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Pseudofilamentous desmids (*Zygnematophyceae*) from an Amazonian floodplain lake (Macapá, AP, Brazil)

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ABSTRACT – The aim of this study was to conduct a floristic inventory and taxonomical characterization of the pseudofilamentous desmids from a floodplain lake in the Oriental Amazon, Northern Brazil. Twenty-one taxa were identified and described. *Desmidium quadratum* var. *constrictum* Nordstedt, *Haplozyga armata* var. *armata* (Nordstedt) Raciborski, and *Spondylosium rectangulare* var. *goyazense* Förster were registered for the first time for the Amazon region. *Desmidium longatum* Wolle, has only been recorded previously in North America and is now registered for the first time in Brazil. According to their frequency of occurrence during the study period, 10 taxa were considered frequent, nine were less frequent, and two were considered rare. Most taxa were collected during both the rainy and the dry (less rainy) seasons, whereas six taxa were exclusively found during the rainy period.

Keywords: classical taxonomy, Curralinho, Northern region, phytoplankton

RESUMO – Desmídias pseudofilamentosas (*Zygnematophyceae*) de um lago de inundação na Amazônia (Macapá, Amapá, Brasil). Este estudo objetivou realizar o inventário florístico e caracterizar taxonomicamente as desmídias pseudofilamentosas de um lago de inundação na Amazônia Oriental, norte do Brasil. Vinte e um táxons foram identificados e descritos. *Desmidium quadratum* var. *constrictum* Nordstedt, *Haplozyga armata* var. *armata* (Nordstedt) Raciborski e *Spondylosium rectangulare* var. *goyazense* Förster foram identificados pela primeira vez como ocorrendo na região Amazônica. *Desmidium longatum* Wolle, que até então havia sido documentado somente para a América do Norte, foi atualmente registrado, pioneiramente, para o Brasil. De acordo com suas frequências de ocorrência ao longo do período estudado, 10 táxons foram considerados frequentes, nove táxons foram considerados menos frequentes e dois tiveram ocorrência rara. A presença da maioria dos táxons foi registrada em ambas as estações climáticas, chuvosa e seca (menos chuvosa), enquanto seis táxons ocorreram somente no período chuvoso.

Palavras-chave: Curralinho, fitoplâncton, região Norte, taxonomia clássica

INTRODUCTION

Pseudofilamentous desmids are typically known for their chain-like structure of cells held together by a mucilaginous sheath, but they do not present any protoplasm continuity between neighboring cells. As the cells remain independent in the chains, the thallus is considered a false filament or a pseudofilament (Felisberto & Rodrigues 2011).

To date, pseudofilamentous desmids include 11 genera and about 106 infrageneric taxa (species, taxonomical varieties, and taxonomical form) that are described according to the classical α-taxonomy. These organisms may form straight or twisted pseudofilaments with cylindrical, subcylindrical, somewhat globular, elliptical, or barrel-shaped cells, in addition to striate, porous, or spiny cell walls (Brook 1981, Oliveira *et al.* 2010, Felisberto & Rodrigues 2011).

Studies on the North Brazilian pseudofilamentous desmids were carried out from aquatic ecosystems of three states of the Amazon region (Amazonas, Pará, and Tocantins), and these reports correspond mostly to the last century (Grönblad 1945, Thomasson 1955, 1971, Scott *et al.* 1965, Förster 1969, 1974, Uherkovich & Schmidt 1974, Uherkovich & Rai 1979, Martins 1980, Bittencourt-Oliveira 1993a, Dias & Sophia 1994, Sophia & Dias 1996, Lopes & Bicudo 2003, Melo *et al.* 2004, 2005, Souza *et al.* 2007, Souza 2008, Melo & Souza 2009, Souza & Melo 2010).

The state of Amapá is located in the eastern portion of the Brazilian Amazon, and it has a very rich river system, which includes estuarine (Amazonian) and continental

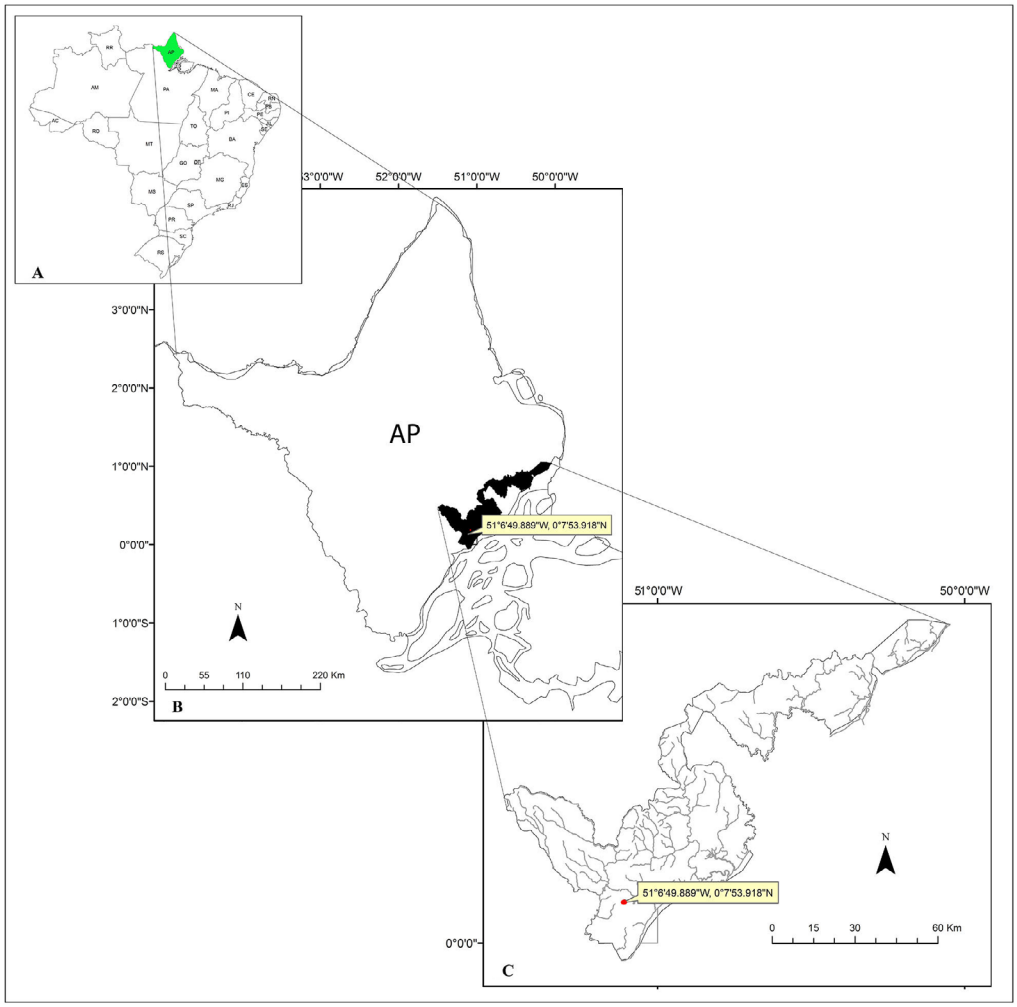
(Oceanic) systems (Takiyama *et al.* 2012). Among its aquatic ecosystems, there are wetlands or floodplain areas located in the state capital city Macapá, which are locally known as "ressacas" areas.

Knowledge of the phytoplankton diversity of the Amapá state is incipient, and no previous work on the taxonomy of the pseudofilamentous desmids has ever been published. The present study aimed to survey the floristic inventory and characterization of the pseudofilamentous desmids from a floodplain area, known as "ressaca" area in the Macapá city, Amapá state, Northern Brazil.

