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The genus *Pinnularia* (Bacillariophyta, Pinnulariaceae) from Lago dos Tigres, Britânia, Goiás, Brazil

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DA SILVA, W.J., RUWER, D., NOGUEIRA, I., DUNCK, B. **The genus *Pinnularia* (Bacillariophyta, Pinnulariaceae) from Lago dos Tigres, Britânia, Goiás, Brazil.** Biota Neotropica. 16(1): e20150028. http://dx.doi.org/10.1590/1676-0611-BN-2015-0028

Abstract: Studies of the genus *Pinnularia* Ehrenb. are only incipient in central-western Brazil, especially in Goiás. Only 20 of the 170 taxa known from Brazil were recorded in this state until now. A taxonomic study of *Pinnularia* from Lago dos Tigres (Tocantins-Araguaia River Basin) recorded 20 specific and infraspecific taxa, distributed in 17 species, including *P. instabilis* whose lectotype is designated here. Only *P. meridiana* var. *meridiana* was previously recorded in aquatic systems of the state. Eighteen taxa are newly recorded for Goiás, and one is the first record in Brazil. The *Pinnularia* flora from Lago dos Tigres contains nine taxa in common with the Amazon River Basin flora, and seven other taxa that occur elsewhere in the Paraná River Basin.
Keywords: *blocked river valley, Pinnularia meridian, Pinnularia instabilis, lectotypification, central-western Brazil.*

DA SILVA, W.J., RUWER, D., NOGUEIRA, I., DUNCK, B. **O gênero *Pinnularia* (Bacillariophyta, Pinnulariaceae) do Lago dos Tigres, Britânia, Goiás, Brasil.** Biota Neotropica. 16(1): e20150028. http://dx.doi.org/10.1590/1676-0611-BN-2015-0028

Resumo: O gênero *Pinnularia* Ehrenb. é incipientemente estudado na região Centro-Oeste brasileira, especialmente em Goiás. Somente 20 de 170 táxons conhecidos no Brasil foram registrados nesse estado até agora. Nesse estudo, objetivou-se a realização de estudos taxonômicos de *Pinnularia* do Lago dos Tigres (Bacia Tocantins-Araguaia). Vinte táxons em nível específico e infraespecífico, distribuídos em 17 espécies, foram observados e caracterizados aqui, incluindo *P. instabilis* cujo lectótipo foi designado aqui. Somente *P. meridiana* var. *meridiana* foi primeiramente registrada em sistemas aquáticos do estado. Dezoito táxons constituíram citações pioneiras para o estado de Goiás e um foi o primeiro registro de ocorrência para o Brasil. A flora de *Pinnularia* do Lago dos Tigres apresentou nove táxons comuns com a Bacia Amazônica e outras sete foram comuns à Bacia do Paraná.
Palavras-chave: *vale bloqueado, Pinnularia meridian, Pinnularia instabilis, lecotipificação, Centro-Oeste.*

Introduction

The taxon name *Pinnularia* was proposed by Ehrenberg (1840a, 1840b) as a subgenus of *Navicula* Bory. Later, Ehrenberg (1843a, 1843b) used the name at generic level. However, the name *Pinnularia* was earlier used by Lindley & Hutton (1835) for a genus of fossil high plants. *Pinnularia* Lindley & Hutton was lesser used than *Pinnularia* Ehrenb., which was conserved against the first one and it is the correct name to generic level according the International Code for Nomenclature of algae, fungi and plants (ICN, McNeill et al. 2012).

Pinnularia is a genus of naviculoid diatoms characterized by valves linear, lanceolate or elliptic, with plane or undulate surfaces (Krammer 2000). Members of this genus usually presented different courses of the internal and external fissure of the raphe; transapically, the valves bear alveolated costal systems, which are simple or partially recovered (Krammer 2000). This genus occurs predominantly in oligotrophic continental waters, with low electrolyte concentration and low pH values (Uherkovich 1984, Metzeltin & Lange-Bertalot 1998, Krammer 2000).

The genus *Pinnularia* comprises more than 2,700 species specific and infraspecific combinations, of which about 674 are currently accepted (Guiry & Guiry 2015). In Brazil, studies about *Pinnularia* recorded approximately 215 taxa (Pereira et al. 2014, Eskinazi-Leça et al. 2016). These studies were mainly concentrated in the regions South (Torgan et al. 1999, Tremarin et al. 2009, 2010), Southeast (Menezes & Dias 2001, Rocha & Bicudo 2008) and North (Hustedt 1965, Metzeltin & Lange-Bertalot 1998, 2007, Pereira et al. 2012, 2013, 2014).

In Central-West Region only 20 taxa were registered until now (Delgado & Souza 2007, da Silva et al. 2011). These studies comprised small areas, such as Distrito Federal, the

regions Central, Northeast, and Southwest from Goiás, and a small city in Mato Grosso. The Central-West, Brazil, bears sources from the main hydrographic regions from the country. Three of these are present in the State of Goiás (i.e., São Francisco, Paraná, and Tocantins-Araguaia). Nowadays, this region has undergoing to deforestation and biocide effects because agricultural practices, which have been listed as one of the main reasons of aquatic biodiversity loss (Tundisi 2003). This impels a race against time in order to know the diversity of algal organisms from areas in similar conditions.

Phylocogical studies in the Western region from Goiás are still scarce. The Lago dos Tigres is localized in this area and it has four studies that approaching the algal biodiversity (i.e., Nabout & Nogueira 2007, Dunck et al. 2012, Oliveira et al. 2012a, 2012b), but none of them recorded species of *Pinnularia*. We aimed here to inventory the species of *Pinnularia* from Lago dos Tigres, Britânia, Goiás, Brazil.

Material and methods

Lago dos Tigres is localized in Britânia, in the West Region from the State of Goiás, Brazil (Figure 1). Commonly called lake, the Lago dos Tigres is, actually, characterized as blocked valley (Nabout & Nogueira 2007), also called drowned valley. Drowned valleys can be originated from the natural damming of water volumes of receptor rivers or by deposition of sediments, creating a barrier to the water (Kalff 2002). In the Lago dos Tigres, the Água Limpa River dammed by the water of the Vermelho River and sediments deposited at the confluence of these two rivers, resulting in a lentic body 50 km^2 of superficial area (Nabout & Nogueira 2007). These systems constitute affluents of the Tocantins-Araguaia River Basin.

This Lago dos Tigres System has acid to neutral waters, which reach temperatures higher than 21 °C. These waters are characterized as oligomesotrophic to mesotrophic, with high oxygen concentration (Nabout & Nogueira 2007). Physical and chemical variables were measured and values of averages and standard deviations ($n = 11$) are provided in Table 1. Depth and water transparency were measured by means measuring tape and Secchi disk, respectively. Water temperature, conductivity, oxygen saturation and pH were determined through a water multi-analyzer (HORIBA U-21). Total nitrogen (TN) and total phosphorus (TP) were inferred according to APHA (2005).

Phytoplankton samples were obtained using 25 µm plankton net. Periphytic material was scraped from artificial substrates (rocks) using toothbrush. These substrates were sampled after the 21st day of colonization. The material examined was collected from the 11 sites along Lago dos Tigres system (Britânia, Goiás), monthly, from June 2004 to November 2004, and from June 2008 and January 2009, totalizing 178 samples (Table 2). All the samples were fixed with Transeau solution (Bicudo & Menezes 2006) and deposited in the Herbarium of the Universidade Federal de Goiás (UFG), with numbers between UFG29864 and UFG29973, and between UFG43636 and UFG43724 (Table 2).

The samples were oxidized according to Simonsen (1974), modified by Moreira-Filho & Valente-Moreira (1981) and permanent slides were mounted using Naphrax®. The material was examined with Zeiss Axioscop 40 microscope and images were captured with an Axiovison system for observation of morphological characteristics of each taxa. A part of oxidized material was deposited under stubs and sputtered with a layer of 150-200 Å of gold in Sputter Coater Desk V (Denton Vacuum, LLC). The preparations were analyzed in a Jeol

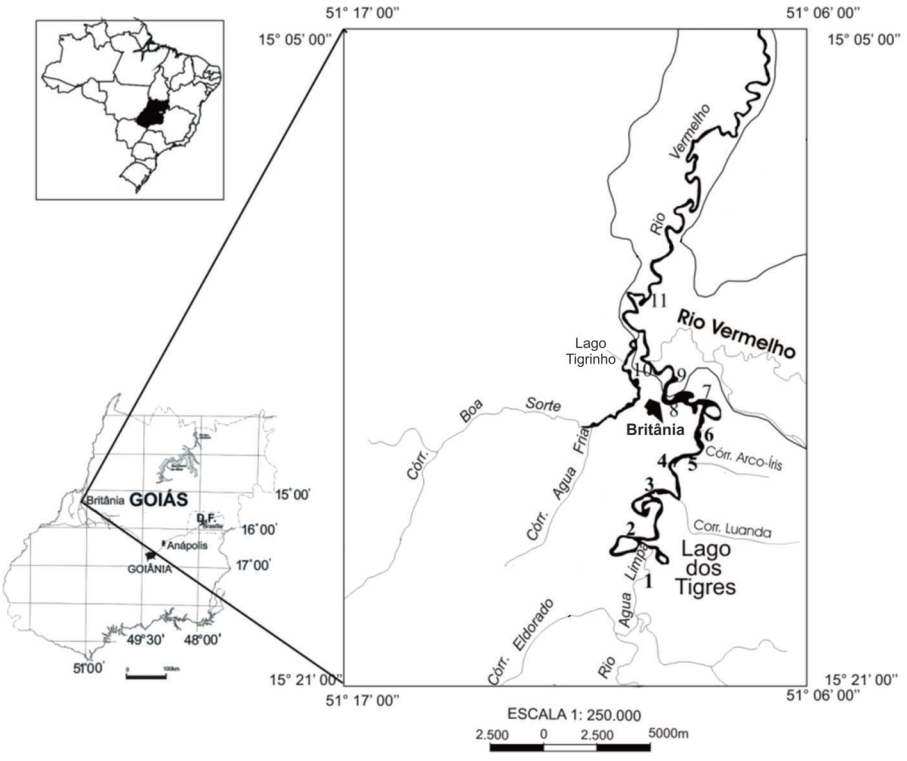

Figure 1. Lago dos Tigres System, Britânia, Goiás, and sampling sites in the study area.

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Table 1. Physical and chemical characterization of Lago dos Tigres System from June/2004 to January/2009 ($n = 11$; Sd: standard deviation; TN: total nitrogen; TP: total phosphorus).

Variables		Jun/04	Jul/04	Aug/04	Sep/04	Oct/04	Nov/04	Jul/08	Aug/08	Sep/08	Oct/08	Nov/08	Dec/08	Jan/09
Depth (m)	Mean	3.93	3.02	2.75	2.24	2.21	2.7	2.45	1.95	1.85	1.77	2.19	2.85	4.28
	Sd	1.23	1.07	0.99	1.02	1.21	1.10	1.27	1.05	1.10	1.3	1.34	1.15	1.05
Transparency (m)	Mean	0.49	0.52	0.51	0.4	0.45	0.32	0.53	0.46	0.41	0.43	0.35	0.37	0.48
	Sd	0.13	0.10	0.16	0.06	0.07	0.07	0.08	0.11	0.09	0.10	0.12	0.10	0.16
Water temperature (°C)	Mean	25.32	25.94	26.19	28.17	30.45	32.01	23.90	27.60	30.50	29.90	30.90	29.50	29.50
	Sd	0.88	0.70	2.05	1.84	1.38	2.22	1.70	2.20	2.20	1.40	1.90	0.70	0.70
Conductivity ($\mu S.s^{-1}$)	Mean	46.25	31.82	22.62	28.64	46.21	30.91	-	21.63	20.1	6.91	4.18	5.36	7.37
	Sd	14.07	7.51	5.84	9.21	13.74	8.86	-	9.77	10.19	3.75	1.78	1.75	5.96
Oxygen saturation (%)	Mean	100.88	111.00	131.64	168.91	134.54	155.82	-	-	-	8.90	8.50	6.70	5.80
	Sd	6.19	6.86	7.98	29.12	9.93	12.18	-	-	-	0.60	0.50	0.800	0.80
TN ($\mu g.L^{-1}$)	Mean	230.00	148.18	94.55	68.18	81.36	139.89	121.60	148.10	234.70	374.90	195.00	129.00	-
	Sd	99.87	69.97	68.76	68.67	35.07	54.24	73.90	68.60	166.00	205.90	108.20	72.80	-
TP ($\mu g.L^{-1}$)	Mean	52.5	52.27	58.18	50	37.73	29.95	20.40	14.30	92.80	19.80	18.50	17.60	-
	Sd	46.60	57.67	76.65	48.78	53.73	25.19	22.5	22.5	144.9	16.6	18.9	23.5	-
pH	Mean	7.30	7.51	6.95	6.81	7.61	7.2	6.22	6.71	6.39	6.38	6.53	6.35	6.35
	Sd	0.46	0.66	0.25	0.40	0.61	0.28	0.51	0.40	0.40	0.32	0.29	0.90	0.88

JSM-6610 scanning electron microscope (Jeol, USA), with an electrical potential of 6 kV, spot size 25–40.

The identification of the taxa at infrageneric level was based on specific bibliography and, as well as possible, based on original material (e.g., Metzeltin & Lange-Bertalot 1998, 2007, Krammer 2000, Metzeltin et al. 2005). The standardization of the author names were made according to IPNI (http://www.ipni.org/).

The frequency of occurrence of each species in the samples was based on Guille (1970), according to which taxa with frequencies up to 10% were considered rare, between 10% and 50%, inclusive, were considered common, and higher than 50% were considered constant.

Results and discussion

Twenty taxa of *Pinnularia* were recorded in this study (Table 3), all of them were considered rare according to the criteria proposed by Guille (1970) because occurred in 0.56% to 5.61% of the 178 samples analyzed in this study. The most frequent were *P. meridiana* var. *meridiana* Metzeltin & Krammer and *P. rumrichiae* Krammer, which occurred in nine and ten samples, respectively. Only *P. meridiana* var. *meridiana* was recorded early in other diatomoflora study from the State of Goiás (Souza & Oliveira 2007, da Silva et al. 2011). Other 18 taxa were firstly recorded in this State from this study, and *Pinnularia microstauron* var. *rostrata* constituted the first report for Brazil. Among the 18 taxa already recorded in Brazil, nine were common to environments from the Amazonas River Basin (Hustedt 1965, Simonsen 1987, Metzeltin & Lange-Bertalot 1998, 2007, Pereira et al. 2012, 2013); seven occurred in states of São Paulo and or Paraná, from the Paraná River Basin (Rocha & Bicudo 2008, Souza & Senna 2009, Moresco et al. 2011); six taxa were common to the Guaraguaçu River Basin, in the State of Paraná (Tremarin et al. 2009, 2010, Santos et al. 2011); and one taxon were common to the Guaíba River Basin, in Rio Grande do Sul (Metzeltin & Lange-Bertalot 1998). The only that already was recorded in Goiás also belongs to the Tocantins-Araguaia River Basin, to which run the waters of the Lago dos Tigres System (Souza & Oliveira 2007, da Silva et al. 2011).

Pinnularia acrosphaeria var. *tumidula*

Krammer, Diatoms of Europe, vol. 1, p. 55, 214, Fig. 21: 8, 9, 2000. (Figure 2)

Holotype. Preparation 1792 MR, Collection Mayer in Regensburgische Botanische Gesellschaft (REG), Regensburg, Germany.

Type locality. Nelubium pond, in the botanical garden from Munich, Germany.

Valves linear, tumid at the middle part; broadly rounded apices; length: 79–82 µm, breadth: 12.5–12.66 µm, length/breadth ratio: 6.32–6.57; axial area broad, linear, presenting granulations; raphe lateral, one terminal end abruptly curve and other sickle-shaped, proximal ends slightly curved to the same direction; striae parallel, becoming slightly radiate towards to the ends of the valves; striae: 12/10 µm.

Material examined. Brazil, State of Goiás, Britânia, Lago dos Tigres, plankton, Nogueira et al. Site 01, 19/10/2008, P01M10, ISN1265 (UFG 43675); Site 4, 04/06/2004, ISN877 (UFG 29866); Rio Vermelho, plankton, Nogueira et al. Site 11, 14/07/2004, ISN907 (UFG 29890).

