

**DIGENEA OF *Salminus brasiliensis* (CUVIER, 1817) (OSTEICHTHYES, CHARACIDAE)
OF THE SÃO FRANCISCO RIVER BASIN, BRAZIL**

**Digenea de *Salminus brasiliensis* (Cuvier, 1817) (Osteichthyes, Characidae)
da bacia do rio São Francisco, Brasil**

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SUMMARY: Three species of Digenea - *Neocladocystis intestinalis* (Vaz, 1932), *Bellumcorpus major* Kohn, 1962 and *Prosthenhystera obesa* (Diesing, 1850) – were found in *Salminus brasiliensis*, an endemic fish of the basin of the São Francisco river, Brazil. *Neocladocystis intestinalis* was located in the intestine, whereas *B. major* and *P. obesa* were located in the gall bladder of the host. *Neocladocystis intestinalis* was the most prevalent, yet no statistically significant difference in the intensity of the infection was observed between the sexes or in relation to the size of the host. This is the first time *N. intestinalis* and *B. major* are reported in *S. brasiliensis*, and their known geographic distribution now includes the São Francisco river basin.

KEY WORDS: Digenea, *Salminus brasiliensis*, São Francisco river, Brazil.

Salminus brasiliensis (Cuvier 1817), a representative of the Characidae that is endemic in the São Francisco river basin, is believed to be threatened with extinction upstream of the Três Marias dam in Minas Gerais (SATO *et al.* 1987). Known popularly as “dourado”, *S. brasiliensis* is the second largest in size among the São Francisco fishes and can reach up to 30 kg, for which reason it is among the region’s most important species for professional and sport fishing (SATO & GODINHO 1999). So far, *Prosthenhystera obesa* (Diesing, 1850) is the only Digenea identified in *S. brasiliensis* of the São Francisco basin (TRAVASSOS 1922; TRAVASSOS *et al.* 1928; TRAVASSOS & KOHN 1965; KOHN *et al.* 1997) and, even though those occurrences were reported for *S. brevidens* (Cuv.) or *S. maxillosus* (Cuv. & Val.) in the São Francisco river basin, they correspond to *S. brasiliensis* (BRITSKI *et al.* 1988).

In this paper, three Digenea species are reported in *S. brasiliensis*, as well as their quantitative relations with this host and the increase of the known geographic distribution of two of these species.

Thirty-six specimens of *S. brasiliensis* were collected in

the São Francisco river, municipality of Três Marias (18°12’32’’S, 45°15’41’’W), during the period between September, 1999 and September, 2000, of which 21 were males varying from 25 to 70 cm in total length (mean: 40.13; standard deviation: ± 17.94 cm) and from 131 to 3800 g in weight (2620.23 ± 1227.13 g) and 15 were females with total length ranging from 30 to 82 cm (66.46 ± 15.39 cm) and weight from 273 to 6550 g (4094.40 ± 1998.33 g). The hosts were identified following BRITSKI *et al.* (1988).

For parasites investigation, the specimens were necropsied in the Laboratório de Ictiologia da Estação de Hidrobiologia e Piscicultura da Companhia de Desenvolvimento dos Vales do São Francisco e Parnaíba (EPT/CODEVASF). The Digenea found were fixed in a solution of ethyl alcohol, commercial formalin (37%) and glacial acetic acid (AFA), stained with Mayer’s acid carmalum, cleared in Faia’s creosot and mounted in Canada’s balsam. Selected specimens were measured under a Nikon Alphaphot Microscope and identified according to TRAVASSOS *et al.* (1928), YAMAGUTI (1971) and THATCHER (1991, 1993). Voucher specimens were deposited in the Helminthologic Collection of the Oswaldo

Table I. Measurements of Digenea of *Salminus brasiliensis* (Cuvier, 1817) from the São Francisco River, Minas Gerais State, Brazil.

