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Cyanobacteria from coastal lagoons of Southern Brazil: coccoid organisms

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ABSTRACT – (Cyanobacteria from coastal lagoons of Southern Brazil: coccoid organisms) Considering the great ecological importance of the cyanobacteria and the need for more detailed information about these organisms in Brazilian waters, this paper provides taxonomic information about the unicellular cyanobacteria flora in lagoon systems along the coastal plains of Rio Grande do Sul State. Sampling was performed in different freshwater bodies along the eastern (Casamento Lake area) and western (near the city of Tapes) banks of the Patos Lagoon (30°40' S-30°10' S and 50°30' W-51°30' W). The samples were collected once in the rainy season and once in the dry season (from May 2003 to December 2003) using a plankton net (25 µm mesh) in pelagic and littoral zones, and by squeezing the submerged parts of aquatic macrophytes. Thirty one species belonging to the families Synechoccocaceae (7 taxa), Merismopediaceae (12 taxa), Chamaesiphonaceae (1 taxon), Microcystaceae (4) and Chroococcaceae (7 taxa) were identified. Among these species, five are reported for the first time in Rio Grande do Sul State: *Chamaesiphon amethystinus* (Rostafinski) Lemmermann, *Chroococcus minimus* (Keissler) Lemmermann, *Coelomoron pusillum* (Van Goor) Komárek, *Coelosphaerium kuetzingeanum* Naegeli, and *Cyanodictyon tubiforme* Cronberg.

Key words - Casamento lake, Chroococcales, Patos Lagoon, Synechococcales

INTRODUCTION

Coastal lagoons are shallow aquatic environments that develop at the interface between coastal terrestrial and marine ecosystems and have high natural productivity as compared to oceanic or adjacent coastal ecosystems (Margalef 1969). Although lagoons are intricately connected to their surrounding environments, they have unique structural and functional mechanisms that result in specific biological productivities and carrying capacities (Terwilliger & Wolflin 2005).

Continental and marine environments influence coastal lagoons. Coastal regions have historically been prone to human habitation, and the resulting rural and urban landscapes reflect human orientations toward the use of the natural capital of lagoons. Lagoons are sensitive areas that play an important role among coastal ecosystems in providing suitable breeding areas for many species, but many lagoons are currently deteriorating because of overuse of their natural capital. Fisheries and aquaculture, tourism, and urban, industrial and agricultural developments are typical uses that are usually not well controlled, and lagoon resources are frequently overexploited – so that their present quality and future capability to sustain productivity is being seriously compromised (Göneng & Wolflin 2005).

There are important coastal lagoons systems along the southern Atlantic coast of South America that comprise a diversity of freshwater lakes not found anywhere else in the world. These aquatic systems are inserted with in a mosaic of heterogeneous terrestrial ecosystems – resulting in great biological diversity.

Cyanobacteria have important roles in aquatic systems and they make up part of the planktic, metaphytic, or benthic communities, representing the base of trophic chain; they are responsible for part of primary productivity of aquatic systems and are relevant in biogeochemical cycles (Wetzel 1983, Padisák 2003).

In Rio Grande do Sul State, southern Brazil, studies investigating phytoplankton community including cyanobacteria have been carried out by Callegaro et al. (1981), Torgan & Garcia (1989), Garcia & Vélez (1995), Torgan et al. (1995), Torgan (1997), and Cardoso & Motta-Marques (2003, 2004). A number of taxonomic studies concerning cyanobacteria have also been conducted by Torgan et al. (1981), Franceschini (1983, 1990), Werner (1984, 1988, 2002), Werner & Rosa (1992), Torgan & Paula (1994), Werner & Sant'Anna (1998, 2000, 2006), and Werner et al. (2008). The study by Werner (2002) was the most extensive study, as well as one of the most important, conducted to date in Rio Grande do Sul State.

The present study is part of a wider project examining the fauna and flora of coastal ecosystems of Rio Grande do Sul, Brazil.

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MATERIAL AND METHODS

Samples were taken from different freshwater bodies on the eastern (Casamento lake area) and western (Tapes City area) banks of the Patos Lagoon (30°40' S-30°10' S and 50°30' W-51°30' W) (figure 1, table 1). The study area is dominated by wetland ecosystems, and the lagoons there are freshwater, shallow (Burger & Ramos 2007) and slightly acidic (Bicca 2007).

Samples were collected once during the rainy season and once during the dry season, from May 2003 to December 2003, using phytoplankton nets (25 µm mesh) in pelagic and littoral zones, and by squeezing the submerged parts of aquatic macrophytes.

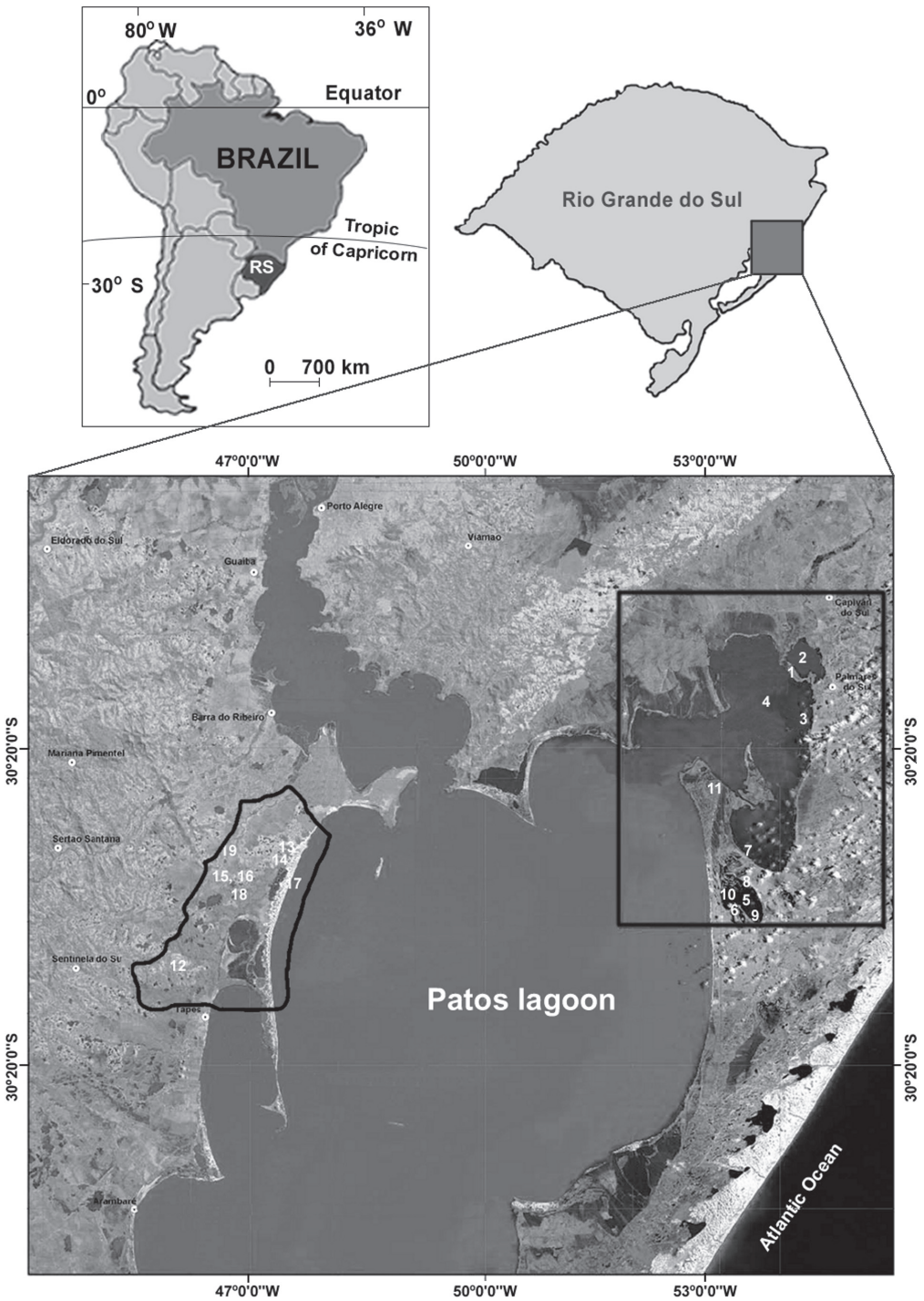


Figure 1. Map of the Casamento Lake region and the area around the city of Tapes (on the coastal plain of Rio Grande do Sul State, Brazil) (modified from Burger & Ramos 2007).

Table 1. Locations of the collections and their respective samples. (M = margin; P = pelagic zone; UTM = Universal Transverse Mercator coordinate system (zone 22); HAS = Alarich Schultz Herbarium).

