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PHLEBOTOMINE SANDFLIES (DIPTERA: PSYCHODIDAE) FAUNA SURVEY IN EJHAWAT, LIBYA

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Eleven species of sandflies were collected from Ejhawat area. Seven species were belonged to the genus *Phlebotomus*, namely, *Phlebotomus papatasi, P. sergenti, P. alexandri. P. chabaudi, P. longicuspis. P. langeroni* and *P. orientalis*. Four species were belonged to the genus *Sergentomyia*, namely, *Sergentomyia minuta, S. fallax, S antennata*, and *S. clydei*. Collections were made by using sticky paper traps, (CDC miniature light traps and direct aspiration method in human dwellings and animal shelters.

INTRODUCTION

Little is known about the sandfly species in Libya. Kadiki and Ashraf (1971) recorded four species in Nalut, namely, *Phlebotomus papatasi, P. sergenti, P. chabaudi* and *P. longicuspis*. Ashford *et al.* (1977) reported eight species collected and identified by the Italian workers, and added one more species. Dar *et al.* (1987) collected large number of *P. longicuspis* and few *P. sergenti in* Wadi Kadiga, and *P. longicuspis* at Shaliony near El-Marj in the Green mountain area, northeast Libya. Twelve new Libyan record species of sandflies were recorded in northwest southwest and northeast of Libya (El-Buni *et al.* 1993).

In the present study attempts were made to collect sandflies by various methods and to investigate their density and morphological characterization in different seasons.

MATERIALS AND METHODS

Sandflies were collected by using sticky paper traps during the period from April to November 1992, and by CDC miniature light traps betwen June to November 1992, three nights

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per month. Eighty sticky papers (20x20 cm) were used every month in 2 animal shelters and 2 human dwellings, 20 each. Two CDC were used in human dwelling and animal shelter, one each. Collections were performed during the time from 1 hr before sunset until 1 hr after sunrise. Direct aspiration method was used every 3 nights in June, July and August for 2 hr from 9:00 to 11:00 P.M. indoor walls of human dwelling. Collected sandflies were washed, cleared in lactophenol de Aman. Every single sandfly was transferred to a drop of polyvenyl lactophenol on a clear slide for identification.

Classification was based on the female pharyngeal armature and spermatheca, and on male genitalia according to the keys of Theodor (1958), Abonnenc (1972), Lewis (1977), Croset *et al.* (1978) and Lane (1986).

Study area and climate

Ejhawat is 109 km away east of Tripoli and 6 km west of EI-Khoms and situated on rocky hill part from Jabal Nafusa (Western mountain) which extends from Wazin on the Tunisian border toward the northeast where touches the sea (Fig. 1). The study area is about 200 m above the sea level, covered with olive, fig, almond trees and wild herbs.

The average annual rainfall is 120 mm and the monthly average temperature ranges from 8°C in January to 39°C in July.

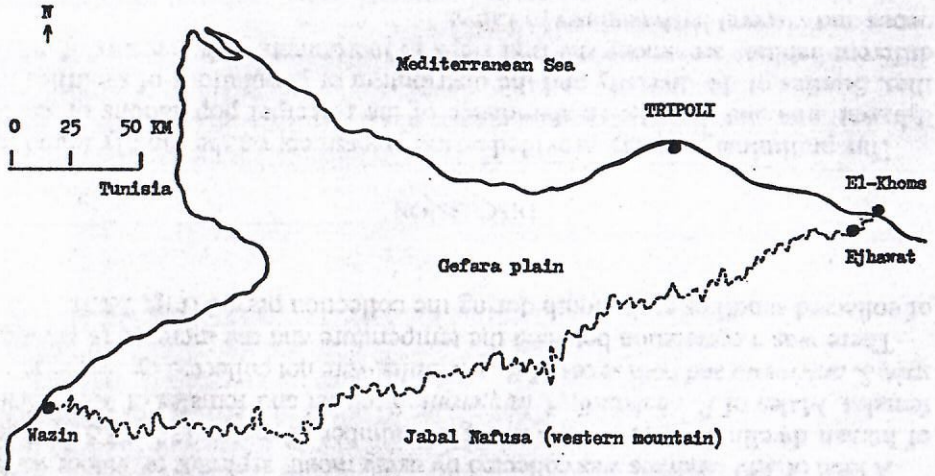


Fig. 1 - Map of northwestern part of Libya, showing the location of Ejhawat.

