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NATURAL INFECTION OF WILD RODENTS BY *SCHISTOSOMA MANSONI* PARASITOLOGICAL ASPECTS

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The evaluation of the role of rodents as natural hosts of Schistosoma mansoni *was studied at the Pamparrão Valley, Sumidouro, RJ, with monthly captures and examination of the animals.*

Twenty-three Nectomys squamipes *and 9* Akodon arviculoides *with a schistosomal infection rate of 56.5% and 22.2% respectively eliminated a great majority of viable eggs.*

With a strain isolated from one of the naturally infected N. squamipes, *we infected 75% of simpatric* Biomphalaria glabrata *and in 100% of albino* Mus musculus *mice.*

The adult worms, isolated from N. squamipes *after perfusion were located mainly in the liver (91.5%) and the mesenteric veins (8.5%). The male/female proportion was of 2:1.*

The eggs were distributed on small intestine segments (proximal, medial and distal portions) and the large intestine without any significant differences in egg concentration of these segments.

In A. arviculoides, *the few eggs eliminated by the stools were viable and there was litlle egg retention on intestinal segments.*

Considering the ease to complete S. mansoni *biological cycle in the* Nectomys/Biomphalaria/ Nectomys *system under laboratory conditions, probably the same is likely to occur in natural conditions.*

In support to this hypothesis there are also the facts that human mansonic schistosomiasis has a very low prevalence in Sumidouro and endemicity among the rodents has not changed even after repetead treatments of the local patients.

Based on our experiments, we conclude that N. squamipes *has become a natural host of* S. mansoni *and possibly may participate in keeping the cycle of schistosomiasis transmission at Pamparrão Valley.*

Key words: *Schistosoma mansoni* – wild rodents – *Nectomys squamipes* – *Akodon arviculoides* – natural infection

In the African continent, several *Schistosoma* species, which parasite human species, circulate also among other orders of mammals: *Artiodactyla, Perissodactyla, Primata, Insectivora* and *Rodentia* (Nelson, 1960; Pitchford, 1977).

In Brazil, the only existing species, *Schistosoma mansoni* has already been reported in marsurpials (Martins et al., 1955) bovine cattle (Barbosa et al., 1962) and rodents (Amorim, 1953; Barbosa et al., 1953; Piva & Barros, 1966; Barbosa, 1972; Dias et al., 1978), beside man.

The occurrence of natural schistosome infection in rodents depends on each epidemiologic situation.

In Alagoas State, *Nectomys squamipes* was found with a high rate of infection in Viçosa,

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however when captured at more than 400 meters from the domicile site, did not present schistosome infection (Amorim, 1962).

Holochilus brasiliensis captured at the Paraiba river Valley (São Paulo) and in São Bento (Maranhão State) presented 75% positive rate for *S. mansoni* (Dias, 1976; Picot et al., 1990).

In Belo Horizonte (Minas Gerais State), the biologic cycle may be completed in the absence of human contamination, under semi-natural conditions, with the *N. squamipes* – *Biomphalaria glabrata* cycle (Antunes et al., 1971) and *Holochilus* – *B. glabrata* (Carvalho et al., 1976).

In natural foci of schistosomiasis at the district of Sumidouro, Rio de Janeiro State, this can also be observed, since there were no changes on the rodents infection rates, despite repeated treatments of the local human population (Carvalho, 1982).

The aim of the present work is to analyse the role of wild rodents as non-human hosts of schistosomiasis, studying an endemic area at the district of Sumidouro, Rio de Janeiro State, Brazil.

MATERIALS AND METHODS

Study area – Sumidouro is located on a mountain region, between the districts of Friburgo and Teresópolis, about 200 km far from the city of Rio de Janeiro. Its geographic coordinates are 22°, 02', 46" latitude South and 42° 41' 21" longitude N. Gr. The weather is light mesothermic and wet (Nimer, 1979) with a hot and wet station (november to march) and other relatively dry and cold (may to october).

In Pamparrão Valley, a rural area of the district, the rodents were captured. The area has about 3 km length, cut by streams and irrigation ditchs for rotation monoculture, specially corn and cucumber.