Area		UTM	HAS
1	Capivari/Casamento wetland (M)	541830-6654326	HAS1043339
2	Capivari lagoon (M)	542910-6655896	HAS104098, HAS104343
3	Casamento lagoon (M)	541607-6654229	HAS104103, HAS104117, HAS104348, HAS104356, HAS104369, HAS104370, HAS104396
4	Casamento lagoon (P)	541719-6654246	HAS104106, HAS104351, HAS104352
5	Gateados lagoon (M)	532524-6621750	HAS104171, HAS104172, HAS104174
6	Gateados wetland	531876-6628854	HAS104131, HAS104132, HAS104134
7	Spillway	532831-6631257	HAS104163, HAS104167, HAS104381
8	Gateados lagoon (M)	532053-6624520	HAS104142,HAS104147
9	Gateados lagoon (M)	532285-6624514	HAS104153, HAS104376
10	Gateados lagoon (P)	533263-6624909	HAS104150, HAS104372, HAS104399
11	Rincão do Anastácio wetland	530749-6639690	HAS104118, HAS104119, HAS104124, HAS104362
12	Capivaras lagoon (M)	473595-6629067	HAS104436
13	Dunas lagoon	473435-6628655	HAS104230, HAS104442
14	Dunas wetland	473603-6628803	HAS104234, HAS104446
15	Charutão lagoon (M)	465956-6623899	HAS104195, HAS104416
16	Charutão lagoon (P)	465745-6623421	HAS104197, HAS104202, HAS104420, HAS104425, HAS104450, HAS104451
17	São Miguel lagoon (M)	464203-6623642	HAS104203, HAS104427
18	Redonda lagoon (M)	465503-6622735	HAS104235, HAS104240
19	Araçá (M)	461948-6626264	HAS104457

The materials were examined using Olympus BH2 and Leica DMLB bright field microscopes. The structures of the mucilaginous envelopes were observed using China ink. The classification proposed by Hoffmann et al. (2005) was adopted to reflect the systematic arrangement and families and lower taxonomic levels according to Komárek & Anagnostidis (1998).

Taxonomic descriptions, photomicrographs, and their occurrence in the aquatic environments studied were provided for all species. The abbreviation "diam." for diameter was used in the species descriptions.

The studied samples were deposited in the Prof. Alarich Schultz Herbarium (HAS, Natural Sciences Museum, Zoobotanical Foundation, Porto Alegre, Rio Grande do Sul, Brazil). The record numbers together with the list of species and occurrences are presented in tables 1 and 2, followed by the identification keys and species descriptions.

Table 2. Cyanobacteria found in coastal lagoons. (WCC = wetlands between the Capivari and Casamento lagoons; CIL = Capivari lagoon; CML = Casamento lake; GL = Gateados lagoon; GW = Gateados wetland; SP = spillway; PAW = Pontal do Anastácio wetland; CAL = Capivaras lagoon; DL = Dunas lagoon; DW = Dunas wetland; CTL = Charutão lagoon; SML = São Miguel lagoon; RL = Redonda lagoon; AR = Araçá).

Species	Casamento lagoon area							Tapes city area						
	WCC	CIL	CML	GW	BG	SP	PAW	CAL	DL	DW	CTL	SML	RL	AR
Aphanocapsa delicatissima			X		X								X	
A. elachista		X	X											
A. holsatica			X			X								
A. incerta			X											
A. koordersii		X	X	X		X	X		X		X	X		
Aphanothece comasii				X										
A. conglomerata				X										
A. minutissima		X	X								X			
A. smithii		X	X				X		X		X			
A. stagnina				X			X		X			X		
Chamaesiphon amethystinus				X										

continue

continuation

Species	Casamento lagoon area							Tapes city area						
	WCC	CIL	CML	GW	BG	SP	PAW	CAL	DL	DW	CTL	SML	RL	AR
Chroococcus dispersus		X											X	
C. distans		X	X	X										
C. limneticus		X	X	X		X								
C. microscopicus		X												
C. minimus						X					X			
C. minutus			X											
C. turgidus	X										X		X	
Coelomoron pusillum				X										
Coelosphaerium kuetzingianum							X							
Cyanodictyon reticulatum			X		X	X								
C. tubiforme			X			X	X							
M. glauca				X				X		X	X	X	X	X
M. punctata							X				X			
M. tenuissima				X		X								
Microcrocis pulchella			X	X										
Microcystis aeruginosa	X	X	X	X		X								
M. protocystis			X										X	
M. smithii											X			
M. wesenbergii			X											
Snowella lacustris			X			X								

RESULTS AND DISCUSSION

Thirty one species of coccoid cyanobacteria belonging to orders Synechococcales (20 species) and Chroococcales (11 species) were found in the aquatic environments sampled (table 2).

Order Synechococcales

1. Cells sessile ..... *Chamaesiphon amethystinus*
1. Cells not sessile 2
   2. Colonies flattened 3
   2. Colonies not flattened 6
3. Cells irregularly arranged ..... *Microcrocis pulchella*
3. Cells arranged in perpendicular rows 4
   4. Cells 1.0-1.4 µm diam. ..... *M. tenuissima*
   4. Cells greater than 2.5 µm diam. 5
5. Cells 2.5-3.5 µm diam. ..... *M. punctata*
5. Cells 3.5-6.5 µm diam. ..... *M. glauca*
   6. Cells peripherally arranged 7
   6. Cells distributed throughout the mucilage 9
7. Cells with central stalk system ..... *Snowella lacustris*
7. Cells without central stalk system 8
   8. Cells oval ..... *Coelomoron pusillum*
   8. Cells spherical or hemispherical ..... *Coelosphaerium kuetzinginanum*
9. Colonies with uniseriate or multiseriate rows of cells 10
9. Colonies with cells irregularly arranged 11
   10. Cells spherical ..... *Cyanodictyon reticulatum*
   10. Cells oval or elongated ..... *C. tubiforme*

11. Cells spherical or hemispherical 12
11. Cells oval to cylindrical with rounded ends 16
12. Cells up to 1.0 µm diam. 13
12. Cells wider than 1.0 µm diam. 14
13. Cells sparsely arranged in mucilage ..... *Aphanocapsa delicatissima*
13. Cells densely arranged in mucilage ..... *A. holsatica*
14. Cells densely arranged in central region of colony ..... *A. incerta*
14. Cells sparsely and irregularly arranged in mucilage 15
15. Cells 2.0-3.0 µm diam. ..... *A. koordersii*
15. Cells up to 2.0 µm diam. ..... *A. elachista*
16. Cells with aerotopes ..... *Aphanothece conglomerata*
16. Cells without aerotopes 17
17. Cells densely arranged in central region of colony ..... *A. comasii*
17. Cells sparsely and irregularly arranged in mucilage 18
18. Cells greater than 3.0 µm diam. ..... *A. stagnina*
18. Cells up to 2.0 µm diam. 19
19. Cells 0.6-1.0 µm diam. ..... *A. minutissima*
19. Cells 1.2-2.0 µm diam. ..... *A. smithii*

SYNECHOCOCCACEAE

Aphanothece comasii Komárková-Legnerová & Tavera, Algolog. Stud. 83: 408, 1996.
Figures 2, 34

Colonies microscopic, spherical or oval, 20.0-37.0 µm diam., 30.0-49.0 µm long; cells densely and irregularly distributed in the central part of colony; mucilage homogenous, colorless, conspicuous margin; cells oval, 1.8-3.0 µm diam., 2.7-4.0 µm long; cell contents blue-green, homogenous or granulated.

Material examined: BRAZIL. Rio Grande de Sul: Palmares do Sul, Gateados wetland, 7-V-2003, *VRWerner s.n.* (HAS104131, HAS104132); Gateados lagoon, 19-XI-2003, *LSCardoso s.n.* (HAS104376).

Comments: Most of the population was formed by small colonies that had cells densely arranged within the central region of the colonial mucilage. The older cells of the colonies were sparsely arranged.

Aphanothece conglomerata Rich, Trans. R. Soc. S. Afr. 20: 185, 1932.
Figure 3

Colonies microscopic, elongated or irregular, 28.5-78.0 µm diam., 80.0-213.0 µm long; cells loosely and irregularly arranged within the colonial mucilage; mucilage, homogenous, colorless rarely lamellate, conspicuous margin (rarely inconspicuous); cells oval, 3.0-3.5 µm diam., 4.0-5.8 µm long; cell contents blue-green, with or without granules; with aerotopes.

Material examined: BRAZIL. Rio Grande de Sul: Palmares do Sul, Gateados lagoon, 9-V-2003, *VRWerner s.n.* (HAS104174).

