

## ***Monoraphidium* and *Ankistrodesmus* (Chlorophyceae, Chlorophyta) from Pantanal dos Marimbus, Chapada Diamantina, Bahia State, Brazil**

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**ABSTRACT** - (*Monoraphidium* and *Ankistrodesmus* (Chlorophyceae, Chlorophyta) from Pantanal dos Marimbus, Chapada Diamantina, Bahia State, Brazil). This study aimed to identify taxa belonging to the genera *Monoraphidium* and *Ankistrodesmus* (Chlorophyceae, Chlorophyta) in two wetland areas of Pantanal dos Marimbus (Baiano and Remanso) in the Marimbus-Iraquara Environmental Protection Area, Bahia State, Brazil, and contribute to the knowledge of Chlorophyceae of Bahia State and Brazil. The materials studied, which were of periphytic and metaphytic origin, came from 64 samples collected in April and June 2011. We identified 18 taxa, 13 from *Monoraphidium* and five from *Ankistrodesmus*. Eight taxa were additions to the continental microalgae flora of Northeastern Brazil. Two taxa rarely found in Brazil were collected during the study: *Monoraphidium dybowskii* and *M. litorale*.

**Key words:** algae, biodiversity, Chlorococcales

**RESUMO** - (*Monoraphidium* e *Ankistrodesmus* (Chlorophyceae, Chlorophyta) do Pantanal dos Marimbus, Chapada Diamantina, BA, Brasil). Este estudo teve por objetivo inventariar os táxons de *Monoraphidium* e *Ankistrodesmus* (Chlorophyceae, Chlorophyta) de duas áreas alagáveis do Pantanal dos Marimbus (Baiano e Remanso), Área de Proteção Ambiental Marimbus-Iraquara, Bahia e contribui para o conhecimento das Chlorophyceae do Estado da Bahia e Brasil. Os materiais estudados, de origem perifítica e metafítica, provieram de 64 amostras coletadas em abril e junho de 2011. Foram identificados 18 táxons, 13 de *Monoraphidium* e cinco de *Ankistrodesmus*, dos quais oito são adições à flora de microalgas continentais da região Nordeste. Dois táxons raramente encontrados no Brasil foram coletados durante este estudo: *Monoraphidium dybowskii* e *M. litorale*.

**Palavras-chave:** algas, biodiversidade, Chlorococcales

### **Introduction**

The Pantanal dos Marimbus is considered one of the main ecosystems in Chapada Diamantina and corresponds to an extensive wetland area that is subject to periodic flooding, draining most of the region's rivers (Sema 2011). The Bahia State Government transformed this region into a protected area (Marimbus-Iraquara EPA) due to its rich biological diversity with Decree n° 2216 of June 14, 1993.

According to Taniguchi *et al.* (2005), despite the immense representation of wetlands in Brazil,

knowledge regarding the algal communities in these aquatic systems is still scarce. Most phycological studies in these environments highlight the Chlorophyceae class as being the most common group (De-Lamonica-Freire & Heckman 1996, De-Lamonica-Freire & Sant'Anna 1993). This group generally stands out due to its extensive distribution, diversity, and species richness, in addition to being essential in ecological studies (Comas 1996).

The two genera *Monoraphidium* Komárková-Legnerová and *Ankistrodesmus* Corda are among those that deserve attention in the Chlorophyceae class.

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Both genera are commonly found in many continental tropical and temperate aquatic environments, primarily those with high nutrient content (Reynolds 1984). In addition, representatives of these genera are widely used in physiological studies due to their rapid growth rate in culture (Sipaúba-Tavares *et al.* 1999, El-Sheekh *et al.* 2003).

The knowledge of the *Monoraphidium* and *Ankistrodesmus* genera in Bahia State is scarce and currently restricted to studies by Menezes *et al.* (2012) and reports of ecological content by Fuentes *et al.* (2010) and Santana (2011), in which the species are represented only by listings. Taxonomic studies with descriptions and illustrations of these genera do not exist for Bahia State.

This study aimed to conduct a taxonomic inventory of the *Monoraphidium* and *Ankistrodesmus* genera at two areas in the Pantanal dos Marimbus (Remanso and Baiano), Chapada Diamantina, to contribute to the knowledge of Chlorophyceae of Bahia State and Brazil.

### Material and methods

The Pantanal dos Marimbus corresponds to a flood plain formed by the confluence of the Santo Antônio, Utinga, and São José Rivers, covering the municipalities of Lençóis and Andaraí in Chapada Diamantina, Bahia State, Brazil. The Marimbus are subdivided in four areas (Remanso, Fazenda Velha, Ferreira and Baiano).

The study was conducted in two areas of the Pantanal dos Marimbus (Remanso and Baiano) (figure 1). The Marimbus do Remanso (41°20'W, 12°40'S), is located at the municipality of Lençóis and near the village of Remanso, and is characterized by calm waters (most zones) with pH 6.6-7.6 and average transparency (2.1 m). It is notable the influence of the Santo Antonio River in the dynamics of the environment, especially in the narrower parts, in which current flow is higher.

The Marimbus do Baiano (41°18'W, 12°45'S), located in the municipality of Andaraí, consists of several interconnected lakes such as Lagoa do Baiano, Lagoa da Isca, Lagoa dos Paus and Olho D'Água do Peri. These subdivisions are most used by local fishermen in the dry season, when the water regime of the Santo Antonio River is well below normal, and then there is no interconnection between them. Considering this subdivision, the samples of

the present study, collected in Marimbus do Baiano, were concentrated in the Lagoa do Baiano. The area is characterized also by calm waters with pH 6.0-7.2 and average transparency (0.9 m). The Marimbus areas have several macrophytes such as *Utricularia foliosa* L., *Cabomba haynesii* Wiersema, *Eichhornia azurea* (Sw.) Kunth., *Nymphaea ampla* (Salisb.) DC, *Salvinia auriculata* Aubl. and *Hydrocleys nymphoides* (Humb. & Bonpl. ex Willd.).

Sixty four samples of periphytic and metaphytic material studied were collected during April and June 2011 (beginning of the dry season) and came mainly from these macrophytes cited. All collections were made using standardized techniques for taxonomic studies of continental microalgae (Bicudo & Menezes 2006).

The metric limits of the specimens were obtained using an ocular micrometer, and the photomicrographs were acquired with a digital camera coupled to an optical microscope. The species were identified based on the specialized literature; the classification system adopted follows Komárek & Fott (1983).

Samples were preserved in Transeau solution follow Bicudo & Menezes (2006), and incorporated in the liquid collection at the Herbarium of the Universidade Estadual de Feira de Santana (HUEFS).

### Results and discussion

In the present study on Pantanal do Marimbus, 18 taxa, 13 from *Monoraphidium* Corda and five from *Ankistrodesmus* Komárková-Legnerová were identified:

Chlorophyta, Chlorellaceae

*Ankistrodesmus* Corda, Alman. Carlsbad, 8: 196. 1838.

Cells in colonies, rarely solitary, forming clumps or loose to dense fascicles, parallel or sometimes spirally arranged around each other. Fusiform cells, longer than wide, may be straight, curved, or sigmoid, with gradually or abruptly tapered ends; smooth cell wall; parietal chloroplast without pyrenoids. Reproduction by 2-16 autospores, arranged in parallel within the mother cell, which are released after the breakup of the cell wall (Comas 1996).

Type species: *Ankistrodesmus falcatus* (Corda) Ralfs 1848.

