Helminth parasites of small mammals in Kerman province, southeastern Iran

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Received: 18 September 2013 / Accepted: 24 March 2014 / Published online: 18 April 2014
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Abstract Fifty-one specimens of small mammals were collected from different locations of Kerman province, southeastern Iran during 2007 and 2009. They constitute six species of rodents (*Meriones persicus*, *Meriones libycus*, *Tatera indica*, *Dryomys nitedula* and *Mus musculus*), one species of Erinaceomorpha (*Paraechinus hypomelas*) and one species of hare (*Lepus europeus*). The rate of helminthic infection was 45.1 % among all trapped specimens. In 28 out of 51 hunted specimens no intestinal helminth parasite was found. Of all mammals examined, 15 (29.4 %) had nematodes, 5 (9.8 %) had cestodes, and 3 (5.9 %) were infected with Acanthocephala. Five different species of parasites were isolated: *Trichuris muris*, *Moniliformis moniliformis*, *Hymenolepis diminuta*, *Hymenolepis nana*, and *Mastophorus muris*. Results of the present study indicate the potential of small mammals in the transmission of zoonotic helminthic infection.

Keywords Helminthes · Small mammals · Rodents · Kerman · Iran

Introduction

Among the small mammals, rodents (Order Rodentia) comprise the largest mammalian order that have a cosmopolitan distribution. They are considered as a key

mammalian group and are highly successful in adapting to many environments throughout the world. More than 1,700 species of rodents have been identified in the world (Corbet and Hill 1991; Wilson and Reader 2005). They are important members of nearly all faunas. Rodents are a remarkable complicated group with respect to morphological diversity. The family Muridae constitutes the largest group of mammalian in Iran (Harington 1977; Etemad 1978). They are considered to transmit diseases and act as reservoir hosts for many zoonotic pathogens including parasites that potentially pose a health risk to humans (Meehan 1984; Mayer et al. 1995; Singleton et al. 2003). Apart from various devastating effects to man, helminth parasites of rodents have an important role in the zoonotic transmission of many diseases including schistosomiasis and angiostrongyliasis. Several studies have been carried out on helminth parasites of wild rodents in Iran (Edrissian et al. 1975, 1976; Zovein et al. 1984; Molavi 1991; Fasihi-Harandi 1992; Yaghoobi-Ershadi et al. 1996; Mohebbi 1997; Mohebbi et al. 1997, 1998; Javadian et al. 1998; Mohebbi and Bahman-Rokh 2001; Rasti et al. 2002). However little data has been documented on this aspect in Kerman province. The scarcity of scientific documentation as well as the underlying threat of rodents as reservoirs of zoonotic helminthes emphasizes the necessity of present study. Our study was carried out on the internal parasite fauna of small wild mammals in several parts of Kerman province. The aim of this study was to identify the helminth parasites of small wild mammals and their zoonotic implications.

Materials and methods

The present study was a descriptive cross-sectional that carried out in eleven counties of Kerman province located

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in south-east of Iran (Table 1). The small mammal samples were collected from November 2007 until February 2009. All the specimens were trapped alive using specially made wire traps. Fruits, pistachio, dates and sweet potatoes were used as baits. The samples were collected during all four seasons round the year. The captured small mammals were not under any conservation and were not listed as threatened species. They transferred to the laboratory and were anesthetized by chloroform and their external characters were measured. Finally their digestive system from pharynx to the rectum were separated and kept in 10 % formalin. Then each animal was prepared as standard museum specimens (skull). Each sample individually labeled by a code number. The specimens were identified to species level based on morphological studies (external and skull characters) using the keys developed by Harrison and Bates (1991), Corbet (1978) and Etemad (1978). The rodent skulls are deposited in the Zoological Museum of Shahid Bahonar University of Kerman (ZMSBUK), Kerman, Iran.

Using scissors the digestive system of each animal was cut into different pieces and each part was dissected and the contents were thoroughly examined for the presence of helminth parasites under stereomicroscope. After a brief washing and relaxing, the isolated parasites were transferred to buffered 10 % formalin. The nematodes were cleared in lactophenol and the tapeworms and acanthocephalans were stained by Carmen Acid technique as described by De Chambrier (2001). The helminthes were identified to the level of genus and species using standard helminthological keys (Yamaguti 1961; Anderson et al. 2009).

Results and discussion

A total of 51 specimens of small mammals belonging to eight species were identified. They constitute six species of rodents, one species of Erinaceomorpha and one species of hare (Table 1). The highest number of hunted specimens was from Rabor county while all of which were characterized as *Meriones persicus* Blanford, 1875. The lowest

numbers were *Dryomys nitedula* Pallas, 1778 and *Lepus europeus* Pallas, 1778. Twenty-eight out of 51 hunted specimens did not have any helminthic infection in the digestive system. From 23 infected specimens, 15 had nematodes, five had cestodes, and three were infected with the Acanthocephala. Highest infection was belonged to the nematodes namely *Trichuris muris* (Schrunk, 1788) and *Mastophorus muris* (Gmelin, 1790) (Table 2).

