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Original Article

Helminth Infections of House Mouse (*Mus musulus*) and Wood Mouse *(Apodemus sylvaticus*) from the Suburban Areas of Hamadan City, Western Iran

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Abstract

Background: To determine the prevalence and intensity of helminths and their zoonotic importance in small rodents inhabiting in the suburban areas of Hamadan City, Iran.

Methods: The present survey was conducted on the helminth infections of two species of rodents *Apodemus sylvaticus* (n=60) and *Mus musculus*(n=72) in the suburban areas of Hamadan City during 2010-2012. Rodents were collected and examined for helminth in the different organs. The nematodes were collected in 5% formalin solution and cleared in lactophenol, cestodes and trematodes collected from intestine fixed in AFA solution and stained by acetocarmine, cleared in xylol for identification.

Results: Helminths found in *A. sylvaticus and M. musculus* and their prevalence for the first time in suburban areas of Hamadan City were as follows; In *A. sylvaticus*: *Cysticercus fasciolaris*(3.33%), *Syphacia fredrici*(26.67%), *S. stroma*(8.33%), *Anoplocephalidae* sp. (1.67%), *Skrjabinotaenia lobata*(5%), *Plagiorchis muris*(1.67%) and in *M. musculus*: *Hymenolepis nana* (16.67%), *H. diminuta* (5.55%), *S. obvelata*(30.56%), *S. obtarom* (9.72%), *Rodentolepis crassa* (1.39%), *C. fasciolaris* (1.39%). Among 11 species in two rodents 4 species including *S. obvelata*, *H. nana*, *H. diminuta,* and *P. muris* have zoonotic importance. Statistically the relation between gender and their helminth infections was not significant in either *M. musculus* or *A. sylvaticus* ($P>0.05$).

Conclusion: This study reports 11 species of helminths and on the other hand 3 species were identified for the first time in Iran and 5 species of them have potential health importance for public health and cat.

Introduction

Rodents are the most widely distributed and the largest group of small mammals in the worldwide (1). They harbor several helminths with medical and veterinary importance. Rodents play important role as reservoir hosts for vector borne diseases agents, such as leishmaniasis (2), toxoplasmosis (3), toxocariasis (4), giardiasis (5) and cryptosporidiosis (6).

Several studies in Iran have been conducted in which helminths of rodents were detected such as: Germi, Dashte–Mogan (7), Kashan (8), Mazandaran (9) and Ahvaz (10).

The aim of this study was to determine the prevalence and intensity of helminth agents in *A. sylvaticus* and *M. musculus* with emphasize on zoonotic helminth species for the first time in the suburban areas of Hamadan City of Iran.

Materials & Methods

Study area

Hamadan City is located in the west of Iran and situated at the northeastern foot of Alvand Mountain. Its coordinates is the 34°80'N and 48°51'E. The annual precipitation is 323.7 mm and a temperature changing of -30°C to 40 °C (Fig. 1).

