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Original Article

Parasitic zoonoses: Gastrointestinal parasites carried by rodents in the west of Iran in 2017

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Summary
Parasitic infections in rodents have zoonotic significance. This study aimed to determine the frequency of gastrointestinal parasites in rodents in Lorestan Province, west of Iran. We captured 118 rodents from eight species, including *Meriones persicus*, *Mus macedonicus*, *Meriones tristrami*, *Microtus qazvinensis*, *Arvicola terrestris*, *Apodemus* sp., *Cricetulus migratorius*, and *Meriones libycus*, in the fall of 2017. Trapped rodents were humanly sacrificed, and the gastrointestinal tracts were removed and examined to identify parasites. The rate of infection with gastrointestinal parasites was 50.8%. The highest diversity of parasites was found in *Meriones persicus*. The most common helminths were *Hymenolepis nana* (13.5%), *Trichuris* sp. (11%), and *Syphacia obvelata* (8.5%). Rodents were also infected with *Heligmosomum* sp. (0.8%), *Trichostrongylus* (1.7%), *Physaloptera* (0.8%), *Hymenolepis diminuta* (0.8%), and *Catenotaenia* sp. (0.8%). The rate of infection with protozoa was 9.3%. Five (4.2%) were infected with *Giardia* sp., and two (1.7%) with *Entamoeba coli*. In addition, *Chilomastix* sp. (0.8%), *Iodamoeba butschlii* (0.8%), and *Eimeria* sp. (0.8%) were seen. The trematode *Notocotylus noyeri* is reported in *Arvicola terrestris* for the first time in Iran. This study emphasizes the impact of rodents on the spread of infectious agents and the necessity of effective preventive programs.
Keywords: Endoparasites, *Notocotylus*, Rodent, Lorestan Province, Iran.

Introduction

Rodents have a high reproduction rate (Lachhman et al., 2008). They can adapt to different locations and changing environments (Seifollahi et al., 2016). More specifically, they have adapted to human habitats and environmental changes (Chaisiri et al., 2012). The human and animal contacts with rodents occur through feces, urine, hair, and saliva that might be infected (Meerburg, 2010), thereby posing a public health threat (Egbunu and Dada, 2016). Moreover, wild rodents

act as definitive and/or intermediate hosts for many endoparasites (Lachhman et al., 2008).

The state of rodents in Iran is no different from that of the rest of the world and has been adequately reported in some cases. Recently, many studies investigated parasites of rodents in different parts of Iran (Pakdel et al., 2013, Yousefi et al., 2014, Arzamani et al., 2017, Rahdar et al., 2017, Ranjbar et al., 2017, Mohebali et al., 2017, Moradpour et al., 2018).

Considering the relatively large size of Iran, its diverse climates, and heterogeneous environmental conditions, a plethora of research is deemed necessary to enhance the public knowledge regarding the parasitic fauna of rodents. The current study aimed to identify the parasites in the alimentary canal of rodents, emphasizing parasitic zoonoses in Lorestan Province in the west of Iran.

Materials and methods

Location

This study took place in Lorestan Province, west of Iran, with geographical coordinates of 46º 50' to 50º 1' E and 32º 40' to 34º 23' N (Figure 1) and tropical, moderate, and cold climates. The average annual precipitation is 420-900 mm. The total area is approximately 28,390 km^2, of which a substantial amount is predominantly covered by oak forests and, to a lesser extent, elm, maple, walnut, and almond trees.

