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Occurrence of Arcellidae (Amorphea, Arcellinida) in a coastal stream in the State of Rio de Janeiro

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ABSTRACT. The aim of this study was to elaborate a taxonomic survey on the testate amoebae of the Family Arcellidae in coastal streams in the State of Rio de Janeiro. Six samplings were conducted in Ubatiba coastal stream (Maricá, RJ). In total, 130 liters water were filtered through a conical net of 60-µm mesh and preserved in 4% formalin. Organisms were identified with the aid of an inverted trinocular microscope. The morphological characteristics (lobose testate amoebae with shell composed of granular chitinoid elements) of each species were recorded. The species were described and illustrated. For the verification of new taxa records of Arcellidae in Rio de Janeiro and their distribution in Brazil, a search based on index articles by Scopus, Web of Science and Google Scholar using the keywords "tecamebas", "testate amoebae", "*Arcella*", "Arcellidae", "Brazil" and "Rio de Janeiro", was performed. Eight Arcellidae species were recorded. Some ecological and taxonomic information was provided. Due to the small amount of information on testate amoebae, this study is important because it reduces the knowledge gap regarding this community in the State of Rio de Janeiro. Furthermore, we suggest new studies on species identification to be conducted to expand regional knowledge about these organisms.

Keywords: *Arcella;* stream; testate amoebae; zooplankton.

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Introduction

Testate amoebae are considered a polyphyletic group of eukaryotic unicellular organisms, they are surrounded by a carapace (shell) formed by organic secretion and aggregated particles of silica or limestone (Alves, Lansac-Tôha, Velho, Joko, & Costa, 2007; Lansac-Tôha, Velho, Costa, Simões, & Alves, 2014). They are heterotrophic organisms, feeding on many different food resources (e.g. algae, bacteria), and classified as carnivorous, omnivorous, osmotrophic or mixotrophic (Arrieira, Schwind, Alves, & Lansac-Tôha, 2017; Rosa, Orikassa, Lopes, & Silva, 2017).

These protists inhabit different biotopes such as riparian vegetation, periphyton, sediment and plankton in continental waters (Alves, Velho, Costa, & Lansac-Tôha, 2012; Miranda & Mazzoni, 2015). Most studies on testate amoebae focuses on lentic systems (standing water or little movement environments) (Fulone, Vieira, Velho, & Lima, 2008; Tôha et al., 2014). Some authors such as Crispim and Watanabe (2000) and Wetzel (2001) suggest that the advective or continuous turbulence downstream of an aquatic ecosystem, considered as the primary factor, negatively affects the development of these groups in this type of environment (Neves, Serafim-Júnior, Ghidini, & Brito, 2007). Considering lotic environments, particularly low order, such as streams, few studies include these organisms, although they are frequent and sometimes dominant in these environments (Fulone, Lima, Alves, Velho, & Lansac-Tôha, 2005; Fulone et al., 2008; Miranda & Mazzoni, 2015).

Arcellidae is one of the most common testate amoebae families in neotropical aquatic ecosystems, ubiquitous in many types of environments across the world (Vucetich, 1978; Miranda & Mazzoni, 2015; Silva, Rangel, Lansac-Tôha, Schwind, & Joko, 2016). Species of this family build their shells with endogenous material and present discoid or hemispherical shape and centered pseudostoma (Souza, 2008). Within this family, *Arcella* is the most taxa-rich genus (Meisterfeld, 2002).

Knowledge about species richness and composition of an environment represents the most important attributes when studying a biological system (Ricklefs & Schluter, 1993). It is known that there are numerous studies aimed at describing the composition and focused on the taxonomy of many groups of organisms (Frota, Ota, Deprá, Ganassin, & Graça, 2020; Pacifico, Almeda, Carmo, & Fidanza, 2019). However, protists especially planktonics, are under-explored groups today (Lansac-Tôha, Bonecker, Velho & Lima, 2004). There are indications that in Brazil, in particular, there are many regions in which knowledge about testate amoebae is in its initial stages (Schwind, Dias, Joko, Bonecker, & Lansac-Tôha, 2013).