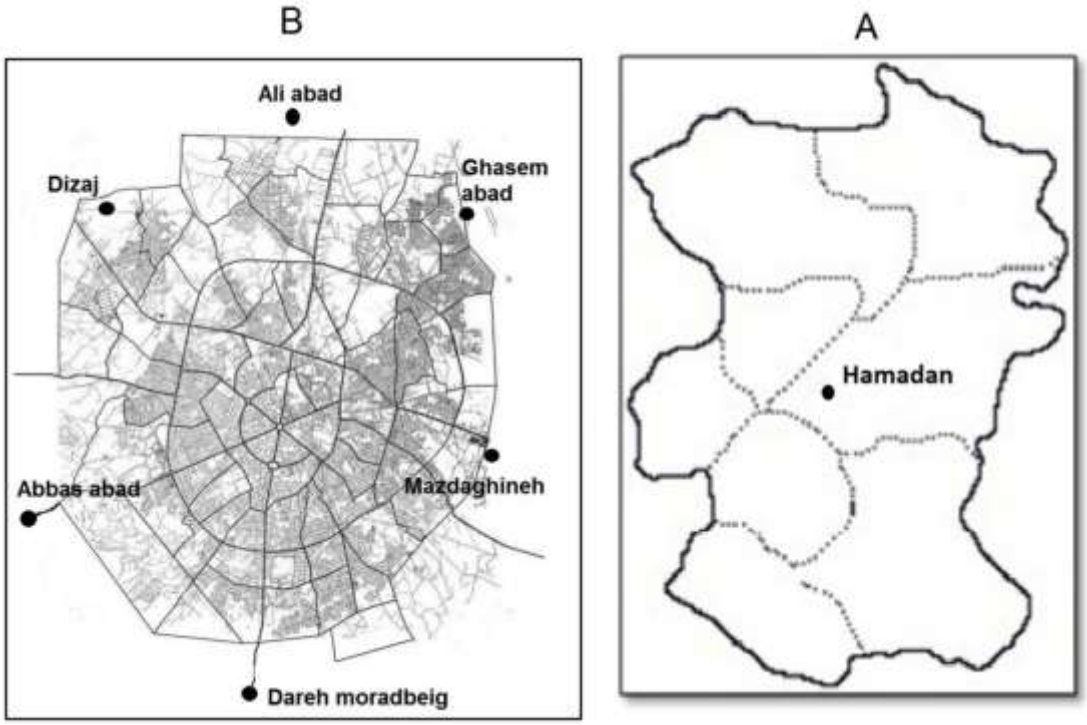

Fig.1: Studied area map
A: Map of Hamadan Province, **B**: Map of Hamadan city

Rodent's collection and Methods

From February 2010 to November 2012, sixty *A. sylvaticus* and seventy two *M. musculus* were collected by live traps from different region in the suburban areas of Hamadan City including Aliabad, Ghasemabad, Mazdaghineh, Darehmoradbeig, Abbas abad and Dizaj (Fig. 1: B). Trapping sites were located in different

habitats including horticulture farms, gardens, granaries and house cellars. Meanwhile, the captured rodents were euthanized and their sexes were recorded. Their skulls were limbed and heads were sent to Department of Medical Entomology of Hamadan Medical Sciences University and rodents identified with aid of references book (1, 11,12).

After necropsies, different organs including pectoral area and abdominal cavity, lung, liver, esophagus, stomach, small intestine, large intestine and cecum and bladder were separated and their contents were examined for helminths. Muscles were digested in acid and pepsin for inspected any larva that were released from muscle (13). Nematodes were preserved in 5% formalin solution and placed under a drop of lacto phenol on temporary mount then cestodes and trematodes were fixed in AFA solution and stained by acetocarmine and cleared in xylol for identification (14-19).

Results

A total of 132 rodents including 60 *A. sylvaticus* (37 males, 23 females) and 72 *M. musculus* (34 males, 38 females) were trapped and examined for intestinal and visceral parasite infections and the alimentary canals and livers were infected. Data on the prevalence and intensity of parasites in house mouse are presented in Table 1.

Table 1: Prevalence and intensity of parasites in 72 *M. musculus* in the suburban area of Hamadan City

Species of helminth	Organ	Number of infected			% Infection	MI* (range)
		Male (34)	Female (38)	Total (72)		
Syphacia ohtarom	Small intestine	5	2	7	9.72	13 (2-24)
Hymenolepis diminuta		2	2	4	5.55	2 (1-3)
Hymenolepis nana		5	7	12	16.67	3 (1-5)
Rodentolepis crassa		0	1	1	1.39	1 (1)
Syphacia obvelata	Large intestine and cecum	10	12	22	30.56	22 (2-187)
Taenia taeniaformis larva (*Cysticercus fasciolaris*)	Liver surface	0	1	1	1.39	1 (1)

*mean intensity

Among parasites In Table 1, 3 species of helminth are zoonoses and one of them e.g. *Cysticercus fasciolaris* is metacestode of *Taenia taeniaformis* in cats. Meanwhile *Syphacia ohtarom* (Fig. 2) was reported for the first time in Iran. Prevalence and Intensity of helminth species are medium to low and multiple infections were observed in *M. musculus* with one species in 30.55% and two species in 16.67% of the hosts. Statistically the relation between gender and their helminth infections was not significant ($P>0.05$). The results of helminths found in wood mouse were summarized in Table 2. Except *S. fredrici* (Fig. 3) and *S. stroma* (Fig. 4), all helminths obtained from this host have been reported in Iran and *P. muris* were zoonotic. Multiple infections in *A. sylvaticus* including one species were found in 21.66% and two

species in 8.33% and three species in 3.33% of the hosts. Statistically the relation between gender and their helminth infections was not significant ($P>0.05$). In general, 33.3% of *A. sylvaticus* and 47.2% of *M. musculus* were infected with one or more helminth species and no helminth infections in pectoral area and abdominal cavity, lung, esophagus, stomach, bladder and muscles were found in any of the examined rodents.

