Original Article

Study on Ectoparasites of *Rhombomys opimus*, the Main Reservoir of Zoonotic Cutaneous Leishmaniasis in Endemic Foci in Iran

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Abstract

Background: Ectoparasites of mammalian hosts play an important role for transmission of diseases from the host reservoirs to human. The aim of this study was to determine the species composition and infestation parameters for parasitic arthropods associated with *Rhombomys opimus.*

Methods: Ectoparasites of *R. opimus* were collected from seven endemic district of ZCL in Iran including Shirvan and Sfaraysen in North Khorasan Province, Kalaleh in Golestan Province, Damghan and Shahrood in Semnan Province, and Badrood and Habibabad in Isfahan Province. The areas of study were mainly desert and plain. Rodents were captured using Sherman life traps during active seasons from May to November 2008. Captured rodents were transported to laboratory and their ectoparasites were picked up using brushing against the fur of the rodents. Ectoparasites were stored in 70% ethanol for their preservation and then identified based on morphological characters.

Results: Ectoparasites belonged to one flea species of *Xenopsylla nuttalli* and one mite species of *Ornithonussus bacoti*. The flea species with 75.3% was more common than the mite. *O. bacoti* might play an important role in transmission of rat mite dermatitis among *R. opimus* colony.

Conclusion: Results will provide an essential clue for combating zoonotic diseases in the region.

Keywords: *Rhombomys opimus*, Ectoparasites, *Xenopsylla nuttalli*, *Ornithonussus bacoti*, Iran.

Introduction

Several studies confirmed the presence of the rodent ectoparasites in Iran (Hagghi et al. 2000, Shayan 2006, Hanafi-Bojd et al. 2007, Telmadarraiy et al. 2007). Rodents are the largest order of mammals, representing 43% of specific global mammalian diversity, and including 443 genera and 2021 different species (Saluzzo et al. 1999). Rodents together with arthropod ectoparasites can play an important role in distribution of the arboviruses, streptococcal infections, choriomeningitis, plague, tularemia, leptospirosis and spirochaetosis (Manson 2005).

Rhombomys opimus is considered as the main reservoir host of zoonotic cutaneous leishmaniasis and plague. Knowledge on reservoir host and their ectoparasites will provide a clue for control planning of diseases in a given areas. There are a few documented papers on ectoparasites of *R. opimus* in different regions of Iran.

The great gerbil, *R. opimus* constructs highly complicated and deep burrows and has one of the most abundant and richest flea as-

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semblages among rodents (Zagniborodova 1960, 1968).

Xenopsylla nuttalli was found on *Hemiechinus auritus, Vulpes vulpes, Rhombomys opimus, Gerbill nanus, Meriones persicus, M eriones meridianus* and *Nesokia indica* in Iran; so, *this* flea is ectoparasite of rodents and wild mammals (Asmar 1979).

The tropical rat mite commonly occurs on rats throughout the world, particularly in tropical and subtropical regions, but also in some temperate areas. It is an ectoparaisite of rats, and attacks people living in rat-infested buildings. Its bite may cause irritation and sometimes painful dermatitis. It is an important pest of laboratory animals, particularly rats, mice, and hamsters, sometimes deteriorating their health or even causing death by exsanguinations (Baker et al. 1956, Vatandoost et al. 2002).

In Iran, *Ornithonyssus bacoti* was reported on other wild rodent including: *Microtus socialis, Meriones persicus*; so this mite is general ectoparasite for extremely wild rodent (Asmar 1979, Telmadarraiy et al. 2005).

However, a few studies on the ectoparasites of rodents and other small mammals have been documented, e.g. study on ectoparasites of domestic animals in Iran (Maghami 1968), ectoparasites of rodents in Semnan (Eghbali 1991), report of a new species of myocoptid mites on *Calomyscus* spp. in Iran (Bochkov et al. 1999), and the study of ectoparasites of *Nesokia indica* and *Meriones* spp. in Ardestan (Moniri et al. 2000).

The aim of this study was to determine the species composition and infestation parameters for parasitic arthropods associated with *R. opimus.*

Materials and Methods

Study areas

Based on distribution if *R. opimus* in Iran, seven districts including Kalaleh (Golestan Province), Esfarayen, Shirvan (Northern Khorassan Province), Shahrood, Damghan (Semnan Province), Badrood and Habibabad (Isfahan Province) were selected for this study (Fig. 1).