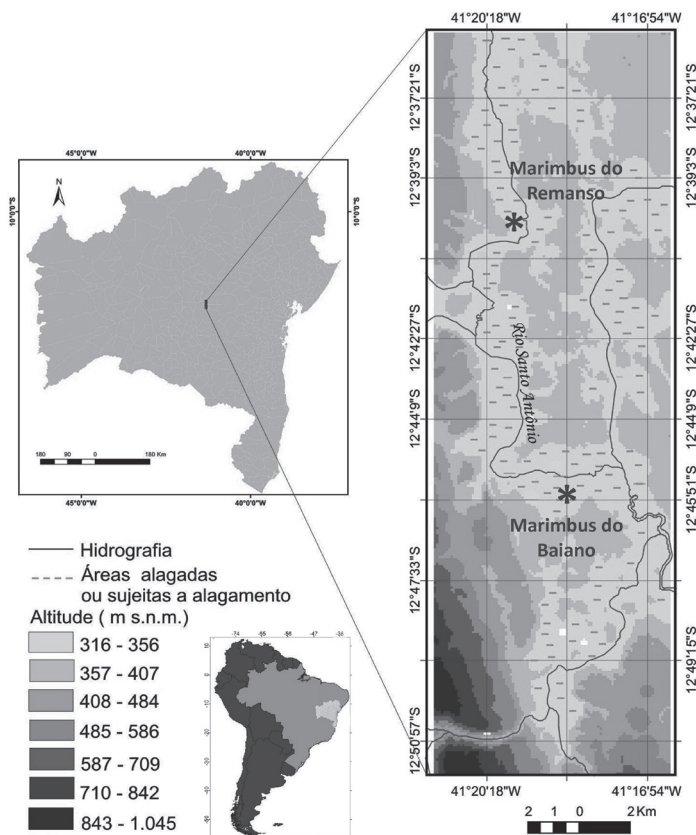


Figure 1. Localization of Pantanal dos Marimbus and the two sampled areas, Bahia State, Brazil (modified from França *et al.* 2011).

Key for identification of the species of *Ankistrodesmus* in the Pantanal dos Marimbus

- 1. Straight or falcate cells
  - 2. Falcate cells joined by a convex medial region ..... *A. falcatus*
  - 2. Straight cells in a crucial or radial arrangement ..... *A. fusiformis*
- 1. Curved, sigmoid, or helical cells
  - 3. Colonies of up to 8 cells, twisted in a helical manner in the medial region ..... *A. spiralis*
  - 3. Colonies with more than 8 cells
    - 4. Colonies with a maximum of 10 fusiform cells, sigmoidally curved in the medial region ..... *A. bernardii*
    - 4. Colonies with a minimum of 16 sigmoid or curved cells throughout their length ..... *A. densus*

*Ankistrodesmus bernardii* Komárek, Nova Hedwigia 37: 138, 176, pl. 25, fig. 65. 1983.

Figure 2a

Fasciculate colonies with approximately 8-10 fusiform cells, slightly sigmoidal curve on the

medial region, 23-28 times longer than broad, joined and interwoven in the medial region of the colony, gradually tapered toward the apex; single, parietal chloroplast without pyrenoids. Cell dimensions: 42.5-58.5 µm in length, 1.5-2.5 µm in width.

Material examined: BRAZIL. BAHIA: Andaraí, Marimbus-Iraquara EPA, Marimbus do Baiano, 1-IV-2011 *G.J.P. Ramos & C.W.N. Moura s.n* (HUEFS178326, HUEFS178327, HUEFS178328, HUEFS178329, HUEFS178330, HUEFS178332, HUEFS178335, HUEFS178336, HUEFS178339, HUEFS178342, HUEFS178343, HUEFS178344); 29-VI-2011, *G.J.P. Ramos & C.W.N. Moura s.n* (HUEFS178362, HUEFS178365, HUEFS178366, HUEFS178373, HUEFS178376, HUEFS178377).

Geographic distribution in Brazil: Tocantins, Mato Grosso, Goiás, Espírito Santo, São Paulo, Rio de Janeiro, Paraná (Menezes *et al.* 2012) and Bahia (present study).

According to Komárek (1983), *Ankistrodesmus bernardii* usually forms colonies with many cells that are variable in length. This species is closely related to *A. densus*, which differs by having curved or sigmoid

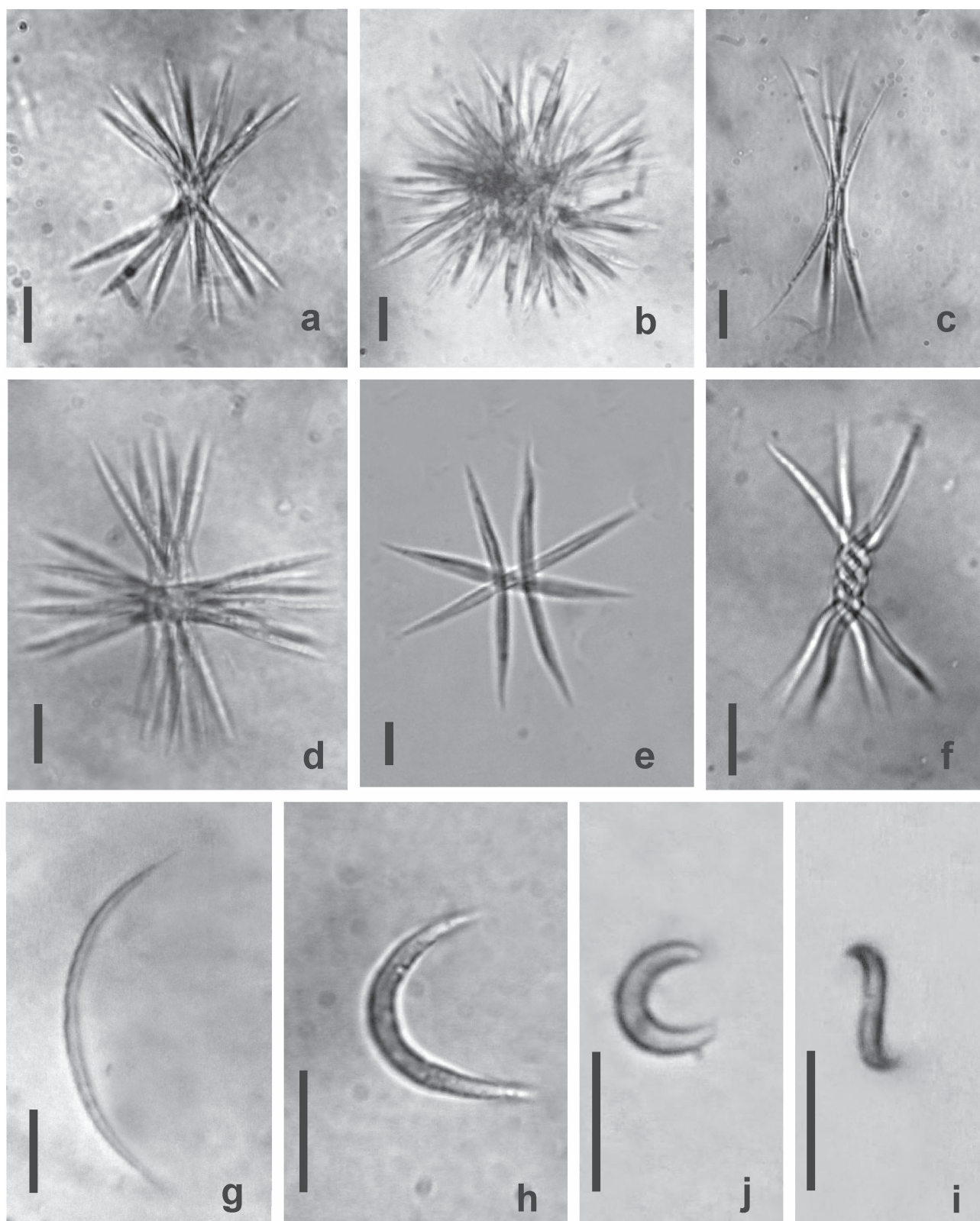


Figure 2. a. *Ankistrodesmus bernardii*; b. *A. densus*; c-d. *A. falcatus*; e. *A. fusiformis*; f. *A. spiralis*; g. *Monoraphidium arcuatum*; h. *M. caribeum*; i-j: *M. circinale* (Bars = 10  $\mu$ m).

cells throughout its length, in addition to having longer cells.

