

## Some Ecological Characteristics of Phlebotomine sandflies in a Focus of Cutaneous Leishmaniasis, Chabahar, Iran

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Article information	Abstract
<p>Article history: Received: 10 Jan 2011 Accepted: 9 Apr 2012 Available online: 15 July 2012</p> <p>Keywords: Ecology Fauna Abundance Sex Ratio Leishmaniasis Iran</p> <p>*Corresponding author at: Department of Medical Entomology and Vector Control, School of Health, Ahwaz Jundishapur University of Medical Sciences, Ahwaz, Iran. E-mail: Hamid.kassiri@yahoo.com</p>	<p><b>Background:</b> Leishmaniasis is one of the main health problems in Iran. The purpose of this study was to determine species composition, sex ratio and relative abundance of sandflies as vectors of cutaneous leishmaniasis.</p> <p><b>Materials and Methods:</b> This cross-sectional study was conducted in Chabahar, Iran. Sandflies were caught using sticky traps. Traps were installed in 21 rural and urban areas.</p> <p><b>Results:</b> A total of 17859 sandflies were caught. Species caught including <i>Phlebotomus papatasi</i> Scopoli, <i>P. salehi</i> Mesghali, <i>P. sergenti</i> Parrot, <i>P. alexandri</i> Sinton, <i>P. kazeruni</i> Theodor and Mesghali, <i>P. bergeroti</i> Parrot, <i>P. mesghali</i> Seyedi-Rashti and Nadim, <i>P. elaeonora</i> Sinton, <i>Sergentomyia clydei</i> Sinton, <i>S. sintoni</i> Pringle, <i>S. tiberiadis</i> Adler, Theodor and Lourie, <i>S. baghdadis</i> Adler and Theodor, <i>S. hodgsoni</i> Sinton, <i>S. dentate</i> Sinton, <i>S. africana</i> Newstead, <i>S. dreyfussi</i> Theodor and Mesghali, <i>S. mervynae</i> Pringle, <i>S. iranica</i> Lewis and Mesghali and <i>S. christophersi</i> Sinton. Seven species, including <i>P. elaeonora</i>, <i>P. kazeruni</i>, <i>S. hodgsoni</i>, <i>S. dreyfussi</i>, <i>S. mervynae</i>, <i>S. iranica</i> and <i>S. christophersi</i> are reported for the first time in Chabahar.</p> <p><b>Conclusion:</b> <i>P. papatasi</i> and <i>P. salehi</i> respectively play the role of primary and secondary vectors of cutaneous leishmaniasis in Chabahar city, due to their high abundance, presence in all the monthly activities, presence in all areas affected with oriental sore and finding leptomonad infection in them.</p>

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### Introduction

Phlebotomine sandflies are important vectors of protozoa, bacteria and viruses [1]. Female sandflies transmit *Leishmania* parasite, which is a flagellate protozoa, to humans or other mammals through bites [2]. Genus *Phlebotomus* in the old world and *Lutzomyia* in new world, which are of order Diptera, sub-order Nematocera and family of Psychodidae, are known as vectors of a variety of Leishmanioses. *Leishmania* infection has no important effect in reduction of sandflies life or survival [3]. So far, 54 species of sandflies have been caught and identified in Iran [2].

With more than annual 30,000 new cases, leishmaniasis is still a major health problem in Iran [5]. Outbreak of cutaneous leishmaniasis in Iran is estimated to be approximately 28 per 100,000 populations. Both forms of cutaneous leishmaniasis (rural and urban) are common in the country and their main vectors are *Phlebotomus papatasi* and *P. sergenti*, respectively [6, 7]. These two species are mainly semi-domesticated and they simply feed from birds in addition to blood feeding from mammals [8].

