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Identification of collected ectoparasites of rodents in the west of Khuzestan Province (Ahvaz and Hovizeh), southwest of Iran

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ABSTRACT

Objective: To determine possible parasitic arthropods fauna in certain rodent species in the west of Khuzestan Province including Ahvaz and its suburb and suburb of Hovizeh, southwest of Iran.
Methods: In the current study Sherman live traps were used to catch the rodents. The rodents were identified using Iranian keys of rodents. The ectoparasites were picked up in different ways from bodies of the anesthetized rodents and stored in 70% ethanol to preserve and identified using international keys.
Results: In the present study 3 species and 4 genera of ectoparasites and 4 species of rodents were identified.
Conclusions: It is important to explain that the great ectoparasite biodiversity in the west of Khuzestan, with small sampling of rodents, described a high risk factor to transmit the different infectious diseases among domestic animals and humans.

1. Introduction

Rodents are infected easily by several parasitic agents because of their life styles, habitats and direct contact together. Therefore, they can be major source of internal and external parasitic infections for animals and humans[1,2].

Arthropod ectoparasites and their rodent hosts play important roles for transmission of zoonotic diseases such as arboviruses associated disease, streptococcal infections, plague, tularemia, leptospirosis and spirochaetosis to human and animals[3-6]. One issue regarding rapid dispersal of rodent ectoparasites is reproduction power of the host rodents. Female rodents have between 4 and 10 litters per year. Therefore, rodent populations can grow rapidly under desirable ecologic conditions of rodent life cycle, which means that infestations can increase rapidly if not detected early[7].

Rodents are the most frequent mammals around the world. They are easily classified into two groups: domestic rodents (mice and rats), which belong to Muridae family of Myomorpha and wild rodents (gerbils), which belong to Cricetidae family of Myomorpha[8-11]. They live in various places; *Mus musculus* (*M. musculus*) of Muridae lives near human habitats and agriculture stores, while *Rattus norvegicus* (*R. norvegicus*) and *Rattus rattus*

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live in sewage waters and *Tatera indica* (*T. indica*) of Critidae in deserts. Rodents are considered as economic pests and public health problems because of their two behaviours: living in close association with man and gnawing the different stuff to keep the incisor teeth worn down for growing continuously[12,13]. The development of control methods against zoonotic parasites is based on our understandings of their identifications, life cycles and transmission patterns in each zoogeographical condition. But their identifications are prior to other subjects in medical or veterinary public health programs. With identifying the rodents and their arthropod parasites as reservoir and vectors, we can make a plan to control the associated diseases in a given area[1,2,14,15].

This is more important when there are more variations in the ecological conditions in a country like Iran with vast and different ecologic areas. This variation in Iran has provided a rich biodiversity of ectoparasites of the rodents in the different areas. One of this region is west of Khuzestan including Ahvaz and Hovizeh. There are very rare documented papers on ectoparasites of rodents in Ahvaz and Hovizeh, Khuzestan Province, southwest of Iran so far; however, there are a few references regarding ectoparasites of other mammals or birds in this region[16,17].

Therefore, the current study was conducted to identify possible parasitic arthropods in certain rodent species in the west of Khuzestan Province including Ahvaz and its suburb and suburb of Hovizeh.

2. Materials and methods

In the current study, Sherman live traps were used and baited with favorable food for rodents according to the season to collect the rodents during 2009-2010. The traps were randomly put at different locations of Ahvaz and Hovizeh areas. In each location, baited traps were situated inside houses and along the rodent routes to their burrows following the permission of householders to collect the domestic rodents, while to collect the wild rodents, the traps were situated in the desert, woodland transects, woodland, old fields and besides the burrows in outdoor places. The traps were collected on consecutive days and the rodents transferred to the medical entomology lab and anesthetized by ether–chloroform method. They were idetified using Iranian keys of rodents[8,18,19].

The ectoparasites were picked up in different ways from bodies of the anesthetized rodents, such as brushing the rodent hairs or ectoparasites were collected after euthanasia of the rodents followed by freezing. The ectoparasites were stored in 70% ethanol to preserve and identify. The arthropod specimens were cleared in 20% KOH using warm bath water for 20 min followed by placing them in 5% acetic acid for 0.5-1 h. Subsequently, the specimens were transmitted to 70%, 80%, 90%, 96% and 100% ethanol to frustrate dehydration and to be prepared as microscopic slides. The specimens were then placed in xylol for 10 s. Finally, specimens were fixed between microscope slides and cover glass using Canada balzam. Mounted specimens were identified using light microscope according to different keys (Durden LA, personal communication)[20-22].

3. Results

In the current study 4 species, of 30 collected rodents, were identified, including 4 (13.4%) *M. musculus*, 20 (66.6%) of *R. norvegicus* of Muridae family and 5 (16.7%) *T. indica* and 1 *Allactaga* sp. (3.33%) of Cricetidae family from Ahvaz and Hoviezeh districts[8,9].

