First parasitological survey of Calomyscus elburzensis (Rodentia; Calomyscidae); two new records of tick from Iran

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Abstract

Rodent species have active role in transmission of serious pathogens and are reservoir for many zoonotic diseases, so their ectoparasitic fauna become of special concern. A survey of ectoparasites occurring on Calomyscus elburzensis was carried out from April through September 2014 in Khaje Morad- a rocky hillsides region situated in the southeast of Mashhad, Iran. A total of 48 Goodwin’s brush-tailed mouse C. elburzensis were examined. Two species of ticks were collected: Red sheep tick, Haemaphysalis punctata Canestrini and Fanzago, 1877 and Vole tick, Ixodes trianguliceps Birula, 1895. Also two specimens of pseudoscorpions, Withius nanus Mahnert 1988 (Cheliferoidea; Withiiide) was hand-collected from body surface of this rodent. These are all new records from Iran and also from this small rodent. Also overall infection rate was 8.33% (4 infected out of 48 Goodwin’s brush-tailed mice). Although C. elburzensis populations in this area did not show a high infestation rate of ectoparasites, but with respect to the fact that infested rodents near human habitations may cause rodent-borne diseases among the inhabitants, thus further parasitological investigations are needed to explore the epidemiologic pattern related to such zoonotic diseases.

Keywords: Calomyscus elburzensis, Ectoparasitic arthropods, Ticks, Pseudoscorpions, Iran

1. Introduction

Synanthropic rodents, particularly those living in close association with man, play a significant role in human health, welfare and economy. Since most of the rodent species are reservoir for many zoonotic diseases and have active role in transmission of serious pathogens, their ectoparasitic fauna become of special interest (Urceuhart et. al. [1], Nava et. al. [2]). Herein, poorly known rodents and those which may uses as pets are of the main concern.

Goodwin’s brush-tailed mouse (Calomyscus elburzensis Goodwin, 1938) has been reported from mountains of north and northeast of Iran; Southern foothills of Elburz mountains in Semnan province (Lebedev et. al. [3]) and also eastern part of Yazd province (Shahabi et. al. [4]). Individuals of this species live in colony (Ellerman [5]) and similar to its all congeneric species (e.g. C. bailwardi), occupy well drained, barren, rocky habitats in the foothills and mountains (Malikov et. al. [6], Morshed and Patton [7]) at elevations of 400-3500 m above the sea level (Nowak [8], Toft [9]).
Although some morphological (Ellerman [5], Musser and Carleton [10]), molecular (Morshed and Patton [7], Shahabi et al. [11], Shahabi et al. [12]) and karyologic (Graphodatsky et al. [13], Shayan and Rafinejad [14]) studies have been conducted, parasitological data collected on brush-tailed mouse species in the wild have been limited to just few reports. In Iran, Shayan and Rafinejad (Shayan and Rafinejad [14]) trapped 9 Calomyscus bailwardi and reported their infection with ticks of genus Haemaphysalis but they made no mention of its species. So, limited studies and little information are available on parasitic status of this beautiful small rodent.

Furthermore, due to the fact that C. elburzensis is one of the endemic species of Iranian plateau and since parasitological investigations on this rodent species were not carried out in Iran yet, the aim of our study was to define the ectoparasite fauna and the prevalence of parasite infections of C. elburzensis in a part of its distribution region.

2. Materials and Methods
2.1 Study area and Field investigation
The investigation was carried out in Khaje Morad, approximately 12 km southeast of Mashhad, Khorasan-Razavi Province, Iran in period of April-September 2014 (Fig 1). This site is located 36°08'-37°03'N and 59°13'-59°42'E, at an altitude of average 1146 m above sea level and in a generally cold and dry climatic region. The maximum and minimum temperatures are +35˚C and -15˚C in summer and winter, respectively. The topography is generally flat with some mounds, well drained, barren, rocky habitats in the foothills. The vegetation on this region is mostly Artemisia sp., Ephedra sp. and Euphorbia sp. (identified by Plant Biodiversity Research Lab, Ferdowsi University of Mashhad). Custom-made mesh live-traps measuring 25 × 9 × 9 cm, baited with different types of baits (included scorched sunflower seed, scorched gourd seed, scorched walnut, sausage chunk, apple and cucumber pieces) were used for capturing. Traps were set before dusk and checked in the early morning. We recorded date, species, sex, body weight and approximately age, as well as the location of arthropod on rodent body and number of collected parasites for all captured individuals.

