

## Original Article

# Ectoparasites of Rodents Captured in Bandar Abbas, Southern Iran

EB Kia, H Moghddas-Sani, H Hassanpoor, H Vatandoost, F Zahabiun, AA Akhavan, AA Hanafi-Bojd, \*Z Telmadarraiy

School of Public Health, Tehran University of Medical Sciences, P.O.Box: 14155-6446, Tehran, Iran

(Received 23 Jul 2008; accepted 5 Nov 2009)

### Abstract

**Background:** Rodents play important role as host of ectoparasites and reservoir of different zoonotic diseases. The aim of this study was to assess the infestation of commensal rodents with ectoparasites in Bandar Abbas, a port city located in the northern part of the Persian Gulf in Iran.

**Methods:** Rodents were captured using live traps during the study period in year 2007. After transferring the rodents to the laboratory, they were identified and then their ectoparasites were collected and mounted for species identification using appropriate systematic keys.

**Results:** A total of 77 rodents were identified including *Rattus norvegicus* (74%), *R. rattus* (16.9%), *Mus musculus* (7.8%) and one hamster. Among all rodents, 40.3% were found infested with ectoparasites. A total of 69 ectoparasites were collected comprising flea, lice, mite and tick. Two species of fleas; *Xenopsylla cheopis* and *X. astia* were identified with higher index of *X. astia*. Two genera of ticks including *Hyalomma* sp. and *Rhipicephalus* sp. were identified. *Laelaps nuttalli* was the only mite found. The *Polyplax spinulosa* was considered as lice ectoparasite.

**Conclusion:** Among all arthropods collected, flea and lice had the most and the least frequency, respectively. Nearly all rodent species were infested with *Xenopsylla*. These fleas are important due to their role in plague and murine typhus transmission. Ticks are important due to their role in CCHF (Crimean-Congo Hemorrhagic Fever), theileriosis, babesiosis, anaplasmosis and ehrlichiosis transmission. Monitoring of ectoparasite infestation is important for preparedness and early warning preparation for possible control of arthropod-borne diseases.

**Keywords:** Rodents, Ectoparasite, Iran

### Introduction

Rodents play an important role in disease transmission by their urine, feces, bite, and ectoparasites. Different disease agents of bacteria, rickettsia, viruses, protozoa and helminthes can be transmitted by rodents to human and animals. Some examples of such diseases are plague, leptospirosis, salmonellosis, rat-bite fever, leishmaniasis, Chagas' disease, Omsk hemorrhagic fever, murine typhus and Lassa fever (Bell et al. 1988) Crimean Congo Hemorrhagic Fever (CCHF theileriosis, babesia, anaplasmosis and Ehrlichiosis (Inokuma et al. 2001, 2003). The close association of commensal

rodents with human and domestic animals is a risk factor for transmission of these diseases.

In the previous reports on the ectoparasites of rodents in different parts of Iran, various species of ectoparasites have been occurred, most of them with medically or veterinary importance. In a study carried out in Korram-Abad, Lorestan Province, Iran during year 2002-2003 a total of 167 rodent specimens were captured. Altogether 218 ectoparasites related to 3 orders, 6 families, 6 genera, and 7 species were recognized. Fleas with 3 species had the most number of species, mites and lice allocated the most (64.67%) and the least (3.21%) frequency of ectoparasites,

\*Corresponding author: Dr Z Telmadarraiy, E-mail: telmadarraiy@tums.ac.ir

respectively. *Haemolaelaps glasgowi* (42.2%) was the most common ectoparasite while, *Nosopsyllus irranus* only constituted approximately 0.91% of specimens (Shayan and Rafinejad 2005).

Motevalli Hagghi et al. (2000 and 2002) conducted two studies in Sari rural and urban areas, southern part of Caspian Sea. They found *R. norvegicus*, *R. rattus*, *Mus musculus*, *Glis glis*, *Apodemus sylvaticus*, *Nesokia indica* and *Arvicola terrestris*. The main important ectoparasites in those studies were *Echinolaelaps echidnini*, *Hoplopleura* sp., *Rhipicephalus* sp. and *Nosopsyllus fasciatus*.