Table 2. Samples collected in the Lago dos Tigres Systems

Herbarium number	Locality	Date	Coordinates	Collector number	Collectors	Habitat
UFG29864	Brazil, State of Goiás, Britânia, Água Limpa River, Água Limpa Farm, Site 1	04/06/2004	15°18'58" S; 51°9'56" W	ISN874	Nogueira, I.S., Martins, L. L., da Silva, W.J., Nabout, J.C.	Phytoplankton
UFG29865	Brazil, State of Goiás, Britânia, Lago dos Tigres, Perdidas Island, Site 2	04/06/2004	15°17'57" S; 51°10'7" W	ISN876	Nogueira, I.S., Martins, L. L., da Silva, W.J., Nabout, J.C.	Phytoplankton
UFG29866	Brazil, State of Goiás, Britânia, Lago dos Tigres, Santo Antônio Farm, Site 4	04/06/2004	15°16'17" S; 51°9'10" W	ISN877	Nogueira, I.S., Martins, L. L., da Silva, W.J., Nabout, J.C.	Phytoplankton
UFG29867	Brazil, State of Goiás, Britânia, Lago dos Tigres, harbor ferry, Site 6	04/06/2004	15°15'12" S; 51°8'33" W	ISN878	Nogueira, I.S., Martins, L. L., da Silva, W.J., Nabout, J.C.	Phytoplankton
UFG29868	Brazil, State of Goiás, Britânia, Lago dos Tigres, Lago dos Tigres Farm, Site 7	04/06/2004	15°14'17" S; 51°8'59" W	ISN879	Nogueira, I.S., Martins, L. L., da Silva, W.J., Nabout, J.C.	Phytoplankton
UFG29869	Brazil, State of Goiás, Britânia, Lago dos Tigres, city in front of the Christ, Site 8	04/06/2004	15°14'9" S; 51°9'27" W	ISN869	Nogueira, I.S., Martins, L. L., da Silva, W.J., Nabout, J.C.	Phytoplankton
UFG29870	Brazil, State of Goiás, Britânia, Lago dos Tigres, outfall of the "lake" in Vermelho River, Site 10	04/06/2004	15°13'18" S; 51°10'6" W	ISN881	Nogueira, I.S., Martins, L. L., da Silva, W.J., Nabout, J.C.	Phytoplankton
UFG29871	Brazil, State of Goiás, Britânia, Lago dos Tigres, new channel of the Vermelho River, Site 11	04/06/2004	15°11'47" S; 51°9'57" W	ISN882	Nogueira, I.S., Martins, L. L., da Silva, W.J., Nabout, J.C.	Phytoplankton
UFG29872	Brazil, State of Goiás, Britânia, Água Limpa River, Água Limpa Farm, Site 1, under macrophytes	04/06/2004	15°18'58" S; 51°9'56" W	ISN889	Nogueira, I.S., Martins, L.L., da Silva, W.J., Nabout, J.C.	Periphyton
UFG29873	Brazil, State of Goiás, Britânia, Lago dos Tigres, harbor ferry, Site 6	04/06/2004	15°15'12" S; 51°8'33" W	ISN875	Nogueira, I.S., Martins, L.L., da Silva, W.J., Nabout, J.C.	Periphyton
UFG29875	Brazil, State of Goiás, Britânia, Lago dos Tigres, outfall of Arco-Íris Stream, Site 5	05/06/2004	15°15'46" S; 51°8'41" W	ISN891	Nogueira, I.S., Martins, L.L., da Silva, W.J., Nabout, J.C.	Periphyton
UFG29876	Brazil, State of Goiás, Britânia, Lago dos Tigres, city in front of the Christ, Site 8	05/06/2004	15°14'9" S; 51°9'27" W	ISN892	Nogueira, I.S., Martins, L.L., da Silva, W.J., Nabout, J.C.	Periphyton
UFG29877	Brazil, State of Goiás, Britânia, Lago dos Tigres, outfall of the "lake" in Vermelho River, Site 10	05/06/2004	15°13'18" S; 51°10'6" W	ISN893	Nogueira, I.S., Martins, L.L., da Silva, W.J., Nabout, J.C.	Periphyton
UFG29878	Brazil, State of Goiás, Britânia, Lago dos Tigres, new channel of the Vermelho River, Site 11	05/06/2004	15°11'47" S; 51°9'57" W	ISN894	Nogueira, I.S., Martins, L.L., da Silva, W.J., Nabout, J.C.	Periphyton
UFG29880	Brazil, State of Goiás, Britânia, Água Limpa River, Água Limpa Farm, Site 1	13/07/2004	15°18'58" S; 51°9'56" W	ISN898	Nogueira, I.S., da Silva, W.J., Nabout, J.C., Oliveira, J.E., Jorge, V.A.	Phytoplankton
UFG29881	Brazil, State of Goiás, Britânia, Lago dos Tigres, Perdidas Island, Site 2	13/07/2004	15°17'57" S; 51°10'7" W	ISN899	Nogueira, I.S., da Silva, W.J., Nabout, J.C., Oliveira, J.E., Jorge, V.A.	Phytoplankton

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Table 2. Continued.

Herbarium number	Locality	Date	Coordinates	Collector number	Collectors	Habitat
UFG29882	Brazil, State of Goiás, Britânia, Lago dos Tigres, outfall of Luanda Stream, Santo Antônio Farm, Site 3	13/07/2004	15°16'47" S; 51°9'44" W	ISN900	Nogueira, I.S., da Silva, W.J., Nabout, J.C., Oliveira, J.E., Jorge, V.A.	Phytoplankton
UFG29883	Brazil, State of Goiás, Britânia, Lago dos Tigres, Santo Antônio Farm, Site 4	13/07/2004	15°16'17" S; 51°9'10" W	ISN901	Nogueira, I.S., da Silva, W.J., Nabout, J.C., Oliveira, J.E., Jorge, V.A.	Phytoplankton
UFG29884	Brazil, State of Goiás, Britânia, Lago dos Tigres, outfall of Arco-Íris Stream, Site 5	13/07/2004	15°15'46" S; 51°8'41" W	ISN902	Nogueira, I.S., da Silva, W.J., Nabout, J.C., Oliveira, J.E., Jorge, V.A.	Phytoplankton
UFG29885	Brazil, State of Goiás, Britânia, Lago dos Tigres, outfall of the "lake" in Vermelho River, Site 9	13/07/2004	15°15'46" S; 51°8'41" W	ISN913	Nogueira, I.S., da Silva, W.J., Nabout, J.C., Oliveira, J.E., Jorge, V.A.	Phytoplankton
UFG29886	Brazil, State of Goiás, Britânia, Lago dos Tigres, harbor ferry, Site 6	13/07/2004	15°15'12" S; 51°8'33" W	ISN903	Nogueira, I.S., da Silva, W.J., Nabout, J.C., Oliveira, J.E., Jorge, V.A.	Phytoplankton
UFG29887	Brazil, State of Goiás, Britânia, Lago dos Tigres, Lago dos Tigres Farm, Site 7	13/07/2004	15°14'17" S; 51°8'59" W	ISN904	Nogueira, I.S., da Silva, W.J., Nabout, J.C., Oliveira, J.E., Jorge, V.A.	Phytoplankton
UFG29888	Brazil, State of Goiás, Britânia, Lago dos Tigres, city in front of the Christ, Site 8	13/07/2004	15°14'9" S; 51°9'27" W	ISN905	Nogueira, I.S., da Silva, W.J., Nabout, J.C., Oliveira, J.E., Jorge, V.A.	Phytoplankton
UFG29889	Brazil, State of Goiás, Britânia, Lago dos Tigres, downstream of the "lake", Lago dos Tigres Farm, Site 9	14/07/2004	15°13'43" S; 51°9'14" W	ISN906	Nogueira, I.S., da Silva, W.J., Nabout, J.C., Oliveira, J.E., Jorge, V.A.	Phytoplankton
UFG29890	Brazil, State of Goiás, Britânia, Lago dos Tigres, outfall of the "lake" in Vermelho River, Site 10	14/07/2004	15°13'18" S; 51°10'6" W	ISN907	Nogueira, I.S., da Silva, W.J., Nabout, J.C., Oliveira, J.E., Jorge, V.A.	Phytoplankton
UFG29891	Brazil, State of Goiás, Britânia, Lago dos Tigres, new channel of the Vermelho River, Site 11	14/07/2004	15°11'47" S; 51°9'57" W	ISN908	Nogueira, I.S., da Silva, W.J., Nabout, J.C., Oliveira, J.E., Jorge, V.A.	Phytoplankton
UFG29895	Brazil, State of Goiás, Britânia, Água Limpa River, Água Limpa Farm, Site 1	19/08/2004	15°18'58" S; 51°9'56" W	ISN945	Nogueira, I.S., da Silva, W.J., Nabout, J.C., Oliveira, J.E., Jorge, V.A.	Phytoplankton
UFG29896	Brazil, State of Goiás, Britânia, Lago dos Tigres, Perdidas Island, Site 2	19/08/2004	15°17'57" S; 51°10'7" W	ISN946	Nogueira, I.S., Martins, L. L., Uto, F.N., Nabout, J.C.	Phytoplankton
UFG29897	Brazil, State of Goiás, Britânia, Lago dos Tigres, outfall of Luanda Stream, Santo Antônio Farm, Site 3	19/08/2004	15°16'47" S; 51°9'44" W	ISN947	Nogueira, I.S., Martins, L. L., Uto, F.N., Nabout, J.C.	Phytoplankton
UFG29898	Brazil, State of Goiás, Britânia, Lago dos Tigres, Santo Antônio Farm, Site 4	19/08/2004	15°16'17" S; 51°9'10" W	ISN948	Nogueira, I.S., Martins, L. L., Uto, F.N., Nabout, J.C.	Phytoplankton

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Table 2. Continued.

Herbarium number	Locality	Date	Coordinates	Collector number	Collectors	Habitat
UFG29899	Brazil, State of Goiás, Britânia, Lago dos Tigres, outfall of Arco-Íris Stream, Site 5	19/08/2004	15°15'46" S; 51°8'41" W	ISN949	Nogueira, I.S., Martins, L. L., Uto, F.N., Nabout, J.C.	Phytoplankton
UFG29900	Brazil, State of Goiás, Britânia, Lago dos Tigres, harbor ferry, Site 6	19/08/2004	15°15'12" S; 51°8'33" W	ISN950	Nogueira, I.S., Martins, L. L., Uto, F.N., Nabout, J.C.	Phytoplankton
UFG29901	Brazil, State of Goiás, Britânia, Lago dos Tigres, Lago dos Tigres Farm, Site 7	19/08/2004	15°14'17" S; 51°8'59" W	ISN951	Nogueira, I.S., Martins, L. L., Uto, F.N., Nabout, J.C.	Phytoplankton
UFG29902	Brazil, State of Goiás, Britânia, Lago dos Tigres, city in front of the Christ, Site 8	19/08/2004	15°14'9" S; 51°9'27" W	ISN952	Nogueira, I.S., Martins, L. L., Uto, F.N., Nabout, J.C.	Phytoplankton
UFG29903	Brazil, State of Goiás, Britânia, Lago dos Tigres, downstream of the "lake", Lago dos Tigres Farm, Site 9	20/08/2004	15°13'43" S; 51°9'14" W	ISN953	Nogueira, I.S., Martins, L. L., Uto, F.N., Nabout, J.C.	Phytoplankton
UFG29904	Brazil, State of Goiás, Britânia, Lago dos Tigres, outfall of the "lake" in Vermelho River, Site 10	20/08/2004	15°13'18" S; 51°10'6" W	ISN954	Nogueira, I.S., Martins, L. L., Uto, F.N., Nabout, J.C.	Phytoplankton
UFG29905	Brazil, State of Goiás, Britânia, Lago dos Tigres, new channel of the Vermelho River, Site 11	20/08/2004	15°11'47" S; 51°9'57" W	ISN955	Nogueira, I.S., Martins, L. L., Uto, F.N., Nabout, J.C.	Phytoplankton
UFG29907	Brazil, State of Goiás, Britânia, Água Limpa River, Água Limpa Farm, Site 1	09/09/2004	15°18'58" S; 51°9'56" W	ISN985	Nogueira, I.S., Martins, L. L., da Silva, W.J., Rodrigues, J.	Phytoplankton
UFG29908	Brazil, State of Goiás, Britânia, Lago dos Tigres, Perdidas Island, Site 2	09/09/2004	15°17'57" S; 51°10'7" W	ISN986	Nogueira, I.S., Martins, L. L., da Silva, W.J., Rodrigues, J.	Phytoplankton
UFG29909	Brazil, State of Goiás, Britânia, Lago dos Tigres, outfall of Luanda Stream, Santo Antônio Farm, Site 3	09/09/2004	15°16'47" S; 51°9'44" W	ISN987	Nogueira, I.S., Martins, L. L., da Silva, W.J., Rodrigues, J.	Phytoplankton
UFG29910	Brazil, State of Goiás, Britânia, Lago dos Tigres, Santo Antônio Farm, Site 4	09/09/2004	15°16'17" S; 51°9'10" W	ISN988	Nogueira, I.S., Martins, L. L., da Silva, W.J., Rodrigues, J.	Phytoplankton
UFG29911	Brazil, State of Goiás, Britânia, Lago dos Tigres, outfall of Arco-Íris Stream, Site 5	09/09/2004	15°15'46" S; 51°8'41" W	ISN989	Nogueira, I.S., Martins, L. L., da Silva, W.J., Rodrigues, J.	Phytoplankton
UFG29912	Brazil, State of Goiás, Britânia, Lago dos Tigres, harbor ferry, Site 6	09/09/2004	15°15'12" S; 51°8'33" W	ISN990	Nogueira, I.S., Martins, L. L., da Silva, W.J., Rodrigues, J.	Phytoplankton
UFG29913	Brazil, State of Goiás, Britânia, Lago dos Tigres, Lago dos Tigres Farm, Site 7	09/09/2004	15°14'17" S; 51°8'59" W	ISN991	Nogueira, I.S., Martins, L. L., da Silva, W.J., Rodrigues, J.	Phytoplankton

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Table 2. Continued.

