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Survey of helminth parasites of the gastrointestinal tract of the house rat, *Rattus rattus* in Kwara State, Nigeria

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ABSTRACT: A survey of helminth parasites of the gastrointestinal tract of house rats, *Rattus rattus*, revealed that 41.46% (323) of the rats harboured helminth parasites. The parasites found belonged to the Phylum Cestoda and Acanthocephala. The Acanthocephala (represented by *Moniliformis* sp) were most dominant accounting for 92.59% of the total parasite recovered, while *Hymenolepis* sp of the Phylum Cestoda accounted for 7.41%. The number of *Moniliformis* sp. recovered per rat (i.e intensity of infection) varied between 1 and 28. There was no relationship between the intensity of infection and host size. However, a degree of relationship existed between the size of the rat, presence of parasites and the size the parasite attained in the rat. It was observed that the parasites found in these rats could be transmitted to man (either through the excrement of these rats or the intermediate hosts of these parasites), thus causing human zoonoses, which is a major public health problem.

Introduction

Helminth parasites belonging to the Cestoda (*Hymenolepis* sp), Acanthocephala (*Moniliformis* sp) and Nematoda (*Heterakis* sp, *Nippostrongylus* sp, *Strongyloides* sp, *Trichinella* sp, e.t.c) have been reported to occur in mice (1,2). These parasites results from the dirty feeding habits of the rats and its general association with filthy environments, for instance, rats frequent refuse dumps, soak away pits, waste baskets and dust bins.

Most of these helminths resides in the gastrointestinal tract, which is the most favoured niche of adult metazoan parasites. Some of these parasites are entirely intraluminal, others partly so, being found within the tissue layers lining the intestinal lumen. However, they all interfere (in varying degrees) with the normal functioning of the gastrointestinal tract (3).

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These parasites can be passed to humans, hence, rats could constitute a serious menace and become an important source of zoonotic diseases to human populations, through their dropping or excrement (which may contain the eggs or infective stages of these helminths parasites) or infected intermediate hosts which frequently come in contact with man's food, and other domestic utensils. Hence, the public health importance of rats, as a major source of zoonotic diseases, become much more apparent, especially, when it is appreciated that they (rats) are present in large numbers in both urban and rural communities and that they come in frequent contact with man's food and his domestic utensils.

In this report, we present the result of a preliminary survey of the helminth parasites of the gastrointestinal tract of the house rat and the zoonotic diseases that can arise from such infections.

Materials and Methods

The 779 rats used for this study were obtained from the University of Ilorin permanent site student's hostel; Unilorin staff quarters located at the G.R.A. (in Ilorin metropolis) and Igbaja a town located at a distance of 69km away from Ilorin, the Kwara state capital. The rats were captured at night using baited traps over a period of ten months. The baits used included raw and cooked cereals, groundnut cake and bread.

Each captured rat was dissected under water to expose the visceral cavity. The alimentary canal was cut off and placed in a petri dish containing saline solution. The different portions of the alimentary canal were then examined using a dissecting microscope.

The parasites obtained from the rats were cleaned in normal saline and then fixed in 4% formalin, thereafter, whole mount preparation of some of the parasites were made.

Detailed identification of the parasites were carried out by Dr. Arlene Jones at the Commonwealth Agricultural Bureau, St Albans England.

Results

Seven hundred and seventy-nine rats were caught and dissected, out of which 323 (41.46%) harboured helminth parasites. Table 1 shows the pattern of infection in the different sites of the study.

The parasites identified belonged to two main Phyla i.e Phylum Cestoda represented by *Hymenolepis* sp. (which accounted for 7.41% of the parasites identified) while *Moniliformis* sp., which accounted for the rest 92.59% of the total parasites found, belonged to the Phylum Acanthocephala (Table 2). However, the highest number of *Moniliformis* sp found per rat was 28 while that of *Hymenolepis* sp was only 2. It is evident from Table 2 that *Moniliformis* sp. was the dominant species which parasitise rats in the study area.

Table 1: Pattern of infection of the house rat in the three localities.

S/No.	Site	No. of Rats Caught (%)	No. of infected rats	Total parasites found
1.	Unilorin P.S. Students' Hostel	437 (56.10)	247	1406
2.	Unilorin G.R.A. Staff Quarters	133 (17.07)	38	95
3.	Igbaja	209 (26.83)	38	38
Total		779	323	1539

Table 2: the types and range of helminth parasites recovered in the rats.

S/No.	Name of parasite	Total number of parasites recorded (%)	Highest number of parasites recorded per rat
1.	*Miniliformis* sp. (Acanthocephala)	1425 (92.59)	28
2.	*Hymenolepsis* sp. (Cestoda)	114 (7.41)	2

It was observed that the size of the rats appeared to indicate infectivity as the bigger rats were more likely than the smaller ones to harbour parasites. The parasites found in the bigger rats were also found to be bigger than those obtained from the smaller rats. The small intestine was the most favoured site of attachment, especially the anterior part of the duodenum. None of the parasite identified was recorded in the oesophagus, stomach and caecum.

