



## Ecological Study of Cutaneous Leishmaniasis Vectors in West of Iran

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### ABSTRACT

In recent years the number of reported cases of cutaneous leishmaniasis in Lorestan province, western, Iran has taken an upward turn and some cases of disease have also been reported from Poledokhtar, Boroujerd and Doroud counties. It seems that Poledokhtar County is one of the endemic foci of the disease. Awareness of the ecological situation of the sandflies has a critical role in the control of Leishmaniasis disease. This study aimed to investigate the ecology of vectors of cutaneous leishmaniasis in the Lorestan province, western Iran. In the present study the sandflies were collected and identified once every two weeks using sticky traps installed in human dwellings, animal dwellings and rodent nests. Our aim was identifying the species of leishmaniasis vectors, the abundance of sand flies to sticky traps and seasonal activities of sandflies. To determine the genus and species, the sand flies were placed on a slide containing a drop of 9 per thousand physiologic serum. After installing 1274 sticky traps a total of 4449 Phlebotomus sandflies were collected and identified from the predetermined locations. In order to determine the fauna. From all the samples collected 2696 (60.60%) were male and 1753 (39.40%) were female. 1562 (35.11%) sandflies were collected from indoor dwellings and 2887 (64.89%) were collected from outdoor dwellings. The female phlebotomus Papatasi species was determined as the dominant genus of the region with 3036 cases. These insects can be a vector of cutaneous leishmaniasis.

**Keywords:** Ecology, sand flies, *Phlebotomus*, Cutaneous Leishmaniasis

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### INTRODUCTION

The certain and main vector of Zoonotic Cutaneous Leishmaniasis (ZCL) in most local foci of disease in countries such as Turkmenistan, Uzbekistan, Saudi Arabia, Iran, Morocco and Tunisia is the phlebotomus Papatasi [1-7]. In all the studies that have taken place on the vector of leishmaniasis disease in Iran, the Phlebotomus Papatasi sand fly has been reported as the primary and proven vector of the disease [8-15]. Besides this species other sand flies have been reported as vectors of parasites in the rodents in rural areas of the country such as P. (Paraphlebotomus) alexandri, P.(Para), anderjevi, P.(Para), caucasicus, P.(Para), mongolensis, P.(Synphlebotomus) ansarii [16-23]. Phlebotomus habitats are varied, however they are most active in the tropical and sub-tropical areas and few have infiltrated temperate regions as well. Mesghali et al identified 12 species of phlebotomus and 11 species of Sergentomyia in Iran in 1961[24]. In a study carried out in 1975 by Javadian et al, they reported 42 species of

sandflies in Iran [25]. Rasi et al. have also reported 44 species of sandflies [26]. Azizi et al. have identified 25 species (14 *Phlebotomus*) as the fauna in Mamasani County, Fars province, Iran [27].

### EXPERIMENTAL SECTION

Due to residential properties in the villages around the cities were made mostly of brick or stone, mortar and mud the capturing and collecting of the sandflies was done using the sticky trap method once every 15 days in indoor and outdoor dwellings. In order to build the sticky traps, white A4 paper with dimensions of 20 x15, soaked in castor oil was used. In each county three houses with good dispersion were chosen as the indoor dwellings, in the villages of Verah zard and Sarab Hamam and the border of Poledokhtar city from Poledokhtar county and the villages of Khosroabad and Meidan from Doroud county and the Villages of Bozazna and Darbe Astaneh from Bourujerd county. Seams and gaps in the hills (especially rodents' nests) and the outer walls of the buildings and the nests of poultry were determined as the outdoor dwellings. In all the cases we would head to three predetermined residential units one hour before sunset and place 10 sticky traps per residential unit, in living rooms, bedrooms, toilets, aisles and animal dwellings as the indoor dwellings. At the same time 30 traps were installed outside the residential units in front of the cracks in the rocks and wild animals' nests. In all the cases the morning after the traps were installed the sticky traps were collected before sunrise and sent to the laboratory for the identification of the sandflies species. Then the sandflies were transferred to acetone for a few seconds using special entomology needles in order to be degreased and after that transferred to tubes containing 70% ethanol for maintenance. A puri-media was used to fix and identify the sandflies species.

After preparation of microscopic slides of sand flies the species were determined using the sand flies recognition keys of Iran. In order to identify the species and monthly activities of the vectors, the trapping and collecting operations continued from April to December once every 15 days.

