SOIL ANALYSIS OF BREEDING SITES OF *PHLEBOTOMUS LANGERONI* NITZULESCU AND *PHLEBOTOMUS PAPATASI* (SCOPOLI) IN EL AGAMY, EGYPT

B. M. EL SAWAF, N. HELMY*, H. A. KAMAL, A. OSMAN, M. SHEHATA

SUMMARY

Soil analysis was carried out on samples obtained from breeding sites of the sandflies *Phlebotomus langeroni* Nitzulescu and *Phlebotomus papatasi* (Scopoli) and compared to non-breeding sites.

Soil characterized by relatively high moisture content, high

organic matter and derivatives, such as phosphorous potassium and nitrogen, high percent of silt and slightly alkaline pH, constitutes peculiar conditions which favour immature development of both species.

RÉSUMÉ : Analyse du sol des gîtes larvaires de *Phlebotomus langeroni* Nitzulescu et *P. papatasi* (Scopoli) à El Agamy, Égypte.

Des analyses de sol ont été faites à partir d'échantillons prélevés dans des gîtes larvaires de *Phlebotomus langeroni* et *P. papatasi* et comparés aux sols de sites où l'on ne rencontre pas de larves de phlébotomes.

Les sols caractérisés par un taux d'humidité relativement élevé,

qui sont riches en matière organique et en composés tels que les phosphates de potassium et les nitrates, qui possèdent un fort pourcentage de limon et un pH légèrement alcalin constituent un biotope favorable au développement de ces deux espèces.

INTRODUCTION

Little soil analysis data has been obtained for sites where sand fly larvae were collected, especially for Old World species. In El Agamy (Alexandria, Egypt) where visceral leishmaniasis occurs (Tewfick *et al.*, 1983) and *P. langeroni* is the suspected vector in the area (El Sawaf *et al.*, 1984); important sand fly breeding sites were determined. These are mainly stone piles on which litter and garbage are thrown, and rodent burrows. Newly emerged *P. langeroni* and *P. papatasi* diagnosed by the criterion of male genitalia (Chaniotis, 1967) were recovered from these sites. Soil samples from breeding sites and from sites, where no sand flies were recovered, were analysed.

* Research and Training Center on Vectors of Diseases, Ain Shams University, Cairo, Egypt, and Faculty of Science, Zagazig University, Egypt.

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MATERIALS AND METHODS

El Agamy is a coastal resort area on the Mediterranean Sea, 14 km West of Alexandria city. In August where the maximum and minimum mean temperatures are 30 and 22° C respectively, three soil core samples were taken from breeding sites and three from non-breeding sites. Soil samples were taken from an area of 15 × 15 cm and 15 cm deep.

Eight soil parameters were determined. Total nitrogen, organic matter and carbonates were determined by the method of Cottenie *et al.* (1982). Phosphorous and calcium were estimated according to Tietz (1976). Chloride was estimated by the Van-Slyke method (1980). The soil moisture was estimated according to Kramer (1949) and the pH determined. Granulometric analysis was carried out by the method of Piper (1950).

RESULTS

The results of the analysis of 6 soil samples are given in Table I. All had slightly alkaline pH associated with high carbonate content.

Samples 1, 2 and 3 were taken from breeding sites. They had high percent moisture, high organic matter, nitrogen potassium and phosphorous content, low chloride and sodium content compared to samples 4, 5 and 6 taken from

TABLE I. — Analysis of soil samples collected from breeding and non-breeding habitats.

Samples No.	Habitats	p mg/g	Na ⁺ mEg/g	K ⁺ mEg/g	N ₂ mg/g	Organic matter mg/g	CO ₂ mg/g	Ca ⁺⁺ mg/g	Cl ⁻ mg/g	pH	Moisture %
1	Rodent burrows*	0.13	0.145	0.015	0.71	11.3	282.5	22.5	24.9	7.42	7.75
2	Stone pile*	0.12	0.175	0.015	0.99	18.2	215.0	21.5	17.9	7.59	4.95
3	Rubbish on the stone piles*	0.17	0.150	0.026	1.42	21.1	397.0	28.0	13.0	7.68	5.85
4	Soil cracks	0.02	0.240	0.008	0.18	06.0	347.5	25.3	29.7	7.54	1.85
5	Unhabited	0.10	0.210	0.002	0.11	05.6	295.0	25.5	26.3	7.61	0.85
6	Garden	0.01	0.155	0.010	0.18	07.8	332.5	22.5	29.3	7.67	0.85

* Breeding sites.

non-breeding sites. There appears to be no significant difference between the calcium values.

The soil samples 4 and 6 taken from soil cracks and a garden respectively are likely subjected to wide temperature and humidity fluctuations compared to other samples while the soil taken from the uninhabited store (sample 5) has the least organic matter content. Table II gives the results of granulometric analysis on the same soil cores collected from breeding and non-breeding sites. The soil texture of the breeding sites was rich in coarse sand (average 29.1 %) and percent silt (average 18.7 %) compared to an average of 15.5 % and 4.5 % respectively in non-breeding sites.

The granulometric composition of fine and very fine sand was higher in the non-breeding soils.

TABLE II. — Granulometric analysis of the soil.

Samples No.	Habitats	% Coarse sand	% Fine sand	% Very fine sand	% Silt
1	Rodent burrows*	26.34	12.81	42.62	17.08
2	Stone pile*	39.83	11.83	37.88	9.75
3	Rubbish on the stone piles*	16.32	5.14	47.23	30.40
4	Soil cracks	14.52	37.71	36.75	5.72
5	Uninhabited store	19.70	32.35	43.01	4.46
6	Garden	7.31	17.60	71.14	3.29

* Breeding sites.

DISCUSSION

The proper soil pH (7.6) obtained for the breeding sites of *P. langeroni* and *P. papatasi* at El Agamy was very close to that estimated for *P. papatasi* in Saudi Arabia by Buttiker and Lewis (1979) and to that, estimated for *P. perniciosus*, *P. perfiliewi perfiliewi* and *Sergentomyia minuta* in Sardinia (Bettini and Melis, 1988). The estimated water content of breeding sites of *P. langeroni* and *P. papa-*

tasi at El Agamy (6.2 %) was high compared to soils taken from non-breeding sites (1.2 %). However, it is extremely low than that estimated for *P. argentipes* (16-22 %) Smith *et al.* (1936). The average organic content of breeding sites (1.8 %) was higher in breeding sites than in non-breeding sites (0.7 %). Although the organic content of breeding sites in El Agamy was lower than that recorded by Smith *et al.* (1936). Yet, Bettini and Miles (1988) speculated that, an organic content as low as 1.4 % was sufficient for larval development of sand flies in Sardinia. The soil nutrients resulting from the decomposition of organic matter, mainly organic nitrogen, phosphorous, potassium and calcium were more concentrated in breeding soils, on the contrary, high chloride, carbonate and sodium were characteristics of non-breeding soils at El Agamy. This may constitute an adverse condition for larval development.

The nature of the soil in El Agamy is generally rich in sand. The breeding soil is interestingly rich in coarse sand providing better aeration of the soil and a significantly higher percent of silt than non-breeding soil, a fact that may account for the maintenance of higher moisture favourable for sand fly larval development.

It is concluded that, the phlebotomine sand flies of El Agamy breed in Sheltered sites rich in organic matter, coarse sand and silt, and that both species *P. langeroni* of the subgenus *Larroussius* and *P. papatasi* of the subgenus *Phlebotomus* require the same nutrients and soil conditions for their larval development, despite their different adult behavioural pattern (El Sawaf *et al.*, 1989).

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