Herbarium number	Locality	Date	Coordinates	Collector number	Collectors	Habitat
UFG29914	Brazil, State of Goiás, Britânia, Lago dos Tigres, city in front of the Christ, Site 8	09/09/2004	15°14'9" S; 51°9'27" W	ISN992	Nogueira, I.S., Martins, L. L., da Silva, W.J., Rodrigues, J.	Phytoplankton
UFG29915	Brazil, State of Goiás, Britânia, Lago dos Tigres, downstream of the "lake", Lago dos Tigres Farm, Site 9	10/09/2004	15°13'43" S; 51°9'14" W	ISN993	Nogueira, I.S., Martins, L. L., da Silva, W.J., Rodrigues, J.	Phytoplankton
UFG29916	Brazil, State of Goiás, Britânia, Lago dos Tigres, outfall of the "lake" in Vermelho River, Site 10	10/09/2004	15°13'18" S; 51°10'6" W	ISN994	Nogueira, I.S., Martins, L. L., da Silva, W.J., Rodrigues, J.	Phytoplankton
UFG29917	Brazil, State of Goiás, Britânia, Lago dos Tigres, new channel of the Vermelho River, Site 11	10/09/2004	15°11'47" S; 51°9'57" W	ISN995	Nogueira, I.S., Martins, L. L., da Silva, W.J., Rodrigues, J.	Phytoplankton
UFG29918	Brazil, State of Goiás, Britânia, Água Limpa River, Água Limpa Farm, Site 1	16/10/2004	15°18'58" S; 51°9'56" W	ISN1023	Nogueira, I.S., Nabout, J.C., Oliveira, J.E., Valente, C.	Phytoplankton
UFG29919	Brazil, State of Goiás, Britânia, Lago dos Tigres, Perdidas Island, Site 2	16/10/2004	15°17'57" S; 51°10'7" W	ISN1024	Nogueira, I.S., Nabout, J.C., Oliveira, J.E., Valente, C.	Phytoplankton
UFG29920	Brazil, State of Goiás, Britânia, Lago dos Tigres, outfall of Luanda Stream, Santo Antônio Farm, Site 3	16/10/2004	15°16'47" S; 51°9'44" W	ISN1025	Nogueira, I.S., Nabout, J.C., Oliveira, J.E., Valente, C.	Phytoplankton
UFG29921	Brazil, State of Goiás, Britânia, Lago dos Tigres, Santo Antônio Farm, Site 4	16/10/2004	15°16'17" S; 51°9'10" W	ISN1026	Nogueira, I.S., Nabout, J.C., Oliveira, J.E., Valente, C.	Phytoplankton
UFG29922	Brazil, State of Goiás, Britânia, Lago dos Tigres, outfall of Arco-Íris Stream, Site 5	16/10/2004	15°15'46" S; 51°8'41" W	ISN1027	Nogueira, I.S., Nabout, J.C., Oliveira, J.E., Valente, C.	Phytoplankton
UFG29923	Brazil, State of Goiás, Britânia, Lago dos Tigres, harbor ferry, Site 6	16/10/2004	15°15'12" S; 51°8'33" W	ISN1028	Nogueira, I.S., Nabout, J.C., Oliveira, J.E., Valente, C.	Phytoplankton
UFG29924	Brazil, State of Goiás, Britânia, Lago dos Tigres, Lago dos Tigres Farm, Site 7	16/10/2004	15°14'17" S; 51°8'59" W	ISN1029	Nogueira, I.S., Nabout, J.C., Oliveira, J.E., Valente, C.	Phytoplankton
UFG29925	Brazil, State of Goiás, Britânia, Lago dos Tigres, city in front of the Christ, Site 8	16/10/2004	15°14'9" S; 51°9'27" W	ISN1030	Nogueira, I.S., Nabout, J.C., Oliveira, J.E., Valente, C.	Phytoplankton
UFG29926	Brazil, State of Goiás, Britânia, Lago dos Tigres, downstream of the "lake", Lago dos Tigres Farm, Site 9	17/10/2004	15°13'43" S; 51°9'14" W	ISN1031	Nogueira, I.S., Nabout, J.C., Oliveira, J.E., Valente, C.	Phytoplankton
UFG29927	Brazil, State of Goiás, Britânia, Lago dos Tigres, outfall of the "lake" in Vermelho River, Site 10	17/10/2004	15°13'18" S; 51°10'6" W	ISN1032	Nogueira, I.S., Nabout, J.C., Oliveira, J.E., Valente, C.	Phytoplankton

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Table 2. Continued.

Herbarium number	Locality	Date	Coordinates	Collector number	Collectors	Habitat
UFG29928	Brazil, State of Goiás, Britânia, Lago dos Tigres, new channel of the Vermelho River, Site 11	17/10/2004	15°11'47" S; 51°9'57" W	ISN1033	Nogueira, I.S., Nabout, J.C., Oliveira, J.E., Valente, C.	Phytoplankton
UFG29929	Brazil, State of Goiás, Britânia, Água Limpa River, Água Limpa Farm, Site 1	05/11/2004	15°18'58" S; 51°9'56" W	ISN1115	Nogueira, I.S., Martins, L. L., da Silva, W.J., Uto, F.N.	Phytoplankton
UFG29930	Brazil, State of Goiás, Britânia, Lago dos Tigres, Perdidas Island, Site 2	05/11/2004	15°17'57" S; 51°10'7" W	ISN1116	Nogueira, I.S., Martins, L. L., da Silva, W.J., Uto, F.N.	Phytoplankton
UFG29931	Brazil, State of Goiás, Britânia, Lago dos Tigres, outfall of Luanda Stream, Santo Antônio Farm, Site 3	05/11/2004	15°16'47" S; 51°9'44" W	ISN1117	Nogueira, I.S., Martins, L. L., da Silva, W.J., Uto, F.N.	Phytoplankton
UFG29932	Brazil, State of Goiás, Britânia, Lago dos Tigres, Santo Antônio Farm, Site 4	05/11/2004	15°16'17" S; 51°9'10" W	ISN1118	Nogueira, I.S., Martins, L. L., da Silva, W.J., Uto, F.N.	Phytoplankton
UFG29933	Brazil, State of Goiás, Britânia, Lago dos Tigres, outfall of Arco-Íris Stream, Site 5	05/11/2004	15°15'46" S; 51°8'41" W	ISN1119	Nogueira, I.S., Martins, L. L., da Silva, W.J., Uto, F.N.	Phytoplankton
UFG29934	Brazil, State of Goiás, Britânia, Lago dos Tigres, harbor ferry, Site 6	05/11/2004	15°15'12" S; 51°8'33" W	ISN1120	Nogueira, I.S., Martins, L. L., da Silva, W.J., Uto, F.N.	Phytoplankton
UFG29935	Brazil, State of Goiás, Britânia, Lago dos Tigres, Lago dos Tigres Farm, Site 7	05/11/2004	15°14'17" S; 51°8'59" W	ISN1121	Nogueira, I.S., Martins, L. L., da Silva, W.J., Uto, F.N.	Phytoplankton
UFG29936	Brazil, State of Goiás, Britânia, Lago dos Tigres, city in front of the Christ, Site 8	05/11/2004	15°14'9" S; 51°9'27" W	ISN1122	Nogueira, I.S., Martins, L. L., da Silva, W.J., Uto, F.N.	Phytoplankton
UFG29937	Brazil, State of Goiás, Britânia, Lago dos Tigres, downstream of the "lake", Lago dos Tigres Farm, Site 9	06/11/2004	15°13'43" S; 51°9'14" W	ISN1123	Nogueira, I.S., Martins, L. L., da Silva, W.J., Uto, F.N.	Phytoplankton
UFG29938	Brazil, State of Goiás, Britânia, Lago dos Tigres, outfall of the "lake" in Vermelho River, Site 10	06/11/2004	15°13'18" S; 51°10'6" W	ISN1124	Nogueira, I.S., Martins, L. L., da Silva, W.J., Uto, F.N.	Phytoplankton
UFG29939	Brazil, State of Goiás, Britânia, Lago dos Tigres, new channel of the Vermelho River, Site 11	06/11/2004	15°11'47" S; 51°9'57" W	ISN1125	Nogueira, I.S., Martins, L. L., da Silva, W.J., Uto, F.N.	Phytoplankton
UFG29940	Brazil, State of Goiás, Britânia, Água Limpa River, Água Limpa Farm, Site 1	13/07/2004	15°18'58" S; 51°9'56" W	ISN934	Nogueira, I.S., da Silva, W.J., Nabout, J. C., Oliveira, J.E., Jorge, V.A	Periphyton
UFG29941	Brazil, State of Goiás, Britânia, Lago dos Tigres, Perdidas Island, Site 2	13/07/2004	15°17'57" S; 51°10'7" W	ISN935	Nogueira, I.S., da Silva, W.J., Nabout, J. C., Oliveira, J.E., Jorge, V.A	Periphyton
UFG29942	Brazil, State of Goiás, Britânia, Lago dos Tigres, Perdidas Island, Site 2	13/07/2004	15°17'57" S; 51°10'7" W	ISN936	Nogueira, I.S., da Silva, W.J., Nabout, J. C., Oliveira, J.E., Jorge, V.A	Periphyton

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Table 2. Continued.

Herbarium number	Locality	Date	Coordinates	Collector number	Collectors	Habitat
UFG29943	Brazil, State of Goiás, Britânia, Água Limpa River, Água Limpa Farm, Site 1	13/07/2004	15°18'58" S; 51°9'56" W	ISN937	Nogueira, I.S., da Silva, W.J., Nabout, J. C., Oliveira, J.E., Jorge, V.A	Periphyton
UFG29944	Brazil, State of Goiás, Britânia, Lago dos Tigres, Perdidas Island, Site 2	13/07/2004	15°17'57" S; 51°10'7" W	ISN938	Nogueira, I.S., da Silva, W.J., Nabout, J. C., Oliveira, J.E., Jorge, V.A	Periphyton
UFG29946	Brazil, State of Goiás, Britânia, Água Limpa River, Água Limpa Farm, Site 1	19/08/2004	15°18'58" S; 51°9'56" W	ISN973	Nogueira, I.S., Martins, L.L., Uto, F. N., Nabout, J.C.	Periphyton
UFG29947	Brazil, State of Goiás, Britânia, Água Limpa River, Água Limpa Farm, Site 1	19/08/2004	15°18'58" S; 51°9'56" W	ISN974	Nogueira, I.S., Martins, L.L., Uto, F. N., Nabout, J.C.	Periphyton
UFG29948	Brazil, State of Goiás, Britânia, Água Limpa River, Água Limpa Farm, Site 1	19/08/2004	15°18'58" S; 51°9'56" W	ISN975	Nogueira, I.S., Martins, L.L., Uto, F. N., Nabout, J.C.	Periphyton
UFG29949	Brazil, State of Goiás, Britânia, Água Limpa River, Água Limpa Farm, Site 1	19/08/2004	15°18'58" S; 51°9'56" W	ISN976	Nogueira, I.S., Martins, L.L., Uto, F. N., Nabout, J.C.	Periphyton
UFG29950	Brazil, State of Goiás, Britânia, Lago dos Tigres, Perdidas Island, Site 2	19/08/2004	15°17'57" S; 51°10'7" W	ISN977	Nogueira, I.S., Martins, L.L., Uto, F. N., Nabout, J.C.	Periphyton
UFG29951	Brazil, State of Goiás, Britânia, Lago dos Tigres, Perdidas Island, Site 2	19/08/2004	15°17'57" S; 51°10'7" W	ISN978	Nogueira, I.S., Martins, L.L., Uto, F. N., Nabout, J.C.	Periphyton
UFG29952	Brazil, State of Goiás, Britânia, Água Limpa River, Água Limpa Farm, Site 1	09/09/2004	15°18'58" S; 51°9'56" W	ISN1013	Nogueira, I.S., Martins, L.L., da Silva, W.J., Rodrigues, J.	Periphyton
UFG29953	Brazil, State of Goiás, Britânia, Água Limpa River, Água Limpa Farm, Site 1	09/09/2004	15°18'58" S; 51°9'56" W	ISN1014	Nogueira, I.S., Martins, L.L., da Silva, W.J., Rodrigues, J.	Periphyton
UFG29954	Brazil, State of Goiás, Britânia, Água Limpa River, Água Limpa Farm, Site 1	09/09/2004	15°18'58" S; 51°9'56" W	ISN1015	Nogueira, I.S., Martins, L.L., da Silva, W.J., Rodrigues, J.	Periphyton
UFG29955	Brazil, State of Goiás, Britânia, Lago dos Tigres, Perdidas Island, Site 2	09/09/2004	15°17'57" S; 51°10'7" W	ISN1016	Nogueira, I.S., Martins, L.L., da Silva, W.J., Rodrigues, J.	Periphyton
UFG29956	Brazil, State of Goiás, Britânia, Lago dos Tigres, Perdidas Island, Site 2	09/09/2004	15°17'57" S; 51°10'7" W	ISN1017	Nogueira, I.S., Martins, L.L., da Silva, W.J., Rodrigues, J.	Periphyton
UFG29957	Brazil, State of Goiás, Britânia, Água Limpa River, Água Limpa Farm, Site 1	16/10/2004	15°18'58" S; 51°9'56" W	ISN1126	Nogueira, I.S., Nabout, J.C., Oliveira, J.E., Valente, C.	Periphyton
UFG29958	Brazil, State of Goiás, Britânia, Água Limpa River, Água Limpa Farm, Site 1	16/10/2004	15°18'58" S; 51°9'56" W	ISN1127	Nogueira, I.S., Nabout, J.C., Oliveira, J.E., Valente, C.	Periphyton

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Table 2. Continued.

Herbarium number	Locality	Date	Coordinates	Collector number	Collectors	Habitat
UFG29959	Brazil, State of Goiás, Britânia, Lago dos Tigres, Perdidas Island, Site 2	16/10/2004	15°17'57" S; 51°10'7" W	ISN1128	Nogueira, I.S., Nabout, J.C., Oliveira, J.E., Valente, C.	Periphyton
UFG29960	Brazil, State of Goiás, Britânia, Lago dos Tigres, Perdidas Island, Site 2	16/10/2004	15°17'57" S; 51°10'7" W	ISN1129	Nogueira, I.S., Nabout, J.C., Oliveira, J.E., Valente, C.	Periphyton
UFG29961	Brazil, State of Goiás, Britânia, Lago dos Tigres, Perdidas Island, Site 2	16/10/2004	15°17'57" S; 51°10'7" W	ISN1130	Nogueira, I.S., Nabout, J.C., Oliveira, J.E., Valente, C.	Periphyton
UFG29962	Brazil, State of Goiás, Britânia, Lago dos Tigres, Perdidas Island, Site 2	16/10/2004	15°17'57" S; 51°10'7" W	ISN1131	Nogueira, I.S., Nabout, J.C., Oliveira, J.E., Valente, C.	Periphyton
UFG29963	Brazil, State of Goiás, Britânia, Água Limpa River, Água Limpa Farm, Site 1	05/11/2004	15°18'58" S; 51°9'56" W	ISN1132	Nogueira, I.S., Martins, L.L., da Silva, W.J., Uto, F.N.	Periphyton
UFG29964	Brazil, State of Goiás, Britânia, Água Limpa River, Água Limpa Farm, Site 1	05/11/2004	15°18'58" S; 51°9'56" W	ISN1133	Nogueira, I.S., Martins, L.L., da Silva, W.J., Uto, F.N.	Periphyton
UFG29965	Brazil, State of Goiás, Britânia, Água Limpa River, Água Limpa Farm, Site 1	05/11/2004	15°18'58" S; 51°9'56" W	ISN1134	Nogueira, I.S., Martins, L.L., da Silva, W.J., Uto, F.N.	Periphyton
UFG29966	Brazil, State of Goiás, Britânia, Água Limpa River, Água Limpa Farm, Site 1	05/11/2004	15°18'58" S; 51°9'56" W	ISN1135	Nogueira, I.S., Martins, L.L., da Silva, W.J., Uto, F.N.	Periphyton
UFG29967	Brazil, State of Goiás, Britânia, Lago dos Tigres, Perdidas Island, Site 2	05/11/2004	15°17'57" S; 51°10'7" W	ISN1136	Nogueira, I.S., Martins, L.L., da Silva, W.J., Uto, F.N.	Periphyton
UFG29968	Brazil, State of Goiás, Britânia, Lago dos Tigres, Perdidas Island, Site 2	05/11/2004	15°17'57" S; 51°10'7" W	ISN1137	Nogueira, I.S., Martins, L.L., da Silva, W.J., Uto, F.N.	Periphyton
UFG29969	Brazil, State of Goiás, Britânia, Lago dos Tigres, Perdidas Island, Site 2	05/11/2004	15°17'57" S; 51°10'7" W	ISN1138	Nogueira, I.S., Martins, L.L., da Silva, W.J., Uto, F.N.	Periphyton
UFG29970	Brazil, State of Goiás, Britânia, Lago dos Tigres, Perdidas Island, Site 2	05/11/2004	15°17'57" S; 51°10'7" W	ISN1139	Nogueira, I.S., Martins, L.L., da Silva, W.J., Uto, F.N.	Periphyton
UFG29973	Brazil, State of Goiás, Britânia, Água Limpa River, Água Limpa Farm, Site 1, under macrophytes	04/06/2004	15°18'58" S; 51°9'56" W	ISN873	Nogueira, I.S., Martins, L.L., da Silva, W.J., Nabout, J.C.	Periphyton
UFG43636	Brazil, State of Goiás, Britânia, Água Limpa River, Água Limpa Farm, Site 1	17/07/2008	15°18'58" S; 51°9'56" W	ISN1226	Nogueira, I.S.	Phytoplankton
UFG43637	Brazil, State of Goiás, Britânia, Lago dos Tigres, Perdidas Island, Site 2	17/07/2008	15°17'57" S; 51°10'7" W	ISN1227	Nogueira, I.S.	Phytoplankton
UFG43638	Brazil, State of Goiás, Britânia, Lago dos Tigres, outfall of Luanda Stream, Santo Antônio Farm, Site 3	17/07/2008	15°16'47" S; 51°9'44" W	ISN1228	Nogueira, I.S.	Phytoplankton

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Table 2. Continued.