RESULTS

A total of 3371 sandflies (both sexes) was collected of which 1936 were *S. minuta* (57.43%), *P. papatasi* 837 (24.83%), *P. sergenti* 350 (10.4%), *P. alexandri* 96 (2.9%), *S fallax* 80 (2.4%), *P. longicuspis* 22 (0.65%), *S. antennata* 20 (0.6%), *P. chabaudi* 11 (0.33%), *P. orientalis* 10 (0.3%), *S. clydei* 5 (0.15%) and *P. langeroni* 4 (0.12%) (Table 1).

High prevalence of males as compared to females was observed among the sandflies caught by various methods. The total percentage of the abundant 3 species collehted by all methods was *S. minuta* (57.43%) fottowed by *P. papatasi* (24.8%) and *P. sergenti* (10.4%) (Table 1).

Table 1: Males and females of sandly species caught by different methods

Species	Sticky paper traps			CDC light traps			Aspirator			All methods		
	M	F	M%	M	F	M%	M	F	M%	T	T%	TM%
P. papatasi	410	148	73.5	137	72	65.6	52	18	74.3	827	24.8	71.6
P. sergenti	172	49	77.8	51	31	62.2	38	9	80.9	350	10.4	74.6
P. alexandri	50	14	78.1	13	10	56.5	7	2	77.7	96	2.85	72.9
P. chabaudi	7	1	87.5	1	1	50.0	0	1	0.0	1	0.33	72.9
P. longicuspis	10	7	58.8	0	1	0.0	4	0	100.0	22	0.65	63.6
P. langeroni	2	0	100.0	1	0	100.0	0	1	0.0	4	0.12	75.0
P. orientalis	8	0	100.0	0	1	0.0	0	0	0.0	10	0.3	80.0
S. minuta	899	561	61.6	152	126	54.7	108	90	54.5	1936	57.4	59.9
S. fallax	32	30	51.6	3	10	23.1	1	4	20.0	80	2.4	45.0
S. antennata	13	2	86.7	2	1	66.7	2	0	100.0	20	0.6	85.0
S. clydei	2	0	100.0	0	1	0.0	0	2	0.0	5	0.15	40.0
Total	1605	812	66.4	365	255	58.9	212	127	62.5	3371	100.0	64.73

M: Male; F: Female; T: Total; *P: Phlebotomus; S: Sergentomyia*

The density of the numerous three species is varied greatly from zero sandfly in April to 131.7 per m² in September for *P. papatasi*, from 0.3 in April to 39.4 per m² in September for *P. sergenti*, and from 9.1 in April to 405 per m² in July for *S. minuta*. There was a decrease of sandfly density towards the end of collection season, *P. papatasi*, 10.6/m², *P. sergenti* 7.3/m², and *S. minuta* 36/m² in November (Table 2).

Table 2: Density of sandflies (No/m²) in the period between April to November 1992

Species	April	May	June	July	August	September	October	November
P. papatasi	0	0.8	24.8	76.5	29.3	131.7	43.0	10.6
P. sergenti	0.3	2.54	6.64	31.8	14.8	39.4	11.7	7.3
P. alexandri	0	0	1.63	16.2	3.5	5.7	2.54	0
P. chabaudi	0	0	0	0.6	0.74	2.4	0	0
P. longicuspis	0	1.9	4.9	4.0	2.0	0	0.5	1.3
P. langeroni	0	0	0	1.0	0.5	0	0	0
P. orientalis	0	0	0.3	0.3	0	4.21	0	0
S. minuta	9.1	24.41	44.94	405.0	179.3	186.4	60.2	36.0
S. fallax	0.2	0	1.7	10.8	5.4	15.	3.8	0
S. antennata	0	0	0.3	7.2	1.5	2.0	0	0
S. clydei	0	0	0.3	1.0	0	0	0	0

