

# Freshwater Snails and Schistosomiasis *Mansoni* in the State of Rio de Janeiro, Brazil: V - Norte Fluminense Mesoregion

Silvana C Thiengo<sup>+</sup>, Aline C Mattos, M Fernanda Boaventura, Márcio S Loureiro, Sonia B Santos, Monica A Fernandez

Departamento de Malacologia, Instituto Oswaldo Cruz-Fiocruz, Av. Brasil 4365, 21045-900 Rio de Janeiro, RJ, Brasil

*In this paper, the fifth of a series dealing with the survey of freshwater gastropods of the state of Rio de Janeiro, the results of collections carried out in the Norte Fluminense Mesoregion from 2002 to 2003 are presented and revealed the occurrence of 19 species: Antillorbis nordestensis; Burnupia sp.; Biomphalaria tenagophila; Drepanotrema anatinum; Drepanotrema cimex; Drepanotrema depressissimum; Drepanotrema lucidum; Ferrissia sp.; Gundlachia ticaga; Gundlachia sp.; Heleobia sp.; Hebetancylus moricandi; Idiopyrgus sp.; Lymnaea columella; Melanoides tuberculatus; Physa acuta; Physa marmorata; Pomacea sordida, and Pomacea sp. Concerning the snail hosts of Schistosoma mansoni only B. tenagophila was found, in contrast with other previously studied mesoregions. No specimens were found harbouring larval forms of S. mansoni although different kinds of cercariae had been observed. An account about the current schistosomiasis transmission sites in this Mesoregion is presented as well.*

Key words: freshwater snails - schistosomiasis mansoni - cercariae - Rio de Janeiro - Brazil

An intensive and detailed survey of freshwater snails of the state of Rio de Janeiro has been performed by the authors since 1997 and the results were published in five papers (Thiengo et al. 1998, 2001, 2002ab, 2004). Thus, aiming to carry on that survey collections were made from March, 2002 to September, 2003 in the following municipalities of the Norte Fluminense Mesoregion: Carapebus, Conceição de Macabu, Macaé, Quissamã (Macaé Microregion), Campos dos Goytacazes, Cardoso Moreira, São Fidélis, São Francisco de Itabapoana, and São João da Barra (Campos dos Goytacazes Microregion).

The freshwater snail species listed include specimens collected by the authors as well as those in the Collection of the Department of Malacology of Instituto Oswaldo Cruz. The distribution of the Afro-Asian snail *Melanoides tuberculatus* and the snail species of medical and veterinary importance, various kinds of cercariae and the number of schistosomiasis cases reported to this region during the last 19 years are also presented.

## MATERIALS AND METHODS

We have adopted the Brazilian Institute of Geography and Statistic (IBGE 1995) procedures in dividing the state of Rio de Janeiro into six Mesoregions (Baixadas, Metropolitan, Centro Fluminense, Sul Fluminense, Norte Fluminense, and Noroeste Fluminense) and the Center of Information and Data of Rio de Janeiro (CIDE 2001) for the new municipalities. The Norte Fluminense Mesoregion is 9731 km<sup>2</sup>, constituting 22.2% of the state.

The molluscs were collected from different suitable snail habitats from all 38 districts of the nine municipalities surveyed. Since at least three different habitats were investigated in each of the districts, an average of 114 samples was obtained. Live snails were kept at the laboratory for a month in aquaria containing dechlorinated tap water and, at the bottom, a thin layer of a 2:1 mixture of screened soil and ground oyster shells as a source of mineral nutrients. Snails were fed on fresh lettuce leaves. In the meantime all specimens were exposed to artificial light at five-day intervals to determine possible infection with trematode larvae. Cercariae were fixed in 70% ethanol, stained with chloridric carmine, mounted in Canada balsam and subsequently identified according to Schell (1970).

The 10 larger specimens of each sample were preserved in Railliet-Henry's fluid after relaxation in a 0.05% hypnol solution and two of them were dissected under stereomicroscope for identification.

Samples of taxonomic importance were deposited at the Malacological Collection of Instituto Oswaldo Cruz.

The cases of schistosomiasis reported from 1985 to the first trimester of 2004 were obtained from the National Health Foundation (Funasa).