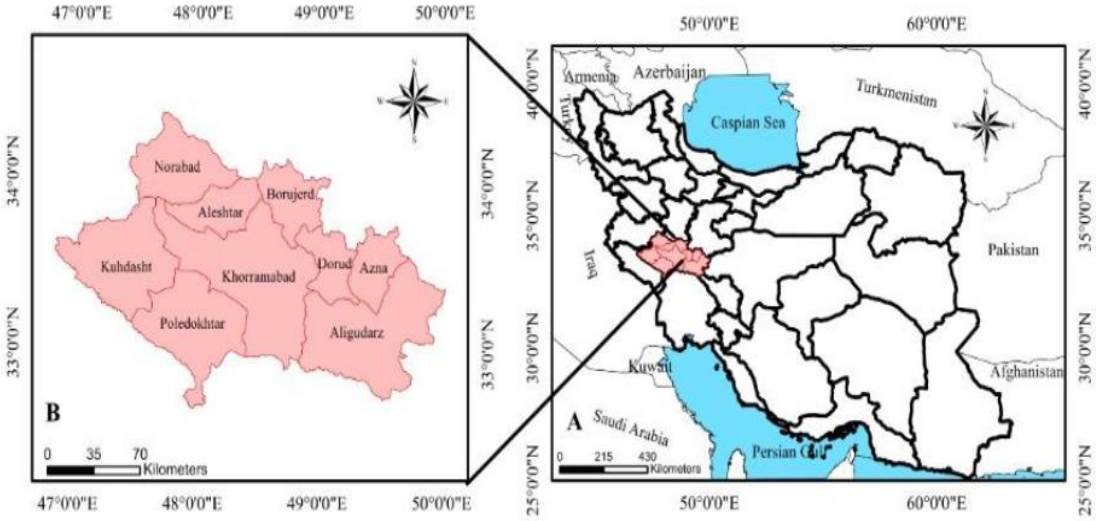

Fig. 1. Map of the study area; A: Map of Iran, B: Map of Lorestan Province.

Rodent samples

In total, 118 rodents were collected from various sites in Lorestan Province in the fall of 2017. The rodents were captured by live traps with roasted almonds as baits and transferred to Lorestan University of Medical Sciences (LUMS) Research Center. Eight species of rodents observed in this study included 59 (50%) *Meriones persicus*, 23 (19.5%) *Mus macedonicus*, 17 (14.4%) *Meriones tristrami*, 10 (8.5%) *Microtus qazvinensis*, five (4.2%) *Arvicola terrestris*, two (1.7%) *Apodemus* sp., one (0.8%) *Cricetulus migratorius*, and one (0.8%) *Meriones libycus*.

The rodents were euthanized using chloroform. Morphological characteristics of rodents were recorded. The ethical principles were followed, and the study obtained the approval of the Ethics Committee of LUMS.

Parasite samples

The rodents were cut open and dissected by necropsy. The alimentary canal of each rodent was removed, and a scalpel blade was used to scrape the

lining membrane. Staining of rodents' stool samples was performed with Lugol's solution and trichrome (Fartest, Isfahan, Iran) to detect protozoan cysts or trophozoites. In addition, the formalin-ether technique was used to examine the stool samples. Afterward, smears were studied microscopically.

In some cases, parts of other organs of the rodent's body were observed during examination in Petri dishes, including the liver. The gastrointestinal contents were examined under a stereomicroscope. The recovered macroscopic worms were maintained in ethanol 70% for future examinations. Subsequently, the worms were transferred to the Iranian National Parasitology Museum, Tehran, Iran, for identification. The helminths were identified using helminthological keys (Satyu, 1961, Simon-Vicente, 1985, Eslami, 1997).

Results

The rate of infection with endoparasites was 50.8%. Besides, 37.3% of the rodents carried one parasite. Simultaneous infection with two parasites and three parasites was 14.4% and 5.1%, respectively. The highest diversity of parasites was found in *Meriones persicus* (Table 1).

The most common helminths were *Hymenolepis nana* (13.5%), *Trichuris* sp. (11%), and *Syphacia obvelata* (8.5%). Examined *Mus macedonicus* was infected with *Catenotaenia* sp. (0.8%). In the mature and gravid portion of *Catenotaenia* sp., the proglottides are longer than wide and genital pores are in the anterior half of the proglottis margin (Figure 2). *Heligmosomum* was seen in 0.8% of rodents. The body of *Heligmosomum* sp. is like a string, delicate, generally spiral, and cuticle with transverse lines (Figure 3). The rate of infection with protozoa was 9.3%. Of 118 fecal samples of rodents, five (4.2%) were infected with *Giardia* sp. and two (1.7%) with *Entamoeba coli*. In addition, three rodents carried one of the following: *Chilomastix* sp. (0.8%), *Iodamoeba butschlii* (0.8%), and *Eimeria* sp. (0.8%). Detailed findings are shown in Table 1.

