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POPULATION DYNAMICS OF CULEX PIPIENS MOLESTUS FORSKAL AND OF CULEX UNIVITTATUS THEOBALD IN ISRAEL

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Introduction

Several epidemics of West Nile fever occurred in Israel in the fifties (Horsfall & Tamm, 1965). The common house mosquito Culex pipiens molestus Forskal was suspected to be the vector of the disease (Oleynik 1952), and has shown itself to be an effective transmittor of the disease in the laboratory (Tahori et al. 1953). However, Culex univittatus Theobald was incriminated to be the major vector of the disease in Egypt (Taylor et al. 1956), South Africa (Jupp & McIntosh 1967), and Israel (Nir et al. 1968). It is therefore of interest to present data of a culicine survey carried out during a period of several years (1955 - 58). This survey provides data on population dynamics of the two major culicine species in Israel, C.p. molestus and C. univittatus. Data on less common culicine species collected during this survey are presented in a separate note. While extensive work on Anophelini in connection with malaria has been carried out in Israel (Theodor 1925; Kligler 1930; Shapiro and Sali- ternik 1930) only little work has been done with Culicini (Barraud 1921; Buxton 1924; Saliternik and Barkai 1953).

Materials and Methods

The mosquitoes were caught by hand aspirator in human dwellings or air raid shelters during the early morning hours. Only at Hulata were they caught by means of grass sweeps. They were identified under light carbon dioxide anesthesia according to the key of O. Theodor (Unpublished, Hebrew University, Jerusalem).

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The sites of collections were: Ashqelon in the Southern Coastal plain; Ramla, Ayanot, Hadera, Pardes-Hanna, Zikhron Ya'aqov, En Shemer, Bahan and Eyal in the Sharon Area; 'En HaMifraz in the Northern Coastal plain; Sha'ar HaGolan in the Jordan Valley; Hulata in the Upper Galilee; and Kefar Ruppin in the Bet Sh'an Valley (Fig. 1). Generally all locations were visited monthly during winter and bimonthly during the other seasons.

Results

Table 1 gives the total number of mosquitoes collected during the survey. More than 38,000 mosquitoes were identified. The most abundant species was Culex p. molestus. However, during certain months Culex univittatus was predominant in some localities. Fig. 2 shows the average number of C.p. molestus and of C. univattatus collected per one visit during the various months of the year for six representative areas in Israel. The data are average of four years (1955-58). Since C. univittatus is incriminated as the possible vector of West Nile fever in Israel, the percentages of C. univittatus of the total Culicine population caught at each of these localities are plotted in Fig. 3. It became clear that at Kefar Ruppin , 'En HaMifraz and Sha'ar HaGolan, C. univittatus was either the predominant species or formed at least a significant part of the Culicine population during the period of July - October. On the other hand, out of 1771 mosquitoes collected in Jerusalem, 1742 were C.p. molestus, the remainder being Culiseta longiareolata (Theobaldia) (Macquart).

At Hulata out of 3800 mosquitoes only 61 were C. univittatus. This may be partly due to a different collection method used there. As mentioned the mosquitoes at Hulata were caught by means of grass sweeps near the swamp and not in human dwellings. An interesting picture appeared in Ashqelon. During May 1956, 124 Culex theileri were caught out of a total of 132 culicines , but only 12 more C. theileri were caught during during the remaining 11 months. The reason for this appearance of C. theileri is unknown.

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Discussion

The selection of human dwellings and air raid shelters as collection sites could of course have influenced the results. Grass sweeps or light traps may show a somewhat different population stratum.

This survey shows that in the warmer parts of the country, such as Kefar Ruppin and Sha'ar HaGolan, where temperatures in summer are about 4°C high han ir coastal area (Ashbel 1945), C. univittatus forms a significant part of the culicine population during July - October. However, temperature is not the only factor w determines prevalence of a Culex species. Local factors in breeding conditions and mosquito control operations certainly play a role. For example, at 'En HaMifraz which shows approximately the same temperature curves as do Ramla or the Sharon Area, a significantly higher percentage of C. univittatus was observed during September (Fig. 3).