## RESULTS

Table I shows the localities where the 19 molluscan species were found: *Antillorbis nordestensis* (Lucena, 1954); *Biomphalaria tenagophila* (Orbigny, 1835); *Burnupia* sp.; *Drepanotrema anatinum* (Orbigny, 1835); *Drepanotrema cimex* (Moricand, 1839); *Drepanotrema depressissimum* (Moricand, 1839); *Drepanotrema lucidum* (Pfeiffer, 1839); *Ferrissia* sp.; *Gundlachia ticaga* (Marcus & Marcus, 1962); *Gundlachia* sp.; *Hebetancylus moricandi* (Orbigny, 1837); *Heleobia* sp.; *Idiopyrgus* sp.; *Lymnaea columella* Say, 1817; *Melanoides tuberculatus* (Müller, 1774); *Physa acuta* Draparnaud, 1805; *Physa marmorata* Guilding, 1828; *Pomacea* sp., and *Pomacea sordida* (Swainson, 1823).

Financial support: CNPq, Fiocruz

<sup>+</sup>Corresponding author. Fax: +55-21-2560-2357. E-mail: sthiengo@ioc.fiocruz.br

Received 28 May 2004

Accepted 26 July 2004

TABLE I  
List of species and localities where they were found in the Norte Fluminense Mesoregion of the state of Rio de Janeiro

Municipalities	Districts	Ampullariidae		Hydrobiidae		Thiaridae		Planorbidae				Physidae		Lymnaeidae		Ancyliidae			
		<i>Pomacea sordida</i>	<i>Pomacea</i> sp.	<i>Heleobia</i> sp.	<i>Idiopyrgus</i> sp.	<i>Melanoides tuberculatus</i>	<i>Antilorbis nordestensis</i>	<i>Biomphalaria tenagophila</i>	<i>Drepanotrema anatum</i>	<i>Drepanotrema cinex</i>	<i>Drepanotrema depressissimum</i>	<i>Drepanotrema lucidum</i>	<i>Physa acuta</i>	<i>Physa marmorata</i>	<i>Lymnaea columella</i>	<i>Burnupia</i> sp.	<i>Ferrissia</i> sp.	<i>Gundlachia itaga</i>	<i>Hebetancylus mortcandi</i>
Macaé Microregion	Carapebus		+				+	+	+		+	+							
	Conceição de Macabu			+															
	Conceição de Macabu	+																	
	Macabuzinho																		
	Macaé																		
	Cachoeiros de Macaé																		
	Córrego do Ouro																		
	Frade																		
	Glicério	+																	
	Macaé																		
Sana																			
Quissamã																			
Quissamã																			
Macaé Microregion	São João da Barra																		
	Barcelos																		
	Pipeiras																		
	São João da Barra																		
	São Francisco de Itabapoana																		
	Barra de Itabapoana																		
	Praça João Pessoa																		
	São Francisco de Itabapoana																		
	São Fidélis																		
	Campos dos Goytacazes Microregion	Cambicasca																	
Colônia																			
Ipuca																			
Pureza																			
São Fidélis																			
São Fidélis																			

→



TABLE II  
List of types of cercariae and the localities where they were found in the Norte Fluminense Mesoregion of the state of Rio de Janeiro