According to Komárek (1983) and Comas (1996), *A. bernardii* is a tropical species that occurs in periphytic communities from meso-eutrophic aquatic environments.

The populations analyzed in the study area are in accordance to the descriptions and illustrations reported by Komárek & Fott (1983), Comas (1996), and Nogueira & Oliveira (2009).

This report constitutes the first citation of the species for Northeastern Brazil.

***Ankistrodesmus densus*** Korshikov, Protococcinae: 300, fig. 262. 1953  
Figure 2b

Fasciculate colonies with 16 or more densely grouped cells; long cells, 18-40 times longer than broad, fusiform, curved, or sigmoid throughout its length, gradually tapered towards the apex, superimposed on each other; single, parietal chloroplast without pyrenoids. Cell dimensions: 50-65  $\mu\text{m}$  in length, 1.25-3.5  $\mu\text{m}$  in width.

Material examined: BRAZIL. BAHIA: Andaraí, Marimbus-Iraquara EPA, Marimbus do Baiano, 1-IV-2011, *G.J.P. Ramos & C.W.N. Moura s.n.* (HUEFS178325, HUEFS178326, HUEFS178327, HUEFS178328, HUEFS178329, HUEFS178330, HUEFS178331, HUEFS178332, HUEFS178333, HUEFS178334, HUEFS178335, HUEFS178336, HUEFS178338, HUEFS178340, HUEFS178342, HUEFS178343, HUEFS178344, HUEFS178345); 29-VI-2011, *G.J.P. Ramos & C.A. Ribeiro s.n.* (HUEFS178362, HUEFS178363, HUEFS178365, HUEFS178366, HUEFS178370, HUEFS178372, HUEFS178373, HUEFS178374, HUEFS178375, HUEFS178378, HUEFS178379); Lençóis, Marimbus-Iraquara EPA, Marimbus do Remanso, 2-IV-2011, *G.J.P. Ramos & C.W.N. Moura s.n.* (HUEFS178352, HUEFS178353, HUEFS178361).

Geographic distribution in Brazil: Amazonas, Tocantins, Goiás, Minas Gerais, São Paulo, Rio de Janeiro, Paraná (Menezes *et al.* 2012) and Bahia (present study).

The populations studied agreed with the descriptions and illustrations reported by Komárek & Fott (1983) and Sant'Anna (1984); however, the analyzed cells are longer than those reported by Bortolini *et al.* (2010).

The taxon is likely cosmopolitan and is found in neutral or acidic waters (Comas 1996, John & Tsarenko 2002).

This report constitutes the first citation of the species for Northeastern Brazil.

***Ankistrodesmus falcatus*** (Corda) Ralfs, Brit Desm., 180, pl. 34, figs. a-c. 1848  $\equiv$  *Micrasterias falcata* Corda, Alman Carlsbad 5: 206, pl. II, fig. 29. 1835.

Figures 2c-2d

Colonies with 1-4 fascicules of four cells arranged in an irregular manner; cells are long, fusiform, slightly curved, falcate, 26-30 times longer than broad, joined together by the convex medial region, gradually tapered towards the apex; single, parietal chloroplast without pyrenoids. Cell dimensions: 40-78.5  $\mu\text{m}$  in length, 1.5-2.5  $\mu\text{m}$  in width.

Material examined: BRAZIL. BAHIA. Andaraí, Marimbus-Iraquara EPA, Marimbus do Baiano, 1-IV-2011, *G.J.P. Ramos & C.W.N. Moura s.n.* (HUEFS178326, HUEFS178328, HUEFS178329, HUEFS178338, HUEFS178344), 29-VI-2011, *G.J.P. Ramos & C.A. Ribeiro s.n.* (HUEFS178362, HUEFS178371, HUEFS178372, HUEFS178375, HUEFS178377); Lençóis, Marimbus-Iraquara EPA, Marimbus do Remanso, 2-IV-2011, *G.J.P. Ramos & C.W.N. Moura s.n.* (HUEFS178347, HUEFS178352, HUEFS178359); 30-VI-2011, *G.J.P. Ramos & C.A. Ribeiro s.n.* (HUEFS178383, HUEFS178385, HUEFS178386, HUEFS178387, HUEFS178388, HUEFS178391, HUEFS178392, HUEFS178393).

Geographic distribution in Brazil: Roraima, Amazonas, Minas Gerais, Espírito Santo, São Paulo, Rio de Janeiro, Paraná, Santa Catarina (Menezes *et al.* 2012) and Bahia (present study).

According to Hindák (1984), when there is displacement of the two central cells of *Ankistrodesmus falcatus* forming angles close or equal to 90°, the colony has similar morphology to that of *A. fusiformis*; however, this species is distinguished by its smaller cell sizes.

The *Ankistrodesmus falcatus* populations examined in this study are consistent with the descriptions and illustrations reported by Komárek & Fott (1983), Nogueira (1991), and Comas (1996), although the maximum metric limits recorded for specimens from Bahia State have been slightly higher than those found by these authors.

John & Tsarenko (2002) and Comas (1996) consider *A. falcatus* cosmopolitan, common in

calm and oligotrophic waters, and to occur in both planktonic and periphytic environments.

This report constitutes the first citation of the species for Northeastern Brazil.

*Ankistrodesmus fusiformis* Corda ex Korshikov, Protococcinae: 300, fig. 263. 1953  
Figure 2e

Colonies of 2-4 (-8) cells, radially or crucially arranged; cells are elongated-fusiform, straight or slightly curved, 26-35 times longer than broad, gradually tapered and pointed apex; single, parietal chloroplast without pyrenoids. Cell dimensions: 27.5-60 µm in length, 1.25-2.5 µm in width.

Material examined: BRAZIL. BAHIA: Andaraí, Marimbus-Iraquara EPA, Marimbus do Baiano, 1-IV-2011, *G.J.P. Ramos & C.W.N. Moura s.n.* (HUEFS178325, HUEFS178326, HUEFS178327, HUEFS178329, HUEFS178330, HUEFS178331, HUEFS178332, HUEFS178336, HUEFS178337, HUEFS178342, HUEFS178343); 29-VI-2011, *G.J.P. Ramos & C.A. Ribeiro s.n.* (HUEFS178362, HUEFS178363, HUEFS178366, HUEFS178368, HUEFS178372, HUEFS178373, HUEFS178374, HUEFS178378, HUEFS178379); Lençóis, Marimbus-Iraquara EPA, Marimbus do Remanso, 2-IV-2011, *G.J.P. Ramos & C.W.N. Moura s.n.* (HUEFS178346, HUEFS178352, HUEFS178353, HUEFS178359), 30-VI-2011, *G.J.P. Ramos & C.A. Ribeiro s.n.* (HUEFS178380, HUEFS178384, HUEFS178385, HUEFS178388, HUEFS178390, HUEFS178391, HUEFS178392, HUEFS178393).

Geographic distribution in Brazil: Amapá, Amazonas, Tocantins, Goiás, Distrito Federal, Espírito Santo, São Paulo, Rio de Janeiro, Paraná, Rio Grande do Sul (Menezes *et al.* 2012) and Bahia (Fuentes *et al.* 2010, Santana 2011).

In the studied *A. fusiformis* populations, there were varied numbers of cells, predominantly in small, ephemeral colonies with 2-4 cells, although colonies with eight cells were found. In addition, there is a cell polymorphism, with cell shape being sometimes straight and sometimes slightly curved.