MATERIAL AND METHODS

Samplings were performed monthly between June 2007 and July 2008 from a permanently flooded station at Curralinho Lake (00º07'54"N, 51º06'50"W), which pertains to the Curiaú River basin and is located in the Curiaú Environment Protection Area, Macapá city, state of Amapá, Brazil (Figs. 1A-C). According to Koppen's Classification, the dominant climate in Amapá is Am, and the Macapá city presents an annual rainfall of 2850 mm, and the monsoon period is between February and May, which present monthly rainfall around 400 mm. The mean annual temperature is 27.6 ºC, varying seasonally between 25.8 ºC and 29 ºC (Alvares *et al.* 2013). According to the Hydrometeorology and Renewable Energy Center (*Núcleo de Hidrometeorologia e Energias Renováveis*, NHMET) of the Institute of Scientific and Technological Research of the State of Amapá (*Instituto de Pesquisas Científicas e Tecnológicas do Amapá*, IEPA), the hydrological cycle is well defined, and it is associated with the seasonality and local rainfall, thus there is a "dry period" or dry season (Fig. 2A) from July to December and a "flood period" or rainy season (Fig. 2B) from January to June.

Samples were collected using a 20 µm mesh plankton net and immediately preserved with Transeau solution (Bicudo & Menezes 2017). All samples were deposited in the "Herbário Científico do Estado Maria Eneyda P. Kauffmann Fidalgo" (SP), São Paulo Municipality, São Paulo state, Brazil, under access numbers SP469217 to SP469228.



Figs. 1 A-C. Geographic localization of the Curralinho Lake, "Ressaca" area, Macapá, Amapá, Brazil. **A**. Localization of the Amapá state (AP) in Brazil (green color); **B**. Curiaú River basin, located in the Curiaú Enviroment Protection Area is highlighted in black; **C**. The sampling station at Curralinho Lake is a red circle.

Figs. 2 A-B. Sampling station at Curralinho Lake. **A**. The dry season or less rainy period; **B**. The rainy season or flood period.

For the taxonomic analyses, temporary slides were prepared and observed under a light microscope (Zeiss Axio Lab A1). Photomicrographs were taken at 400x magnification with an image capture system (ZEN Zeiss software v. 2012) coupled to the microscope. Classification was performed in accordance with methodologies from van-den-Hoeck *et al.* (1997) and Bicudo & Menezes (2017). Classic and contemporary literature including taxonomic revisions, monographs, and floristic works were used for specific and infra-specific identification of taxa. Frequency of occurrence of the species in each sample was calculated in terms of percentage and classified according to Matteucci & Colma (1982) as follows: very frequent ($F > 70\%$ occurrence), frequent ($F > 40 \leq 70\%$), less frequent ($F > 10 \leq 40\%$), and rare ($F < 10\%$).

RESULTS

Twelve samples were analyzed, and 21 taxa were identified (including species, varieties, and taxonomic forms), which were distributed in the following eight genera: *Bambusina* Kützing ex Kützing (3 taxa), *Desmidium* C. Agardh ex Ralfs (7), *Groenbladia* Teiling (2), *Haplozyga* (Nordstedt) Raciborski (1), *Hyalotheca* Eheremberg ex Ralfs (2), *Mateola* (Nordstedt) Coesel (1), *Phymatodocis* Nordstedt (1), and *Spondylosium* Brébisson ex Kützing (4). All taxa recorded were described.

Class: *Zygnematophyceae*
Order: *Desmidiales*
Family: *Desmidiaceae*

Bambusina borreri (Ralfs) Cleve var. ***borreri***, Öfversigt af Kongliga Vetenskaps-Akademiens Förhandlingar 20:496. 1864. *Desmidium borreri* Ralfs, The British Desmidieae. 58, pl. 3. 1848.
(Figs. 3A-C)

Cells 1-2 times greater in length than width, 15-43 × 13-22 µm, 8-14 µm broad at the apex and 12-22 µm wide at the isthmus. Semicells pyramidal-truncated and barrel-shaped; parallel lateral margins, narrow towards the apex; broad and truncated apex; small basal inflation on either side of the isthmus; open median constriction; shallow median sinus; hyaline cell wall; axial chloroplast.

Material examined: BRAZIL, AMAPÁ, Macapá, Curralinho Lake, 02.VI.2007, *C.B. Araújo* (SP469217), 03.VII.2007, *C.B. Araújo* (SP469218), 14.I.2008, *C.B. Araújo* (SP469223), 12.II.2008, *C.B. Araújo* (SP469224), 15.IV.2008, *C.B. Araújo* (SP469226), 13.V.2008, *C.B. Araújo* (SP469227), 15.VII.2008, *C.B. Araújo* (SP469228).

Comments: the present specimens did not show the longitudinal striation at the apex of semicells. Ralfs (1848) identified this species as *Desmidium borreri* Ralfs. However, in 1845, the same species was identified as *Bambusina brebissonii* Kützing by Kützing (1845), and it was validated by the same author in Kützing 1849. Cleve (1864) clarified that *Bambusina borreri,* based on Ralfs' material, was synonymous to *B. brebissonii*. Gontcharov (2008) designated *Bambusina borreri* as the type species of *Bambusina*. However, according to Guiry (2013), this was incorrect because *B. brebissonii* Kützing ex Kützing was included in its original publication as a heterotypic synonym of *B. borreri*. Due to this, according to the latter author, *B. brebissonii* must be considered the type species of *Bambusina* and a 'nomen conservadum' for *Gymozyga* Ehremberg ex Kützing. *D. borreri* should be considered as a basionym and *B. borreri* as a synonym for *B. brebissonii*.

Distribution in Brazil: Amazonas (Thomasson 1955, Förster 1974, Martins 1980, Souza & Melo 2010); Bahia (Förster 1964, Martins & Bicudo 1987, Bicudo & Martins 1989, Oliveira *et al.* 2010); Goiás (Dias & Sophia 1994); Mato Grosso (De-Lamonica-Freire 1992, Camargo *et al.* 2009); Pará (Grönblad 1945, Scott *et al.* 1965, Förster 1969); Paraná (Bittencourt-Oliveira 1993b); Rio Grande do Sul (Rosa *et al.* 1987, Rosa *et al.* 1988, Burliga *et al.* 2016); São Paulo (Bicudo 1969, Bicudo & Samanez 1984, 2016, Taniguchi *et al.* 1998); Tocantins (Dias & Sophia 1994); Federal District (Leite & Senna 1992).

Bambusina borreri (Ralfs) Cleve var. ***brasiliensis*** (Förster) Bourrelly & Couté, Amazoniana 7(3): 258, pl.26, fig. 8. 1982. *Bambusina brebissonii* Kützing var. *brasiliensis* Förster, Amazoniana 2(1-2):101, pl. 53, fig. 22. 1969.
(Fig. 4)

Cell 2-3 times greater in length than width, 37-81 × 15-20 µm, 8-13 µm broad at the apex and 12-19 µm broad at the isthmus. Semicells pyramidal-truncated; delicate and longitudinal striation in the apical region; parallel lateral margins that were slightly concave near the base; shallow median constriction; hyaline cell wall; axial chloroplast.

Material examined: BRAZIL, AMAPÁ, Macapá, Curralinho Lake, 02.VI.2007, *C.B. Araújo* (SP469217), 03.VII.2007, *C.B. Araújo* (SP469218), 12.II.2008, *C.B. Araújo* (SP469224), 26.III.2008, *C.B. Araújo* (SP469225), 15.IV.2008, *C.B. Araújo* (SP469226), 15.VII.2008, *C.B. Araújo* (SP469228).

Comments: Förster (1969) originally described this species as *B. brebissonii* var. *brasiliensis* Förster based on material collected in the Jurucuí Lake in the municipality of Santarém, state of Pará. Bourrely & Couté (1982) reclassified this variety as *B. borreri* under the new combination *B. borreri* var. *brasiliensis* Bourrely & Couté, based on material collected in the French Guiana.

Distribution in Brazil: Pará state (Förster 1969).

Bambusina borreri (Ralfs) Cleve var. ***majus*** C.B.Araújo, C.E.M.Bicudo & S.Melo, *comb. nov. Gymnozyga moniliforms* Ehrenberg var. *majus* Raciborski, Flora, Jena 81: 31. 1985.
(Figs. 5A-B)

Cell 1.6 times greater in length than width, 35-44 × 21-29 µm, 12-16 µm broad at the apex and 20-24 µm broad at the isthmus. Semicells pyramidal-truncated; parallel lateral margins, strongly concave at the base; straight, truncated apex with 2 tiny angular spines; shallow median constriction; open median sinus; hyaline cell wall; axial chloroplast.

