

An Entomological survey of Phlebotomine Sand flies (Diptera: Psychodidae) in Ravansar County, Kermanshah Province, West of Iran

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Abstract: Phlebotomine sand flies are biological vectors of leishmaniasis in some regions of Iran. In order to determine fauna and species combination of sand flies, an investigation was carried out in Ravansar County, Kermanshah Province, west of Iran. Sand flies collected in 3 villages of Ravansar County from June to October of 2008. The specimens were collected, using 900 sticky traps. Collected sand flies conserved in 70% ethanol and mounted in Puri's medium. To identification of specimens, key of sand flies was used. Totally 4645 (57.6% male and 42.4% female) from outdoors (58%) and indoors (42%) were collected and 9 species including *Phlebotomus papatasi*, *P. alexandri*, *P. sergenti*, *P. major*, *P. perfilliwi*, *Sergentomyia sintoni*, *S. dentata*, *S. antennata* and *S. theodori* were identified. *P. papatasi* was predominant species in the region with 51.2% all of collected sand flies and *S. theodori* with 0.2% of all specimens had the lowest frequency in this area. It is recommended to eliminate rodents, especially wild rodents at least 300-500 meters around the villages. Health education about use of bed nets in the evening can prevent the residents from sand flies bites.

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Introduction

Sand flies are insects that are belonging to Order of Diptera and Subfamily of Phlebotominae. *Phlebotomus* genera are the vectors of leishmaniasis in old world including Iran. About 30 species of sand flies are proven vectors to about 20 species of leishmania parasites (Motovali Emami & Yazdi 2008, Kavarizadeh et al. 2013, Rassi et al., 2004; Yaghoobi-Ershadi, 2012, Rassi et al. 2006, Rassi et al. 2007, Rassi et al. 2008, Rassi et al. 2011). Study about of Iranian sand flies has been started since 1930 by foreign researchers such as Adeler, Teodor and Louri (Yaghoobi-Ershadi, 2012). The first attempt for comprehensive entomological survey in Iranian sand flies fauna had been done by Mesghali in 1943. In this study 11 species of *Sergentomyia* and 12 species of *Phlebotomus* were reported (Seyyedi-Rashti & Nadim 1992). Another study in 1975 had revealed that there were 42 species of Phlebotomine sand flies (Javadian and Nadim 1975). Another study showed 54 species of sand flies (Kassiri et al. 2000). Rassi and Hanafi-Bojd reported 44 confirmed species and 10 unconfirmed species as Iranian phlebotomine sand flies (Rassi & Hanafi-Bojd 2006). Studies in many parts of Iran by Iranian Entomologists revealed

that in any region of the country, some species of sand flies are distributed (Kavarizadeh et al., 2013; Motovali Emami et al., 2008; Nazari & Zahirnia, 2012; Akhoundi et al., 2013; Abdoli et al., 2007; Hazratian et al., 2011; Farzin-Nia & Hanafi-Bojd, 2007). The literature review about sand flies fauna revealed that there was not any published article about this insect in this county, so this study was conducted to determinate sand flies fauna, relative population density and sex ratio of sand flies in Ravansar County, Kermanshah province, west of Iran.

Materials & Methods

Study area

The survey was carried out in 2008 in Ravansar County (34°45'N 46°41'E). Ravansar County is located in 55 Km from Kermanshah province with almost cold and humid climate. The population of this county was 45324 in 2008. Ravansar County is about 1140 square kilometers. The lowest temperature in winter was 1.3°C and the highest temperature in summer was 30.5°C (I.R. Iran Meteorological Organization 2008). The majority of people's occupations in this county are agriculture and livestock farming.