The graphs of (Fig. 2) were plotted by using the data from all collecting sites with the highest number of sandflies caught by sticky paper traps. *P. papatasi*, *P. sergenti* and *S. fallax* showed two peaks in July and September. *S. minuta* and *P. alexandri* showed one peak in July. The graphs of (Fig. 3) were plotted using the data from all collecting sites with CDC traps. One peak was observed for *P. papatasi* in September and for *P. sergenti*, *P. alexandri* and *S. fallax* in August. White, two peaks were observed for *S. minuta* in August and October.

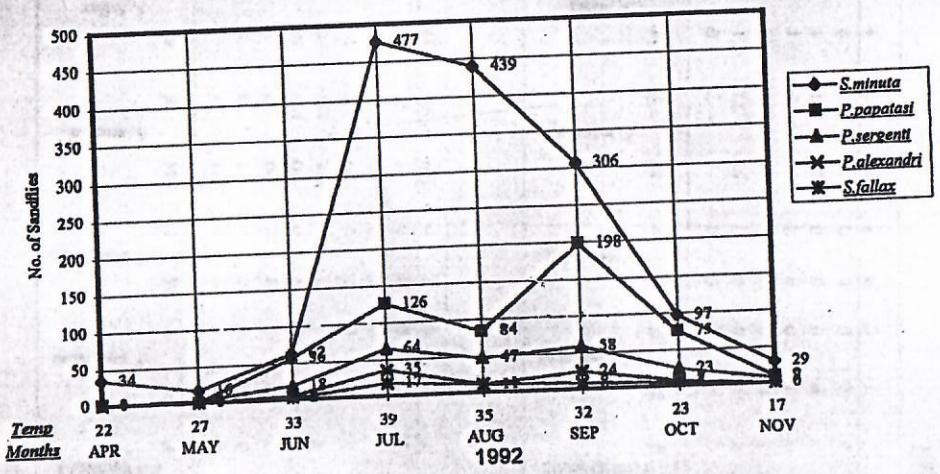
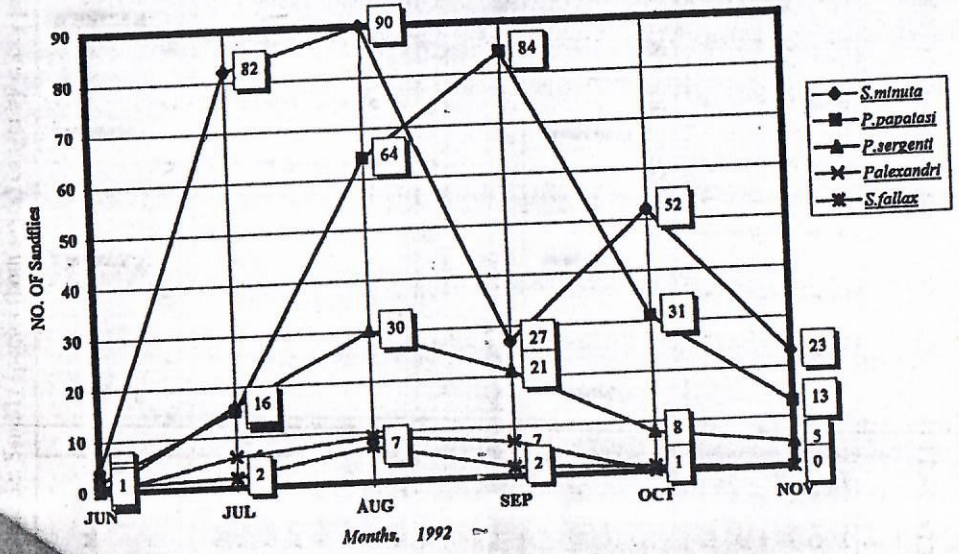


Fig. 2 - Seasonal frequency variations of sandflies caught by sticky paper traps.