However, the precise location of the parasites in the duodenum was found to be altered when both parasite species (*Hymenolepis* and *Moniliformis* spp) parasitise the same rat. The *Moniliformis* in such cases were found to be much more anteriorly distributed than when they were the only helminth parasite in the gut.

In heavy Acanthocephalan infection, the cells lining the epithelium were observed to be damaged at the point of attachment of the proboscal hooks of the parasites. Similarly, the cells adjacent to the areas of the proboscis attachment were observed to be compressed.

Discussion

41.46% of the rats examined harboured parasites. This goes on to show that parasites are ubiquitous and that parasitism is a highly successful way of life. The high prevalence of infection amongst the rats caught at the Unilorin permanent site hostel (Table 1) could be due to the fact that most of them were big, which is in line with the observations of others (3).

In this study, only representatives of the Phylum Acanthocephala and Phylum Cestoda were found, this may be due to the fact that house rats have a narrow (or restricted) diet range when compared with that of other wild rodents, thus limiting the type of parasites that they will harbour.

The result with respect to the number of *Hymenolepis* sp. found per rat agrees with the findings of other workers Pike & Chappel (4). Similarly, the number of *Moniliformis* sp found per rat (in this study) is also in line with the findings of Nicholas (5), (see Table 2).

The parasites found in this study were recovered from the duodenum. The restriction of the parasites to the duodenum is a result of the fact that the type and amount of nutrient vary along the length of the gastro intestinal tract (thus creating a "nutrient gradient"), with the duodenum providing the most ideal habitat for the parasite (3). However, an interesting distribution pattern or niche specialization occur in Acanthocephalans, normally it is observed that the female worms are usually more anteriorly distributed than the male ones (where the two co exist).

The location of parasites is also influenced by concurrent infections (3) as observed in this study, and also by migratory movement (as exhibited by *Hymenolepis* sp.) in response to various stimuli (6-9).

Generally, it has been observed that the pathogenic effects produced by a parasite in the host depends on the number of parasites present, habits (reproductive, locomotion, attachment organs, life cycle etc) of the parasites and the degree of adaptation that has developed between the host and the parasite (10).

Specifically, for the acanthocephala, the major pathogenic effect they produce is trauma (11). This occurs when the proboscal hooks and spines pierce and ruptures the lining of the host intestine, and in some cases it may lead to

complete perforation of the intestine. It should be noted that Acanthocephalans too exhibit some degree of migratory movement, thus, during the process of relocating to a new site, new lesions are produced. These lesions may become infected with bacteria etc, leading to localised and general peritonitis, haemorrhage, pericarditis, etc. Hence, they are regarded as the most injurious of the helminth gastrointestinal tract parasites (10). There are other pathogenic effect produced by Acanthocephalans, for instance, they may mechanically impair absorption of food (in heavy infections) by covering the mucosa of the intestine or by physically obstructing the movement of food in the gastro intestinal tract.

In the case of *Hymenolepis* sp., it lacks an armed scolex (12), hence, it uses 4 strong and highly muscular suckers for attachment (obviously, an armed scolex would be a hindrance or a complete barrier to its migratory movement). Hence, the damage it cause is only in the area of nutrient absorption which is highly minimal (13) and thus inconsequential (when compared to the quantity of food materials ingested by the host).

Acanthocephalans are rare parasites of man, human infection however, have been reported (5,11,14-15). Its intermediate host include cockroaches and beetles which are closely associated with humans (i.e. they could be found in the kitchen, on pieces of furniture, in food materials, etc) and hence the parasites could be accidentally taken up by humans from the excrement of these intermediate hosts in these places and even through accidental ingestion of these intermediate hosts.

Hymenolepis sp on the other hand, usually occurs in man, and, experimentally, more than 90 arthropod species (some of which are closely associated with humans) have been used experimentally as its intermediate host. However, *Tribolium and Tenebrio* sp (the stored grain beetle) are the ones most commonly involved in the natural infections of both rats and man (11,16).

The intermediate hosts of these parasites can easily transmit infection to human beings when cereals, dried fruits and other similar foods that have become infected are ingested by man. Thus, efforts should be made to keep our environment clean of these intermediate hosts and the house rats, themselves, in order to prevent human infection with these parasites. This is necessary in view of the rather high prevalence (41.46%) of infection observed in the rats, and the fact that the parasites found in these rats are not host specific, i.e they can infect various hosts (5), especially man, due to the natural close interaction that exist between man, rats and the intermediate hosts of these parasites.

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