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Laboratory based diagnosis of leishmaniasis in rodents as the reservoir hosts in southern Iran, 2012

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ABSTRACT

Objective: To examine the fauna of rodents as zoonotic cutaneous leishmaniasis reservoir hosts in Zarqan County, Fars Province, south of Iran, during 2012.

Methods: During 2012, wild rodents from different parts of this region were caught by Sherman traps and checked by the examination of liver and spleen smears, for *Leishmania* infection, to see which species were acting as reservoir hosts; the slides were then processed to extract DNA for molecular test using PCR assay.

Results: From 108 rodent species caught, 63% were male and 37% identified as female. *Meriones libycus* was the most abundant species caught (80.5%) and 5.7% of them were found to be smear-positive for *Leishmania* amastigotes. The other species were *Rattus rattus* (14.8%) and *Mus musculus* (4.7%), but none of them were found positive. *Leishmania* infection was observed in male and female samples microscopically. Moreover, molecular results revealed *Leishmania major* in three male and two female specimens.

Conclusions: Based on our knowledge, *Meriones libycus* is incriminated as the main reservoir hosts of *Leishmania major* in the rural area of Zarqan.

1. Introduction

Leishmaniasis is a term allocated to a range of infections caused by human pathogens like *Leishmania* spp. (Kinetoplastida: Trypanosomatidae). It is one of eight important neglected tropical diseases of World Health Organization. About two million people are annually exposed to this disease.

Cutaneous leishmaniasis (CL) is a sand fly-borne skin infection caused by the blood parasite *Leishmania*[1]. It is still a major public health issue in Iran, where most CL cases are zoonotic with rodents acting as reservoir hosts in many rural areas. Zoonotic cutaneous leishmaniasis (ZCL) is essentially an infection of rodents with natural foci. In Iran, the causative agent of ZCL, *Leishmania major* (*L. major*), is often transmitted to humans by the bites of the female sand fly, *Phlebotomus papatasi* (*P. papatasi*), mostly from rodent hosts that act as reservoirs for the human infection[2]. ZCL occurs in most rural areas of the arid and semi-arid regions but the northwest provinces of Iran. Definitely, *P. papatasi* is the main vector and

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various feral rodents, particularly but not exclusively those in the subfamily Gerbillinae (Rodentia: Muridae), are reservoir hosts. Rodents are the largest order of mammals with a population of more than any other mammal and are the reason of many health and economic losses. One of the major health problems among these animals is their role as reservoir hosts of zoonotic disease and one of the most important diseases is CL[3].

So far, two species of parasites have been identified as human pathogens. Among the four major forms of the diseases caused by different flagellated protozoan species of *Leishmania* type, two forms of skin CL and visceral leishmaniasis in Iran are endemic. There are two forms of CL caused by *Leishmania tropica* (*L. tropica*) (dry or urban) and *L. major* (wet or rural). In general, CL in recent decades has been expanding its geographic region and is endemic in 15 provinces of the country and there are sporadic cases in other regions as well. The annual registered number of cases in Iran is 20 000-30 000 and its annual incidence is 28 per 100 000 individuals under risk[4].

ZCL has high incidence in arid and semi-arid regions of North Africa, the Middle East and Central Asia, where *P. papatasi* is the main vector and various species of tailed rodents have been introduced as the main reservoirs. *Rhombomys opimus* (*R. opimus*) is the main reservoir in Central Asia and *Psammomys obesus* is the main reservoir in North Africa. Despite all efforts by health authorities in controlling CL, unfortunately, the spread of the disease in different areas of country is evident in recent years. In the wet or ZCL form, tailed rodents in subfamily of Gerbillinae have been introduced as the main reservoirs in Iran and the world[5]. In the central and north eastern foci of the country and the south of Tehran, the species *R. opimus* has been reported as proven and primary reservoir and *Meriones libycus* (*M. libycus*) species has been reported as the secondary reservoir of the disease. Recently, a group of researchers reported 37.5% infection in the *R. opimus* species in Kalale, Golestan Province, Iran[6].

In West and South west regions of the country, *Tatera indica* (*T. indica*) is the main reservoir and *Nesokia indica* and *M. libycus* are introduced as the secondary reservoir of the disease[7]. In the southeast of the country, *Meriones hurrianae* has been reported as proven and primary reservoir and *T. indica* is the secondary reservoir. In rural areas of the cities Arsanjan and Neiriz, *M. libycus* species plays the role of primary and proven reservoir of the disease[8,9]. The same species with 8.4% infection has been reported in Marvdasht, Fars Province, south of Iran[10]. *T. indica* species infected with *L. major* has been reported in Kharameh, Fars Province, south of Iran[11]. A recent report on *Leishmania* infection in Jahrom region of Fars Province and closest focus to the studied area, found four *Marinobacter persicus* and two *T. indica* infected and one infection in each of the two rodents of *Mus musculus* (*M. musculus*) and *Rattus rattus* (*R. rattus*)[12]. Another report on *Leishmania* infection in Larestan region of Fars closest focused on the studied area and found four cases of *T. indica* and two cases of infection in two rodent samples of *Gerbillus* spp[13]. In addition, recently, *Leishmania turanica* has been detected from *Nesokia indica* in Kermanshah Province. Also for the first time, *L. major* was separated from *Gerbillus nanus* in Jask county in Hormozgan Province, south of Iran[14,15].

A gerbil is a small mammal of the order Rodentia. Once known simply as "desert rats", the gerbil subfamily includes about 110 species of African, Indian, and Asian rodents, including sand rats and jirds, all of which are adapted to arid habitats. *M. libycus* is a species of rodent in the family Muridae. It is found in Afghanistan, Algeria, China, Egypt, Iran, Iraq, Jordan, Kazakhstan, Libya, Mauritania, Morocco, Saudi Arabia, Syria, Tunisia, Turkmenistan, and Uzbekistan. *M. libycus* occupies desert habitats, generally in areas with stabilized dunes (desert and semi-desert habitats). It is sometimes found in arable land. It is a highly mobile species, frequently changing burrows or even migrating should forage conditions deteriorate.

In recent years, in Zarqan County, the number of cases of ZCL has been increased. Considering that in the control of ZCL wild animals are involved, the control of this disease is complicated. So the only justified control method is the identification of rodents and determination of ZCL reservoirs around public settlements within a radius of 500 meters based on the flight range of vectors. Considering that some 1 300 cases of ZCL were recorded in 2012 in Zarqan district, Fars Province, Iran, this research was conducted. The present study was designed to examine the fauna of rodents as ZCL reservoir hosts in Zarqan county, Fars Province, south of Iran, during 2012.

2. Materials and methods

2.1. Study area

Fars Province placed in south of Iran covers an area of about 122 400 km^2. Zarqan county is located 25 km to the northeast of Shiraz, the capital city of Fars Province (29°46′