Before this study, no complete and developed research was conducted on faunistic, species composition, abundance, sex ratio and temporal distribution of sandflies of Chabahar County; whereas, this region is one of the important foci of cutaneous leishmaniasis. The first

study on sandflies of Sistan & Baluchestan province was conducted by Theodor and Mesghali [9]. They reported seven species of sand flies. Through a study, Seyedi-Rashti, Nadim and Mesghali reported 11 species of *Phlebotomus* and 10 species of *Sergentomyia* in Baluchestan [10]. Other than these two studies, there is no other research in this province on the types of sand flies. In the study on fauna and abundance of sandflies in Rafsanjan county, Kerman Province, eight species (three species of *Phlebotomus* and five species of *Sergentomyia*) were determined [11].

In addition, in the study on determination of fauna of sandflies in Haji-Abad county, Hormozgan province, fourteen species (six species of *Phlebotomus* and eight species of *Sergentomyia*) were collected [12]. Regarding sandflies in Hormozgan province in 1989, six species of genus *Phlebotomus* and 10 species of genus *Sergentomyia* were reported [13].

Recent studies show that due to the free zones, agricultural expansion and population growth in Chabahar county, cases of cutaneous leishmaniasis significantly increased. Therefore, given the nature of the disease and characteristics of the zone, the principled struggle against sandflies is very effective and useful in controlling disease. Therefore, it is essential to have a complete understanding of the fauna (species composition) and

relative abundancy of sandflies of the region, which is the final and main goal of this study.

## Materials and Methods

This descriptive cross-sectional study was conducted in 1997 to determine some ecological features of sandflies in Chabahar county.

Chabahar county is located along the Sea of Oman and has 3 divisions (Dashtyari, Polan and Markazi), 2 cities (Chabahar and Negor), 7 rural districts and approximately 460 hamlets. This county is located in the southeast of the country and at a distance of 2000 kilometers from the center of the country and 652 kilometers from the provincial capital. This region is considered of desert areas due to low rainfall and has relatively high humidity due to the proximity to the sea. Its total area is 13162 km<sup>2</sup> and has a population of over 200 thousand people. Chabahar is on the height of 7 meters above sea level and has a longitude of 60 (degrees) - 37 (minutes) and latitude of 25 (degrees) - 17 (minutes). The average annual air temperature is 36.4°C, average annual relative humidity of 75.9 % and average annual rainfall is about 100 mm.

Catching and collecting sandflies was performed using sticky paper traps. Trapping operations were performed a total of 31 times and 1791 sticky paper traps were installed in Chabahar city and villages Talang, Kambel-Soleimanl, Thies-Kopan, Polan, Nobandian, Negor, Moman, Ryndan, Pirsohrab, Konarak, Shirgovaz, Bahokalal, Thies, Orakie, Kahir, Zar-abad, Garmbit, Jahlian, Beris and Pasabandar.

Sticky paper traps were installed before sunset in houses, stables, nests of rodents and dogs, grooves and holes in walls and other external places and were collected the next day before sunrise.

These traps and the sandflies attached to them transferred to the laboratory. After that, sandflies put for a few seconds in acetone using entomology needle and then, they transferred to a container containing 70% alcohol for long-term preservation. For identification and diagnosis of sand flies, they were mounted on a slide containing a drop of puri's medium. Sandfly species identified using authentic keys [14-16].

## Results

During this study, a total of 17859 sandflies were collected and identified from different regions of Chabahar county (internal and external sites). A collection including 19 species (8 species of *Phlebotomus* and 11 species of *Sergentomyia*) identified as the sandfly fauna in the county. Species of *Phlebotomus papatasi* with 6230 numbers (34.88%), *Sergentomyia clydei* with 5996 numbers (33.57%), *S. sintoni* with 2900 numbers (16.23%) and *P. salehi* with 2326 numbers (13.02%) from total specimens caught, were in the first to fourth order in terms of relative abundance.

