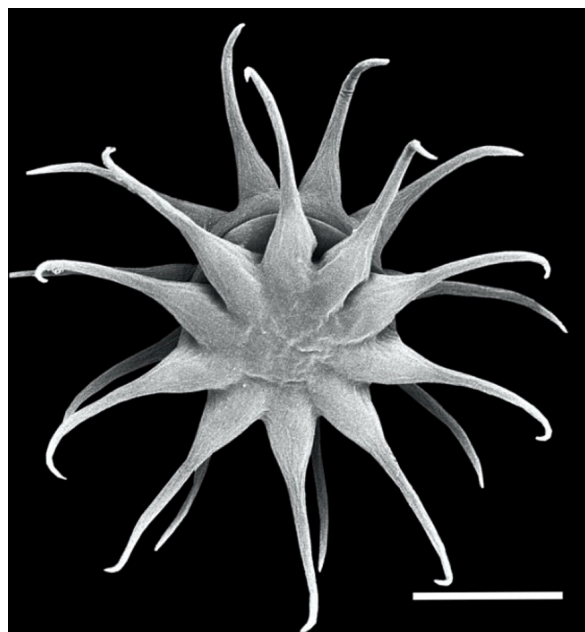


Photo 4. Cell of *Croasdalea marthae* in SEM. Apical view. Scale bar: 20 µm.

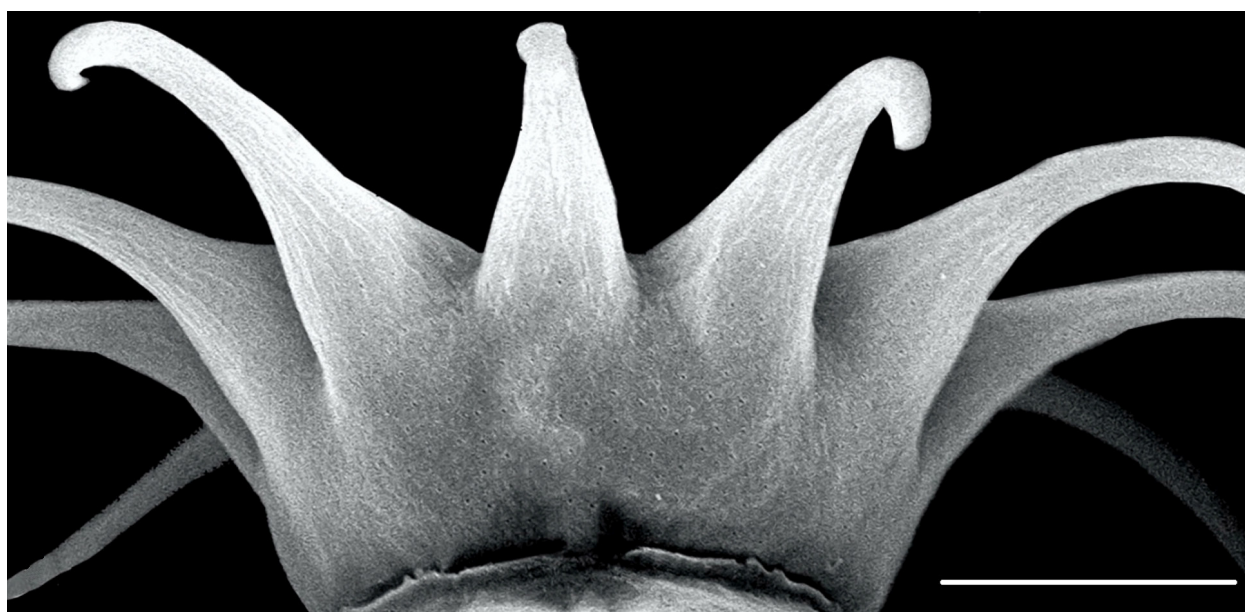


Photo 5. Cell of *Croasdalea marthae* in SEM. Details of the semicell. Scale bar: 20 µm.