While the population peaks of both species do not coincide, both appear in large numbers during the late summer - early autumn. Thus fluctuations in their population dynamics could not by themselves explain the fact that in Israel the virus was isolated from C. univittatus only (Nir et al. 1968). Precipitin tests carried out on mosquitoes collected in South Africa have shown that C. univittatus prefers avian blood over mammals blood by a ratio of about 80 : 20 (Paterson et al. 1964). Similar tests in Egypt (Taylor et al. 1956) indicate that C. p. molestus shows no preference for avian blood over mammals. It was suggested (Klingberg et al. 1959) that feeding of mosquitoes on viremic migratory birds initiates epidemic outbreaks of West Nile fever during July - October which is the West Nile fever season in Israel (Goldblum 1959). Thus the difference in host preference between the two species implicates C. univittatus as the major vector of West Nile fever in Israel. It would be interesting to carry out such host-preference studies in Israel.

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C. univittatus is found in the Ethiopean region, the Mediterranean region, Iran, Pakistan and India to Turkestan (Stone et al. 1959). It is the most common species of Culicini in the Sudan (Lewis 1958), and together with C. antennatus, in Egypt (Taylor et al. 1956).

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References

Ashbel, D. 1945. Daily temperatures in the Near East. Hebrew University, Jerusalem. 72 pp.

Barraud, P.S. 1921. Mosquitoes collected in Palestine and adjacent territories. Bull. entomol. Res. 11: 387 - 95.

Buxton, P.A. 1924. Applied entomology of Palestine. Bull. entomol. Res. 14 : 289 - 340.

Goldblum, N. 1959. West Nile fever in the Middle East. Proc. 6th Int. Cong. Trop. Med.& Malar. 5 : 112 - 125.

Horsfall, F.L. and Tamm, M.D. 1965. Viral and rickettsial infections of man. Lippincott Comp. Philadelphia. p. 633.

Jupp, P.G., and McIntosh, B.M. 1967. Ecological studies on Sindbis and West Nile viruses in South Africa. II. - Mosquito bionomics. S. Afr. J. Med. Sci. 32 : 15 - 33.

Kligler, I.J. 1930. The epidemiology and control of malaria in Palestine. University of Chicago Press. 240 pp.

Klingberg, M.A., Jasinska - Klingberg, W., and Goldblum, N. 1959 . Certain aspects of the epidemiology and distribution of immunity of West Nile virus in Israel. Proc. 6th Int. Cong. Trop. Med. & Malar. 5 : 132 - 140.

Mattingly, P.F. 1965. The systematics of the Culex pipiens complex. WHO Vector Control 14: 1 - 9.

Nir, Y., Goldwasser, R., Lasowski, Y. and Margalit, J. 1968. Isolation of West Nile virus strains from mosquitoes in Israel. Am. J. Epidem. 87: 496 - 501.

Olejnik, E. 1952. Infectious adenitis transmitted by Culex molestus. Bull. Res. Counc. Israel 2 : 210 - 1.

Paterson, H.E., Bronsden, P., Levitt, J. and Worth, C.B. 1964. Some culicine mosquitoes (Diptera, Culicidae) of Ndumu, Republic of South Africa. Medical Proceedings (South Africa). 188 - 192.

Saliternik, Z. and Barkai, A. 1963. Mosquitoes in Israel (In Hebrew). Israel Ministry of Health. pp. 83.

Shapiro, J. and Saliternik, Z. 1930. Malaria in Palestine. (In Hebrew). Haseffer Press, Jerusalem. 144 pp.

Stone, A., Knight, K.L. and Starcke, H. 1959. A synoptic catalog of the mosquitoes of the world. Thomas Say Foundation. Vol. VI. 358 pp.

Tahori, A.S., Sterk, V.V. and Goldblum, N. 1955. Studies on the dynamics of experimental transmission of West Nile virus by Culex molestus. Amer. J. Trop. Med. Hyg. 4 : 1015 - 27.

Taylor, R.M., Work, T.H., Hurlbut, H.S. and Rizk, F. 1956. A study of the ecology of West Nile virus in Egypt. Amer. J. Trop. Med. & Hyg. 5 : 579 - 620.

Theodor, O. 1925. Observations on Palestinian Anopheles. Bull. entomol. Res. 15 : 377 - 382.

