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Prevalence of helminths in rodents and shrews from Cotonou town, Benin

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Abstract

Parasitized animals can be hazards for the human population health. The current study aimed to determine parasitic helminths infection in 1070 trapped small mammals from Cotonou town in Benin. Rodents and shrews were trapped using wire netting traps and anesthetized. The gastrointestinal tracts were removed and examined to identify parasitic helminths. The results indicated that 6 % (65/1070) of the examined small mammals were infected with nine helminths species including *Moniliformis moniliformis* (40.3%), *Mastophorus muris* (6%), *Rictularia* sp. (4.5%), *Nematoda* sp. (1.5%), *Catenotaeniapusilla* (3%), *Hymenolepis diminuta* (34.3%), *Hymenolepis spp.* (1.5%), and *Rodentolepis fraterna* (7.55%), *Rodentolepis microstoma* (1.5%). No helminths were found in shrews. There was no difference in the prevalence according to the sex of parasitized hosts. The examined rodents were more infected with *Moniliformis moliniformis* than other helminths. As rodents are reservoirs of several zoonotic parasites, then, the control of these animals has an important role in the public health safeguarding.

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Introduction

Rodents are known to transmit diseases and act as reservoir host for many zoonotic pathogens including parasites that pose a health risk to humans (Walsh *et al.,* 1993*;* Mayer*et al.,* 1995*;* Singleton *et al.,* 2003). For example, Synanthropic rodents, particularly rodents of genus *Rattus,* are recognized as reservoirs of several viral (Hantavirus, arenavirus) and bacterial pathogens *(Yersinia enterocolitica, Leptospira spp., Rickettsia akari) (*Coto,1997*;* Enría and Levis, 2004).Among the most common parasitic diseases are giardiasis, hydatid disease, trichinellosis and several helminthiasis such as the tapeworms *Hymenolepis nana and H. diminuta (*Acha and Scyfres, 1992; Coto, 1997). In order to control these diseases, thehelminths of rodents have been studied inmany countries in the world*:* UK, Webster and Macdonald (1995); Spain, Feliu *et al.* (2007); Italy, Ceruti *et al.*(2001), Milazzo *et al.* (2010a), Milazzo *et al.* (2010b) and Milazzo *et al.* (2011); Lithuania, Mažeika *et al.*(2003); Iran, Pakdel *et al.(2013)* and Nateghpour *et al.* (2015); Croatia, Stojčević *et al.* (2004) and Konjević (2007); Serbia, Kataranovski *et al.* (2011); USA, Easterbrook, (2007); South Korea, Seong *et al.*(1995) ; Qatar, Abu-Madi *et al.* (2008)*;* Argentina, Gomez Villafane *et al.*(2008) *;* Malaysia, Paramesvaran *et al.* (2012), Zain *et al.* (2012)*;* Sénégal, Brouat *et al.* (2007) and Diagne *et al.* (2016)*;* Egypt, Elshazly *et al.* (2008) ; Azzam (2016) ; South Africa, Appleton *etal.* (2006); India, Singla *et al.* (2008) and Coomansingh *et al.* (2009), Zain *et al.* (2012)*;* Indo-Chinese peninsula, Chaisiri *et al.* (2015); Kandy district, Sumangali *et al.* (2012); and Nigeria, Ajayi *et al.* (2007), Onyenwe *et al.* (2009), Ekeh and Ekechukwu (2009), Mbaya *et al.* (2011), Awoyomi *et al.* (2015) and Akpan *et al.* (2015), Paul *et al.* (2016).

But, in Benin, little is known about helminths' infection in rodents. The work of Assogba *et al.* (2009) on the gastrointestinal helminths of cane rats (*Thryonomys swinderianus*, Temminck 1827) reported for the first time the presence of certain helminths. No studies have been conducted on the prevalence of helminths in small mammals of Cotonou town. This study aims to investigate the helminthic infestations in small mammals caught in different areas of anthropozoonotic risks in Cotonou town.