Table 1. The distribution of infection with gastrointestinal parasites among rodents in the west of Iran

Parasites	Numbers of infected rodents	Species of rodents							
		Meriones persicus	*Mus macedonicus*	*Meriones tristrami*	*Microtus caspiansis*	*Arvicola terrestris*	*Apodemus* sp	*Cricetulus migratorius*	*Meriones libycus*
Heligmosomum sp.	1	-	-	-	1	-	-	-	-
Physaloptera sp.	1	1	-	-	-	-	-	-	-
Syphacia obvelata	10	2	7	-	1	-	-	-	-
Trichostrongylus sp.	2	1	-	-	-	-	1	-	-
Trichuris sp.	13	9	-	4	-	-	-	-	-
Catenotaenia sp.	1	-	1	-	-	-	-	-	-
Hymenolepis diminuta	1	1	-	-	-	-	-	-	-
Hymenolepis nana	16	10	2	2	-	-	-	1	1
Tetrathyridium=Mesocestoides larva	1	1	-	-	-	-	-	-	--
Notocotylus noyeri	4	-	-	-	-	4	-	-	--
Chilomastix sp.	1	1	-	-	-	-	-	-	-
Eimeria sp.	1	1	-	-	-	-	-	-	
Entamoeba sp.	2	2	-	-	-	-	-	-	-
Giardia sp.	5	2	1	1	-	1	-	-	-
Iodamoeba sp.	1	1	-	-	-	-	-	-	-

It is important to note that the trematode *Notocotylus noyeri* is reported in *Arvicola terrestris* for the first time in Iran. This trematode has 15 distinct ventral papillae in each of the three rows. It has an oral sucker but not a ventral one (Figure 4, 5). All captured *Arvicola* species were severely infected with *Notocotylus* (100%). They had diarrhea and dark green, bulky, and foul-smelling stools with severe inflammation of the intestines. In the current study, the captured rodents were infected with helminths four times more than with protozoa.

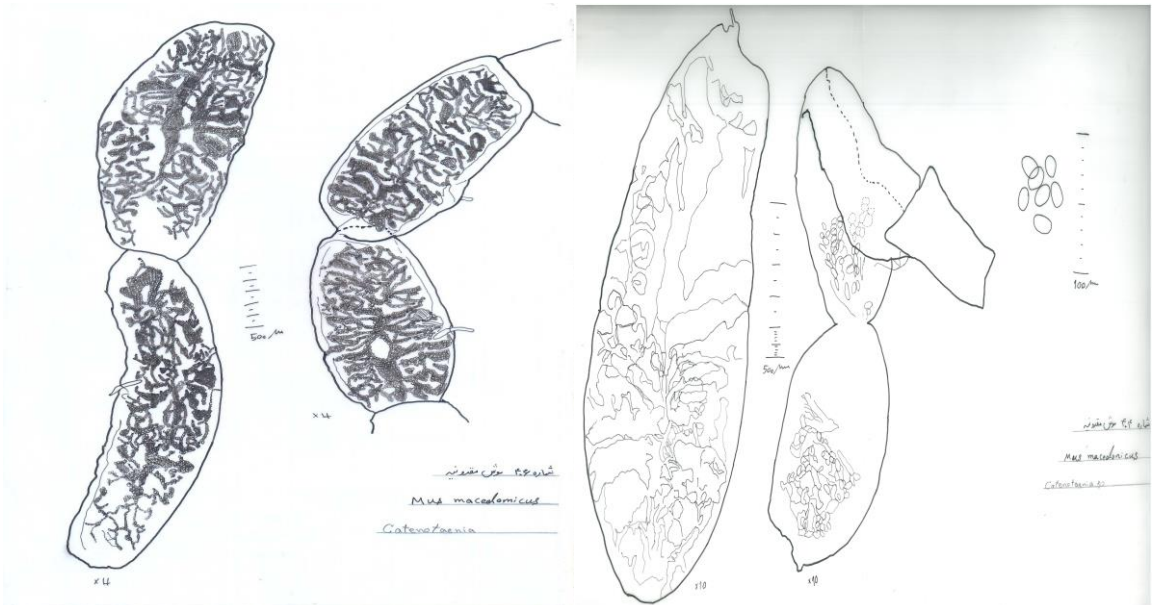

Fig. 2. *Catenotaenia* sp. (Identified and depicted by the Iranian National Parasitology Museum).