Table 1. Total number of mosquitoes collected during the survey (1955-58)

Locality	C. p. molestus			C. univittatus			Other species			Total		
	♂	♀	Total	♂	♀	Total	♂	♀	Total	♂	♀	Total
Ashqelon	99	487	586	70	171	241	91	110	201	260	768	1028
Ramla	1038	3711	4749	18	456	474	8	0	8	1064	4167	5231
Ayanot	462	4270	4732	1	4	5	5	10	15	468	4284	4752
Hadera	6	469	475	15	100	115	17	26	43	38	595	633
Pardes-Hana	472	1354	1826	98	102	200	40	42	82	610	1498	2108
Zikhron Ya'aqov	1444	1515	2959	769	819	1588	52	72	124	2265	2406	2671
En Shemer	1155	3579	4734	25	117	142	3	11	14	1183	3707	4890
Bahan-Eyal	790	692	1482	41	39	80	27	33	60	858	764	1622
En HaMifraz	524	1598	2122	234	405	639	9	14	23	767	2017	2784
Sha'ar HaGolan	980	1409	2389	78	379	457	3	9	12	1061	1797	2858
Hulata	921	2618	3539	20	41	61	50	144	194	991	2803	3794
Kefar Ruppin	171	435	606	200	1158	1358	9	32	41	380	1625	2005
Jerusalem	226	1516	1742	0	0	0	1	28	29	227	1544	1771
Total	8288	23653	31941	1569	3791	5360	315	531	846	10172	27975	38147

Other species were mainly: Culex theileri Theobald , C. tritaeniorhynchus Giles , Culiseta longiareolata (Macquart), Aedes caspius (Pallas), Uranotaenia unguiculata Edwards.