Thus, given the importance of testate amoebae in continental aquatic environments and the scarcity of research related to these protists in low order lotic environments, especially in the State of Rio de Janeiro (Miranda & Mazzoni, 2015), the present study aimed to describe and illustrate the testate amoebae taxa of Arcellidae from a coastal stream. In addition, we aim to contribute to the knowledge about the occurrence and geographic distribution of these organisms in this State and in the Southeast region of Brazil.

Material and methods

Study area

Located in Serra do Mar, 70 km to the north from Rio de Janeiro city, the Ubatiba Stream is a small coastal stream, that runs through the municipality of Maricá. It rises in the Serra do Espraiado, approximately 540 meters above sea level, and flow for 16 kilometers before reaching the Maricá lagoon system (Mazzoni & Rezende, 2003). Water level is solely regulated by, and fluctuates according to, rainfall and run-off with abundant summer rain, enhancing water fluctuations (November to January) (Mazzoni & Lobón-Cervià, 2000). Riparian vegetation is altered in some parts of the stream, but remnants of Atlantic Forest are still present on the tops of surrounding hills (Miranda & Mazzoni, 2015) (Figure 1).

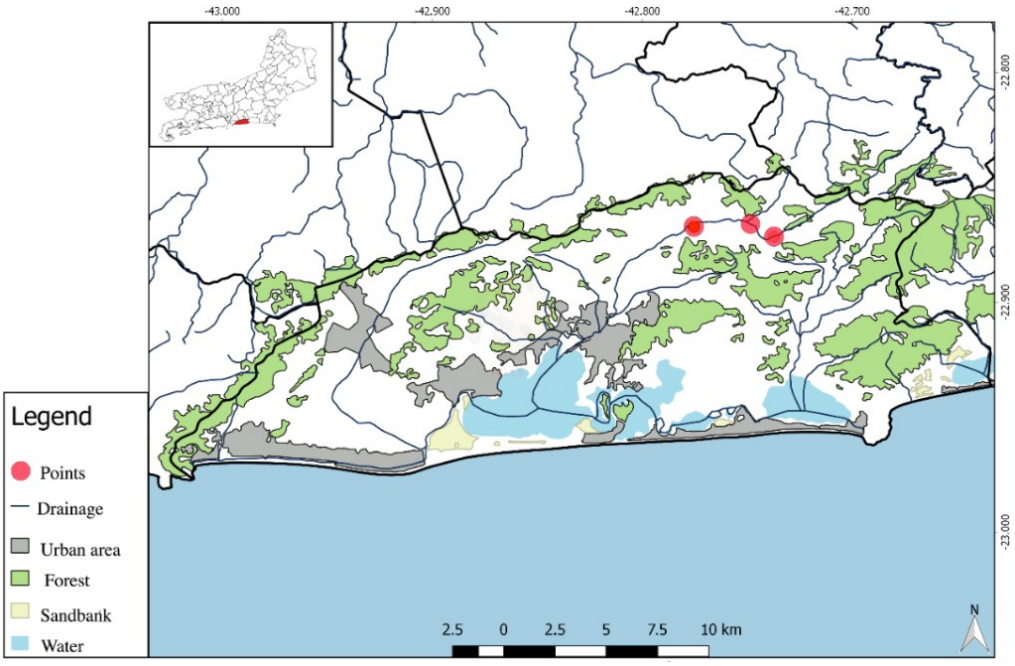

Figure 1. Ubatiba Stream (Maricá, Rio de Janeiro). Study area with the location of the sampling points (some points are superimposed due to the next location).

Sampling design and laboratory analysis

Six samplings were carried out in the Ubatiba stream (RJ) between 2014 (May/C1, August/C2, September/C3, December/C4) and 2015 (February/C5 and March/C6), to observe the occurrence of the family in the dry and rainy seasons. Samples were collected in five points with different hydrological characteristics (Table 1).

At each sampling, 130 liters of stream water were taken using a 13-liter graduated bucket and filtered through a 60 µm mesh conical net. The retained material was preserved in 4% aqueous solution of formalin and packed in screw-cap flasks to avoid evaporation.

Table 1. Hydrological characteristics of the sampling points of the study.

