Giardia Survey in Live-trapped Small Domestic and Wild Mammals in Four Regions in the Southwest Region of the State of São Paulo, Brazil

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For the first time, a survey on Giardia *in live-trapped small domestic and wild mammals was performed in four regions of State of the São Paulo, Brazil, with special attention to the parasitism of* Rattus rattus rattus *by* Giardia. *This species was found infected in all studied sites: Botucatu (15.4%), Conchas (28.5%), Itaporanga (38.7%) and São Roque (100%). Two new hosts and their frequency of infection were described for* Giardia *in* Nectomys squamipes, *an aquatic rodent and in* Bolomys lasiurus, *a forest rodent (100% and 14.3%, respectively). Both* G. muris *and* G. duodenalis *groups were found in scrapings of intestinal mucosa of those rodents. Mixed infection was observed in some animals. It is important to emphasize the infection by* G. duodenalis *in the black rat as this species lives as a comensal with man and in* N. squamipes *as it may contaminate small streams used for domestic consumption. Therefore, further investigation will be necessary to elucidate the potencial of these rodents to act as reservoirs of* Giardia *for man.*

Key words: *Giardia* - rodents - *Rattus rattus* - *Nectomys* - *Bolomys* - Brazil

Ninety five waterborne outbreaks of human giardiasis were reported from 1965 to 1985 in the United States (Craum 1990) and both human and animal contaminations from water have been implicated in most of these outbreaks. Some epidemiological surveys for wild animal populations have suggested that aquatic animals as beaver (Kirner et al. 1978, Frost et al. 1980), the water vole and muskrat (Frost et al. 1980, Navin et al. 1985, Pacha et al. 1985, 1987) can be reservoir hosts for *Giardia* cysts capable of infecting humans.

The situation of human giardiasis infection in Brazil is endemic and the reports about *Giardia* in wild animals are rare. Fonseca (1916) reported the finding of *G. intestinalis* in monkeys (*Cebus carayá*); *G. muris* in rats (*Rattus norvegicus*), *G. cuniculi* in rabbits and hedgehog (*Coendu villosus*). Presence of *G. irarae* was shown in irara (*Tayra barbara*), an aquatic carnivorous animal and *G. tucani* in toucan (*Rhamphastos ariel*) by Carini (1945).

Considering that investigations with wild reservoirs of *Leishmania* sp. have been developed in our laboratory, these animals were studied to determine the presence and type of *Giardia* in each animal, with special attention to the parasitism of *Rattus rattus*. It was the first time that this kind of work was performed in Brazil.

MATERIALS AND METHODS

Epidemiological data - Botucatu, Conchas, Itaporanga and São Roque, the four municipalities where the domestic and sylvatic mammals were captured, are situated in the southwest of the State of São Paulo, Brazil.

The live animals were captured with livetraps (Vanzolini & Papavero 1967) using dry cheese, maize, manioc, yam, orange and birds. The capture of animals in Itaporanga and Conchas was performed in primary forests near the margin of Itararé and Peixe rivers, respectively. The other capture sites were a maize plantation, food depositories and near the houses. In Botucatu, the rodents were caught in the Campus of the University (UNESP). All the study areas were human habitats.

Species of live-trapped animals - The animals were of unknown age, both sexes and belonging to several different mammalian orders and species, as follows: from Botucatu - 52 domestic rats (*R. r. rattus*); from Conchas: 3 armadillos (*Euphractus sexcinctus*); 14 opossuns (9 *Didelphis marsupialis* and 5 *D. albiventris*); 14 rodents (12 *R. rattus*, 1 *N. squamipes*, 1 *Mus musculus*); from Itaporanga: 101 rodents (93 *R. rattus*, 7 *Bolomys lasiurus*, 1 of de family Cricetidae); 72 opossuns (45 *D. albiventris*, 27 *D. marsupialis*); 6 lizards (*Tupinambis teguixin*); 2 quatis (*Nasua*

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nasua); 2 carnivorous animals (1 *Procyon cancrivorus*, 1 *Lutreolina crassicaudata*); from São Roque - 12 rodents (9 *R. rattus*, 3 *N. squamipes*).