2.2 Trapped animals and Parasitological examination
A total of 48 individuals of Calomyscus elburzensis (12 adult and 5 subadult males, 15 adult and 4 subadult females and 12 juveniles) were trapped alive in 438 trap nights in Khaje Morad region. Since some ectoparasites leave the body of the host shortly after death, the captured rodents were transferred from the cages to closed containers before the euthanization process to ensure the collection of the ectoparasites present on the body of the euthanized hosts. Their traps were checked for probable presence of ectoparasites too. Each individual were euthanized separately with ether in a glass container quickly. Then the fur and the skin of each rodent were examined for the presence of ectoparasites groups (ticks, mites, fleas and louse) precisely. In all cases, ectoparasites were recovered by combing their body hairs with a toothbrush on the water surface. The ectoparasites were all collected with fine forceps and preserved in labeled vials containing 70% ethanol until they were identified. Then they were mounted on permanent slides following the conventional techniques.
for each group and then identified using different keys (Tenerio and Goff [15], Baker [16], Men et al. [17]).

All experimental procedures were performed in compliance with the Department of Biology, Ferdowsi University of Mashhad, Mashhad, Iran guidelines on the care and use of laboratory and experimental animals.

The following formulae were used to calculate the prevalence (P) and average ectoparasite abundance (A) of each ectoparasite category (Men et al. [17]):

\[
P = \frac{H}{H} \times 100\%; \quad A = \frac{N_i}{H} \times 100\%
\]

Where \( H \) represents the total individuals of rodent hosts (\( C. elburzensis \)) and \( H_i \) represents the individual rodent hosts parasitized by a certain ectoparasite category \( i \). And \( N_i \) represents the individuals of a certain ectoparasite category \( i \) (e.g. ticks, pseudoscorpions).

### 3. Results

From a total of 48 Goodwin’s brush-tailed mouse, \( Calomyscus elburzensis \), which were trapped from the Khaje Morad region, two species of ticks were obtained (Table 1). The ticks were Red sheep tick, \( Haemaphysalis punctata \) Canestrini and Fanzago, 1877, and Vole tick, \( Ixodes trianguliceps \) Birula, 1895. The number and species of ectoparasites recovered from the Goodwin’s brush-tailed mouse are presented in Table 1.

A small proportion (8.33% of \( C. elburzensis \)- 4 individuals out of 48- was infested with ectoparasites and the average ectoparasite abundance reached 12.5% (Table 2).

Although \( C. elburzensis \) populations which were distributed in the study region did not show high infestation rate, it harbored two species of ectoparasites. This is the first record of these two parasites from this small rodent.

Also on one occasion, two specimens of pseudoscorpions, \( Withius nanus \) Mahnert 1988 (Cheliferoidea; Withiidae; Withiinae) was hand-collected from body surface of \( C. elburzensis \) which was a new record from Iran and also from this family of rodents (Nassirkhani and Hamidi [18]).

### Table 1: Ectoparasites collected from \( Calomyscus elburzensis \) trapped from a rocky region, in southeast of Mashhad, Khorasan-Razavi Province, Iran, from April till September 2014.*

<table>
<thead>
<tr>
<th>Species</th>
<th>Number of ectoparasite individuals</th>
<th>Number of infected host</th>
<th>Infestation rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ticks</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( Haemaphysalis punctata )</td>
<td>2</td>
<td>2</td>
<td>4.16</td>
</tr>
<tr>
<td>( Ixodes trianguliceps )</td>
<td>2</td>
<td>1</td>
<td>2.08</td>
</tr>
<tr>
<td><strong>Pseudoscorpian</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( Withius nanus )</td>
<td>2</td>
<td>1</td>
<td>2.08</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>6</td>
<td>8.33</td>
</tr>
</tbody>
</table>

* A total of 48 \( C. elburzensis \) was examined.