Sampling points	Hydrologic characteristics
P1 (Preserved point)	22º52´11.29'' S and 42º44' 04.62'' W: Semilotic; Rocky substrate with sandy areas and puddles with litter and gravel; Riparian vegetation composed of grass and herbaceous.
P2 (Preserved point)	22º52' 13.73'' S and 42°44'0.60.2'' W: Semilotic; Substrate formed by rocks, gravel, sand and shale; Riparian vegetation consisting primarily of herbaceous plants and some bushes.
P3 (Point under moderate anthropic impact)	22°51'57.75'' S and 42°44'54.08'' W: Semilotic; Substrate formed by rocks, gravel and sand; Fragmented riparian vegetation, consisting of some grasses.
P4 (impacted by anthropic activity)	22°52'00.77'' S and 42°46'31.29'' W: Lentic; This point receives domestic effluent from clandestine connections from nearby residential condominiums; Substrate composed of sand, litter and fine gravel.
P5 (Point impacted by the discharge of domestic effluents and illegal removal of sand from the banks of the stream)	22°52'02.17'' S and 42°46'3104'' W: Semilotic; Substrate is composed of shale, sand, rocks and gravel; The riparian zone is highly fragmented.

Concomitantly, environmental variables were measured for: depth (m), temperature (ºC), turbidity (m), chlorophyll-a (µg L^{-1}), phosphate (µg L^{-1}) and ammonia (µg L^{-1}). Chlorophyll and phosphate analyses were performed in the laboratory according to the methodology of Golterman, Clyno, and Ohnstad (1978). In order to characterize the sampling points, the averages and the coefficient of variation of the studied variables were calculated.

For the analysis of the Arcellidae individuals, sedimentation plates with 2 mL sample, resulting from the sedimentation for thirty minutes in Utermöhl chambers, were used. The organisms were identified in an inverted trinocular microscope (Nikon Eclipse TS 100F), with an objective of 20, with an ocular millimeter for morphometric measurements, based on measurements of 30 organisms of each species.

The taxonomic framework followed for the classification of species identified in this study was that of Adl et al. (2019). Images of the species were captured directly from the inverted microscope, using Images Pro Plus 70 software. Legends applied to the average measurements in the species description were DS = shell diameter; SH = shell height; PD = pseudostoma diameter. The morphological characteristics of each species were recorded as well as their coloration.

The code (C1-C6/P1-P5) was used to designate the analysis of the samples collected in the six samplings (C1 to C6), the five sampling points (P1 to P5). For the verification of new records of taxa of the Family Arcellidae in the State of Rio de Janeiro and their distribution in Brazil, articles indexed by Scopus, Web of Science, Science Direct and Google Scholar were consulted using the following keywords: "tecamebas", "testate amoebae", "*Arcella*", "Arcellidae", "Brazil" and "Rio de Janeiro". A legend was used in the description of the species: fig. = figure; figs. = figures; p. = page; pl. = plate.

Results

During the study period, the sampled points showed significant variation in the environmental variables related to productivity. The coefficient of variation showed that the ammonia concentration presented the largest variation, followed by chlorophyll-a (Table 2).

Table 2. Mean values and coefficient of variation (CV%) of the environmental variables in the preserved and dammed system during the study period. (DO= Dissolved oxygen; pH=pH; Turb=Turbidity; Chlor= Chlorophyll-a; Phos= Phosphate; Ammo= Ammonia).

	P1		P2		P3		P4		P5	
	Mean	CV%	Mean	CV%	Mean	CV%	Mean	CV%	Mean	CV%
Depth	0.18	18.7	0.21	32.9	0.22	39.3	1.14	31.2	0.17	4.1
TH_2O	22.3	10.5	21.9	9.64	24.2	11.5	23.6	12.4	22.5	10.6
DO	7.84	14.9	7.11	10.6	6.34	17.6	4.46	39.1	3.53	50.06
pH	7.7	5.7	7.96	8.05	8.42	10.8	7.48	17.6	7.27	26.2
Turb.	0.95	47.3	1.68	43.1	0.59	32.4	2.17	54.6	3.05	58.6
Chlor.	0.40	96.2	0.56	69.7	0.51	66.2	0.72	80.6	3.98	130.4
Phos.	352.1	26.1	282.9	18.8	226.6	29.05	187.3	38.9	157.2	72.6
Ammo.	11.19	83.3	12.5	121.1	84.8	149.8	19.7	180.05	137.8	216.2

Eight Arcellidae species were recorded in the Ubatiba Stream (Figure 1). In each species, the description and information about the presence in biotopes and sampling points along the river were provided.