Herbarium number	Locality	Date	Coordinates	Collector number	Collectors	Habitat
UFG43639	Brazil, State of Goiás, Britânia, Lago dos Tigres, Santo Antônio Farm, Site 4	17/07/2008	15°16'17" S; 51°9'10" W	ISN1229	Nogueira, I.S.	Phytoplankton
UFG43640	Brazil, State of Goiás, Britânia, Lago dos Tigres, outfall of Arco-Íris Stream, Site 5	17/07/2008	15°15'46" S; 51°8'41" W	ISN1230	Nogueira, I.S.	Phytoplankton
UFG43641	Brazil, State of Goiás, Britânia, Lago dos Tigres, harbor ferry, Site 6	17/07/2008	15°15'12" S; 51°8'33" W	ISN1231	Nogueira, I.S.	Phytoplankton
UFG43642	Brazil, State of Goiás, Britânia, Lago dos Tigres, Lago dos Tigres Farm, Site 7	17/07/2008	15°14'17" S; 51°8'59" W	ISN1232	Nogueira, I.S.	Phytoplankton
UFG43643	Brazil, State of Goiás, Britânia, Lago dos Tigres, city in front of the Christ, Site 8	17/07/2008	15°14'9" S; 51°9'27" W	ISN1233	Nogueira, I.S.	Phytoplankton
UFG43644	Brazil, State of Goiás, Britânia, Lago dos Tigres, downstream of the "lake", Lago dos Tigres Farm, Site 9	18/07/2008	15°13'43" S; 51°9'14" W	ISN1234	Nogueira, I.S.	Phytoplankton
UFG43645	Brazil, State of Goiás, Britânia, Lago dos Tigres, outfall of the "lake" in Vermelho River, Site 10	18/07/2008	15°13'18" S; 51°10'6" W	ISN1235	Nogueira, I.S.	Phytoplankton
UFG43646	Brazil, State of Goiás, Britânia, Lago dos Tigres, new channel of the Vermelho River, Site 11	18/07/2008	15°11'47" S; 51°9'57" W	ISN1236	Nogueira, I.S.	Phytoplankton
UFG43649	Brazil, State of Goiás, Britânia, Água Limpa River, Água Limpa Farm, Site 1	19/08/2008	15°18'58" S; 51°9'56" W	ISN1239	Nogueira, I.S.	Phytoplankton
UFG43650	Brazil, State of Goiás, Britânia, Lago dos Tigres, Perdidas Island, Site 2	19/08/2008	15°17'57" S; 51°10'7" W	ISN1240	Nogueira, I.S.	Phytoplankton
UFG43651	Brazil, State of Goiás, Britânia, Lago dos Tigres, outfall of Luanda Stream, Santo Antônio Farm, Site 3	19/08/2008	15°16'47" S; 51°9'44" W	ISN1241	Nogueira, I.S.	Phytoplankton
UFG43652	Brazil, State of Goiás, Britânia, Lago dos Tigres, Santo Antônio Farm, Site 4	19/08/2008	15°16'17" S; 51°9'10" W	ISN1242	Nogueira, I.S.	Phytoplankton
UFG43653	Brazil, State of Goiás, Britânia, Lago dos Tigres, outfall of Arco-Íris Stream, Site 5	19/08/2008	15°15'46" S; 51°8'41" W	ISN1243	Nogueira, I.S.	Phytoplankton
UFG43654	Brazil, State of Goiás, Britânia, Lago dos Tigres, harbor ferry, Site 6	19/08/2008	15°15'12" S; 51°8'33" W	ISN1244	Nogueira, I.S.	Phytoplankton
UFG43655	Brazil, State of Goiás, Britânia, Lago dos Tigres, Lago dos Tigres Farm, Site 7	19/08/2008	15°14'17" S; 51°8'59" W	ISN1245	Nogueira, I.S.	Phytoplankton
UFG43656	Brazil, State of Goiás, Britânia, Lago dos Tigres, city in front of the Christ, Site 8	19/08/2008	15°14'9" S; 51°9'27" W	ISN1246	Nogueira, I.S.	Phytoplankton

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Table 2. Continued.

Herbarium number	Locality	Date	Coordinates	Collector number	Collectors	Habitat
UFG43657	Brazil, State of Goiás, Britânia, Lago dos Tigres, downstream of the "lake", Lago dos Tigres Farm, Site 9	20/08/2008	15°13'43" S; 51°9'14" W	ISN1247	Nogueira, I.S.	Phytoplankton
UFG43658	Brazil, State of Goiás, Britânia, Lago dos Tigres, outfall of the "lake" in Vermelho River, Site 10	20/08/2008	15°13'18" S; 51°10'6" W	ISN1248	Nogueira, I.S.	Phytoplankton
UFG43659	Brazil, State of Goiás, Britânia, Lago dos Tigres, new channel of the Vermelho River, Site 11	20/08/2008	15°11'47" S; 51°9'57" W	ISN1249	Nogueira, I.S.	Phytoplankton
UFG43662	Brazil, State of Goiás, Britânia, Água Limpa River, Água Limpa Farm, Site 1	16/09/2008	15°18'58" S; 51°9'56" W	ISN1252	Nogueira, I.S.	Phytoplankton
UFG43663	Brazil, State of Goiás, Britânia, Lago dos Tigres, Perdidas Island, Site 2	16/09/2008	15°17'57" S; 51°10'7" W	ISN1253	Nogueira, I.S.	Phytoplankton
UFG43664	Brazil, State of Goiás, Britânia, Lago dos Tigres, outfall of Luanda Stream, Santo Antônio Farm, Site 3	16/09/2008	15°16'47" S; 51°9'44" W	ISN1254	Nogueira, I.S.	Phytoplankton
UFG43665	Brazil, State of Goiás, Britânia, Lago dos Tigres, Santo Antônio Farm, Site 4	16/09/2008	15°16'17" S; 51°9'10" W	ISN1255	Nogueira, I.S.	Phytoplankton
UFG43666	Brazil, State of Goiás, Britânia, Lago dos Tigres, outfall of Arco-Íris Stream, Site 5	16/09/2008	15°15'46" S; 51°8'41" W	ISN1256	Nogueira, I.S.	Phytoplankton
UFG43667	Brazil, State of Goiás, Britânia, Lago dos Tigres, harbor ferry, Site 6	16/09/2008	15°15'12" S; 51°8'33" W	ISN1257	Nogueira, I.S.	Phytoplankton
UFG43668	Brazil, State of Goiás, Britânia, Lago dos Tigres, Lago dos Tigres Farm, Site 7	16/09/2008	15°14'17" S; 51°8'59" W	ISN1258	Nogueira, I.S.	Phytoplankton
UFG43669	Brazil, State of Goiás, Britânia, Lago dos Tigres, city in front of the Christ, Site 8	16/09/2008	15°14'9" S; 51°9'27" W	ISN1259	Nogueira, I.S.	Phytoplankton
UFG43670	Brazil, State of Goiás, Britânia, Lago dos Tigres, downstream of the "lake", Lago dos Tigres Farm, Site 9	17/09/2008	15°13'43" S; 51°9'14" W	ISN1260	Nogueira, I.S.	Phytoplankton
UFG43671	Brazil, State of Goiás, Britânia, Lago dos Tigres, outfall of the "lake" in Vermelho River, Site 10	17/09/2008	15°13'18" S; 51°10'6" W	ISN1261	Nogueira, I.S.	Phytoplankton
UFG43672	Brazil, State of Goiás, Britânia, Lago dos Tigres, new channel of the Vermelho River, Site 11	17/09/2008	15°11'47" S; 51°9'57" W	ISN1262	Nogueira, I.S.	Phytoplankton
UFG43675	Brazil, State of Goiás, Britânia, Água Limpa River, Água Limpa Farm, Site 1	19/10/2008	15°18'58" S; 51°9'56" W	ISN1265	Nogueira, I.S.	Phytoplankton
UFG43676	Brazil, State of Goiás, Britânia, Lago dos Tigres, Perdidas Island, Site 2	19/10/2008	15°17'57" S; 51°10'7" W	ISN1266	Nogueira, I.S.	Phytoplankton

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Table 2. Continued.

Herbarium number	Locality	Date	Coordinates	Collector number	Collectors	Habitat
UFG43677	Brazil, State of Goiás, Britânia, Lago dos Tigres, outfall of Luanda Stream, Santo Antônio Farm, Site 3	19/10/2008	15°16'47" S; 51°9'44" W	ISN1267	Nogueira, I.S.	Phytoplankton
UFG43678	Brazil, State of Goiás, Britânia, Lago dos Tigres, Santo Antônio Farm, Site 4	19/10/2008	15°16'17" S; 51°9'10" W	ISN1268	Nogueira, I.S.	Phytoplankton
UFG43679	Brazil, State of Goiás, Britânia, Lago dos Tigres, outfall of Arco-Íris Stream, Site 5	19/10/2008	15°15'46" S; 51°8'41" W	ISN1269	Nogueira, I.S.	Phytoplankton
UFG43680	Brazil, State of Goiás, Britânia, Lago dos Tigres, harbor ferry, Site 6	19/10/2008	15°15'12" S; 51°8'33" W	ISN1270	Nogueira, I.S.	Phytoplankton
UFG43681	Brazil, State of Goiás, Britânia, Lago dos Tigres, Lago dos Tigres Farm, Site 7	19/10/2008	15°14'17" S; 51°8'59" W	ISN1271	Nogueira, I.S.	Phytoplankton
UFG43682	Brazil, State of Goiás, Britânia, Lago dos Tigres, city in front of the Christ, Site 8	19/10/2008	15°14'9" S; 51°9'27" W	ISN1272	Nogueira, I.S.	Phytoplankton
UFG43683	Brazil, State of Goiás, Britânia, Lago dos Tigres, downstream of the "lake", Lago dos Tigres Farm, Site 9	20/10/2008	15°13'43" S; 51°9'14" W	ISN1273	Nogueira, I.S.	Phytoplankton
UFG43684	Brazil, State of Goiás, Britânia, Lago dos Tigres, outfall of the "lake" in Vermelho River, Site 10	20/10/2008	15°13'18" S; 51°10'6" W	ISN1274	Nogueira, I.S.	Phytoplankton
UFG43685	Brazil, State of Goiás, Britânia, Lago dos Tigres, new channel of the Vermelho River, Site 11	20/10/2008	15°11'47" S; 51°9'57" W	ISN1275	Nogueira, I.S.	Phytoplankton
UFG43688	Brazil, State of Goiás, Britânia, Água Limpa River, Água Limpa Farm, Site 1	15/11/2008	15°18'58" S; 51°9'56" W	ISN1278	Nogueira, I.S.	Phytoplankton
UFG43689	Brazil, State of Goiás, Britânia, Lago dos Tigres, Perdidas Island, Site 2	15/11/2008	15°17'57" S; 51°10'7" W	ISN1279	Nogueira, I.S.	Phytoplankton
UFG43690	Brazil, State of Goiás, Britânia, Lago dos Tigres, outfall of Luanda Stream, Santo Antônio Farm, Site 3	15/11/2008	15°16'47" S; 51°9'44" W	ISN1280	Nogueira, I.S.	Phytoplankton
UFG43691	Brazil, State of Goiás, Britânia, Lago dos Tigres, Santo Antônio Farm, Site 4	15/11/2008	15°16'17" S; 51°9'10" W	ISN1281	Nogueira, I.S.	Phytoplankton
UFG43692	Brazil, State of Goiás, Britânia, Lago dos Tigres, outfall of Arco-Íris Stream, Site 5	15/11/2008	15°15'46" S; 51°8'41" W	ISN1282	Nogueira, I.S.	Phytoplankton
UFG43693	Brazil, State of Goiás, Britânia, Lago dos Tigres, harbor ferry, Site 6	15/11/2008	15°15'12" S; 51°8'33" W	ISN1283	Nogueira, I.S.	Phytoplankton
UFG43694	Brazil, State of Goiás, Britânia, Lago dos Tigres, Lago dos Tigres Farm, Site 7	15/11/2008	15°14'17" S; 51°8'59" W	ISN1284	Nogueira, I.S.	Phytoplankton

Continued on next page

Table 2. Continued.

Herbarium number	Locality	Date	Coordinates	Collector number	Collectors	Habitat
UFG43695	Brazil, State of Goiás, Britânia, Lago dos Tigres, city in front of the Christ, Site 8	15/11/2008	15°14'9" S; 51°9'27" W	ISN1285	Nogueira, I.S.	Phytoplankton
UFG43696	Brazil, State of Goiás, Britânia, Lago dos Tigres, downstream of the "lake", Lago dos Tigres Farm, Site 9	16/11/2008	15°13'43" S; 51°9'14" W	ISN1286	Nogueira, I.S.	Phytoplankton
UFG43697	Brazil, State of Goiás, Britânia, Lago dos Tigres, outfall of the "lake" in Vermelho River, Site 10	16/11/2008	15°13'18" S; 51°10'6" W	ISN1287	Nogueira, I.S.	Phytoplankton
UFG43698	Brazil, State of Goiás, Britânia, Lago dos Tigres, new channel of the Vermelho River, Site 11	16/11/2008	15°11'47" S; 51°9'57" W	ISN1288	Nogueira, I.S.	Phytoplankton
UFG43701	Brazil, State of Goiás, Britânia, Água Limpa River, Água Limpa Farm, Site 1	11/12/2008	15°18'58" S; 51°9'56" W	ISN1291	Nogueira, I.S.	Phytoplankton
UFG43702	Brazil, State of Goiás, Britânia, Lago dos Tigres, Perdidas Island, Site 2	11/12/2008	15°17'57" S; 51°10'7" W	ISN1292	Nogueira, I.S.	Phytoplankton
UFG43703	Brazil, State of Goiás, Britânia, Lago dos Tigres, outfall of Luanda Stream, Santo Antônio Farm, Site 3	11/12/2008	15°16'47" S; 51°9'44" W	ISN1293	Nogueira, I.S.	Phytoplankton
UFG43704	Brazil, State of Goiás, Britânia, Lago dos Tigres, Santo Antônio Farm, Site 4	11/12/2008	15°16'17" S; 51°9'10" W	ISN1294	Nogueira, I.S.	Phytoplankton
UFG43705	Brazil, State of Goiás, Britânia, Lago dos Tigres, outfall of Arco-Íris Stream, Site 5	11/12/2008	15°15'46" S; 51°8'41" W	ISN1295	Nogueira, I.S.	Phytoplankton
UFG43706	Brazil, State of Goiás, Britânia, Lago dos Tigres, harbor ferry, Site 6	11/12/2008	15°15'12" S; 51°8'33" W	ISN1296	Nogueira, I.S.	Phytoplankton
UFG43707	Brazil, State of Goiás, Britânia, Lago dos Tigres, Lago dos Tigres Farm, Site 7	11/12/2008	15°14'17" S; 51°8'59" W	ISN1297	Nogueira, I.S.	Phytoplankton
UFG43708	Brazil, State of Goiás, Britânia, Lago dos Tigres, city in front of the Christ, Site 8	11/12/2008	15°14'9" S; 51°9'27" W	ISN1298	Nogueira, I.S.	Phytoplankton
UFG43709	Brazil, State of Goiás, Britânia, Lago dos Tigres, outfall of the "lake" in Vermelho River, Site 9	12/12/2008	15°13'43" S; 51°9'14" W	ISN1299	Nogueira, I.S.	Phytoplankton
UFG43710	Brazil, State of Goiás, Britânia, Lago dos Tigres, outfall of the "lake" in Vermelho River, Site 10	12/12/2008	15°13'18" S; 51°10'6" W	ISN1300	Nogueira, I.S.	Phytoplankton
UFG43711	Brazil, State of Goiás, Britânia, Lago dos Tigres, new channel of the Vermelho River, Site 11	12/12/2008	15°11'47" S; 51°9'57" W	ISN1301	Nogueira, I.S.	Phytoplankton
UFG43714	Brazil, State of Goiás, Britânia, Água Limpa River, Água Limpa Farm, Site 1	21/01/2009	15°18'58" S; 51°9'56" W	ISN1304	Nogueira, I.S.	Phytoplankton

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Table 2. Continued.