The local human population (75 individuals) dwells distributed in 25 houses.

Methodology for study of the infection – Capture was carried out between August 1985 and December 1986, with a suitcase-type trap and bananas with peanut cream and oat meal (Moojen, 1943). Every month, for three days in a row, 60 traps were prepared along the main stream at sundown.

Two coprological examination were carried out at the laboratory with three-day intervals by the tecnique of Kato modified (Katz et al., 1972) and Lutz (Lutz, 1919).

The animals were sacrified with sulphuric ether, perfused (Smithers & Terry, 1965) and necropsiaed. Residual worms were collected by dissection or smashing of the liver (Standen, 1953).

The intestine was divided in four segments: proximal small intestine (near the stomach), medial small intestine, distal small intestine and the large intestine. From each segment 2.0 cm were taken out for performing the oogram.

Keeping the cycle in the laboratory – The liver and feces of *N. squamipes* captured at Pamparrão Valley, served for the isolation of the (*R*) strain of *S. mansoni*. The liver was homogenized in a liquefier with cold saline and water filtered in equal parts. This suspension was washed twice. The first with aquarium and saline at 2:1 proportion and the second, only with aquarium water (Faerstein, 1987). The sediment was exposed to a luminous focus to stimulate miracidial eclosion (Standen, 1951).

Forty specimens of *B. glabrata* from Sumidouro, with 5 mm diameter, were exposed to 10 miracidia each (Standen, 1952). Young albino mice (7 days age) were infected by the transcutaneous route, with 50 cercariae from the (*R*) strain. After 30 days, the animals were submitted to a coprological examination (Katz et al., 1972).

Statystical Analysis – The data concerning parasitological examinations of *N. squamipes* were analysed by the chi-square test, Willcoxon, Kruskal-Wallis and Mann-Whitney tests. Values of $p \leq 0,05$ (Conover, 1971) were considered statistically significant.

In *Akodon arviculoides,* the size of the sample was not enough for the statistic analysis.

RESULTS

Of the cricetidae rodents captured, 23 were classified as *N. squamipes* (Brants, 1827) and nine as *A. arviculoides* (Wagner, 1842) 2n = 14. The rates of infection were of 56.5% for *N. squamipes* and 22.2& for *A. arviculoides*.

The positive *N. squamipes* were caught in several points of the main Valley stream.

The two coprologic examinations performed showed averages of 908 to 914 eggs respectively, with a non-significant difference (Table I). All *N. squamipes* eliminated viable eggs of the two positive *A. arviculoides*, only one presented viable eggs in stools (48 eggs per gram of feces).

TABLE I

Natural infection of *Nectomys squamipes* by *Schistosoma mansoni* in Sumidouro, RJ. Quantification of the number of eggs for gram of feces in two stool examinations performed with a three-day interval, by the Kato-Katz method. Examination with invalidated results.

Animal	1st Examination	2nd Examination	Average
1	3432	912	2172
2	456	744	600
3	48	240	144
4	144	192	168
5	–	48	24
6	1536	2448	1992
7	288	1080	684
8	492	1392	942
9	1776	1176	1476
Average	908	914	911

There was no significant difference at the level of 5% (test of Wilcoxon, W = 0,9477, p = 0,3432).

The total number of worms recovered from *N. squamipes* varied between 8 and 142, with an average of 35 (Table II).

An average number of male worms (22) was found in the liver, greater than the number of female worms (10). In the mesentery, the average of male worms was also greater than that of the female ones: 2 an 1 respectively. There was a significant difference on the following aspects: greater number of worms in the liver than in mesentery, greater proportion of males in relation to females, even in the liver as well as the mesentery.

Only two of the nine *A. arviculoides* presented infection. In one of them, only one adult male worm was found in the portal system. On the other, no adult worms were found.

In *N. squamipes* the small intestine medial portion concentrated the greatest absolute number of eggs (Table III). However, significant differences were not found between the various intestinal segments.