AMORPHEA Domain Adl et al., 2019
AmoebozoaLühe 1913, sensu Cavalier-Smith 1998
•Tubilinea Smirnov et al., 2005
••Elardia Kang et al., 2017
•••Arcellinida Kent 1880
••••Sphaerothecina Kosakyan 2016
•••••Arcellidae Ehrenberg1843

Arcella artocrea (Leidy, 1876) (Figure 2: 1,1a)
Leidy (1876): p. 57; Deflandre (1963): p. 239, fig. 9.25.

Material examined. Brazil: Maricá (Rio de Janeiro): Ubatiba Stream (22º 55' 10" S; 42° 49' l04" W). Viviane Bernardes dos Santos Miranda, 18.04.2015. Thirty organisms (C1-C6/P1-P5).

Short description. The shell is circular, conical and often covered by depressions. Presents irregular border. Surface mammillated or pitted. Pseudostoma brown, circular, invaginated and circulated by about thirty large and small pores; Measurements: DS = 150-162µm; SH = 9-12µm; PD = 55-57µm.

Ubatiba Stream: This species was recorded in all sampling points (P1 to P5), in the plankton and riparian vegetation. However, *Arcella artocrea* was observed only in the rainy season (C4, C5 and C6).

Ecological distribution in the Southeast region of Brazil. This species has been observed in riparian vegetation of a stream (Miranda & Mazzoni, 2015).

Arcella conica (Playfair, 1917) (Figure 2: 2, 2b)
Playfair (1917): p. 640, figs. 16-17; Deflandre (1928): p. 238-240, figs. 244-255; Velho, Tôha, and Serafim-Junior (1996): p. 40, pl. I, fig. 8; Lansac-Tôha, Alves, Velho, Robertson and Joko (2008): p. 179-181, pl. I, fig.2; Souza (2008): p. 72, figs. a-b; Silva et al. (2016): p. 231-235, fig. 4.

Material examined. Brazil: Maricá (Rio de Janeiro): Ubatiba Stream (22º 55' 10" S; 42° 49' l04" W). Viviane Bernardes dos Santos Miranda, 19.04.2015. Thirty organisms (C1-C6/P1-P5).

Short description. In lateral view, the shell is composed of facets forming a pyramid. In apical view, the shell is approximately circular with a polygon of eight or nine concave sides and rounded edges. The pseudostoma is circular with or without a buccal tube. Shell color is yellow to brown; Measurements: DS = 64-67 µm; SH = 34-36 µm; PD = 37-39 µm.

Ubatiba Stream: *Arcella conica* was observed in preserved and impacted points (P1, P3, P4 and P5), associated with riparian vegetation and plankton. It was present in the dry and rainy seasons (C1, C2, C3, C5 and C6).

Ecological distribution in the Southeast region of Brazil. This species has been observed in association with riparian vegetation of streams and in lakes (Barbosa et al., 2014; Miranda & Mazzoni, 2015; Lopes et al., 2017).

Arcella costata Ehrenberg, 1847 (Figure 2; 3, 3a)
Deflandre (1928): p. 240-241, figs. 257-258; fig. 45; Souza (2008): p. 73, figs. a-c; Tôha et al. (2008): p. 181, pl.I, fig. 3; Silva et al. (2016): p. 231-235, fig. 5.

Material examined. Brazil: Maricá (Rio de Janeiro): Ubatiba Stream (22º 55' 10" S; 42° 49' l04" W). Viviane Bernardes dos Santos Miranda, 23.04.2015. Thirty organisms (C1-C6/P1-P5).

