

NATURAL AND EXPERIMENTAL INFECTION OF PLANORBIDS FROM THE ISLAND OF SANTA CATARINA (BRAZIL).

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SUMMARY

Studies on eight localities on the Island of Santa Catarina revealed the presence of three species of the molluscan family Planorbidae: *Biomphalaria tenagophila*, *Drepanotrema cimex* and *Biomphalaria oligoza*, the first one being naturally infected by *Cercaria ocellifera*, a furcocercaria with morphological characteristics of *Cercaria caratinguensis*, and by an unknown furcocercaria. *Drepanotrema cimex* was infected by a furcocercaria with characteristics of *C. caratinguensis* and by *C. macrogranulosa*. No natural infection was found in *B. oligoza*. *B. tenagophila* showed no susceptibility to the experimental infection by the BH-MG strain of *Schistosoma mansoni* from Belo Horizonte and maintained at laboratory in *B. glabrata* snails.

KEY WORDS: Planorbid; *Biomphalaria* sp.; *Drepanotrema* sp.; Trematode; Cercariae; Furcocercariae; Infection; *Schistosoma mansoni*; Schistosomiasis.

INTRODUCTION

Many snails act as intermediate hosts of parasites whose adult forms develop in wild and domestic animals as well as in men. The planorbids, pulmonated freshwater snails belonging to the molluscan family Planorbidae, include the genus *Biomphalaria* Preston, 1910, which is vector of *Schistosoma mansoni* Sambon, 1907, the worm causing Schistosomiasis in Brazil²². This genus comprises ten species described in this country⁷, three of them (*B. glabrata*, *B. tenagophila* and *B. straminea*) being effective vectors of the parasite⁸.

In Brazil, such snails can be considered still more important since South-American schistosomiasis caused by *S. mansoni* prevails¹³ and tends to expand. The Health Ministry estimated 5.5 million infected people within 17 studied Brazilian States in 1985⁹. Due to its relevance to public health, several authors have been trying to update information on planorbid population, such as their geographical distribution and susceptibility. According to

CUNHA⁴ these are the first steps towards an epidemiological study of schistosomiasis in any region. Susceptibility studies provide data, which help to predict the potential of an area to become endemic³.

The schistosomiasis control is difficult to be made due to the epidemiological characteristics of the disease²⁰. Its expansion, for instance, is due mainly to internal migratory movements¹⁸, responsible for new foci.

The first focus of active transmission in the State of Santa Catarina was described recently, in 1980, in the district of São Francisco do Sul¹. In 1991 another one was detected in Jaraguá do Sul (FUNASA, not published data).

Planorbids are often suitable to become intermediate hosts to other trematodes besides *S. mansoni*. Many vertebrates are parasitized by digenetics whose larvae develop inside these snails¹², disturbing their development and reducing their fecundity, besides inhibiting or suppressing superinfection with *S. mansoni*⁵.

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Taking these facts into account, this paper tries to supply the first data on natural and experimental infection of planorbids of the Island of Santa Catarina.

MATERIAL AND METHODS

The Island of Santa Catarina locates between 27°10' and 27°50' latitude South and 42°25' and 48°35' longitude West. The snails were collected, during 1989, at the following sites on the Island: Vargem Grande, Vargem Pequena, Ratonos and Canasvieiras (Northern sites); Córrego Grande (at the Island center); and Rio Tavares, Campeche and Ribeirão da Ilha (Southern sites). The collected species were taken to the laboratory and submitted to a light focus for two hours in a 50ml Becker cup containing 10ml dechlorated water. They were afterwards observed under stereomicroscope to detect natural infection. The snails presenting negative results were submitted to new examinations each 15 days during 75 days. Some specimens were dissected for species identification, confirmed by Dr. W. L. Paraense (Oswaldo Cruz Institute, Rio de Janeiro) and Dr. L.A. Magalhães (Biology Institute, State University of Campinas, São Paulo).