The sex ratio in the sand flies, genus *Phlebotomus*, was 241.3 males per 100 females. The sex ratio of the sandflies of genus *Sergentomyia* was determined 92.3

males per 100 females. Regarding *P. papatasi* and *P. salehi*, sex ratios were calculated respectively 253.2 males per 100 females and 196.7 males per 100 females. The full composition of species, relative abundance and sex ratio of sandflies caught in Chabahar county is given in table 1.

**Table 1.** Fauna, relative abundance, species composition and sex ratio of sandflies caught in Chabahar county

Sex	Species	Male N(%)	Female N(%)	Total N(%)
	<i>Phlebotomus papatasi</i> (Scopoli, 1786)	4466(71.7)	1764(28.3)	6230(34.77)
	<i>P. Salehi</i> (Mesghali, 1965)	1542(66.3)	784(33.7)	2326(13.02)
	<i>P. sergenti</i> (Parrot, 1917)	94(95.9)	5(4.1)	99(0.55)
	<i>P. alexandri</i> (Sinton, 1928)	54(90)	6(10)	60(0.33)
	<i>P. kazeruni</i> (Theodor and Mesghali, 1964)	10(100)	0(0)	10(0.05)
	<i>P. mesghali</i> (Seyedi-Rashti and Nadim, 1970)	4(100)	0(0)	4(0.02)
	<i>P. bergeroti</i> (Parrot, 1934)	4(100)	0(0)	4(0.02)
	<i>P. elaeonora</i> (Sinton, 1931)	2(100)	0(0)	2(0.01)
	<i>Sergentomyia clydei</i> (Sinton, 1928)	3569(59.5)	2427(40.5)	5996(33.57)
	<i>S. sintoni</i> (Pringle, 1953)	679(23.4)	2221(76.6)	2900(16.23)
	<i>S. tiberiadis</i> (Adler, Theodor and Lourie, 1930)	73(61.9)	45(38.1)	118(0.66)
	<i>S. baghdadis</i> (Adler and Theodor, 1929)	33(62.2)	19(37.7)	53(0.29)
	<i>S. hodgsoni</i> (Sinton, 1933)	14(63.6)	8(36.4)	22(0.12)
	<i>S. dentata</i> (Sinton, 1933)	10(58.8)	7(41.2)	17(0.09)
	<i>S. africana</i> (Newstead, 1912)	0(0)	6(100)	6(0.03)
	<i>S. dreyfussi</i> (Theodor and Mesghali, 1964)	0(0)	6(100)	6(0.03)
	<i>S. mervynae</i> (Pringle, 1953)	1(25)	3(75)	4(0.02)
	<i>S. christophersi</i> (Sinton, 1927)	0(0)	2(100)	2(0.01)
	<i>S. iranica</i> (Lewis and Mesghali, 1961)	1(100)	0(0)	1(0.005)
	Total	10556(59.1)	7303(40.9)	17859(100)

## Discussion

To determine fauna, a total of 17859 sandflies were collected from internal and external sites. About 48.9% of which were *Phlebotomus* and the rest (51.1%) were *Sergentomyia*. A total of 19 species of sandflies were found in Chabahar county.

Chabahar county, which is of old focus of cutaneous leishmaniasis, recently has had a dramatic increase in cases of disease. Thus, this study was designed for bioecological evaluation of (fauna, abundance, species composition and sex ratio) of sandflies in this county. Earlier, in Chabahar county, species of *P. papatasi*, *P. sergenti*, *P. salehi*, *P. bergeroti*, *P. alexandri*, *P. mesghali*, *S. sintoni*, *S. dentata*, *S. baghdadis*, *S. pawlowskyi*, *S. clydei*, *S. tiberiadis* and *S. africana* were reported [10]. These species (except *S. pawlowskyi* Perfil'ev, 1933) along with seven other species including *P. elaeonora*, *P. kazeruni*, *S. hodgsoni*, *S. dreyfussi*, *S. mervynae*, *S. iranica* and *S. christophersi* which are reported in this study for the first time in Chabahar county

, are introduced as fauna and species composition of sandflies in this county.