Municipalities	Trematode		Mollusc host
	Larval stages	Possible family	
Campos	Xiphidiocercariae	-	<i>Pomacea</i> sp.
	Xiphidiocercariae	-	<i>B. tenagophila</i>
	Xiphidiocercariae (Ubiquita cercaria)	Microphallidae	<i>B. tenagophila</i>
	Xiphidiocercariae (Ornatae cercaria)	Haplometridae or Macroderoididae	<i>D. depressissimum</i>
	Echinostome cercaria	Echinostomatidae	<i>B. tenagophila</i>
	Echinostome cercaria	Echinostomatidae	<i>D. depressissimum</i>
	Strigid cercaria	Strigeidae or Diplostomatidae	<i>D. lucidum</i>
Conceição de Macabu	Xiphidiocercariae (Ubiquita cercaria)	Microphallidae	<i>P. sordida</i>
Macaé	Xiphidiocercariae	-	<i>G. ticaga</i>
	Echinostome cercaria	Echinostomatidae	<i>Pomacea</i> sp.
	Echinostome cercaria	Echinostomatidae	<i>B. tenagophila</i>
	Strigid cercaria	Strigeidae or Diplostomatidae	<i>D. cimex</i>
Quissamã	Strigid cercaria	Strigeidae or Diplostomatidae	<i>D. cimex</i>
São Fidélis	Xiphidiocercariae (Ubiquita cercaria)	Microphallidae	<i>Pomacea</i> sp.
	Xiphidiocercariae (Ornatae cercaria)	Haplometridae or Macroderoididae	<i>D. depressissimum</i>
	Xiphidiocercariae (Ornatae cercaria)	Haplometridae or Macroderoididae	<i>D. lucidum</i>
	Xiphidiocercariae (Ornatae cercaria)	Haplometridae or Macroderoididae	<i>L. columella</i>
	Echinostome cercaria	Echinostomatidae	<i>B. tenagophila</i>
	Pleurolophocercus cercariae	Opistorchiidae, Cryptogonimidae or Heterophyidae	<i>Heleobia</i> sp.
São Francisco de Itabapoana	Xiphidiocercariae	-	<i>B. tenagophila</i>
	Echinostome cercaria	Echinostomatidae	<i>B. tenagophila</i>
	Pleurolophocercus cercariae	Opistorchiidae, Cryptogonimidae or Heterophyidae	<i>Heleobia</i> sp.
São João da Barra	Xiphidiocercariae	-	<i>D. cimex</i>
	Xiphidiocercariae	-	<i>Pomacea</i> sp.
	Echinostome cercaria	Psilostomatidae	<i>D. cimex</i>
	Strigid cercaria	Strigeidae or Diplostomatidae	<i>Ferrissia</i> sp.

## DISCUSSION

The present study extended the geographical distribution of *B. tenagophila* in the state of Rio de Janeiro (Paraense 1986, Thiengo et al. 1998, 2001, 2002a b, 2004). It was previously recorded in Metropolitana Mesoregion (all municipalities), Centro Fluminense Mesoregions (all municipalities), Baixadas Mesoregion (all municipalities except Arraial do Cabo), Sul Fluminense Mesoregion (all municipalities except Parati), and Norte Fluminense Mesoregion (Campos dos Goytacazes and Macaé), including 69 municipalities in the state. The records for Carapebus, Conceição de Macabu, Quissamã, São João da Barra, São Francisco de Itabapoana, São Fidélis, and Cardoso Moreira are new.

In relation to the non-vector planorbid species, *D. anatum* was the most common, followed by *D. cimex*. In the previously studied mesoregions, the most frequent species were *D. anatum* in the Metropolitana and Centro Fluminense Mesoregions (Thiengo et al. 2001, 2002a), *D. cimex* in the Baixadas Mesoregion (Thiengo et al. 2002b) and *D. lucidum* in the Sul Fluminense Mesoregion (Thiengo et al. 2004). The distribution of *A. nordestensis*,

previously known in 28 municipalities in the state (Thiengo et al. 1998, Santos et al. 1999, Thiengo et al. 2001, 2002ab, 2004), is now extended to include Campos, Conceição de Macabu, Macaé, and São Fidélis.

*Lymnaea columella* shows wide range in the state and, in Norte Fluminense Mesoregion specimens were collected from five municipalities and 16 districts.

Of the remaining *Pulmonata* species, *P. marmorata* was found most frequently (8 municipalities; 27 districts) similarly to Baixadas, Centro and Sul Fluminense Mesoregions (Thiengo et al. 2002a b, 2004).

The Afro-Asian thiarid *M. tuberculatus* was found in four municipalities and seven districts in the northern Norte Fluminense Mesoregion. The current distribution of that invasive gastropod competitor of planorbid intermediate hosts of *S. mansoni* in Brazil had already been reported by our group (Fernandez et al. 2003). The first record of that species in the country was in 1967 in Santos, state of São Paulo, and since then it has been recorded in the Distrito Federal and 17 out of the 26 states from Brazil.

Concerning the other Prosobranchia, hydrobiid species were found in the all municipalities, but Conceição de

Macabu and Quissamã. *Heleobia* sp. was the most frequent species of Hydrobiidae, and *Idiopyrgus* sp. was found only in Campos. As in Mesoregion Baixadas the geographical distribution of hydrobiid species is probably due to favorable environmental conditions such as the occurrence of many brackish waterbodies, where most specimens were collected.

Specimens of *Pomacea* sp., collected from eight municipalities, are quite different from those reported by Thiengo et al. (2002ab, 2004) in Centro Fluminense, Baixadas and Sul Fluminense Mesoregions. Further morphological and molecular studies are being undertaken on samples from those regions, in order to identify them.