Short description. The shell is formed by an incomplete pyramid of five to seven facets. The apical profile of the shell is approximately circular and presents a star with five to seven points formed by the pyramid facets. The oral face is wider than the apical face. The pseudostoma is circular with a buccal tube. The color of the shell is yellow to brown. Measurements: DS = 88-90µm; SH = 37-41µm; PD = 24-27µm.

Ubatiba Stream: *Arcella costata* was recorded in impacted points with lentic characteristics (P4 and P5). It was present in the riparian vegetation and in the plankton. Although observed in the dry season, this species was more common in the rainy season. (C3, C4 and C5).

Ecological distribution in the Southeast region of Brazil. This species has been recorded in samples of plankton, sediments and riparian vegetation of distinct aquatic environments (Ferraz, Landa & Paprocki, 2009; Miranda & Mazzoni, 2015; Lopes et al., 2017; Misailidis, et al., 2017).

Arcella discoides Ehrenberg, 1843 (Figure 2; 4, 4a)
Penard (1902): p. 403, figs. 1-2; Deflandre (1928): p. 256-257, figs. 324-326; Velho et al. (1996): p. 43, pl. II, fig. 14; Lahr and Lopes (2009): p.133-134; Silva et al. (2016): p. 232, fig. 9.

Material examined. Brazil: Maricá (Rio de Janeiro): Ubatiba Stream (22º 55' 10" S; 42° 49' l04" W). Viviane Bernardes dos Santos Miranda, 24.04.2015. Thirty organisms (C1-C6/P1-P5).

Short description. Shell generally circular in apical view, plane-convex in lateral view, sometimes arched; diameter about three to four times the height; without a distinct rim or border. Two nuclei or more. Pseudostoma circular, invaginated, bordered by a shallow lip, usually surrounded by a ring of numerous small pores. Shell yellow or brown. Measurements: DS = 85-88µm; SH = 11-13µm; PD = 37-40µm.

Ubatiba Stream: *Arcella discoides* has been recorded in preserved and impacted points (P2, P3, P4 and P5). It was present in the riparian vegetation and in the plankton and only in the dry season (C1, C2 and C3).

Ecological distribution in the Southeast region of Brazil. *Arcella discoides* has been identified in different biotopes as mosses, sediments, plankton and aquatic macrophytes of lotic and lentic systems (Fulone et al., 2005; Laut, Silva, Figueiredo Jr., & Laut, 2011; Barbosa et al., 2014, Miranda & Mazzoni, 2015; Silva, Oliveira, & Wisniewski, 2017; Lopes et al., 2017).

Arcella gibbosa Penard, 1890 (Figure 2: 5, 5a)

Deflandre (1928): p. 227-229, figs. 190-206; Deflandre (1953): fig. 89-F; Velho et al. (1996): p. 39, pl. I, fig. 5; Souza (2008): p. 77, figs. a-b.; Lahr and Lopes (2009): p. 128, 129, 137, figs 1-f; Silva et al. (2016): p. 232, fig. 15.

Material examined. Brazil: Maricá (Rio de Janeiro): Ubatiba Stream (22º 55' 10" S; 42° 49' l04" W). Viviane Bernardes dos Santos Miranda, 25.04.2015. Thirty organisms (C1-C6/P1-P5).

Short description. Shell colorless, yellow, orange or brown, circular in dorsal view and hemispherical in lateral view, with an enlargement at the basis (the keel or basal border). Surface is smooth, but the aboral surface has a series of regular depressions. Invaginated pseudostoma, circular and with a distinct rim or lip; Measurements: DS = 118-121µm; SH = 35-37µm; PD = 39-42µm.

Ubatiba Stream: *Arcella gibbosa* was recorded in all sampling points (P1 to P5), in the plankton and riparian vegetation, in the rainy and dry seasons (C1, C2, C3, C4, C5 and C6).

Ecological distribution in the Southeast region of Brazil. Records of this species were obtained from plankton samples, aquatic macrophytes and sediments (Barbosa et al., 2014, Miranda & Mazzoni, 2015; Lopes et al., 2017; Misailidis et al., 2017).