In this study 3 species and 4 genera of ectoparasites were identified. Results of the current research presented two sub phyla, Insecta and Arachnida, of Arthropoda. The identified insect genera of ectoparasites were *Polyplax stephensi* (*P. stephensi*) (Figure 1) and *Polyplax spinulosa* (*P. spinulosa*) and *Eulinognathus* sp. of Anoplura (Polyplacidae family) and *Xenopsylla* sp. (Figure 2) of Siphonaptera (Pulicidae family) orders[21,23,24].

Figure 1. *P. stephensi* (from *T. indica*).

Figure 2. *Xenopsylla* sp. (from *R. norvegicus*).

The identified arachnid ectoparasites were *Ornithonyssus* sp. (Figure 3) of Acarina: Mesostigmata order (family of Macronyssidae), *Liponyssoides sanguineus* (*L. sanguineus*) (Figure 4) of Acarina: Mesostigmata order (family of Dermanyssidae) and *Hemaphysalis* sp. (Figure 5) of Acarina: Metastigmata order (family of Ixodidae)[21]. All the figures are original.

Totally, 6 of 30 collected (20%) rodents were infested with mentioned ectoparasites. In the Muridae family, *R. norvegicus* were infested with *L. sanguineus*, *Ornithonyssus* sp. (Figures 3 and 4), *Xenopsylla* sp. and *P. spinulosa*, and *M. musculus* were found free of ectoparasites.

In the Cricetidae family, *Allactaga* sp. were only infested with *Eulinognathus* sp., and *T. indica* with *Hemaphysalis* sp., *Ornithonyssus* sp. and *P. stephensi*[21,23,24].

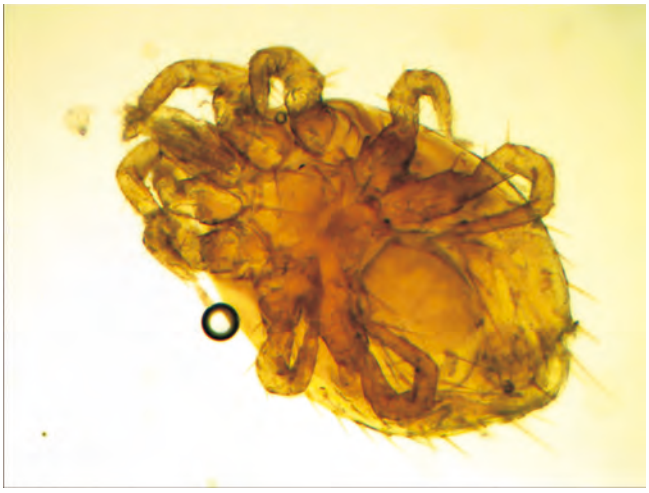

Figure 3. *Ornithonyssus* sp. (from *R. norvegicus*).

Figure 4. *L. sanguineus* (from *R. norvegicus*).

The most frequent ectoparasites were *Polypolax* spp. followed by *Xenopsylla* sp., *Ornithonyssus* sp., *L. sanguineus*, *Hemaphysalis* sp. and *Eulinognathus* sp. in the present study.

Figure 5. *Hemaphysalis* sp. (from *T. indica*).

4. Discussion

In the current study 3 species and 4 genera of ectoparasites were identified. All of identified insect, tick and mite ectoparasites in the current study have been recorded as medically important arthropoda.

Ornithonyssus sylviarum and *Ornithonyssus bacoti* (*O. bacoti*) of *Ornithonyssus* sp. should be of medical importance. The main medical importance of *Ornithonyssus sylviarum* in the case of human is due to its bitting and leaving allergic respiratory reactions; however the *Bartonella*-like pathogen of human haemolytic-uraemic syndrome has been isolated from this mite[21].

O. bacoti, the tropical mite, not only parasitizes the wild and domestic rats but also bites human as the accidentally host. It is the intermediate host of filarial worm, *Litomosoides carinii*, of rodents and transmites experimentally and naturally (as minor vector) *Rickettsia typhi* (murine typhus), *Rickettsia akari* (human rickettsialpox), *Coxiella burnetii* (Q-fever), *Francisella pestis*, *Francisella tularensis*, *Trypanosoma cruzi* (Chaga's disease) and coxackie virus[21].

Regarding medical importnce of *L. sanguineus*, it must be noted that this house mouse mite, which parasitezes both mice and rats, is a blood feeding ectoparasite. They cause general debility, anemia, decreased reproduction and death. *L. sanguineus* transmites *Rickettsia akari*, human rickettsialpox and Q-fever[21].

