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OCCURRENCE AND PREVALENCE OF MACROPARASITES OF AFRICAN GIANT RATS (*CRICETOMYS GAMBIANUS*) IN A SAVANNA REGION OF NIGERIA

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ABSTRACT

Rodents play an important role in the transmission of zoonotic diseases since they serve as reservoirs of these infections. A survey of ecto and intestinal parasites of the African giant rat (*Cricetomys gambianus*) was carried out between January and May, 2018 in Ilorin to access their potential as reservoirs of zoonoses. A total of 60 African giant rats were caught live using single catch rat traps which were set around bushes, near human habitation. The giant rats were euthanized with chloroform and thoroughly examined for ectoparasites. The giant rats were dissected and the alimentary canal removed. Direct smear floatation and sedimentation methods were used to detect endoparasites in the animals. The prevalence of different types of endoparasites were: *Hymenolepis nana* (33.3 %), *Hymenolepis diminuta* (25.0 %), *Aspicularis tetraptera* (29.2 %), and *Acanthocephala* spp. (12.5 %), while the ectoparasites were: *Ixodes rasus* (37.9 %), *Xenopsylla cheopis* (44.8 %) and *Ornithonyssus bacoti* (17.2 %). African giant rats harbour quite a number of infections that can be spread to humans especially in developing countries where most communities are economically disadvantaged, thus the need to properly enlighten the populace.

Key words: macroparasites; occurrence; rodents; savanna; zoonoses

INTRODUCTION

The African giant rat (*Cricetomys gambianus*) is a known reservoir of zoonotic diseases [2, 4, 6]. Rat-borne diseases are responsible for more deaths of humans than all of the wars in history [10, 15]. Rats destroy much of the food crops stored by the farmers. Zoonotic diseases are transmitted directly by rats through bites, urine and faeces [2, 5, 6, 12]. Indirect transmission of diseases can also take place through rat-borne ectoparasites such as the flea, *Xenopsylla cheopis*. Rodents are the most abundant order of mammals and are one of the few groups of animals that flourish in close associations with humans [7]. It is well known that members of the order Rodentia globally harbour different ecto and intestinal arthropods, of which many are vectors for diseases of medical and veterinary importance [10, 14]. Rats have successfully exploited a wide range of habitats and environments throughout the world [8]. The African giant rats (*Cricetomys gambianus*) are known to be a successful group of mammals basically as a result of its adaptability, high reproduction frequency and its ability to survive in a variety of ecological niches while exploiting a variety of food materials [4, 9, 14]. Rodents are known to pose great devastating risk to man acting as reservoirs of diseases thus increasing the possibility of acquiring rodent-borne zoonosis which is of major health concern to man [1, 3, 8]. Human parasitic infections acquired through transmission from wild rats such as African giant rats present a huge problem in tropical countries like Nigeria [8, 13]. The giant rat has been found to mainly live in the savanna region and also in the edges of the forest and in mountain areas 3,500 m above the sea level [4].

In Nigeria, only a few studies have been carried out on the ecto and intestinal parasitic fauna of the African giant rat, *Cricetomys gambianus* [1, 2, 3, 6]. However, there are no documented information on the ecto and intestinal parasitic fauna in *Cricetomys gambianus* in Ilorin, a savannah region of Nigeria. Data gathered from studies on the dynamics of parasitic lifecycle and the role of wild rats as vectors is essential for epidemiologist to carry out proper control efforts in managing rat-borne diseases.

This paper reports on the ecto and endo parasitic fauna of *Cricetomys gambianus* and their possible public health potentials in Ilorin, north central Nigeria.

MATERIALS AND METHODS

Ilorin, the capital of Kwara State, north central Nigeria is located within Longitudes 4°30´ and 4°5´E and Latitudes 8°25´ and 8°40´N. The soil of the area is typically coarse and sandy. The climate is tropical, with a mean annual temperature of 27 °C, relative humidity of 76 % and rainfall of 1,800 mm. The presence of tall trees and grasslands characterize the area. The general environmental conditions are suitable for the growth and survival of *C. gambianus*, which results in a high number in the study area.

Ethical statement

Ethical approval was sought and granted by the University of Ilorin Ethical committee.

The authors declare that there is no conflict of interest.

Animals

Altogether sixty (60) African giant rats were included in the study. The animals caught were kept in cages where they were properly fed with animal feed and water and monitored. Of the sixty rats examined, 48 (80 %) were males while 12 (20 %) were females..

Ectoparasite collection

The African giant rats captured were subjected to morphometric examinations. The rats were identified based on the descriptions from Taylor et al. [17]. Morphometric measurements of head, tail, ear and hind leg were recorded. The fur of each specimen was combed with a fine-tooth comb to dislodge any ectoparasite onto a white paper. Fine forceps were used to remove ticks and mites from the skin when it was difficult to dislodge them by combing. The contents on the white paper were examined carefully with a hand lens and later placed into specimen bottles containing 70 % alcohol, except for ticks which were mounted for identification. Mites and lice were cleared in lactophenol and mounted for identification. Morphometric characteristics such as weight and length of the animals were used to ascertain the parasitic abundance.