Parasites identification - Trophozoites and cysts of *Giardia* were detected by examining scrapings of the intestinal mucosa fixed in Schaudinn's solution and stained by the Heidenhain's iron hematoxylin method. The faecal material was examined by Zinc flotation method.

Two attempts to cultivate the parasites of *G. duodenalis* group from *R. rattus* in TYI-S-33, were made in laboratory. Measurements were taken from thirty trophozoites recovered from at least three animals of each host species, except for those recovered from a unique exemplary host. All the measurements were taken for animals from Conchas, Itaporanga and São Roque region; only length and width of trophozoites with median bodies were considered.

RESULTS

As shown in Table I, among the mammalian orders examined, only rodents were infected with *Giardia*. The parasitism in *R. r. rattus* was more expressive than in other rodents. These infected animals were found in the four studied sites. We observed that *N. squamipes* and *B. lasiurus* were found infected only in the region of São Roque and Itaporanga, respectively.

The rodents species examined were infected

TABLE I

Occurence of *Giardia* in live-trapped animals from four regions of the State of São Paulo, Brazil

Location	Animal species	No. of positive/total	%
Botucatu	Domestic rat (*Rattus rattus rattus*)	8/52	15.4
São Roque	Domestic rat (*R. r. rattus*)	9/9	100.0
	Aquatic rodent (*Nectomys squamipes*)	3/3	100.0
Conchas	Armadillo (*Euphractus sexcintus*)	0/3	0.0
	Opossum (*Didelphis marsupialis*)	0/9	0.0
	Opossum (*D. albiventris*)	0/15	0.0
	Domestic rat (*R. r. rattus*)	4/14	28.5
	Forest rodent (*Mus musculus*)	0/1	0.0
	Aquatic rodent (*N. squamipes*)	0/1	0.0
Itaporanga	Domestic rat (*R. r. rattus*)	36/93	38.7
	Forest rodent (*Bolomys lasiurus*)	1/7	14.3
	Forest rodent (Cricetidae)	0/1	0.0
	Opossum (*D. marsupialis*)	0/27	0.0
	Opossum (*D. albiventris*)	0/45	0.0
	Lizard (*Tupinambis teguixin*)	0/6	0.0
	Quati (*Nasua nasua*)	0/2	0.0
	Carnivorous animal (*Procyon cancrivorus*)	0/1	0.0
	Carnivorous animal (*Lutreolina crassicaudata*)	0/1	0.0

TABLE II

Occurence of *Giardia* morphological groups in live trapped small rodents from four regions of the State of São Paulo, Brazil

Rodents species	*Rattus rattus rattus*			*Bolomys lasiurus*			*Nectomys squamipes*		
Location	*G. muris* group	*G. duodenalis* group	MI[a]	*G. muris* group	*G. duodenalis* group	MI	*G. muris* group	*G. duodenalis* group	MI
Conchas[b]	1	1	0						
Botucatu[c]	3	1	1						
Itaporanga	19	9	8	1	0	0			
São Roque	1	8	1				1	1	1

a: MI mixed infection; *b*: *Giardia* was not identified in two animals; *c*: *Giardia* was not identified in three animals

TABLE III

Dimensions of *Giardia* trophozoites from *Rattus rattus rattus*, *Bolomys lasiurus* and *Nectomys squamipes* captured in four regions of the State of São Paulo, Brazil

Giardia group	Mean (μm)	Conchas	Itaporanga		São Roque		Range	
		R. rattus	*R. rattus*	*B. lasiurus*	*R. rattus*	*N. squamipes*	Smaller	Greater
Giardia muris	length	9.75	12.16	12.12	13.26	13.28	9.75	13.28
	width	6.73	8.61	8.80	8.61	8.72	6.73	8.80
Giardia duodenalis	length	12.98	14.23	-	16.77	18.32	12.98	18.32
	width	6.47	9.75	-	9.23	9.49	6.47	9.75

by trophozoites of *G. muris* or *G. duodenalis* groups, except the *B. lasiurus* which had only *G. muris*. Some animals had mixed infection (Table II). The two attempts to cultivate the trophozoites of *G. duodenalis* isolated from domestic rat were unsuccessful.