Materials and methods

Study area

Trapping of small mammals was performed from July to November 2008 and November 2009 to December 2010. The trapping stations were scattered throughout Cotonou (Fig.1).

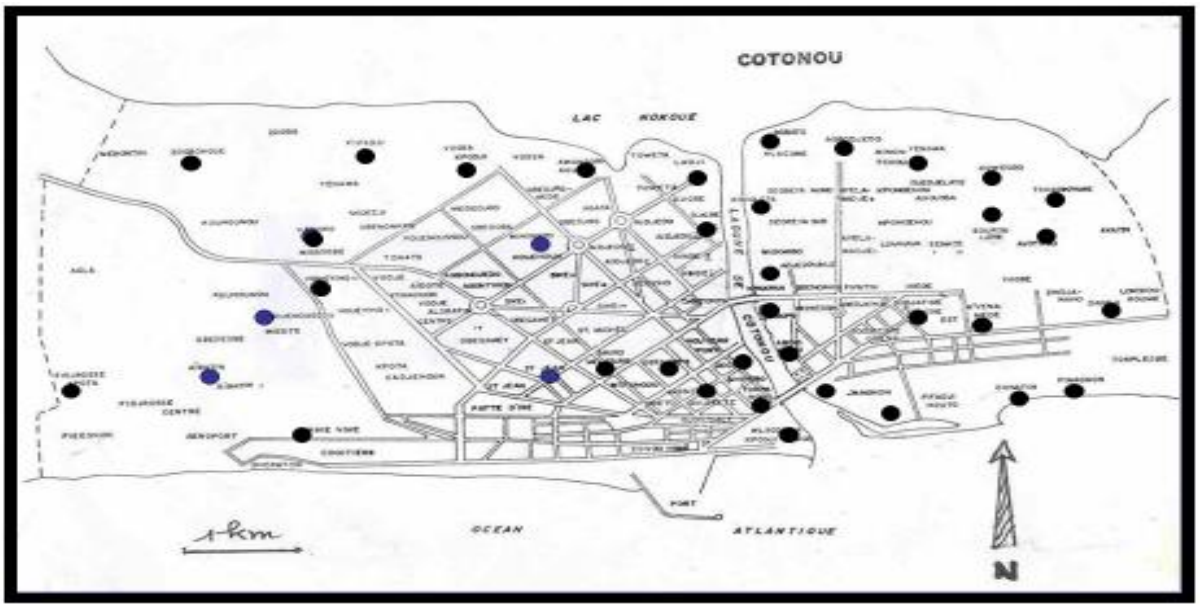

Fig. 1. Trapping stations.

This township is the main city of Benin and benefits from climatic conditions of subequatorial type characterized by two rainy seasons separated by two dry seasons.

Small mammals trapping and helminths identification

Trapping of small mammals was conducted following Houéménou (2006). Trapped small mammals were anesthetized by placing them in iron bag containing cotton wool soaked with chloroform or ether. Taxonomic identifications were performed based on morphologic traits following De Visser*et al.* (2001).

The sex was determined by visual inspection of external sexual organs. Gastrointestinal tracts (GI tracts) were removed from the body.

The helminths were isolated and preserved in alcohol at 96%. All the helminths were identified from their morphology and morphometry following the literature.

Statistical analysis

Data collected were analyzed using the software SAS (Statistical Analysis System, 2006). The Procfreq procedure was used to calculate frequencies. Prevalences were expressed as percentages and the 95 % confidence interval (CI) was calculated. The prevalences comparison was performed by the Z-bilateral test at a level of 5%.

Results

The general prevalence of helminths of all species was 6% (65/1070) in the small mammals of Cotonou town. Nine species of helminth parasites including three nematodes (*Mastophorus muris*, *Nematoda sp*, *Rictularia sp*.), five cestodes (*Catenoteaniapusilla, Hymenolepis diminuta*, *Rodentolepisfraterna, Rodentolepis microstoma, Hymenolepis sp*.) and one acanthocephalan (*Moniliformis moniliformis*) were recovered from 700 *Rattusrattus*, 148 *R. norvegicus*, 118 *Mastomys sp*., 14 *Dasymusrufilus* and 9Musdomesticus. Five species of small mammals were parasitized by helminths.