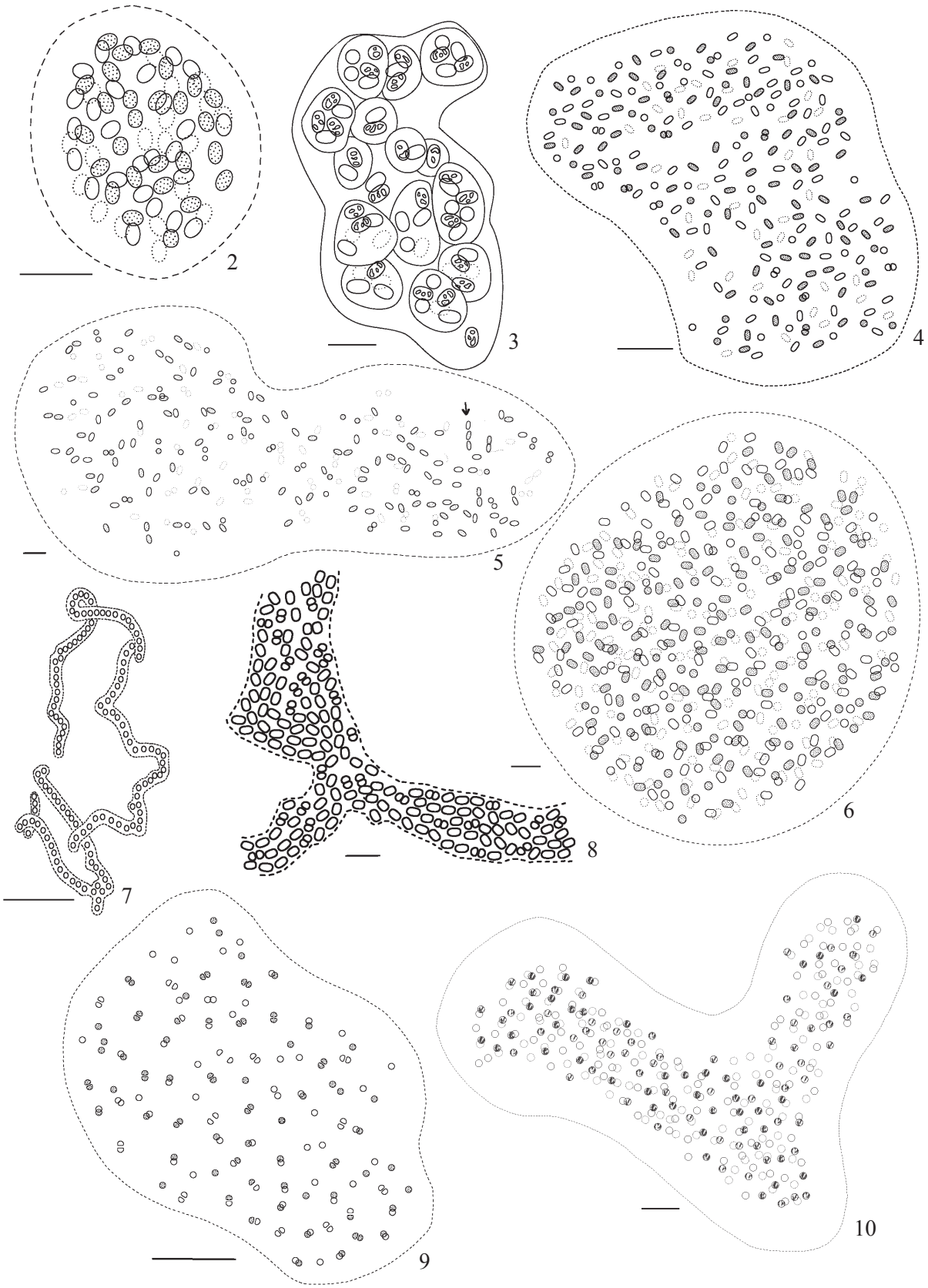
Comments: Most of the population had aggregate colonies that were arranged within a common mucilage. This feature was also observed in *A. elebans* (Brébisson) Elenkin. However, *A. elebans* is known from temperate zones and has small cells (1-2(-3) µm diam. × 2.8-6.5 µm long), while *A. conglomerata* is known from tropical and subtropical zones (Komárek & Anagnostidis 1998).

Aphanothece minutissima W. West, Proc. R. Ir. Acad.31: 35, 1912.
Figure 4

Colonies microscopic, spherical, elongated or irregular, 45.0-60.0 µm diam., 54.0-96.6 µm long; cells loosely and irregularly arranged within the colonial mucilage; mucilage homogenous, colorless, diffluent margin; cells oval to cylindrical with rounded ends, 0.6-1.0 µm diam., 1.3-1.8 µm long; cell contents blue-green, homogenous.

Material examined: BRAZIL. Rio Grande do Sul: Capivari do Sul, Capivari lagoon, 5-V-2003, *LCTorgan s.n.* (HAS104098, HAS104343); Tapes, Charutão lagoon, 3-VI-2003, *VRWerner s.n.* (HAS104202); Palmares do Sul, Rincão do Anastácio wetland, 28-X-2003, *SMAlves-da-Silva s.n.* (HAS104369); Casamento lagoon, 18-XI-2003, *LSCardoso s.n.* (HAS104352).

Comments: *Aphanothece pulverulenta* Bachman, *A. nebulosa* Skuja, and *A. minutissima* are very similar. According to Komárková-Legnerová & Cronberg



Figures 2-10. 2. *Aphanothece comasii*. 3. *A. conglomerata*. 4. *A. minutissima*. 5. *A. smithii* (arrow: cells in rows). 6. *A. stagnina*. 7. *Cyanodictyon reticulatum*. 8. *C. tubiforme*. 9. *Aphanocapsa delicatissima*. 10. *A. elachista*. Bar = 10 µm.

(1994), these three species may belong to *A. minutissima*. However, Komárek & Anagnostidis (1998) consider *A. pulverulenta* and *A. minutissima* synonymous, with *A. nebulosa* being a distinct species because it has smaller cells.

Aphanthece smithii Komárková-Legnerová & Cronberg, Algolog. Stud. 72: 25, 1994.
Figures 5, 35

Colonies microscopic, spherical, oval, elongated, or irregular, 52.5-108.6 µm diam., 62.9-221.8 µm long; cells loosely and irregularly arranged within the colonial mucilage; mucilage homogenous, colorless, diffluent margin; cells oval to cylindrical with rounded ends, 1.2-2.0 µm diam., 1.7-2.9 µm long; cell contents blue-green, homogenous; rare and minute aerotopes.

Material examined: BRAZIL. Rio Grande do Sul: Palmares do Sul, Rincão do Anastácio wetland 7-V-2005, *VRWerner s.n.* (HAS104124); Capivari lagoon, 18-XI-2003, *LSCardoso s.n.* (HAS104343); Casamento lagoon, 18-XI-2003, *LSCardoso s.n.* (HAS104351, HAS104352); Tapes, Charutão lagoon, 3-VI-2003, *LCTorgan s.n.* (HAS104195, HAS104202), 2-XII-2003, *LSCardoso s.n.* (HAS104420, HAS104425); Dunas lagoon, 4-VI-2003, *VRWerner s.n.* (HAS104230), 3-XII-2003, *LSCardoso s.n.* (HAS104442).

Comments: The populations studied showed wider variations of their cell dimensions than the maximum specified by Komárková-Legnerová & Cronberg (1994). However, other features were according to the species diagnosis. Colony size and shape were variable, and the elongated colonies showed cells arranged in simple rows, like *Cyanodictyon tubiforme* Cronberg (figure 4).

Aphanothece stagnina (Sprengel) Braun, In: Rabenhorst, Flora Eur. Algar. 157: 1572, 1863.
Figures 6, 36

Colonies microscopic, spherical, elongated or irregular, 35.0-125.0 µm diam., 63.0-247.5 µm long; cells loosely and irregularly arranged within the colonial mucilage; mucilage homogenous, colorless, diffluent margin (rarely conspicuous); cells oval to cylindrical with rounded ends, sometimes with their own colorless gelatinous envelopes, 4.0-6.0 µm diam., 6.0-9.0 µm long; cell contents blue-green, homogenous.

Material examined: BRAZIL. Rio Grande do Sul: Palmares do Sul, Rincão do Anastácio wetland, 7-V-2003, *VRWerner s.n.* (HAS104124); Gateados wetland, 8-V-2003, *VRWerner s.n.* (HAS104134); Mostardas, Gateados lagoon, 8-V-2003, *LCTorgan s.*n. (HAS104147), 9-V-2003, *VRWerner s.n.* (HAS104174); Tapes, São Miguel lagoon, 4-VI-2003, *VRWerner s.n.* (HAS104203); Dunas lagoon, 4-VI-2003, *VRWerner s.n.* (HAS104230).

Comments: Although *A. stagnina* is known to be benthic and to form a macroscopic thallus, it can occasionally be found in the plankton; there are records (Komárková-Legnerová & Cronberg 1994, Werner 1988, 2002, Franceschini 1992, Joosten 2006) of this species forming microscopic thalli, as was observed in the present study. According to Komárek & Kastovsky (2003) and Komárek (2006), *A. stagnina* is phylogenetically distinct from Synechococcaceae and belongs to Cyanobacteriaceae (Hoffmann et al. 2005).

Cyanodictyon reticulatum (Lemmermann) Geitler, In: Pascher, Süβw. Fl. Heft. 12: 103, 1925.
Figures 7, 37

Colonies microscopic, more or less spherical, or slightly elongated to irregular, 12.0-33.0 µm diam., 24.0-47.5 µm long; cells arranged in simple gelatinous rows, forming reticulate colonies; mucilage homogenous, colorless, conspicuous margin; cells spherical, 0.9-1.4 µm diam.; cell contents blue-green, homogenous.

Material examined: BRAZIL. Rio Grande de Sul: Palmares do Sul, Casamento lagoon, 5-V-2003 *VRWerner s.n.* (HAS104103, HAS104117), 7-V-2003, *LCTorgan s.n.* (HAS104106), 18-XI-2003, *LSCardoso s.n.* (HAS104351, HAS104352); Spillway 7-V-2003, *LCTorgan s.n.* (HAS104163, HAS104167), 18-XI-2003, *LSCardoso s.n.* (HAS104381); Gateados wetland, 7-V-2003, *VRWerner s.n.* (HAS104131, HAS104132); Capivari lagoon, 18-XI-2003, *LSCardoso s.n.* (HAS104343).

Cyanodictyon tubiforme Cronberg, Arch. Hydrobiol. 80: 193, 1988.
Figures 8, 38-39

Colonies microscopic, elongated or irregular, sometimes clathrate, up to 326.0 µm long; cells arranged in multicellular rows in colony; mucilage homogenous, colorless, diffluent margin; cells oval, elongated, hemispherical after division, 2.0-2.4 µm diam., 2.0-2.9 µm long; cell contents blue-green, homogenous.