This study was carried out in Lorestan province on the vectors of Leishmaniasis in order to prepare for Disease Control and care programs. As the incoming patients with cutaneous Leishmaniasis come to health centers from endemic areas from other provinces in the country and on the other hand in two of the counties of the province (kouhdasht and Poledokhtar) the transmission of the disease is also reported as endemic and also considering the new cases of cutaneous Leishmaniasis in the county of Khorramabad, Lorestan province that is neighbor of kouhdasht and Poledokhtar counties therefore carrying out this study in order to identify vectors and the fauna of sandflies and similar studies seem absolutely necessary [28-35].

### RESULTS

In the present study after installing 1274 sticky traps a total of 4449 *Phlebotomus* sandflies were collected and identified from the predetermined locations In order to determine the fauna. From all the samples collected 2696 (60.60%) were male and 1753 (39.40%) were female. 1562 (35.11%) sandflies were collected from indoor dwellings and 2887 (64.89%) were collected from outdoor dwellings (Tables 1-3).

**Table 1: Prevalence of *Phlebotomus* Genus and species that were collected from Poledokhtar county, Lorestan province, Iran**

Species	Gender				Collecting place				Total	
	Male		Female		Indoor dwellings		Outdoor dwellings		No	%
	No	%	No	%	No	%	No	%		
<i>P. papatasi</i>	815	54.70	675	45.30	437	29.33	1053	70.67	2980	<b>61.88</b>
<i>P. sergenti</i>	279	66.75	139	33.25	195	46.65	223	53.35	836	<b>17.36</b>
<i>P. alexandri</i>	167	71.67	66	28.33	69	29.61	164	70.39	466	<b>9.68</b>
<i>P. tobbi</i>	79	66.95	39	33.05	47	39.83	71	60.17	236	<b>4.90</b>
<i>P. major</i>	38	53.52	33	46.48	16	22.54	55	77.46	142	<b>2.95</b>
<i>P. andreievi</i>	31	73.81	11	26.19	10	23.81	32	76.19	84	<b>1.74</b>
<i>P. caucasicus</i>	12	70.59	5	29.41	4	23.53	13	76.47	34	<b>.71</b>
<i>P. ansari</i>	10	90.91	1	9.09	2	18.18	9	81.82	22	<b>.45</b>
<i>P. mongolensis</i>	6	75.00	2	25.00	0	0	8	100.00	16	<b>.33</b>
<b>Total</b>	<b>1437</b>	<b>59.68</b>	<b>971</b>	<b>40.32</b>	<b>780</b>	<b>32.39</b>	<b>1628</b>	<b>67.61</b>	<b>4816</b>	<b>100</b>

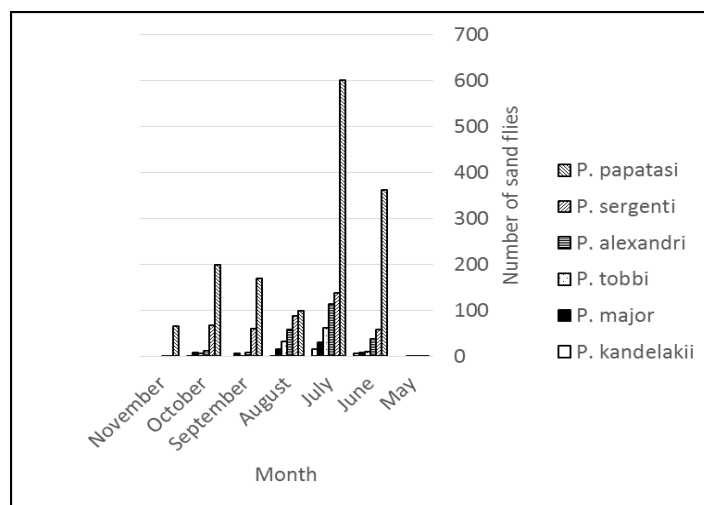
Table 2: Prevalence of *Phlebotomus* Genus and species that were collected from Boroujerd county, Lorestan province, Iran

