

Intestinal Helminths Infections of *Calomyscus cf. bailwardi* (Rodentia: Calomyscidae) from Fars Province, Southern Iran

Saeed Shahabi^{1,2}, PhD;
Ali Pouryousef¹, PhD candidate;
Kourosh Azizi², PhD;
Bahador Sarkari¹, PhD

¹Department of Parasitology and Mycology, School of Medicine, Shiraz University of Medical Sciences, Shiraz, Iran

²Department of Medical Entomology and Vector Control, School of Health, Shiraz University of Medical Sciences, Shiraz, Iran

Correspondence:

Bahador Sarkari, PhD;
Department of Parasitology and Mycology, School of Medicine, Shiraz University of Medical Sciences, Shiraz, Iran

Tel: +98 9177101575

Email: sarkarib@sums.ac.ir

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Abstract

Background: Rodents have a significant role as a reservoir in zoonotic diseases. Rodents which live close to human habitats such as murid species play an important role in public health and economy. The current study aimed to evaluate the intestinal helminths infections of the Zagros Mountain rodent, *Calomyscus* (*Calomyscus cf. bailwardi*), in Shiraz, capital of Fars province, southern Iran.

Methods: This cross-sectional study was carried out from April to October 2019, and a total of 10 *Calomyscus* were trapped. The animals were transferred to the animal laboratory for euthanization and dissection. Each of the digestive organs was separately cut and examined to identify their intestinal helminths. Parasites were removed by a special needle, and then transferred to 5% glycerin alcohol for the identification of the isolated helminths, using carmine staining.

Results: Among the 10 total numbers of specimens, 60% (6 out of 10) were infected. All of the intestinal helminths obtained from the rodents were identified as *Syphacia obvelata*.

Conclusion: Given the fact that the infected rodents which live in close contact with human society may cause rodent-borne infections among the residents, this parasitological study can be important in identifying the epidemiologic pattern related to zoonotic diseases, especially in rarely studied host species like *Calomyscus cf. bailwardi*.

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Introduction

Many rodents living close to human habitats such as murid species play an important role in public health and economy. These animals are important as a reservoir, carrier or incidental hosts from the veterinary and medical aspects, and contribute to the transmission of zoonotic diseases.^{1,2} Furthermore, some gastrointestinal helminths, as endoparasites, have been isolated from human and rodents communities which have a significant role in human health.^{1,3} The rodent species of the genus *Calomyscus* inhabit arid, rocky hillsides and mountains in Syria, Azerbaijan, Iran, Turkmenistan, Afghanistan and Pakistan.⁴⁻⁶ Molecular

evidence suggests that *Calomyscus* is either a basal clade sister to the Nesomyidae or an isolated clade basal to the radiation of the cricetid and murid rodents within the superfamily Muroidea.⁷⁻⁹ The genus *Calomyscus* Thomas 1905 has long been considered monotypic and represented by the species *C. bailwardi*.⁴ However, Musser and Carleton (2005) recognized eight geographic species for the genus: *C. bailwardi*, *C. baluchi*, *C. elburzensis*, *C. grandis*, *C. hotsoni*, *C. mystax*, *C. tsolovi*, and *C. urartensi*.¹⁰ The Zagros Mountain species, *C. cf. bailwardi* are distributed in the Zagros Mountains of western and southern Iran in the provinces of Kurdistan, Ilam, west Esfahan, and East Khuzestan, Luristan, Fars, and west Kerman. Recently, molecular

and geometric-morphometric analyses by Akbari et al. in 2016,¹¹ delineated three distinct evolutionary units in the genus from the Zagros Mountains that may deserve species status other than *C. bailwardi*. Their results showed that the Zagros Mountains in Iran had a high species diversity due to a complex topography that has promoted geographic isolation in the genus *Calomyscus*.¹¹ So far, there is no data concerning the endoparasites of the Zagros Mountain *Calomyscus*. The present study is the first to report the endoparasite of this rodent through a part of its distribution range. Since this species is one of the endemic species of the Iranian plateau and since the rodents were collected from rocky hillsides of the mountainous area near the human residence in the city of Shiraz, capital of Fars province in southern Iran, the present data are of parasitological importance for human health.

Material and Methods

Shiraz is the capital of Fars Province in southern Iran. Its coordinate is 29°36'37" N and 52°31'52"E. The population of Shiraz is 1,869,001 (the fifth-most-populous city in Iran).¹²

This cross-sectional study was carried out in Shiraz during April to October 2019. The study area consisted of mountainous and horticultural regions. The study was approved by the Ethics Committee of Shiraz University of Medical Sciences. Live traps with baits such as puff paste were set at forenamed regions for 12 hours (sundown to sunrise). Then, the trapped rodents were transferred to the animal laboratory of Shiraz University of Medical Sciences. Four external measurements of rodents (HBL: head and body length, TL: tail length, FL: hind-foot

length (claw excluded), EL: ear length) were taken to the nearest millimeter (mm) by a ruler. The rodents were identified based on identification keys^{10, 13, 14} with consideration to new revisions on *Calomyscus* species of Iran.^{4-6, 11} After dissection, all the digestive systems were removed and stored in plates containing 70% alcohol. The organs were separately cut with the scalpel blade and observed under a stereomicroscope. The parasites were removed by a special needle, and then transferred to 5% glycerin alcohol to identify the isolated helminths, using carmine staining and the characteristics of each helminth.¹⁵ The prevalence of the infected rodents, abundance of the endoparasites and mean intensity of parasites related to each host were calculated as follows:¹⁶

Prevalence (%) = (Number of the infected host) / (Total number of host examined) × 100

Abundance (%) = (Number of parasites) / (Total number of host examined) × 100

Mean intensity (%) = (Number of parasites) / (Total number of the infected host) × 100

Results

Of the captured rodents, 10 were identified as *Calomyscus cf. bailwardi*, from which 6 were male and 4 were female. Mean and standard error for external measures of the rodents were as follows: HBL = 73.66 ± 2.07, TL = 91.29 ± 1.25, EL = 19.37 ± 0.46, FL = 19.63 ± 0.45.

