

Rotifera of the Três Lagoas Lake Complex, João Pessoa, state of Paraíba, Brazil

Lays Tamara Dantas-Silva* and Ênio Woclyli Dantas

Universidade Estadual da Paraíba, Centro de Ciências Biológicas e Sociais Aplicadas, Campus V. Pós-Graduação em Ecologia e Conservação, Rua Horácio Trajano s/n Cristo. CEP 58070-450. João Pessoa, PB, Brazil.

* Corresponding author. E-mail: lays.tamara@hotmail.com

ABSTRACT: The aim of the present study was to survey the rotifer composition of the Três Lagoas Lake Complex in the city of João Pessoa, state of Paraíba, Brazil. These urban lakes receive waste from the surrounding neighborhoods. Samples were carried out every two months between August 2008 and August 2009. The rotifers were identified using an optical microscope and specialized literature. Seventeen species were found, distributed among eight families and ten genera. Brachionidae was the most representative family. There were four new records for the state of Paraíba – *Asplanchna priodonta* (Gosse, 1850), *Asplanchna* sp., *Rotaria rotatoria* (Pallas, 1766) and *Squatinella* sp.

INTRODUCTION

Zooplankton is a group of heterotrophic invertebrates that live suspended in the water column. Its biomass is composed mainly by rotifers, micro-crustaceans (cladocerans and copepods) protozoans (Hutchinson 1967), and other, less frequent organisms. According to Rodriguez and Matsumura-Tundisi (2000), Rotifera predominates among the groups, accounting for more than 60% of the community composition. This may be explained due to rotifers are opportunistic organisms with a high rate of intrinsic growth and the capacity to absorb a wide diversity of nutritional resources, characteristics that allow these organisms to colonize different environments, even the most instable ones (Allan 1976). Rotifers adapt easily to environmental variations, which difficult any constant spatial-temporal standardization of the composition and occurrence of species.

According to Schäfer (1985), rotifers generally occur in freshwaters and have a wide diversity of shapes. These organisms are important to the dynamics of water bodies and are considered a bioindicator of their trophic state (Costa and Stripari 2008) as a link in the food chain, transferring matter and energy and replacing small organisms in their ecological niche (Bonecker and Aoyagui 2005).

The aim of the present study was to carry out the first survey of rotifer species in the Três Lagoas Lake Complex in the municipality of João Pessoa, state of Paraíba, Brazil and contribute with new data on the zooplanktonic fauna in the state.

MATERIALS AND METHODS

Study site

The Três Lagoas Lake Complex (07°10'02" S, 34°53'51" W) is located in the proximities of roadway BR-230, which links the municipality of João Pessoa to the interior of the state, and BR-101, which offers access to the states of Rio Grande do Norte and Pernambuco. The complex is formed by four urban lakes, two of which originated from

the construction of a viaduct (Figure 1). These lakes are characterized by the presence of floating and emerging macrophytes and receive sewage from the surrounding neighborhoods. Only three of the four lakes in the ecosystem were selected for the data collection (Ponte Lake, Desconhecida Lake and Misteriosa Lake); the fourth (Lake Salvíneas) was not studied due to its high degree of deterioration.

Data collection and analysis

The collections were performed every two months for a one-year period beginning in August 2008. Three replicates were chosen per lake (Figure 1). For the collection of Rotifera, 50 liters of water were filtered from each sampling site using a 68- μ m plankton net. The material was contained in plastic amber recipients (100 mL) and fixed with 4% formol. The rotifers were quantitatively analyzed on Sedgwick-Rafter chamber under an optical microscope at the Botany Laboratory of Campus V of the Universidade Estadual da Paraíba, Brazil. The community was identified using species identification keys for the group (Ruttner-Kolisko 1974; Pontin 1978). Frequency of occurrence was categorized in the following method: rare (occurrence in 0% to 20% of the samples); low frequent (occurrence in 21% to 50%); frequent (51% to 80%) and very frequent (occurrence in 81% to 100%), proposed by Matteucci and Colma (1982). The sampled material was deposited in the collection of Campus V of the Universidade Estadual da Paraíba, Brazil.