Herbarium number	Locality	Date	Coordinates	Collector number	Collectors	Habitat
UFG43715	Brazil, State of Goiás, Britânia, Lago dos Tigres, Perdidas Island, Site 2	21/01/2009	15°17'57" S; 51°10'7" W	ISN1305	Nogueira, I.S.	Phytoplankton
UFG43716	Brazil, State of Goiás, Britânia, Lago dos Tigres, outfall of Luanda Stream, Santo Antônio Farm, Site 3	21/01/2009	15°16'47" S; 51°9'44" W	ISN1306	Nogueira, I.S.	Phytoplankton
UFG43717	Brazil, State of Goiás, Britânia, Lago dos Tigres, Santo Antônio Farm, Site 4	21/01/2009	15°16'17" S; 51°9'10" W	ISN1307	Nogueira, I.S.	Phytoplankton
UFG43718	Brazil, State of Goiás, Britânia, Lago dos Tigres, outfall of Arco-Íris Stream, Site 5	21/01/2009	15°15'46" S; 51°8'41" W	ISN1308	Nogueira, I.S.	Phytoplankton
UFG43719	Brazil, State of Goiás, Britânia, Lago dos Tigres, harbor ferry, Site 6	21/01/2009	15°15'12" S; 51°8'33" W	ISN1309	Nogueira, I.S.	Phytoplankton
UFG43720	Brazil, State of Goiás, Britânia, Lago dos Tigres, Lago dos Tigres Farm, Site 7	21/01/2009	15°14'17" S; 51°8'59" W	ISN1310	Nogueira, I.S.	Phytoplankton
UFG43721	Brazil, State of Goiás, Britânia, Lago dos Tigres, city in front of the Christ, Site 8	21/01/2009	15°14'9" S; 51°9'27" W	ISN1311	Nogueira, I.S.	Phytoplankton
UFG43722	Brazil, State of Goiás, Britânia, Lago dos Tigres, downstream of the "lake", Lago dos Tigres Farm, Site 9	22/01/2009	15°13'43" S; 51°9'14" W	ISN1312	Nogueira, I.S.	Phytoplankton
UFG43723	Brazil, State of Goiás, Britânia, Lago dos Tigres, outfall of the "lake" in Vermelho River, Site 10	22/01/2009	15°13'18" S; 51°10'6" W	ISN1313	Nogueira, I.S.	Phytoplankton
UFG43724	Brazil, State of Goiás, Britânia, Lago dos Tigres, new channel of the Vermelho River, Site 11	22/01/2009	15°11'47" S; 51°9'57" W	ISN1314	Nogueira, I.S.	Phytoplankton

Distribution. Brazil, State of São Paulo, São Paulo, Parque Estadual das Fontes do Ipiranga (Rocha & Bicudo 2008); Pioneer citation for the State of Goiás.

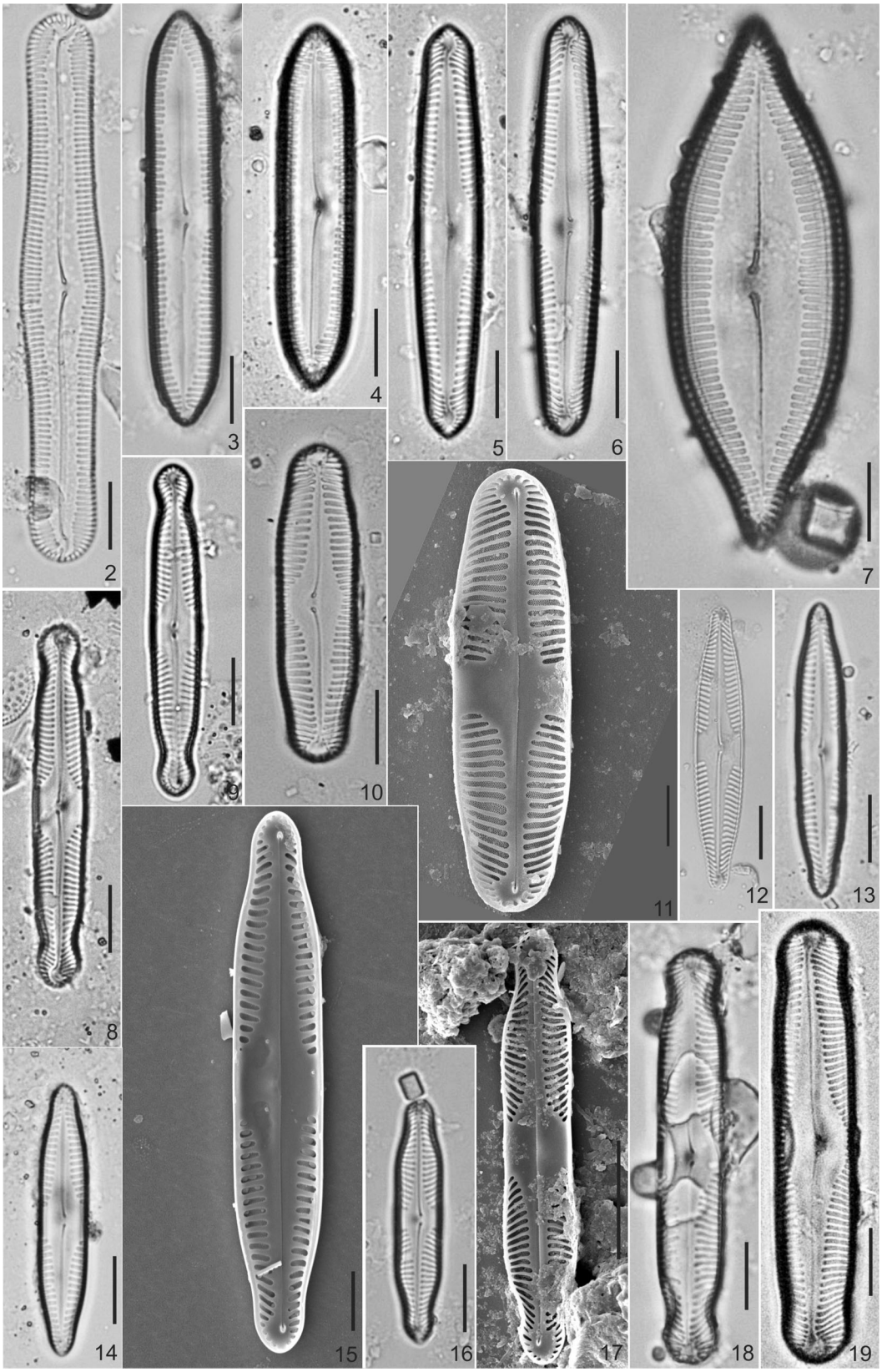
Remarks. Krammer (2000, p. 55, 214) cited in the original description the specimens recorded on "Figs. 21: 8, 9" as representatives of *P. acrophaeria* var. *tumidula*. However, in the legend of these figures, Krammer (2000, p. 300) cited "Figs. 8, 9. *Pinnularia acrosphaeria* var. *turgidula* Grunow ex Cleve (p. 55)". Krammer (2000, p. 300) still described the specimens recorded on the figures 8 and 9 originally from "Nelubium pond in the botanical garden Munich, slide 1792 MR) which corresponds to the type and type locality of *P. acrosphaeria* var. *tumidula* (and not *P. acrosphaeria* var. *turgidula*), i.e., "Nelubium pond in the botanical garden Munich, slide 1792 MR" (see Krammer 2000, p. 55, 214). Because the agreement with the type and type locality and with the original description of the taxa, we concluded that the description of the legend is, actually, a typographic error that can be corrected. In contrast, if it was not accepted as typographic error, the taxon would not be valid because was published without an illustration as required by Art. 44.2 of the ICN (McNeill et al., 2012). Similarly, other authors seem to consider the legend of the Krammer (2000, figures 21: 8, 9) as a typographical error since has adopted the name as validly proposed (e.g., Rocha & Bicudo 2008, Montoya-Moreno et al. 2013).

The diacritical characteristic of this taxon from the nominated variety is the prominent intumescence at the middle part of the valve (Krammer 2000). The specimens found in Lago dos Tigres agreed with the original description and is very similar to the type material illustrated by Krammer (2000, figure 21: 9). Rocha & Bicudo (2008) also found *P. acrosphaeria* var. *tumidula* in the State of São Paulo, which the specimens of the Lagos dos Tigres were similar.

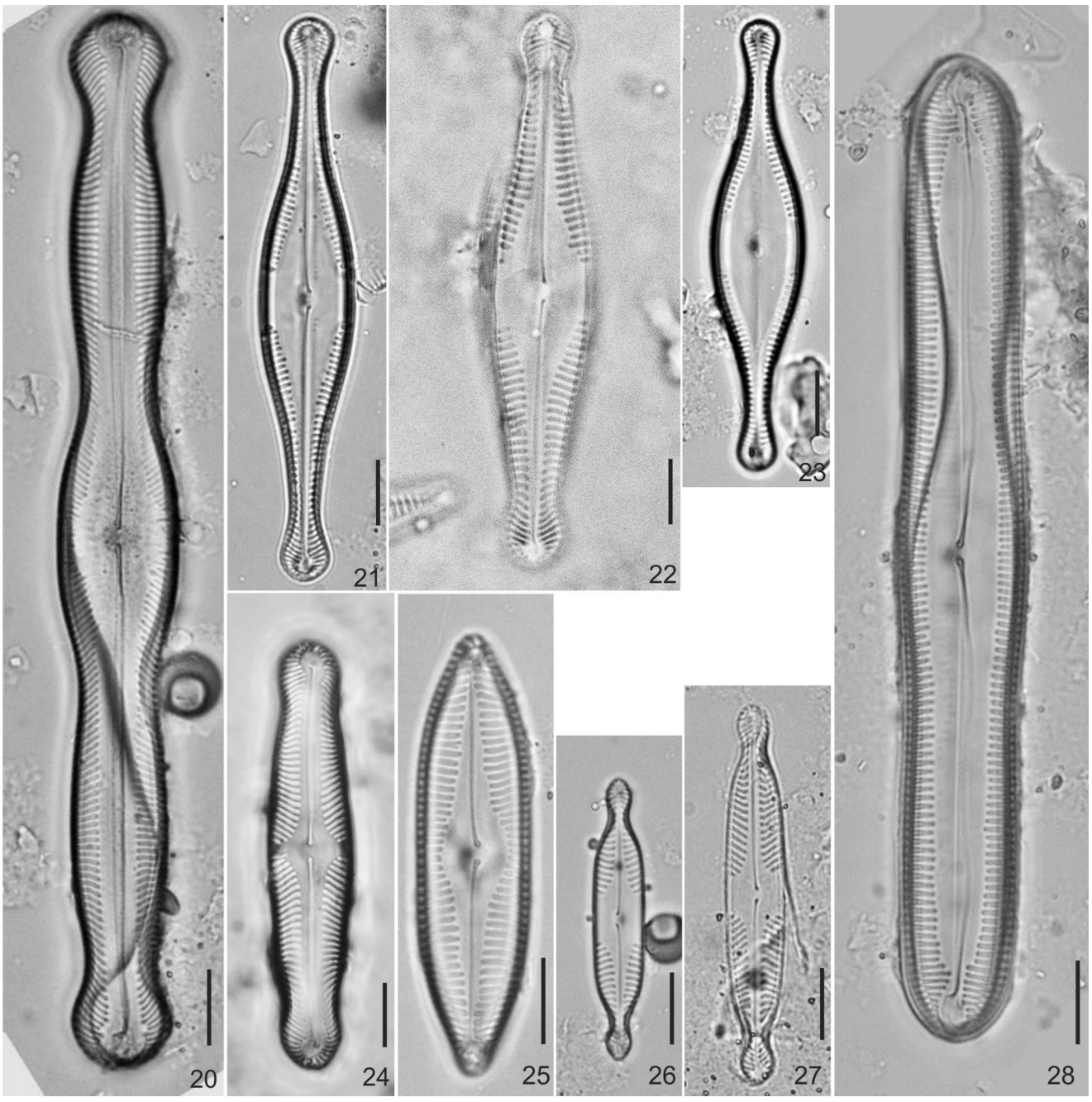
All the taxa subscribed to *P. acrophaeria* present axial area with granulations (Krammer 2000). Although this feature was observed in the representatives of *P. acrophaeria* var. *tumidula* from Lago dos Tigres, it seems to be inconspicuous during the process of microphotography (Figure 2). This seems to be the case of the representatives recorded by Rocha & Bicudo (2008, Figures 43, 44), in which the granulations were little evident in the pictures but this data was provided in the characterization of the species.

Table 3. Morphometric characteristics of the representatives of *Pinnularia* found in Lago dos Tigres System

Species	Length (μm)	Breadth (μm)	Length/breadth ratio	Striae in 10 μm	Valves	Axial area
Pinnularia acrosphaeria var. *tumidula*	79–82	12.5–12.66	6.32–6.57	12	linear, tumid at the middle part	broad, linear
Pinnularia brauniana var. *sanctipaulensis*	49.12–53.93	7.68–8.37	6.15–6.91	10–12	linear-lanceolate	somewhat rhomboid, with large fascia reaching the margins
Pinnularia certa	48–60	7–9	5.97–7.92	10–11	linear-lanceolate	lanceolate
Pinnularia cf. *acuminata*	45–61	10.5–12	4.01–5.79	10–11	linear	wide, linear-lanceolate
Pinnularia divergens var. *mesoleptiformis*	64.24–72.81	12.04–13.78	4.82–5.25	10–11	lanceolate, triundulate margins	linear
Pinnularia hudsonii	61.81–67.64	10–11	5.6–6.6	10–11	lanceolate	lanceolate, broad
Pinnularia instabilis	53.71–83.11	17.7–21.3	3.03–4.54	10	lanceolate, wide	lanceolate, broad
Pinnularia latarea	45.69–62.6	7.91–10.38	5.77–6.03	11–12	linear, with slightly undulated margins	narrowly lanceolate
Pinnularia mayeri	52	7	7.42	10–11	linear-lanceolate	linear-lanceolate
Pinnularia meridiana var. *meridiana*	43.81–62.79	8.22–11.37	4.01–6.16	11	linear, with bi-undulate margins	rhomboid
Pinnularia microstauron var. *brasiliensis*	41.14–45.79	7.22–8.6	5.37–6.57	10–11	linear, with bi-undulated margins	rhomboide
Pinnularia microstauron var. *rostrata*	35.2–36.49	6.23–7.32	4.89–5.41	10–13	linear	rhomboid
Pinnularia perumbrosa	105.49–148.22	11.13–17.88	7.78–8.78	10–12	linear, triundulate and inflamade at the middle part	linear-lanceolate
Pinnularia rostratissima f. *subundulata*	81.85–91.22	12.47–15.43	5.83–6.53	8–10	rhomboid-lanceolate, inflated at the middle part and slightly undulated margins	broad, rhomboid
Pinnularia rostratissima var. *rostratissima*	81.27–88.12	13.78–15.63	5.63–5.89	10–11	fusiform-lanceolate, strongly inflated at the middle part	broad, lanceolate
Pinnularia rostratissima var. *ventricosa*	70	15	4.66	12	fusiform-lanceolate, inflated at the middle part	fusiform
Pinnularia rumrichiae	38.17–43.24	7.12–8.01	4.81–5.92	10–12	linear	lanceolate
Pinnularia silviasalae	58.71–69.52	11.32–12.76	4.98–5.95	10–12	linear, with slightly undulated margins	indistinct from the axial area to broadly circular, almost reaching the margins
Pinnularia superpaulensis	123.2–126.7	17.14–19.33	6.41–7.01	10–11	linear, slightly tumid at middle part	lanceolate
Pinnularia variarae	49.32–54.27	13.65–15.13	3.59–3.81	9–11	linear-lanceolate, with straight margins	circular to elliptical, sometimes indistinct from the axial area



Figures 2–19. Species of *Pinnularia* from Lago dos Tigres (Figures 2–10, 12–14, 16, 18, 19: light microscopy; Figures 11, 15, 17: scanning electron microscopy); Figure 2. *Pinnularia acrosphaeria* var. *tumidula*; Figures 3, 4. *Pinnularia acuminata*; Figures 5, 6. *Pinnularia hudsonii*; Figure 7. *Pinnularia instabilis*; Figures 8, 9. *Pinnularia mayeri*, Figures 10, 11. *Pinnularia meridiana* var. *meridiana*; Figure 12. *Pinnularia certa*; Figure 13–15. *Pinnularia microstauron* var. *brasiliensis*; Figures 16–17. *Pinnularia microstauron* var. *rostrata*; Figure 18. *Pinnularia latarea*; Figure 19. *Pinnularia silviasalae*. Scale bar: Figures 2–10, 12–14, 16–19: 10 µm; Figures 11, 15: 5 µm.