Material examined: BRAZIL. Rio Grande do Sul: Palmares do Sul, Casamento lagoon, 5-V-2003, *VRWerner s.n.* (HAS104103, HAS104106); Rincão do Anastácio wetland, 7-V-2003, *VRWerner s.n.* (HAS104119); Spillway, 7-V-2003, *VRWerner s.n.* (HAS104167).

Comments: Probably the first citation for Rio Grande do Sul State since no prior reference was found.

MERISMOPEDIACEAE

Aphanocapsa delicatissima W. & G. S. West, J. Limn. Soc. (Bot.) 40: 431, 1912.
Figure 9

Colonies microscopic, spherical, oval or elongated, 13.6-78.7 µm diam., 29.6-168.7 µm long; cells loosely and irregularly arranged within the colonial mucilage; mucilage homogenous, fine, colorless, diffluent margin; cells spherical, hemispherical after division, 0.8-1.0 µm diam.; cell contents blue-green, homogenous.

Material examined: BRAZIL. Rio Grande do Sul: Palmares do Sul, Gateados wetland, 7-V-2003, *VRWerner s.n.* (HAS104132); Casamento lagoon, 18-XI-2003, *LSCardoso s.n.* (HAS104352); Tapes, Redonda lagoon, 4-VI-2003, *VRWerner s.n.* (HAS104235).

Comments: *Aphanocapsa delicatissima* is very similar to *A. elachista* W. West et G. S. West, although *A. elachista* has larger cells than *A. delicatissima*.

Aphanocapsa elachista (W. & G. S. West), J. Linn. Soc. Bot., 30: 276, 1894.
Figure 10, 40

Colonies microscopic, spherical, oval, elongated or irregular, 55.0-97.5 µm diam., 60.0-350.0 µm long; cells loosely and irregularly arranged within the colonial mucilage; mucilage homogenous, fine, colorless, diffluent margin; cells spherical, hemispherical after division, 1.5-2.0 µm diam.; cell contents blue-green, homogenous.

Material examined: BRAZIL. Rio Grande do Sul: Palmares do Sul, Gateados wetland, 7-V-2003, *VRWerner s.n.* (HAS104132); Casamento lagoon, 18-XI-2003, *LSCardoso s.n.* (HAS104352); Tapes, Redonda lagoon, 4-VI-2003, *VRWerner s.n.* (HAS104235).

Comments: The taxonomy of planktic *Aphanocapsa* species or unclear. The morphologies of the species are very simple, differing by their cell dimensions, and by the cell organization in the colony. *Aphanocapsa elachista* is very similar to *A. koordersii*, as both develop microscopic colonies with more or less sparsely distributed cells within a fine and colorless slime. As *A. elachista* has smaller cells than *A. koordersii* (Komárková-Legnerová & Cronberg 1994, Komárek & Anagnostidis 1998), these two species can be separated by cell size.

Aphanocapsa holsatica (Lemmermann) Cronberg & Komárek, Algolog. Stud. 75: 327, 1994.
Figure 11

Colonies microscopic, elongated or irregular, 42.3-53.8 µm diam., 55.0-215.6 µm long; cells densely and irregularly arranged within the colonial mucilage; mucilage homogenous, fine, colorless, diffluent margin; cells spherical, 0.8-1.0 µm diam.; cell contents blue-green, homogenous.

Material examined: BRAZIL. Rio Grande do Sul: Palmares do Sul, Casamento lagoon, 7-V-2003, *LCTorgan s.n.* (HAS104106); Spillway, 7-V-2003, *LCTorgan s.n.* (HAS104163).

Aphanocapsa incerta (Lemmermann) Cronberg & Komárek, Algolog. Stud. 75: 327, 1994.
Figures 12, 41

Colonies microscopic, spherical or oval, 40.0-52.0 µm diam., 42.0-64.5 µm long; cells densely and irregularly arranged in the central area of the colonial mucilage; mucilage homogenous, fine, colorless, diffluent margin; cells spherical, 1.0-1.5 µm diam.; cell contents blue-green, homogenous.

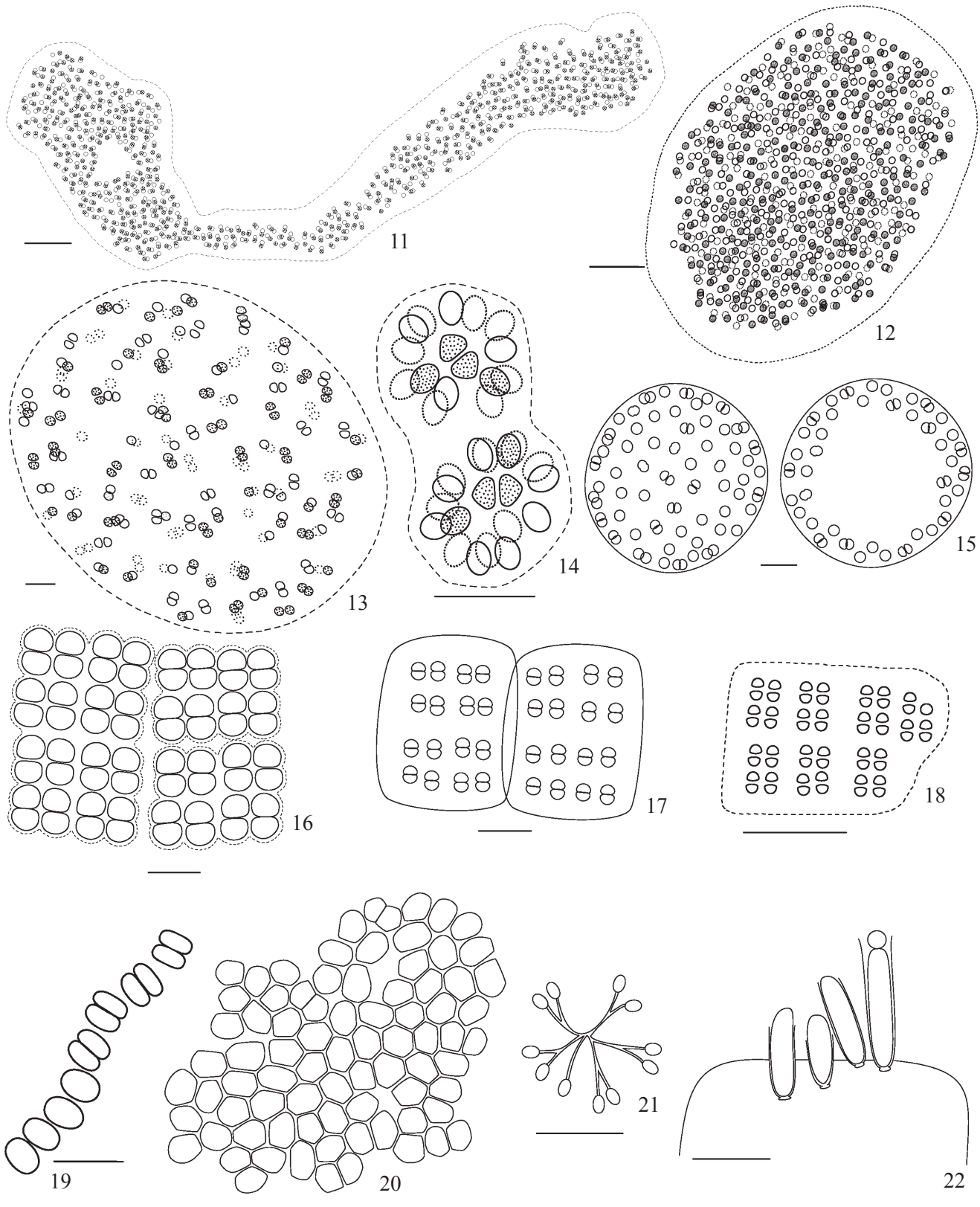
Material examined: BRAZIL. Rio Grande do Sul: Palmares do Sul, Casamento lagoon, 18-XI-2003, *LSCardoso s.n.* (HAS104351, HAS104352).

Comments: *Aphanocapsa incerta* is very similar to *A. delicatissima* and to *A. holsatica*, and all three species have small cells. They can be separate by colony morphology or by cell arrangement, with *A. incerta* having spherical colonies and cells densely arranged in central area, *A. delicatissima* has cells sparsely arranged in the colonial mucilage, and *A. holsatica* forms elongated or irregular colonies.

Aphanocapsa koordersii Ström, Nyt. Mag. Naturv. 61: 128, 1923.
Figures 13, 42

Colonies microscopic, spherical or oval, 49.0-219.0 µm diam., 68.7-254.2 µm long; cells loosely and irregularly arranged within the colonial mucilage; mucilage homogenous, fine, colorless, diffluent margin; cells spherical, hemispherical after division, 2.0-3.0 µm diam.; cell contents blue-green, homogenous.

