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RESEARCH NOTE

A Preliminary Survey of Gastrointestinal Helminths of Murids (Rodentia: Muridae) at Five Selected Localities in Western Sarawak

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ABSTRACT

Field survey of gastrointestinal helminths on rodents from family Muridae were conducted at five localities in Western Sarawak from June 2013 until April 2014. A total of 31 host individuals comprising six species of murids were examined for gastrointestinal helminths using opportunistic necropsy. The hosts examined were *Leopoldamys sabanus*, *Maxomys rajah*, *M. surifer*, *M. whiteheadi*, *Niviventer cremoriventer* and *Sundamys muelleri*. Of these host species, 186 individuals consisting of two taxonomic groups of helminths were recovered, namely Nematoda and Cestoda. This study contributes to the growing literature on the infestation of endoparasites in rodents especially in Sarawak.

Keywords: Cestodes, gastrointestinal helminths, Muridae, nematodes

Taxonomically, rodents can be divided into five main suborders based on their musculature and associated structures of the skulls (Carleton & Musser, 2005). These include Anomaluromorpha, Castorimorpha, Hystricomorpha, Myomorpha and Sciuromorpha. Among these, Muridae or murids which represented suborder Myomorpha are known as the largest mammalian family (Wilson & Reeder, 2005). Being a group that consists of the largest number of species, rodents are significantly known as the reservoirs of zoonotic diseases (Paramasvaran *et al*., 2009). Rodents may act as a definitive or intermediate host of endoparasites especially those represented the group of intestinal helminths lead to increasing concerns on humans and domestic animals (Singla *et al.,* 2008).

Gastrointestinal helminth is a type of intestinal parasite that resides in the gastrointestinal tract by depleting the host nutrients. Helminths can be divided into three phyla; Platyhelminthes, Nemathelminthes and Acanthocephalan which is further divided into classes; Trematoda, Cestoda and Nematoda (Bhatia *et al.,* 2006). Some parasitic helminths of rodents in Malaysia are known to be of public health importance such as *Heterakis* sp., *Taenia taeniaeformis*, *Hymenolepis nana* and *H. diminuta* (Paramasvaran *et al*., 2005 & 2009). Research on the role of parasites through contamination of human and wildlife animals remains largely understudied in Malaysia and there is lacking of published report for Western Sarawak. The aim of this study is therefore to identify the gastrointestinal helminths present at five selected localities in Western Sarawak that is of known public health importance. In addition, this study will enhance the knowledge on helminthic infestation in murid rodents in Malaysia.

The samplings were conducted from June 2013 until April 2014 in Bako National Park (BNP), Kubah National Park (KNP), Matang Wildlife Center (MWC), Tanjung Datu National Park (TDNP) and Universiti Malaysia Sarawak Arboretum (UA). A total of 100 cage traps were set up throughout the sampling period using banana and pineapple as baits.

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Rodents captured were euthanized with chloroform and their morphometric measurements and weight were recorded. Sex and species of the rodents were also determined. Identification of rodents was made following McKenna *et al.* (1997), Payne *et al.* (2005), and Francis (2008).

Opportunistic necropsy as described by Gillespie (2006) was used to examine gastrointestinal parasites. Helminths found in the gastrointestinal tract were collected and individually placed in a 50 ml tube containing 70% ethanol. The solution was changed daily with a fresh decreasing concentration of ethanol. For prolonged preservation, gastrointestinal helminths were treated with alcohol glycerol mixture. For identification purpose, nematodes recovered were fixed and cleared with lactophenol as temporary mounts and observed under microscope while cestodes were first hydrated, stained, dehydrated following Bhatia *et al.* (2006) and mounted in Canada balsam mounting media. All the helminths found were separated into their respective classes based on their morphological characteristics (Bhatia *et al*., 2006). Key characteristics for morphological identification were observed under stereo and compound microscopes following Gibbons (1986 & 2010), Bhamrah and Juneja (1991), and Bhatia *et al.* (2006). The prevalence of endoparasite infestation was then calculated.

A total of 31 individual murids comprising six host species (*Leopoldamys sabanus, Maxomys rajah, M. surifer, M. whiteheadi, Niviventer cremoriventer* and *Sundamys muelleri*) were collected (Table 1). From these, 14 were assessed to be infected by gastrointestinal helminths (Table 2). A total of 186 individuals of gastrointestinal helminths from two taxonomic groups, Nematode and Cestode were discovered. All of the gastrointestinal helminths were identified based on morphological characters which are used to separate gastrointestinal helminths that have same morphology but cannot be identified to species level. Among these, only two of the nematodes, *Strongyloides* sp. (Figure 1) and *Toxocara* sp. (Figure 2) were able to be identified up to genus level. Other nematodes and cestodes consisting 13 and two different morphological species, respectively were recorded (Table 3). Helminths were classified based on the shape of the body and attachment organs. Nematodes were morphologically classified according to their elongated and round body with tapered ends while cestodes were morphologically classified based on their elongated and dorsoventrally flattened body.