The material analyzed is consistent with the descriptions and illustrations by Komárek & Fott (1983), Sant'Anna (1984), and Bortolini *et al.* (2010).

*Ankistrodesmus fusiformis* was previously cited for Bahia State by Fuentes *et al.* (2010) and Santana (2011) from analysed material from the Rio de Contas and Almada River, respectively. The authors did not provided comments or illustrations of the material

studied. Therefore, we consider the present study to be the first time that the occurrence of the species was confirmed in Bahia State.

The taxon is likely cosmopolitan and is usually found in the plankton and periphyton of aquatic environments (Comas 1996, John & Tsarenko 2002).

*Ankistrodesmus spiralis* (W.B.Turner) Lemmermann, Arch Hydrobiol U Planktonk, 4: 176. 1908 ≡ *Rhaphidium spirale* W.B.Turner, Alg Ind Orient, 156, pl. XX, fig. 26. 1893.

Figure 2f

Colonies with a fascicle, composed of 2-8 fusiform cells, 20-26 times longer than broad, joined together and twisted in a helical manner in the medial region, tapered apices; single, parietal chloroplast without pyrenoids. Cell dimensions: 40-50 µm in length, 1.5-2.5 µm in width.

Material examined: BRAZIL. BAHIA: Andaraí, Marimbus-Iraquara EPA, Marimbus do Baiano, 1-IV-2011, *G.J.P. Ramos & C.W.N. Moura s.n.* (HUEFS178327, HUEFS178329, HUEFS178333, HUEFS178341, HUEFS178342, HUEFS178344); 29-VI-2011, *G.J.P. Ramos & C.A. Ribeiro s.n.* (HUEFS178372); Lençóis, Marimbus-Iraquara EPA, Marimbus do Remanso, 2-IV-2011, *G.J.P. Ramos & C.W.N. Moura s.n.* (HUEFS178347, HUEFS178352, HUEFS178359), 30-VI-2011, *G.J.P. Ramos & C.A. Ribeiro s.n.* (HUEFS178380, HUEFS178383, HUEFS178385, HUEFS178389, HUEFS178390, HUEFS178391, HUEFS178392, HUEFS178393, HUEFS178394).

Geographic distribution in Brazil: Paraíba, Goiás, Distrito Federal, Minas Gerais, São Paulo, Rio de Janeiro, Paraná (Menezes *et al.* 2012) and Bahia (present study).

Morphologically, *Ankistrodesmus spiralis* is similar to *A. densus*; however, this species is distinguished by having a colony with 16 or more cells, less torsion throughout the cell, and larger cell measurements (wider and longer cells).

The populations analyzed in the Pantanal dos Marimbus agreed with the descriptions and illustrations presented by Komárek & Fott (1983), Hindák (1988), and Bortolini *et al.* (2010), although the cell dimensions shown by these latter authors were smaller than those found in the studied specimens.

According to John & Tsarenko (2002), *A. spiralis* is cosmopolitan and is common in acidic aquatic environments. This report constitutes the first citation of the species for Bahia State.

***Monoraphidium*** Komárková-Legnerová, In Fott, Stud Phyc: 96. 1969.

Single cells, fusiform, cylindrical, longer than broad, straight, curved or sigmoid, sometimes spiral, gradually tapered towards the apex, which may be tapered or rounded; smooth cell wall; parietal chloroplast, without pyrenoids. Reproduction by 4-8 autospores, arranged in series within the mother cell, which are released after breaking up the wall of the mother cell into two parts (Comas 1996).

Type species: *Monoraphidium griffithii* (Berk.) Komárková-Legnerová 1969.

Artificial key for identify the species of *Monoraphidium* in the Pantanal dos Marimbus

1. Apices of the cells rounded
  2. Cylindrical, straight, or slightly curved cells .....  
..... *M. dybowskii*
  2. Reniform cells
    3. Cells 9-12 µm long ..... *M. minutum*
    3. Cells 4-6 µm long ..... *M. nanum*
1. Apices of the cell tapered
  4. Fusiform, straight, or slightly curved cells
    5. Cells shorter than 30 µm
      6. Straight cells ..... *M. litorale*
      6. Slightly curved cells
        7. Tapered to finger-like apices,  
25-28.5 µm long ..... *M. pusillum*
        7. Needle-like apices, 12-20 µm long .....  
..... *M. tortile*
    5. Cells longer than 40 µm
      8. Long needle-like apices,  
50-105 µm long ..... *M. kormakovae*
      8. Short spine apices, 45-58 µm long .....  
..... *M. griffithii*
  4. Arched, sigmoid, or spiral cells
    9. Arched cells
      10. Cells up to 12 µm long ..... *M. circinale*
      10. Cells above 12 µm long
        11. Cells 30-45(-56) µm long .....  
..... *M. arcuatum*
        11. Cells 12.5-18.75 µm long ... *M. caribeum*
    9. Sigmoid or spiral cells
      12. Cells 7.5-12 µm long ..... *M. contortum*
      12. Cells 34-39 µm long ..... *M. irregulare*

***Monoraphidium arcuatum*** (Korshikov) Hindák, Alg Stud 1: 25. 1970 ≡ *Ankistrodesmus arcuatus* Korshikov, Protococcineae, 296, fig. 297. 1953.

Figure 2g

Cells solitary, arched or semi-circular, gradually narrowing to the ends with pointed apices; single

parietal chloroplast, without pyrenoids. Cell dimensions: 30-45(-56) µm in length, 1.5-2.5 µm in width.

Material examined: BRAZIL. BAHIA: Andaraí, Marimbus-Iraquara EPA, Marimbus do Baiano, 1-IV-2011, *G.J.P. Ramos & C.W.N. Moura s.n.* (HUEFS178326, HUEFS178327, HUEFS178328, HUEFS178329, HUEFS178332, HUEFS178341, HUEFS178342, HUEFS178343, HUEFS178344); 29-VI-2011, *G.J.P. Ramos & C.A. Ribeiro s.n.* (HUEFS178362, HUEFS178363, HUEFS178365, HUEFS178366, HUEFS178372, HUEFS178373, HUEFS178374, HUEFS178376, HUEFS178378); Lençóis, Marimbus-Iraquara EPA, Marimbus do Remanso, 2-IV-2011, *G.J.P. Ramos & C.W.N. Moura s.n.* (HUEFS178347, HUEFS178351, HUEFS178352, HUEFS178353, HUEFS178354); 30-VI-2011, *G.J.P. Ramos & C.A. Ribeiro s.n.* (HUEFS178380, HUEFS178384, HUEFS178385, HUEFS178387, HUEFS178388, HUEFS178389, HUEFS178390, HUEFS178391, HUEFS178392, HUEFS178393, HUEFS178394).

Geographic distribution in Brazil: Amazonas, Tocantins, Rio Grande do Norte, Pernambuco, Goiás, Distrito Federal, Espírito Santo, São Paulo, Rio de Janeiro, Paraná (Menezes *et al.* 2012) and Bahia (Menezes *et al.* 2012, Fuentes *et al.* 2010).

*Monoraphidium arcuatum* is morphologically similar to *M. indicum* Hindák; however, this species differs by having larger cell dimensions and being generally more rounded and curved.

The studied populations corroborate with the descriptions, measurements, and illustrations reported by Komárek & Fott (1983), Comas (1996), Nogueira (1999), and Bortolini *et al.* (2010).

Fuentes *et al.* (2010) & Menezes *et al.* (2012) reported the occurrence of *M. arcuatum* in Bahia State. These authors did not describe or illustrate the morphology of the material studied. Due to the lack of factual information contained in these studies, the reports by Fuentes *et al.* and by Menezes *et al.* were discarded, and the present study is considered as a pioneer in Bahia State.

The taxon is likely cosmopolitan, occurring in the plankton and metaphyton (Komárek & Fott 1983) or in the plankton and periphyton from eutrophic environments (Comas 1996).