Material examined: BRAZIL. Rio Grande do Sul: Palmares do Sul, Rincão do Anastácio wetland 7-V-2003, *VRWerner s.n.* (HAS104118, HAS104124); Capivari lagoon, 18-XI-2003, *LSCardoso s.n.* (HAS104343); Casamento lagoon, 18-XI-2003, *LSCardoso s.n.* (HAS104352), 19-XI-2003, *LSCardoso s.n.* (HAS104356, HAS104369); Gateados lagoon, 19-XI-2003, *LSCardoso s.n.* (HAS104376); Spillway, 19-XI-2003, *LSCardoso s.n.* (HAS104381); Tapes, Charutão lagoon, 3-VI-2003, *VRWerner s.n.* (HAS104195, HAS104202), 2-XII-2003, *LSCardoso s.n.* (HAS104420); São Miguel lagoon,



Figures 11-22. 11. *Aphanocapsa holsatica*. 12. *A. incerta*. 13. *A. koordersii*. 14. *Merismopedia glauca*. 15. *M. punctata*. 16. *M. tenuissima*. 17. *Microcrocis pulchella* (lateral view). 18. *M. pulchella* (apical view). 19. *Coelomoron pusillum*. 20. *Coelosphaerium kuetzingianum*. 21. *Snowella lacustris*. 22. *Chamaesiphon amethystinus*. Bar = 10 μm.

4-VI-2003, *LCTorgan s.n.* (HAS104203); Dunas lagoon, 3-XII-2003, *LSCardoso s.n.* (HAS104442).

Comments: Cells remain close after cell division, with tetrads frequently being observed. *Aphanocapsa koordersii* is similar to *A. elachista* and to *A. planctonica* G. M. Smith. It differs from *A. elachista* only in cell size. The difference between *A. koordersii* and *A. planctonica* is that the former is known from tropical and subtropical regions, while the latter is only known from temperate zones.

Coelomoron pusillum (Van Goor) Komárek & Hindák, Algolog. Stud. 50-53: 210, 1988.
Figures 14

Colonies microscopic, spherical or slightly oval, 14.5-18.8 µm diam.; cells more or less radially arranged along the periphery of the colonial mucilage; mucilage homogenous, colorless, and diffluent; cells oval, 2.2-4.0 µm diam., 3.2-4.5 µm long; cell contents blue-green, homogenous.

Material examined: BRAZIL. Rio Grande do Sul: Mostardas, Gateados lagoon, 9-V-2003, *VRWerner s.n.* (HAS104171).

Comments: *Coelomoron pusillum* was originally described as belonging to the genus *Coelosphaerium,* but was later transferred to *Coelomoron* by Komárek & Hindák (1988) based on cell shape. This species is widely distributed. *Coelomoron tropicale* Senna, Peres & Komárek and *C. microcystoides* Komárek are similar to *C. pusillum,* but differ in terms of colony sizes and by cell distributions. *Coelomoron tropicale* has cells densely and radially gathered in the colonial mucilage, while the cells of *C. pusillum* are slightly distant and not oriented with respect to one another. *Coelomoron microcystoides* forms larger colonies than *C. pusillum* (Senna et al. 1998). Probably the first citation for Rio Grande do Sul since no prior reference was found.

Coelosphaerium kuetzingianum Nägeli, Gatt. Einzell. Alg. 54, 1849.
Figure 15

Colonies microscopic, spherical, 50.0-61.5 µm diam.; cells loosely and irregularly arranged near the colony surface; mucilage homogenous, fine, colorless, diffluent margin; cells spherical, hemispherical after division, 2.3-2.9 µm diam.; cell contents blue-green, homogenous or granular.

Material examined: BRAZIL. Rio Grande do Sul: Tapes, Charutão lagoon, 4-VI-2003, *LCTorgan s.n.* (HAS104202); Palmares do Sul, Casamento lagoon, 19-XI-2003, *LSCardoso s.n.* (HAS104369).

Comments: *Coelosphaerium kuetzingianum* and *C. aerugineum* Lemmermann are very similar and commonly misidentified. *Coelosphaerium kuetzingianum* probably has cosmopolitan occurrence (but very frequent mainly in tropical regions), while *C. aerugineum* is known from temperate zones (Komárek & Anagnostidis 1998). Probably the first citation for Rio Grande do Sul since no prior reference was found.

Merismopedia glauca (Ehrenberg) Kützing, Phycol. Germ.142, 1845.
Figures 16, 43

Colonies microscopic, flat, tabular, rectangular, composed of 8-192 cells disposed more or less loosely in perpendicular rows within the colonial mucilage, 20.0-110.0 µm diam., 30.0-165.5 µm long; mucilage homogenous, fine, colorless, diffluent margin; cells spherical, widely oval, hemispherical after division, 3.5-6.5 µm diam.; cell contents blue-green, homogenous.

Material examined: BRAZIL. Rio Grande do Sul: Mostardas, Gateados lagoon, 8-V-2003, *VRWerner s.n.* (HAS104142), 9-V-2003, *VRWerner s.n.* (HAS104171, HAS104172); Tapes, Charutão lagoon, 3-VI-2003, *LCTorgan s.n.* (HAS104195, HAS104197, HAS104202), 2-XII-2003, *LSCardoso s.n.* (HAS104416, HAS104425), 3-XII-2003, *LSCardoso s.n.* (HAS104450, HAS104451); São Miguel lagoon, 4-VI-2003, *VRWerner s.n.* (HAS104203), 2-XII-2003, *LSCardoso s.n.* (HAS104427); Redonda lagoon, 4-VI-2003, *VRWerner s.n.* (HAS104235, HAS104240); Capivaras lagoon, 3-XII-2003, *LSCardoso s.n.* (HAS104436); Araçá, 3-XII-2003, *LSCardoso s.n.* (HAS104457); Dunas wetland, 3-XII-2003, *LSCardoso s.n.* (HAS104446).

Comments: The features of the populations observed are consistent with the species diagnosis, except in terms of their cell sizes, which are larger than the maximum value cited by Komárek & Anagnostidis (1998).

Merismopedia punctata Meyen, Neues Syst. Pfl. Physiol. 3: 440, 1839.
Figure 17

Colonies microscopic, flat, tabular, rectangular, composed by 16-64 cells disposed more or less loosely in perpendicular rows, 15.0-35.0 µm diam., 20.0-53.0 µm long; mucilage homogenous, fine, colorless, diffluent margin; cells spherical, hemispherical after division, 2,.5-3.5 µm diam.; cell contents blue-green, homogenous.

Material examined: BRAZIL. Rio Grande so Sul: Tapes, Charutão lagoon, 3-VI-2003, *VRWerner*

s.n. (HAS104195), 4-VI-2003, *LCTorgan s.n.* (HAS104197, HAS104202); Palmares do Sul, Rincão do Anastácio wetland, 29-X-2003, *SMAlves-da-Silva s.n.* (HAS104362).

Comments: *Merismopedia punctata* is a common species and very similar to *M. glauca* and *M. hyalina* (Ehrenberg) Kützing. It differs from *M. glauca* in terms of cell size. *Merismopedia punctata* can be distinguished from *M. hyalina* by the smaller numbers of cells in its colonies and by the somewhat irregular cell arrangement in *M. hyalina*.

Merismopedia tenuissima Lemmermann, Bot. Zbl. 76: 154, 1898.
Figure 18

Colonies microscopic, flat, tabular, quadrate, composed of 16-32 cells disposed more or less densely in perpendicular rows, 14.0-18.5 µm diam., 16.0-20.0 µm long; mucilage homogenous, fine, colorless, diffluent margin; cells spherical, hemispherical after division, 1.0-1.4 µm diam.; cell contents blue-green, homogenous.

Material examined: BRAZIL. Rio Grande do Sul: Palmares do Sul, Gateados wetland, 7-V-2003, *VRWerner s.n.* (HAS104132); Spillway, 7-V-2003, *LCTorgan s.n.* (HAS104163).

Comments: *Merismopedia tenuissima* and *M. africana* Komárek & Cronberg are similar as both have small cells; they can be distinguished by their colony morphology, as *M. africana* always forms arcuate colonies.

Microcrocis pulchella (Buell) Geitler in Engler & Prantl, Natürl. Planzenfam., 56, 1942.
Figures 19-20, 44

Colonies microscopic, flat, tabular, elongated, and irregular, 40.0-68.5 µm diam., 52.0-102.0 µm long; cells densely and irregularly arranged; mucilage homogenous, colorless, and diffluent; cells polygonal in apical view, elongated or oval at the periphery of the colonial mucilage, becoming hemispherical after division, spherical, 3.0-4.0 µm diam., 4.4-5.2 µm long; cells elongated in lateral view, 4.0-4.8 µm long; cell contents blue-green, homogenous.

Material examined: BRAZIL. Rio Grande do Sul: Mostardas, Gateados lagoon, 9-V-2003, *VRWerner s.n.* (HAS104171); Palmares do Sul, Casamento lagoon, 27-X-2003, *SMAlves-da-Silva s.n.* (HAS104348).

Comments: *Microcrocis pulchella* was originally described as *Holopedia pulchella* by Buell (1938) from specimens found growing in the inner region of a cyanobacterial mass. This species is not common but was previously observed in a brackish water zone in southern Brazil by Werner & Sant'Anna (2006). The species was observed in freshwater in the present study, as originally described (Buell, 1938). The morphologies of the cells and their arrangement in the colonies resemble *M. granulata* (Skuja) Skuja. Nevertheless, *M. granulata* has wavy or rolling colonial margins, while *M. pulchella* develops flat colonies.

