

Species composition of Phlebotomine sandflies (Diptera: Psychodidae) in Nikshahr county, south-eastern Iran

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ABSTRACT

Background & objectives: Sandflies are reported as the vectors of different kinds of leishmaniasis to human. There are foci of the disease in Iran. The aim of this study was to determine the fauna and species composition of sandflies to find the probable vectors of leishmaniasis in Nikshahr county, south-east of Iran, where cutaneous leishmaniasis is endemic.

Methods: Sandflies were collected by sticky paper traps from 20 collection stations located in plain and mountainous area of Nikshahr county. The sex ratio and relative abundance of different species were also determined.

Results: A total of 11,455 sandflies revealed 23 species collected and identified. *Phlebotomus alexandri*, *P. sergenti*, *P. papatasi*, *P. salehi*, and *P. keshishiani* were the most important vector species found in this study.

Interpretation & conclusion: During this survey 13 species are identified for the first time from Nikshahr county—*P. bergeroti*, *P. eleanorae*, *P. keshishiani*, *P. halepensis*, *S. hodgsoni*, *S. christophersi*, *S. mervynae*, *S. dentata*, *S. dreyfussi*, *S. iranica*, *S. africana*, *S. grekovi* and *S. palestinensis*, while *P. keshishiani* is an important vector of visceral leishmaniasis in south of Iran. These data demonstrate five vectors of leishmaniasis are active in the study area.

Key words Iran; Nikshahr; sandfly; species composition

INTRODUCTION

Phlebotomine sandflies are vectors of some diseases including leishmaniasis, bartonellosis and sand fly fever to human. More than 700 species of sandflies are recorded around the world¹. In Iran, there are 52 reported species of sandflies belonging to the subgenera *Adlerius*, *Euphlebotomus*, *Larrousius*, *Paraphlebotomus*, *Phlebotomus*, *Synphlebotomus*, *Grassomyia*, *Parrotomyia*, *Parvidens*, *Rondanomyia*, *Sergentomyia* and *Sintonius*². *Phlebotomus papatasi* and *P. salehi* are the main and secondary vectors of zoonotic cutaneous leishmaniasis (ZCL) caused by *Leishmania major* in Iran, respectively. *Leishmania major* is also isolated from *P. caucasicus* group and *P. ansarii* in rodent burrows^{3,4}. In case of anthroponotic cutaneous leishmaniasis (ACL), *P. sergenti* is the main proven vector in Iran^{5,6}. There are four species of sandflies involved in the transmission of visceral leishmaniasis to humans. They include *P. major*, *P. keshishiani*, *P. kandellakii* and *P. perfiliewi*. However, *L. infantum* that causes visceral leishmaniasis has been isolated from *P. alexandri*⁷⁻⁹. Cutaneous leishmaniasis has newly emerged in rural areas of Mirjaveh, Chabahar

and Konarak districts, around the Nikshahr county, Sistan and Baluchistan province^{10,11}.

The aim of this study was to determine the fauna and species composition of Phlebotomine sandflies in Nikshahr county, south-eastern part of Iran, where some foci of cutaneous leishmaniasis are reported and population exchange with endemic areas of cutaneous leishmaniasis in Pakistan and Afghanistan exists.

MATERIAL & METHODS

Study area

Nikshahr county is located in Sistan and Baluchistan province, south-east of Iran. Latitude and longitude of the center of the county is 36° 14'N and 60° 13'E. It has 23,930 km² space and 510 m altitude from the sea level. Based on the last census of 2006 the population of this county was 187,313. This county has three cities of Nikshahr, Qasreqand and Fanooj, 16 rural districts and 816 villages. The study area has a dry and warm weather in summer and temperate during winters. It has two ecosystems in plain and mountainous areas. Scattered rainfall happens in summer and winter and total annual pre-

precipitation is about 150 mm. The climate of the county is classified as very warm desert. The average temperature during the year is 28°C with minimum and maximum of 3 and 49°C, respectively. The annual average relative humidity is 36.8%.

Methods

Sandflies were caught outdoors by sticky paper traps from rodent burrows, caves, cracks of rocks, and holes across the riverside in different hilly and plain areas of Nikshahr county, during 6 months of spring and summer. These traps were easier to use than the light-traps in this area, because of some local difficulties. Collection sites were: Nikshahr, Qasreqand, Ab-band, Holonchegan, Zeineddin, Hichan, Tange-sarhe, Takht-e-Malek, Mahban, Keshik, Orang, Kooshk, Kahoorkan, Chahan, Fanooj, Bent, Chanef, Ramazan kalak, Peap and Espeke. Traps were installed before sunset and collected before sunrise. Sandflies were removed by needle and put in acetone to wash the oil on their bodies and then transferred and preserved in 70% ethanol. In the laboratory, they were mounted in the Puri’s medium and identified using identification key¹². Sex ratio of all the species was calculated as: No. of males/No. of females × 100