Table 1. Helminths prevalence by species.

Species	Number of examined individuals	Number of infested individuals	Prevalence (%)	Confidence Interval (%)
Mus domesticus	9	1	11.11ab	20.53
Mastomys sp.	118	3	2.54bc	2.84
Rattus norvegicus	148	15	10.14a	4.86
Rattus rattus	700	45	6.43ab	1.82
Dasymusrufilus	14	1	7.14ab	13.49
Crocidura olivieri	78	0	0.00c	0.00
Other	3	0	0.00abc	0.00
Total	1070	65	6.07	1.43

Prevalences of the same column followed by different letters, differ significantly at a level of 5%.

The highest prevalence of helminths was 11.11% (1/9) recorded in *Mus domesticus* and the lowest, 2.54% (3/118) registered in *Mastomys sp*. No helminths were found in shrews despite the high number (78) of the treated specimens (Table 1). The variation of prevalence by species was not significantly different except for *Crocidura olivieri* (0.00%) (Z-bilateral test at 5%).

Considering the sex of parasitized individuals, there was no difference between mâles and females helminths' prevalences of *R. rattus*, *R. norvegicus* and of *Mastomys* sp. However, for all the infected rodents, the prevalence was higher in females (Table 2).

Among the 9 zoonnotic helminths identified species, the most abundant were *Monoliformis moniliformis* 40% (27/67) and *Hymenolepis diminuta* 34% (23/67).

Table 2. Prevalence of infected rodents by sex.

Species	Number of examined individuals	Infested males		Infested females	
		Prevalence (%)	IC	Prevalence (%)	IC
Mastomys sp.	118	0.85a	1.65	1.69a	2.33
Rattus norvegicus	148	3.38a	2.91	6.76a	4.04
Rattus rattus	700	2.43a	1.14	4.00a	1.45
Total of captures	966	2.38b	0.96	4.14a	1.26

Prevalences of the same line followed by different letters differ significantly at a level of 5%.

The two species of the genus *Rattus* were parasitized by the two predominant helminth species: *R. rattus* (65%:15/23 *H. diminuta* and 93%: 25/27 *M. moniliformis*) and *R. norvegicus* (34%: 8/23 *H. diminuta*) (Table 3).

Table 3. Repartition of helminths species by hosts.

Species	*Mus domesticus*	*Mastomys sp*	*R. norvegicus*	*D. rufulus*	*R. rattus*	Total
M. moniliformis	0	1	0	1	25	27
Mastophmuris	0	1	2	0	1	4
Rictularia sp.	0	1	0	0	2	3
Nematoda sp.	0	0	1	0	0	1
C. pusilla	0	0	1	0	1	2
Hymenolepis diminuta	0	0	8	0	15	23
Hymenolepis sp.	0	0	1	0	0	1
Rodentolepis fraterna	0	0	2	0	3	5
Rodentolepis microstoma	1	0	0	0	0	1
TOTAL	1	3	15	1	47	67

Three species of helminths were absent in *Rattus rattus, (Nematoda sp., Hymenolepis sp. and Rodentolepis Microstoma)* while *M. moniliformis* and *Hymenolepis diminuta* were the most abundant (Table 4a).

Table 4a. Helminths' prevalence in *Rattus rattus*.

Species	*R. rattus*	Prevalences (%)	IC (%)
M. moniliformis	25	53.19a	14.27
Mastoph Muris	1	2.13c	4.13
Rictularia sp.	2	4.26c	5.77
Nematoda sp.	0	0.00c	0.00
C. pusilla	1	2.13c	4.13
Hymenolepis diminuta	15	31.91b	13.33
Hymenolepis sp.	0	0.00c	0.00
Rodentolepis Fraterna	3	6.38c	6.99
Rodentolepis Microstoma	0	0.00c	0.00
Total	47	100.00	

Prevalences of the same coloumn followed by different letters differ significantly at a level of 5%.