RESULTS AND DISCUSSION

The Rotifera fauna in the Três Lagoas Lake Complex was composed by 17 species, distributed among eight families and 10 genera (Table 1). Brachionidae was the most representative family, with seven species. This family is composed of detritivorous organisms and consumers of bacteria. Due to these habits, species of Brachionidae are commonly found with greater richness and density in



FIGURE 1. Aerial image of Três Lagoas lake complex and respective sampling sites, João Pessoa, Paraíba, Brazil. Source: Google Earth.

eutrophic environments (Gannon and Stemberger 1978; Orcutt and Pace 1984).

Gannon and Stemberger (1978), Mäemets (1983) and Pejler (1983) carried out studies on Rotifera, reporting these organisms to be bioindicators of the trophic state of ecosystems. Among the species found in Três Lagoas, only *Anuraeopsis fissa* (Gosse, 1851), *Epiphanes* sp. and *Squatinella* sp. were not reported in these studies. The other taxa, but *Keratella cochlearis* (Gosse, 1851) and the genus *Asplanchna* (Gosse, 1850) that are indicators

of mesoeutrophic and oligotrophic environments, respectively (Mäemets 1983), are considered characteristic of eutrophic environments.

Brachionus calyciflorus (Pallas, 1766) and *Squatinella* sp. were the most frequent species, occurring in 100% and 81% of the samples, respectively, whereas *Asplanchna priodonta* (Gosse, 1850), *Asplanchna* sp., *K. cochlearis*, *Keratella valga* (Ehrenberg, 1834), *Keratella tropica* (Apstein, 1907) and *Rotaria rotatoria* (Pallas, 1766) were rare (Table 2).

TABLE 1. Inventory of species of plankton rotifers in the Três Lagoas Lake Complex, João Pessoa, Paraíba, Brazil (August 2008 to August 2009).

PHYLUM ROTIFERA
CLASS MONOGONONTA
Order Ploimida
Family Asplanchnidae
<i>Asplanchna priodonta</i> (Gosse, 1850)
<i>Asplanchna</i> sp.
Family Brachionidae
<i>Anuraeopsis fissa</i> (Gosse, 1851)
<i>Brachionus calyciflorus</i> (Pallas, 1766)
<i>Brachionus falcatus</i> (Zacharias, 1898)
<i>Brachionus havanaensis</i> (Rousselet, 1911)
<i>Epiphanes</i> sp.
<i>Keratella cochlearis</i> (Gosse, 1851)
<i>Keratella valga</i> (Ehrenberg, 1834)
<i>Keratella tropica</i> (Apstein, 1907)
<i>Squatinella</i> sp.
CLASS BDELLOIDEA
Order Philodinida
Family Philodinidae
<i>Rotaria rotatoria</i> (Pallas, 1766)
Family Lecanidae
<i>Lecane</i> sp.
<i>Lecane bulla</i> (Gosse, 1886)
<i>Lecane lunaris</i> (Ehrenberg, 1832)
Family Notommatidae
<i>Cephalodella</i> sp.
Family Synchaetidae
<i>Polyarthra vulgaris</i> (Carlin, 1943)

Studies of composition and abundance of zooplankton species and comparison among different environments in lakes made by Nunes *et al.* (1996) in Paraná, Martínez *et al.* (2000) in Mato Grosso do Sul, Keppeler and Hardy (2004) in Acre, Crispim *et al.* (2006) in Paraíba and Bini *et al.* (2007) in Goiás, show an average of 43 taxa of rotifers by ecosystem. This figure is higher than that found in the Três Lagoas Lake Complex. These studies were performed with monthly or seasonal collections in the coastal region and also in depth, which may explain the greater number of taxa found. These authors also showed Brachionidae as most representative family, except Bini *et al.* (2007), whose ruling family was Lecanidae. Among the species found in Três Lagoas, *B. calyciflorus*, *Brachionus falcatus* (Zacharias, 1898), *Brachionus havanaensis* (Rousselet, 1911), *K. cochlearis*, *K. tropica*, *K. valga*, *Lecane bulla* (Gosse, 1886), *Lecane lunaris* (Ehrenberg, 1832) and *Polyarthra vulgaris* (Carlin, 1943) were also found in the studies cited above.