...variations of sandflies caught by CDC light traps.

S. minuta caught by sticky paper traps showed slightly higher females than males in June and November and *S. fallax* in June, September and October (Table 3a). Sandflies caught by CDC showed higher females than males in July and October for *P. papatasi*, in September for *P. alexandri*, in October for *S. minuta* and in August for *S. fallax*. One female *P. chabaudi* was caught in October, one female *P. longicuspis* in August, two females *P. orientalis* in September and one female *S. clydei* in June (Table 3b).

A total of 339 sandflies was collected by using mouth aspirator on indoor walls of human dwelling. Table 1 showed higher number of males 212 (62.5%) than females. Males of *P. chabaudi*, *P. langeroni*, *S. clydei* and females of *S. longicuspis*, *S. antennata* and both sexes of *P. orientalis* were not collected by aspirator.

There was a correlation between the temperature and the increase in number of collected sandflies each month during the collection period (Fig. 2&3).

DISCUSSION

This preliminary survery provided a first assessment on the sandfly found in Ejhawat area and the relative abundance of the principal populations of sandflies. Studies of the diversity and the distribution of populations of sandflies in different habitats are among the first steps in incriminating the vectors of cutaneous and visceral leishmaniasis in Libya.

In this present work *S. minuta*, *P. papatasi* and *P. sergenti* were the most abundant species, represented (92.64%) of all our catches by various methods. The two suspected vectors for cutaneous leishmaniasis, represented (24.8%) for *P. papatasi* and (10.4%) for *P. sergenti*. The people in this area at risk due to high percentage of *P. papatasi* the proven vector for *Leishmania major* in Tunisia (Ben-Ismail *et al.* 1987), in Egypt (Wahba *et al.* 1990) and in Libya (El-Buni *et al.* 1994). *P. sergenti* ranked third and it is a proven vector for *L. killicki* in southwest of Tunisia (Ben-Ismail, personal communication). The high percentage of *P. papatasi* and *P. sergenti* in the area under study, might have a preferential domestic and peridomestic biotopes.

The indoor and outdoor density observations showed an abundance of sandfilies. The density of *S. minuta* is dependent on reptile presence. It is one of the proven vectors of *Leishmania*-like parasites (Sauroleishmania) Rioux *et al.* (1969) found *L. tarentolae* in monocytes of *Tarentola mauritanica* from Southern France. Lizards were found in human dwellings and animal shelters in the area under study. Killick-Kendrick *et al.* (1986) summarized the taxonomy of Sauroleishmania. The density of *P. papatasi* and *P. sergenti* is dependent in human and animal presence (Ali Musa *et al.* 1991). People in the study area are use to sit or sleep outdoors during the hot period in summer nights. Humans and animals may attract female sandflies whereas most males kept close to the resting sites and plants

Table 3a: Sandfly species (both sexes) caught by sticky paper traps.

Months	P. papatasi		P. sergenti		P. alexandri		P. chabaudi		P. longicuspis		P. langeroni		P. orientalis		S. minuta		S. fallax		S. antennata		S. clydei	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
April	0	0	1	0	0	0	0	0	0	0	0	0	0	0	23	11	1	0	0	0	0	0
May	1	0	2	1	0	0	0	0	1	0	0	0	0	0	13	3	0	0	0	0	0	0
June	47	9	15	3	4	1	0	0	3	2	0	0	0	0	30	32	0	2	0	1	1	0
July	93	33	48	16	26	9	2	1	4	0	1	0	1	0	280	197	10	7	7	1	1	0
August	70	10	37	10	10	1	2	0	2	3	1	0	0	0	288	151	7	4	3	0	0	0
September	147	51	44	14	5	3	3	0	0	0	0	0	7	0	199	107	11	13	3	0	0	0
October	39	36	20	3	5	0	0	0	0	1	0	0	0	0	52	45	3	4	0	0	0	0
November	4	5	5	2	0	0	0	0	0	1	0	0	0	0	14	15	0	0	0	0	0	0
Total	410	148	172	49	50	14	7	1	10	7	2	0	8	0	899	561	32	30	13	2	2	0

Table 3b: Sandfly species (both sexes) caught by CDC light traps.