Snowella lacustris (Chodat) Komárek & Hindák, Algolog. Stud. 50-53: 203, 1988.
Figure 21

Colonies microscopic, spherical or oval, 22.0-45.0 µm diam., 23.0-51.0 µm long; mucilage homogenous, colorless, diffluent margin, stalks thin; cells more or less radially arranged at the periphery of the colony; cells obovoid, 1.3-2.5 µm diam., 2.0-3.2 µm long; cell contents blue-green, homogenous.

Material examined: BRAZIL. Rio Grande do Sul: Palmares do Sul, Casamento lagoon, 5-V-2003, *VRWerner s.n.* (HAS104103), 27-X-2003, *SMAlves-da-Silva s.n.* (HAS104348), 18-XI-2003, *LSCardoso s.n.* (HAS104351, HAS104352); Spillway, 7-V-2003, *LCTorgan s.n.* (HAS104163).

CHAMAESIPHONACEAE

Chamaesiphon amethystinus (Rostafinski) Lemmermann, Krypt. Fl. Mark Brandenb. 3: 99, 1910.
Figures 22, 45

Cells solitary, or arranged parallel to one another and form groups but each is attached individually to the substrate; sheath hyaline, firm, colorless; cells cylindrical or slightly widening toward the ends, widely rounded at apex, blunt at base, with gelatinous pad, 3.0-4.5 µm diam., 6.4-18.5 µm long; cell contents blue-green, homogenous; exocytes rare, spherical, solitary.

Material examined: BRAZIL. Rio Grande do Sul: Mostardas, Gateados lagoon, 9-V-2003, *VRWerner s.n.* (HAS104171).

Comments: The population studied was similar in its morphology and size to *Chamaesiphon incrustans* Grunow. Nevertheless, the specimens showed a distinct and gelatinous pad that assisted in its adherence, while *C. incrustans* does not have any such adhering disk (Komárek & Anagnostidis 1998). The exocytes, rarely observed, were spherical and solitary. Probably the first citation for Rio Grande do Sul State since no prior reference was found.

Order Chroococcales

1. Cells with aerotopes 2
1. Cells without aerotopes 5
   2. Cells up to 4.5 µm diam. ..... *Microcystis smithii*
   2. Cells broader than 4.5 µm diam. 3
3. Colonies enveloped by a distinctly delimited mucilage, usually slightly refractive on the margins, lobate colonies ..... *M. wesenbergii*
3. Colonies enveloped by diffluent, sometimes indistinct slime, colonies not lobate 4
   4. Colonies with densely distributed cells ..... *M. aeruginosa*
   4. Colonies with sparsely arranged cells ..... *M. protocystis*
5. Cells solitary or in small groups (2-4 cells) 6
5. Cells forming colonies with more than 8 cells 7
   6. Cells up to 7.5 µm diam. ..... *Chroococcus minutus*
   6. Cells broader than 8.0 µm diam. ..... *C. turgidus*
7. Cells up to 1.1 µm diam. ..... *C. microscopicus*
7. Cells more than 1.1 µm diam. 8
   8. Cells up to 4.5 µm diam. 9
   8. Cells larger than 5.3 µm diam. 10
9. Cells remain in groups after division, irregularly distributed, cells 3.0-4.5 µm diam. …..... *C. dispersus*
9. Cells separate after division, usually distant one from another, cells 2.4-3.0 µm diam. ..... *C. minimus*
   10. Cells 5.3-7.5 µm diam., without individual envelopes around cells ..... *C. distans*
   10. Cells 6.0-10.5 µm diam., with narrow individual envelopes around cells ..... *C. limneticus*

MICROCYSTACEAE

Microcystis aeruginosa (Kützing) Kützing, Tab. Phycol. 1: 6, 1846.
Figures 23, 46

Colonies mucilaginous, microscopic, irregular, usually elongated, lobate, sometimes clathrate, 45.0-127.0 µm diam., 68.0-335.0 µm long; irregularly and densely arranged cells in the central part of the colonial mucilage; mucilage colorless, structureless, diffluent, sometimes forming a wide margin; cells spherical, sometimes slightly elongated, 4.5-6.5 µm diam.; cell contents blue-green; with aerotopes.

Material examined: BRAZIL, Rio Grande do Sul: Palmares do Sul, Casamento lagoon, 5-V-2003, *VRWerner s.n.* (HAS104106), 28-X-2003, *SMAlves-da-Silva s.n.* (HAS104370, HAS104396); Spillway, 7-V-2003, *LCTorgan s.n.* (HAS104167), 18-XI-2003, *LSCardoso s.n.* (HAS104351); Capivari lagoon, 18-XI-2003, *LSCardoso s.n.* (HAS104343); Mostardas, Gateados lagoon, 8-V-2003, *VRWerner s.n.* (HAS104142), 19-XI-2003, *LSCardoso s.n.* (HAS104372, HAS104376), 20-XI-2003, *LSCardoso s.n.* (HAS104399); Capivari do Sul, Capivari/Casamento wetland, 27-X-2003, *SMAlves-da-Silva s.n.* (HAS104339).

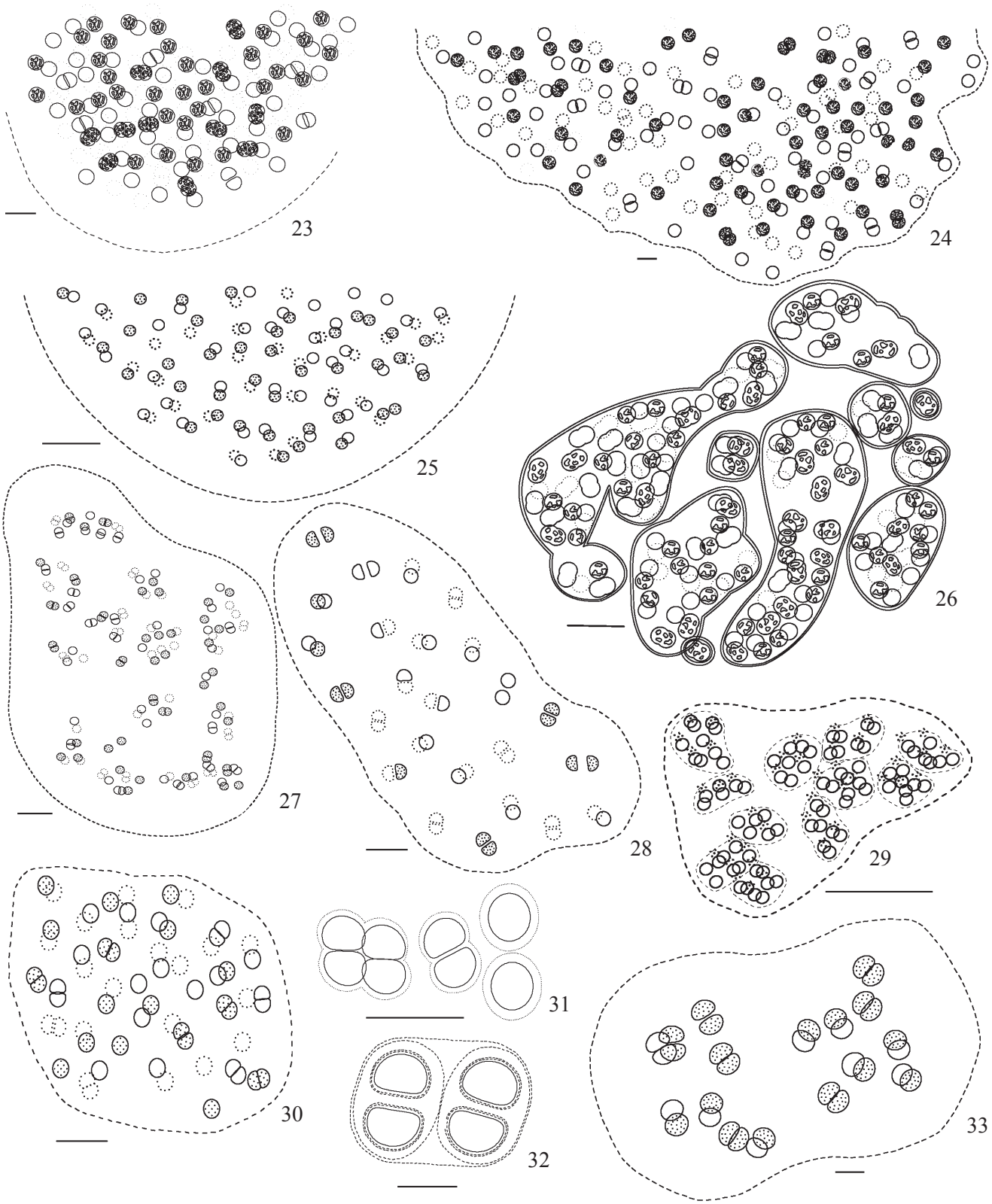
Comments: *Microcystis aeruginosa* is the most widespread species in Brazil (Sant'Anna & Azevedo 2000), but misidentifications have probably contributed to its presumed distribution (Sant'Anna et al. 2004).

Microcystis protocystis Crow, New Phytol. 22(2): 62, 1923.
Figures 24, 47

Colonies mucilaginous, microscopic, irregular, spherical or elongated, 125.0-305.0 µm diam., 150.0-434.0 µm long; cells irregularly and sparsely arranged within the colonial mucilage; mucilage colorless, structureless, diffluent; cells spherical, sometimes with their own colorless gelatinous envelopes, 4.5-6.5 µm diam.; cell contents blue-green; with aerotopes.