Endoparasites collection

The entire gut was removed and dissected into sections and placed in separate petri dishes that had saline solutions. The stomach and caecum contents were filtered and all endoparasites recovered were collected, counted and preserved in 70 % alcohol before further identification. Helminths were processed according to the different types. Endo and ectoparasites were examined, identified and determined using direct microscopic examination. Ectoparasites species was determined based on morphological characteristics while helminths were identified using keys of Taylor et al. [17].

Statistical analysis

The data were entered into Microsoft excel spreadsheet 2007 and a descriptive analysis was used to determine the prevalence, while the Chi-square test was employed to determine the prevalence amongst the animals. All statistical analysis was performed using a statistical package for social sciences (SPSS) software package version 20.

RESULTS

Figure 1 shows the overall prevalence in the intestinal and ectoparasites in the sixty African giant rats. Of the rats examined, 24 (45.3 %) were infected with intestinal parasites, while 29 (54.7 %) had ectoparasites.

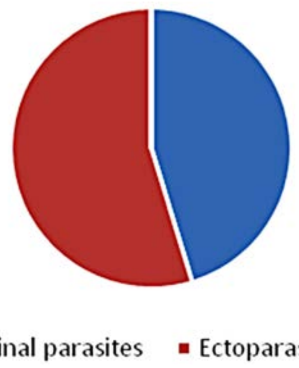

Fig. 1. Overall prevalence of intestinal and ectoparasites isolated from the giant rats in Ilorin

Prevalence of intestinal parasites in relation to sex

Of the 48 males studied, *Hymenolepis diminuta* had the highest prevalence of 20.8 %. Of the 12 female rats studied, *Hymeolepis nana* showed the greatest prevalence (16.7 %). *Acanthocephalan* was the least prevalent in males with 4.2 % while *Hymenolepis diminuta* was least (4.2 %) in females. The prevalence of ectoparasites in relation to sex, revealed three species identified infesting African giant rats, *Xenopsylla cheopis* had the highest prevalence of 44.8 %, while *Ornithonyssus bacoti* had the least prevalence of 17.2 % (Table 1).

The prevalence of ectoparasites in relation to sex, revealed three species identified infesting African giant rats, *Xenopsylla cheopis* had the highest prevalence of 44.8 %, while *Ornithonyssus bacoti* had the least prevalence of 17.2 % (Table 2).

Prevalence of intestinal and ectoparasites in relation to the length of the animal

The measurements of the body condition have long been used to infer the impacts of parasitism on an animal's nutritional state or overall wellness. If these conditions reflect the host health, then examining relationship between animal weight, length and infection status is a convenient way to measure parasite impacts on their hosts.

Table 1. Prevalence of intestinal parasites stratified by sex

Parasite isolated	No. examined	Total No. infected [%]	Sex	
			Male [%]	Female [%]
Hymenolepsis nana	60	8 (33.3)	4 (16.7)	4 (16.7)
Hymenolepsis diminuta	60	6 (25.0)	5 (20.8)	1 (4.2)
Aspicularis teraptera	60	7 (29.2)	4 (16.7)	3 (12.5)
Acanthocephala spp.	60	3 (12.5)	1 (4.2)	2 (8.3)

Table 2. Prevalence of ectoparasites stratified by sex

Parasite isolated	No. examined	Total No. infected [%]	Sex	
			Male [%]	Female [%]
Ixodes rasus	60	11 (37.9)	7 (63.6)	4 (36.4)
Xenopsylla cheopis	60	13 (44.8)	10 (34.5)	3 (10.3)
Ornithonyssus bacoti	60	5 (17.2)	2 (6.9)	3 10.3)

Table 3 shows the prevalence level in relation to the length of the rats. The number of intestinal and ectoparasites were found to increase slightly with an increase in the body size. Parasites with a body length of 62—64 cm length showed the greatest prevalence with 25.0 % in the intestinal parasites and 27.6 % in the ectoparasites.

Prevalence of intestinal and ectoparasites in relation to the weight of the animal

Table 4 shows the prevalence level in relation to the weight of the rats. There was a marked increase in the prevalence of the intestinal parasite in relation to the increase in the body weight. Rats weighing between 1.58—1.63 kg had the highest prevalence of 29.2 %, while rats with 1.38—1.42 kg had the lowest prevalence with 12.5 %.