Figures 20–28. Species of *Pinnularia* from Lago dos Tigres (light microscopy); Figure 20. *Pinnularia perumbrosa*; Figure 21. *Pinnularia rostratissima* var. *rostratissima*; Figure 22. *Pinnularia rostratissima* f. *subundulata*; Figure 23. *Pinnularia rostratissima* var. *ventricosa*; Figure 24. *Pinnularia divergens* var. *mesoleptiformis*; Figure 25. *Pinnularia variarae*; Figure 26. *Pinnularia rumrichiae*; Figure 27. *Pinnularia brauniana* var. *sanctipaulensis*; Figure 28. *Pinnularia superpaulensis*. Scale bar: 10 μm.

Pinnularia brauniana var. *sanctipaulensis*

A.C.R. Rocha, Hoehnea, vol. 35, n. 4, p. 603, Figs. 21–25, 2008. (Figure 27)

Holotype. Preparation SP255743 in Herbário "Maria Eneyda P. Kauffmann Fidalgo" (SP) do Instituto de Botânica da Secretaria do Meio Ambiente do Estado de São Paulo.

Type locality. Lago das Ninféias, Parque Estadual das Fontes do Ipiranga, São Paulo, State of São Paulo, Brazil.

Valves linear-lanceolate; capitate apices; length: 49.12–53.93 μm, breadth: 7.68–8.37 μm, length/breadth ratio: 6.15–6.91; axial area linear to linear-lanceolate; axial area somewhat rhomboid, with large fascia reaching the margins; raphe lateral, terminal fissures hooked, proximal fissures curved to the same side; striae radiated, becoming convergent towards to the ends of the valves; striae: 10–12/10 μm.

Material examined

Brazil, Goiás, Britânia, Lago dos Tigres, plankton, Nogueira et al., Site 11, 20/10/2008, P11M10, ISN1275 (UFG 43685).

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Distribution

Brazil, State of São Paulo, São Paulo, Parque Estadual das Fontes do Ipiranga (Rocha & Bicudo 2008); Pioneer citation for the State.

Pinnularia certa

Krammer & Metzeltin, Iconogr. Diatomol., vol. 5, p. 166, Figs. 178: 12–17, 1998. (Figure 12)

Holotype. Preparation 2607c KASSEL, Collection Krasske in Naturkundemuseum im Ottoneum (KASSEL), Kassel, Germany.

Type locality. Demerara River, Guyana.

Valves linear-lanceolate; narrowly rounded apices; length: 48–60 μm, breadth: 7–9 μm, length/breadth ratio: 5.97–7.92; axial area lanceolate; central area rectangular, reaching the valvae margins; raphe lateral, proximal raphe fissures unilaterally deflected; striae short, radiate, becoming convergent towards to the ends of the valves; striae: 10–11/10 μm.

Material examined. Brazil, State of Goiás, Britânia, Lago dos Tigres, Baía das Perdidas, periphyton, Nogueira *et al.* Site 2, 13/07/2004, ISN939 (UFG 29945); Água Limpa River, plankton, Nogueira *et al.* Site 1, 09/09/2004, ISN985 (UFG 29907).

Distribution. Brazil, State of Amazonas, Lago Calado; State of Pará, Tapajós River (Metzeltin & Lange-Bertalot 1998); Pioneer citation for the State of Goiás.

Remarks. Pinnularia *certa* is very similar to *P. microstauron* var. *brasiliensis* Krammer & Metzeltin (see below), including metric characteristics as recorded in their original descriptions (Metzeltin & Lange-Bertalot 1998). However, *P. certa* presents wider central margin reaching the margins than in *P. microstauron* var. *brasiliensis*. Moreover, *P. microstauron* var. *brasiliensis* has straight and parallel margins while in *P. certa* the margins are slightly convex.

The outline of the individuals found in Lago dos Tigres was similar to *P. certa*. However, some of these representatives were longer (48–60 μm against 43–54 μm) and or narrower (7–9 μm against 8.4–9.4 μm) than the type population characterized by Metzeltin & Lange-Bertalot (1998).

Pinnularia cf. *acuminata*

W.Sm., Syn. British. Diat., vol. 1, p. 55, Fig. 18: 164, 1853. (Figures 3, 4)

Lectotype. Preparation IX-38-A7 VH, Collection Van Heurck in the Dr. Henri Van Heurck Museum (AWH), Antwerp, Belgium, designated by Krammer (2000, p. 159).

Isolectotype. Preparation 20600 BM, Collection Natural History Museum in the Natural History Museum (BM), London, England, designated by Krammer (2000, p. 159).

Type locality. Premmay Peat, Aberdeenshire, Scotland.

Valves linear, sometimes with slightly concave margins at the middle part; cuneate apices; length: 45–61 μm, breadth: 10.5–12 μm, length/breadth ratio: 4.01–5.79; axial area wide, linear-lanceolate, reaching $\frac{1}{2}$ of the breadth of the valvae; central area with thin fascia, reaching the valves margins; raphe lateral, proximal ends slightly curved to the same side; striae short, parallel, becoming slightly convergent towards to the ends of the valves; striae: 10–11/10 μm.

Material examined. Brazil, State of Goiás, Britânia, Lago dos Tigres, Baía das Perdidas, periphyton, Nogueira et al., Site 2, 13/07/2004, ISN939 (UFG 29945); Água Limpa River, plankton, Nogueira et al., Site 1, 09/09/2004, ISN985 (UFG 29907); Lago dos Tigres, plankton, Nogueira et al., Site 10, 18/07/2008, P10M07, ISN1235 (UFG 43645), Site 01, 15/11/2008, P01M11, ISN1278 (UFG 43688).

Distribution. Brazil, State of Amazonas, Negro River (Metzeltin & Lange-Bertalot 2007); State of Paraná, Guaraguaçu River (Tremarin et al. 2010); Pioneer citation for the State of Goiás.

Remarks. *P. acuminata* and *P. inconstans* Mayer presents similar outlines, but the first one has acuminate apices, wider axial area and an inconspicuous to small fascia (Krammer 2000, figures 144: 7–9). On the other hand, the neotype specimens of *P. inconstans* have more rounded ends of the valvae, narrower axial area, and a conspicuous fascia (Krammer 2000, figures 143:3–5, 11, 12). Such similarities lead to confusions concerning the identification of the two taxa in some studies of diatom flora.

Pinnularia inconstans sensu Krammer (2000, Fig 143: 10), from Demerara River, Guyana, and *P. inconstans* sensu Tremarin et al. (2010), from the State of Paraná, Brazil, for example, present more similar characteristics to the complex *P. acuminata*, specially *P. acuminata* var. *guyanensis* Metzeltin & Lange-Bert. (Metzeltin & Lange-Bertalot 2007). This taxa differs from the nominated variety because breather (9.5–10 against 12–16 μm) and smaller valves (36–42 against 40–84 μm), and higher density of striae (10–11 against 8–10 striae per 10 μm) (Metzeltin & Lange-Bertalot 2007).

The representatives of *Pinnularia* cf. *acuminata* from Lago dos Tigres were similar to *P. inconstans* sensu Krammer (2000, Fig 143: 10) and *P. inconstans* sensu Tremarin et al. (2010), and, concomitantly, to *P. acuminata* var. *guyanensis*, but presented breadth values intergrading with those of the nominated variety. The densities of striae of the specimens from Lago dos Tigres were slightly higher than *P. acuminata* var. *acuminata* but agreed with *P. acuminata* var. *guyanensis*. However, *Pinnularia* cf. *acuminata* presented a wider axial area and more cuneated valvar ends than the type of *P. acuminata*.

The outline, including valvar ends, and axial area of *Pinnularia* cf. *acuminata* was similar to *P. acuminata* var. *novaezealandica* Krammer sensu Tremarin et al. (2010). However, the representatives found in Lago dos Tigres were smaller (45–61 μm against 86.1–133.3 μm), and narrower (10.5–12 μm against 13.3–14.1 μm) than the specimens in Tremarin et al. (2010). Similarly to our representatives, *P. acuminata* var. *novaezealandica* sensu Tremarin et al. (2010, figure 9) differs from the type specimens of this taxon as illustrated by Krammer (2000, figures 148: 1–5) because presents wider axial area and more cuneated valvar ends, although agreed partially with *P. acuminata* var. *novaezealandica* [*novazealandica*] sensu Metzeltin & Lange-Bertalot (2007, Figures 262: 1–3).

The individuals from Lago dos Tigres present outline to *P. subacuminata* Krammer & Metzeltin, but still here the axial area of *Pinnularia* cf. *acuminata* was slightly narrower, the valvar ends were cuneate instead cuneate-rounded, as observed in *P. subacuminata*. Moreover, *P. subacuminata* is larger (45–61 μm against 95–115 μm) than the specimens from Lago dos Tigres.

Compared to *P. angustivalva* Krammer & Metzeltin, *Pinnularia* cf. *acuminata* present axial area slightly wider, smaller central area, margins slightly convex, and valvar ends cunead-obtuse against cuneate in the representatives os Lago dos Tigres. Some

representatives of *Pinnularia* cf. *acuminata* were larger (38–54 μm against 45–61 μm) and all were wider (6.7–8 μm against 10.5–12 μm), and less densely striated (13–14/10 μm against 10–11/10μm) than *P. angustivalva*.

Other similar species is *P. instabiliformis* Krammer & Metzeltin, which also present wide axial area but the valvar ends cuneate-subrostrate (Metzeltin & Lange-Bertalot 1998, figures 8–11) or cuneate- rounded (Metzeltin & Lange-Bertalot 1998, Figures 8–12) comparing to the simply cuneate valvar ends of *Pinnularia* cf. *acuminata*. Some representatives of *Pinnularia* cf. *acuminata* were larger (36–52 μm against 45–61 μm) or slightly wider (10.4 – 11.7 μm against 10.5–12 μm) than *P. instabiliformis*.

Since Lago dos Tigres presented intermediate specimens between several taxa compared here, we identified the taxon as *Pinnularia* cf. *acuminata*, the oldest epithet and the most similar taxon of this complex. More accurate studies should be carried out in order to verify the limits and circumscription among the taxa of this complex.

Pinnularia divergens var. *mesoleptiformis*

Metzeltin e Lange-Bert., Iconogr. Diatomol, vol. 5, p. 170, Figs. 173: 1–4, 1998. (Figure 24)

Holotype. Preparation AmS-521, Collection Lange-Bertalot in Botanisches Institüt der J. W. Goethe Universität, Frankfurt/Main, Germany.

Type locality. Kaieteur-Falss, Potaro River, Guyana.

Valves lanceolate, triundulate margins; rounded apices; length: 64.24–72.81 μm, breadth: 12.04–13.78 μm, length/breadth ratio: 4.82–5.25; axial area linear; central area rhomboid, with fascia reaching the margins; raphe lateral, terminal fissures bayonet-shapes, proximal fissures curved to the same side; striae radiated, becoming convergent towards to the ends of the valves; striae: 10–11/10 μm.

Material examined. Brazil, State of Goiás, Britânia, Lago dos Tigres, plankton, Nogueira *et al.* Site 5, 04/07/2004, ISN878 (UFG 29867); Site 4, 04/06/2004, ISN877 (UFG 29866); Site 11, 17/10/2004, ISN1033 (UFG 29928);

Distribution. Brazil, State of Paraná, Guaraguaçu River (Tremarin et al. 2009, 2010); State of São Paulo, São Paulo, Parque Estadual das Fontes do Ipiranga (Rocha & Bicudo 2008); Pioneer citation for the State of Goiás.

Remarks. The specimens from Lago dos Tigres agreed with the description provided by Metzeltin & Lange-Bertalot (1998). They also were similar but smaller than those illustrated by Rocha & Bicudo (2008) and Tremarin et al. (2010).

Pinnularia hudsonii

Metzeltin, Lange-Bert. & García-Rodríguez, Iconogr. Diatomol., vol. 15, p. 156, Figs 177:1–11, 2005. (Figures 5, 6)

Holotype. Preparation Uru 2002-2, Collection Lange-Bertalot in Botanisches Institüt der J. W. Goethe Universität, Frankfurt/Main, Germany.

Type locality. Rio de La Plata, near Colonia Del Sacramento, Uruguay.

Valves lanceolate; rostrate-cuneate apices; length: 61.81–67.64 μm, breadth: 10–11 μm, length/breadth ratio: 5.6–6.6; axial area lanceolate, broad; central area with fascia, reaching the valvae margins; raphe lateral, terminal ends hooked, proximal ends slightly curved in the same direction.; striae radiate, becoming convergent towards to the ends of the valves; striae: 10–11/10 μm.

Material examined. Brazil, Goiás, Britânia, Lago dos Tigres, plankton, Nogueira et al., Site 8, 13/07/2004, ISN904 (UFG 29887), Site 7, 17/07/2008, P07M07, ISN1232 (UFG 43642); Site 10, 18/07/2008, P10M07, ISN1235 (UFG 43645), Site 11, 20/10/2008, P11M10, ISN1275 (UFG 43685).

Distribution. Brazil, State of Paraná, Guaraguaçu River (Tremarin et al. 2010); Salto Amazonas River (Santos et al. 2011); Pioneer citation for the State of Goiás.

Remarks. The specimens from Lago dos Tigres agreed with the type material, except by the ends which are slight cuneate in the material from Britânia. Similar ends were observed also in the material from Guaraguaçu River (Tremarin et al. 2010, figure 34), what suggest this characteristic as a possible morphological variation into the species.

Pinnularia instabilis

(A. Schmidt) Metzeltin in Metzeltin & Lange-Bertalot, Iconogr. Diatomol., vol. 5, p. 178, Figs. 194: 1–3, Figs. 205: 4–5, 1998. (Figure 7)

Basionym. *Navicula instabilis* A.Schmidt, A. Schmidt's Atlas, Figures 43: 38–40, non Figures 43: 35–37, 1875.

Lectotype (designated here). One figure in Schmidt (1875, Figure 43: 39) (Figure 7)

Lectotype locality. Demerara River, Guyana.

Valves lanceolate, wide; acuminate or attenuated-peaked apices; length: 53.71–83.11 μm, breadth: 17.7–21.3 μm, length/breadth ratio: 3.03–4.54; axial area lanceolate, broad, reaching $\frac{1}{2}$ of the breadth of the valvae; raphe filiform to slightly lateral, terminal ends hooked and proximal ends curved to the same direction; striae parallel becoming slightly radiate towards to the ends of the valves; striae: 10/10 μm.

Material examined. Brazil, State of Goiás. Britânia, Lago dos Tigres, plankton, Nogueira *et al*., Site 2, 13/07/2004, ISN898 (UFG 29880); Site 4, 04/06/2004, ISN877 (UFG 29866), Site 7, 17/07/2008, P07M07, ISN1232 (UFG 43642); Site 01, 16/09/2008, P01M09, ISN1252 (UFG 43662); Site 02, 16/09/2008, P02M09, ISN1253 (UFG 43663); Site 11, 20/10/2008, P11M10, ISN1275 (UFG 43685), periphyton, Site 2, 09/09/2004 ISN1014 (UFG 29953).

Distribution. Brazil, State of Amazonas, Tupé Lake (Pereira et al. 2013); Pioneer citation for the State of Goiás.

Remarks. In its original proposal, Schmidt (1875, Figures 43: 35–40) illustrated *P. instabilis*. In the legend of these illustrations, he (Schmidt 1875) highlighted his figures 43: 37 and 43: 39 with the acronym "typ.", indicating there and in other parts of his study, the typical representatives of respective taxa. Based on the outline and measures of these illustrations, Metzeltin in Metzeltin & Lange-Bertalot (1998, p. 178) considered the set of Schmidt's specimens of Figures 43: 35–37 as *P. subacuminata* Krammer & Metzeltin and regarded the name *P. instabilis* to Schmidt's specimens from figures 43: 38–40. Since the preferences of Schmidt (1875, figures 43: 37, 39) proven to be ambiguous and that, among them, only remain the figure 43: 39 as the original sense, we designated it as lectotype. Complementarily, we designated as epitype one specimen in preparation from a sample from Demerara River, Guyana, in Collection Hustedt called "A.S." (A.Schmidt), which the specimens found in Lago dos Tigres agreed.