Ectoparasites of various species of rodents were examined from Sarepole Zehab, Kermanshah Province, Iran, during 2005. A total of 139 rodents included 6 species of hosts were captured during all different seasons and examined for ectoparasites. The hosts included *Microtus socialis*, *Mus musculus*, *Rattus rattus*, *Nesokia indica*, *Meriones persicus* and *Tatera indica*. The 9 species of ectoparasites recovered included 3 fleas (*Pulex irritans*, *Xenopsylla buxtoni*, *Nosopsyllus medus*), one sucking lice (*Polyplax spinulosa*), two ticks (*Rhipicephalus* sp., *Hyalomma* sp.), and 3 mites (*Laelaps nuttalli*, *Dermanyssus sanguineus*, *Ornithonyssus bacoti*). Among all arthropod collected, the lice and flea had the most and least frequency, i.e. 77.7% and 4.4%, respectively (Telmadarraiy et al. 2007).

A study was carried out by Hanafi-Bojd et al. (2007) in Bandar Abbas in a control program campaign. They found 105 rodents demonstrating four species including *R. rattus* (3%), *R. norvegicus* (78%), *M. musculus* (3%) and *Tatera indica* (16%), before the control program. After 12 months, the duration of control program, rodents were re-captured to assessment the success of control activity. In this stage, 35 small mammals demonstrating four species were obtained including *R. norvegicus* (51.4%), *R. rattus* (37.1%), *T. indica* (8.6%) and one weasel (2.9%). The identified ectoparasites were *Xenopsylla bux-*

*toni*, *Rhipicephalus* sp., *Polyplax gerbilli*, *Hoplopleura captiosa*, *Ornithonyssus bacoti*, *Laelaps nuttalli*, *Dermanyssus americanus*, *Dermanyssus sanguineus*, *Haemolaelaps glasgowi* and *Echinolaelaps echidninus*.

During an investigation on the endoparasites of rodents in Ahvaz, Khuzestan Province, south western Iran, a total of 90 rodents including 14 *M. musculus*, 4 *R. rattus* and 72 *R. norvegicus* were trapped from different localities of Ahvaz and its suburbs, during 1998-2000. Examination of different tissues and identification of parasite species showed that the variation among helminth species was wide especially those which arthropods are involved in their life cycles. The most prevalent species of rodents was *R. norvegicus* in which *Trypanosoma lewisi* and *Trichosomoides crassicauda* were the most prevalent species of protozoan and helminth parasites, respectively. *Gongylonema monigi*, *Streptopharagus kuntzi* and *Rictularia ratti* from *R. norvegicus* and *Gongylonema neoplasticum* from both *R. norvegicus* and *R. rattus* were reported for the first time in Iran. Report of *Physocephalus sexalatus* from *R. norvegicus* apparently comprised a new host species in the world (Kia et al. 2001). Similar studies on endoparasites of rodents in other parts of the country and the association of medical and veterinary important arthropods will reveal better understanding the life cycles of arthropod-borne disease. There is considerable potential for investigation of the ecological, physiological and systematic relationships of the ectoparasites and their hosts. Unfortunately, there has been no coordinated research effort, and much of the research has been directed only to economically important species or disease vectors. In order to find a correlation among ectoparasites and endoparasites joint studies on both agents with improvement of inter-sectoral coordination of medical entomologists and parasitologists is essential.

The aim of this study was to determine the frequency of ectoparasites in commensal rodents of Bandar Abbas for further control measures.

## Materials and Methods

### Geographical information on study area

Bandar Abbas lies in the western part of Hormozgan Province of Iran. It is the capital city of the province and the main port in Iran in the Persian Gulf. This has made it a developing city with many new constructions. It has also become an important trading center. This aspect of development has led to migration of too many people to Bandar Abbas, both from other provinces of Iran and from the neighboring countries. Bandar Abbas is situated on flat ground with an average altitude of 9 meter above sea level. Its coordinates are: 27°11'N 56°16'E. The city has a hot and humid climate. Maximum temperature in summer can reach up to 49 °C while in winters the minimum temperature drops to about 5 °C. The annual rainfall is around 251 mm and the relative humidity is 66% (Fig.1).