DISCUSSION

This study is the first detailed account of intestinal and ectoparasites of public health importance in the Giant rats captured in Ilorin, north central Nigeria. African giant rats are known to harbour various types of parasites of which some are zoonotic and can cause death to humans [16]. These rats have adapted to living in close association with humans where they utilize human agricultural products

Table 3. Prevalence of parasitic fauna in relation to length of the animal

Length [cm]	No. examined	Intestinal parasites [%]	Ectoparasites [%]
47—49	9	2 (8.3)	2 (6.9)
50—52	12	3 12.5)	3 (10.3)
53—55	12	4 (16.7)	3 (10.3)
56—58	10	4 (16.7)	6 (20.7)
59—61	9	5 (20.8)	7 (24.1)
62—64	8	6 (25.0)	8 (27.6)
Total	**60**	**24 (47.2)**	**29 (54.7)**

Table 4. Prevalence of parasitic fauna in relation to the weight of the animal

Weight [kg]	No. examined	Intestinal parasites [%]	Endoparasites [%]
1.38—1.42	10	3 12.5)	3 (10.3)
1.43—1.47	14	4 (16.7)	5 (17.2)
1.48—1.52	14	4 (16.7)	6 (20.7)
1.53—1.57	12	6 (25.0)	7 (24.1)
1.58—1.63	10	7 (29.2)	8 (27.6)
Total	**60**	**24 (47.2)**	**29 (54.7)**

and waste as their food resources and buildings as their homes [11]. The need to understand the implications of the parasites harboured by the giant rats to humans and their environment is needed, thus the need for the present study. In this study, a total prevalence of 88.3 % of macro parasites (endo and ectoparasites) were recorded. This is higher than a prevalence of 55.3 % in Enugu south eastern Nigeria [4]. The high parasites prevalence recorded in this study is indicative of the possible transmission of zoonotic helminths from rodents to humans. This could occur as a result of consumption of uncooked or improperly cooked food contaminated with the infective larvae, eggs or metacercariae. Ectoparasites recorded in the study were 54.7 %, with flea (*Xenopslla cheopis*) having the highest occurrence. Other researches in other parts of this country reported similar findings [3, 9]. *Xenopslla cheopis* is known to be an important vector of plague, endemic typhus and parasitic cestodes such as *H. diminuta* and *Dipylidium caninum* [4]. *X. cheopis* is a potential intermediate hosts for *H. diminuta* usually found in grain storage facilities or in farms where grains are being stored. Ectoparasites were unevenly distributed on the host body and were found to be more predominant on the anterior trunk of the body than any other region of the body. Ectoparasites were not found in the tail region probably due to little amount of blood flow and/or reduced fur in this region.

In the present study, ectoparasites were more observed than intestinal parasites. This finding disagrees with the observation of Mbaya [9] in Maiduguri, north eastern Nigeria. The relatively high abundance of ectoparasites could be linked to the relative conducive environmental condition that allows the parasites to thrive. These high burdens indicate the importance of this rodents in the transmission of arthropod-borne diseases in the study area [7]. In the gut of the rats, *H. nana* had the highest occurrence which disagrees with the work of Okoye, Obiezue [14] in Enugu, south east Nigeria. Both *H. nana* and *H. diminuta* are zoonotic cestode helminths, although *H. diminuta* is not common in humans. *H. diminuta* is transmitted to humans by the ingestion of *Tribolium confusum* (flour beetle, an intermediate host), with infested cereals, or by the faecal oral route. Faecal contents of rats infected with *H. diminuta* are attractive in some manner to beetles, and this is an evidence that a tapeworm is able to enhance its transmission chances by influencing the foraging of its intermediate host. *H. nana* is transmitted through faecal-oral contact (eggs) or by accidental ingestion of intermediate hosts harbouring cysticercoids [6]. In relation to sex, the male rats harboured more endoparasites than the female counterparts, a result similar to Mbaya [9] in Maiduguri. The higher intensity of infection seen in males could be suggestive of high activeness in search of food thereby making them more predisposed to eggs, cysts and larvae of parasites. Also, in terms of ectoparasites, more male rats harboured more parasites than their female counterparts. This finding is in agreement with the work of Ekeh, Ekechukwu [4]. African giant rats with longer lengths tend to harbour more macro parasites (endo and ectoparasites). This agrees with the findings of Ekeh, Ekechukwu [4]. This suggests that the longer the rats the higher their surface exposure to parasites. In relation to weight, rats with higher weights harboured more macro parasites. Larger species ingest more endoparasites and have more surface area for ectoparasites. Animals that eat larger volume of food have more exposure to parasites. This explains why larger and heavier giant rats harboured more parasites. Rodent species are ubiquitous and may serves as bridges between many different environments and parasite populations. As a consequence, a good number of rodent species have higher parasite loads. Hosts with larger size occupy larger ecological niches in which several parasites are present.

CONCLUSIONS

The information presented here updates our understanding of the major parasitic infections that African giant rats harbour and can be transmitted to humans and other animal populations in Ilorin, north central Nigeria. The possibility of these rats contaminating the environment, food and water sources with these parasites poses a public health threat since these rats live in close association with humans. Rat control measures should be applied to control giant rats as it has a public health risk.

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