Material examined: BRAZIL, AMAPÁ, Macapá, Curralinho Lake, 02.VI.2007, *C.B. Araújo* (SP469217), 03.VII.2007, *C.B. Araújo* (SP469218), 15.IV.2008, *C.B. Araújo* (SP469226), 13.V.2008, *C.B. Araújo* (SP469227), 15.VII.2008, *C.B. Araújo* (SP469228).

Comments: Raciborski (1895) reported the present variety as *Gymnozyga moniliforms* var. *majus* Raciborski. Later on, based on material collected nearby in the Arapiuns and the Tapajós rivers, Pará state, Scott *et al.* (1965) proposed a new combination by reclassified this species from *Gymnozyga* to *Bambusina*: *Bambusina brebissonii* Kützing var. *majus* (Raciborski) Croasdale. Although *B. brebissonii* is the type species of *Bambusina*, it is currently considered as synonymous by some authors and consequently reclassified to *B. borreri*. Thus, the present report proposes the new combination *Bambusina borreri* var. *majus*, and the combination in Scott *et al.* (1965) should be considered synonymous. This variety differs from the species type based on the presence of straight truncated apices with two tiny angular spines.

Distribution in Brazil: Pará state (Scott *et al.* 1965, Förster 1969).

Desmidium baileyi (Ralfs) Nordstedt var. ***baileyi*** f. ***baileyi***, Acta Universitatis lundensis 16:4. 1880. *Aptogonum baileyi* Ralfs, The British Desmidieae. 208, pl. 35, fig. 1a-c. 1848.
(Fig. 6)

Cells were about equal in length and width, 18-22 × 18-21 μm, and the cells were joined at their apex. Semicells rectangular; parallel lateral margins with small undulations; apical margin concave with long angular projections forming a more or less cylindrical connective process that overlap adjacent cells; indistinct or unclear median constriction; median sinus reduced to a slight undulation; hyaline cell wall; axial chloroplast.

Material examined: BRAZIL, AMAPÁ, Macapá, Curralinho Lake, 14.I.2008, *C.B. Araújo* (SP469223), 15.IV.2008, *C.B. Araújo* (SP469226), 13.V.2008, *C.B. Araújo* (SP469227).

Comments: this species is easy to identify, due to the angular cylindrical processes that connect the cells into pseudofilaments. Semicell margins are smooth or slightly undulated in the presently examined specimens.

Distribution in Brazil: Amazonas (Förster 1974, Martins 1980, Souza & Melo 2010); Bahia (Oliveira *et al.* 2010); Mato Grosso (De-Lamonica-Freire 1992); Pará (Scott *et al.* 1965, Förster 1969); Paraná (Bittencourt-Oliveira 1993b, Picelli-Vicentim 1984); Rio de Janeiro (Sophia 1987); Rio Grande do Sul (Borge 1903, Bicudo & Ungaretti 1986, Burliga *et al.* 2016); São Paulo (Bicudo & Bicudo 1965, Bicudo 1969, Bicudo & Samanez 1984, 2016, Bicudo *et al.* 1999).

Desmidium elegans (Raciborski) Grönblad, Acta Societatis Scientiarum Fennicae: ser. B, 2(6): 34, pl. 15, fig. 331-333. 1945. *Hyalotheca elegans* Raciborski, Flora, Jena 81: 31, pl. 3-4, fig. 1. 1895.
(Figs. 7A-B)

Cells 1-2 times greater in length than width, 24-44 × 18-19 μm, 10-17 μm broad at the apex and 16-22 μm broad at the isthmus. Semicells pyramidal-truncated; straight apical margins; lateral margins slightly concave; apical and basal angles that were sub-rectangular-rounded; shallow median constriction; open median sinus; hyaline cell wall; axial chloroplast.

Material examined: BRAZIL, AMAPÁ, Macapá, Curralinho Lake, 02.VI.2007, *C.B. Araújo* (SP469217), 03.VII.2007, *C.B. Araújo* (SP469218), 12.II.2008, *C.B. Araújo* (SP469224), 15.IV.2008, *C.B. Araújo* (SP469226), 13.V.2008, *C.B. Araújo* (SP469227), 15.VII.2008, *C.B. Araújo* (SP469228).

Comments: the cell wall of this species showed some variation between smooth or finely punctuated to punctuated with pores that were arranged in decussing series (Bicudo & Samanez 2016). However, it was not possible to observe the series of pores close to the semicell apex in any of these individually analyze specimens. According to the literature, the species may sometimes show variation in the measurements of pseudofilaments, as some specimens are slender and some others more robust. The present specimens were morphologically similar, and their measurements were comparable to those in Grönblad (1945: fig. 332).

Distribution in Brazil: Amazonas (Förster 1974, Souza & Melo 2010); Bahia (Oliveira 2011); Goiás (Dias & Sophia 1994); Pará (Grönblad 1945, Scott *et al.* 1965); São Paulo (Bicudo & Samanez 1984, 2016); Federal District (Leite & Senna 1992).

Desmidium graciliceps (Nordstedt) Lagerheim var. ***graciliceps***, Öfversigt Kongliga Svenska Vetensk-Akademiens Förhandlingar 42(7): 228. 1885. *Desmidium quadratum* Nordstedt var. *graciliceps* Nordstedt *in* Wittrock & Nordstedt, Algae Exsiccatae 8: nº 367. 1880.
(Figs. 8A-B)

Cells were about equal in length and width, 20-23 × 14-22 μm broad, 6-7 μm broad at the apex and 13-14 μm broad at the isthmus. Semicells pyramidal-truncated; straight apical margins, truncated in the middle part; undulated lateral margins that were convergent to the semicell apex; rounded basal angles; shallow median constriction; open median sinus, which is linear or acute; hyaline to light brown cell wall; axial chloroplast.

Material examined: BRAZIL, AMAPÁ, Macapá, Curralinho Lake, 15.IV.2008, *C.B. Araújo* (SP469226), 15.VII.2008, *C.B. Araújo* (SP469228).

Comments: the characteristic features of this species were the truncated semicells in their middle part, straight apical margins, and undulated lateral margins, which converge to the semicell apex. According to Oliveira (2011) and Bittencourt-Oliveira (1993b), *Desmidium graciliceps* (Nordstedt) Lagerheim is morphologically similar to *Desmidium grevillii* De Bary, but the latter differs in having relatively smaller cells and narrower apex.

Distribution in Brazil: Bahia (Förster 1964, Oliveira *et al.* 2010, Oliveira 2011); Mato Grosso (Borge 1925); Pará (Scott *et al.* 1965, Förster 1969); Paraná (Bittencourt-Oliveira 1993b); Rio Grande do Sul (Sophia *et al.* 2005); São Paulo (Bicudo 1969, Bicudo & Samanez 1984, 2016).

Desmidium graciliceps (Nordstedt) Lagerheim var. ***groenbladii*** C.Bicudo & Samanez, Bibliotheca Phycologica 68: 39, fig. 11. 1984.
(Fig. 9)

Cell 1.6 times greater in length than width, 43-48 × 23-26 μm, 9-10 μm broad at the apex and 18-19 μm broad at the isthmus. Semicells pyramidal-truncated; straight apical

margin; convergent undulated lateral margins with slight concave at the subapical region; rounded basal angles; shallow median constriction; open to linear median sinus; hyaline to light brown cell wall; axial chloroplast.

Material examined: BRAZIL, AMAPÁ, Macapá, Curralinho Lake, 03.VII.2007, *C.B. Araújo* (SP469218), 15.IV.2008, *C.B. Araújo* (SP469226), 15.VII.2008, *C.B. Araújo* (SP469228).