***Monoraphidium caribeum*** Hindák, Algol Stud 1: 26, fig. 11. 1970.

Figure 2h

Cells solitary, arched in a semi-circle, slightly tapered at the ends; parietal chloroplast and without pyrenoids. Cell dimensions: 12.5-17.5  $\mu\text{m}$  in length, 1.5-2.5  $\mu\text{m}$  in width.

Material examined: BRAZIL. BAHIA: Andaraí, Marimbus-Iraquara EPA, Marimbus do Baiano, 1-IV-2011, *G.J.P. Ramos & C.W.N. Moura s.n.* (HUEFS178344); 29-VI-2011, *G.J.P. Ramos & C.A. Ribeiro s.n.* (HUEFS178364, HUEFS178372, HUEFS178373); Lençóis, Marimbus-Iraquara EPA, Marimbus do Remanso, 2-IV-2011, *G.J.P. Ramos & C.W.N. Moura s.n.* (HUEFS178352); 30-VI-2011, *G.J.P. Ramos & C.A. Ribeiro s.n.* (HUEFS178392).

Geographic distribution in Brazil: Amazonas, Rio de Janeiro, Paraná (Menezes *et al.* 2012) and Bahia (present study).

According to Comas (1996), *Monoraphidium caribeum* differs from *M. arcuatum* only by cell dimensions. In addition to these dimensions, it is possible to observe in the analyzed populations that cells of *M. arcuatum* have gradually tapered apices.

The material analyzed in the present study agreed with the descriptions and illustrations of specimens studied by Komárek & Fott (1983), Comas (1996), and Nogueira (1999).

The species is cosmopolitan and is found primarily in the plankton and periphyton from eutrophic aquatic environments (Comas 1996).

This report constitutes the first citation of the species for Northeastern Brazil.

***Monoraphidium circinale*** (Nygaard) Nygaard, Bot Tidsskr 73: 212. 1979  $\equiv$  *Monoraphidium capricornutum* (Printz) Nygaard var. *circinale* Nygaard, K danske Vidensk Selsk Skr, 21(1): 60, fig. 14-29. 1977

Figures 2i-2j

Cells solitary, fusiform, arched in semi-circles, in viewed sideways, are in the contour spherical; slightly tapered at the ends; single parietal chloroplast without pyrenoids. Cell dimensions: 4.5-10.5  $\mu\text{m}$  in length, 1.5-2  $\mu\text{m}$  in width.

Material examined: BRAZIL. BAHIA: Andaraí, Marimbus-Iraquara EPA, Marimbus do Baiano, 1-IV-2011, *G.J.P. Ramos & C.W.N. Moura s.n.* (HUEFS178332, HUEFS178342, HUEFS178344); Lençóis, Marimbus-Iraquara EPA, Marimbus do Remanso, 2-IV-2011, *G.J.P. Ramos & C.W.N. Moura s.n.* (HUEFS178352); 30-VI-2011, *G.J.P. Ramos & C.A. Ribeiro s.n.* (HUEFS178390).

Geographic distribution in Brazil: Amazonas, Goiás, São Paulo, Rio de Janeiro, Paraná (Menezes *et al.* 2012) and Bahia (present study).

Morphologically, *Monoraphidium circinale* is similar to *M. minutum*; however, this species differs by having cylindrical poles and generally broader cells.

The specimens analyzed in the Pantanal dos Marimbus have slightly smaller cell measurements than those reported by Nogueira (1999) and Hindák (1988); however, they are consistent with the description and illustrations reported by Komárek & Fott (1983).

According to Komárek & Fott (1983), the species is usually found in the plankton, primarily in eutrophic and alkaline environments.

This report constitutes the first citation of this species for Northeastern Brazil.

***Monoraphidium contortum*** (Thuret) Komárková-Legnerová, Stud Phycol:104, pl. 18, fig. 1-5. 1969  $\equiv$  *Ankistrodesmus contortus* Thuret, Mem Soc Imper Sci Nat Cherbourg 4:158, pl. I, fig. 31. 1856.

Figure 3a

Cells solitary, irregularly curved, from sigmoid to spiral (1.0-1.5 turns), gradually tapered apices, pointed ends; single parietal chloroplast without pyrenoids. Cell dimensions: 7.5-12  $\mu\text{m}$  in length, 1.5-2  $\mu\text{m}$  in width.

Material examined: BRAZIL. BAHIA: Andaraí, Marimbus-Iraquara EPA, Marimbus do Baiano, 1-IV-2011, *G.J.P. Ramos & C.W.N. Moura s.n.* (HUEFS178329, HUEFS178330, HUEFS178342); 29-VI-2011, *G.J.P. Ramos & C.A. Ribeiro s.n.* (HUEFS178364, HUEFS178365, HUEFS178366, HUEFS178370, HUEFS178375); Lençóis, Marimbus-Iraquara EPA, Marimbus do Remanso, 2-IV-2011, *G.J.P. Ramos & C.W.N. Moura s.n.* (HUEFS178347, HUEFS178352); 30-VI-2011, *G.J.P. Ramos & C.A. Ribeiro s.n.* (HUEFS178381, HUEFS178390).

Geographic distribution in Brazil: Rio Grande do Norte, Pernambuco, Distrito Federal, Minas Gerais, Espírito Santo, São Paulo, Rio de Janeiro, Rio Grande do Sul (Menezes *et al.* 2012) and Bahia (Fuentes *et al.* 2010, Santana 2011, Menezes *et al.* 2012).

According to Comas (1996), *Monoraphidium contortum* has high phenotypic plasticity. Morphologically, the taxon is similar to *M. irregulare* (G.M. Smith) Komárková-Legnerová; however, this species differs by having more sigmoid cells and larger cell measurements.



The material studied agreed with the descriptions and illustrations presented by Komárek (1983), Comas (1996), Tucci *et al.* (2006), and Hentschke & Torgan (2010), although the maximum cell measurements reported by the first two authors are larger than those of the specimens studied.

Thus far, the *M. contortum* recorded for the Bahia State has appeared only on species lists (Fuentes *et al.* 2010, Santana 2011, Menezes *et al.* 2012), where the lack of data such as descriptions and illustrations makes it difficult to study these species. Therefore, we consider the present study to be the first confirmed report of the occurrence of these species in Bahia State.

According to Komárek (1983), *M. contortum* is one of the most common Chlorococcales in continental water bodies. The species is cosmopolitan and is found in both plankton and periphyton, from oligotrophic to eutrophic environments (Comas 1996, John & Tsarenko 2002).

***Monoraphidium dybowskii*** (Woloszýnska) Hindák & Komárková-Legnerová, Stud Phycol: 108-109. pl. 21. 1969 ≡ *Keratococcus dybowskii* Woloszýnska, Bull Int Acad Sci Cracovie, Cl Sci Math Nat Sér B: 127, pl. 14, fig. 29, 1917

Figure 3b

Cells solitary, cylindrical, straight or slightly curved with rounded apices; parietal chloroplast without pyrenoids. Cell dimensions: 16-22.5 µm in length, 3.75-6.25 µm in width.

Material examined: BRAZIL. BAHIA: Andaraí, Marimbus-Iraquara EPA, Marimbus do Baiano, 1-IV-2011, *G.J.P. Ramos & C.W.N. Moura s.n.* (HUEFS178332); 29-VI-2011, *G.J.P. Ramos & C.A. Ribeiro s.n.* (HUEFS178364, HUEFS178372); Lençóis, Marimbus-Iraquara EPA, Marimbus do Remanso, 30-VI-2011, *G.J.P. Ramos & C.A. Ribeiro s.n.* (HUEFS178380, HUEFS178381, HUEFS178394).

Geographic distribution in Brazil: Goiás (Nogueira 1999), São Paulo (Lopes 1999, Ferragut *et al.* 2005) and Bahia (present study).