Sand flies collection & identification

Sand flies were collected from June to October of 2008. The samples were collected from 3 villages of Ravansar County including Birda, Tappeh Lori and Tappeh Kuik. The specimens were collected with sticky traps (castor oil-coated white papers 20 cm×30 cm) from outdoors including (30 traps/village/time) and indoors (30 traps/village/time) of 5 replicates. The traps were set at sunset and collected before sunrise of the next day. Collected sand flies were removed from sticky traps by insect needle, rinsed in acetone and then conserved in 70% ethanol. All specimens mounted as permanent microscopy slides, using Puri's medium (Smart et al. 1965). The sex ratio of all sand flies collected were determined and identified, using key of sand flies (Nadim and Javadian 1976, Lewis 1982, Seyed-Rashti and Nadim 1992). Table 1 shows Climatological condition of Ravansar County during sampling specimens in 2008.

Table 1: Climatological conditions of Ravansar County, 2008

Month	Temperature (°c)		Relative humidity (%)	
	Max	Min	Max	min
June	31.7	15.8	36	10
July	34.9	20.4	28	7
August	38	22.3	28	7
September	33.9	18.5	40	11
October	27.3	11.2	46	13

Results

In the present study, 4645 sand flies (57.6% male and 42.4% female) were collected of which 2695 (58%) from outdoors and 1950 (42%) from indoors. 9 species of sand flies (5 species of *Phlebotomus* and 4 species of *Sergentomyia*) were

recognized. The most frequent species was *P.papatasi* (51.2%) followed by *S.dentata* (16.9%) and *S.sintoni* (13.7%). *P.papatasi* was dominant species in the region that formed 76.7% and 32.8% of total collected sand flies in indoors and outdoors respectively. Among *Sergentomyia* species, *S.dentata* was dominant sand fly in outdoors with 28.5% of total collected sand flies from outdoors places. *S.theodori* had the lowest frequency with only 0.2% of total collected sand flies (Tables 2- 4). The sex ratios (number of males/females × 100) of *P.papatasi*, *S.dentata* and *S.sintoni* in indoors were 132.7, 183.3, 187.5 and in outdoors were 146.6, 144.3, 118.9, respectively.

Discussion

In the present survey, 5 species of *Phlebotomus* and 4 species of *Sergentomyia* were collected. This is the first report of sand flies fauna in this region. *P.papatasi* was the prevalent species in this survey that is similar to other studies in Iran (Kavarizadeh et al. 2013, Kassiri et al. 2011, Motovali Emami & Yazdi 2008, Lewis et al. 1961, Nazari & Zahirnia 2012, Akhondi et al. 2013, Hazratian et al. 2011) but it is different to another studies in Iran (Kassiri and Javadian 2012, Abdoli et al. 2007, Kassiri et al. 2011a, Farzin-Nia & Hanafi-Bojd 2007) that *P.papatasi* was not the predominant species. Cross et al. (1996) have reported that *P.papatasi* was the most abundant species in areas with mean minimum temperature of 16°C and maximum temperature of 44°C from May to October. In the present study *P.papatasi* collected in June with min temperature of 15.8°C and max temperature of 27.3°C in October (June-October) that is similar to other studies (Kavarizadeh et al. 2013, Motovali Emami & Yazdi 2008, Abdoli et al. 2007, Hazratian et al. 2011).

Table 2: Number of collected Sand flies from outdoors and indoors in Ravansar county, Kermanshah province due to species of sand flies, 2008(1-Male; 2-Female)

Place Species	Birda				Tappeh Lori				Tappeh Kuik				Total
	Indoors		Outdoors		Indoors		Outdoors		Indoors		Outdoors		
	M ¹	F ²	M	F	M	F	M	F	M	F	M	F	
<i>P.papatasi</i>	257	232	211	126	432	312	187	167	164	99	127	65	2379 (51.2)
<i>P.alexandri</i>	0	0	8	4	0	0	2	1	0	0	3	2	20 (0.4)
<i>P.major</i>	34	27	21	17	20	16	27	19	24	20	11	8	244 (5.2)
<i>P.sergenti</i>	24	19	27	21	28	23	18	15	14	11	10	7	217 (4.7)
<i>P.perfiliwii</i>	29	23	33	27	41	29	15	11	17	15	26	16	282 (6.1)
<i>S.sintoni</i>	12	7	126	114	0	0	103	79	3	1	105	88	638 (13.7)
<i>S.dentata</i>	4	2	176	123	0	0	112	97	7	4	165	94	784 (16.9)
<i>S.antennata</i>	0	0	5	3	0	0	23	14	0	0	19	9	73 (1.6)
<i>S.theodori</i>	0	0	2	1	0	0	4	1	0	0	0	0	8 (0.2)
<i>Total</i>	360	310	609	436	521	380	491	404	229	150	466	289	4645(100)