Table 2: Prevalence and intensity of parasites in 60 *A. sylvaticus* in the suburban area of Hamadan City

Species of helminth	Organ	Number of infected			% Infection	MI* (range)
		Male (23)	Female (37)	Total (60)		
Anoplocephalidae sp	Small intestine	0	1	1	1.67	1 (1)
Skrjabinotaenia lobata		2	1	3	5	1 (1)
Plagiorchis muris		1	0	1	1.67	12 (12)
Syphacia stroma	Small and Large intestine	3	2	5	8.33	5 (4-8)
Syphacia fredrici		10	7	17	28.33	26 (3-67)
Taenia taeniaformis larva (*Cysticercus fasciolaris*)	Liver surface	1	1	2	3.33	1.5 (1-2)

*mean intensity

Fig. 2: *Syphacia ohtarom* obtained from *M. musculus*. **A:** Female anterior end. **B:** Male posterior end (Photograph by Ali Yousefi)

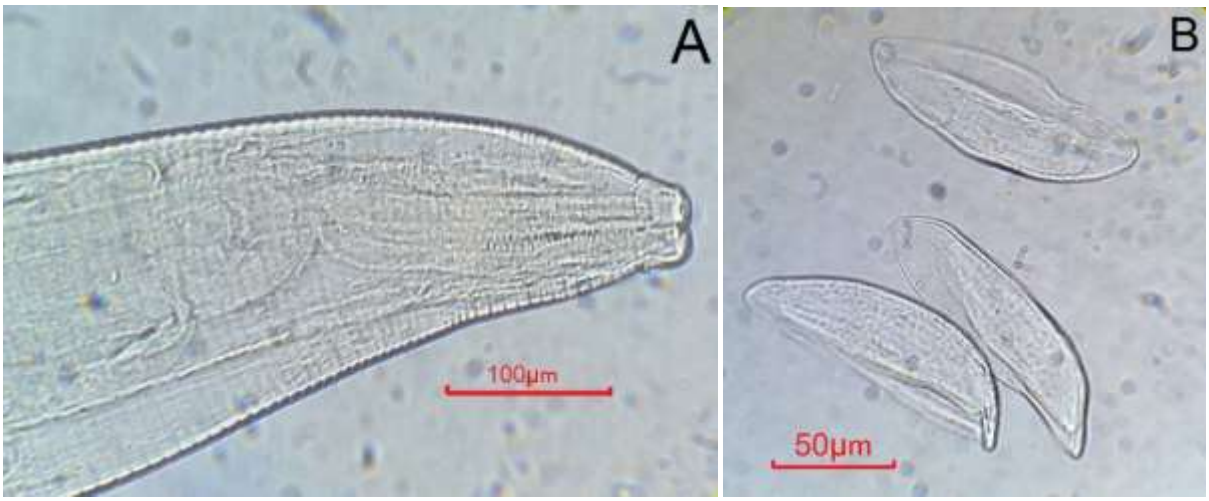

Fig. 3: *Syphacia fredrici* obtained from *A. sylvaticus*. **A:** Female anterior end. **B:** Egg (Photograph by A. Yousefi)