Arcella hemisphaerica undulata Deflandre, 1928 (Figure 2: 6,6a)

Deflandre (1928): p. 214, figs. 122-124; Vucetich (1973): p. 290, pl. I, fig. 3; Lahr and Lopes (2009): p. 130; Silva et al. (2016): p. 233, 235, fig. 21.

Material examined. Brazil: Maricá (Rio de Janeiro): Ubatiba Stream (22º 55' 10" S; 42° 49' l04" W). Viviane Bernardes dos Santos Miranda, 30.05.2015. Thirty organisms (C1-C6/P1-P5).

Short description. At lateral view, the dorsal face of the shell is hemispherical, with regular undulations. The pseudostoma is circular and slightly invaginated, with buccal tube. The shell is yellow or brown; Measurements: DS = 50-62µm; SH = 28-31µm; PD = 20-23µm.

Ubatiba Stream: *Arcella hemisphaerica undulata* was recorded exclusively in the riparian vegetation and only in one point with lentic characteristics, P5. This species was observed only in the dry season (C1).

Ecological distribution in the Southeast region of Brazil. In Southeast region, this species has been recorded in planktonic, sediment and aquatic macrophytes samples from lotic systems (Lahr & Lopes, 2009; Miranda & Mazzoni, 2015; Silva-Neto et al., 2015).

Arcella megastoma Penard, 1902 (Figure 2: 7, 7a)

Penard (1902): p. 409; Wailes (1913): p. 204-205, pl. XV, figs. 1-2; Deflandre (1928): p. 267-268, figs. 363-372; Lansac-Tôha et al. (2008): p.182, pl. I, fig. 6; Lahr and Lopes (2009): p. 128; Silva et al. (2016): p. 234, 236, fig. 16.

Material examined. Brazil: Maricá (Rio de Janeiro): Ubatiba Stream (22º 55' 10" S; 42° 49' l04" W). Viviane Bernardes dos Santos Miranda, 04.05.2015. Thirty organisms (C1-C6/P1-P5).

Short description. Apically, the shell outline is discoid. It presents a circular pseudostoma proportionally large and rounded by fine pores. The oral face is little invaginated without buccal tube. The shell is flattened laterally. Shell color is yellow to dark brown; Measurements: DS = 204-206µm; SH = 18-22µm; PD = 175-178µm.

Ubatiba Stream: This species was recorded in all sampling points (P1 to P5), in the plankton and riparian vegetation and in the rainy and dry season (C1, C2, C3, C4 and C5).

Ecological distribution in the Southeast region of Brazil. Records of this species has been obtained from samples of mosses, sediments, plankton and aquatic macrophytes (Fulone et al., 2005; Fulone et al., 2008; Ferraz et al., 2009; Barbosa et al., 2014; Lahr & Lopes 2009; Miranda & Mazzoni, 2015; Misailidis et al., 2017).

Arcella vulgaris Ehrenberg, 1830 (Figure2: 8, 8a)

Penard (1890): p. 151, pl. V, figs. 56-66; Wailes (1913), pl. XV, fig. 5; Deflandre (1928): p. 219-221, figs. 156-164; Velho et al. (1996): p. 37, pl I, fig. 1; Lansac-Tôha et al. 2008: p. 182, pl. I, fig. 7; Silva et al. (2016): p. 234-235, fig. 22.

Material examined. Brazil: Maricá (Rio de Janeiro): Ubatiba Stream (22º 55' 10" S; 42° 49' l04" W). Viviane Bernardes dos Santos Miranda, 18.04.2015. Thirty organisms (C1-C6/P1-P5).

Short description. In lateral view, the shell is rounded with an expansion in the oral part. In apical view, the shell is circular, with folded edge and presents two concentric circles. The inner circle represents the pseudostoma and the outermost circle corresponds to the expansion in the oral part. Circular and invaginated pseudostoma, presenting a buccal tube. Shell color is dark brown, orange or yellow; Measurements: DS = 92-96µm; SH = 59-62µm; PD = 38-36µm.

Ubatiba Stream: This species was observed in all sampling points (P1 to P5). It was recorded in the plankton and riparian vegetation and in the rainy and dry seasons (C1, C2, C3, C4, C5 and C6).