The prevalence of helminths found in 14 host individuals was calculated. It was observed that *L. sabanus, M. rajah, M. surifer, M. whiteheadi, N. cremoriventer* and *S. muelleri* were positive with gastrointestinal helminths. Most of the host species trapped in this study is *M. rajah* (Table 1) with the highest number of individuals trapped from KNP. This indicates that *M. rajah* is commonly found compared to other murids as this common forest rat species has a very wide distribution throughout Southeast Asia (Francis, 2008). In comparison to the other localities, KNP has recorded the most number of individual found. This might be due to the large sampling areas that involved both high and low elevation with addition of longer transects. From the result, *N. cremoriventer* were found in all localities except MWC.

Table 1. Total number of rodents caught for gastrointestinal screening in five localities of Western Sarawak.

Species	Localities[1]					Number of individuals (Percentage of individuals caught)
	UA	KNP	MWC	BNP	TDNP	
Leopoldamys sabanus	0	4	2	0	0	6 (19.35%)
Maxomys rajah	0	5	2	0	4	11 (35.48%)
Maxomys surifer	0	0	0	0	1	1 (3.23%)
Maxomys whiteheadi	1	0	1	1	1	4 (12.90%)
Niviventer cremoriventer	1	1	0	1	1	4 (12.90%)
Sundamys muelleri	1	0	2	2	0	5 (16.13%)
Total						**31**

[1]Localities: UA = UNIMAS Arboretum; KNP = Kubah National Park; MWC = Matang Wildlife Centre; BNP = Bako National Park; TDNP = Tanjung Datu National Park.

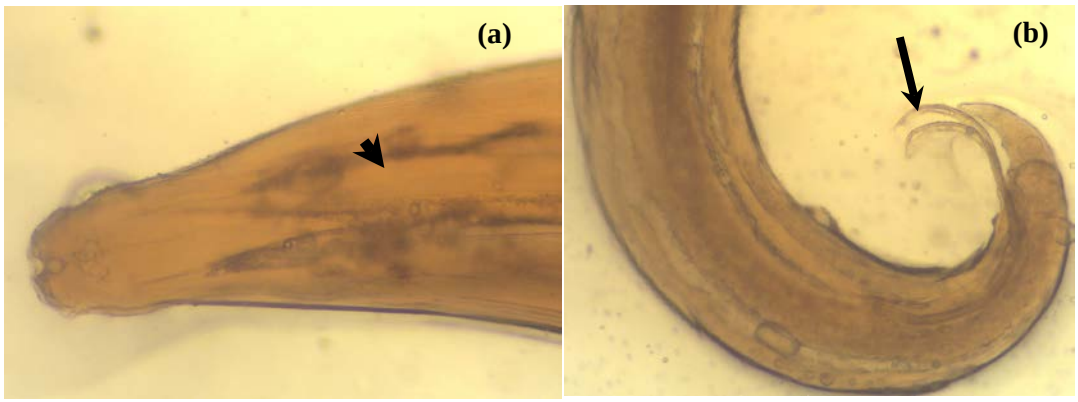

Figure 1. (a) Image showing the head with rhabditiform pharynx (arrowhead), and (b) tail with spicules (arrow) of *Strongyloides* sp.

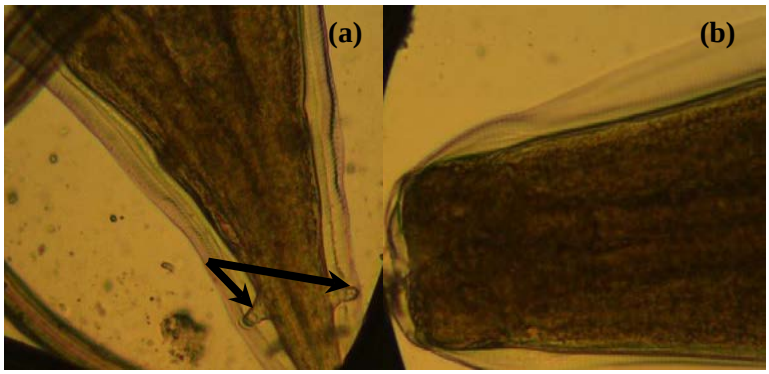

Figure 2. (a) Image showing the anterior part of adult head with bilobed mouthpart (arrow), and (b) tail of *Toxocara* sp.

This species was mostly caught from forested areas of KNP, BNP, TDNP and UA during the study. According to Payne *et al.* (2005), this species is usually found in tall and secondary forests, forest edge and lightly wooded areas. This might explained why *N. cremoriventer* is not found in MWC as the sampling site is located nearby a picnic area.

The prevalence of infection is highest in *M. surifer* (Table 2). This was probably due to the single individual species found during this entire study. Therefore, the probability for this species to have the highest number of gastrointestinal helminths infection is high. The result also showed that *N. cremoriventer* is having the second highest infection among murids. From this study, it was observed that *Toxocara* sp. showed the second highest prevalence of infestation and *M. rajah* showed predominant murid host with positive infection compared to the other murids (Table 3). This was probably due to the wide distribution of *M. rajah* as a common forest rat and was expected to be found in all forested areas of sampling location (Francis, 2008; Payne *et al.*, 2005). The presence of endoparasites found in forested areas clearly indicates that parasite infestation are not only restricted to the urban areas. Anthropogenic activities such as logging, changes in plantation, environment disturbance might be the contributing factors that lead to interaction between human and host species to transmit diseases. This has been strongly supported by McKinney (2002) that stated the impact of urbanization will increase the population density of rodents as the environment offers a great abundance of food resources and shelters. With an increasing rate of urbanization, the interaction will be higher and there is a possibility for host species to

Table 2. The percentage of positive gastrointestinal helminth infection in six species of murids caught.