The trophozoites of *Giardia* found in the rodents were morphologically similar in appearance to *G. muris* or *G. duodenalis* groups. The measurements of trophozoites of *G. muris* and *G. duodenalis* groups were shown in Table III. A regional variation in the size of trophozoites was observed but the width of *G. duodenalis* from Conchas was different from those of other regions.

DISCUSSION

The mouse and black rat living as a commensal with man, have been recognized as vector of many human diseases. From the standpoint of epidemiological knowledgement of giardiasis, it is very interesting to know its frequency in house rodent and wild animals in Brazil where there is no reference about the presence of this intestinal parasite in those hosts. The results showed that *G. muris* and *G. duodenalis* groups were found in the intestine of *R. r. rattus* and *N. squamipes*. Some animals had mixed infection. On *B. lasiurus* only *G. muris* was detected. Regional variation was seen in the prevalence of *Giardia* (Table I) but frequency was high in most of the regions. Except for the rodents, all the other species of wild animals examined were negative to *Giardia*. As the number of the animals was small the negative results may not represent the true condition of the *Giardia* parasitism in those animals.

Few papers give information on the presence of these intestinal protozoa in house rodents. Hamajima and Ischii (1963) detected *G. muris* in 11 mice (84.62%) out of 13 (*Mus molossinus*) from the Hakozaki region (Japan). Vives and Zeledon (1957) found trophozoites of *Giardia* in seven *R. r. rattus*, although they did not determine the species of *Giardia* in those hosts. Kasai (1978) reported the presence of *G. muris* and *G. simoni* in many species of rodents in Japan without discriminating the parasite and the hosts. Haiba (1956) examining the wild black rat reported its complete freedom from these flagellates.

According to many authours, *G. muris* can parasite the black rat (Filice 1952, Kulda & Nohrynková 1978), but there is no reference about the presence of *G. duodenalis* group in the black rat. Haiba (1956) could not show parasites in the intestine of wild black rat inoculated with cysts of human *Giardia*. In the present research, for the first time, a survey for *Giardia* infection in the domestic rat was performed and also determined the *Giardia* species occuring in that rodent. Considering the cosmopolitan way of life of *R. r. rattus* it is important to ask what the parasitism by *G. duodenalis* means. For concluding that this rodent species has a potencial to act as a possible reservoir to *Giardia* for man more investigations are necessary, as there is no cross transmission reference and no isolate of *G. duodenalis* was obtained *in vitro*. The present two attempts to cultivate it were unsuccessful. Cultures with trophozoites were performed but no growing could be observed.

On the order hand, it was the first time that the presence of *Giardia* was reported in *B. lasiurus*, and *N. squamipes*. *B. lasiurus*, a cricetine rodent, inhabits the Brazilian low lands, cultivated or recently abandoned fields. This species is primarily nocturnal and it constructs a burrow system with several openings and one or two tunnels that lead to a spherical nest chamber about 40 cm below the surface: it is strictly terrestrial and omnivorous in captivity. *N. squamipes* generally occurs near a swamp, lake or stream. Its diet includes vegetation, insects, tadpoles and small fish. Nests are built on the ground under old logs or bush heaps. It is very prevalent in the State of São Paulo (Nowak 1991).

The parasitism of *N. squamipes* by *G. duodenalis* group is very interesting because this rodent may contaminate small streams used for domestic consumption as it has been reported for

beavers and muskrats in the United States. Although, the *Giardia* trophozoites were morphologically similar to trophozoites observed in humans, further investigations on these animals and this parasite are necessary before any conclusion about the role or the parallelism between *N. squamipes* and beaver or muskrat in the United States. According to Jakubowski (1990), it is prudent from the point of public health to consider that all organism of *G. duodenalis* group has potencial to infect man.

An interesting aspect was the frequency of mixed infection. This fact has been rare and one of the first reports that showed the mixed presence of *G. muris* and *G. lamblia* in laboratory rats was performed by Haiba (1950). The present results show that the detection of intestinal trophozoites is probably a sensitive method for diagnosing *Giardia* mixed infection and also show that an extra attention is necessary for the examination of intestinal material, because it is easy to confuse *Giardia* groups when the isolate is from a host with mixed infection. The biological meaning of mixed infection needs to be elucided.

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