Species	Gender				Collecting place				Total	
	Male		Female		Indoor dwellings		Outdoor dwellings			
	No	%	No	%	No	%	No	%	No	%
<i>P. papatasi</i>	420	60.09	279	39.91	245	35.05	454	64.95	1398	<b>64.96</b>
<i>P. sergenti</i>	115	70.55	48	29.45	65	39.88	98	60.12	326	<b>15.15</b>
<i>P. alexandri</i>	65	65.66	34	34.34	36	36.36	63	63.64	198	<b>9.20</b>
<i>P. tobbi</i>	29	53.70	25	46.30	21	38.89	33	61.11	108	<b>5.02</b>
<i>P. major</i>	16	72.73	6	27.27	7	31.82	15	68.18	44	<b>2.04</b>
<i>P. kandelakii</i>	11	57.89	8	42.11	8	42.11	11	57.89	38	<b>1.77</b>
<i>P. caucasicus</i>	7	63.64	4	36.36	2	18.18	9	81.82	22	<b>1.02</b>
<i>P. ansari</i>	5	83.33	1	16.67	0	0	6	100	12	<b>.56</b>
<i>P. halpensis</i>	3	100	0	0	0	0	3	100	6	<b>.28</b>
<b>Total</b>	<b>671</b>	<b>62.36</b>	<b>405</b>	<b>37.64</b>	<b>384</b>	<b>35.69</b>	<b>692</b>	<b>64.31</b>	<b>2152</b>	<b>100</b>

Table 3: Prevalence of *Phlebotomus* Genus and species that were collected from Doroud county, Lorestan province, Iran

Species	Gender				Collecting place				Total	
	Male		Female		Indoor dwellings		Outdoor dwellings			
	No	%	No	%	No	%	No	%	No	%
<i>P. papatasi</i>	361	61.92	222	38.08	257	44.08	326	55.92	1166	<b>60.73</b>
<i>P. sergenti</i>	95	55.23	77	44.77	67	38.95	105	61.05	344	<b>17.92</b>
<i>P. alexandri</i>	41	56.94	31	43.06	29	40.28	43	59.72	144	<b>6.98</b>
<i>P. tobbi</i>	39	59.09	27	40.91	22	33.33	44	66.67	132	<b>6.87</b>
<i>P. major</i>	20	60.61	13	39.39	14	42.42	19	57.58	66	<b>3.44</b>
<i>P. kandelakii</i>	13	76.47	4	23.53	5	29.41	12	70.59	34	<b>1.77</b>
<i>P. caucasicus</i>	9	81.82	2	18.18	3	27.27	8	72.73	22	<b>1.15</b>
<i>P. ansari</i>	7	87.50	1	12.50	1	12.50	7	87.50	16	<b>.83</b>
<i>P. halpensis</i>	3	100	0	0	0	0	3	100	6	<b>.31</b>
<b>Total</b>	<b>588</b>	<b>60.93</b>	<b>377</b>	<b>39.07</b>	<b>398</b>	<b>41.24</b>	<b>567</b>	<b>58.76</b>	<b>1930</b>	<b>100</b>

The results of this study show that in all the counties the abundance of *Plebotomus Papatasi* was higher than all the species of *Phlebotomus* and the highest amount captured was from Poledokhtar County and *Phlebotomus sergenti* and *Phlebotomus alexandri* in order had the highest abundance after *P. papatasi* between the species of the *Phlebotomus* genus captured. The abundance of the other species captured with regard to male and female and indoor and outdoor dwellings are shown in Table 1, 2, 3. The seasonal and monthly activities of the sandflies with regard to the species and genus and places of capture are shown in Figures 1, 2, 3.

Figure 1: Monthly prevalence of *Phlebotomus* sand flies from May to November, Poledokhtar county, Lorestan province, Iran

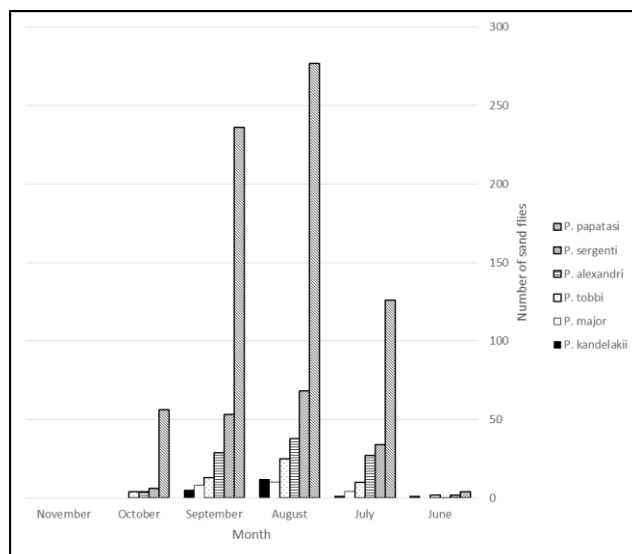


Figure 2: Monthly prevalence of *Phlebotomus* sand flies from June to November, Boroujerd country, Lorestan Province, Iran