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Pinnularia latarea

Krammer, Diatoms of Europe, vol. 1, p. 110, 224, Figs. 80: 1–6, 84: 13-15, 2000. (Figure 18)

Holotype. Preparations 89, 101 and 102 IOS, Collection Schimanski in Institut für Oberflächenanalyse, Meerbusch, Germany.

Type locality. Mönau-Weiher, near Erlangen, Bavaria, Germany.

Valves linear, with slightly undulated margins; capitates apices; length: 45.69–62.6 µm, breadth: 7.91–10.38 µm, length/breadth ratio: 5.77–6.03; axial area narrowly lanceolate, central area expanded, with fascia until reaching the margins; raphe filiform to slightly lateral; striae radiated, becoming convergent towards to the ends of the valves; striae: 11–12/10 µm.

Material examined. Brazil, State of Goiás. Britânia, Lago dos Tigres, plankton, Nogueira *et al.* Site 1, 16/09/2008, P01M09 (UFG 43662), Site 1, 19/08/2008, P01M08 (UFG 43649); Site 07, 19/08/2008, P07M08 (UFG 43655); Site 1, 19/10/2008, P01M10 (UFG 43675); Site 5, 04/07/2004, ISN878 (UFG 29867); Água Limpa River, plankton, Nogueira *et al.* Site 1, plankton, 09/09/2004, ISN985 (UFG 29907).

Distribution. Brazil, State of São Paulo, São Carlos, Monjolinho River (Souza & Senna 2009); State of Paraná, Maringá, Nazaré Stream (Moresco et al. 2011); Pioneer citation for the State of Goiás;

Remarks. The specimens found in Lago dos Tigres agreed with the original description provided by Krammer (2000), except by some representatives more densely striated (11–12/10 µm against 8–10/10 µm). However, the specimens observed in this study presented more linear outlines than the type specimens (Krammer 2000, figures 84: 13–15). The measures and outlines of the Lago dos Tigres material were also similar to that provided by Metzeltin et al. (2005, figures 168:1–14), from Uruguay material, and to that found by Souza & Senna (2009), in São Paulo, including the slight undulation observed in the margins.

Two representatives of *P. latarea* found by Moresco et al. (2011, figures 40, 41) presented similar outlines the type specimens provided by Krammer (2000). A third individual (Moresco et al, 2011, figure 42), however, had outline linear similarly to the individuals observed in Lago dos Tigres.

Pinnularia mayeri

Krammer, Biblioth. Diatomol., vol. 26, p. 115, Figs. 42: 1–4, 1992. (Figures 8, 9)

Holotype. Preparation 912 MR, Collection Mayer in Regensburgische Botanische Gesellschaft (REG), Regensburg, Germany.

Type locality. Outlet of a fish pond, near Hozheim (Oberpfalz near Kladorf), Bavaria, Germany.

Valves linear-lanceolate; capitate apices; length: 52 µm, breadth: 7 µm, length/breadth apices: 7.42; axial area linear-lanceolate, central area rhomboid, with fascia reaching the margins; raphe filiform, terminal fissures hooked and proximal fissures curved to the same side; striae radiate, becoming convergent toward to the ends of the valves; striae: 10–11/10 µm

Material examined. Brazil, State of Goiás, Britânia, Lago dos Tigres, plankton, Nogueira *et al.* Site 4, 04/06/2004, ISN877 (UFG 29866); Site 11, 06/11/2004, ISN1113 (UFG 29939), Lago dos Tigres, Baía das Perdidas, periphyton, Nogueira *et al.,* Site 2, 13/07/2004, ISN936 (UFG 29942), 13/07/2004, ISN939 (UFG 29945);

Distribution. Brazil, State of São Paulo, São Paulo, Parque Estadual das Fontes do Ipiranga (Rocha & Bicudo 2008); Pioneer citation for the State of Goiás.

Remarks. *Pinnularia mayeri* found in Lago dos Tigres agreed with those found in São Paulo by Rocha & Bicudo (2008) and with the original description provided by Krammer (2000). However, the individuals from type material presented outline more lanceolate than our specimens (see Krammer 2000, Figures 96: 9–13).

The outline and measures of the specimens from Lago dos Tigres are also similar to *Pinnularia pisciculus* var. *angusta* Metzeltin & Krammer in Metzeltin & Lange-Bertalot (1998, figures 175: 6–12, 194: 5, 6), and those illustrated in Metzeltin & Lange-Bertalot (2007, figures 267: 8–12, 273: 1–8), except by the more prominent valvar ends, as well as in *P. mayeri*. *P. pisciculus* var. *angusta* also presents specimens with outline more linear, such as in the Lago dos Tigres material, to lanceolate specimens such as in *P. mayeri*. This variance can suggest a possible conspecificity of these two taxa.

Pinnularia meridiana var. *meridiana*

Metzeltin & Krammer in Metzeltin & Lange-Bertalot, Iconogr. Diatomol., vol. 5, p. 180, Figs 181: 1, 2, 4, 5, 1998. (Figures 10, 11)

Holotype. Preparation AmS-305, Colletion Lange-Bertalot in Botanisches Institüt der J. W. Goethe Universität, Frankfurt/Main, Germany.

Type locality. Stream in Porto Alegre, State of Rio Grande do Sul, Brazil.

Valves linear, with bi-undulate margins; broad cuneate-rounded apices; length: 43.81–62.79 µm, breadth: 8.22–11.37 µm, length/breadth ratio: 4.01–6.16; axial area rhomboid; central area wide, rhomboid, with fascia not reaching the margins; raphe lateral, terminal fissures hooked, with helicto-glossa present (Figure 11), proximal ends curved to the same side; striae parallel to slightly radiated, becoming convergent towards to the ends of the valves; striae: 11/10 µm.

Material examined. Brazil, State of Goiás, Britânia, Lago dos Tigres, plankton, Nogueira *et al.* Site 1, 17/07/2008, P01M07, ISN1226 (UFG 43636), Site 10, 18/07/2008, P10M07, ISN1235 (UFG 43645); Site 4, 11/12/2008, P04M12, ISN1294 (UFG 43704); Site 5, 04/07/2004, ISN878 (UFG 29867); Site 3, 19/08/2004, ISN945 (UFG 29895); Site 5, 09/09/2004, ISN989 (UFG 29911); Vermelho River, plankton, Nogueira *et al.* Site 11, 05/07/2004, ISN881 (UFG 29870); Site 11, 17/10/2004, ISN1033 (UFG 29928); Água Limpa River, plankton, Nogueira *et al.* Site 1, 14/07/2004, ISN908 (UFG 29891).

Distribution. Brazil, State of Goiás, Formosa, Paranã River, site 15; Salobro River, site 16; Crixás River, site 17; Paranã River, site 29; Nova Roma, Forquilha Stream, site 7 (Souza & Oliveira 2007, da Silva et al. 2011); State of São Paulo, São Carlos, Monjolinho River (Souza & Senna 2009); State of Paraná, Matinhos, Guaraguaçu River; Pontal do Paraná, Guaraguaçu River; General Carneiro, Salto do Amazonas River; Lagoa da Fazenda São Pedro; Araucárias Reservoir; Neno Stream (Tremarin et al. 2009); State of Rio Grande do Sul, Porto Alegre (from the original material in Metzeltin & Lange-Bertalot 1998).

Pinnularia microstauron var. *brasiliensis*

Krammer & Metzeltin, Iconogr. Diatomol, vol. 5, p. 181, Figs. 179: 9–15, 1998. (Figures 13–15)

Holotype. Preparation AmS-562, Colletion Lange-Bertalot in Botanisches Institüt der J. W. Goethe Universität, Frankfurt/ Main, Germany.

Type locality. Tapajós River, State of Amazonas, Brazil.

Valves linear, with bi-undulated margins; cuneate-rostrate apices; length: 41.14–45.79 μm, breadth: 7.22–8.6 μm, length/ breadth ratio: 5.37–6.57; axial area rhomboide; central area rhomboidal, with fascia reaching the margins; raphe lateral, terminal fissures hooked, proximal fissures curved to the same side; striae short, parallel to radiate, becoming convergent towards to the ends of the valves; striae: 10–11/10 μm

Material examined. Brazil. Goiás. Britânia. Lago dos Tigres, plankton, Nogueira *et al.* Site 1, 16/09/2008, P01M09, ISN1252 (UFG 43662), Site 01, 15/11/2008, P01M11, ISN1278 (UFG 43688), Site 5, 19/08/2008, P05M08, ISN1243 (UFG 43653).

Distribution. Brazil, State of Pará, Tapajós River (from the original material in Metzeltin & Lange-Bertalot 1998); Pioneer citation for the State of Goiás.

Remarks. See comments above, in *P. certa.*

Pinnularia microstauron var. *rostrata*

Krammer, Diatoms of Europe, vol. 1, p. 74, 217, Figs. 51: 8–18, 2000. (Figures 16, 17)

Holotype. Preparation 18B, Collection Krammer in Alfred-Wegener-Institut für Polar- und Meeresforschung (BRM), Bremerhaven, Germany.

Type locality. Hesepertywist near Nordhorn, Emsland, Germany.

Valves linear; rostrate apices; length: 35.2–36.49 μm, breadth 6.23–7.32 μm, length/breadth ratio: 4.89–5.41; axial area rhomboid; central area romphoid, with fascia reaching the margins; raphe filifom, terminal fissures hooked, proximal fissures curved to the same side; striae radiate, becoming convergent towards to the ends of the valves; striae: 10–13/10 μm

Material examined. Brazil, State of Goiás, Britânia, Lago dos Tigres, plankton, Nogueira *et al.* Site 1, 19/08/2008, P01M08, ISN1239 (UFG 43649).

Distribution. Pioneer citation for the country.

Remarks. *Pinnularia microstauron* var. *rostrata* distinguish from the nominate variety because is narrower (6–7 μm against 10–12.4 μm) and presents rostrate apices (Krammer 2000). This taxon is somewhat similar to *P. microstauron* var. *brasiliensis* considering the dimensions, the valvar outline and axial and central areas, but presents clear differences respect to the shape of the apices, which is narrower in the variety *brasiliensis* than in the variety *rostrata* (Figures 13–17).

The specimens observed in Lago dos Tigres were very similar to the material type of *P. microstauron* var. *rostrata* described by Krammer (2000), with some individuals more densely striated than the type population (10–13/10 μm against 10–11/10 μm). The representatives from Lago dos Tigres were also similar to the specimens illustrated by Metzeltin *et al.* (2005, Figures 164: 7, 8, 23), which, however, presented less prominent apices compared to those.

The specimens of the Lago dos Tigres were also similar to *Pinnularia* cf. *microstauron* var. *rostrata* observed by Canani et al. (2011), from Minas Gerais. Nevertheless, the only one specimen recorded by Canani et al. (2011) was larger than the type of *P. microstauron* var. *rostrata* and our specimens (9.8 μm against 6–8 μm), and it can belong to another taxa, closed to this group.

Pinnularia perumbrosa

Metzeltin & Lange-Bert., Iconogr. Diatomol, v. 18, p. 215, Figs. 269: 1, 2, 270: **1–3, 2007. (Figure 20)**

Basionym. *Pinnularia umbrosa* var. *tropica* Metzeltin & Krammer in Metzeltin & Lange-Bertalot, Iconogr. Diatomol, v. 5, p. 194, Figs. 182: 7–9, 1998.

Holotype. Preparation AmS-597, Collection Lange-Bertalot in Botanisches Institüt der J. W. Goethe Universität, Frankfurt/ Main, Germany.

Type locality. State of Amazonas, Brazil.

Valves linear, triundulate and inflamade at the middle part; broad capitates apices; length: 105.49–148.22 μm, breadth: 11.13–17.88 μm, length/breadth ratio: 7.78–8.78; axial area linear-lanceolate, reaching 1/3 of the breadth of the valvae; central area rhomboid, with fascia reaching the margins; raphe lateral, terminal fissures sickle-shaped, proximal fissures slightly curved to the same side; striae radiate, becoming convergent towards the ends of the valves; striae: 10–12/10 μm.

Material examined. Brazil, State of Goiás, Britânia, Lago dos Tigres, plankton, Nogueira *et al.* Site 05, 17/07/2008, P05M07, ISN1230 (UFG 43640); Site 01, 19/10/2008, P01M10, ISN1265 (UFG 43675).

Distribution. Brazil, State of Amazonas, Calado Lake (from the original material in Metzeltin & Lange-Bertalot 1998, 2007); Negro River (Pereira et al. 2012); Pioneer citation for the State of Goiás.

Remarks. *Pinnularia umbrosa* var. *tropica* was initially described from fossil material. The type material presented 87–100 μm length, 13.4–14.7 μm breadth, 6.59–7.3 length/ breadth ratio, and 10–12 striae in 10 μm (Metzeltin & Lange-Bertalot 1998). Metzeltin & Lange-Bertalot (2007) considered the morphometric differences between *P. umbrosa* var. *tropica* and the nominated variety as enough to rising that taxon at specific level, under the new name *P. perumbrosa*, since the combination with epithet *tropica* would not be possible into the genus *Pinnularia*. In this study, Metzeltin & Lange-Bertalot (2007) identified other fossil specimens from Amazonas as *P. perumbrosa.* These specimens presented 98.46–113.0 μm length, 12.31–13.85 μm breadth, length/ breadth ratio 7.33–8.65, amplifying the metric characteristics of this species. Moreover, both group of specimens illustrated by Metzeltin & Lange-Bertalot (1998) and Metzeltin & Lange-Bertalot (2007) have margins conspicuously undulated and breath values that decrease from the middle part towards the ends of the valvae.

Live specimens of *P. perumbrosa* were recorded by Pereira et al. (2012). These specimens presented similar outlines compared to the Metzeltin & Lange-Bertalot's (1998, 2007) material. Although the *P. perumbrosa sensu* Pereira et al. (2012) was larger than the type population, this agreed with those specimens illustrated by Metzeltin & Lange-Bertalot (2007).

Metzeltin & Lange-Bertalot (2007) also described *P. diandae* Metzeltin & Lange-Bert. with undulated margins and similar structure to *P. perumbrosa*, highlighting metric characters as diacritic. *Pinnularia diandae* reach 260 μm length, and about 20 μm breadth.

The material observed in Lago dos Tigres presented larger specimens than any material of *P. perumbrosa* but it could metrically agree with *P. diandae*. Nevertheless, the smallest length values of our material interbreed with measures of *P. perumbrosa* (Metzeltin & Lange-Bertalot 2007, Pereira et al. 2012). Moreover, our material presented also a decrease of the breadth values from

the middle part towards to the ends of the valvae, similarly to *P. perumbrosa*, what is not observed in *P. diandae*.

Pinnularia rostratissima f. *subundulata*

Hust., Int. Rev. Hydrobiol., vol. 50, p. 397, Fig. 27, 1965. (Figure 22)

Holotype. Specimen marked in preparation P5/17, Finder 582.4–7, Collection Hustedt in Alfred-Wegener-Institut für Polar- und Meeresforschung (BRM), Bremerhaven, Germany (Simonsen 1987, Figure 754: 2).

Type locality. Tapajoz River, State of Pará, Brazil.

Valves rhomboid-lanceolate, inflated at the middle part and slightly undulated margins; prominent capitate apices; length: 81.85–91.22 µm, breadth: 12.47–15.43 µm, length/breadth ratio: 5.83–6.53; axial area broad, rhomboid; central area rhomboid, reaching the margins; raphe lateral, terminal fissures hooked, proximal fissures curved to the same side; striae short, radiate, becoming convergent towards the ends of the valves; striae: 8–10 /10 µm.