Comments: this species has longer cells with broader apices than *D. graciliceps* var. *graciliceps* (Nordstedt) Lagerheim. Grönblad (1945) identified samples as *D. graciliceps* var. *groenbladii* as form "*gracilius*", and later, Scott *et al.* (1965) and Förster (1969) identified their samples as var. "*gracilius*". Despite neither the form nor the variety were ever formally proposed, Bicudo & Samanez (1984) designated specimens of this kind representative of *D. graciliceps* var. *groenbladii* Bicudo & Samanez.

Distribution in Brazil: Bahia (Oliveira *et al.* 2010); Pará (Scott *et al.* 1965, Förster 1969); São Paulo (Bicudo & Samanez 1984, 2016); Federal District (Leite & Senna 1992).

Desmidium longatum Wolle, Desmids of the United States. 26, pl. 49, fig. 6. 1884. *Gymnozyga longata* (Wolle) Nordstedt *in* Wittrock & Nordstedt, Algae Exsiccatae 15: nº 803. 1886.
(Figs. 10A-C)

Cell 2.3 greater in length than width, 65-83 × 28-39 µm, 14-20 µm broad at the apex and 22-31 µm broad at the isthmus. Semicells pyramidal-truncate; straight apical margins; parallel lateral margins, slightly divergent to the apex; broad apex; broad to moderate truncated median constriction; conspicuous basal inflation on both sides of the isthmus; open to linear median sinus; hyaline cell wall; axial chloroplast.

Material examined: BRAZIL, AMAPÁ, Macapá, Curralinho Lake, 02.VI.2007, *C.B. Araújo* (SP469217), 03.VII.2007, *C.B. Araújo* (SP469218), 15.IV.2008, *C.B. Araújo* (SP469226), 15.VII.2008, *C.B. Araújo* (SP469228).

Comments: the present species resembles *Bambusina brebissonii* Kützing or *Bambusina borreri* (Ralfs) Cleve. However, *D. longatum* Wolle is different, as it presents twisted pseudofilaments, elliptic cells in an apical view, and cells larger than *B. brebissonii*. The specimens identified here are larger than the ones from North America, registered in Croasdale *et al.* (1983: 35-40 × 25-28 µm).

Distribution in Brazil: first record of this species in Brazil.

Desmidium quadratum Nordstedt var. ***quadratum*** Acta Universitatis lundensis 9: 49, pl. 1, fig. 24. 1873.
(Figs. 11A-B)

Cell were slightly wider than long, 15-16 × 19-21 µm, 11-14 µm broad at the apex and 18-19 µm broad at the isthmus. Semicells pyramidal-truncated; straight apical margins; lateral margins convergent, undulated, and slightly concave at the subapical region; rounded basal angles; shallow median constriction; open and linear median sinus; hyaline to light brown cell wall; axial chloroplast.

Material examined: BRAZIL, AMAPÁ, Macapá, Curralinho Lake, 14.I.2008, *C.B. Araújo* (SP469223), 15.IV.2008, *C.B. Araújo* (SP469226).

Comments: according to Bicudo & Samanez (2016), presence of *D. quadratum* var. *quadratum* Nordstedt in Brazil is somewhat questionable, mainly due to the existence of morphological "major" and "minor" expressions. Furthermore, according to Oliveira (2011), several taxonomic identifications of specimens of this species in the literature are not consistent, since they may have included descriptions and illustrations that do not exactly match those of typical *D. quadratum* specimens.

Distribution in Brazil: Amazonas (Souza 2008, Souza & Melo 2010); Bahia (Oliveira 2011); Goiás (Dias & Sophia 1994); Pará (Grönblad 1945, Scott *et al.* 1965, Förster 1969); Mato Grosso (De-Lamonica-Freire 1992); Rio de Janeiro (Sophia 1987, 1999); São Paulo (Borge 1918, Bicudo 1969, Bicudo & Samanez 1984, 2016).

Desmidium quadratum Nordstedt var. ***constrictum*** Nordstedt, Kongliga Svenska Vetensk Akademiens Handlingar 22(8): 25. 1888.
(Fig. 12)

Cell were about as broad as they were long, 35 × 36 µm, 22 µm broad at the apex and 32 µm broad at the isthmus. Semicells pyramidal-truncated; straight apical margins; lateral margins convergent, undulated, and slightly concave at the subapical region; rounded basal angles; shallow to slightly deep median constriction; open median sinus; hyaline to light brown cell wall; axial chloroplast.

Material examined: BRAZIL, AMAPÁ, Macapá, Curralinho Lake, 13.V.2008, *C.B. Araújo* (SP469227).

Comments: this variety differs from the typically observed characteristics for the species. It presented larger cells with narrower apices and a shallow to slightly deep constriction in the mid region, which results in a constricted appearance of the pseudofilament. Förster (1964) proposed *D. quadratum* var. *constrictum* Förster as a new variety, referring to it as *D. quadratum* f. "maior" Grönblad, based on Grönblad's (1945) material. These authors divided some specimens of *D. quadratum* into larger and smaller forms. However, Croasdale *et al.* (1983) used the name *Desmidium quadratum* var. *constrictum* Nordstedt proposed by Nordstedt (1888) and should be considered legitimate because it refers to Wolle's (1884: pl. 49, fig. 5). The new

variety proposed by Förster (1964) based on Brazilian material must be rejected, and its occurrence only reported in Goiás state, Brazil.

Distribution in Brazil: Goiás (Förster 1964).

Groenbladia neglecta (Raciborski) Teiling var. ***neglecta***, BotaniskaNotiser 1952(3): 276. 1952. *Hyalotheca neglecta* Raciborski, Flora, Jena 8(1): 30, pl. 3, fig. 2-3. 1895.
(Figs. 13A-B)

Cells 3-3.6 times greater in length than width, 33-45 × 10-12 µm, 8-10 µm broad at the apex. Semicells cylindrical; truncated apical margins; parallel lateral margins; subquadrate angles; almost imperceptible median constriction; hyaline cell wall; axial chloroplast.

Material examined: BRAZIL, AMAPÁ, Macapá, Curralinho Lake, 02.VI.2007, *C.B. Araújo* (SP469217), 03.VII.2007, *C.B. Araújo* (SP469218), 14.I.2008, *C.B. Araújo* (SP469223), 12.II.2008, *C.B. Araújo* (SP469224), 26.III.2008, *C.B. Araújo* (SP469225), 15.IV.2008, *C.B. Araújo* (SP469226),13.V.2008, *C.B. Araújo* (SP469227).

Comments: the characteristic features of this species are: semicells cylindrical with truncated apical margins and parallel lateral margins, with subquadrate angles and an almost imperceptible median constriction.

Distribution in Brazil: Amazonas (Förster 1974, Souza & Melo 2010); Bahia (Oliveira 2011); Pará (Scott *et al.* 1965).

Groenbladia neglecta (Raciborski) Teiling var. ***elongata*** Scott & Grönblad, Acta Societatis Scientiarum Fennica: nov. ser. B, 2(8): 48, pl. 35, fig. 17-25. 1957.
(Figs. 14A-B)

Cells 4-5 times greater in length than width, 44-84 × 7-15 µm, 6-13 µm broad at the apex. Semicells cylindrical; broadly truncated apical margins; parallel lateral margins; subquadrate angles; shallow and broad median constriction; median sinus with a small invagination; hyaline cell wall; axial chloroplast.

Material examined: BRAZIL, AMAPÁ, Macapá**,** Curralinho Lake, 02.VI.2007, *C.B. Araújo* (SP469217), 03.VII.2007, *C.B. Araújo* (SP469218), 14.I.2008, *C.B. Araújo* (SP469223), 12.II.2008, *C.B. Araújo* (SP469224),15. IV.2008, *C.B. Araújo* (SP469226),13.V.2008, *C.B. Araújo* (SP469227), 15.VII.2008, *C.B. Araújo* (SP469228).

Comments: this variety differs from the typically observed characteristics of the species, as it presents longer cells and a median sinus with a small invagination.

Distribution in Brazil: Amazonas (Förster 1974, Souza 2008, Souza & Melo 2010); Bahia (Oliveira *et al.* 2010); Pará (Scott *et al.* 1965, Förster 1969).

