

## SANDFLY SPECIES COMPOSITION ALONG AN ALTITUDINAL TRANSECT IN SOUTHERN SINAI, EGYPT<sup>1</sup>

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**SUMMARY.** Sandflies were sampled in three areas of Southern Sinai, representing different ecological conditions and defined by altitudes. Of 489 specimens collected, 486 sandflies were identified: *Phlebotomus papatasi*, *P. bergeroti*, *P. alexandri*, *P. sergenti*, *P. kazeruni*, *P. orientalis*, *P. arabicus*, *P. major*, *Sergentomyia tiberiadis*, *S. adleri/clydei*, *S. schwetzi*, *S. palestinesis*, *S. fallax* and *S. christophersi*. Sandfly community composition and relative species abundance differed in the three areas and included two species in Abu Rudeis (on coast), 13 species in Feiran oasis and 12 species in St. Catherine (highest altitude). Species composition also differed between wild and peridomestic habitats in each area, with species diversity greater in wild habitats.

**Key-words :** Sandflies. Altitude. Sinai.

### Composition de la faune des Phlébotomes selon un transect altitudinal du Sinai méridional.

**RÉSUMÉ.** Les Phlébotomes ont été échantillonnés dans trois territoires du Sud du Sinai, présentant des conditions écologiques et des altitudes différentes. Sur 489 exemplaires collectés, 486 ont été identifiés : *Phlebotomus papatasi*, *P. bergerosti*, *P. alexandri*, *P. sergenti*, *P. kazeruni*, *P. orientalis*, *P. arabicus*, *P. major*, *Sergentomyia tiberiadis*, *S. adleri/clydei*, *S. schwetzi*, *S. palestinesis*, *S. fallax* et *S. christophersi*.

La composition des populations de Phlébotomes et l'abondance relative des espèces diffèrent dans les trois territoires considérés. Deux espèces sont reconnues à Abou Roudeis (sur le littoral), treize dans l'oasis de Feiran et 12 à Sainte-Catherine (à l'altitude la plus élevée). Le spectre des espèces varie dans chaque territoire, selon que le milieu est non habité ou mis en culture, sauvage ou péri-domestique, avec une densité plus grande dans les zones non humanisées.

**Mots-clés :** Phlebotomus. Altitude. Sinai.

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## Introduction

Sandfly species composition varies according to the ecological conditions in different parts of the world (Lane, 1986). In Egypt, seven sandfly species have been recorded *Phlebotomus papatasi* in Cairo (Willcocks, 1917), *Sergentomyia squamipleuris* in Sharkiya (Khalil, 1934), *P. sergenti* in Cairo (Theodor, 1948), *Sergentomyia tiberiadis* in Aswan (Hassan, 1968), *S. palestinesis* in Kharga oasis and *S. minuta* in Cairo (Zein El Dine, 1972) and *Phlebotomus langeroni* in El Agamy, Alexandria (El Sawaf *et al.*, 1984). Recently, Lane (1986) reviewed the sandfly fauna of Egypt and increased this to 21 species: 8 *Phlebotomus* and 13 *Sergentomyia*.

Biogeographically, Egypt can be divided into three zones which differ floristically and faunistically, Lower Egypt and Northern Sinai, Upper Egypt and Southern Sinai (Lane, 1986). The Southern triangle of Sinai is the most mountainous zone of the peninsula, the geomorphology of S. Sinai varying between high mountainous rocky areas and scattered valleys (Hume, 1925 and Shata, 1950) suggesting that the sandfly fauna of this area is distinct from that of N. Sinai and the rest of Egypt.

Sandflies have not been extensively studied in S. Sinai but in N. Sinai *P. papatasi* and *S. antennata* were recorded (Lane, 1986). Until recently, neither cutaneous nor visceral leishmaniasis was considered common in Egypt and were only known from occasional clinically diagnosed cases. Morsy *et al.* (1982) and Rifaat *et al.* (1983a) have shown cutaneous leishmaniasis to be more widespread than previously thought. Human visceral leishmaniasis was detected for the first time in Egypt, from El Agamy, a suburb of Alexandria governorate (Tewfik *et al.*, 1983). Available epidemiological evidence indicates that *P. langeroni* is the probable vector (El Sawaf *et al.*, 1984; Beier *et al.*, 1986, 1 and 3 and El Said *et al.*, 1986).