Ecological distribution in the Southeast region of Brazil. This species is very common in different aquatic environments. Present in plankton, sediment, aquatic macrophytes and in internal bromeliads (Barbosa et al., 2014; Miranda & Mazzoni, 2015; Lahr & Lopes 2009; Lopes et al., 2017).

Discussion

Our results showed that the variables that varied the most throughout the study were those related to productivity, such as ammonia and chlorophyll-a. It is known that the variation in productivity variables is closely related to the nutritional status of aquatic ecosystems and consequently the occurrence of zooplanktonic species therein (Mantovano et al., 2019), such as testate amoebae (Schwind, Arrieira, Simões, Bonecker, & Lansac-Tôha, 2017).

In aquatic environments, the Family Arcellidae is considered one of the most representative families among testate amoebae, being highlighted by several other studies developed in inland aquatic environments (Velho et al., 1996), especially in the upper Paraná River floodplain (Lansac-Tôha et al., 2008).

The results show an important richness of *Arcella* compared to other studies in the Center-West, Southeast, North, South and Northeast regions of Brazil (Miranda & Mazzoni, 2015; Silva et al., 2016; Rosa et al., 2017), confirming the importance of studies on the record of these protists in the Ubatiba Stream. In addition, this study showed the presence of species found in environments with more studies, for example, in the floodplain of the Upper Paraná River (Velho et al., 1996; Lansac-Tôha et al., 2009; Lansac-Tôha et al., 2014) and the Middle Doce River basin (Barbosa et al., 2014).

The species richness found in the Ubatiba Stream may be associated with structuring of the sampled environments provided by riparian vegetation. The areas along the stream banks encompass a variety of microhabitats (Esteves, 2011; Silva et al., 2016). This condition could favor the biological richness of testate amoebae (Schwind, Arrieira, Mantovano, Bonecker, & Lansac-Tôha, 2016). The presence of *Arcella* in the planktonic environment can be justified by the flow of water from the stream, which promotes the resuspension of the sediment, facilitating the availability of nutrients for the species (Thomaz, Bini, & Bozelli, 2007). The current of the stream would also collaborate with the exchange of organisms among the existing biotopes, besides favoring the dispersion of the species throughout the stream (Miranda & Gomes, 2013; Miranda & Mazzoni, 2015).

The first records on *Arcella* in the State of Rio de Janeiro were made by Wailes (1913), which identified some species in mosses, and Cunha (1914), who registered this genus in samples of river plankton. Later Miranda and Gomes (2013) identified some species of *Arcella* composing the plankton of a small-order river located in the Baixada Fluminense. Miranda and Mazzoni (2015) reported species in a coastal stream in the metropolitan region, inhabiting plankton and ciliary vegetation, being the only study developed in streams in the State of Rio de Janeiro. Laut et al. (2011) reported some species in sediments of lagoons in the State, as well as Silva-Neto et al. (2015), which in addition to registering *Arcella* species in sediment samples, also found species in bromeliad tanks. Finally, Lopes et al. (2017) found some species of *Arcella* in reservoirs in the State.