In the checklist presented in this study, the genera *Brachionus* (Pallas, 1766), *Cephalodella* (Bory de St Vincent, 1826), *Epiphanes* (Ehrb, 1832), *Keratella* (Bory de St Vincent, 1822) and *Lecane* (Nitzsch, 1827), besides the species *Anuraeopsis fissa* (Gosse, 1851) and *P. vulgaris* already have records in the state of Paraíba (Crispim and Freitas 2005; Crispim and Watanabe 2000; Crispim *et al.* 2006; Montenegro *et al.* 2006; Silva *et al.* 2009; Vieira *et al.* 2009). Although with a smaller number of taxa, the composition of rotifers in the Três Lagoas Lake Complex had four new records for the state of Paraíba – *A. priodonta*, *Asplanchna* sp., *R. rotatoria* and *Squatinella* sp.

TABLE 2. Frequency of occurrence (FO) of plankton rotifers in the Três Lagoas Lake Complex (Paraíba, Brazil). Legends: + occurrence of taxon, - absence of taxon; R = rare; LF = low frequent; F = frequent; VF = very frequent.

LAKES →	DESCONHECIDA						PONTE					MISTERIOSA					FO					
	aug/08	oct/08	dec/08	feb/09	apr/09	jun/09	aug/09	aug/08	oct/08	dec/08	feb/09	apr/09	jun/09	aug/09	aug/08	oct/08		dec/08	feb/09	apr/09	jun/09	aug/09
Asplanchnidae																						
<i>Asplanchna priodonta</i>	+	-	-	+	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	R
<i>Asplanchna</i> sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	R
Brachionidae																						
<i>Anuraeopsis fissa</i>	+	-	+	+	+	-	+	-	-	-	+	+	-	-	-	-	+	+	+	-	-	LF
<i>Brachionus calyciflorus</i>	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	VF
<i>Brachionus falcatulus</i>	+	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	+	+	+	LF
<i>Brachionus havanaensis</i>	+	-	+	+	+	+	-	-	-	+	+	-	-	-	-	-	-	-	-	+	-	LF
<i>Epiphanes</i> sp.	+	+	+	+	-	-	-	+	+	+	+	+	-	-	+	+	+	+	-	-	-	F
<i>Keratella cochlearis</i>	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	R
<i>Keratella valga</i>	+	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	R
<i>Keratella tropica</i>	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	+	-	R
<i>Squatinella</i> sp.	-	-	+	+	+	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+	-	VF
Lecanidae																						
<i>Lecane</i> sp.	-	-	-	-	+	+	+	-	-	-	+	-	+	+	+	-	-	-	-	-	-	LF
<i>Lecane bulla</i>	+	+	+	+	+	+	+	-	+	+	-	-	-	+	-	-	-	+	-	-	-	F
<i>Lecane lunaris</i>	+	+	+	+	+	+	+	+	+	-	+	+	-	-	-	-	-	-	-	-	-	F
Notommatidae																						
<i>Cephalodella</i> sp.	+	-	+	+	+	+	+	-	+	-	+	+	+	-	-	-	-	-	-	-	-	LF
Philodinidae																						
<i>Rotaria rotatoria</i>	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	R
Synchaetidae																						
<i>Polyarthra vulgaris</i>	+	-	+	-	-	+	-	-	-	-	-	-	+	-	+	-	-	-	+	+	+	LF