Haplozyga armata (Nordstedt) Raciborski var. ***armata***, Flora, Jena 81: 32, pl. 3-4, fig. 6. 1895. Basionym: *Gymnozyga armata* Nordstedt, Acta Universitatis lundensis 3: 1, pl. 1, fig. 1-3. 1889.
(Fig. 15)

Cells 2 times greater in length than width, 27-42 × 14-21 µm, 6-10 µm broad at the apex and 14-15 µm broad at the isthmus. Semicells hexagonal; straight to slightly convex lateral margin; apex straight; 1 intumescence ornamented with a ring of robust spines and a small divergent indentation at the base; moderate median constriction; open to acute median sinus; smooth cell wall.

Material examined: BRAZIL, AMAPÁ, Macapá, Curralinho Lake, 02.VI.2007, *C.B. Araújo* (SP469217), 12.II.2008, *C.B. Araújo* (SP469224), 15.IV.2008, *C.B. Araújo* (SP469226), 13.V.2008, *C.B. Araújo* (SP469227), 15.VII.2008, *C.B. Araújo* (SP469228).

Comments: *Haplozyga* (Nordstedt) Raciborski is a typically tropical genus and includes only two species and one taxonomical variety: *Haplozyga armata* var. *armata* (Nordstedt) Raciborski, *Haplozyga armata* var. *raciborskii* Förster and *Haplozyga eckertii* Förster. The species *H. armata* var. *armata* was originally described as *Bambusina* (*Gymnozyga*) *armata* Nordstedt by Nordstedt (1889). However, according to Bicudo & Menezes (2017), it was reclassified, in 1985, as *Gymnozyga* section: *Haplozyga*. Considering that specimens of *Haplozyga* are morphologically very distinct from those of *Bambusina* and of all other desmids genera, it worth maintaining it as a distinct genus until other polyphasic studies using molecular and phylogenetic analyses can confirm its taxonomic classification.

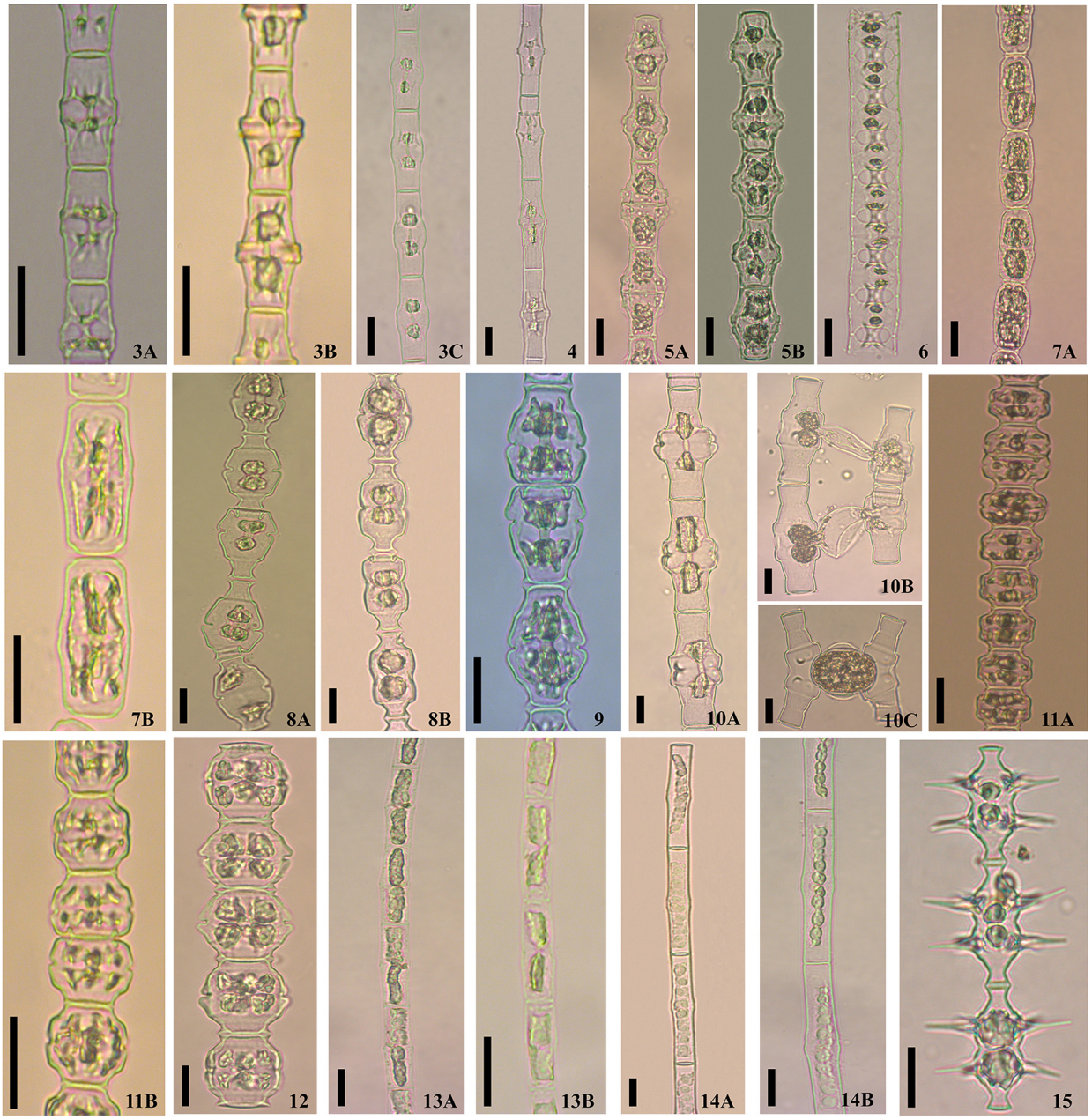
Distribution in Brazil: Goiás (Förster 1966); São Paulo (Förster 1966).

Hyalotheca dissiliens Brébisson *ex* Ralfs var. ***dissiliens***, Ralfs, BritishDesmidieae. 51, pl. 1, fig. 1a-i. 1848.
(Figs. 16A-B)

Cells 1.2 times greater in length than width, 23-26 × 20-22 µm, 18-20 µm broad at the apex. Semicells pyramidal-truncated with rounded angles; straight to slightly convex lateral margins; truncated apical margins; shallow median constriction; open median sinus.

Material examined: BRAZIL, AMAPÁ, Macapá, Curralinho Lake, 02.VI.2007, *C.B. Araújo* (SP469217).

Comments: this species presents particular morphometry with an arrangement of apical pores and a lobed axial chloroplast, similar to those of *Desmidium siolii* Förster that was proposed by Förster (1969) based on specimens collected in Pará state. According to Martins (1980), the main difference between the above two species is their cell division process, which results in an invagination of the cell wall in *Desmidium*.



Figs. 3-15. Pseudofilamentous desmids of Curralinho Lake, Macapá, Amapá, Brazil. **3 A-C**. *Bambusina borreri*. **A**, **B**. detailed cells; **C**. detailed pseudofilament; **4**. *B. borreri* var. *brasiliensis*; **5 A-B**. *B. borreri* var. *majus*, detailed cells and pseudofilaments; **6**. *Desmidium baileyi* var. *baileyi* f. *bailey*; **7 A-B**. *D. elegans*. **A**. detailed pseudofilament, **B**. detailed cell; **8 A-B**. *D. graciliceps* var. *graciliceps*. **A**. frontal view of the pseudofilament, **B**. slight modification of the pseudofilament frontal view; **9**. *D. graciliceps* var. *groenbladii*; **10 A-C**. *D. longatum*. **A**. pseudofilament frontal view, **B**. formation of the elongate conjugation tube, **C**. zygospore; **11 A-B**. *D. quadratum* var. *quadratum*. **A**. detailed pseudofilament, **B**. detailed cells; **12**. *D. quadratum* var. *constrictum*; **13 A-B**. *Groenbladia neglecta* var. *neglecta*. **A**. detailed pseudofilament, **B**. detailed cells; **14 A-B**. *G. neglecta* var. *elongata*. **A**. detailed pseudofilament, **B**. detailed cells; **15**. *Haplozyga armata* var. *armata*. Scale bars = 10 µm.