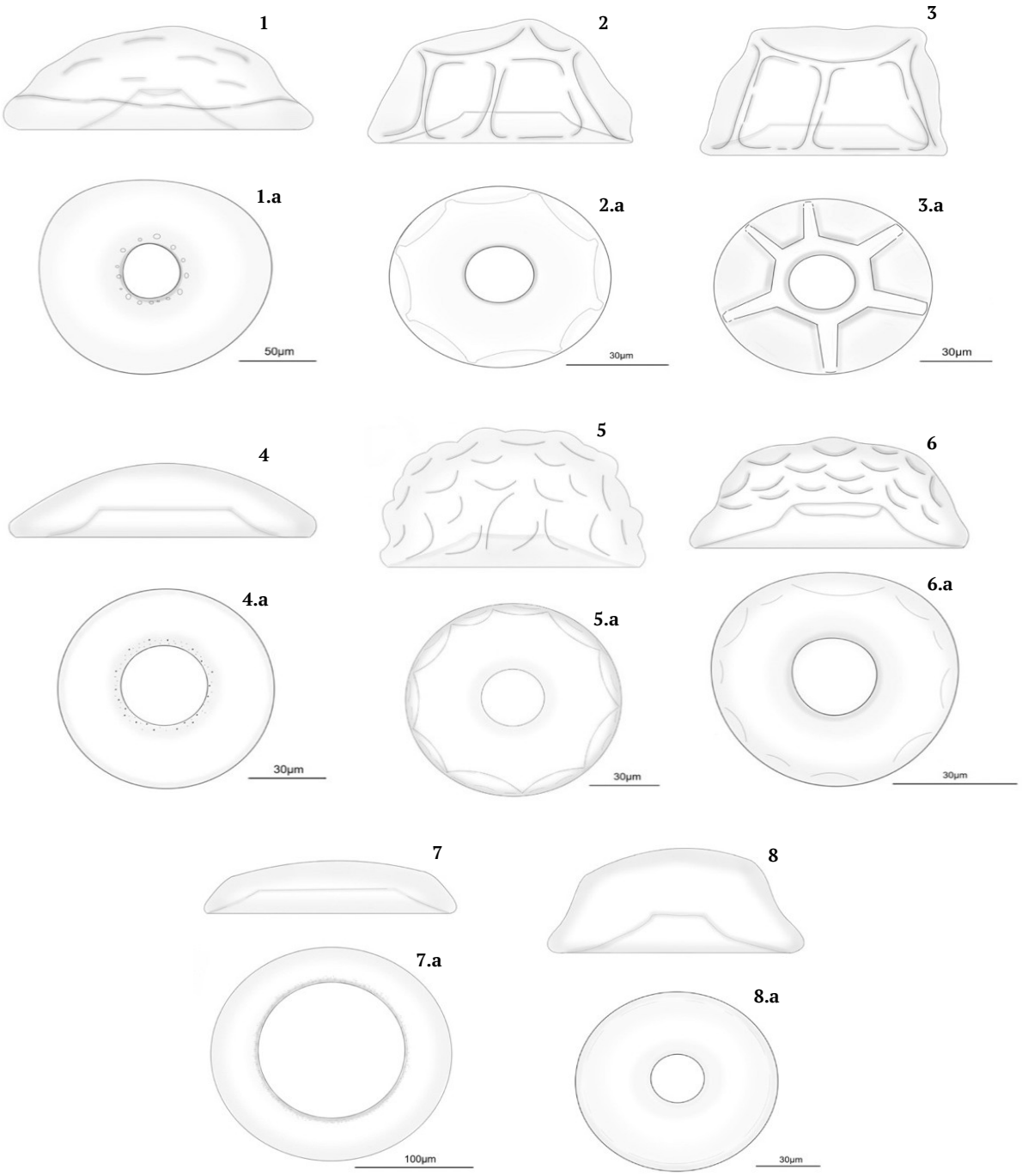

Figure 2. Arcellidade of Ubatiba stream, Rio de Janeiro. (1) *Arcella artocrea* lateral view, (1a) ventral view; B (2) *Arcella conica* lateral view, (2a) ventral view; (3) *Arcella costata* lateral view, (3a) ventral view; (4) *Arcella discoides* lateral view, (4a) ventral view; (5) *Arcella gibbosa* lateral view, (5a) ventral view; (6) *Arcella hemisphaerica undulata* lateral view, (6a) ventral view; (7) *Arcella megastoma* lateral view, (7a) in ventral view; (8) *Arcella vulgaris* lateral view, (8a) ventral view.

Most species of the Family Arcellidae were present in the Ubatiba Stream during the dry and rainy seasons. This suggests that these organisms are able to adapt to seasonal variations that interfere with the hydrological and abiotic aspects of the stream, as well as the availability of nutrients to capture these testate amoebae (Miranda & Mazzoni, 2015, Rosa et al., 2017).

Conclusion

The presence of the Family Arcellidae in the Ubatiba Stream shows that lotic environments have a considerable richness of testate amoebae. However, the present study emphasizes the importance of encouraging the development of taxonomic surveys on testate amoebae in lotic ecosystems, especially in the State of Rio de Janeiro, where there is little information available about this community.

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