Material examined: BRAZIL. Rio Grande do Sul: Palmares do Sul, Casamento lagoon, 5-V-2003, *LCTorgan s.n.* (HAS104106), 19-XI-2003, *LSCardoso s.n.* (HAS104369); Tapes, Charutão lagoon, 3-XII-2003, *LSCardoso s.n.* (HAS104451).

Comments: a mucilaginous envelope around each cell makes *Microcystis protocystis* distinct from other *Microcystis* species, although not all colonies had cells with individual envelopes. Cell sizes of *M. protocystis* and *M. aeruginosa* are similar, but these species can be distinguished by the different arrangements of the cells within their colonies.



Figures 23-33. 23. *Microcystis aeruginosa*. 24. *M. protocystis*. 25. *M. smithii*. 26. *M. wesenbergii*. 27. *Chroococcus dispersus*. 28. *C. microscopicus*. 29. *C. distans*. 30. *C. minimus*. 31. *C. minutus*. 32. *C. turgidus*. 33. *Limnococcus limneticus*. Bar = 10 µm.

Microcystis smithii Komárek & Anagnostidis, Preslia, 67: 21, 1995.
Figures 25, 48-49

Colonies mucilaginous, microscopic, spherical, oval or elongated, 80.0-150.0 µm diam., 93.0-357.0 µm long; cells irregularly and sparsely arranged within the colonial mucilage; mucilage colorless, structureless, diffluent; cells spherical, single or in pairs after division, 3.5-4.5 µm diam.; cell contents blue-green, with one or several aerotopes in each cell.

Material examined: BRAZIL. Rio Grande do Sul: Tapes, Charutão lagoon, 3-VI-2003, *VRWerner s.n.* (HAS104195).

Comments: As many cells are arranged in pairs within the colonial mucilage, *M. smithii* appears similar to *Aphanocapsa* species. Nevertheless, the presence of aerotopes in the cells allows differenciation and correct classification of the *Microcystis* genus.

Microcystis wesenbergii (Komárek) Komárek In Kondrateva, Cvetenie vody, 32, 1968.
Figures 26, 50

Colonies microscopic, 20.0-69.0 µm diam., 35.0-157.0 µm long, spherical, elongated, lobate, irregular, clathrate, sometimes composed of subcolonies; cells irregularly arranged within the colonial mucilage; mucilage colorless, structureless, with distinctly delimited, firm, continuous, with refractive outline; cells spherical, 5.0-8.0 µm diam.; cell contents blue-green; with aerotopes.

Material examined: BRAZIL. Rio Grande do Sul: Palmares do Sul, Casamento lagoon, 5-V-2003, *LCTorgan s.n.* (HAS104106).

CHROOCOCCACEAE

Chroococcus dispersus (Keissler) Lemmermann, Ark. Bot. 2(2): 102, 1904.
Figure 27

Colonies free floating, microscopic, elongated or irregular, 62.5-71.7 µm diam., 80.3-89.7 µm long; cells irregularly arranged, sometimes in groups, which are distant from one other within the colonial mucilage; mucilage colorless, firm, diffluent; cells spherical or hemispherical after division, 3.0-4.5 µm diam.; cell contents blue-green, homogenous.

Material examined: BRAZIL. Rio Grande do Sul: Palmares do Sul, Capivari lagoon, 18-XI-2003, *LSCardoso s.n.* (HAS104343); Tapes, Charutão lagoon, 3-XII-2003, *LSCardoso s.n.* (HAS104451).

Comments: *Chroococcus dispersus* belongs to the group of planktic *Chroococcus* species. The main distinguishing feature of this species is that the cells are distributed in small groups that remain distant from one another within this the colonial mucilage. It differs from *Limnococcus limneticus* (Lemmermann) Komárková et al. by its smaller cell dimensions and by having colonies with greater numbers of cells.

Chroococcus distans (G. M. Smith) Komárková-Legnerová & Cronberg, Algolog. Stud. 72: 26-27, 1994.
Figures 28, 51

Colonies microscopic, elongated or irregular, 55.5-70.8 µm in diameter, 67.3-121.8 µm long; cells irregularly and sparsely arranged within the colonial mucilage; mucilage colorless, firm, homogenous, diffluent; cells 5.3-7.5 µm in diameter, spherical or hemispherical after division, individual envelops lacking; cell contents blue-green, homogenous.

Material examined: BRAZIL. Rio Grande do Sul: Mostardas, Gateados lagoon, 8-V-2003, *LCTorgan s.n.* (HAS104150); Palmares do Sul, Casamento lagoon, 27-X-2003, *SMAlves-da-Silva s.n.* (HAS104348), 18-XI-2003, *LSCardoso s.n.* (HAS104352); Capivari lagoon, 18-XI-2003, *LSCardoso s.n.* (HAS104343).

Comments: The cell characteristics of *Chroococcus distans* and *Limnococcus limneticus* are similar, but the species can be distinguished by their colony sizes and by the arrangements of the cells within the colonial mucilage. *Chroococcus distans* forms larger colonies and the cells of older colonies are more distant one from the other.

Chroococcus microscopicus Komárková-Legnerová & Cronberg, Algolog. Stud. 72: 28, 1994.
Figure 29

Colonies free floating, microscopic, irregular, 5.5-18.5 µm diam., 6.5-30.0 µm long; cells forming groups, which are irregularly arranged within the colonial mucilage; mucilage colorless, firm, homogenous, diffluent; cells spherical, 0.8-1.1 µm diam.; cell contents blue-green, homogenous.

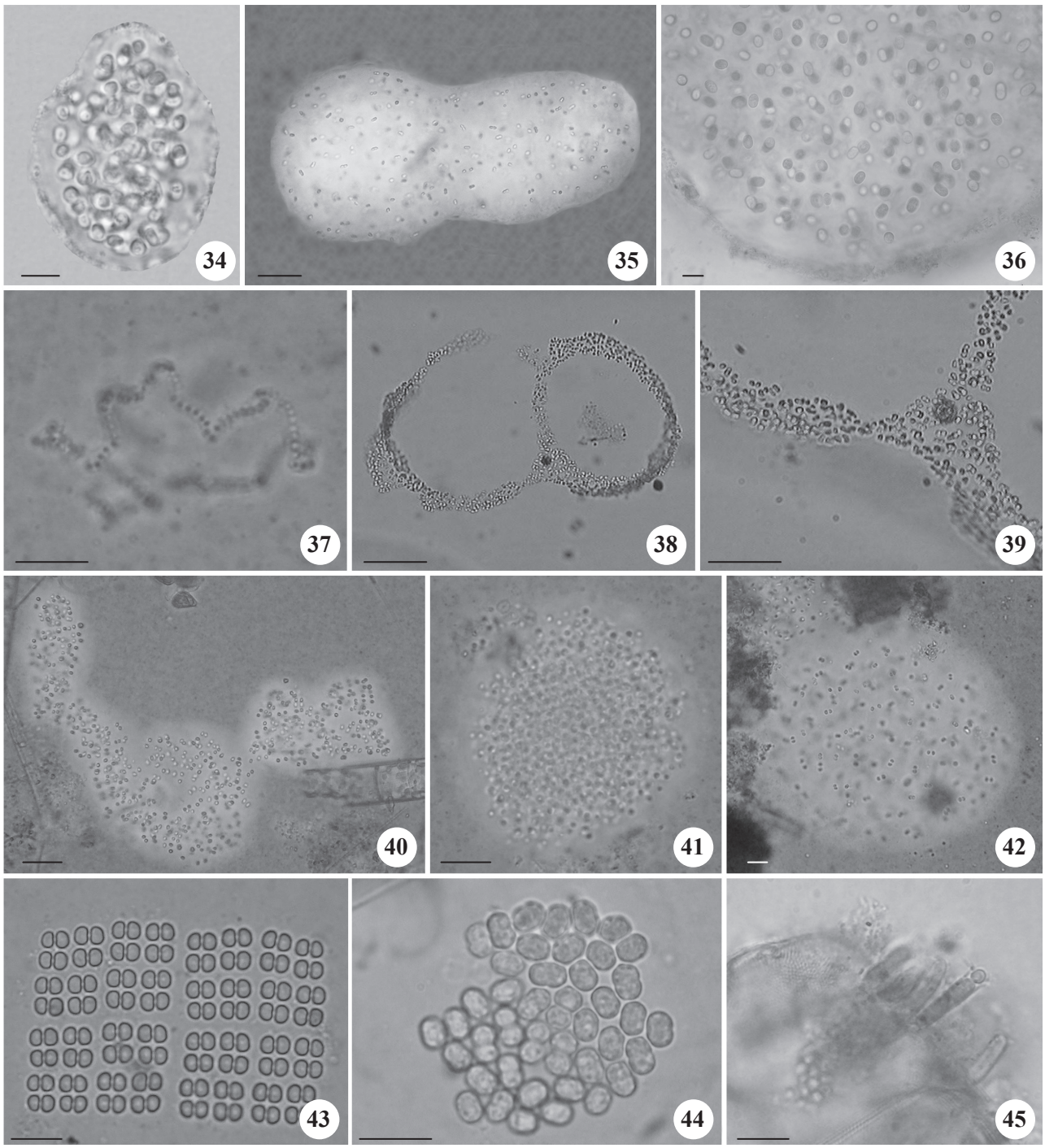
Material examined: BRAZIL. Rio Grande do Sul: Palmares do Sul, Capivari lagoon, 18-XI-2003, *LSCardoso s.n.* (HAS104343).