Distribution in Brazil: Amazonas (Thomasson 1955, Uherkovich & Schmidt 1974, Uherkovich & Rai 1979, Sophia & Dias 1996, Melo & Souza 2009, Souza & Melo 2010); Goiás (Felisberto & Rodrigues 2002, Nogueira *et al.* 2016); Pará (Förster 1969); Paraná (Bittencourt-Oliveira 1993b, Felisberto & Rodrigues 2011); Rio Grande do Sul (Rosa *et al.* 1987, Rosa *et al.* 1988, Burliga *et al.* 2016).

Hyalotheca javanica (Gutwinski) Coesel, Nordic Journal of Botany 20(3): 379, fig. 39-40. 2000. *Hyalotheca indica* Turner var. *javanica* Gutwinski, Bulletin International de l'Academie des Sciences de Cracovie 39: 579, pl. 36, fig. 2. 1902.

(Figs. 17A-B)

The filament is not twisted. Cells 2 times longer than broad, 18-27 × 11-14 µm and 10-12 µm broad at the apex. Semicells barrel-shaped, joined by their apex; parallel lateral margins; slight elevation in the mid region; truncated apical margins; shallow median constriction.

Material examined: BRAZIL, AMAPÁ, Macapá, Curralinho Lake, 02.VI.2007, *C.B. Araújo* (SP469217), 03.VII.2007, *C.B. Araújo* (SP469218), 14.I.2008, *C.B. Araújo* (SP469223), 12.II.2008, *C.B. Araújo* (SP469224), 26.III.2008, *C.B. Araújo* (SP469225), 13.V.2008, *C.B. Araújo* (SP469227), 15.VII.2008, *C.B. Araújo* (SP469228).

Comments: *Hyalotheca indica* var. *javanica* Gutwinski was proposed by Gutwinski (1902). This variety was reported in Brazil for the first time from material collected by Grönblad (1945) in the state of Pará. In 1965, Scott *et al.* (1965) proposed f. *maior* Grönblad & Croasdale based on specimens that presented cells relatively longer than those of the typical form and a punctated cell wall arranged in less regular horizontal rows. However, those authors did not publish the measurements of the specimens they studied. Coesel (2000) reclassified *H. indica* var. *javanica* to species level: *Hyalotheca javanica* (Gutwinski) Coesel. This was based on comments by West & West (1902), and they also considered that var. *javanica* specimens are relatively broader with a shallow median sinus that is difficult to notice, as well as less-rounded apical angles. Considering the literature, var. *javanica* and f. *maior* include a clear, obvious overlap of measurements. Thus, it was decided by Coesel (2000) that this taxon be maintained at the species level, and *H. indica* var. *javanica* be considered a basionym. The measurements range, including the both taxa, is as follows: cell 11-22 µm long, 9-16 µm broad, and apex 11-13 µm broad. Also, the f. *maior* proposed in Scott *et al.* (1965) should be considered a heterotypic (taxonomic) synonym of *H. indica* var. *javanica*.

Distribution in Brazil: Pará state (Grönblad 1945, Scott *et al.* 1965, Förster 1969).

Mateola curvata (Nordstedt) Coesel, Algological Studies 86: 15. 1997. *Desmidum curvatum* Nordstedt, Lunds Universitets Årsskrift 25: 1, pl. 1, fig. 4-6. 1889.
(Fig. 18)

Cell 1.4 times longer than broad, 29-35 µm long, 20-32 µm broad, 7-8 µm broad at the apex, and 18-19 µm broad at the isthmus. Semicells subquadrate with 4 conical lobes that curved upwards and diverging from each other at first and then converging between lobes of adjacent cells; slightly narrower apex; deep median constriction; wide open median sinus; hyaline to brown cell wall; axial chloroplast.

Material examined: BRAZIL, AMAPÁ, Macapá, Curralinho Lake, 12.II.2008, *C.B. Araújo* (SP469224), 13.V.2008, *C.B. Araújo* (SP469227).

Comments: this species is easily identified, due to its semicells morphology with 4 conical lobes curved upward, divergent or convergent shape between adjacent cells, and apex slightly narrower than the rest of the semicell. Salisbury (1936) considered this species morphologically different from all other desmids species (including all *Desmidium* taxa). Thus, he proposed a new genus named *Mateola* and *Mateola acutiloba* Salisbury as species type. However, this new proposition was taxonomically unacceptable because the latter material was already used by Norsdstedt (1889) when he proposed *Desmidium curvatum* Norsdstedt. Coesel (1997) examined vegetative cells and sexual stages of this species from material collected in French Guiana. He observed a reasonable number of cell division stages, identifying a unique cell division septum to define the new genus *Mateola*. According to Coesel (1997), the conjugation process occurs via formation of elongate conjugation tubes, followed by the fusion of emerging gametes in between the mating gametangial cells, as well as the smooth walled compressed-globose zygospores. For Coesel (1997), in fact, there are two good reasons to consider *Mateola* a good genus, as follows: (1) *D. curvatum* species is morphologically distinct; and (2) this species does not show any particular ultrastructure like pore patterns present in other *Desmidium* species. Thus, the present study is in agreement with Coesel (1997) that *Desmidum curvatum* should be considered the basionym, and *Mateola acutiloba* should be considered synonym of *Mateola curvata*.

Distribution in Brazil: Bahia (Oliveira 2011); Pará (Scott *et al.* 1965, Förster 1969, Thomasson 1971); São Paulo (Nordstedt 1889); Federal District (Leite & Senna 1992).

Phymatodocis nordstedtiana var. ***nordstedtiana*** f. minor Börgesen, Videnskabelige Meddelelser Dansk Naturhistorisk Forening 1890: 930 (sep. p. 25), text fig. p. 930. 1890.
(Figs. 19A-B)

Cell 1.2 times longer than broad, 15-32 × 21-25 µm, and 11 µm wide at the isthmus. Semicells sub-rectangular; straight apical margins on each side; parallel lateral margins slightly straight or swollen in the mid region; moderate median constriction; linear median sinus, sometimes open at the proximal region; hyaline to light brown cell wall.

Material examined: BRAZIL, AMAPÁ, Macapá, Curralinho Lake, 03.VII.2007, *C.B. Araújo* (SP469218), 12.II.2008, *C.B. Araújo* (SP469224), 15.IV.2008, *C.B. Araújo* (SP469226).

Comments: *Phymatodocis nordstedtiana* Wolle often presents some morphological variation, but the literature usually refers to two different forms: f. *nordstedtiana* (Wolle 1884) and f. *minor* (Börgesen 1890). According to Croasdale *et al.* (1983), the "minor" form somewhat resembles var. *novizelandica* Nordstedt (1887). It is distinguished by a more or less prominent intumescence in the center of each semicell, which is rarely straight, presents very little convex, and is never upwardly convergent. From an apical view, the semicell of the "minor" form has a rectangular and slightly convex lateral margin in the median region.

Additionally, it is distinct from the f. *nordstedtiana* based on the smaller size of its cells. However, according to Bicudo & Samanez (2016), the difference in the size between the individuals of the typical form and the "minor" form may sometimes lead to overlap.

Distribution in Brazil: Amazonas (Souza 2008); Bahia (Oliveira 2011); Pará (Förster 1969); Rio de Janeiro (Sophia 1987); São Paulo (Borge 1918, Bicudo & Samanez 1984, 2016).

Spondylosium desmidiiforme (Borge) G.S.West, Journal of Botany 42: 286, pl. 464, fig. 11-12. 1904. *Sphaerozosma desmidiiforme* Borge, Arkiv för Botanik 1: 120, pl. 5, fig. 23a-c. 1903.
(Fig. 20)

Cell 2.3 times broader than long, 10 × 24 µm and 21 µm broad at the isthmus. Semicells oblong and narrow; lateral margins broadly round; broadly truncated apical margin; concave basal margin; easily visible and shallow median constriction; broad median sinus; axial chloroplasts.