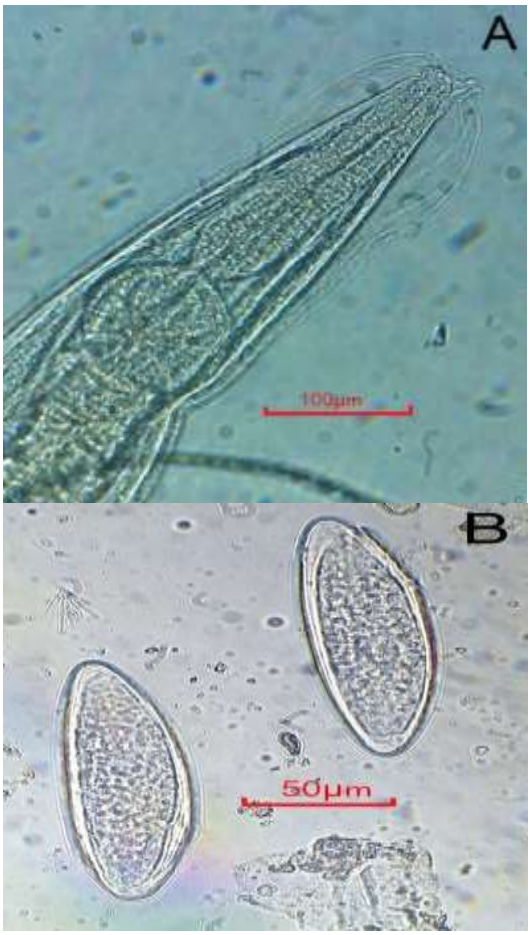

Fig. 4: *Syphacia stroma* obtained from *A. sylvaticus* **A:** Female anterior end **B:** Egg (Photograph by A. Yousefi)

Discussion

Principally most rodent species live in specific habitats (1). In our investigation, two species of rodents, *M. musculus* and *A. sylvaticus* were found in the suburban area of Hamadan City. Generally house mouse live in houses, granaries, barns and wood mouse inhabit in grassy fields, cultivate areas and into human habitations in the fall and winter.

The helminth infections aspects of the two rodents were nearly similar, for example the six species of helminths exist in the two rodents. No significance was observed between gender and helminth infections in two examined species of rodents ($P>0.05$).

In Iran few studies have been carried out on helminth infections of house mouse, such as in Mazandaran (9) Kashan (8) and Kermanshah (20), among them *S. obvelata*, *H. diminuta* and *T. taeniaeformis* metacestode were common in *M. musculus* in Iran. In the other researches in Belegrad, Serbia (21) and Faisalabad (22), *H. diminuta*, *H. nana, C. fasciolaris* and *Rodentolepis* sp. were reported.

In addition, there is one study on the helminth infections of *A. sylvaticus* in Mazandaran of Iran (9) and 2 helminths, *Nippostrongyloides khazary* and *Trichuris muris* were recorded and results differ from our study. In contrary to

the previous findings in Mazandaran of Iran, obtained helminths of *A. sylvaticus* in Sierra Gredos, Spain contains 11 species which 4 species e.g. *Plagiorchis* sp., *T. taeniaeformis* metacestode, *S. stroma* and *S. fredrici* were similar to our study (23). In the other study in the River Avena; southern Italy, *A. sylvaticus* harbored 5 helminths and among them, *S. stroma* and *S. fredrici* were similar to our findings (24).

Many authors have linked fluctuation in abundance of a rodent reservoir population with variability in number of new human cases or outbreak of disease (25). In India the relation was observed between of *H. nana* infection and abundance of mouse and total infected humans are about 40 millions (26), also about 500 millions in the world (27). In Iran *H. nana* (dwarf tapeworm) is relatively common in human (28) and *H. diminuta*, one case in Mashhad (29), five cases in Minab villages (30) and also in a sixteen-month-old female infant in Tehran were observed (31). In the meantime *S. obvelata* is reported from Philippine in 3 infants (32).

Plagiorchiidae trematodes with the transmission ability to human are important for public health. Its life cycle is indirect and Lymnaeidae species, aquatic insect larva and freshwater fishes are intermediate hosts (33). The first case of natural human infection by *P. muris* was recorded in Japan and reported a human case in the Republic of Korea (34). On the other hand *C. fasciolaris* is the metacestode of *T. taeniaformis* in rodents and infected cats and *T. taeniaformis* was observed in cats of Tehran (35), Moghan (36), Shiraz (37), and Bandar-e-Anzali (38).

Conclusion

Human beings and animals are at risk with zoonotic helminths from rodents and human activities that disturb the ecosystems (e.g. land use changes) where these rodents live which play important role in the epidemiology of zoonotic diseases. Further studies should be carried out in other parts of Iran in order obtain more detailed picture of helminths diversity in country.

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