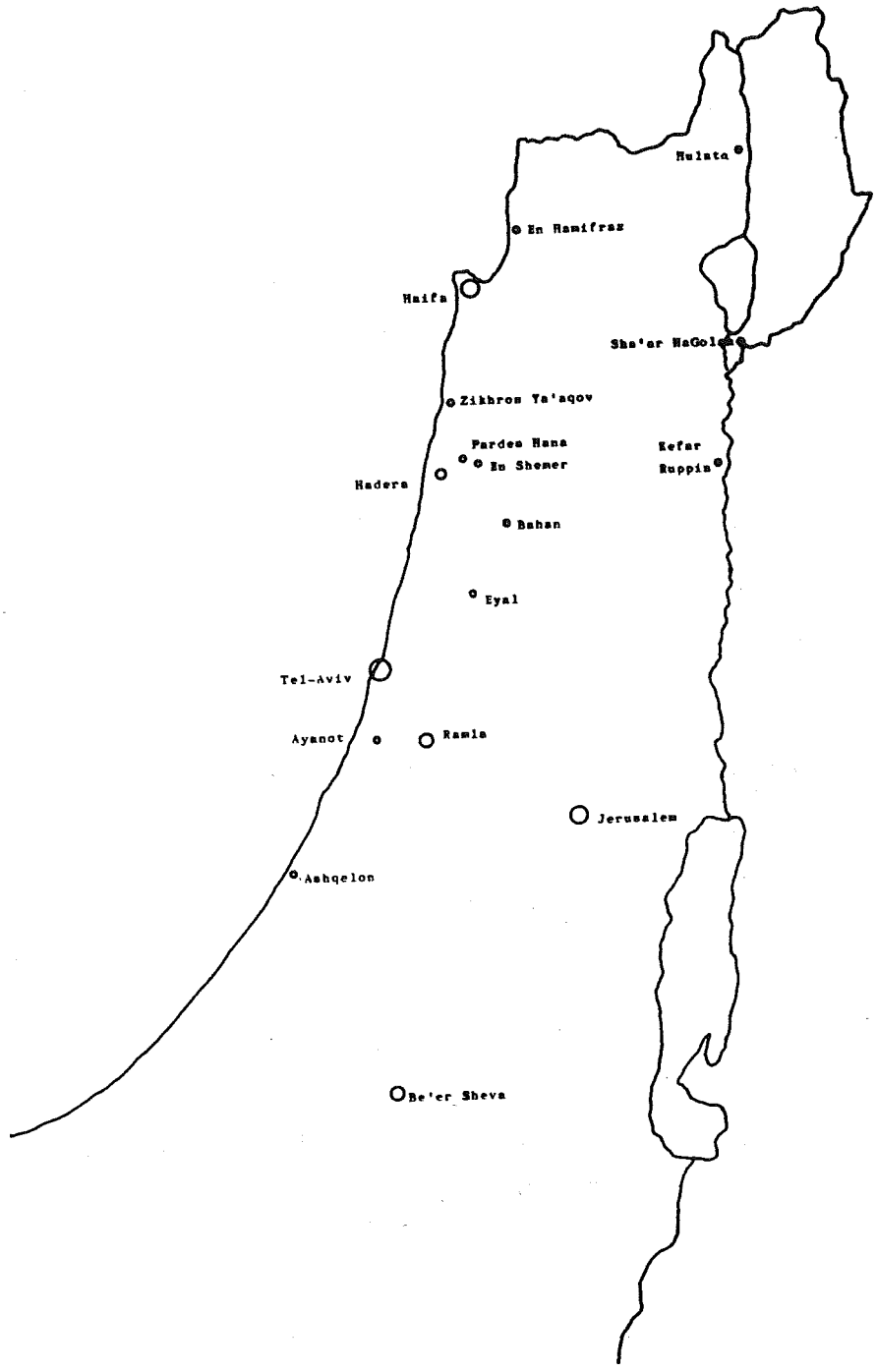

Fig. 1. Map of Israel showing location of collection sites.

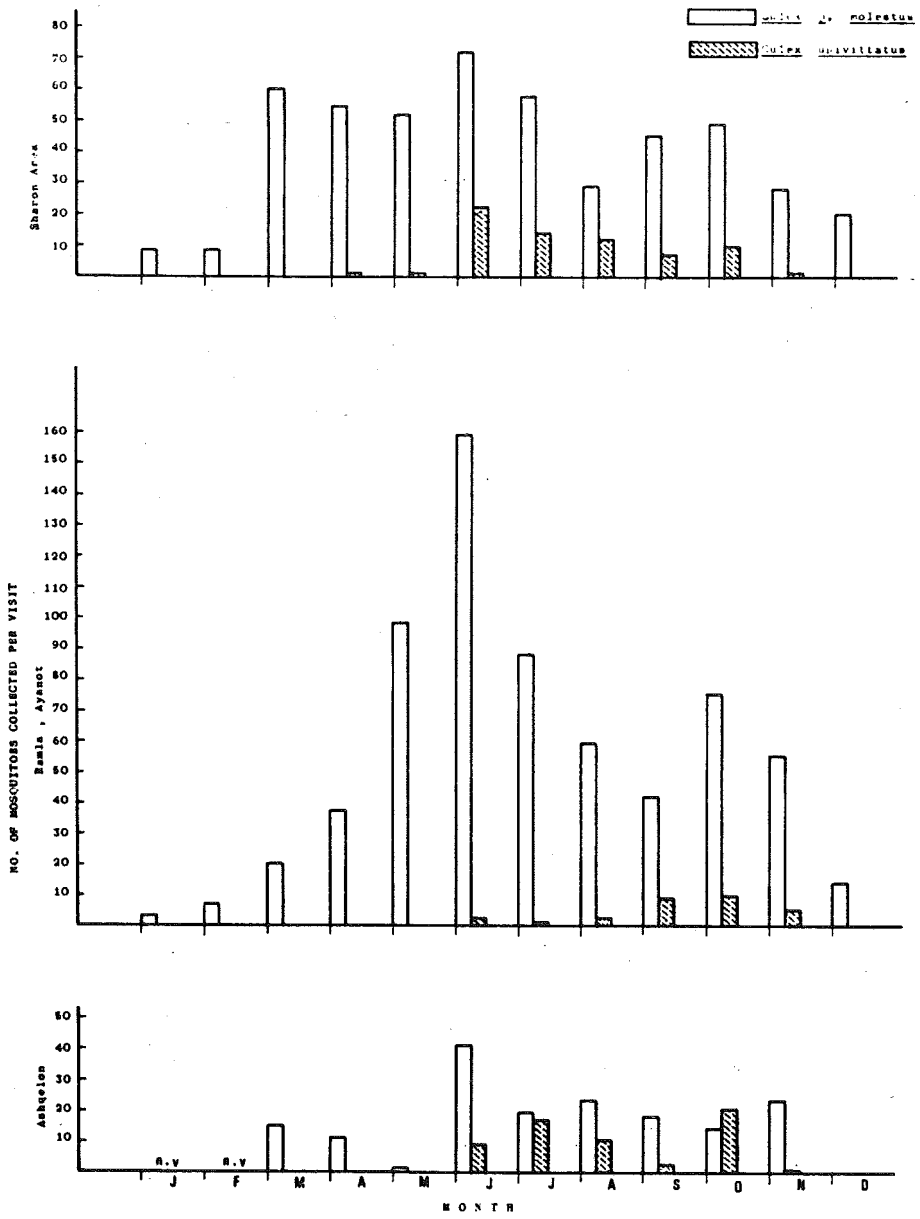

Fig. 2a. Number of C. p. molestus and C. univittatus adults collected per visit during 1955-58. N.V. not visited. Ashqelon; Ramla-Ayanot; Sharon Area.

