

Short Communication

The Sand Fly Fauna of an Endemic Focus of Visceral Leishmaniasis in Central Iran

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Abstract

Visceral leishmaniasis due to *Leishmania infantum* is endemic in many rural areas of Iran. An investigation was carried out during April to November 2001 in Ghahan rural district of Qom Province, in order to identify the phlebotomine sand fly fauna. 971 sand flies were totally collected from outdoor and indoor resting places by sticky traps. Ten species of phlebotomine sand flies including 8 species of the genus *Phlebotomus* (*Phlebotomus sergenti*, *P. major*, *P. alexandri*, *P. kandelakii*, *P. tobbi*, *P. brevis*, *P. halepensis*, *P. (Adlerius)* sp) and 2 species of the genus *Sergentomyia* (*Sergentomyia pawlowsky* and *S. theodori*) were collected from outdoor and indoor resting-places by sticky traps. High indoor density of *P. sergenti* (46.9%) and *P. major* (40.4%) was found with the peak of activity in early July. Based on the results of the present study and also the related studies in other VL foci of Iran, *P. major* can be considered as the probable vector of the disease in the area.

Keywords: Sand flies, Visceral leishmaniasis, Ecology, Qom, Iran

Introduction

Visceral leishmaniasis (VL) caused by *Leishmania infantum*, exists in about 70 countries, is an endemic disease in many parts of Iran, especially in northwest and south of the country. It is a serious public health problem in these areas. Since the first report of the disease by Pouya in 1949, about 9000 cases were reported in Iran (unpublished data, Institute of Public Health Research). Dogs (*Canis familiaris*) are reported as the main reservoir of VL, but wild carnivores such as jackals and foxes have been also found infected with *Leishmania infantum*. So they may be considered as reservoirs of the infection, particularly in areas where sporadic cases of the disease were reported

(Nadim 1978, Hamidi et al. 1982).

Moreover, two species of parasite, *L. infantum* and *L. donovani*, have been isolated from rodents in northwest of the country (Mohebbali et al. 1998). Leptomonad infection of *Phlebotomus major*, *P. keshishiani*, *P. perfiliewi* and *P. kandelakii* were reported in the main VL foci in Iran (Nadim et al. 1992, Sahabi et al. 1992, Seyedi-Rashti et al. 1995, Rassi et al. 1997).

The first case of the disease was reported in 1997 from Ghahan rural district, the study area, and two other cases were observed by the authors in the following years. The area is a new endemic focus of VL in our country (Fakhar et al. 2004).

The objective of this study was to determine the sand fly fauna of the area.

Materials and Methods

Ghahan rural district (50° 90' N, 34° 44' E) is located in Qom Province, central Iran, and has a dry climate with a total rainfall of 122 mm and altitude of 2000 m. The mean maximum and minimum of monthly temperature in January and June 2001 was reported -0.3 and 37 °C, respectively. The relative humidity was ranged from 11.9% in September to 73.4% in January. The entomological studies were conducted in Anjile village, where the VL cases were reported.

From April to November 2001, sand flies were collected biweekly by 60 sticky traps from 3 outdoor (hole of rocks and caves, dog shelters) and 3 indoor (living rooms, cow shelter, stable) resting places. In this method, traps were installed after sunset and were collected before the following sunrise. Sand flies were removed from the traps, rinsed in acetone and then conserved in 70% ethanol. All specimens were mounted as permanent microscopy slides, using Puri's medium (Smart 1965). Species identification was carried out using the keys of Lewis (1982), Nadim and Javadian (1976) and Seyedi-Rashti and Nadim (1992).

Results

A total of 971 adult sand flies were collected biweekly by sticky traps during April to November 2001, and the following species belonging to genera of *Phlebotomus* and *Sergentomyia* were identified (Table 1). The outdoor species were: *Phlebotomus sergenti* (28.6%), *P. major* (6.8%), *P. alexandri* (2.7%), *P. kandelakii* (2.4%), *P. tobbi* (0.2%), *P. brevis* (0.2%), *P. (Adlerius) sp* (0.5%), *Sergentomyia pawlowsky* (1.7%) and *S. theodori* (56.9%). Sand flies, collected from indoor resting places were: *Phlebotomus sergenti* (46.9%), *P. major* (40.4%), *P. alexandri* (4.3%), *P. kandelakii* (3.9%), *P. tobbi* (0.4%), *P. brevis* (0.2%), *P. halepensis* (1.6%), *P. (Adlerius) sp* (0.9%) and *S. theodori* (1.4%). Sand fly activity started in April and ended in October. Common sand flies were *P. sergenti* (46.9%), *P. major* (40.4%) in indoor resting places and *S. theodori* (56.9%) and *P. sergenti* (28.6%) in outdoors. The sex ratio (number of males/females x 100) of *P. sergenti* and *P. major* was 431.8 and 250 in outdoors, and 338.3 and 460 in indoors, respectively.