LITERATURE CITED

- Allan, J.D. 1976. Life history patterns in zooplankton. *American Naturalist* 110(971): 165-180.
- Bini, L.M., L.C.G. Vieira, J. Machado and L.F.M. Velho. 2007. Concordance of Species Composition Patterns among Microcrustaceans, Rotifers and Testate Amoebae in a Shallow Pond. *International Review of Hydrobiology* 92(1): 9-22.
- Bonecker, C.C. and A.S.M. Aoyagui. 2005. Relationships between rotifers, phytoplankton and bacterioplankton in the Corumbá reservoir, Goiás State, Brazil. *Hydrobiologia* 546: 415-421.
- Costa, L.O. and N.L. Stripari. 2008. Distribuição da comunidade zooplânctônica em um trecho do médio Rio Grande no município de Passos (MG), Brasil. *Ciência et Praxis* 1(1): 53-58.
- Crispim, M.C. and T. Watanabe. 2000. Caracterização Limnológica das bacias doadoras e receptoras de águas do Rio São Francisco: 1 – Zooplâncton. *Acta Limnológica Brasiliensis* 12: 93-103.
- Crispim, M.C. and G.T.P. Freitas. 2005. Seasonal effects on zooplanktonic community in a temporary lagoon of northeast Brazil. *Acta Limnológica Brasiliensis* 17(4): 385-393.
- Crispim, M.C., L.L. Ribeiro, S.E.M. Gomes, G.T.P. Freitas and F.R. Serpe. 2006. Comparison of different kind of semi-arid aquatic environments based on zooplankton communities. *Revista de biologia e ciências da terra*. 1: 98-111.
- Gannon, J.E. and R.S. Stemberger. 1978. Zooplankton (Especially Crustaceans and Rotifers) as Indicators of Water Quality. *Transactions of the American Microscopical Society* 97(1): 16-35.
- Hutchinson, G.E. 1967. *A Treatise on Limnology II: Introduction to lake biology and the limnoplankton*. New York: Wiley-Interscience Publication 1115 p.
- Keppeler, E.C. and E.R. Hardy. 2004. Abundance and composition of Rotifera in an abandoned meander lake (Lago Amapá) in Rio Branco, Acre, Brazil. *Revista Brasileira de Zoologia* 21(2): 233-241.
- Mäemets, A. 1983. Rotifers as indicators of lake types in Estonia. *Hydrobiologia* 104: 357-361.
- Martínez, J.C.C., A. Canesin and C.C. Bonecker. 2000. Species composition of rotifers in different habitats of an artificial lake, Mato Grosso do Sul State, Brazil. *Acta Scientiarum* 22(2): 343-346.
- Matteucci, S.D. and A. Colma. 1982. La Metodología para el Estudio de la Vegetación. *Colection de Monografías Científicas, Série Biología* 22: 1-168.
- Montenegro, A.K.A., M.C. Crispim, J. Torellian and R.S.A. Marinho. 2006. The influence of the methodology in the results of food diet analysis of *Steindachnerina notonota* (Miranda Ribeiro 1937), in Taperoá II Dam, Paraíba State. *Revista de Biologia e Ciências da Terra: Suplemento Especial* 1: 180-191.
- Nunes, M.A., F.A. Lansac-Tôha, C.C. Bonecker, M.C. Roberto and L. Rodrigues. 1996. Composição e abundância do zooplâncton de duas lagoas no Horto Florestal Dr. Luiz Teixeira Mendes, Maringá, Paraná. *Acta Limnológica Brasiliensis* 8: 207-219.
- Orcutt, J.D. and M.L. Pace. 1984. Seasonal dynamics of rotifer and crustacean zooplankton populations in a eutrophic, monomictic lake with a note on rotifer sampling techniques. *Hydrobiologia* 119: 73-80.
- Pejler, B. 1983. Zooplanktic indicators of trophy and their food. *Hydrobiologia* 101: 111-114.
- Pontin, R.M. 1978. A key to the freshwater planktonic and semi-planktonic Rotifera of the British Isles. *Freshwater Biological Association. Scientific Publication* 38: 1-178.
- Rodriguez, M.P. and T. Matsumura-Tundisi. 2000. Variation of density, species composition and dominance of rotifers at a shallow tropical reservoir. *Revista Brasileira de Biologia* 60(1): 1-9.
- Ruttner-Kolisko, A. 1974. Plankton rotifers: Biology and taxonomy. *Die Binnengewässer* 26: 1-146 (Supplement).
- Schäfer, A. 1985. *Fundamentos de ecologia e biogeografia de águas continentais*. Porto Alegre: EDURGS. 532 p.
- Silva, A.M.A., P.R. Medeiros, M.C.B.C. Silva and J.E.L. Barbosa. 2009. Diel vertical migration and distribution of zooplankton in a tropical Brazilian reservoir. *Biotemas* 22(1): 49-57.
- Vieira, A.C.B., L.L. Ribeiro, D.P.N. Santos and M.C. Crispim. 2009. Correlation between the zooplanktonic community and environmental variables in a reservoir from the Northeastern semi-arid. *Acta Limnológica Brasiliensis* 21(3): 349-358.

RECEIVED: October 2010

ACCEPTED: December 2011

PUBLISHED ONLINE: February 2012

EDITORIAL RESPONSIBILITY: Inga Ludmila Veitenheimer Mendes