According to Hindák (1977), *Monoraphidium dybowskii* is distinguished from other species in the genus by having cylindrical cells that are straight with rounded apices. Morphologically, the taxon resembles *M. obtusum*; however, this species differs by having larger cell dimensions and straighter apices.

The specimens studied were slightly longer than those described by Hindák (1977), Komárek & Fott

(1983), and Komárek (1983), although they are within the metric limits reported by Nogueira (1999).

Until the 1980s, the species was known only in Central Europe (Komárek & Fott 1983). Comas (1996) reported the taxon occurring in aquatic environments ranging from oligotrophic to Cuban mesotrophic, as a part of the plankton. In Brazil, the species was initially reported in an oligotrophic lake in the municipality of São Paulo (Lopes 1999) and in a meso-eutrophic reservoir in Goiás State (Nogueira 1999).

This report constitutes the first citation of the species for Northeastern Brazil.

***Monoraphidium griffithii*** (Berkeley) Komárková-Legnerová Stud Phycol: 98, pl. 11, fig. 1-4. 1969 ≡ *Closterium griffithii* Berkeley, Ann Mag Nat Hist Ser 2, 13: 256, pl. XIV, fig. 2. 1854.

Figure 3c

Cells solitary, fusiform, elongated, 16-22 times longer than broad, straight or slightly curved, gradually narrowing and terminating in an acute or short spine; parietal chloroplast without pyrenoids. Cell dimensions: 45-58 µm in length, 2-3.5 µm in width.

Material examined: BRAZIL. BAHIA: Andaraí, Marimbus-Iraquara EPA, Marimbus do Baiano, 1-IV-2011, *G.J.P. Ramos & C.W.N. Moura s.n.* (HUEFS178325, HUEFS178326, HUEFS178327, HUEFS178328, HUEFS178329, HUEFS178330, HUEFS178332, HUEFS178335, HUEFS178336, HUEFS178338, HUEFS178339, HUEFS178342, HUEFS178343, HUEFS178344, HUEFS178345); 29-VI-2011, *G.J.P. Ramos & C.A. Ribeiro s.n.* (HUEFS178362, HUEFS178363, HUEFS178364, HUEFS178365, HUEFS178366, HUEFS178368, HUEFS178370, HUEFS178372, HUEFS178373, HUEFS178374, HUEFS178375, HUEFS178378); Lençóis, Marimbus-Iraquara EPA, Marimbus do Remanso, 2-IV-2011, *G.J.P. Ramos & C.W.N. Moura s.n.* (HUEFS178347, HUEFS178348, HUEFS178351, HUEFS178352, HUEFS178353, HUEFS178354, HUEFS178357, HUEFS178358, HUEFS178361, HUEFS170431), 30-VI-2011, *G.J.P. Ramos & C.A. Ribeiro s.n.* (HUEFS178380, HUEFS178381, HUEFS178382, HUEFS178383, HUEFS178384, HUEFS178385, HUEFS178387, HUEFS178388, HUEFS178389, HUEFS178390, HUEFS178391, HUEFS178392, HUEFS178393, HUEFS178394).

Geographic distribution in Brazil: Amazonas, Rio Grande do Norte, Pernambuco, Distrito Federal,

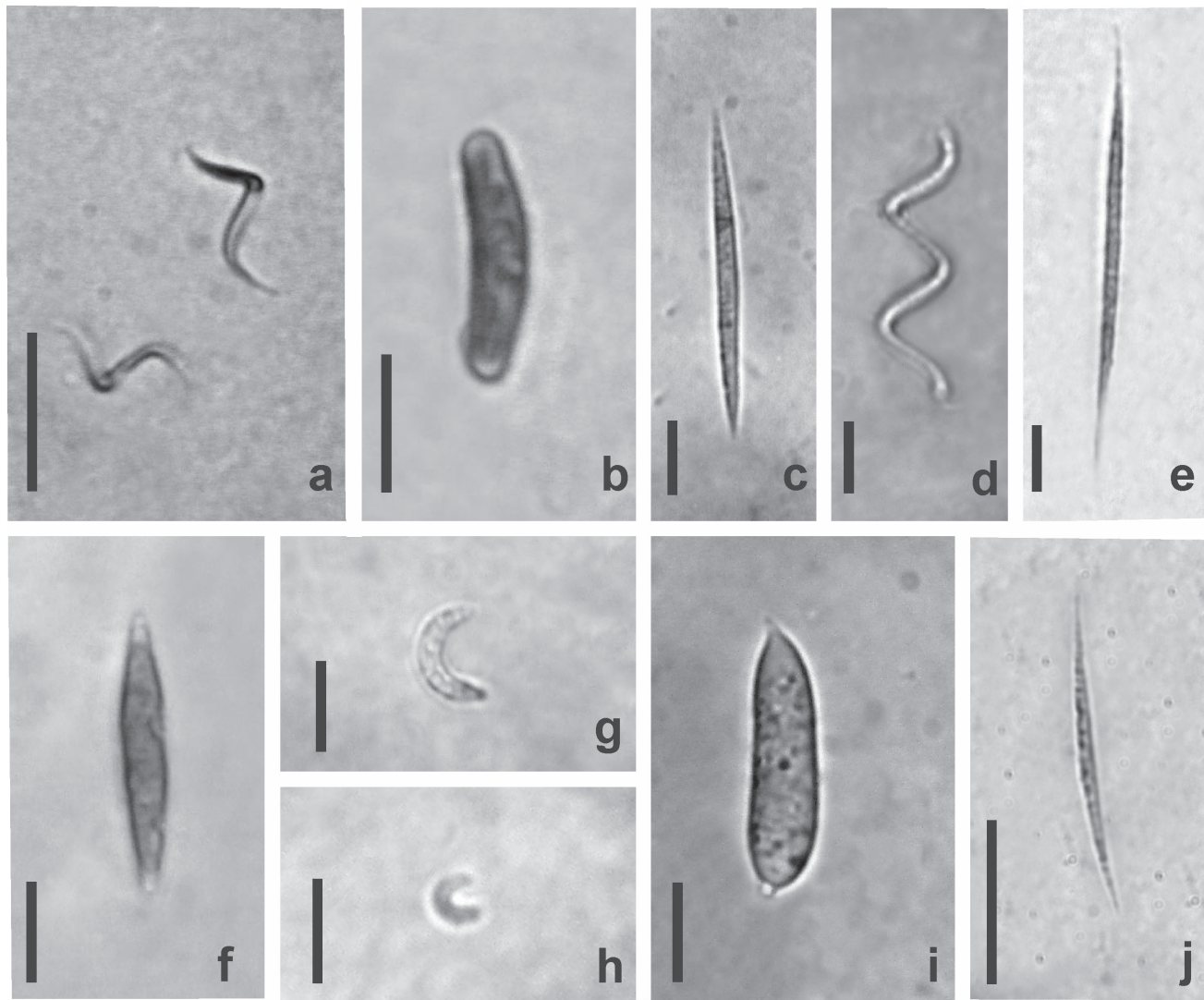


Figure 3. a. *Monoraphidium contortum*; b. *M. dybowskii*; c. *M. griffithii*; d. *M. irregulare*; e. *M. kormakovae*; f. *M. litorale*; g. *M. minutum*; h. *M. nanum*; i. *M. pusillum*; j. *M. tortile* (Bars = 10 µm).

Espírito Santo, São Paulo, Rio de Janeiro (Menezes *et al.* 2012) and Bahia (Fuentes *et al.* 2010, Santana 2011).

The presence of fusiform cells that are straight with tapered apices approach *Monoraphidium griffithii* with *M. komarkovae* and *M. tortile* (W. West & G.S. West) Komárková-Legnerová; however, *M. komarkovae* differs by having a higher length/width ratio and more tapered and pointed apices, while *M. tortile* differs by having less cell dimensions.