The obtained cercariae were observed at the optic microscope and photographed, being afterwards fixed in vapour formol. Species identification was confirmed by Dr. P. de T. Artigas (Parasitology Department, State University of Campinas, São Paulo) and Dr. J.F. Vaz (Biology Department, São Paulo University).

For laboratory infection by *S. mansoni* the BH-MG strain from Belo Horizonte was used.

This strain is maintained in laboratory through successive passages from albino mice to *B. glabrata* snail. Snails of F1 generation (approximately 8mm in diameter) were exposed to ten miracidia each. The miracidia were taken from infected mice liver according to the techniques described by OLIVER-GONZALES *et al.*¹⁶ and GRIFFITHS & BEESLEY⁶. *B. tenagophila* from São Francisco do Sul (Santa Catarina State) was used as control. The snails examination followed the techniques described by SOUZA *et al.*²¹.

RESULTS

Just half of the eight investigated sites revealed the presence of planorbid specimens, as shown in Table 1. Between the snails collected in Córrego Grande, 30 *B. tenagophila* Orbigny, 1835, presented infection by furcocercariae with characteristics of *Cercaria caratinguensis* Ruiz, 1953 (Fig. 1); 5 were infected with *C. ocellifera* Lutz, 1917 (Fig. 3) and 4 with an unknown furcocercaria (Fig. 2). Among the *Drepanotrema cimex* Moricand, 1839, 4 were infected with a *C. caratinguensis*-like furcocercariae; 3 with *C. macrogranulosa* Ruiz, 1952 (Fig. 4) and one with both *C. macrogranulosa* and *C. caratinguensis*-like furcocercariae.

Data referring to experimental infection of *B. tenagophila* by *S. mansoni* BH-MG strain are summarized in Table 2.

DISCUSSION

At the sites Vargem Grande, Vargem Pequena, Ratonos and Campeche no genus of

Table 1.
Planorbids collected in four localities of the Island of Santa Catarina (Brazil), 1989.

| Locality and date | Planorbid | | |
|-------------------------------|-----------------------|-------------------|-------------------------|
| | <i>B. tenagophila</i> | <i>B. oligoza</i> | <i>Drepanotrema</i> sp. |
| Córrego Grande (10/1989) | 1303 | 0 | 25* |
| Rio Tavares (09/1989) | 0 | 8 | 0 |
| Ribeirão da Ilha (09/1989) | 0 | 14 | 19* |
| Canasvieiras (04/1989) | 0 | 0 | 53 |

*All planorbids *D. cimex*

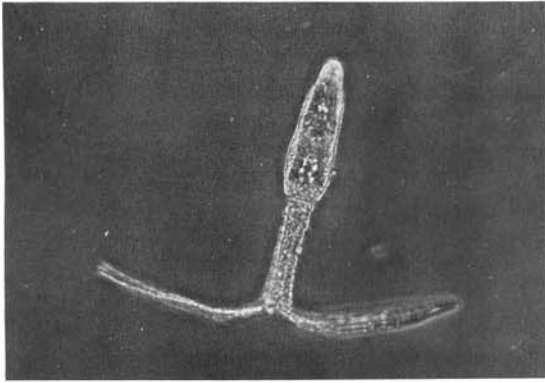


Fig. 1 – Photograph of a furcocercaria with morphologic characteristics of *Cercaria caratinguensis*. 240 times enhanced.