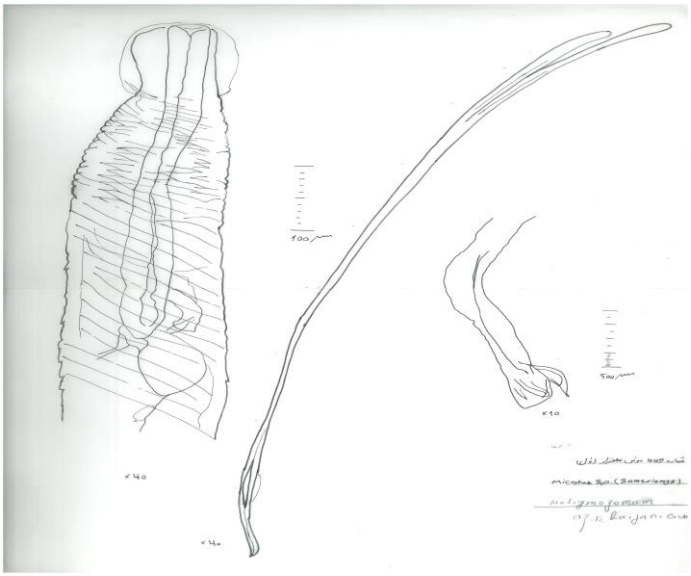

Fig. 3. *Heligmosomum* sp. (Identified and depicted by the Iranian National Parasitology Museum).

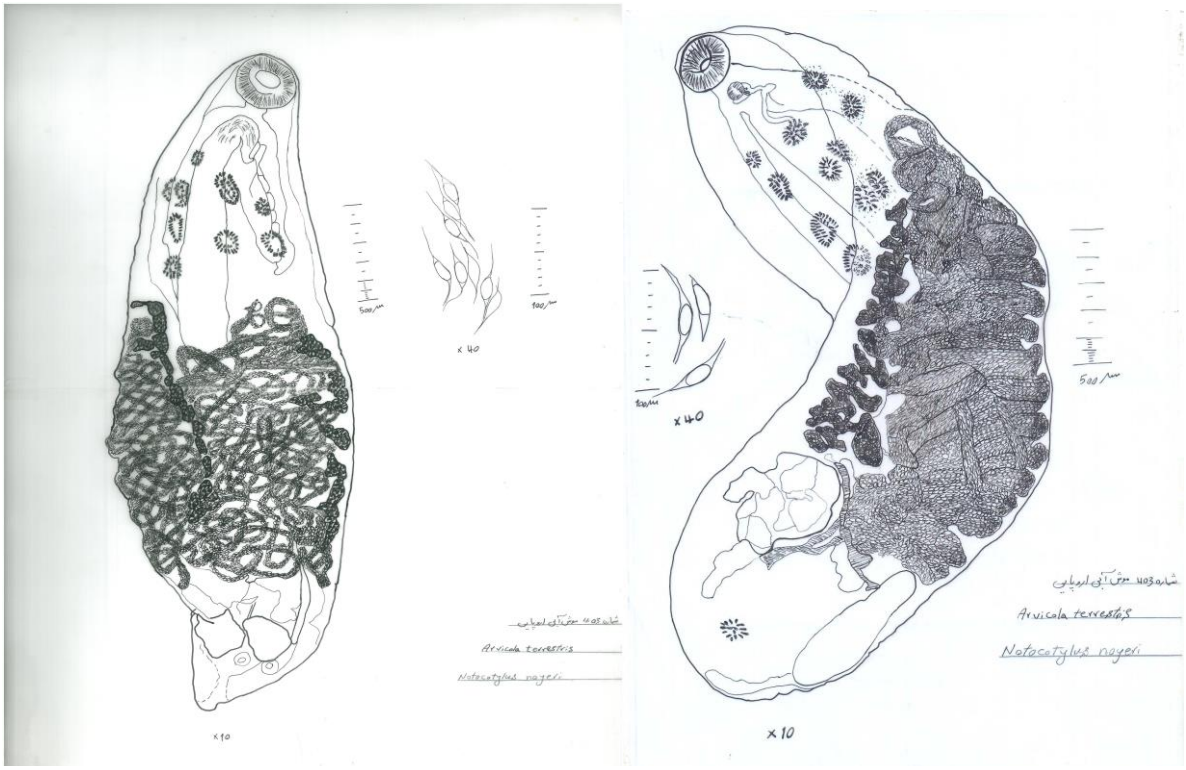

Fig. 4. *Notocotylus noyeri* (Identified and depicted by the Iranian National Parasitology Museum

Fig. 5. *Notocotylus noyeri* was obtained from *Arvicola terrestris* (Photograph by Hassan Nayebzadeh).