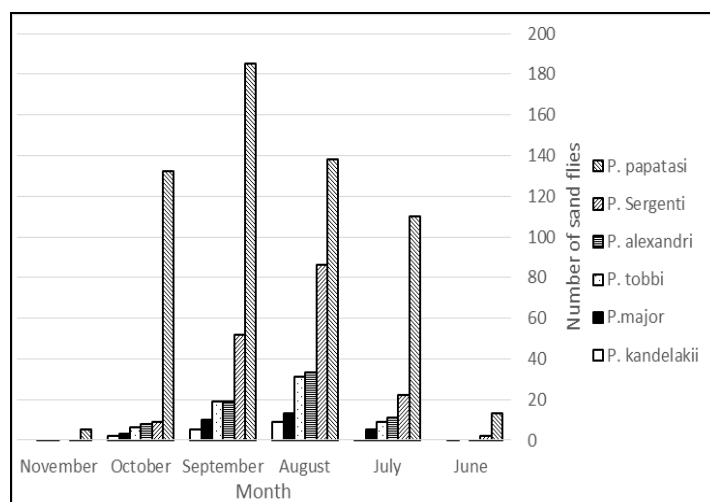


Figure 3: Monthly prevalence of *Phlebotomus* sand flies from June to November, Doroud country, Lorestan Province, Iran

## DISCUSSION AND CONCLUSION

In the present study Poledokhtar county which is one of the southern counties of the province and has a subtropical climate and also Boroujerd and Doroud counties which are located at the north east and north west of the province with a temperate climate were chosen for this study and a total of 1274 sticky traps were installed in the indoor and outdoor dwellings. The female *Phlebotomus Papatasi* was identified as the regions dominant species with 1176 (12.67%). The study of Leishmaniasis vectors and identifying the sandflies fauna seems very important as a prelude to many epidemiological and ecological studies. Due to climatic and weather conditions of this area there is a high diversity of fauna conditions, so results of this study can be used in the design hypothesis for epidemiology and disease vectors. The *P. papatasi* and *P. sergenti* are known vectors of cutaneous Leishmaniasis in Iran [7-14]. Aghasi and Sharifi identified two species of *Phlebotomus* in their study carried out in Bam [36].

In the study carried out by Berenji et al. in the northern parts of Mashhad County two species of the *Phlebotomus* genus were identified [37]. Doroudgar et al. identified 11 species of sandflies belonging to the *Phlebotomus* genus in Kashan County [38]. In the study carried out by Azizi and Fekri 3 species of the *Phlebotomus* genus were identified as the sand fly fauna of Jasak County in Hormozgan province [39, 40]. There is a high chance that the *P. papatasi* or *P. sergenti* can be introduced as the main vectors for Cutaneous Leishmaniasis in the region. Due to the prevalence of the disease with local transmission patterns in the city of Poldokhtar and significant numbers of incoming cases in other parts of the province (especially cases coming from other provinces and recognition of areas of potential development of epidemics in the province in terms of geographical location and abundance of vectors of disease and displacement, Cutaneous leishmaniasis disease would be a major health problem in the region over the coming years and countering the expansion would require a multi-jurisdictional approach with the use of existing facilities to reduce the adverse health and social effects of the disease.

Poledokhtar County the parasite of the disease exists and the spread of it is slow. In Poledokhtar County with consideration of the low distances between villages (less than 5 kilometers) there is a serious threat for this county in the upcoming years which stresses the need for more attention from the authorities.

As can be seen in the Figures the sandflies were inactive during the autumn and winter seasons. The sandflies activity in Poledokhtar County in south Lorestan province which has a warm climate started from May and continued until November and the maximum activity and population was in July and with the weather getting colder in autumn their activity reduces (Figure 1).

In Boroujerd and Doroud counties that have a temperate climate the sandflies are inactive 6 months of the year (autumn and winter) and their activity starts in June with the warming of the weather. In Boroujerd county the maximum activity and population is in August (Figure 2) and in Doroud County in September (Figure 3) and the activity reduces with the colder weather and reaches its minimum in November.

Nine species of the *Phlebotomus* genus were identified in Boroujerd and Doroud counties which have a similar climate. The species diversity in both counties are similar. Nine species were also identified in Poledokhtar County which has a warm climate. Instead of the *P. halepensis* and *P. kandelakii* that were identified in Boroujerd and Doroud counties, two other species were identified called *P. mongolensis* and *P. andreievi* which shows that different climate conditions can cause species diversity but the abundance and monthly activities of the mentioned four species mentioned are much less compared to the *P. papatasi*, *P. sergenti*, *P. alexandri*, *P. tobbi* and *P. major* therefore have less importance in disease transmission (Tables 1-3).

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