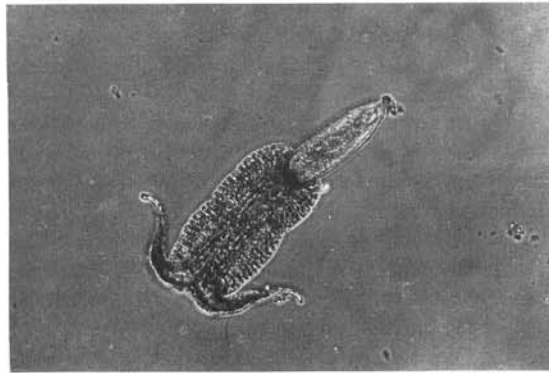


Fig. 2 – Photograph of an unknown furcocercaria. 140 times enhanced.

the Planorbidae family was found. From all places where planorbids could be found, Córrego Grande presents the greatest number of snails, represented by *Drepanotrema cimex* and *Biomphalaria tenagophila* (table 1). Since the last one is intermediate host to *S. mansoni*, this locality acquires great meaning relating to sanitary conditions.

The obtained results show that while *B. tenagophila* from São Francisco do Sul had an infection index of 56.56%, *B. tenagophila* from Córrego Grande did not show to be susceptible to BH-MG of *S. mansoni* strain. The infection was not successful in any examined snail.

In spite of these results, it is not prudent to exclude the possibility that these snails may act as intermediate hosts to other *S. mansoni* strains. It is well known that natural trematode transmission may depend critically on the degree of compatibility of local snails and trematode strains¹⁰.

For a long time *B. tenagophila* was considered an ineffective host for *S. mansoni*, being called *Planorbis immunis* by Lutz, due to experimental infection failure². Different natural or experimental infection rates are indeed due to different degrees of physiological adaptation between parasite and host, being not only the result of high or low susceptibility to a certain snail strain¹⁷.

The area of schistosomiasis transmission through *B. tenagophila* has been expanding lately. Parasite strains which become more adapted to infect these snails may spread the disease along regions where it still does not exist¹⁴.

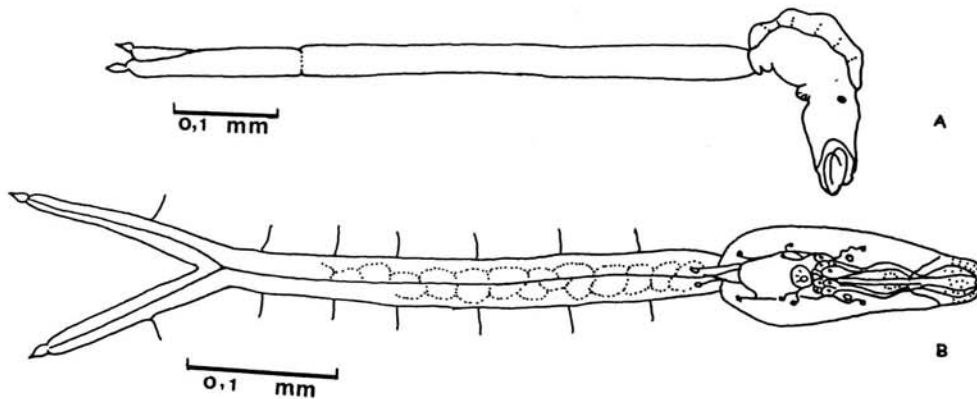


Fig. 3 – *Cercaria ocellifera*. A. side-view; B. ventral-view. Extracted from NARUTO, 1984¹⁵.

Table 2.

Results of the experimental infection of *Biomphalaria tenagophila* from Córrego Grande, Santa Catarina Island (Brazil), compared to that of São Francisco do Sul, using the BH-MG strain of *Schistosoma mansoni*.

| Snails | Experimental group (from Córrego Grande) | Control group (from São Francisco do Sul) |
|-----------------------|---------------------------------------------|----------------------------------------------|
| Exposed to infection | 105 | 122 |
| Examined* | 102 | 106 |
| Eliminating cercariae | – | 69 |
| Infection rate | – | 56.56% |

*Three specimens from Córrego Grande and 16 from São Francisco do Sul died.