Discussion

This study is the first of its type reporting gastrointestinal parasites from *Meriones persicus*, *Mus macedonicus*, *Meriones tristrami*, *Microtus qazvinensis*, *Arvicola terrestris*, *Apodemus* sp., *Cricetulus migratorius*, and *Meriones libycus* in Lorestan Province, Iran. Overall, 50.8% of the rodents were infected with at least one parasite. In

the current study, the most infected rodent was *M. persicus*, which agrees with a study in Boyer-Ahmad Province (Seifollahi et al., 2016). In the present study, *Notocotylus noyeri* were found in *Arvicola terrestris* as the first report in Iran. Another species of *Notocotylus* (*N. neyrai*) has already been reported in *Arvicola* in Zanjan, Iran (Moradpour et al., 2018). Although the two species are different in morphological characteristics (Simon-Vicente et al., 1985), it may render better results if molecular tests are performed on both species found in Iran. The species of *Notocotylus* were not reported by Fasihi et al. (2016) in Kerman, Iran. It can be attributed to the issue that fresh-water snails are primary, intermediate hosts of trematodes, and the number of snails is not high in desert areas compared to the Lorestan climate (Fasihi Harandi et al., 2016).

Several helminthic and protozoan parasites use rodents as the reservoirs of different zoonotic diseases (Seifollahi et al., 2016). Besides, *H. nana* and *H. diminuta*, which are common in rodents, are potentially transmissible to humans. They have been reported in previous studies of rodents in Iran (Gholipoury, et al., 2016, Arzamani. et al., 2017, Rahdar et al., 2017, Moradpour et al., 2018). Also, *H. nana* is a common infection in Iranian children while individual cases of *H. diminuta* infection have been reported from Iran and other parts of the world (Abu-Madi et al., 2005, Mowlavi, et al., 2008, Hosseini et al., 2015). In the present study, the most common helminths were *H. nana* (13.5%). Kia et al. (2001) reported that 12.5% of *Rattus norvegicus* were infected with *H. nana* in Ahvaz. Gholami et al. (2002) found that 15% of rodents were infected with *H. nana* in Sari. About 10.8% of mice were infected with *H. nana* in Kashan, Iran (Rasti, et al., 2000). Another cestode found in the present study was *Catenotaenia* sp. Rashidi et al. (2017) reported that 3.6% of trapped rodents in Kurdistan Province were infected with *Catenotaenia*. The infection rate with *S. obvelata* in our study was 8.5%. This is in agreement with previous reports (Rahdar et al., 2017, Ranjbar et al., 2017). In a study conducted by Rahdar et al. (2017), 10% of rodents were infected with *Physaloptera*. Kia et al. (2010) observed that 0.6% of *M. persicus* were infected with this nematode in Ardabil Province, Iran. In the present study, *Physaloptera* was seen in 0.8% of rodents. Cockroach serves as an intermediate host for this nematode. Therefore, the life cycle of *Physaloptera* depends on the distribution of cockroachs (Moradpour et al., 2018). In the present study, one of the nematodes found in *Microtus qazvinensis* was *Heligmosomum* sp., with a 0.8% infection rate. This parasite has been reported by Kia et al. (2001) in *M. persicus* and *M. socialis*. Recently, this nematode has been reported by Mohammadi et al. (2022) among the rodents in Kurdistan from Iran. We observed *Mesocestoides* sp. larva (*Tetrathyridium*) in *Meriones persicus* (0.8%), similar to other research among rodents in Iran (Kia et al., 2010, Moradpour et al., 2018).

In the current study, the infection rate with *Giardia*, as a significant intestinal protozoon, was 4.2%. In a study performed in Palestine, Al Hindi and Abu-Haddaf (2013) reported a rate of 14.6% for *Giardia* infection in rodents. A study conducted in Poland reported an infection rate of 96.3% in *Microtus* and 48.3% in *Apodemus* species (Bajer et al., 2002). Studies by Rasti et al. (2000) and Kia et al. (2001) reported 25% and 2.7% infection rates in Kashan and Ahvaz cities of Iran, respectively. The observed difference can be attributed to the effect of climate and the nutritional or habitat preferences of rodents (Seifollahi et al., 2016). In the current study, *Entamoeba* was observed in the studied rodents (1.7%). The finding agrees with other reports from Iran (Rasti et al., 2000, Kia et al., 2001, Seifollahi et al., 2016, Rahdar et al., 2017).

