



Fauna and the distribution of Phlebotominae sand flies (Diptera: Psychodidae) in Sanandaj County, Kurdistan Province, west of Iran, 2017

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Original Article

Abstract

BACKGROUND: Phlebotominae sand flies, belonging to Psychodidae family, are very important because some species of them are biological vector of cutaneous and visceral leishmaniasis in Iran. An investigation was carried out in Sanandaj County, west of Iran, to evaluate the fauna, sex ratio, and species combination.

METHODS: The samples collected using sticky traps from indoors and outdoors of 5 villages in year 2017. The traps were fixed before sunset, and collected at sunrise in the morning of the next day. The collected sand flies preserved in 70% ethanol and mounted, using Puri's medium, and identified using the keys of Iranian sand flies.

RESULTS: Totally, 907 sand flies comprising Phlebotomus genus (58%) and Sergentomyia genus (42%) were captured. The collected sand flies consisted of: Phlebotomus papatasi, Phlebotomus perfilliwei, Phlebotomus major, Phlebotomus kandellakii, Phlebotomus sergenti, Sergentomyia sintoni, Sergentomyia dentata, Sergentomyia antennata, and Sergentomyia theodori. Phlebotomus papatasi, Sergentomyia dentata and Sergentomyia sintoni were predominant species, respectively.

CONCLUSION: The high abundance of sand flies especially Phlebotomus papatasi can lead to incidence and prevalence of leishmaniasis disease in this region. So, the complementary studies especially, polymerase chain reaction (PCR) studies are suggested to evaluate the infection rate of Leishmania parasite in sand flies and rodents.

KEYWORDS: Animals, Sand Fly, Leishmaniasis, Population Density, Iran

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Introduction

Leishmaniasis is still one of the most important diseases that affect the poorest people in the world, especially in developing countries. The disease can be chronic. It is estimated that 350 million people are at risk and about

2 million new cases are affected every year; of which, about 1.5 million are cutaneous, and the rest are visceral.^{1,2}

The disease is caused by protozoa of the genus Leishmaniasis, and is one of the 10 major diseases in the World Health Organization (WHO) context.³ Leishmaniasis is transmitted to humans by some species of female sand flies, and are present in four

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continents except Australia. The disease is currently occurring in 98 countries, and is common in a region with a very different topography.^{1,2,4}

Phlebotominae sand flies are belonging to Psychodidae family, and they contain six genera. In the old world, 3 genera including *Phlebotomus* (13 subgenera), *Sergentomyia* (10 subgenera), and *Chinius* (4 species) are found.⁵ There are more than 900 species and subspecies of sand flies in the world; but less than 10% of them transmit leishmania parasite to humans in old and new world.⁶⁻⁸ Sand flies are also vectors to some viruses such as sand fly fever virus.

Study about Iranian sand flies has begun since 1930 by a limited number of entomologists such as Adler *et al.* They have studied some parts of Iran such as Kermanshah and Hamadan in the west of Iran.⁹ The basic studies on Iranian sand flies was done by Mesghali in 1943.¹⁰ Based on IrSandflybase, 50 species of sand flies are distributed in Iran.¹¹ Studies by some researchers about Iranian sand flies indicate that some species of sand flies are distributed.¹²⁻¹⁷ Many studies conducted that, faunistic studies of insects as the vectors of arthropod-borne diseases are necessary prior for ecological, epidemiological, and biological researches.^{5,6,18} This research aimed to determine sand fly fauna and their distribution in Sanandaj County, west Iran, in 2017.

Materials and Methods

This was a cross-sectional study, carried out in 2017. The place of the study was 5 villages of Sanandaj County in Kurdistan Province. During June to October 2017, 5 villages including Naisar, Sarbghamish, Kani Moshkan, Dadaneh, and Doshan were surveyed monthly.

Sand flies were collected using sticky traps (castor oil-coated white papers 20 × 30 cm) from indoors (bedrooms, halls, toilets and stables), and outdoors (rodent burrows,

mountains and rock rifts) of 5 replicates as 30 traps/village/time. The traps were set 1 hour before sunset, and were collected before sunrise in the next day.

The collected specimens were removed by needle, and put in acetone to wash the oil on their bodies; and then transferred and preserved in 70% ethanol. All specimens mounted as permanent microscopy slides, using Puri's medium.¹⁹ Sex ratio of all species was calculated based on: (No. of males/No. of females) × 100.