Material examined: BRAZIL, AMAPÁ, Macapá, Curralinho Lake, 15.IV.2008, *C.B. Araújo* (SP469226).

Comments: according to Bicudo & Samanez (2016), the original description of *Spondylosium desmidiiforme* (Borge) G.S.West was reported by Borge (1903) as *Sphaerozosma desmidiiforme* Borge, and the material collected in Rio Grande do Sul state. Förster (1969) observed variation in the cell measurements, as well as in the open median sinus of semicells of the f. *tenuius* Förster that he examined. Based on this information, Bicudo & Samanez (2016) considered *Spondylosium desmidiiforme* var. *desmidiiforme* f. *tenuius* and *Spondylosium desmidiiforme* var. *desmidiiforme* f. *desmidiiforme* identified by Förster (1964) as heterotypic synonyms, since they found no difference between the circumscriptions of both these taxa.

Distribution in Brazil: Amazonas (Thomasson 1971, Förster 1974, Martins 1980, Souza 2008); Bahia (Förster 1964, Martins & Bicudo 1987, Bicudo & Martins 1989, Oliveira *et al.* 2010, Oliveira 2011); Pará (Scott *et al.* 1965, Förster 1969); Paraná (Bittencourt-Oliveira 1993b); Rio de Janeiro (Sophia 1987); Rio Grande do Sul (Borge 1903, 1918); São Paulo (Bicudo & Samanez 1984, 2016).

Spondylosium pulchrum Bailey var. ***pulchrum*** *in* Ralfs, British Desmidieae. 209, pl. 35, fig. 3. 1848.
(Fig. 21)

Cell 1.7 times broader than long, 38 × 65 µm and 19 µm broad at the isthmus. Semicells more or less transversally elliptical; rectangular lateral margins; broadly rounded angles and were slightly convex along its extension; deep median constriction; open median sinus, sometimes sublinear or clearly linear close to the isthmus; hyaline cell wall; 4-lobed chloroplast.

Material examined: BRAZIL, AMAPÁ, Macapá, Curralinho Lake, 13.V.2008, *C.B. Araújo* (SP469227), 15.VII.2008, *C.B. Araújo* (SP469228).

Comments: the study of the material collected at the Taperinha farm, Santarém, Pará state, allowed Grönblad (1945) to provide the most comprehensive documentation of this species in Brazil. This author referred to var. *brasilienses* Nordstedt and illustrated the zygospore and two more individual specimens: one of them with a closed sinus and the other one with an open sinus. According to Bicudo & Samanez (2016), this species was represented by two distinct morphological populations, one with elliptical semicells and sinus open, and the other one with oblong semicells and sinus closed or almost linear throughout. Nevertheless, both morphologies can be observed in different cells of one and the same pseudofilament.

Distribution in Brazil: Bahia (Bicudo & Martins 1989, Oliveira *et al.* 2010); Pará (Grönblad 1945, Scott *et al.* 1965); Paraná (Bittencourt-Oliveira 1993b, Biolo *et al.* 2008); Rio de Janeiro (Sophia 1987); São Paulo (Bicudo & Samanez 1984, 2016, Taniguchi *et al.* 1998); Federal District (Leite & Senna 1992).

Spondylosium rectangulare (Wolle) West & West var. ***rectangulare***, Transactions of the Linnean Society, London: ser. 2, 5(5): 231, pl. 12, fig. 13-14. 1896. *Sphaerozosma rectangulare* Wolle, Desmids of the United States. 31, pl. 49, fig. 9. 1884.
(Fig. 22)

Cell 2.7 times broader than long, 20 × 55-92 µm, and 14-24 µm broad at the isthmus. Semicells oblong-rectangular; apical margin straight, convex at the end; each angle ending in 1 short spine; median constriction deep; median sinus open; cell wall hyaline; chloroplast axial.

Material examined: BRAZIL, AMAPÁ, Macapá, Curralinho Lake, 02.VI.2007, *C.B. Araújo* (SP469217), 03.VII.2007, *C.B. Araújo* (SP469218), 12.II.2008, *C.B. Araújo* (SP469224), 15.IV.2008, *C.B. Araújo* (SP469226), 15.VII.2008, *C.B. Araújo* (SP469228).

Comments: the presence of this species was documented in Brazil by Grönblad (1945), based on material collected in the state of Pará. Morphological variation was detected in this study when considering different cells of the same pseudofilament. The sinus opening varied as it was either broadly open and acute or open next to the isthmus or closed at the distal region due to the convergence of the semicell spines.

Distribution in Brazil: Goiás (Förster 1964); Pará (Grönblad 1945, Förster 1969).

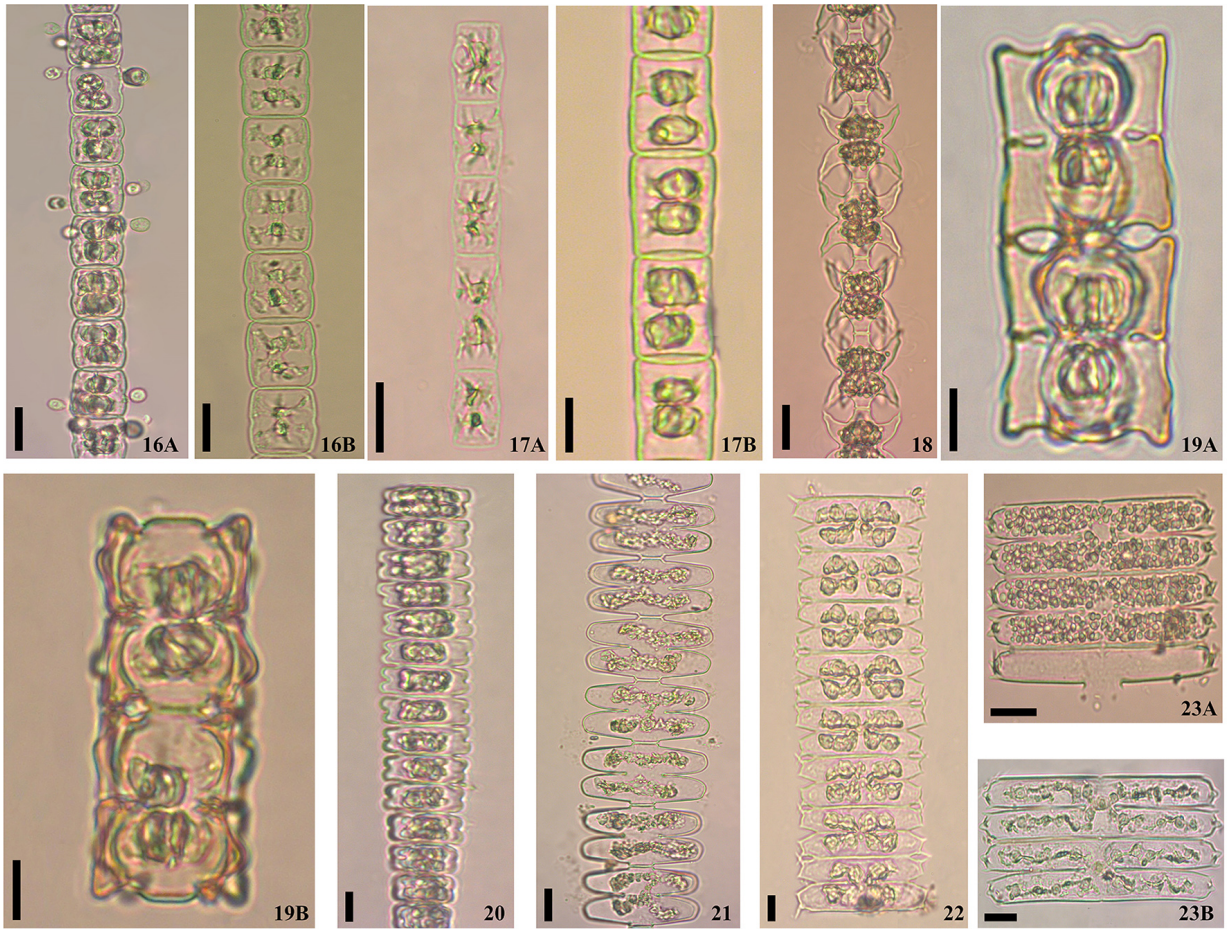
Spomdylosium rectangulare (Wolle) West & West var. ***goyazense*** Förster, Hydrobiologia 23 (3-4): 434, pl. 35, fig. 15-17, pl. 37, fig. 11-12, pl. 50, fig. 19-20. 1964. (Figs. 23A-B)

Cell 2.7 times broader than long, 27 × 92-96 µm and 24 µm broad at the isthmus. Semicells oblong-rectangular; straight apical margin that were sometimes convex at the terminal extension; each angle ended at a robust spine; there was 1 spine in the mid region of the lateral margins; deep median constriction; linear to open median sinus; axial chloroplast.