Table 3: Sex Ratio in collected sand flies from Ravansar county, Kermanshah province due to Species of sand flies, 2008

Gender Species	Male			Female			Sex Ratio		
	indoors	Outdoors	total	Indoors	outdoors	Total	indoors	Outdoors	Total
<i>P.papatasi</i>	853	525	1378	643	358	1001	132.7	146.6	137.7
<i>P.alexandri</i>	0	13	13	0	7	7	0	185.7	185.7
<i>P.major</i>	78	59	137	63	44	107	123.8	134.1	128
<i>P.sergenti</i>	66	55	121	53	43	96	124.5	127.9	126
<i>P.perfiliwii</i>	87	74	161	67	54	121	129.8	137	133
<i>S.sintoni</i>	15	334	349	8	281	289	187.5	118.9	120.8
<i>S.dentata</i>	11	453	464	6	314	320	183.3	144.3	145
<i>S.antennata</i>	0	47	47	0	26	26	0	180.8	180.8
<i>S.theodori</i>	0	6	6	0	2	2	0	300	300
<i>Total</i>	1110	1566	2676	840	1129	1969	132.1	138.7	135.9

Table 4: Sand flies collected from Ravansar county, Kermanshah province due to month of collection, 2008

Species \ Month	June	July	August	September	October	Total (%)
<i>P.papatasi</i>	621	232	876	542	108	2379 (51.2)
<i>P.alexandri</i>	5	0	12	3	0	20 (0.4)
<i>P.major</i>	34	31	93	49	37	244 (5.2)
<i>P.sergenti</i>	26	27	72	54	38	217 (4.7)
<i>P.perfiliwii</i>	49	41	101	52	39	282 (6.1)
<i>S.sintoni</i>	129	105	209	121	74	638 (13.7)
<i>S.dentata</i>	154	137	240	139	114	784 (16.9)
<i>S.antennata</i>	14	11	21	17	10	73 (1.6)
<i>S.theodori</i>	0	3	3	2	0	8 (0.2)
<i>Total</i>	1032	587	1627	979	420	4645(100)

P.alexandri that is present in some parts of the world from sea level to 1500 m above sea level including coastal plain, inland plateau and highland valleys from Spain and Morocco east to the mountains in northwestern China as far south as southern Ethiopia and Djiboti (Fryauff et al. 1995, Maroloi et al. 2001, Kamal et al 2003) was collected in outdoors places of this region. This species is rare species in some parts of Iran including highlands and plains (Rassi & Hanafi-Bojd 2006). In our study, this insect was collected only in outdoors places with 0.4% of total collected sand flies. Doroudgar et al. (1999) reported 17 species of sand flies including 11 species of *Phlebotomus* and 6 species of *Sergentomyia* from Kashan County. Saghafipour et al. (2000) reported 7 species of sand flies including 3 species of *Phlebotomus* and 4 species of *Sergentomyia* that *P. papatasi* was the prevalent species of them that is similar to our findings. All of collected *Phlebotomus* species in this region are vectors of Cutaneous and Visceral leishmaniasis in some parts of Iran, it is suggested that studies should be conducted in this area to evaluate leishmania infection of this insect especially in rodents. The high abundance of *P.papatasi* in this region can be a

burglar alarm for incidence of leishmaniasis in this area. It is recommended to eliminate rodents, especially wild rodents at least 300-500 meters around the villages. Health education about use of bed nets in the evening can prevent the residents from sand flies bites.

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