In Sinai, 27 cases of cutaneous leishmaniasis have only recently been recorded by Bassili *et al.* (1983) but there is no corresponding information on sandflies.

The study of the sandfly fauna of S. Sinai examines species composition along an altitudinal transect focusing on three principal ecological zones.

## Materials and methods

### DESCRIPTION OF THE STUDYING AREAS

Southern Sinai was divided into three altitudinal zones.

a) *Saint-Catherine*, which lies in the center of S. Sinai with an altitude of 1,500-2,500 m in height (Max. Temp. 17° C in August and Min. Temp. 0° C in January, mean R. H. of 33 % and mean rainfall of 62 mm/year), b) *Feiran oasis* (Wadi Feiran), which lies about the mid-way, between Saint Catherine and Abu Rudeis, with an altitude of 200-500 m in height (Max. Temp. 22° C in August

and Min. Temp. 14° C in January, mean R. H. of 42 %, and mean rainfall of 31 mm/year, and c) *Abu Rudeis*, which lies north east of St. Catherine and Feiran oasis, with an altitude of less than 20 m in height (Max. Temp. 29.6° C in August and Min. Temp. 16° C in January, mean R. H. of 58 % and mean rainfall of 20.5 mm/year).

#### SAMPLING

At each of the three studying zones, sandflies were sampled both around houses (peridomestic sites) and at about 4 km from a village or settlement (wild sites). Sampling was carried out using the sticky trap technique as described by Kirk and Lewis (1940), Chemical light/sticky trap and CDC light trap (Sudia and Chamberlain, 1962).

In Saint Catherine, seven stations were chosen for this study. A total of 303 sticky traps, 10 chemical light/sticky trap and one CDC light trap were used at different habitats.

In Feiran oasis, 5 stations were selected for sandflies collection. A total of 373 sticky traps; 9 chemical light/sticky traps and 2 CDC light traps were used at different habitats.

In Abu Rudeis, collections were performed in only three selected stations. An estimated number of 175 sticky traps, 5 chemical light/sticky trap were used at different habitats.

Collections from the three different zones were performed throughout six successive days, in August, 1984.

#### MOUNTING AND IDENTIFICATION

Collected samples were placed in 70 % alcohol labelled and transferred to the Ain Shams Center for mounting and identification. Female sandflies that contained blood were cleared in chloral hydrate solution, before being mounted. Separated heads and abdomens were mounted in Puri's medium using the technique described by Hopkins (1936). Identification of the sandfly species was carried out by Dr. Bahira El Sawaf, in the British Museum (Natural History) London, and voucher specimens were deposited there.

### Results

During the six day-trip to southern Sinai, a total of 489 phlebotomine sandflies was collected from the three localities: Saint Catherine; Feiran oasis; and Abu Rudeis. Of the collected specimens, 486 flies were identified as 8 *Phlebotomus* and 6 *Sergentomyia* and only one *Phlebotomus* and two *Sergentomyia* could not be identified.

In Saint Catherine, a total of 226 flies (161 *Phlebotomus* and 65 *Sergentomyia*)

was collected from the peridomestic and wild sites. The species composition within the genus *Phlebotomus* was similar in peridomestic and wild sites except for *P. major* which was captured as one male near a hotel 6 km north east of Saint Catherine, whereas the species composition within the genus *Sergentomyia* was rather higher in wild sites than the peridomestic sites (table I).

In Feiran oasis (Wadi Feiran), a total of 261 flies (161 *Phlebotomus* and 100 *Sergentomyia*) were collected from both peridomestic and wild sites. The species composition of the peridomestic sites in Feiran oasis was similar to that of the wild sites except for *P. sergenti* and *P. arabicus* which were only found in the peridomestic sites (table I).

Abu Rudeis is omitted from the table since all collections were negative for sandflies from peridomestic sites, while in the wild sites only two flies, *P. alexandri* and *P. sergenti*, were caught.

TABLE I. — Sandfly species composition in peridomestic and wild sites in areas of different altitudes in Southern Sinai.