RESULTS

A total of 1540 sticky traps were installed during the study period at 20 collection sites and 11,455 sandflies falling in 23 species were caught (Table 1). Twenty-seven percent of the specimens were *Phlebotomus* species while

Table1. Species composition, abundance and sex ratio of phlebotomine sand flies in Nikshahr county south-east of Iran

Species	No.	Relative frequency (%)	Sex ratio
<i>P. alexandri</i>	1185	10.34	12.4
<i>P. bergeroti</i>	13	0.11	0
<i>P. eleanorae</i>	3	0.03	–
<i>P. halepensis</i>	1	0.01	0
<i>P. kazeruni</i>	348	3.04	7.1
<i>P. keshishiani</i>	2	0.02	0
<i>P. mesghali</i>	277	2.42	50.5
<i>P. papatasi</i>	359	3.14	19.7
<i>P. salehi</i>	8	0.07	0
<i>P. sergenti</i>	893	7.79	10.7
<i>S. africana</i>	6	0.05	200
<i>S. baghdadis</i>	304	2.65	56.7
<i>S. christophersi</i>	632	5.52	101.3
<i>S. clydei</i>	742	6.47	65.3
<i>S. dentata</i>	125	1.10	40.4
<i>S. dreyfussi</i>	49	0.43	600
<i>S. grekovi</i>	1	0.01	0
<i>S. hodgsoni</i>	1496	13.06	74.2
<i>S. iranica</i>	29	0.26	0
<i>S. mervynae</i>	228	1.99	385.1
<i>S. palestinensis</i>	1	0.01	–
<i>S. sintoni</i>	1019	8.89	104.2
<i>S. tiberiadis</i>	3734	32.59	64.3
Total	11455	100	–

73% were *Sergentomyia*. *Phlebotomus alexandri* and *S. tiberiadis* were the most common species among *Phlebotomus* and *Sergentomyia* genera, respectively

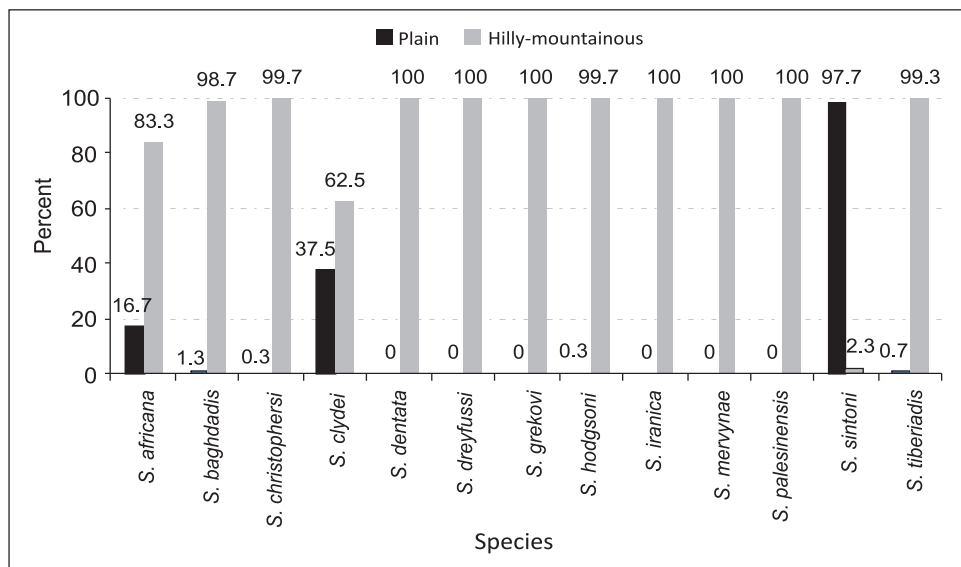


Fig. 1: Species composition of *Sergentomyia* spp in different geographical places of Nikshahr county, southern Iran