Faunistic richness and species diversity of sandflies in Chabahar is very significant compared with other studies on determination of sand flies' fauna in other counties of the country. In a study in Chabahar county, Kassiri and Javadian reported leptomonaad infection in *P. salehi* for the first time in Iran and in *P. papatasi* for the first time in Sistan & Balochestan Province. According to this study, out of 667 *P. papatasi* and 465 *P. salehi* dissected, respectively, 14 (2.1%) and 5 (1.07%) cases had leptomonaad infection [17].

In a study on sandflies in Taibad county, in Iran-Afghanistan border, Mahdavi et al caught a total of 8 species (3 species of genus *Phlebotomus* and five species of genus *Sergentomyia*) [18]. In the study on sand fly fauna in Bam county, Aghassi and Sharifi introduced only 5 species [19]. In the study on sandflies of Marvdasht county, Kalantari et al. identified eight species as fauna [20]. Aghaie-Afshar et al. reported fauna of sandflies in Baft county, Kerman province, to be very diverse, containing 16 species [21].

In this study, *P. papatasi* with 34.88% of all caught samples was the dominant species. In the study of Azizi et al. in Nourabad Mamassani county, *P. papatasi* with 24.2% of all collected samples was introduced as the dominant species [22]. In the study of Aghaie-Afshar et al. in Baft county, *P. papatasi* with 33.74% was the dominant species [21]. In Kalaleh county, *P. papatasi* composed 41.2% of caught sandflies and were introduced the dominant species [23].

In this study, *S. clydei* and *S. sintoni* composed respectively 33.57% and 16.23% of the species caught. In the study on sandflies of Kalaleh, *S. sintoni* and *S. clydei* respectively composed 36% and 0.3% of the caught species [23]. In Bam city, *S. sintoni* composed 1.69 % of the species of sandflies caught and *S. clydei* was not caught [19]. *S. clydei* in Kenya is known as vector of *Leishmania adleri* Heisch, 1954 and also in Iran and Afghanistan, it has been found to be infected with promastigote [24]. Meanwhile, *S. sintoni* was introduced

as vector of lizard leishmaniasis in Iran and Afghanistan [25].

The results of studies on sex ratio of sandflies in Chabahar county showed that 59.1% of caught sandflies were male and the rest (40.91%) were female. Regarding *P. papatasi*, sex ratio was determined 253.2 males per 100 females. In the study on sandflies in Bam city, 81.3% of collected sandflies were male and 18.7% were female. Also, sex ratio of *P. papatasi* was 618 males per 100 females [19]. Sex ratio of sandflies is not the same issue for all species and depends on the method to catch the sand fly.

Species diversity of sandflies of Chabahar county is very rich which indicates the expansion of bio-geographical status of the region. In this study, seven species of sandflies were reported for the first time in this county.

According to the survey results and findings also leptomonaad infection in *P. papatasi* and *P. salehi*, these species seem to be the primary and secondary vectors of cutaneous leishmaniasis in the region, respectively. In this regard, it is recommended that an organized and coherent plan should be designed and implemented including vector and reservoir control programs, as well as public education to control and prevent cutaneous leishmaniasis.

#### Acknowledgements

Hereby, valuable cooperation of Health Research and Education Center of Iranshahr and Medical Health Network of Chabahar in this study was greatly appreciated.

#### Authors' Contributions

All authors had role in design, work, statistical analysis and manuscript writing.

#### Conflict of Interest

The authors declare no conflict of interest.

#### Funding/Support

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*Please cite this article as:* Kassiri H, Javadian E. Some ecological characteristics of phlebotomine sand flies in a focus of cutaneous leishmaniasis, Chabahar, Iran. *Zahedan J Res Med Sci (ZJRMS)* 2012; 14(8): 21-24.