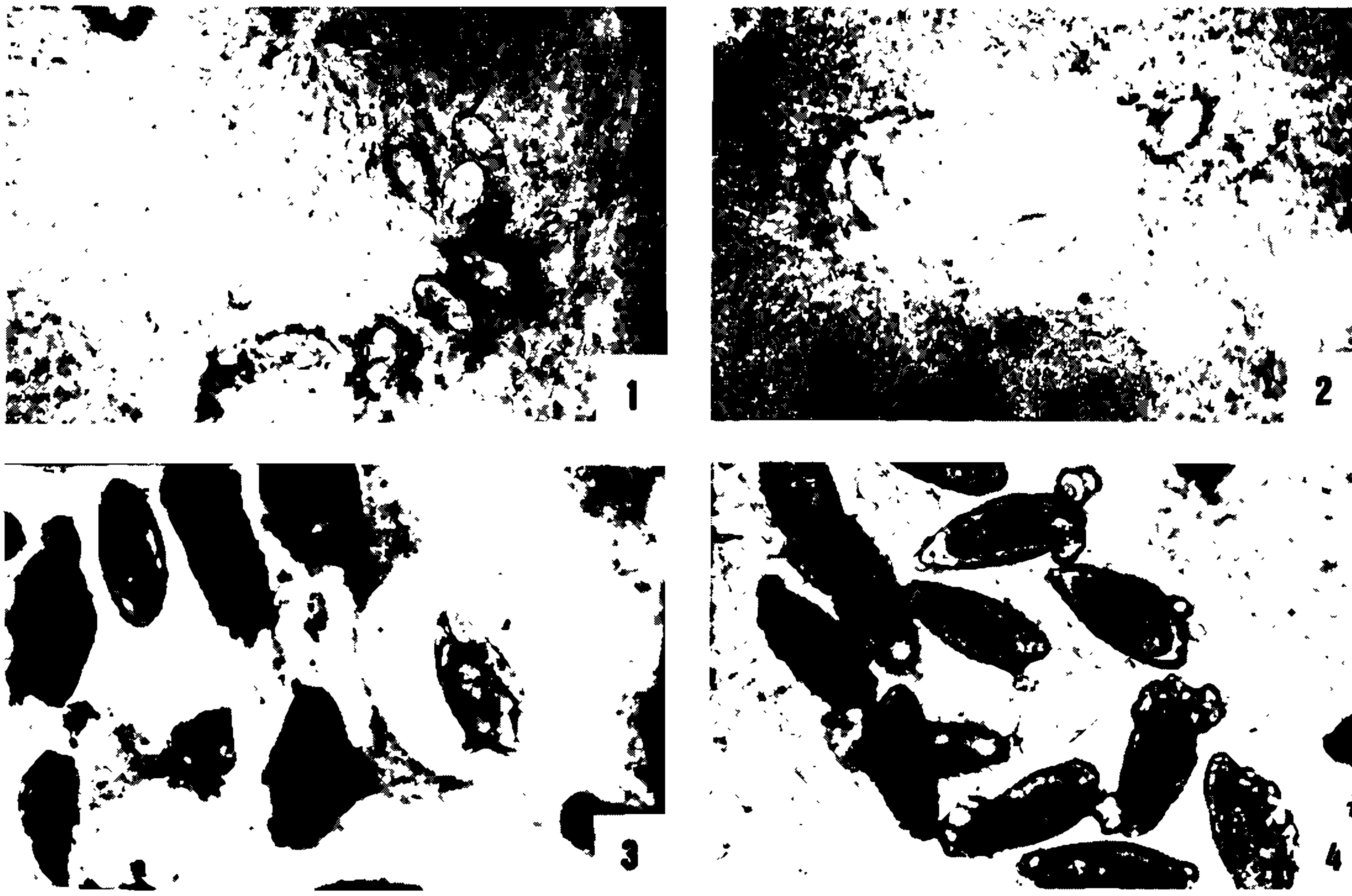
The eggs found on the intestinal wall of *N. squamipes* presented usual morphologic pattern (Fig. 1-3), but in a case there were also eggs with abnormal protuberances in its membrane shield (Fig. 4). This animal remained alive in the laboratory for 490 days.