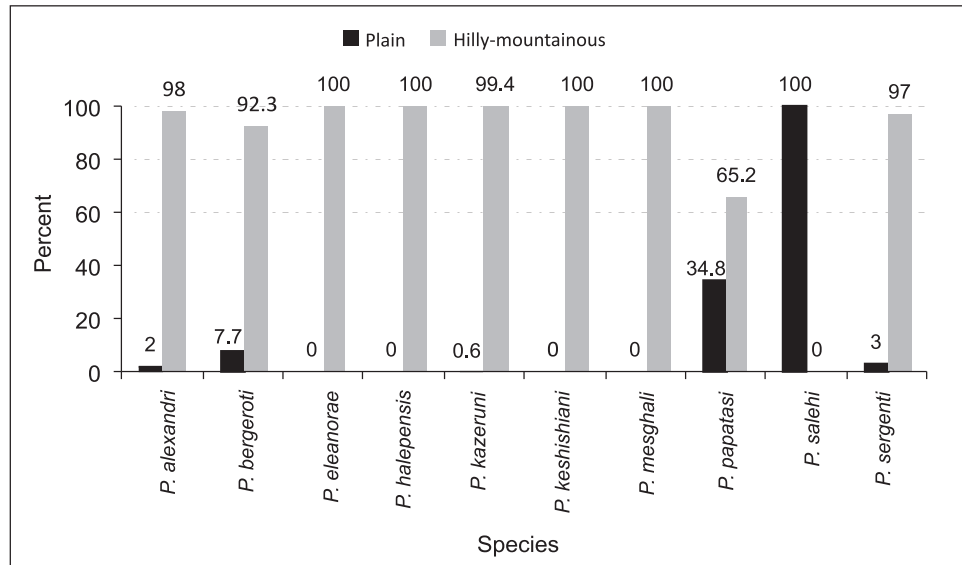


Fig. 2: Species composition of *Phlebotomus* spp in different geographical places, Nikshahr county, southern Iran

(Table 1). Sex ratio for different species is also shown in Table 1. The highest sex ratio was 600 for *S. dreyfussi*.

A total of 9955 sandflies representing 22 species were collected in hilly and mountainous area, while 1500 specimens including 13 species were captured in plain area. *Sergentomyia dentata*, *S. dreyfussi*, *S. grekovi*, *S. iranica*, *S. mervynae*, *S. palestinensis*, *P. eleanorae*, *P. halepensis*, *P. keshishiani* and *P. mesghali* were collected only in mountainous area, while *P. salehi* alone was found in plain area. *Phlebotomus alexandri* (98%), *P. bergeroti* (92.3%), *P. kazeruni* (99.4%), *P. papatasi* (65.2%), *P. sergenti* (97%), *S. africana* (83.3%), *S. baghdadis* (98.7%), *S. christophersi* (99.7%), *S. clydei* (62.5%), *S. hodgsoni* (99.7%), *S. mervynae* (98.7%) and *S. tiberiadis* (99.3%) were mainly distributed in the hilly and mountainous areas (Figs. 1 and 2).

DISCUSSION

Both forms of cutaneous and visceral leishmaniasis are endemic in Iran and so determining the fauna of sandflies in different parts of the country indicates the potential for establishment of a new focus of the disease. In the current survey, 13 sandfly species were identified for the first time from Nikshahr county. These include *P. bergeroti*, *P. eleanorae*, *P. keshishiani*, *P. halepensis*, *S. hodgsoni*, *S. christophersi*, *S. mervynae*, *S. dentata*, *S. dreyfussi*, *S. iranica*, *S. africana*, *S. grekovi* and *S. palestinensis*. These species must add to 22 sandfly species of the province that have been reported in previous

studies^{11,13}.

In the current study, five proven vectors of cutaneous and visceral leishmaniasis in Iran, *P. papatasi*, *P. salehi*, *P. sergenti*, *P. alexandri* and *P. keshishiani* were collected. These species are reported as vectors of leishmaniasis in different parts of Iran^{6,8, 14-17}. A newly reported focus of ZCL is located in Mirjaveh district¹⁰, north-east of Nikshahr, although another study showed the disease is endemic in Chabahar and Konarak counties, south of the study area¹¹. In these foci, gerbil burrows housing *Meriones hurrianae* and *Tatera indica* can be found frequently. Kasiri and Javadian¹⁶ reported the natural leptonad infection of *P. papatasi* and *P. salehi* from the gerbil burrows of Chabahar county. This may be an alarm for extension of ZCL to neighbor counties, such as Nikshahr, because of the migration behavior of the gerbils.

The number and species of sandflies collected in the mountainous and hilly area was more than that of plain area. This may be due to bionomics of the captured sandflies, while the mountainous area has different micro-habitats for reproduction of these insects. Due to limited availability of congenial environmental conditions and breeding habitats in the plain area, less number of species are reported than the mountainous area.

South-eastern corner of Iran is located in the oriental region of the world, like Pakistan, Bangladesh and India. Check-list of phlebotomine sandflies in Baluchistan of Pakistan, close to our study area shows 23 species including 7 *Phlebotomus* and 16 *Sergentomyia*¹⁸. A study on sandflies in arid and semi-arid areas of Rajasthan of India

reported 14 species, among them *P. papatasi*, *P. sergenti*, *S. clydei*, *S. baghdadis* and *S. christophersi*¹⁹ were common in the collected species. Sandfly fauna of an endemic focus for visceral leishmaniasis in Bangladesh includes 9 species²⁰. Some species of our study are the same with the above mentioned surveys.

Illegal immigration from Afghanistan and Pakistan, where the cutaneous leishmaniasis is endemic,^{21,22} to the Nikshahr is another potential risk factor for establishing the cutaneous leishmaniasis in the area, because both *P. sergenti* and *P. papatasi*, the vectors of *L. tropica* and *L. major* are present in this part of the country.

More detailed studies on leptomonad infection of the suspected vector species, fauna and parasitic infection of the potential reservoir hosts of the cutaneous leishmaniasis are suggested to find the epidemiological aspects of the disease in this county.

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