Material examined: BRAZIL, AMAPÁ, Macapá, Curralinho Lake, 02.VI.2007, *C.B. Araújo* (SP469217), 03.VII.2007, *C.B. Araújo* (SP469218), 13.V.2008, *C.B. Araújo* (SP469227).

Comments: the present variation differs from the typical species, as it is greater in size and has the apical margin of straight semicells. It also has a slight incision at the mid region and rounded lateral margins with four overlapping divergent spines or tubers at the angular ends. Förster (1964) described this variety from material collected from the Fêmeas River in Porta Azul in Goiás state. Scott *et al.* (1965) proposed f. *maius* Scott & Croasdale from material collected in the state of Pará, due to its broader width and an apical indentation when compared to *S. rectangulare* (Wolle) West & West. The illustration in Scott *et al.* (1965) showed measurements and morphology in agreement with the ones registered in Förster (1964) as *S. rectangulare* var. *goyazense* Förster. Due to the above difficulty in differing specimens cited by the latter authors, and considering that the specimens in the present study showed morphological variation even in the same pseudofilament, it was decided to consider both taxa as synonymous (heterotypic or taxonomic synonyms).

Distribution in Brazil: Goiás (Förster 1964, Nogueira *et al.* 2016); Pará (Scott *et al.* 1965).



Figs. 16-23. Pseudofilamentous desmids of Curralinho Lake, Macapá, Amapá, Brazil. **16 A-B**. *Hyalotheca dissiliens* var. *dissiliens*. **A**. fungi in the cell wall of the algae, **B**. detailed cells; **17 A-B**. *H. javanica*. **A**. detailed pseudofilament, **B**. detailed cells; **18**. *Mateola curvata*; **19 A-B**. *Phymatodocis nordstedtiana* var. *nordstedtiana* f. *minor*. **A**. pseudofilament frontal view, **B**. pseudofilament lateral view; **20**. *Spondylosium desmidiiforme*; **21**. *S. pulchrum* var. *pulchrum*; **22**. *S. rectangulare* var. *rectangulare*; **23 A-B**. *S. rectangulare* var. *goyazense*, detailed cells and pseudofilaments. Scale bars = 10 µm.

DISCUSSION

There have been recent changes in taxonomic studies based on polyphasic approaches, especially with the use of molecular and phylogenetic analyses. However, classical or α-taxonomy based on conventional measures is still a widely used tool to identify and differentiate species, especially in Brazil, where species are frequently recorded within classical taxonomic studies in all regions since the XIX century.

Knowledge of desmids taxonomy is based on vegetative cells morphology, and numerous subspecific taxa have been described. Many of them are based solely on the analysis of a single specimen, not of a population, and they do not include measurements, comments, and illustrations. These facts have resulted in confusion for description of some varieties and taxonomical forms, in addition to taxonomic and nomenclatural problems in the literature. For example, these discrepancies were observed in the literature for some pseudofilamentous genera like *Bambusina*, *Desmidium* or even *Hyalotheca* and *Groenbladia*, and the latter two can be differentiated only on the basis of their chloroplasts.

The currently large number of desmid taxa is clearly inadequate for classification, justifying an important and accurate revision of the system that includes use of polyphasic approaches and literature data. In the case of using only morphological or traditional analyses, it is extremely necessary to be careful, especially when proposing new taxa. This is because these observations can represent merely morphological expressions or ecomorphae, as were already reported in many desmids' studies (*e.g.* Bicudo & Sormus 1972, Sormus & Bicudo 1974).

Concerning all previous studies about the phytoplankton taxonomy in the Amapá state, only two publications were found after examining the specialized literature. First, Förster (1963) described material collected from the Oiapoque River, on the border between Amapá state and French Guiana. In this study, he identified five taxa of desmids: *Desmidium laticeps* Nordstedt fac. 4-radiata, *Desmidium laticeps* Nordstedt fac. 5-radiata, *Euastrum laticeps* f. *evolutum* Grönblad, *Cosmarium pseudomagnificum* Hinode f. *brasiliense* Förster, and *Closterium pseudolunula* Borge var. *concavum* Förster. The other study was carried out by Souza & Melo (2011) in Novo Lake, located in the lake region, coastal plain, in the Continental or Oceanic region of Amapá. In their study, 35 taxa were identified and classified into species and taxonomical variety of three desmids genera: *Staurastrum* Meyen *ex* Ralfs, *Staurodesmus* Teliling, and *Xanthidium* Ehrenberg emend. Ralfs. Therefore, the current dearth of information on pseudofilamentous desmids taxonomy warrants the species inventory and taxonomic varieties carried out in the present study, and it is considered pioneer for this state, especially for the capital Macapá.

According to the present results, *Desmidium quadratum* var. *constrictum*, *Spondylosium rectangulare* var. *goyazense*, and *Haplozyga armata* var. *armata* are new reported occurrences for the Amazon region. In addition, *Desmidium longatum* was registered for the first time in Brazil. During the present study, 10 taxa were considered frequent (F > 40% ≤ 70% per sample), another nine taxa were considered less frequent (F > 10% ≤ 40% per sample), and *Spondylosium desmidiiforme* and *Mateola curvata* were considered rare (F < 10%) (Table 1).

Most taxa occurred during both the rainy and dry (less rainy) periods. However, *Desmidium baileyi* var. *baileyi* f. *baileyi*, *D. quadratum* var. *quadratum*, *D. quadratum* var. *constrictum*, *Haplozyga armata* var. *armata*, *Mateola curvata*, and *Spondylosium desmidiiforme* were collected only during the rainy period (Tab. 1).

Table 1. Seasonal occurrence of pseudofilamentous desmids at Curralinho Lake (FR: relative frequency; F: frequent; LC: less common; R: rare; BP: both periods, rainy and less rainy; RP: rainy period.

Taxon	F.R. (%)	Category	Seasonal occurrence
Bambusina borreri var. *borreri*	58,33	F	BP
B. borreri var. *brasiliense*	50	F	BP
B. borreri var. *majus*	50	F	BP
Desmidium baileyi var. *baileyi* f. *baileyi*	33.33	LC	RP
D. elegans	50	F	BP
D. graciliceps var. *graciliceps*	16.66	LC	BP
D. graciliceps var. *groenbladii*	25	LC	BP
D. longatum	33.33	LC	BP
D. quadratum var. *quadratum*	16.66	LC	RP
D. quadratum var. *constrictum*	16.66	LC	RP
Groenbladia neglecta var. *neglecta*	58.33	F	BP
G. neglecta var. *elongata*	58.33	F	BP
Haplozyga armata var. *armata*	41.66	F	RP
Hyalotheca dissiliens var. *dissiliens*	41.66	F	BP
H. javanica	58.33	F	BP
Mateola curvata	8.33	R	RP
Phymatodocis nordstedtiniana var. *nordstedtiniana* f. *minor*	25	LC	BP
Spondylosium desmidiiforme	8.33	R	RP
S. pulchrum var. *pulchrum*	16.66	LC	BP
S. rectangulare var. *rectangulare*	41.66	F	BP
S. rectangulare var. *goyazense*	25	LC	BP

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