Comments: *Chroococcus microscopicus* and *C. aphanocapsoides* Skuja are similar, both having small cells. These two species can be distinguished by their

cell and colony sizes, where *C. aphanocapsoides* has larger colonies and large cells distributed within a common colonial mucilage, while *C. microscopicus* has smaller cells that are united into small groups, with each cell being surrounded by an individual mucilaginous sheath.

Chroococcus minimus (Keissler) Lemmermann, Ark. F. Bot. 2: 102, 1904.
Figures 30, 52

Colonies free floating, microscopic, oval, irregular, 30.5-48.3 µm diam., 50.3-63.8 µm long; cells more or



Figures 34-45. 34. *Aphanothece comasii*. 35. *A. smithii*. 36. *A. stagnina*. 37. *Cyanodictyon reticulatum*. 38-39. *C. tubiforme*. 40. *Aphanocapsa elachista*. 41. *A. incerta*. 42. *A. koordersii*. 43. *Merismopedia glauca*. 44. *Microcrocis pulchella*. 45. *Chamaesiphon amethystinus*. Figures 34-35, 37, 40-42 stained with ink to visualize the mucilage. Bar = 10 µm (34-38, 40-45); 50 µm (39).

less regularly arranged within the colonial mucilage; mucilage colorless, firm, homogenous, diffluent; cells spherical or hemispherical after division, sometimes with individual envelope around cells, 2.4-3.0 µm diam.; cell contents blue-green, homogenous.

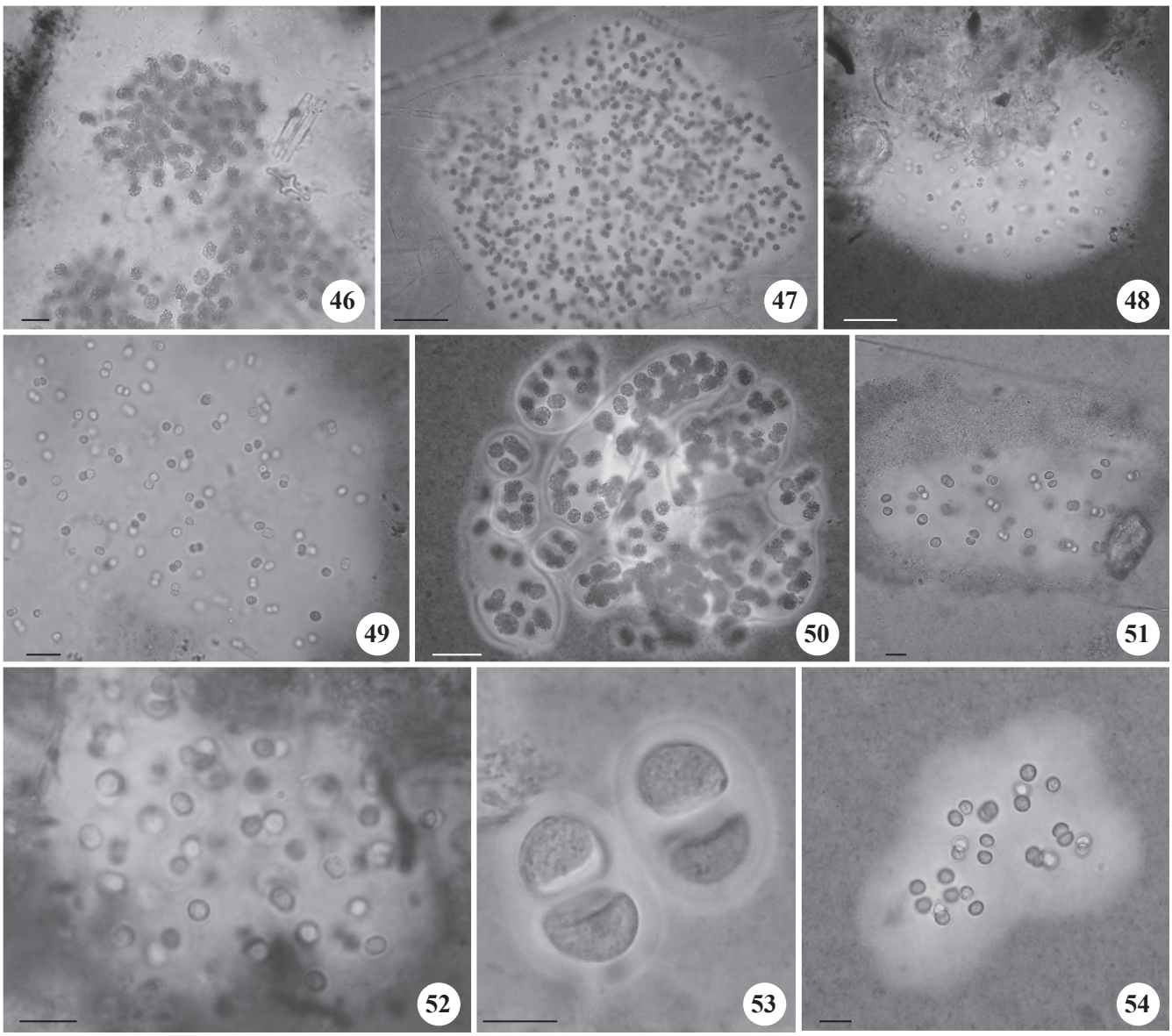
Material examined: BRAZIL. Rio Grande do Sul: Palmares do Sul, Spillway, 7-V-2003, *LCTorgan s.n.* (HAS104163); Tapes, Charutão lagoon, 2-XII-2003, *SMAlves-da-Silva s.n.* (HAS104416).

Comments: Reported for the first time in Rio Grande do Sul.

Chroococcus minutus (Kützing) Nägeli, Gatt. Einz. Algen. 46, 1849.
Figure 31

Colonies with few cells (2-4); cells solitary or microscopic, oval, elongated; mucilage colorless, firm, homogenous, sometimes lamellate, delimited; cells spherical or hemispherical after division, 5.0-7.5 µm diam.; cell contents blue-green, homogenous.

Material examined: BRAZIL. Rio Grande do Sul: Palmares do Sul, Casamento lagoon, 18-XI-2003,



Figures 46-54. 46. *Microcystis aeruginosa*. 47. *M. protocystis*. 48. *M. smithii* (general appearance). 49. *M. smithii* (details of the cells and aerotopes). 50. *M. wesenbergii*. 51. *Chroococcus distans*. 52. *C. minimus*. 53. *C. turgidus*. 54. *Limnococcus limneticus*. Figures 46-54 stained with ink to visualize the mucilage. Bar = 10 µm (46, 49-54); 20 µm (47-48).

LSCardoso s.n. (HAS104352), 19-XI-2003, *LSCardoso s.n.* (HAS104356).

Comments: This species is widely reported from various biotopes throughout the world including mangrove swamps, aerophytic, and metaphytic habitats, thermal springs, and alkaline subtropical and tropical swamps, springs, creeks, and lakes. In this study it was observed in plankton.

Chroococcus turgidus (Kützing) Nägeli, Gatt. Einz. Algen. 46, 1849.
Figures 32, 53

Microscopic few-celled colonies (2-4 cells) that are oval, elliptic; mucilage colorless, firm, homogenous or lamellate, delimited; cells spherical or hemispherical after division, 8.0-12.5 µm diam.; cell contents blue-green, homogenous or finely granular.

Material examined: BRAZIL. Rio Grande do Sul: Tapes, Charutão lagoon, 3-VI-2003, *VRWerner s.n.* (HAS104202), 3-XII-2003, *LSCardoso s.n.* (HAS104451); Dunas wetland, 4/6/2003, *VRWerner s.n.* (HAS104234); Redonda lagoon, 4-VI-2003, *VRWerner s.n.* (HAS104235); Palmares do Sul, Capivari lagoon, 18-XI-2003, *LSCardoso s.n.* (HAS104343).

Comments: This species is widely distributed and has been reported from a great variety of habitats. Numerous taxonomic varieties have been described and probably represent a collective species.

Limnococcus limneticus (Lemmermann), Komárková et al., Hydrobiol., 639: 79, 2010.
Figures 33, 54

Colonies microscopic, oval, elongated or irregular, 40.0-60.0 µm diam., 60.3-85.5 µm long; cells irregularly arranged within the colonial mucilage, sometimes in indistinct groups (2-6 cells); mucilage colorless, firm, homogenous, diffluent; cells spherical or hemispherical after division, usually with individual envelope, 6.0-10.5 µm diam.; cell contents blue-green, homogenous.

Material examined: BRAZIL. Rio Grande do Sul: Capivari do Sul, Capivari lagoon, 5-V-2003, *LCTorgan s.n.* (HAS104098), 18-XI-2003, *LSCardoso s.n.* (HAS104343); Palmares do Sul, Casamento lagoon, 5-V-2003, *VRWerner s.n.* (HAS104103), 29-X-2003, *SMAlves-da-Silva s.n.* (HAS104396); Spillway, 7-V-2003, *LCTorgan s.n.* (HAS104167); Mostardas, Gateados laggon, 8-V-2003, *LCTorgan s.n.* (HAS104150, HAS104153), 19-XI-2003, *LSCardoso s.n.* (HAS104376).

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