### Rodent collection

Rodents were collected using live traps. The traps were set at different parts of the city

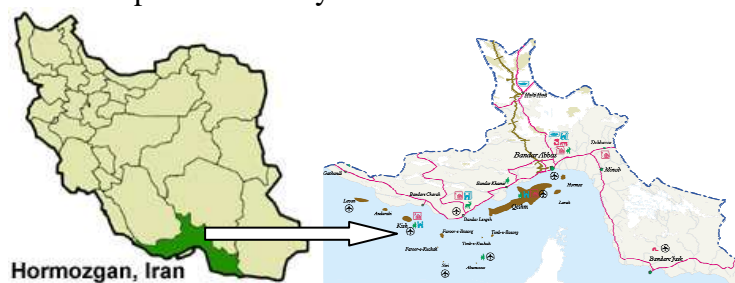


Fig. 1. Hormozgan Province and Bandar Abbas City, Iran

## Results

During this study, a total of 77 rodents were captured from different parts of the city in Bandar Abbas. The rodents included four species (Table 1). Among commensal rodents *Rattus norvegicus* and *Mus musculus* had the most and least frequency (74%, versus 7.8%, respectively). In general 40.3% of the rodents were found infested with ectoparasites. A total of 69 ectoparasites were col-

lected from the rodents including lice (*Polyplox spinulosa*), ticks (*Hyalomma* sp. and *Rhipicephalus* sp.), mite (*Laelaps nuttalli*) and flea (*Xenopsylla astia* and *X. cheopis*), with the highest rate of the latest. The ectoparasite groups and their abundance in each host are shown in Table 1. According to this table the catch rate of ectoparasites on *R. norvegicus*, *R. rattus*, *M. musculus* and hamster were 76.8, 11.6, 1.5 and 10.1%, respectively.

### Trapped rodents

Ectoparasites collection was transferred to laboratory and after morphometrical measurements their ectoparasites were picked up using brush against the fur of rodents. Mites, lice and fleas were collected by this method. Occasionally forceps were used for tick collection. All ectoparasites were stored at 70% alcohol for preservation and further species identification.

### Ectoparasites and rodents identification

Ectoparasite samples were mounted using clearing, dehydration and mounting procedure and preserved constantly with Canada balsam. Species identification of lice, flea, mites and also ticks were carried out according to the available systematic keys (Strandtmann & Wharton, 1958). Rodents were identified after recording their different morphological characteristics.

**Table 1.** Ectoparasite groups among rodents in Bandar Abbas, Hormozgan Province

Rodent species	Ectoparasite								Total catch	
	Flea		Mite		Lice		Tick		Catch No.	Catch rate (%)
	Catch No.	Catch rate (%)	Catch No.	Catch rate (%)	Catch No.	Catch rate (%)	Catch No.	Catch rate (%)		
<i>R. norvegicus</i> (n=57)	47	88.7	3	5.7	1	1.9	2	3.8	53	76.8
<i>R. rattus</i> (n=13)	6	75	2	25	0	0	0	0	8	11.6
<i>M. musculus</i> (n=6)	0	0	1	100	0	0	0	0	1	1.5
Hamster (n=1)	7	100	0	0	0	0	0	0	7	10.1
Total (n=77)	60	87	6	8.7	1	1.4	2	2.9	69	100

## Discussion

Ectoparasites of rodents play an important role for disease transmission to human and animals. For example *X. cheopis* (oriental rat flea) and *X. astia* are responsible for transmitting *Yersinia pestis*, the causative agent of plague. As it is now generally admitted, one or more species of fleas occurring on the common rats, *R. rattus* and *R. norvegicus*, are concerned in the transmission of plague. Thus, the study of these fleas has become a matter of the highest importance in connection with the prevention of the diseases. In the current study, the most abundant ectoparasite was *Xenopsylla* with 88.7% catch rate in *R. norvegicus*.