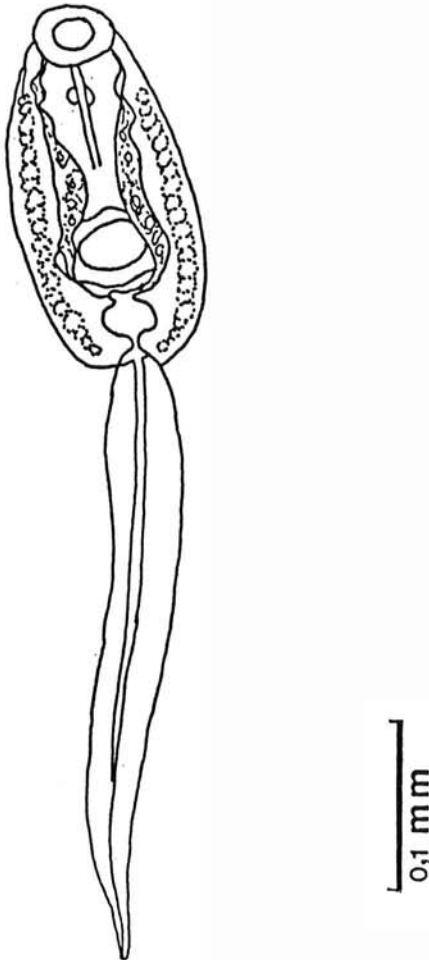


Fig. 4 – *Cercaria macrogranulosa*. Extracted from NARUTO, 1984¹⁵.

Due to internal migration carriers of schistosomiasis are found in almost all Brazilian States, independently from the existence of a transmission focus, thus causing the development of new ones, stable or occasional¹⁹.

On what concerns natural infection our tests showed positive results just for the planorbids found at Córrego Grande, which were infected by four different trematode species. The most represented, *C. caratinguensis*-like furcocercariae (Fig. 1), infected 2.3% of the *B. tenagophila* snails and 16% of the *Drepanotrema cimex*, the later seeming to be more susceptible to this type of infection. Although the importance of investigation trematodes which have as intermediate hosts some vector snails of *S. mansoni* is evident, there are not enough anatomical data or more extensive information available. Researches studying digenetic larvae found in planorbids will certainly come across a greater diversity than the one already described. These trematodes are able to reduce or to suppress superinfection by *S. mansoni*, or also to disturb snail development⁵. MACHADO *et al.*¹² verified that *B. tenagophila* previously infected by acculeated distomocercariae were protected from *S. mansoni* superinfection in 87% of the cases.

Investigating several specimens of *B. tenagophila* from Louveira (São Paulo State), MACHADO *et al.*¹¹ found that the natural infection was monospecific in 96.56% of the snails. Contemporary parasitism was verified only in 3.35% of the cases. This corresponds to our results: just one specimen (2.2% of the natural infected snails), *Drepanotrema cimex*, showed infection by *C. macrogranulosa* (Fig. 4)

and by a furcocercariae resembling *C. caratinguensis*.

The finding of a larval form such as a furcocercariae (Fig. 2), which according to Dr. P. de T. Artigas (personal communication) has not yet been described in the literature, illustrates the need for further trematode studies. We plan to describe this unknown larvae at next.

RESUMO

Infecção natural e experimental de Planorbídeos da Ilha de Santa Catarina (Brasil).

Pesquisas em oito localidades da Ilha de Santa Catarina revelaram a presença de três espécies da família Planorbidae: *Biomphalaria tenagophila*, *Drepanotrema cimex* e *B. oligoza*, estando a primeira naturalmente infectada por *Cercaria ocellifera*, furcocercária com características morfológicas de *C. caratinguensis* e uma furcocercária desconhecida. O segundo molusco citado, estava infectado com *C. macrogranulosa* e com furcocercária com características de *C. caratinguensis*, não sendo constatada infecção natural em *B. oligoza*. No processo de infecção experimental com cepa BH-MG de *Schistosoma mansoni*, cepa originária de Belo Horizonte e mantida em laboratório em molusco *B. glabrata*, *B. tenagophila* não se mostrou suscetível.

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