Concerning *R. norvegicus*, *Hymenolepis diminuta* was the most found helminths whereas *M. moniliformis, Rictularia sp and Rodentolepis Microstoma* were absent (Table 4b).

Discussion

Helminths species by host

In our results, *H. diminuta* parasitized both species of the genus *Rattus*. The rodents, in particular rats, are the final and natural hosts of *H. diminuta* (Marangi *et al.*, 2003). Infection with *H. diminuta* has also been reported in *Rattus spp*. in Kuala Lumpur (Leong *et al.* 1979), Nigeria (*H. diminuta* Mafiana *et al.*, 1997), Iran (Sadjjadi and Massoud 1999) and in the Philippines (Claveria *et al.*, 2005).

Table 4b. Helminths'prevalence in *R. norvegicus*.

Species	*R. norvegicus*	Prevalences (%)	IC (%)
M. moniliformis	0	0.00b	0
Mastoph Muris	2	13.33b	17.20
Rictularia sp.	0	0.00b	0.00
Nematoda sp.	1	6.67b	12.62
C. pusilla	1	6.67b	12.62
Hymenolepis diminuta	8	53.33a	25.25
Hymenolepis sp.	1	6.67b	12.62
Rodentolepis Fraterna	2	13.33b	17.20
Rodentolepis Microstoma	0	0.00b	0
Total	15	100.00	0

Prevalences of the same coloumn followed by different letters differ significantly at a level of 5%.

Hymenolepis spp. is the rat dwarf tapeworm that infects humans when contaminated food with rat feces containing viable eggs is ingested (Onyenwe, 2009). Slums and food non-protection would be risky factors for infestation with *H. diminuta*. According to Ngongeh (2011), human cestodoses occur in the whole world. Their prevalence and distribution are linked to the dietary habits of the populations.

Sumangali *et al.* (2012), in their work on urban rodents in the Kandy areas, identified *H. diminuta* and *M. moniliformis* as zoonotic agents. Among the zoonoses, hymenolepiasis affects about 36 million people (Sumangali *et al.*, 2012). Paul *et al.* (2016), during a survey conducted on domestic rats in Nigeria, found that out of 85 rats sampled, a total of 7 (8.2%) were positive for gastrointestinal helminths and that the only species of helminths identified was *Hymenolepis diminuta*. Their findings justified the expansion of hymenolepiasis over the world.

Hymenolepiasis is a neglected zoonotic disease in humans, caused by cestodes *Hymenolepis nana* (dwarf tapeworm) and *H. diminuta* (rat tapeworm). *H. nana* and *H. diminuta* are globally widespread, but endemic to Asia, Southern and Eastern Europe, Central and South America, and Africa (Yang *et al.*, 2017).

The two dominant species of commensal rats, the brown rat (*Rattus norvegicus*) and the black rat (*R. rattus*), are distributed throughout the world (Milazzo *et al.*, 2010). The close association between rats and humans increases exposure to zoonotic agents.

Prevalence of infected rodents by sex

Our results show that parasitism by helminths has not been associated with the sex of rodents. They are comparable with those of Coomansingh *et al.* (2009) who concluded after a study on endoparasites in rats that, intestinal parasites are unrelated to the hostssex.

Ajayi *et al.,* (2007) came to the same conclusion when studying the helminths of rodents caught around human settlements in Jos, Nigeria. Similar result was found by Abu-Madi *et al.* (2001). However, our results are in opposition with those of Mafiana *et al.* (1997) in Nigeria, who found that males have a higher prevalence than females.

Conclusion

This study showed that zoonotic helmninthic parasites was present in the small mammals of the city of Cotonou and among them, *Moniliformis moniliformis* and *Hymenolepis diminuta* were the most abundant.

The rodents, *R. norvegicus* and R. *rattus* were the two natural hosts of *H. diminuta* and *R. rattus* is the main natural reservoir of *M. moniliformis*.

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