Among the ancylids *G. ticaga* occurred in six municipalities and was the most frequently found species as well as the previously studied mesoregions. Of the remaining ancylid species, *H. moricandi* was reported in the Metropolitana Mesoregion only (Thiengo et al. 1998), under the name of *Gundlachia moricandi* (Orbigny, 1837); specimens of *Burnupia* sp. were found in the Baixadas and Metropolitana Mesoregions whereas those of *Ferrissia* sp. in all previously studied Mesoregions.

Due to the limitation of logistic resources available to Funasa no intensive parasitological surveys have been done during the last years. Thus the number of positive cases in the period studied (82 in three municipalities) must be seen as underestimated information.

With regard to other trematode, the xiphidiocercariae group was the most frequently larval type found in the molluscs, corroborating Thiengo et al. (2002a b, 2004).

#### ACKNOWLEDGEMENTS

To Dr Patricia Moza (Funasa, RJ) for informing the number of cases of schistosomiasis in the state.

#### REFERENCES

- CIDE-Centro de Informações e Dados do Rio de Janeiro 2001. Secretaria do Estado de Planejamento, Desenvolvimento Econômico e Turismo, Rio de Janeiro: map.
- Fernandez MA, Thiengo SC, Simone LRL 2003. Distribution of the introduced freshwater snail *Melanoides tuberculatus* (Mollusca; Thiaridae) in Brazil. *The Nautilus 117*: 78-82.
- IBGE 1995. Síntese da documentação histórico-administrativa e geográfica dos Estados do Brasil – Rio de Janeiro. Fundação Instituto Brasileiro de Geografia e Estatística, Rio de Janeiro.
- Paraense WL 1975. Fauna planorbídica do Brasil. In CS Lacaz, RG Baruzzi, W Siqueira Jr (eds), *Introdução à Geografia Médica do Brasil*, Edgard Blücher & Univ. São Paulo, São Paulo, p. 213-239.
- Paraense WL 1986. Distribuição dos caramujos no Brasil. In FA Reis, I Faria, N Katz (eds), *Modernos Conhecimentos sobre Esquistossomose Mansônica*, Biblioteca da Academia Mineira de Medicina, Belo Horizonte, p. 117-128.
- Santos SB, Monteiro DP, Fernandez MA, Thiengo SC 1999. Primeiro registro de *Antillorbis nordestensis* (Lucena) (Mollusca, Gastropoda, Planorbidae) para a Ilha Grande, Angra dos Reis, Rio de Janeiro. *Rev Bras Zool 16*: 257-259.
- Schell S 1970. *How to Know the Trematodes*, WMC Brown Co. Publ, Dubuque, 355 pp.
- Thiengo SC, Fernandez MA, Boaventura MFF, Stortti MA 1998. A survey of gastropods in the Microrregião Serrana of Rio de Janeiro, Brazil. *Mem Inst Oswaldo Cruz 93* (Suppl. I): 233-234.
- Thiengo SC, Fernandez MA, Boaventura MF, Gault CE, Silva HFR, Mattos AC, Santos SB 2001. Freshwater snails and schistosomiasis mansoni in the state of Rio de Janeiro, Brazil: I – Metropolitan Mesoregion. *Mem Inst Oswaldo Cruz 96* (Suppl.): 177-184.
- Thiengo SC, Fernandez MA, Boaventura MF, Santos SB, Mattos AC 2002a. Freshwater snails and schistosomiasis mansoni in the state of Rio de Janeiro, Brazil: II – Centro Fluminense Mesoregion. *Mem Inst Oswaldo Cruz 97*: 621-626.
- Thiengo SC, Fernandez MA, Boaventura MF, Magalhães MG, Santos SB 2002b. Freshwater snails and schistosomiasis mansoni in the state of Rio de Janeiro, Brazil: III – Baixadas Mesoregion. *Mem Inst Oswaldo Cruz 97* (Suppl. I): 43-46.
- Thiengo SC, Mattos AC, Boaventura MF, Fernandez MA 2004. Freshwater snails and schistosomiasis mansoni in the state of Rio de Janeiro, Brazil: IV – Sul Fluminense Mesoregion. *Mem Inst Oswaldo Cruz 99*: 275-280.