Health and medical importance of *Polypolax* spp. is reffered to pediculosis among rats and mice. However, *P. spinulosa* can transmit *Haemobartonella muris*, *Trypanosoma lewisi*, and *Rickettsia typhi*. The clinical signs associated with *Polyplax* spp. include anemia and general unthriftiness, leading to debilitation[21].

The earliest study of Kaneko has discussed the roles of different rodent species regarding the medical importance of *Polypolax* spp. in the transmission of *Rickettsia* spp. and virus of Mexican typhus[25]. It was proved that the mentioned pathogens have been isolated very easily from guinea pig; however they could not

isolate those pathogens from other rodent hosts[25].

Haemaphysalis spp. are medically important ticks which transmit different groups of pathogens including protozoa (*Babesia*), bacteria (tularemia), *Rickettsia* spp. and arboviruses. However, their bites are annoying and cause blood loss to the animal and human hosts[21].

Based on the obtained results of the present study we can explain that the biodiversity of rodents in the studied area was rich compared to the other studies in different places because we reported 4 species of 30 collected rodents. However, Shayan and Rafinejad from Iran have reported 7 species of 168 collected rodents (in Lorestan as the nearest area to our study area) and Changbunjong *et al*. from Thailand reported 4 species of 130 collected rodents[26,27].

In contrast, biodiversity of ectoparasites in Bandar Abbas was richer than biodiversity of ectoparasites in west of Khuzestan in our study[4], since they have reported 10 species of arthropods from 130 rodents. These comparisons reflect that rodents in Bandar Abbas, south of Iran, are at greater risk of infestation with ectoparasites than the rodents in the west of Khuzestan. This fact is due to an economic factor. Bandar Abbas is an economical port of Persian Gulf of Iran. The transport activities in Bandar Abbas has provided a greater risk factor for rodents to be infested with ectoparasites due to more contact with introduced rodents from overseas. However both area have subtropical climate. According to Soliman *et al*. and Krasnov *et al*., climatological and other environmental conditions affect rodent hosts as well as their ectoparasites[28,29], but ectoparasites appreared with a greater diversity in Bandar Abbas than Hovizeh as a comparative case because of the economic facor.

Polyplax spp., as a louse, was the major collected ectoparasite in the current study. However, in the study of Lorestan as the nearest and the most similar study to our research and study of Sarpole-Zahab in Kermanshah, west of Iran, the different flea species were the major collected ectoparasites[26,30]. It is assumed that the similarity in geographical structure can bring the similarity in the fauna of the ectoparasites in the different areas, for instance, both the afformentioned areas of Lorestan and Sarpol-Zahab are mountainous in the west of Iran[29]. Therefore, the both areas found higher frequency of fleas compared to our studied area as a plane region where the lice were the most frequently collected arthropods of rodents.

The results of the present study are also different from study of Hanafi-Bojd *et al*. in Bandar Abbas with *Laelaps nuttalli* mite as the most aboundant species followed by *Xenopsylla buxtoni* flea[4].

The results of our study were similar to that of a study by Nateghpour *et al*. in the Baluchistan from point of the collected lice as the major species among the collected ectoparasites[5]; and it is a considerable result, because both studied area, Baluchistan and west of Khuzestan areas, southeast and soutwest of Iran, respectively, are very far from each other, but these areas are considered as deserts and this reflects the explanations of Krasnov *et al*. about the similariy of ectoparasites fauna due to the habitats[29]. This similarity shoud be a point to do more research.

The dominant species was *P. spinulosa* lice in the studies of Soliman *et al*. and Yassin from Egypt, whose results were similar to the current study result[28,31].

Geographical distribution of rodent ectoparasites is the most important risk factor for their hosts including human and rodents from point of an ecologic factor, but the habitat characters of activities of the rodent and human hosts are vital from point of medical importance and should be regarded as a determining agent when they are all present together in medical centres and hospitals regarding transmission of human diseases.

. In the current study, *Ornithonyssus* sp. was reported from *R. norvegicus* in some parts of of Hovizeh; however *O. bacoti* has been reported from Golestan hospital of Ahvaz[32]. The latter is more important from point of medical views because spreading of *O. bocotti* in a hospital provides a disaster problem among the hospitalized person and staff compared to *Ornithonyssus* sp. from outdoor rodents.

The species of collected rodents in our study were relatively similar to that of other studies in Iran. However, the most similar result regarding the rodent species to our study was result of a study conducted by Hanafi-Bojd *et al*[4] .

In conclusion, the common species of rodents in different areas of Iran are similar, but the degree of ectoparasite infestation and biodiversity among the rodents are different.

It is also important to note that the great ectoparasites biodiversity in the west of Khuzestan with small sampling of rodents, is describing a high risk factor to transmit the different infectious diseases among domestic animals and humans. Therefore, more attention must be paid to rodent and arthropod vector control programs at the same time to prevent the spread of zoonotic diseases in the studied area.

Conflict of interest statement

We declare that we have no conflict of interest.

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