Amongst 10 examined specimens, 6 cases (60%) were found to be infested with the endoparasite. In this study, the only helminth which was infecting the *Calomyscus cf. bailwardi* was *Syphacia obvelata* (Figures 1, 2).



Figure 1: *Syphacia obvelata* obtained from *C. bailwardi*. A: Male anterior end. B: Female anterior end C: Female posterior end (Carmine staining)

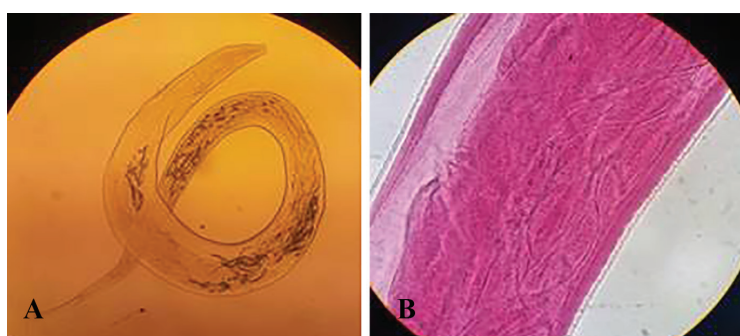


Figure 2: *Syphacia obvelata* obtained from *C. bailwardi*. A: Female whole worm (not stained). B: Uterus containing egg

A total of 58 *Syphacia* were isolated from all 6 infected rodents. The prevalence of the infected rodents, abundance of the endoparasites and mean intensity of parasites related to the host were 60%, 580%, and 966%, respectively. There was no statistically significant difference in the prevalence of helminth infections in male and female rodents ($P>0.05$).

Discussion

Rodents, particularly those living in close contact with human communities, can play an important role as a reservoir of zoonotic diseases.¹⁷⁻²⁰ Therefore, it is necessary to identify their parasitic infections. Despite the fact that the endoparasitic fauna of the rodents is of special interest, the slightly known rodents and those which may be used as pets are of major concern. Rodent pinworms belong to the genus *Aspicularis* and *Syphacia* of the Oxyuridae family.²¹ These parasites are detected routinely within rodent facilities, and their persistence despite control measures indicates deficiencies in the diagnostic and eradication processes.²¹ Pinworms can affect rodents' manners.²² *Calomyscus* are a group of small rodents found in Syria, Azerbaijan, Iran, Turkmenistan, Afghanistan, and Pakistan. They are found in rocky outcrops and semi-mountainous areas in desert regions.⁴ In the present study, the endoparasite infection in *Calomyscus cf. bairdardi* was reported for the first time from Iran. Since in our study parasitic contamination was investigated only in one species of rodent (*C. bairdardi*), the rate of the isolated parasites was limited. In the present study, 60 % of the rodents were infected with *Syphacia*. The lowest and highest rates of contamination were 2 and 32 helminths. The low diversity of endoparasites in *Calomyscus cf. bairdardi* is likely to be due to the low number of samples evaluated in this study. The infection rate and mean number of endoparasites per rodent can be affected by the species of rodents and other environmental factors such as vegetation, topography, and season.²³ In a study carried out by Ranjbar et al.,² in the BoyerAhmad District, southwest Iran, noparasitic infection in *Calomyscus cf. bairdardi* was found. The high prevalence of *Syphacia obvelata* infections in this study may be due to the high prevalence of this helminth in other species of the rodents in the area. Since most of the rodents live and feed within a small region, infections are easily maintained among the population. A study on 11 wild rodent species in the Jaz Murian region located in the southeast of Iran revealed the most infested species as Indian Gerbil (*T. indica*), in which 28 of 30 captured specimens (93%) were infected with six genera of nematode endoparasites.²⁴ The study also reported the highest mean intensity for *Physaloptera* sp. in *Meriones libycus* (850%).²⁴ In the present study, abundance and mean intensity of *S. obvelata*. related to the host (*Calomyscus cf. bairdardi*) were 580% and 966%, respectively. The high abundance

and mean intensity of the endoparasite observed in this rodent are considerable and are of parasitological importance. Nevertheless, *Syphacia* is not a zoonotic important helminth and does not pose a threat to human health.²⁵ Since the number of investigated specimens in the present study was low, further surveys with larger number of rodents are recommended to find out the probable existence of other zoonotic parasites in this species of rodent.

Conclusion

Given the fact that infected rodents living in close contact to the human residences may cause rodent-borne infections among the residents, further parasitological studies are needed to identify the epidemiologic pattern related to zoonotic diseases, especially in the rarely studied host species such as *Calomyscus cf. bairdardi*.

Conflict of Interest: None declared.

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