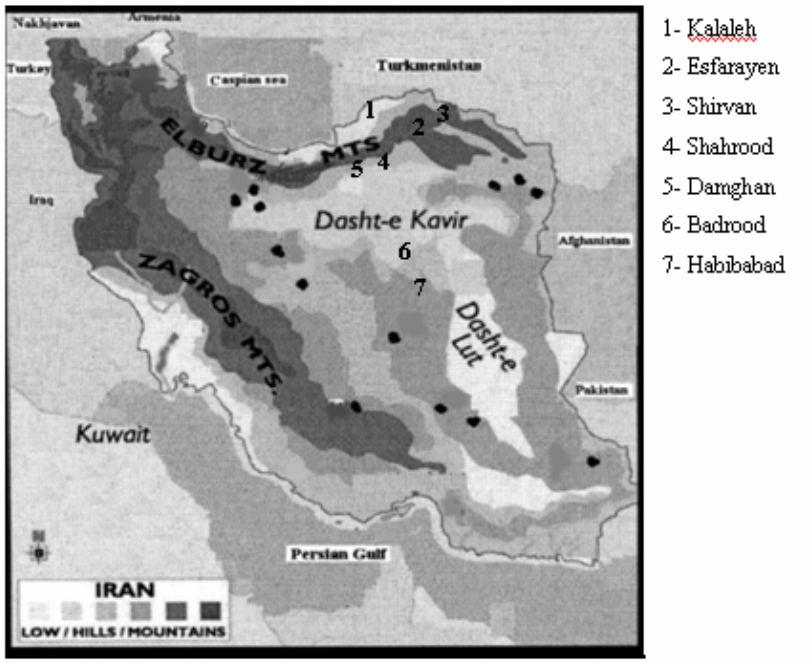

Fig. 1. The map of study areas located in Zoonotic Cutaneous Leishmaniasis foci

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Rodent collection

The gerbils were live captured at different localities of above-mentioned areas, using Sherman traps, baited with roasted walnut, cucumber, tomato and placed close to active burrows. They were set up monthly in the early morning and evening from spring to autumn 2008.

Collection of ectoparasites

Captured rodents were transported to the laboratory at the Department of Medical Entomology and Vector Control, School of Public Health, Tehran University of Medical Sciences, Iran and their ectoparasites were picked up using brushing against the fur of rodents. Ectoparasites were stored in 70% ethanol for their preservation and identification. Specific identification systematic keys were used for species identification.

Identification of ectoparasites and rodents

Preparing of microscopic slid of ectoparasites were carried out as follows: Specimens were washed with water several times, and cleared with KOH (%10) for 1–24 h. then, they were washed with distilled water. In next stage all specimens were placed in 5% acetic acid for 0.5–1 h and washed with distilled water. Then they were transferred into 50% ethanol for 1 h followed by ethanol 70%, 90% and pure ethanol for 1-24 h, respectively. Specimens were then placed in clove juice for 1–24 h. In this stage, only fleas were maintained in xylol for 1-24 h. Finally, specimens were fixed on microscope slides using canadabalzam mounting material.

Different criteria of morphology of rodents were used for *R. opimus* identification. Field operation, site selection, active reconnaissance, trap timing, trapping method, trap baiting, trap collection, biometrics measurement, data recoding, ectoparasites collection laboratory operation, preparation of rodent skulls, mounting of ectoparasite, identification using valid keys, confirmation of some species by expertise Institute was carried out according to standard methods provided (Kranatz 1975, Etemad 1978, Asmar 1979).

Results

Totally 50 *R. opimus* were captured and 97 specimens of ectoparasites were observed. Two species of ectoparasites were identified including *Xenopsylla nuttalli* (flea) and *Ornithonussus bacoti* (mite) (Fig. 2). *Xe. nuttalli* was dominant (75.3%) collected specimen Fleas were found in all parts of the study areas. The most frequency of *Xe. nuttalli* (58.9%) was in Badrood County. The highest frequency of Xe. *nuttalli* was 12.33% in Habibabad, 58.9% in Badrood, 6.85% in Esfarayen, 5.48% in Shirvan, 2.74% in Shahrood, 4.1% in Damghan and 9.59% in Kalaleh. The most frequency of *Ornithonyssus bacoti* (54.16%) was found in Esfarayen County. This species was not observed in Kalaleh, Habibabad and Badrood. The frequency of *Or. bacoti* was 54.16% in Esfarayen, 20.83% in Shirvan, 12.5% in Damghan and 12.5% in Shahrood (Fig. 3).