The specimens analyzed are consistent with the descriptions and illustrations by Komárek (1983), Comas (1996), Ferragut *et al.* (2005), Tucci *et al.* (2006), and Hentschke & Torgan (2010).

Fuentes *et al.* (2010) and Santana (2011) reported the occurrence of *M. griffithii* in Bahia State but did

not provide descriptions or illustrations to allow for the restudy of these species. Therefore, we consider the present study to be the first confirmed report of the occurrence of this species in Bahia State.

According to Comas (1996), *M. griffithii* is likely a cosmopolitan species that is usually found in the plankton from mesotrophic and eutrophic environments.

***Monoraphidium irregulare*** (G.M. Smith) Komárková-Legnerová, Stud Phycol:106, pl. 19. 1969 ≡ *Dactylococcopsis irregularis* G.M.Smith, Ark Bot, 17(13): 6, figs. 26-28. 1922.

Figure 3d

Cells solitary, fusiform to sigmoid, with one or two curves, sometimes cylindrical in the medial region, gradually tapered apices, pointed ends;

single parietal chloroplast, without pyrenoids. Cell dimensions: 34-39 µm in length, 1-1.5 µm in width.

Material examined: BRAZIL. BAHIA: Andaraí, Marimbus-Iraquara EPA, Marimbus do Baiano, 1-IV-2011, *G.J.P. Ramos & C.W.N. Moura s.n.* (HUEFS178329, HUEFS178332, HUEFS178333, HUEFS178344); 29-VI-2011, *G.J.P. Ramos & C.A. Ribeiro s.n.* (HUEFS178362, HUEFS178372); Lençóis, Marimbus-Iraquara EPA, Marimbus do Remanso, 2-IV-2011, *G.J.P. Ramos & C.W.N. Moura s.n.* (HUEFS178352, HUEFS178361), 30-VI-2011, *G.J.P. Ramos & C.A. Ribeiro s.n.* (HUEFS178389, HUEFS178390, HUEFS178391).

Geographic distribution in Brazil: Bahia, Distrito Federal, Goiás, Minas Gerais, Paraíba, Paraná, Rio de Janeiro, Santa Catarina, São Paulo and Tocantins (Menezes *et al.* 2012).

The populations studied at Pantanal dos Marimbus had slightly shorter cells than those described by Komárek & Fott (1983), Comas (1996), and John & Tsarenko (2002), although they were within the metric limits specified by Hindák (1988) and Nogueira (1999).

The first reference to *M. irregulare* for Bahia State appears in Menezes *et al.* (2012), but the author did not provide a description or illustration of the material to allow for the restudy of the species. Therefore, we consider the present study to be the first confirmed report of the occurrence of this species in Bahia State.

The taxon is likely cosmopolitan and is widely distributed in the plankton from oligotrophic and mesotrophic environments (Comas 1996, John & Tsarenko 2002).

***Monoraphidium komarkovae*** Nygaard, Bot Tidsskr 73(3/4): 212. 1979  
Figure 3e

Cells solitary, fusiform, straight, elongated, approximately 20 times longer than broad, cylindrical in the center, gradually narrowing to long needle-like apices; parietal chloroplast and without pyrenoids. Cell dimensions: 50-105 µm in length, 1.5-2.5 µm in width.

Material examined: BRAZIL. BAHIA: Andaraí, Marimbus-Iraquara EPA, Marimbus do Baiano, 1-IV-2011, *G.J.P. Ramos & C.W.N. Moura s.n.* (HUEFS178326, HUEFS178327, HUEFS178332, HUEFS178342), 29-VI-2011, *G.J.P. Ramos & C.A. Ribeiro s.n.* (HUEFS178363, HUEFS178364, HUEFS178372); Lençóis, Marimbus-Iraquara EPA,

Marimbus do Remanso, 2-IV-2011, *G.J.P. Ramos & C.W.N. Moura s.n.* (HUEFS178348, HUEFS178352); 30-VI-2011, *G.J.P. Ramos & C.A. Ribeiro s.n.* (HUEFS178380, HUEFS178383, HUEFS178390, HUEFS178393).

Geographic distribution in Brazil: Goiás, São Paulo, Rio de Janeiro, Paraná (Menezes *et al.* 2012) and Bahia (Fuentes *et al.* 2010, Santana 2011).

The populations from Bahia State analyzed during this study agreed with the descriptions and illustrations reported by Komárek & Fott (1983), Nogueira (1991), and John & Tsarenko (2002).

Fuentes *et al.* (2010) and Santana (2011) reported the occurrence of *M. kormakovae* in Bahia State from the analysis of material from the Rio de Contas and Almada River, respectively. However, the authors did not provide descriptions or illustrations of the materials that were identified, thereby preventing the restudy of the species. Therefore, we consider the present study to be the first confirmed report of the occurrence of this species in Bahia State.

***Monoraphidium litorale*** Hindák, Biol Prace 30 (1): 228, pl. 80, fig. 1. 1984.  
Figure 3f

Cells solitary, fusiform, straight, gradually tapered apices, pointed ends; single parietal chloroplast without pyrenoids. Cell dimensions: 22.5-28 µm in length, 2.5-3.5 µm in width.

Material examined: BRAZIL. BAHIA: Andaraí, Marimbus-Iraquara EPA, Marimbus do Baiano, 29-VI-2011, *G.J.P. Ramos & C.A. Ribeiro s.n.* (HUEFS178372); Lençóis, Marimbus-Iraquara EPA, Marimbus do Remanso, 30-VI-2011, *G.J.P. Ramos & C.A. Ribeiro s.n.* (HUEFS178387, HUEFS178389). Geographic distribution in Brazil: Goiás (Nogueira 1999) and Bahia (present study).

*Monoraphidium litorale* is morphologically close to *M. pusillum* (Printz) Komárková-Legnerová and *M. affixum* Hindák, differing from the first by having less tapered apices and generally longer cells and differing from the second by having smaller and straighter cells.

The populations of *M. litorale* analyzed in this study agreed with the descriptions and illustrations reported by Hindák (1984) and John & Tsarenko (2002).

The first record of this species for Brazil appears in Nogueira (1999) from material collected in a Samambaia reservoir, located at the Universidade Federal de

Goiás (UFG), Goiás State, but the cell dimensions presented by this author are smaller than those found in the specimens from the Pantanal dos Marimbus.

This report constitutes the first citation of the species for Northeastern Brazil.

***Monoraphidium minutum*** (Nägeli) Komárková-Legnerová, Stud Phycol:109. 1969  $\equiv$  *Rhaphidium minutum* Nägeli, Gatt Einzell Alg, p.83, pl. IV: C, fig. 2. 1849.

Figure 3g

Cells solitary, lunate or reniform, in the same plane, to the ends rounded; single parietal chloroplast without pyrenoids. Cell dimensions: 9-12  $\mu\text{m}$  in length, 2.5-3  $\mu\text{m}$  in width.

Material examined: BRAZIL. BAHIA: Lençóis, Marimbus-Iraquara EPA, Marimbus do Remanso, 30-VI-2011, *G.J.P. Ramos & C.A. Ribeiro s.n.* (HUEFS178389, HUEFS178393).

Geographic distribution in Brazil: Amazonas, Distrito Federal, Espírito Santo, Paraná, Rio de Janeiro, and São Paulo (Menezes *et al.* 2012), and Bahia (Menezes *et al.* 2012, Santana 2011).

According to its morphological features, *Monoraphidium minutum* is close to *M. nanum* (Ettl) Hindák; however, this species is distinguished by having smaller cell dimensions and cells with a smaller degree of curvature. It is similar to the solitary cells of *Kirchneriella* Schmidle but differs by having cells surrounded by a sheath of mucilage.