Character	<i>Neocladocystis intestinalis</i> (Vaz, 1932)	<i>Bellumcorpus major</i> (Kohn, 1962)	<i>Prosthenthystera obesa</i> (Diesing, 1850)
Length/Width (mm)	Mean (range) (n*)	Mean (range) (n*)	Mean (range) (n*)
Body	1.40 (0.80-1.90) (n=10)	6.85 (6.50-8.30) (n=8)	13.50 (9.75-16.5) (n=3)
	0.39 (0.21-0.55) (n=10)	3.57 (2.88-3.66) (n=8)	8.09 (7.10-8.65) (n=3)
Oral sucker	0.12 (0.07-0.16) (n=10)	-	1.25 (0.92-1.65) (n=3)
	0.09 (0.07-0.13) (n=10)	-	1.09 (0.90-1.65) (n=3)
Rhynchus	-	0.65 (0.60-0.70) (n=8)	-
	-	0.54 (0.45-0.58) (n=8)	-
Pharynx	0.05 (0.05-0.06) (n=10)	0.28 (0.26-0.30) (n=8)	0.57 (0.24-0.98) (n=3)
	0.04 (0.04) (n=10)	0.30 (0.30-0.33) (n=8)	0.58 (0.24-0.96) (n=3)
Eggs (µm)	40 (n=10)	25 (n=8)	75 (65-92) (n=6)
	10 (n=10)	15 (n=8)	51 (32-91) (n=6)
	Intestine	Gall bladder	Gall bladder

* number of specimens measured

Cruz Institute (CHIOC), Rio de Janeiro, Brazil. Ecological terminology (prevalence, mean intensity of infection and mean abundance) follows BUSH *et al.* (1997). The Chi-square test (χ^2) with Yate's correction, evaluated the number of hosts collected by sex. A Student's t-test was used to evaluate hosts total length as related to hosts sex, and the intensity of infection in relation to host sex. Prevalence as related to host sex was evaluated throughout the *G* log-likelihood test. The intensity of infection in relation to hosts total length was tested using Spearman rank correlation coefficient (r_s). The statistical tests were conducted in accordance with ZAR (1996) and the statistical significance was evaluated at $P < 0.05$. The analysis included only parasite species with prevalence greater than 10%, following that recommended by BUSH *et al.* (1990).

A larger number of males than females hosts were examined, but this wasn't statistically significant ($\chi^2=1.0$; $0.50 < P < 0.25$). The male hosts were smaller than the females, which wasn't also statistically significant ($t=1.76 \times 10^{-5}$; $P < 0.99$).

Of 36 specimens of *S. brasiliensis* examined, 29 (18 males and 11 females) were infected with Digenea. These totaled 183 specimens, of which 156 were *Neocladocystis intestinalis* (Vaz, 1932) Manter & Pritchard, 1969 (Acanthostomidae), located in the medium and posterior intestines (CHIOC - n° 34578), 20 were *Bellumcorpus major* Kohn, 1962 (Bucephalidae) (CHIOC - n° 34576), and 7 were *Prosthenthystera obesa* (Callodistomidae) (CHIOC - n° 34577), located in the gall bladder. Table I shows the measurements of the Digenea specimens.

Of the 29 parasitized *S. brasiliensis* specimens, 23 were infected with a single Digenea species (19 with *N. intestinalis*, 2 with *B. major*, and 2 with *P. obesa*) and six were infected

with two Digenea species (3 with *N. intestinalis* and *B. major* and also 3 with *N. intestinalis* and *P. obesa*). No one host was infected with *B. major* and *P. obesa* concomitantly.

Neocladocystis intestinalis occurred in 69% of the hosts, with a mean intensity of 6.2 and mean abundance of 4.4. No significant variation was found between the male and female hosts either in prevalence ($G=0.18$; $0.75 < P < 0.50$) or in the number of *N. intestinalis* ($t=0.24$; $P < 0.50$), and there wasn't also significant correlation between the intensity of the infection with this parasite and the size of the male ($r_s=-0.21$; $P=0.36$) and female ($r_s=-0.09$; $P=0.73$) hosts.