Months	P. papatasi		P. sergenti		P. alexandri		P. chabaudi		P. longicuspis		P. langeroni		P. orientalis		S. minuta		S. fallax		S. antennata		S. clydei	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
June	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	1	0	0	0	1
July	5	10	11	5	4	2	0	0	0	0	0	0	0	0	55	27	1	1	2	1	0	0
August	51	13	19	11	5	4	1	0	0	1	0	0	0	0	49	41	1	6	0	0	0	0
September	58	26	13	8	3	4	0	0	0	0	1	0	0	2	16	11	1	1	0	0	0	0
October	15	16	4	4	0	0	0	1	0	0	0	0	0	0	18	34	0	1	0	0	0	0
November	6	7	2	3	1	0	0	0	0	0	0	0	0	0	12	11	0	0	0	0	0	0
Total	137	72	49	31	12	10	1	1	0	1	1	0	0	2	152	126	3	10	2	1	0	1

CDC light traps not used during April and May due to technical fault.

It is difficult to explain the constant predominance of male sandflies in all collected species by various methods except for *S. fallax* caught by CDC traps and aspirators. Bettini *et al* (1986) recorded high percentage of males for *P. perniciosus, P. perfiliewi* and *S. minuta*. The same phenomenon was obserbed by Maroli and Bettini (1977) in Tuscany for *P. perniciosus* caught by various methods; by Croret *et al.* (1978) and Danceso *et al.* (1982) in Tunisia and by Helal *et al.* (1987) for *P. papatasi, P. perniciosus* and *P. longicuspis* in Sidi Bouzid, Tunisia. Males remained dominant during the whole period of collection, while *P. longicuspis* is one of the proven vectors of visceral leishmaniasis in the mediterranean basin (WHO, 1984) but it has very low appearance in Ejhawat area. Rising temperature stimulated the increase of sandly populations (Fig. 2), where low number of sandflies were recorded during low temperature at the beginning and end of collection season.

Ctenoductylus gondii is abundant in the study area, it is incriminated reservoir host for *L. killicki* in Southern Tunisia (Ben-Ismail, personal communication).

Nevertheless, specific surveys of sandfly species have to be carried out as well as the active cutaneous leishmaniasis case detection and rodents survey in Ejhawat area and other areas.

REFERENCES

ABONNENC E. (1972) — Les Phlebotomes de la région Ethcopienne (Diptera: Psychodidae).*Memories* ORSTOM *55*:289

ALI MUSA S., EIRABAA F.M.A., ABDEL NOUR O.M. (1991) — Studies on phlebotomine sandflies in an active focus of leishmaniasis in the Sudan. *Parassitologia, 33*:55-62

ASHFORD R.W., SCHNUR L.F. CHANCE M.L., SAMAAN S.A. AHMED H.N. (1977)—Cutaneous leishmaniasis in the Libyan Arab Republic: preliminary ecological finding. *Ann. Trop. Med. Parasit., 71*:265-271.

BEN-ISMAIL R. GRAMICCIA M., GRADONI L., HELAL H., BEN RACHID M. S. (1986) — Isolation of *Leishmania major* from *Phlebotomus papatasi* in Tunisia. *Trans. R. Soc. Trop. Med. Hyg. 81*:749

BETTINI S., CONTINI C., ATZENI M.C., TOCCO G. (1986) — Leishmaniasis in Sardinia. I. Observations on a larval breeding site of *Phlebotomus perniciosus, Phlebotomus perfiliewi* and *Sergentomyia minuta* (Diptera: Psychodidae) in the canine leishmaniasis focus of solemi-nis (Cagliari). *Ann. Trop. Med. Parasit., 80*:307-315.