Conclusions

There is an information gap regarding the transmission of zoonotic parasites to humans, which can be addressed by providing evidence on the rodent parasitic fauna in various zoogeographical regions. Future research should focus on the seasonal prevalence of various parasites and determining the role of paratenic and intermediate hosts in the life cycle of parasites investigated in this study.

The current study revealed that rodents in Lorestan Province are infected with many gastrointestinal parasites. Some of them pose risks for residents and domestic animals. Inappropriate disposal of human waste and fertilizers (human or animal fertilizers) may be the reason for the high prevalence of intestinal protozoan infection in rodents. This study indicates that rodents increase the risk of zoonotic parasite transmission.

As our study proved the infestation of rodents with different zoonotic parasites, particularly *Hymenolepis* sp., the authors suggest interventions to curb rodent populations. In addition, there should be programs to increase the awareness of the local people about the risks of rodents.

Acknowledgment

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Ethics approval

The authorization number is LUMS.REC.1395/157 in the Lorestan University of Medical Sciences, Khorramabad, Iran.

Conflict of interest

The authors declare no conflict of interest.

References

Al-Hindi A.I. & Abu-Haddaf E. Gastrointestinal parasites and ectoparasites biodiversity of Rattus rattus trapped from Khan Younis and Jabalia in Gaza strip, Palestine. *Journal of the Egyptian Society of Parasitology*, 2013, 4(1), 259-68.

Abu-Madi M.A., Behnke J.M., Mikhail M., Lewis J.W. & Al-Kaabi ML. Parasite populations in the brown rat Rattus norvegicus from Doha, Qatar between years: the effect of host age, sex and density. *Journal of Helminthology*, 2005, 79(2), 105-11.

Arzamani K., Salehi M., Mobedi I., Adinezade A., Hasanpour H., Alavinia M., Darvish J., Shirzadi M.R. & Mohammadi Z. Intestinal helminths in different species of rodents in north Khorasan Province, northeast of Iran. *Iranian Journal of Parasitology*, 2017, 12(2), 267-73.

Bajer A., Bednarska M., Pawełczyk A., Behnke J.M., Gilbert F.S. & Sinski E. Prevalence and abundance of Cryptosporidium parvum and Giardia spp. in wild rural rodents from the Mazury Lake District region of Poland. *Parasitology*, 2002, 125(1), 21-34.

Chaisiri K., Chaeychomsri W., Siruntawineti J., Ribas A., Herbreteau V. & Morand S. Diversity of gastrointestinal helminths among murid rodents from northern and northeastern Thailand. *Southeast Asian Journal of Tropical Medicineand Public Health*, 2012, 43(1), 21-28.

Egbunu A.A. & Dada E.O. Prevalence of Intestinal Helminth Parasites of domestic rats in selected sites around student hall of residence in the Federal University of Technology, Akure, Nigeria. *International Journal of Current Microbiology and Applied Sciences*, 2016, 5(4), 918-23.

Eslami, A., 1997. Veterinary helminthology. 2nd ed., Vol. I Trematoda, Tehran University publication, Tehran.

Fasihi Harandi M., Madjdzadeh S.M. & Ahmadinejad M. Helminth parasites of small mammals in Kerman Province, southeastern Iran. *Journal of Parasitic Diseases*, 2016, 40(1), 106-9.

Gholami S.A., Motevali, H.F., Moabedi I. & Shahabi S. Study of helmintic intestinal parasites in the rodents from the rural and central regions of Mazandaran Province in the years 1997 to 1999. *Journal of Mazandaran University of Medical Sciences*, 2002, 12(35), 67-75.

Gholipoury M., Rezai H.R., Namroodi S. & Khazaeli F.A. Zoonotic and non-zoonotic parasites of wild rodents in Turkman Sahra, Northeastern Iran. *Iranian Journal of Parasitology*, 2016, 11(3), 350-7.

Hosseini G., Sarkari B., Moshfe A., Motazedian M.H., & Khabisi S.A. Epidemiology of human fascioliasis and intestinal helminthes in rural areas of Boyer-Ahmad Township, Southwest Iran; A population based study. *Iranian Journal of Public Health*, 2015, 44(11), 1520-5.