The predominance of flea has been reported in some similar studies. In a study in Huambo, Angola eight species of ectoparasites were collected from 166 commensal rodents, including *R. rattus*, *R. norvegicus* and *Mus musculus* from January to December 1986. The oriental rat flea, *X. cheopis*, was the predominant species with respect to mean intensity and prevalence. The mite *Laelaps muricola*, the louse *Polyplax spinulosa*, one species of *Ixodes* latreille, and one species of *Ornithonyssus sambon* were also recorded (Linardi et al. 1994). In another study which presented ectoparasites for four species of commensal murid rodents *Rattus rattus pale-*

*lae*, *R. argentiventer*, *R. exulans* and *Mus musculus castaneus* in Sulawesi Utara, Indonesia, the flea, *X. cheopis*, was the most common on *R. rattus* (Durden and Page 2008). Additionally, rat ectoparasite surveys in relation to Murine Typhus Fever in Puerto Rico were studied by Fox and García-Moll (1961). They found that rats were infested with *X. cheopis*. Other common rat ectoparasites, *Laelaps nuttalli*, *Ornithonyssus bacoti*, *Listrophoroides expansus*, and *Polyplax spinulosa* increased in abundance.

In the present study, the highest total catch rate was related to *R. norvegicus*. The catch rate of flea on rats was 87%; this figure for mite was calculated as 8.7%. In a study carried out in Egypt from April 2006 to March 2007 (El Kady et al. 2007) the ectoparasites infesting commensally rodents of different localities were determined. Totally 135 rodents were captured including *R. norvegicus*, *R. rattus frugivorous*, *R. rattus alexandrinus* and *Mus musculus*. From 388 ecto-parasite infested rodent collected number and ecto index was: fleas n= 114 (0.84 flea/rat), lice n= 93 (0.69 lice/rat), mites n= 165 (1.2 mite/rat) and larva of ticks n= 16 (0.12 tick/rat). In this study fleas n= 53 (0.76 flea/rat), lice n= 1 (0.69 lice/rat), mites n= 5 (0.07 mite/rat) and nymph of ticks n= 16 (0.12 tick/rat), *Mus musculus* including only mites n= 1 (0.16 mite/Mus) and flea in Hamster n= 7 (7 flea/Ham.) Another



study in Egypt revealed that *Rattus rattus frugivorus*, *R. norvegicus* and *Meriones shawi* were the most vulnerable hosts for ectoparasites while *Mus musculus* harbored the lowest numbers of ectoparasites. Fleas, lice and mites were found on rodent species the whole year round, but reached a peak in the spring and summer months. The isolated ectoparasites included *X. cheopis*, *Leptopsylla segnis*, *Echidnophaga gallinacea*, *Polyplax spinulosa*, *P. vacillata*, *P. gerbilli*, *Ornithonyssus bacoti*, *Laelaps nuttalli*, *Echinolaelaps echidninus* and *Haemolaelaps glasgowi*. Distribution of ectoparasites varied according to rodent host and location (El Deeb et al. 1999).

In the survey conducted on commercial and wild rodents from different locations in Wadi Hanifah in Riyadh six species of rodents were collected. The trapped rodents in descending order of numbers were *Rattus rattus rattus*, *Acomys dimidiatus*, *Meriones libycus*, *R. rattus frugivorus*, *R. rattus alexandrinus* and *Mus musculus*. The ectoparasites were a flea, *Xenopsyllus* sp. on *R. rattus frugivorus* and a tick, *Rhipicephalus turanicus* on each of *A. dimidiatus* and *R. rattus alexandrinus*. They mentioned that rodents' ectoparasites were low in study area and this is probably due to the severe hot and very dry weather mainly in the summer season (Alahmed and Al-Dawood 2001). After all, the catch rate and infestation rate to different ectoparasite depend on season, size of rodents, host preference, sex of host, host age, location of capture and co-evolution between rodent and ectoparasites.

To sum up the results of the current study, the role of commensal rodents as hosts of several ectoparasites, all with medically and veterinary importance is emphasized. In this regard, the infestation of both *R. norvegicus* and *R. rattus* with *Xenopsylla* is highlighted. Additionally, the infestation of the lone hamster, which was an accidentally trapped pet, with a relatively high burden of flea is an indication of the importance of such rodents in

transmission of arthropod borne disease in the area, especially to children who are in close contact with pet animals. The results of present study will provide information to the authorities for prevention and control of rodent borne disease in the region.

## Acknowledgments

The authors would like to appreciate very much for kind collaboration of health staff in Bandar Abbas and also other colleagues who had contribution especially M Aboulhasanni, Z Talai, M Jedari, N Hosseini Vasokalani for their kind help. This research was financially supported by Tehran University of Medical Sciences. The authors declare that they have no conflicts of interest.