Material examined. Brazil, State of Goiás, Britânia, Lago dos Tigres, plankton, Nogueira *et al.* Site 5, 04/07/2004, ISN878 (UFG 29867); Site 4, 04/06/2004, ISN877 (UFG 29866); Site 1, 09/09/2004, ISN985 (UFG 29907); Site 6, 16/10/2004, ISN1028 (UFG 29923); Site 8, 16/10/2004, ISN1030 (UFG 29925), Lago dos Tigres, Baía das Perdidas, periphyton, Nogueira *et al.* Site 2, 13/07/2004, ISN939 (UFG 29945).

Distribution. Brazil, State of Amazonas (Metzeltin & Lange-Bertalot 1998); State of Pará, Tapajós River, Arapiuns River (Hustedt 1965, Simonsen 1987); Pioneer citation for the State of Goiás.

Remarks. see remarks in *P. rostratissima* var. *rostratissima*.

Pinnularia rostratissima var. *rostratissima*

Hustedt, Int. Rev. Hydrobiol., vol. 50, p. 397, Fig. 26, 1965. (Figure 21)

Holotype. Specimen marked in preparation P5/16, Finder 354.16, Collection Hustedt in Alfred-Wegener-Institüt für Polar- und Meeresforschung (BRM), Bremerhaven, Germany (Simonsen 1987, Figure 754: 1).

Type locality. Tapajós River, State of Pará, Brazil.

Valves fusiform-lanceolate, strongly inflated at the middle part; capitates apices; length: 81.27–88.12 µm, breadth: 13.78–15.63; length/breadth ratio: 5.63–5.89; axial area broad, lanceolate; central area lanceolate, with fascia reaching the margins; raphe lateral, terminal fissures hooked, proximal fissures curved to the same side; striae short, radiate, becoming convergent towards to the ends of the valves; striae: 10–11/10 µm.

Material examined. Brazil, State of Goiás, Britânia, Lago dos Tigres, plankton, Nogueira *et al.* Site 11, 20/10/2008, P11M10, ISN1275 (UFG 43685).

Distribution. Brazil, State of Amazonas, Jaú River (Díaz-Castro et al. 2003); State of Pará, Tapajós River, Arapiuns River (Hustedt 1965, Simonsen 1987, Metzeltin & Lange-Bertalot 1998); Pioneer citation for the State.

Remarks. The original material of *P. rostratissima* presented length 78–93 µm, 11–14 µm breadth and 10–11 striae in 10 µm (Hustedt 1965). Hustedt (1965) also described *P. rostradissima* f. *subundulata* Hust. which differed from nominate forma from the ends of the valve and slight undulations on the margins. Moreover, the outline of the forma *subundulata* is some rhomboidal whereas in the forma *rostratissima* is some fusiform.

Simonsen (1987) illustrated the type of *P. rostratissima* which, according to Metzeltin & Lange-Bertalot (1998) presented length 94 µm, breath 13.4, 9.5–10 striae in 10 µm. Based on these estimative, Metzeltin & Lange-Bertalot (1998) proposed *P. rostratissima* var. *parva* Metzeltin & Lange-Bert. and *P. rostratissima* var. *ventricosa*. Metzeltin & Lange-Bert. According these authors, the variety *parva* would have narrower specimens than the nominate variety (10–11 µm), while the variety *ventricosa* would be broader specimens (14–17.5 µm). However, Metzeltin & Lange-Bertalot (1998) did not take into account the range of measures of specimens in the population characterized by Hustedt (1965), which are intersected with the breath values of the varieties *parva* and *ventricosa*. Despite this, the specimens of *P. rostratissima* var. *parva* described by Metzeltin & Lange-Bertalot (1998) are smaller than the nominate variety (59–63 µm against 78–94 µm). *P. rostratissima* var. *ventricosa* may be similarly distinguished from the nominated variety (54–74 µm against 78–94 µm). Moreover, this taxon presents specimens visually more inflated what can be numerically proved by lower length/breadth values [3.86–4.41 (5.28) instead $\geq$ 5.57].

The specimens of *P. rostratissima* var. *rostratissima* found in Lago dos Tigres are similar to the outline of the type specimen illustrated by Simonsen (1987, Figure 754: 1). The breath values of these specimens intergrading with the values of *P. rostratissima* var. *rostratissima*, as described by Hustedt (1965), and *P. rostratissima* var. *ventricosa*. But they would not match with *P. rostratissima* var. *ventricosa*, because it was larger and not so inflated as the variety *ventricosa* (i.e., length/breadth value higher than 5.57).

Pinnularia rostratissima var. *ventricosa*

Metzeltin e Lange-Bert., Iconogr. Diatomol, vol. 5, p. 186, Figs. 169: 1–5, 203: 1, 4, 1998. (Figure 23)

Holotype. Preparation AmS-526, Collection Lange-Bertalot in Botanisches Institüt der J. W. Goethe Universität, Frankfurt/Main, Germany.

Type locality. Essequibo-River, Guyana.

Valves fusiform-lanceolate, inflated at the middle part; capitate apices; length: 70; breadth: 15, length/breadth ratio: 4.66; axial area fusiform, central area indistinct of the axial area, with fascia reaching the margins; raphe lateral, terminal fissures hooked, proximal fissures curved to the same side; striae short, slightly radiated, becoming convergent towards the ends of the valves; striae: 12/10 µm.

Material examined. Brazil, State of Goiás, Britânia, Lago dos Tigres, plankton, Nogueira *et al.*, Site 8, 13/07/2004, ISN904 (UFG 29887); Vermelho River, plankton, Nogueira *et al.* Site 11, 05/06/2004, ISN881 (UFG 29870), Site 10, 18/07/2008, P10M07, ISN1235 (UFG 43645); Site 01, 16/09/2008, P01M09, ISN1252 (UFG 43662); Site 11, 20/10/2008, P11M10, ISN1275 (UFG 43685).

Distribution. Brazil, State of Amazonas (Metzeltin & Lange-Bertalot 1998), Negro River (Metzeltin & Lange-Bertalot 2007, Pereira *et al.* 2012); Tupé Lake (Pereira *et al.* 2013); Pioneer citation for the State of Goiás.

Remarks. see remarks in *P. rostratissima* var. *rostratissima*.

Pinnularia rumrichiae

Krammer, Diatoms of Europe, vol. 1, p. 110, 223, Figs. 51: 8–18, 2000. (Figure 26)

Holotype. Preparation Eu-SF 117, Collection Lange-Bertalot in Botanisches Institüt der J. W. Goethe Universität, Frankfurt/Main, Germany.

Type locality. Julma, Ölkky near Kuusamo, Finland.

Valves linear; capitates apices, with very narrow necks; length: 38.17–43.24 μm, breadth: 7.12–8.01 μm, length/breadth ratio: 4.81–5.92; axial area lanceolate; central area rhomboid, with fascia reaching the margins; raphe filiform to slightly lateral, terminal fissures hooked, proximal fissures curved to the same side; striae radiated, becoming convergent towards to the ends of the valves; striae: 10–12/10 μm.

Material examined. Brazil, State of Goiás, Britânia, Lago dos Tigres, plankton, Nogueira *et al.* Site 5, 04/07/2004, ISN878 (UFG 29867); Site 4, 04/06/2004, ISN877 (UFG 29866); Site 8, 16/10/2004, ISN1030 (UFG 29925), Site 6, 09/09/2004, ISN989 (UFG 29911); Vermelho River, plankton, Nogueira et al. Site 11, 14/07/2004, ISN907 (UFG 29890); Site 4, 19/08/2008, P04M08, ISN1242 (UFG 43652), Site 01, 16/09/2008, P01M09, ISN1252 (UFG 43662), Site 1, 19/10/2008, P01M10, ISN1265 (UFG 43675), Site 9, 19/08/2008, P09M10, ISN1273 (UFG 43683), Site 01, 15/11/2008, P01M11, ISN1278 (UFG 43688).

Distribution. Brazil, State of Paraná, Guaraguaçu River (Tremarin et al. 2010); Pioneer citation for the State of Goiás.

Remarks. The specimens from Lago dos Tigres agreed with the original description of *P. rumrichiae*, except in cases that some specimens presented lower length/breadth ratio (4.81–5.85 against 5.6–6.8). Our material was also similar to specimens of *P. rumrichiae* observed by Tremarin et al. (2010) [cited as *P.* "*rumrichae*" but correted in this study according to the Article 60.12 and Recommendation 60C.1 of the International Code for Nomenclature of algae, fungi and plants (McNeill et al. 2012)]. In this case, the illustrated specimens also presented lower length/breadth ratio than the type material (4.92–5.26). Metzeltin et al. (2005) recorded *P. rumrichiae* from Uruguay with lower length/breadth ratio than the type material (4.44–5.83), but the specimens illustrated by them presented more prominent apices and not so narrow necks, compared to the type population.

Pinnularia rumrichiae is similar to *P. brauniana* (Grunow) Mills, a taxon also recorded in aquatic systems from Brazil (Metzeltin & Lange-Bertalot 1998). Despite to present very similar measures and conspicuously capitates valves, the outline of *P. brauniana* is lanceolate, differently of *P. rumrichiae* that present valves with more straight margins, i.e., linear valves, what agreed with the material from Lago dos Tigres.

Pinnularia silviasalae

Metzeltin, Lange-Bert. & García-Rodríguez, Iconogr. Diatomol, vol. 15, p. 160, Figs 169: 1–12, 2005. (Figure 19)

Holotype. Preparation Uru, Collection Lange-Bertalot in Botanisches Institüt der J. W. Goethe Universität, Frankfurt/Main, Germany.

Type locality. Creek, Departament of Colonia, Uruguay.

Valves linear, with slightly undulated margins; subcapitate to broadly capitate apices; length: 58.71–69.52 μm, breadth: 11.32–12.76 μm, length/breadth ratio: 4.98–5.95; axial area lanceolate; axial area indistinct from the axial area to broadly circular, almost reaching the margins; raphe lateral, terminal fissures hooked, proximal fissures curved to the same side; striae radiated, becoming convergent towards to the ends of the valves; striae: 10–12/10 μm.

Material examined. Brazil, State of Goiás, Lago dos Tigres, Baía das Perdidas, periphyton, Nogueira et al. Site 2, 13/07/2004, ISN936 (UFG 29942), Lago dos Tigres, plankton, Nogueira et al. Site 10, 18/07/2008, P10M07, ISN1235 (UFG 43645).

Distribution. Brazil, State of Pará, Belterra, Jucuruí Lake (Metzeltin & Lange-Bertalot 2007); Pioneer citation for the State of Goiás.

Remarks. *Pinnularia silviasalae* differs of similar taxa [e.g., *P. rhomborea* var. *brevicapitata* Krammer, *P. microstauron* (Ehrenb.) Cleve, *P. gibba* Ehrenb. Sensu Metzeltin et al. (2005, figures 166: 1–3), *P. parvulissima* Krammer, and *P.* cf. *parvulissima* Metzeltin et al. (2005, figures 166: 4–6)] from outline, shape and dimensions of the apices, and outline and size of the axial area.

The type material of *P. silviasalae* was also similar to *P. doehringii* Frenguelli, but this taxon is larger (58.78–99.32 μm against 43–70 μm) and breather (12.16–14.96 μm instead 11.5–12 μm), presented broad capitate ends, and central area with fascia reaching the margins. In *P. silviasalae*, this last characteristic occurred in only one specimen of the type population.

Among the representatives of *P. silviasalae* recorded by Metzeltin & Lange-Bertalot (2007, figures 263: 1–6), one specimen was larger than the type material [53.07–67.69 (90.0) μm against 43–70 μm], and a population presented few protracted to subcapitate apices and fascia reaching the margins.

The metric characteristics of the valve, and the dimensions and outline of the axial area of the specimens from Lago dos Tigres were similar to the type of *P. silviasalae*. However, we observed only specimens with capitates apices and with some representatives more densely striated than the type population (10–12/10 μm against 8–10/10 μm). This variation in relation to the type material can be filled by *P. silviasalae* sensu Metzeltin & Lange-Bertalot (2007, figures 263: 1–6). This could indicate that the material type is composed by representatives of part of the variability known for the species.

Pinnularia superpaulensis

(Hust.) Metzeltin e Lange-Bert., Iconogr. Diatomol, vol. 18, p. 226, Figs. 257: 1–3, 2007. (Figure 28)

Basionym. *Pinnularia elegantoides* f. *linearis* Hust., Int. Rev. Hydrobiol., vol. 50, p. 398, Fig. 30, 1965.

Holotype. Specimen marked in preparation 318/40, Finder 400.6, Collection Hustedt in Alfred-Wegener-Institut für Polar- und Meeresforschung (BRM), Bremerhaven, Germany (Simonsen 1987, figures 754: 4, 5).

Type locality. Jucuruí Lake, Brazil.

Valves linear, slightly tumid at middle part; rounded apices; length: 123.2–126.7 μm, breadth: 17.14–19.33 μm, length/breadth ratio: 6.41–7.01; axial area lanceolate; axial area indistinct from the axial area to broadly circular, almost reaching the margins; raphe lateral, terminal fissures hooked, proximal fissures curved to the same side; striae radiated, becoming convergent towards to the ends of the valves; striae: 10–11/10 μm.

Material examined. Brazil, State of Goiás, Britânia, Lago dos Tigres, plankton, Nogueira et al., Site 10, 18/07/2008, P10M07, ISN1235 (UFG 43645).

Distribution. Brazil, State Amazonas, Tupé Lake (Pereira et al. 2013); State of Pará, Belterra, Jucuruí Lake; Igarapé do Tento, Arapiuns River (Hustedt 1965, Simonsen 1987, Metzeltin & Lange-Bertalot 2007); Pioneer citation for the State of Goiás.

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Remarks. The material observed in Lago dos Tigres was larger than the type material of *P. superpaulensis* (111 µm against 123.2–126.7 µm) (Simonsen 1987, figure 754: 4). On the other hand, Metzeltin & Lange-Bertalot (2007, figures 257: 1–3) presented specimens of this taxon larger than the type and our material (122.30–131.54 µm length).

Pinnularia superpaulensis was recorded in Tupé Lake, Amazonas, Brazil (Pereira et al. 2013). The metric range of the specimens described in this study is wide and match with the type, *P. superpaulensis* sensu Metzeltin & Lange-Bertalot (2007) and our material (89.3–144 µm). However, the illustrated material in Pereira et al. (2013) had distinct outline compared to these others.

The diversity of *Pinnularia* in central-western Brazil is still incipiently known. From twenty taxa recorded in this study, 18 were new occurrences in State of Goiás. This demonstrates the potential of aquatic environments of this region to encompass biological diversity still not known. Because tributaries of the main Hydrographic River Basin from Brazil are present in Goiás and the importance of aquatic biological communities to the maintenance of the quality of this systems, studies about the flora of diatom and other algae groups should be carried out urgently in this State. Thus, these studies could provide important data to the management of aquatic resources of the Country.

Pinnularia variarae

Metzeltin & Lange-Bert., Iconogr. Diatomol, vol. 5., p. 194, Figs. 181: 8–10, 193: 5, 1998. (Figure 25)

Holotype. Preparation AmS-581, Collection Lange-Bertalot in Botanisches Institüt der J. W. Goethe Universität, Frankfurt/Main, Germany.

Type locality. Lago Calado, State of Amazonas, Brazil.

Valves linear-lanceolate, with straight margins; cuneate apices; length: 49.32–54.27, breadth: 13.65–15.13, length/breadth ratio: 3.59–3.81; axial area lanceolate; axial area circular to elliptical, sometimes indistinct from the axial area; raphe lateral, terminal fissures hooked, proximal fissures curved to the same side; striae radiated, becoming convergent towards to the ends of the valves; striae: 9–11/10 µm.

Material examined. Brazil, State of Goiás, Britânia, Lago dos Tigres, plankton, Nogueira *et al.* Site 1, 17/07/2008, P01M07, ISN1226 (UFG 43636), Site 01, 15/11/2008, P01M11, ISN1278 (UFG 43688).

Distribution. Brazil, Amazonas, Lago Calado (Metzeltin & Lange-Bertalot 1998); State of São Paulo, São Carlos, Monjolinho River (Souza & Senna 2009); Pioneer citation for the State of Goiás.

Remarks. Some of the specimens from Lago dos Tigres were slightly narrower and more densely striated valves than the original material of *P. variarea*, what was also observed by Souza & Senna (2009).

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