Kia E.B., Homayouni M.M., Farahnak A., Mohebali M. & Shojai S. Study of endoparasites of rodents and their zoonotic importance in Ahvaz, south west Iran. *Iranian Journal of Public Health*, 2001, 30(1-2), 49-52.

Mohammadi A., Bozorgomid A., Sedaghat M.M., Mowlavi G., Abai M.R, & Mostafavi E. Assessment of the Endoparasite Fauna amongst the Rodents in Kurdistan Province, west of Iran. *Iranian Journal of Parasitology*, 2022, 17(1), 70-8.

Mohebali M., Zarei Z., Khanaliha K., Kia E.B., Motavalli-Haghi A., Davoodi J., Rezaeian T., Tarighi F., & Rezaeian M. Natural intestinal protozoa in rodents (Rodentia: Gerbillinae, Murinae, Cricetinae) in northwestern Iran. *Iranian Journal of Parasitology*, 2017, 12(3), 382-88.

Moradpour N., Borji H., Darvish J., Moshaverinia A. & Mahmoudi A. Rodents helminth parasites in different region of Iran. *Iranian Journal of Parasitology*, 2018, 13(2), 275-84.

Meerburg B.G. Rodents are a risk factor for the spreading of pathogens on farms. *Veterinary Microbiology*, 2010, 142(3-4), 464-5.

Mowlavi G.H., Mobedi I., Mamishi S., Rezaeian M., Ashtiani M.H., & Kashi M. Hymenolepis diminuta (Rodolphi, 1819) infection in a child from Iran. *Iranian Journal of Public Health*, 2008, 37(2), 120-2.

Pakdel N., Naem S., Rezaei F. & Chalehchaleh A.A. A survey on helminthic infection in mice (Mus musculus) and rats (Rattus norvegicus and Rattus rattus) in Kermanshah, Iran. *Veterinary Research Forum*, 2013, 4(2), 105-9.

Rahdar M., Sadat Roointan E.A., Vazirianzadeh B. & Alborzi A. Study of internal parasites of rodents in ahvaz, south-west of Iran. *Jundishapur Journal of Health Sciences*, 2017, 9(1), 1-5.

Ranjbar M.J., Sarkari B., Mowlavi G.R., Seifollahi Z., Moshfe A., Khabisi S.A. & Mobedi I. Helminth infections of rodents and their zoonotic importance in Boyer-Ahmad District, Southwestern Iran. *Iranian Journal of Parasitology*, 2017, 12(4), 572-79.

Rashidi Gheshlagh M., Tavassoli M. & Esmaeilnejad B. Survey on gastero-intestinal parasitic helminthes in rodents of Saqqez country. Kurdistan Province. *Journal of Animal Environment*, 2017, 9(4), 81-4.

Rasti S., Moubedi I., Dehghani R. & Drodgar A. The survey of gastrointestinal helminths of mice in Kashan. *Journal of the Faculty of Veterinary Medicine, University of Tehran*, 2000, 55(4), 57-9.

Satyu, Y., 1961, Systema Helminthum, Vol 3, Pt. I. Interscience Publishers, New York, London.

Seifollahi Z., Sarkari B., Motazedian M.H., Asgari Q., Ranjbar M.J. & Abdolahi Khabisi S. Protozoan parasites of rodents and their zoonotic significance in Boyer-Ahmad District, Southwestern Iran. *Veterinary Medicine International*. 2016, 2016, 1-5.

Simon-Vicente F., Mas-Coma S., Lopez-Roman R., Tenora F. & Gallego J. Review of Notocotylus species (Trematoda: Notocotylidae) parasitizing rodents in Europe. *Folia Parasitol*ogy, 1985, 1(32), 21-33.

Singla L.D., Singla N., Parshad V.R., Juyal P.D., & Sood N.K. Rodents as reservoirs of parasites in India. *Integrative Zoology*, 2008, 3(1), 21-6.

Yousefi A., Eslami A., Mobedi I., Rahbari S. & Ronaghi H. Helminth infections of house mouse (Mus musulus) and wood mouse (Apodemus sylvaticus) from the suburban areas of Hamadan city, western Iran. *Iranian Journal of Parasitology*, 2014, 9(4), 511-18.