The populations studied were slightly larger than those described by Komárek (1983) and Comas (1996), although they are within the metric limits referred to by Komárek & Fott (1983), Nogueira (1999), and John & Tsarenko (2002).

Menezes *et al.* (2012) and Santana (2011) reported the occurrence of *M. minutum* in Bahia State; however, the authors did not present descriptions or illustrations of the material to allow us to compare them to the specimens studied here. Therefore, we consider the present study to be the first confirmed report of the occurrence of this species in Bahia State.

According to Comas (1996), this species is cosmopolitan and is frequently found in tropical environments, inhabiting both plankton and periphyton from alkaline water bodies.

***Monoraphidium nanum*** (Ettl) Hindák, Biol Prace, 26(6):145, pl. 59, figs. 2-4. 1980  $\equiv$  *Nephrodiella nana* Ettl, Nova Hedwigia 28: 559. 1977

Figure 3h

Cells solitary, lunate or reniform, to the ends rounded, parietal chloroplast without pyrenoids. Cell dimensions: 4-6  $\mu\text{m}$  in length, 2.5-3.5  $\mu\text{m}$  in width.

Material examined: BRAZIL. BAHIA: Andaraí, Marimbus-Iraquara EPA, Marimbus do Baiano, 1-IV-2011, *G.J.P. Ramos & C.W.N. Moura s.n.* (HUEFS178329, HUEFS178332, HUEFS178333, HUEFS178341); Lençóis, Marimbus-Iraquara EPA, Marimbus do Remanso, 2-IV-2011, *G.J.P. Ramos & C.W.N. Moura s.n.* (HUEFS178352, HUEFS178354), 30-VI-2011, *G.J.P. Ramos & C.A. Ribeiro s.n.* (HUEFS178390).

Geographic distribution in Brazil: Amazonas, Bahia, Espírito Santo, Goiás, Rio de Janeiro, Santa Catarina and São Paulo (Menezes *et al.* 2012).

Hindák (1988) described the phenotypic plasticity in *M. nanum*, varying from reniform to oblong or ovate.

The specimens studied in the Pantanal dos Marimbus agrees with the descriptions and illustrations of individuals analyzed by Komárek & Fott (1983), Nogueira (1999), and Tucci *et al.* (2006).

***Monoraphidium pusillum*** (Printz) Komárková-Legnerová, Stud Phycol:102-103, pl. 16. 1969.

Figure 3i

Cells solitary, fusiform, straight to slightly curved, generally very broad in the medial region; tapered to finger-like apices; parietal chloroplast without pyrenoids. Cell dimensions: 25-28.5  $\mu\text{m}$  in length, 5-7.5  $\mu\text{m}$  in width.

Material examined: BRAZIL. BAHIA: Lençóis, Marimbus-Iraquara EPA, Marimbus do Remanso, 30-VI-2011, *G.J.P. Ramos & C.A. Ribeiro s.n.* (HUEFS170417, HUEFS170421).

Geographic distribution in Brazil: Bahia, Goiás, Paraná, Pernambuco, Rio de Janeiro, and São Paulo (Menezes *et al.* 2012).

The specimens studied had slightly larger cell than those described by Komárek & Fott (1983) and Comas (1996).

The first reference to *M. pusillum* in Bahia State is in Menezes *et al.* (2012), but the authors did not provide description or illustration of the material that would allow us to restudy the taxon. Therefore, we consider the present study to be the first confirmed report of the occurrence of these species in Bahia State.

The species is likely cosmopolitan and is usually found in the plankton from oligotrophic to mesotrophic aquatic environments (Comas 1996, John & Tsarenko 2002).

***Monoraphidium tortile*** (W. West & G.S. West)  
Komárková-Legnorová, Stud Phycol, p.102-103.  
1969 ≡ *Ankistrodesmus tortilis* W. West & G.S. West,  
J Linn Soc Bot 40: 431. 1912.

Figure 3j

Cells solitary, fusiform, straight or slightly curved, tapered apices; single parietal chloroplast without pyrenoids. Cell dimensions: 12-20 µm in length, 1.5-2.5 µm in width.

Material examined: BRAZIL. BAHIA: Andaraí, EPA Marimbus-Iraquara, Marimbus do Baiano, 29-VI-2011, *G.J.P. Ramos & C.A. Ribeiro s.n.* (HUEFS178372); Lençóis, EPA Marimbus-Iraquara, Marimbus do Remanso, 30-VI-2011, *G.J.P. Ramos & C.A. Ribeiro s.n.* (HUEFS178381).

Geographic distribution in Brazil: Amazonas, Tocantins, Mato Grosso, Distrito Federal, São Paulo, Rio de Janeiro, Paraná (Menezes *et al.* 2012) and Bahia (present study).

Komárek & Fott (1983) considered *M. pseudobraunii* (J.H. Belcher & Swale) Heynig to be synonymous to *M. tortile*, although Hindák (1984) recognizes the two species to be separate.

The populations from Bahia State that were analyzed in this study agreed with the descriptions and illustrations by Komárek & Fott (1983), John & Tsarenko (2002), and Ferragut *et al.* (2005).

This report constitutes the first citation of the species for Northeastern Brazil.

The taxonomic inventory conducted at the two areas of the Pantanal dos Marimbus (Baiano and Remanso) recorded the occurrence of 18 taxa, 13 of *Monoraphidium* and five of *Ankistrodesmus*.

Of the total taxa studied, eight are cited for the first time in Northeastern Brazil: *Ankistrodesmus bernardii*, *A. densus*, *A. falcatus*, *Monoraphidium caribeum*, *M. circinale*, *M. dybowskii*, *M. litorale*, and *M. tortile*, as well as *Ankistrodesmus spiralis* is an addition to continental microalgae flora of Bahia State.

During the analysis of the *Monoraphidium* genus, the main difficulty to identifying certain species (*M. arcuatum* and *M. caribeum*) was related to the degree of curvature of the cells, which was sometimes more or less open. In addition, taxa with typically straight cells, such as *M. griffithii*, sometimes had slightly curved cells. In *Ankistrodesmus*, the main difficulty in separating the colonies into different groups was in delimiting the taxa because the single cells are usually confused with individuals of *Monoraphidium*,

i.e., cells of *A. spiralis* that are similar to *M. irregulare*. However, in both cases, studying the populations was essential for differentiating between the taxa.

The number of species of *Monoraphidium* identified in the present study was higher when compared with the studies of Ferragut *et al.* (2005) and Tucci *et al.* (2006), which cited seven and eight taxa respectively, in the shallow oligotrophic reservoir (lake at IAG) and in the Lago das Garças, both in São Paulo State; Bortolini *et al.* (2010), who recorded three taxa in the Embrapa Gado de Corte in Mato Grosso do Sul State; and Hentschke & Torgan (2010), who reported four taxa at the Butiazal de Tapes and Lagoa do Casamento in Rio Grande do Sul State.

*Monoraphidium dybowskii*, reported by Nogueira (1999) and Ferragut *et al.* (2005), and *M. litorale* reported by Nogueira (1999), which are all rare in Brazil, were collected in this study.

Comparing the occurrence of species at the two areas in the Pantanal dos Marimbus (Baiano and Remanso), we found that almost all of the taxa were common between the two areas, except for *Ankistrodesmus bernardii*, which occurred only at Baiano, and *Monoraphidium minutum*, which only occurred at Remanso. The most representative species in the study area were *Monoraphidium griffithii* and *Ankistrodesmus densus*.

This study has expanded the knowledge of the biodiversity of the *Ankistrodesmus* and *Monoraphidium* in Bahia State and extends the geographic distribution of these in Northeastern Brazil. Based on the results obtained, the number of taxa recorded for Bahia of the *Ankistrodesmus* increased from three to five taxa and *Monoraphidium* from eight to thirteen.

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