### Table 2: Prevalence and average abundance of ectoparasites on \( Calomyscus elburzensis \) in the study area (Khaje Morad rocky region, southeast of Mashhad).

<table>
<thead>
<tr>
<th>Ectoparasite category</th>
<th>Number of individuals</th>
<th>Number of species</th>
<th>Prevalence (( P % ))</th>
<th>Average abundance (( A % ))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ticks</td>
<td>4</td>
<td>2</td>
<td>6.25</td>
<td>8.33</td>
</tr>
<tr>
<td>Pseudoscorpion</td>
<td>2</td>
<td>1</td>
<td>2.08</td>
<td>4.16</td>
</tr>
<tr>
<td>All ectoparasites</td>
<td>6</td>
<td>3</td>
<td>8.33</td>
<td>12.5</td>
</tr>
</tbody>
</table>

### 4. Discussion

On one hand, rodents are one of the main health problems, especially in densely populated areas. On the other hand, understanding the richness of ectoparasite species provides valuable insights into their ecological roles in the regulation of their host populations and communities (Stanko et al. [19], Krasnov et al. [20]). So rodent’s diversity and their ectoparasite fauna become of special concern. \( Haemaphysalis punctata \) can be found on cattle, sheep, goat, horse, deer, rabbit hosts in areas of cold/ humidity (e.g. UK coasts) and semi desert areas (e.g. Central Asia). \( Ixodes trianguliceps \) feeds on such mammals as shrew, rats,
mice, hedgehogs, foxes, squirrels, moles, rabbits and hares. It also frequently feeds on horses and humans. This species is generally found in the nests/burrows of its host in forest areas where the environment has a high humidity, however it has also been found at high altitudes of up to 2400 m and tree-less areas (Nefedova et. al. [21], University of Bristol [22]. University of Bristol [23]), Shayan and Rafinejad (Shayan and Rafinejad [14]) were recorded Haemaphysalis sp. from Calomyscus bailwardi, Meriones persicus, Microtus socialis and Rattus rattus, also genus Ixodes was recorded from Apodemus flavicollis and Rattus norvegicus from Iran (Pakdad et. al. [24]). As noted above, since humidity is an important factor in distribution of these two ticks, C. elburzensis infestation by H. punctata and I. trianguliceps was not far of mind.

Our study showed that the total number of the ectoparasite species and the abundance of each species per rodent host (C. elburzensis) from the survey site (Khaje Morad rocky region) were low in this study. The low prevalence of ectoparasites in C. elburzensis individuals is probably due to low number of samples captured in this study. However the infestation rate and mean number of ectoparasites per rodent may be affected by rodent host species and other environmental factors such as the microhabitats of the hosts (Haas [25]). For example, the degree of infestation of ectoparasite in a special host can be varying among sex classes or age groups. In most rodent species, male individuals are bigger in size and are more active so that they have high chances of being infested. Furthermore several parasite infections could be increased with age (Yassin [26]). Pollitzer (Pollitzer [27]) found that the microhabitats of the hosts sometimes play an important role in determining the abundance of certain ectoparasites. Also it’s noted that environmental conditions, such as season, topography and vegetation can affect rodent hosts and their ectoparasites (Soliman et. al. [28]).

We couldn’t find any other ectoparasite groups (mites, fleas and louse) from C. elburzensis in the study area, so it will need further investigations to answer our questions about diversity and abundance of different ectoparasite groups on this small rodent host.

5. Conclusion

Finally with respect to the fact that infested rodents near human habitations may cause rodent-borne diseases among the inhabitants, thus further parasitological investigations are needed to explore the epidemiologic pattern related to such zoonotic diseases especially in poorly studied host species.

6. Conflict of interest

The author declares that she have no competing interests and have not a financial relationship with the organization that sponsored the research.

7. Acknowledgment

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8. References

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