## References

- Alahmed AM, Al-Dawood AS (2001) Rodents and their ectoparasites in Wadi Hanifah, Riyadh City, Saudi Arabia. *J Egy Soc Parasitol.* 31(3): 737–43.
- Bell JC, Plamer SR, Payne Jm (1988) The zoonosis: infection transmitted from animal to man. Edward Arnold Press, London UK.
- Durden LA, Page BF (2008) Ectoparasites of commensal rodents in Sulawesi Utara, Indonesia, with notes on species of medical importance. *Med Vet Entomol.* 5(1): 1–7.
- El Kady GA, El Shazly AM, Mikhail MW, Bahgat IM (2007) Ectoparasites of commensal rodents in Talkha Center, Dakahlia Governorate, Egypt. *J Egypt Soc Parasitol.* 37(3): 825–33.
- El Deeb HI, Zidan ZH, El Hawashy N, Mourad AA (1999) Rodent ectoparasites relationships at new reclaimed areas of Egypt. *Annals of Agr Sci.* 44(2): 799–810.
- Fox I, García-Moll I (1961) Rat Ectoparasite Surveys in Relation to Murine Typhus

- Fever in Puerto Rico. *Am J Trop Med Hyg.* 10(4): 566-573.
- Hanafi-Bojd AA, Shahi M, Baghaili M, Shayeighi M, Razmand N, Pakari A (2007) A study on rodent ectoparasites in Bandar Abbas: the main economic southern seaport of Iran. *Iranian J Envir Hlth Sci Engin.* 4(3): 173-176.
- Hartelt K, Oehme R, Frank H, Brockmann SO, Hassler D, Kimmig P (2004) Pathogens and symbionts in ticks: prevalence of *Anaplasma phagocytophilum* (*Ehrlichia* sp.), *Wolbachia* sp., *Rickettsia* sp., and *Babesia* sp. in Southern Germany. *International J Med Microbiol Supplement.* 293(37): 86-92.
- Inokuma H, Parola P, Raoult D, Brouqui P (2001) Molecular survey of *Ehrlichia* infection in ticks from animals in Yamaguchi Prefecture, Japan. *Vet Parasitol.* 99(4): 335-339.
- Inokuma H, Beppu T, Okuda M, Shimada Y, Sakata Y (2003) Epidemiological survey of *Anaplasma platys* and *Ehrlichia canis* using ticks collected from dogs in Japan. *Vet Parasitol.* 115(4): 343-348.
- Kia EB, Homayouni MM, Farahnak A, Mohebbali M, Shojai S (2001) Study of Endoparasites of Rodents and their Zoonotic Importance In Ahvaz, South West Iran. *Iranian J Pub Health.* 30(1-2): 49-52
- Linardi PM, Gomes AF, Botelho JR (1994) Some ectoparasites of commensal rodents from Huambo, Angola. *J Med Entomol.* 31(5): 754-56.
- Motevall-Hagghi F, Gholami SH, Sharifi M, Sedaghat MM, Parsi B (2000) Study of rodents ectoparasites in Sari city and central regions of Mazandaran province in 1997-98. *Iranian J Mazandaran University of Med Sci.* 27(10): 7-10.
- Motevall-Hagghi F, Gholami SH, Sharifi M, Mobedi I, Sobhani I, Sedaghat MM, Najafpour AA (2002) Study of rodents ectoparasites in urban areas of Mazandaran province in 1997-99. *Iranian J Mazandaran Uni Med Sci.* 27(13): 72-77.
- Shayan A, Rafinejad J (2006) Arthropod Parasites of Rodents in Khorram Abbad district, Lorestan Provincen of Iran. *Iranian J Pub Health.* 35(3): 70-76.
- Strandtmann RW, Wharton GW (1958). A manual of mesostigmatid mites parasitic on vertebrates. University of Maryland. pp 330.
- Telmadarraiy Z, Vatandoost H, Mohammadi S, Akhavan AA, Abai MR, Rafinejad J, Kia EB, Faghih Naini F, Jedari M, Aboulhasani M (2007) Determination of rodent ectoparasite fauna in Sarpole-Zahab district, Kermanshah Province, Iran, 2004-2005. *Iranian J Arthropod-Borne Dis.* 1(1): 58-62.