Bellumcorpus major showed prevalence of 14%, mean intensity of 4.0, and mean abundance of 0.6. Occurred only in males and was not related significantly with the size of the hosts ($r_s=-0.57$; $P=0.08$).

Prosthenthystera obesa occurred in 14% of the infected *S. brasiliensis* specimens, with a mean intensity of 1.4 and mean abundance of 0.2. No significant difference was found between males and female hosts neither in prevalence ($G=-0.9$; $0.75 < P < 0.50$), nor in the intensity of the infection ($t=0.51$; $P < 0.50$). The correlation between the intensity of the infection and the size of the males ($r_s=0.28$; $P=0.22$) and females ($r_s=0.08$; $P=0.77$) hosts was not statistically significant.

Neocladocystis intestinalis was the most prevalent and abundant species, followed by *B. major*. This finding supports the hypothesis that, being piscivorous, *S. brasiliensis* is more likely to acquire Digenea such as *N. intestinalis*, which uses vertebrates (fish) as intermediate hosts in their life cycle (YAMAGUTI 1971) than *P. obesa*, whose smaller prevalence is probably due to the little or accidental consumption of mollusks (intermediate hosts) by *S. Brasiliensis*.

The intensity of *N. intestinalis* infection did not differ

significantly between the male and female hosts examined. Also, there wasn't significant correlation between the intensity of the infection and the size of the hosts. These results show that *N. intestinalis* infects *S. brasiliensis* regardless of the sex or size of the host, that indicates that *S. brasiliensis*, whether male or female, feeds on smaller fish from its early days to adulthood.

Neocladocystis intestinalis found from the intestine of *S. brasiliensis*, was also registered in *S. maxillosus* from Mogi-Guaçu, Tietê and Paraná rivers and in *S. hilarii* Cuv. & Val. from Mogi-Guaçu river (FERNANDES & KOHN 2001).

Bellumcorpus major, which so far had only been found in the stomach and intestine of *S. hilarii* (THATCHER 1991), now has a new location in the gall bladder of *S. brasiliensis*.

In the São Francisco river basin *P. obesa* was recorded by TRAVASSOS (1922) in non identified "dourados" from Lassance, Minas Gerais, TRAVASSOS *et al.* (1928) in *S. brevidens* and by KOHN *et al.* (1997) in *S. brevidens* from Pirapora, Minas Gerais. *Prosthenhystera obesa* was also registered according to PAVANELLI *et al.* (1992), KOHN *et al.* (1997), ISAAC *et al.* (2000) in *S. maxillosus* from Paraná River, Paraná, by KOHN *et al.* (1997) in *S. brevidens* from Grande River, Bahia and of the *S. hilarii* from São Paulo. *Neocladocystis intestinalis* and *B. major* are here reported for the first time in *S. brasiliensis*, and their geographic distribution has been extended to the São Francisco river basin.

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SUMÁRIO

Três espécies de Digenea - *Neocladocystis intestinalis* (Vaz, 1932), *Bellumcorpus major* Kohn, 1962 and *Prosthenhystera obesa* (Diesing, 1850) - foram encontradas em *Salminus brasiliensis*, peixe endêmico da bacia do Rio São Francisco. *Neocladocystis intestinalis* foi localizada no intestino, enquanto que *B. major* e *P. obesa* foram encontradas na vesícula biliar do hospedeiro. *Neocladocystis intestinalis* foi a espécie mais prevalente e sua intensidade de infecção não foi influenciada estatisticamente pelo sexo nem

pelo tamanho do hospedeiro. Esta é a primeira vez que *N. intestinalis* e *B. major* são encontradas em *S. brasiliensis*, e a distribuição geográfica dessas espécies agora incluem a bacia do São Francisco.

PALAVRAS-CHAVE: Digenea, *Salminus brasiliensis*, rio São Francisco, Brasil.

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