Species	Number of individuals caught	Number of infected murids	Percentage of infection
Leopoldamys sabanus	6	3	50%
Maxomys rajah	11	3	27.27%
Maxomys surifer	1	1	100%
Maxomys whiteheadi	4	2	50%
Niviventer cremoriventer	4	3	75%
Sundamys muelleri	5	2	40%
Total	**31**	**14**	

be a carrier of diseases. Majority of the host species captured were infected with one or more endoparasites, although all host species appeared to be healthy. The results showed that helminths were recovered from stomach, small intestine and large intestine of the infected murids (Table 3) which probably because most of the unprocessed foods are located between small intestine and stomach. Therefore, the probability of helminths to accumulate food sources is higher.

Many of the published literatures stated that some helminths are well known for their zoonotic potential to human such as *C. hepatica*, *Heterakis spumosa, H. diminuta* and *Taenia taeniaformis* (Pakdel et al., 2014; Paramasvaran *et al.,* 2005). Some of the helminths found are known to be a potential carrier for zoonotic diseases. *Toxocara* sp. and *Strongyloides* sp. that are found in this study are known to have zoonotic potentials to human as described by Ballweber (2001) and Dillard *et al.* (2007). These helminths may infect humans during direct contact when handling the animals. Therefore, cautions should be considered when working with the animals in the field.

Table 3. Total number of gastrointestinal helminths and their location in six infected rodents.

Gastrointestinal helminths	Host species						Location			Total number of helminths
	Leopoldamys sabanus	*Maxomys rajah*	*Maxomys surifer*	*Maxomys whiteheadi*	*Niviventer cremoriventer*	*Sundamys muelleri*	S[1]	SI[2]	LI[3]	
Nematode										
Strongyloides sp.	0	0	1 (5.56%)	0	0	0		√		1 (0.54%)
Toxocara sp.	0	104 (92.86%)	14 (77.78%)	4 (44.44%)	10 (83.33%)	0	√	√	√	132 (70.97%)
Morph sp. 1	0	1 (0.89%)	0	0	1 (8.33%)	0			√	2 (1.08%)
Morph sp. 2	17 (53.13%)	0	0	0	0	0	√	√		17 (9.14%)
Morph sp. 3	2 (6.25%)	0	0	0	0	0	√			2 (1.08%)
Morph sp. 4	1 (3.13%)	0	0	0	0	0	√			1 (0.54%)
Morph sp. 5	5 (15.63%)	0	0	0	0	0	√	√	√	5 (2.69%)
Morph sp. 6	0	3 (2.68%)	0	0	0	0	√	√	√	3 (1.31%)
Morph sp. 7	6	3 (2.68%)	0	0	0	0	√	√		9 (4.84%)
Morph sp. 8	0	0	0	0	0	3 (100%)	√		√	3 (1.31%)
Morph sp. 9	0	0	0	5 (55.56%)	0	0	√			5 (2.69%)
Morph sp. 10	0	0	1 (5.56%)	0	0	0			√	1 (0.54%)
Morph sp. 11	0	0	1 (5.56%)	0	0	0		√		1 (0.54%)
Morph sp. 12	0	0	1 (5.56%)	0	0	0		√		1 (0.54%)
Morph sp. 13	0	1 (0.89%)	0	0	0	0			√	1 (0.54%)
Cestode										
Morph sp. 14	0	0	0	0	1 (8.33%)	0			√	1 (0.54%)
Morph sp. 15	1 (3.13%)	0	0	0	0	0		√		1 (0.54%)
	32 (17.20%)	112 (60.22%)	18 (9.68%)	9 (4.84%)	12 (6.45%)	3 (1.61%)				**186**

[1]stomach; [2]small intestine; [3]large intestine.

From the survey conducted, it can be concluded that 186 individuals of gastrointestinal parasites were collected from 31 individual hosts. From 31 individual hosts, 14 showed gastrointestinal helminths infection with a few of them were infected with two nematode species namely *Strongyloides* sp. and *Toxocara* sp. which are known to be of public health importance. Since this is the first study conducted to survey the gastrointestinal helminths of rodents in Western Sarawak, the data may not be as comprehensive as other published literatures. The identification of helminths can only be made to the genus and morphology level. It is suggested that comprehensive study should be done to gain more insights on the risk of endoparasites and zoonotic diseases. Future studies may be inclusive of extensive sampling sizes and sites as well as longer period of study for better understanding on the infection and the related zoonotic disease. With two medically important helminths found in this study, better understanding of the types of wildlife parasites that persist in zoological aspects are needed. The implementation of control measures also needed to emphasize in preventing disease transmission to human.

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