Species	Saint Catherine (> 1 500 m)				Feiran Oasis (200-500 m)			
	Wild		Peri- domestic		Wild		Peri- domestic	
	No flies ♀	♂	No flies ♀	♂	No flies ♀	♂	No flies ♀	♂
<i>Phlebotomus</i>								
<i>papatasi</i> Scopoli	—	—	—	—	—	1	—	1
<i>bergeroti</i> Parrot	—	—	—	—	—	2	16	98
<i>alexandri</i> Sinton	1	2	2	3	1	2	1	—
<i>sergenti</i> Parrot	2	12	39	36	—	—	4	4
<i>kazeruni</i> Theodor and Mesghali	—	14	2	14	1	—	2	5
<i>orientalis</i> Parrot	—	12	1	4	—	9	4	6
<i>arabicus</i> Theodor	4	9	1	2	—	—	—	3
<i>major</i> Annandale	—	—	—	1	—	—	—	—
<i>sp.</i>	—	—	—	—	—	1	—	—
Total	161				161			
<i>Sergentomyia</i>								
<i>tiberiadis</i> Adler, Theodor and Lourie	—	2	—	2	2	9	5	29
<i>adleri/clydei</i> Sinton	2	1	—	—	8	4	9	3
<i>schwetzi</i> Adler, Theodor and Parrot	—	—	—	2	—	1	3	—
<i>palestinensis</i> Adler, Theodor	—	2	1	—	—	2	4	5
<i>fallax</i> Parrot	20	26	—	3	5	8	—	—
<i>christophersi</i> Sinton	1	2	—	—	—	1	1	—
<i>sp.</i>	—	1	—	—	—	—	—	—
<i>sp.</i>	—	—	—	—	1	—	—	—
Total	65				100			

The sandfly composition is remarkably different in Saint Catherine and Feiran oasis than in Abu Rudeis. In Saint Catherine, both *Phlebotomus* and *Sergentomyia* species were present except *P. papatasi* and *P. bergeroti*. In Feiran oasis, all species were recorded except *P. major*. In Abu Rudeis, only two *Phlebotomus* species, *P. alexandri* and *P. sergenti*, were present.

Within the genus *phlebotomus*, *P. major* is the only species collected exclusively in peridomestic sites, while all other species could be found in peridomestic and wild sites considerably, e. g. *P. bergeroti* and *P. sergenti* were collected in large numbers in peridomestic than in wild areas. Whereas, within the genus *Sergentomyia* the species composition was similar in each site and *S. fallax* showed a tendency for wild areas based on the number collected in wild (table I).

### Discussion

The sandfly composition of the southern Sinai suggests a marked affinity with the fauna of the Arabian Peninsula (Lewis and Buttiker, 1982), particularly Asir, Yeman (Lewis, 1974b) and to a lesser but still significant extent, to the highlands of eastern Africa.

It is of interest to note that there is a remarkable difference in sandfly species composition in Saint Catherine and Feiran oasis than in Abu Rudeis which is presumably due to the difference in altitude at the three localities.

The peridomestic character of *P. papatasi* is not clear in southern Sinai since only a small number was collected. Its presence in wild areas confirmed that this species is not purely domestic. Similar conditions were observed in Saudi Arabia by Buttiker *et al.* (1982).

The occurrence of *P. major* in Saint Catherine is consistent with the habitat characteristics of this species group. *P. major* is only abundant at altitude above 300 m, in Greece (Leger *et al.*, 1979).

*P. bergeroti* and *P. sergenti* that were collected both from peridomestic and wild areas constituted the highest percentage of phlebotomine sandflies collected from southern Sinai. Both are suspected vectors of cutaneous leishmaniasis in other parts of the world (Buttiker *et al.*, 1982 and Molyneux, 1977).

*P. kazeruni* that was encountered both in peridomestic and wild sites in southern Sinai at high altitude, occurs only in low rocky deserts in Afghanistan (Artemiev, 1978) and is found in remote wadis and hills in Saudi Arabia (Buttiker and Lewis, 1984). Recently this species was found at relatively high altitude in Maroc (Rioux *et al.*, 1986).

Some sandfly species identified throughout this study, are known vectors of leishmaniasis. As for cutaneous leishmaniasis, *P. alexandri* in north Africa (Dedet, 1979) and *P. sergenti* in U. S. S. R. (W. H. O., 1984). As for visceral leishmaniasis *P. orientalis* in the Sudan (Hoogstraal and Hyneman, 1969) and *P. major* in Greece (Leger *et al.*, 1979).

This study was undertaken as a first step in examining the sandfly species

composition. Further studies are needed to define habitat characteristics of each species and to monitor for *Leishmania* transmission, in conjunction with changing ecological conditions due to changing land-use and settlements in southern Sinai.

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