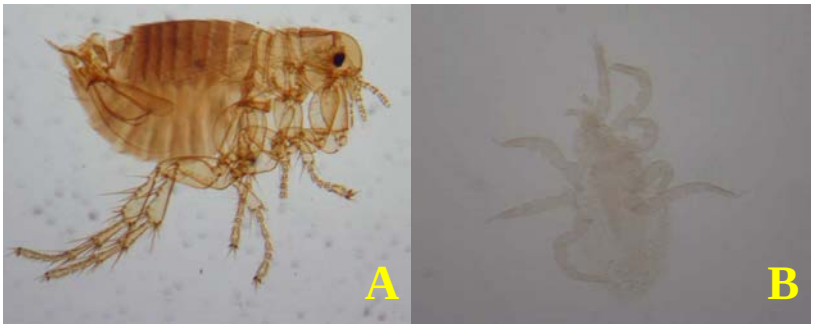

Fig. 2. Ectoparasites collected from *R. opimus* in the study area: A: *Xenopsylla nuttalli* and B: *Ornithonyssus bacoti*

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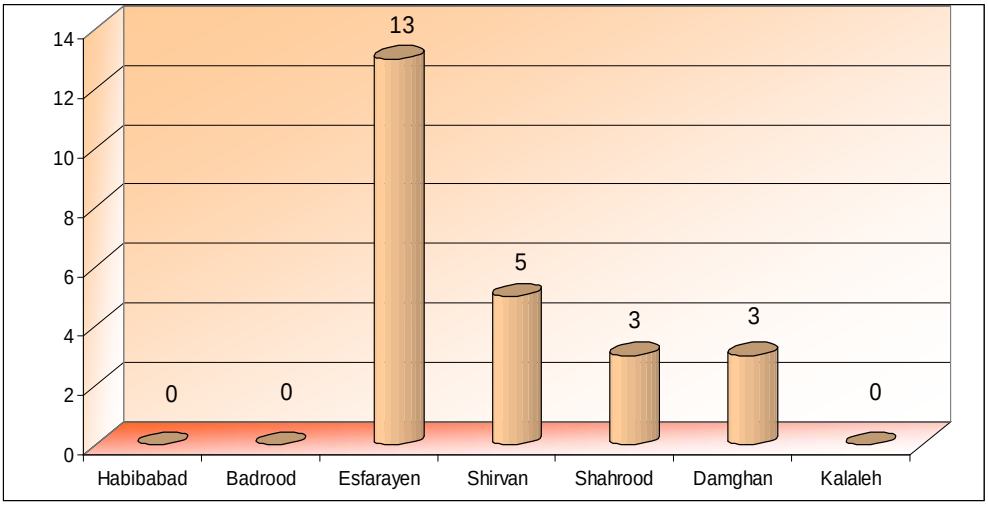

Fig. 3. Frequency and geographical distribution of *Ornithonyssus bacoti* species collected from *R. opimus* in the study area.

Discussion

Rhombomy opimus has an important role in the cycle of zoonotic diseases such as plague and zoonotic cutaneous leishmaniasis (ZCL) in Iran, Afghanistan and China (Parvizi et al. 2003, Yaghoobi-Ershadi et al. 2003, 2004, Rassi et al. 2006, 2007, Faulde et al. 2008)

*X*e. *Xenopsylla nuttali* was previously reported from Isfahan, Sabzevar, Kurdistan and Golestan. (Zagniborodova 1960, 1968). In this study we report the presence of this species in Isfahan, Golestan, Northern Khorasan and Semnam. It seems that this flea is adapted on this rodent and regardless of the rodent different geographical habitats it can be found wherever the rodent present.

The differences of prevalence ectoparasites in this area did not show relationship to the locality of their hosts. *R. opimus* was captured in different seasons but seasonal changes had no effect on the abundance of ectoparasite. Ectoparasites such as lice and ticks were not found in this study and this was attributed to the technique used. There was no significant relationship between host body weight and abundance of ectoparasites.

Some of the ectoparasites that are identified in this study are potentially vectors of veterinary and medical importance diseases.

Mites of *O. bacoti* were not found in Isfahan and Golestan Provinces. These two provinces do not have similar topography as well as climatic characters. However, this mite has been found in other provinces similar to either Isfahan or Golestan. More investigations need to clarify the reasons of the biased distribution of the species in indifferent localities in Iran. This mite is a pest of rats (Tenorio et al. 1980) and called the tropical rat mite. There is one report indicating the association of this mite with cases of skin dermatitis in humans (Baker et al. 1956).