Five different species of helminthes were isolated from 21 *M. persicus* in which the highest amount of infection belonged to *T. muris* (26.3 %) and the least frequent helminth parasite was *Moniliformis moniliformis* (Bremser, 1811) (5.3 %). Of seven *Meriones libycus* Lichtenstein, 1823, two species of parasites were isolated. Two *M. libycus* (28.6 %) had *T. muris* and one (14.3 %) had *Hymenolepis nana* (von Siebold 1852, Blanchard 1891). Of five *Tatera indica* (Hardwicke, 1807), two (40 %) were infected with *T. muris*. One out of 12 (8.3 %) *Nesokia indica* (Gray, 1830) had *Hymenolepis diminuta* (Rudolphi 1819) and the rest (91.7 %) were free of intestinal helminthic infection. We trapped only two *Mus musculus* Linnaeus, 1758 of which one was infected with *H. nana* and *T. muris* was found in the other specimen. In the two hedgehogs, *Paraechinus hypomelas* (Brandt, 1836), the acanthocephalan *M. moniliformis* was found. No helminth parasite was found in the only trapped *L. europeus*.

Our research showed that nematodes are the most frequent intestinal helminth of the rodents in Kerman area and they were mainly seen in *M. persicus*. Intestinal nematodes were not seen in *N. indica*, *P. hypomelas*, *D. nitedula*, and *L. europeus*. There were fewer mammals with acanthocephalas infection but both trapped *P. hypomelas* and also one *M. persicus* were infested to this helminth. Generally in arid and semi-arid regions like Kerman province small mammals are mostly infected by soil- and arthropod-transmitted helminthes. This is the case in our study as most of the parasites isolated were soil/arthropod-transmitted nematodes or acanthocephalans.

In the present study 29.4 % of specimens were infested with nematoda, 5.9 % with Acanthocephalas, and 9.8 %

Table 1 Geographical distribution of the small mammals trapped in 11 counties of Kerman province (Region 1: Kerman city, Rafsanjan, Anar, Baghin, Zangiabad, Kouhpayeh; Region 2: Mahan, Rabor, Rayen, Region 3: Ravar, Bam)

Region	<i>Meriones persicus</i>	<i>Meriones libycus</i>	<i>Tatra indica</i>	<i>Dryomys nitedula</i>	<i>Nesokia indica</i>	<i>Lepus europeus</i>	<i>Paraechinus hypomelas</i>	<i>Mus musculus</i>	Total
Region 1	3	2	0	0	3	1	2	1	12
Region 2	18	5	5	1	3	0	0	1	33
Region 3	0	0	0	0	6	0	0	0	6
Total	21	7	5	1	12	1	2	2	51

Table 2 Frequency distribution of helminth parasites isolated from small mammals in Kerman province, Iran

Small mammal	Helminth infection				Total
	Nematoda No. (%)	Cestoda No. (%)	Acanthocephala No. (%)	Negative No. (%)	
<i>M. persicus</i>	10 (47.6)	1 (4.8)	1 (4.8)	9 (42.9)	21 (41.2)
<i>M. libycus</i>	2 (28.6)	1 (14.3)	–	4 (57.1)	7 (13.7)
<i>Tatera indica</i>	2 (40)	–	–	3 (60)	5 (9.8)
<i>Nesokia indica</i>	–	1 (8.3)	–	11 (91.7)	12 (23.5)
<i>Dryomys nitedula</i>	–	1 (100)	–	–	1 (2.0)
<i>Lepus europeus</i>	–	–	–	1 (100)	1 (2.0)
<i>Paraechinus hypomelas</i>	–	–	2 (100)	–	2 (3.9)
<i>Mus musculus</i>	1 (50)	1 (50)	–	–	2 (3.9)
Total	15 (29.4)	5 (9.8)	3 (5.9)	28 (54.9)	51 (100)

with Cestoda. This is in agreement with the study conducted on parasitic fauna of rodents in Isfahan province, central Iran (Fasihi-Harandi 1992). In Isfahan area 40, 3 and 11 % of hunted rodents were infected with the nematodes, acanthocephalas and cestodes respectively, while there was not any trematode infestation. In another research in the domestic rodents of Kashan, Iran, 40.8 % of the rodents were infected with the nematodes, 8.3 % with cestodes and 7.5 % of the animals were double infected with both nemetodes and cestodes (Rasti et al. 2002). None of the above-mentioned studies in Isfahan and Kashan as well as the present research found rodents with trematode infection. However in another study carried out in the more humid regions of Caspian littoral in Mazandaran province, 1.2 % of the rodents were infected with the trematode *Echinostoma* Rudolphi, 1809 (Gholami et al. 2002). This is because of the fact that trematodes are mainly depended on fresh-water snails as their primary intermediate host, and the snail population is relatively small in the desert climate of central parts of Iran in comparison to numerous aqueous habitats in the north of Iran.

Acknowledgments This study was supported by grant of Vice Chancellor of research of Shahid Bahonar University of Kerman, Iran. We wish to thank Mr. S. M. Mansouri, Mr. R. Sharifzadeh, Mr. M. Rajabi, Mr. Meisam Ghiasi, Mrs. F. Iranmanesh and plant protection division of Organisation of Agriculture, Kerman branch for assistance in sample collection.

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