CROSET H., RIOUX J. A., MAISTRE M., BAYAR N. (1978) — Les phlebotomes de la Tunisie (Diptera: Phlebotomidae). Mise au point systematique, chorologique et ethologique. *Ann. Parasitol. (Paris) 53*:711-749.

DANCESO P., CHADLY A. (1982) — Bioecologic aspects of phlebotamine sandflies in relation to human and canine visceral leishmaniasis in northern Tunisia. *Arch. Int. Pasteur. Tun. 59*:225-241.

DAR F.K., EL MAUHOUB M., KIDWAI S.A., MAHABRESH M.I., SABA A., ELBOURI K. W. (1987) — Preliminary observations on the epidemiology of visceral leishmaniasis in the Libyan Arab Jamahiriya. In: Paediatrics Infectious Disease in Arab Countries, Edited A.Y. ElZouki, John Wiley and Sons, Ltd.

EL-BUNI A., TALEB I., BEN-DARIF A., REFAI A., AL-EDODI K., TAWAIL A., FTAITI A., BEN-ISMAIL R. (1993)—Leishmaniasis in Libya and studies on sandflies. *Arch. Inst. Pasteur Tun. 70*:465-466.

EL-BUNI A., ANNAJAR B., BEN-DARIF A., REFAI A., TALEB I., AL-EDODI K., EL-HOUSK M., ZAATOUR O., BEN-ISMAIL R. (1994) — Isolation of leishmanial parasites from sandfly species in Libya. *Jamahiriya's Second Conferences on Medical Sciences*. 7-11/5/94.

HELAL A., BEN-ISMAIL R., BACH-HAMBA D., SIDHOM M., BETTINI S., BEN-RACHID M. S. (1987) — Engluete entomologique dans le foyer de leishmaniose cutanee zoonotique (*Leishmania major*) de Sidi Bouzid (Tunisie) en 1985. *Bull. Soc. Path. Ex., 80*:349-356.

KADIKI O., ASHRAF M.A. (1971) — Cutaneous leishmaniasis in the Libyan Arab Republic. *Ministry of Health, Tripoli* 26pp. *Mimeo*.

KILLICH-KENDRICH R., LAINSON R., RIOUX J.A. SAFJANOVA V.M. (1986) — The taxonomy of *Leishmania*-like parasites of reptiles. *Leishmania*. Taxonomic et phylogenes. Applications eco-epidemiologiques. *Coll Int. CNRS INSERN, 1984). IMEEE, Montpellier*, 143-148.

LANE D.J. (1977) — The sandflies of Egypt (Diptera: Psychodidae). *Bull. Br. Mus. - Nat. Hist. (Ent.), 52*:1-35.

LEWIS D.J. (1977) — Proposal for a stable classification of the phlebotomine sandflies (Diptera: Psychodidae). *Stem. Entomol., 2*:319-332.

MAROU M., BETTINI S. (1977) — Leishmaniasis in Tuscany (Italy). I. An investigation on phlebotomine sandflies in Grosseto Province. *Trans. R. Soc. Trop. Med. Hyg. 71*:315321.

RIOUX J.A., KNOEPFLER L.P., MARTINI A. (1969) — Presence en France de *Leishmania tarentolae* Wenyon, 1921 Parasite du gecko *Tarentola mauritanica* (L., 1758). *Ann. Parasit. Hum. Comp., 44*:115-116.

THEODOR O. (1958) — Psychodidae-Phlebotamine. *Flieg. Palacarkt. Reg., 90*:1-55.

WAHBA M.M., SCHNUR L.F., MORSY T.A., MERDAN A. (1990) — The characterization of *Leishmania major* from *Phlebotomus papatasi* (Scopoli) caught in northern Sinai, Egypt. *Trans. R. Soc. Trop. Med. Hyg., 84*:785-786.

WORLD HEALTH ORGANIZATION (1984) — The leishmaniasis, *Techn. Rep. Series 701. Geneva.*