Results

Totally, 907 sand flies collected and identified. 576 specimens (63.5%) were male, and the others were female. 526 of the total collected sand flies (58%) were *Phlebotomus* genus, and 42% of collected sand flies were *Sergentomyia* genus. Totally, 9 species (5 species of *Phlebotomus* and 4 species of *Sergentomyia*) were identified. The most common species was *Phlebotomus papatasi* (45.2%), followed by *Sergentomyia dentata* (16.9%), *Sergentomyia sintoni* (12.3%), and *Sergentomyia antennata* (10.2%). The lowest frequency of the collected sand flies was observed in *Phlebotomus kandellaki* (Table 1). The highest sex ratio showed in *Phlebotomus papatasi* (233.3), followed by *Sergentomyia antennata* (220.7).

465 sand flies (51.3%) were collected from indoors, and 442 (48.7%) from outdoors. The highest frequency of caught sand flies from indoors and outdoors, was due to *Phlebotomus papatasi* (69.5%) and *Sergentomyia dentata* (25.8%), respectively (Table 2).

Discussion

The results of the present study showed that 9 species of sand flies were distributed in this county; that 5 of them were *Phlebotomus* and 4 of them were *Sergentomyia*. *Phlebotomus papatasi* was the most predominant species in this study; that is similar to previous studies in Iran.^{5,6,12-17,20,21}

Table 1. Species composition, abundance, and sex ratio of phlebotominae sand flies in Sanandaj County, west of Iran, in 2017

Species	Number			Relative frequency (%)			Sex ratio
	Male	Female	Total	Male	Female	Total	
Phlebotomine papatasi	287	123	410	49.8	37.2	45.2	233.3
Phlebotomine perfiliewi	10	6	16	1.7	1.8	1.8	166.7
Phlebotomine kandelakii	3	2	5	0.5	0.6	0.6	150.0
Phlebotomine major	18	22	40	3.1	6.6	4.4	81.8
Phlebotomine sergenti	34	21	55	5.9	6.3	6.1	161.9
Sergentomyia dentata	89	64	153	15.4	19.3	16.9	139.1
Sergentomyia antennata	64	29	93	11.1	8.8	10.2	220.7
Sergentomyia theodori	8	15	23	1.4	4.5	2.5	53.3
Sergentomyia sintoni	63	49	112	10.9	14.8	12.3	128.6
Total	576	331	907	100	100	100	-

The species were collected from all places both indoors and outdoors in all months from June to October. This is the second report of sand flies fauna in this part of Iran. The first study was conducted in 2005, 11 species including 6 species of *Phlebotomus* genus and 5 species of *Sergentomyia* genus were reported (Vahabi and Yaghoobi-Ershadi, unpublished data).

In a study in Jask County, Iran, eight species including 3 species of *Phlebotomus* and 5 species of *Sergentomyia* were identified as the fauna of the region.²² In another study in Yazd and its outskirts, Iran, 10 species including 9 species of *Phlebotomus*, and only one specimen of *Sergentomyia* were collected and identified.⁶ In that research, 69.2% of the collected sand flies were the *Phlebotomus* genus

that is similar to the finding of the present study.

The five species of the collected *Phlebotomus* are the vectors of cutaneous and visceral leishmaniasis in Iran. The abundance of these species, especially *Phlebotomus papatasi* and *Phlebotomus sergenti* that identified as the main vectors of zoonotic and anthroponotic cutaneous leishmaniasis (ZCL and ACL) in Iran can be a danger to the spread of the disease in these areas. *Phlebotomus papatasi* was collected in all places of five villages from indoors and outdoors. This finding suggests that there is possibility for transmitting of ZCL in this county, provided that there are other effective factors in disease transmission. Leishmaniasis, if left untreated, can even be annoying, like brucellosis.²³

Table 2. Phlebotomine sand flies collected from Indoor places and Outdoor places, Sanandaj County, west of Iran, in 2017

Species	Indoors			Outdoors		
	Male	Female	Total (%)	Male	Female	Total (%)
Phlebotomine papatasi	215	108	323 (69.5)	72	15	87 (19.7)
Phlebotomine perfiliewi	6	3	9 (1.9)	4	3	7 (1.6)
Phlebotomine kandelakii	1	2	3 (0.6)	2	0	2 (0.4)
Phlebotomine major	7	16	23 (4.9)	11	6	17 (3.8)
Phlebotomine sergenti	23	17	40 (8.6)	11	4	15 (3.4)
Sergentomyia dentata	25	14	39 (8.4)	64	50	114 (25.8)
Sergentomyia antennata	21	7	28 (6.1)	43	22	65 (14.7)
Sergentomyia theodori	0	0	0 (0)	8	15	23 (5.2)
Sergentomyia sintoni	0	0	0 (0)	63	49	112 (25.4)
Total	298	167	465 (100)	278	164	442 (100)

Conclusion

The high frequency of *Phlebotomus papatasi* can be a warning for the emergence of ZCL in this county. Further studies on the ecological, biological, and epidemiological status of sand flies and leishmaniasis are recommended.

Conflict of Interests

Authors have no conflict of interests.

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