Table 1. Fauna and frequency of sand flies in the village of Anjile, Ghahan rural district, Qom province, 2001

| Species | Place of collection | | | | | |
|----------------------------------|---------------------|------|----------|------|-------|------|
| | Indoors | | Outdoors | | Total | |
| | No. | % | No. | % | No. | % |
| <i>Phlebotomus sergenti</i> | 263 | 46.9 | 117 | 28.6 | 380 | 39.1 |
| <i>Phlebotomus major</i> | 226 | 40.4 | 28 | 6.8 | 254 | 26.2 |
| <i>Phlebotomus alexandri</i> | 24 | 4.3 | 11 | 2.7 | 35 | 3.6 |
| <i>Phlebotomus kandelakii</i> | 22 | 3.9 | 10 | 2.4 | 32 | 3.4 |
| <i>Phlebotomus halepensis</i> | 9 | 1.6 | 0 | 0 | 9 | 0.9 |
| <i>Phlebotomus tobbi</i> | 2 | 0.4 | 1 | 0.2 | 3 | 0.3 |
| <i>Phlebotomus brevis</i> | 1 | 0.2 | 1 | 0.2 | 2 | 0.2 |
| <i>Phlebotomus (Adlerius) sp</i> | 5 | 0.9 | 2 | 0.5 | 7 | 0.7 |
| <i>Sergentomyia theodori</i> | 8 | 1.4 | 234 | 56.9 | 242 | 24.9 |
| <i>Sergentomyia pawlowsky</i> | 0 | 0 | 7 | 1.7 | 7 | 0.7 |

Discussion

Fakhar et al. (2004) introduced a new endemic focus of kala-azar in Ghahan rural district, Qom Province. A preliminary study on VL vectors of the area showed four species: *P. major*, *P. alexandri*, *P. sergenti* and *S. dentata* (Akhavan et al. 2000), although we could not find the latter species. They reported *P. major* as the dominant species in both indoors and outdoors. Study on the sand fly fauna in Kashan County, near our study area, showed 17 species (Dourodgar et al. 1999). Their identified species were: *P. papatasi*, *P. sergenti*, *P. alexandri*, *P. major*, *P. tobbi*, *P. kandelakii*, *P. ansarii*, *P. halepensis*, *P. longiductus*, *P. brevis*, *P. jacusieli*, *S. sintoni*, *S. dentata*, *S. powlowskyi*, *S. tiberiadis*, *S. palaestinis*, and *S. clydei*.

Two probable vectors of visceral leishmaniasis, *P. major* and *P. kandelakii* were collected from this area. Regarding high density of *P. major* in outdoor and indoor resting places, and also based on the related studies in other VL foci of Iran, this species is considered as a probable vector. Another study in southern foci of the country has reported *Leishmania* infection in this species (Sahabi et al. 1992). It is the main vector of VL in Greece (Leger et al. 1979) and is also considered to be a vector of VL in other countries of Mediterranean basin (Hoogstral et al. 1969). *P. major* was first reported from northern part of Iran (Pervomaniski 1948). It has been also found in all areas where human cases of VL have been reported. Based on epidemiological evidence, *P. major* is suspected to be the main vector of VL in Iran (Nadim 1978).

Two other species collected in this study, *P. kandelakii* and *P. alexandri*, have been reported as probable VL vectors in Iran (Rassi et al. 2005, Azizi et al. 2006). *P. kandelakii* appears to be a vector of *L. donovani* in Georgia (Perfil'ev 1966) and was considered to be the main vector of VL in Transcaucasia (Sergieiev 1979). This sand fly currently introduced as the proven vector of visceral leishmaniasis in Iran

with a natural infection rate of 1.1% (Rassi et al. 2005).

Phlebotomus alexandri is introduced as the proven vector of *L. donovani* in China (Guan et al. 1986), and is considered to be an important vector of CL in the south of the former Soviet Union (Lewis 1982). Females of this species have been found infected with flagellates in a CL area of Khuzestan, Iran (Javadian et al. 1975) and the species is suspected of transmitting CL in Tunisia (Croset et al. 1978). Azizi et al. (2006) reported *P. alexandri* infected with *L. infantum* in Fars Province, southern Iran. Demonstrating natural infection of *P. tobbi* with *L. infantum* shows that this species may be the most probable vector of *L. infantum* in Cyprus where promastigotes of *L. infantum* zymodeme MON1 were isolated from this species (Leger et al. 2000).

Three species of *P. alexandri*, *P. kandelakii* and *P. tobbi* had low density in the study area and it is unlikely to have a role in VL transmission, but complementary studies are suggested to determine the proven vector(s).

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