TABLE II

Natural infection of *Nectomys squamipes* by *Schistosoma mansoni* in Sumidouro, RJ. Number of adult worms recovered by perfusion and dissection

Animal	Liver			Mesentery			Total		
	No.	Male	Female	No.	Male	Female	No.	Male	Female
1	6	6	0	2	1	1	8	7	1
2	10	7	3	7	6	1	17	13	4
3	14	10	4	10	7	3	24	17	7
4	19	12	7	2	1	1	21	13	8
5	46	36	10	0	0	0	46	36	10
6	12	8	4	2	1	1	14	9	5
7	28	23	5	7	5	2	35	28	7
8	10	8	2	2	2	0	12	10	2
9	139	97	42	3	2	1	142	99	43
10	9	7	2	0	0	0	9	7	2
11	68	38	30	3	2	1	71	40	31
12	25	13	12	10	5	5	35	18	17
Average	32	22	10	3	2	1	35	24	11

These results showed significant differences at the level of 5%.



Eggs found in intestinal mucosa of *Nectomys squamipes* - Figs 1, 2, 3: eggs with usual aspect. Direct examination x 125 (Figs 1, 2). Direct examination x 500 (Fig. 3). Fig. 4: eggs with abnormal protuberances in its covering membrane.

TABLE III

Natural infection of *Nectomys squamipes* by *Schistosoma mansoni* in Sumidouro, RJ. Distribution of the number of eggs/cm^2 in four intestinal wall fragmentos along the digestive tract

Animal	Intestine			
	Small			Large
	Proximal	Medial	Distal	
1	409	513	595	410
2	30	385	533	201
3	1314	1536	1449	546
4	359	2018	1863	1768
5	280	1076	756	134
6	747	1207	841	398
7	–	307	171	40
8	–	102	32	34
9	555	6480	3430	2342
10	0[a]	43	42	31
11	37	1073	831	320
12	36	1177	1128	192
Average	314	1326	972	535

a: number of eggs/cm^2 less than one (0,4). Examination with invalidated result.
There was no significant difference (5%) by the Kruskal – Wallis method.

The average distribution of eggs on *A. arviculoides* small intestine was much different: 9 eggs at the proximal portion, 6 at the medial portion and 2 at the distal portion of the small intestine.

Three quarters of the snails infected at the laboratory from eggs of *N. squamipes*, eliminated cercariae. It was shown that all mice were infected with worms of both sexes.

DISCUSSION

The type of habitat, the frequency and length of the contacts the animals may have with the superficial water collections and their susceptibility to the parasitism are some of the main aspects for the interpretation of the role of those non-human hosts in schistosomiasis epidemiology.

Among the species studied, *A. arviculoides* does not seem to have epidemiological importance, since although its natural infection rate did not present statistically significant differences in relation to *N. squamipes*, the number of eggs per gram of feces found in the examination of the captured animals in the field, was very low. However, *N. squamipes* has all the conditions to be an important species in schistosomiasis transmission. This rodent lives on the streams and riverbanks vegetation as well as ditches or cultivated lands where there is much water where they swim actively (Moojen, 1943).

Under the biologic point of view, eggs are eliminated for more than an year (Carvalho, 1982) fact related to the length of infection (more than 400 days in one of our observations), just as in other good hosts (Warren, 1964). Besides this, there is a good production of fertile eggs, (average of 900 eggs per gram of feces) able to complete the biologic cycle under laboratory conditions (Silva, 1981; Rodrigues-Silva, 1989).

From the epidemiological viewpoint at the beginning of the observations, the rate of rodent infection was greater than the human population rate (Silva & Andrade, 1982), having not changed even with chemotherapic treatment of parasitized local inhabitants, what suggests that transmission between *Nectomys* does not depend on the man-snail-man-cycle.

It is conclude that at Pamparrão Valley, schistosomiasis acts as a zoonosis, with *N. squamipes* as the main host. We suggest this fact shall be taken into consideration upon the preparation of endemy control projects in areas with similar epidemiologic charachteristics.

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