Overall, we have documented the presence of two ectoparasites species distributed in wide geographical ranges from northeastern to central regions of Iran. The area of study is forming some important cutaneous leishmaniasis foci in Iran.

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References

Asmar M, Piazak N, Karimi Y (1979) Fleas: Pictorial Identification Key of Fleas of Iran. Publication of Pasteur Insitute of Iran, Tehran.

Bochkov A, Malikov V, Arbabi M (1999) *Trichoecius calomysci* sp. (Acari: Myocoptidae), A new mite species from Iran. Folia. Parasitol. 46: 316–18.

Eghbali M (1991) Study of rodents and their ectoparasites in Semnan. [MS thesis]. School of Public Health, Tehran University of Medical Sciences, Iran.

Etemad A (1978) Mammals of Iran, Rodents and Identification Key. Natural Resource Protection and Human environment Association Press, Tehran.

Faulde M, Schrader J, Heyl G, Amirih M, Hoerauf A (2008) Zoonotic cutaneous leishmaniasis outbreak in Mazar-e Sharif, northern Afghanistan: an epidemiological evaluation. Med Microbiol J. 298(5-6): 543–50.

Hanafi-Bojd AA, Shahi M, Baghaii M, Shayeghi M, Razmand N, Pakari A (2007) A study on rodent ectoparasites in Bandar Abbas: the main economic southern of Iran. J Environ Health Sci Eng. 4(3): 173-176.

Kranatz GW (1975) A Manual of Acarology. O.S.U. book stores Inc, Corvallis, Oregon state.

Maghami G (1968) External parasites of livestock in Iran. Arch Inst Razi. 20: 81-83.

Moniri V, Sahabi Z, Vatandoost H, et al. (2000) Ectoparasites of *Nesokia indica* and *Meriones* spp. in Ardestan. The 14th Iranian Plant Protection congress, Isfahan University of Technology, Iran. pp. 305–306.

Parvizi P, Benlarbi M, Ready PD (2003) Mitochondrial and Wolbachia markers for the sandfly *Phlebotomus papatasi*: little population differentiation between peridomestic sites and gerbil burrows in Isfahan province. Iran. Med Vet Entomol. 17(4): 351–62.

Saluzzo JF, Dodet B (1999) Emergence and Control of Rodent-Borne Viral Diseases. Elsevier Science, Paris.

Shayan A, Rafinejad J (2006) Arthropod parasites of rodents in Khorram Abbad district, Lorestan provincen of Iran. Iranian J Publ Health. 35(3): 70–76.

Telmadarraiy Z, Vatandoost H, Mohammadi S, Akhavan AA, Abai MR, et al. (2007) Determination of rodent ectoparasite fauna in Sarpole-Zahab district, Kermanshah province, Iran. Iranian J Arthropod-Borne Dis. 1(1): 58–62.

Tenorio JM, Goff ML (1980) Ectoparasites of Hawaiian Rodents (Siphonaptera, Anoplura and Acari). Special Publication Department of Entomology Bishop Museum, Honolulu.

Vatandoost H, Hanafi Bojad AA (2002) Ectoparasites of Medical and Veterinary Importance. Tehran University of Medical Science publications, Tehran.

Yaghoobi-Ershadi MR, Akhavan AA, Zahrai-Ramazani AR, Abai MR, Ebrahimi B, Vafaei-Nazhad R, Hanafi-Bojd AA, Jafari R (2003) Epidemiological study in a new focus of cutaneous leishmaniasis in the Islamic Republic of Iran. East Mediterr Health J. 9(4): 816–826.

Yaghoobi-Ershadi MR, Jafari R, Hanafi-Bojd AA (2004) A new epidemic focus of zoonotic cutaneous leishmaniasis in central Iran. Ann Saudi Med. 24(2): 98–101.

Zagniborodova EN (1960) Fauna and Ecology of Fleas on the Western Turkmenistan. In: Fenyuk BK (Ed): Problems of Natural Nidi and Epizootiology of Plague in Turkmenistan, Turkmenian Anti-Plague Station and All- Union Sci Anti-Plague Inst Microb, Saratov, pp. 320–334.

Zagniborodova EN (1968) Long-Term Study of the Ecology of Fleas of the Great Gerbil in the Southern Central Kara-Kum Desert. In: Fenyuk BK (Ed): Rodents and Their Ectoparasites, Saratov Univ Press, Saratov, pp. 78–86.

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