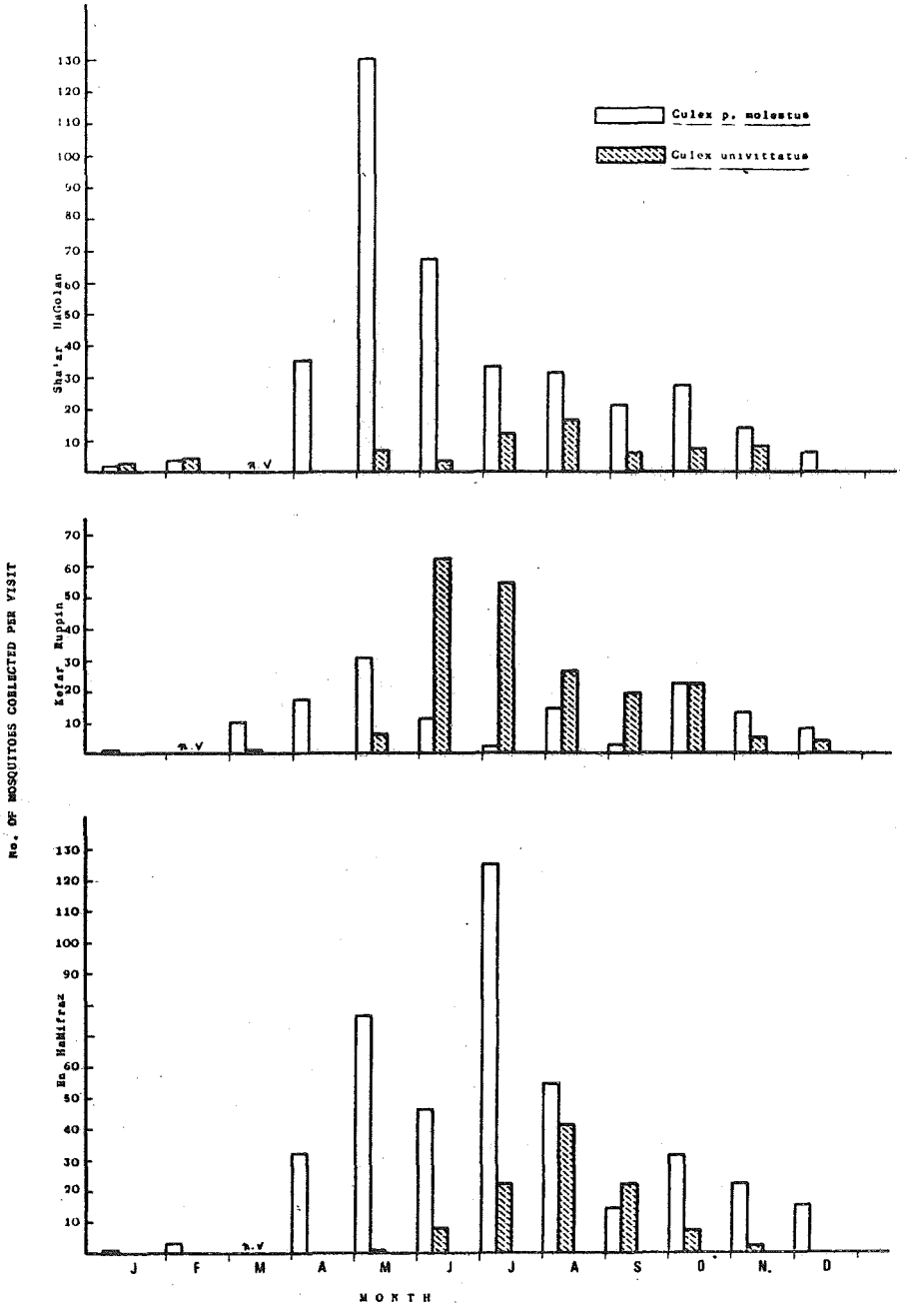

Fig. 2b. Number of C. p. molestus and C. univittatus adults collected per visit during 1955-58. N.V. not visited. En Ha'Mifraz; Kefar Ruppin; Sha'ar Hagolan.

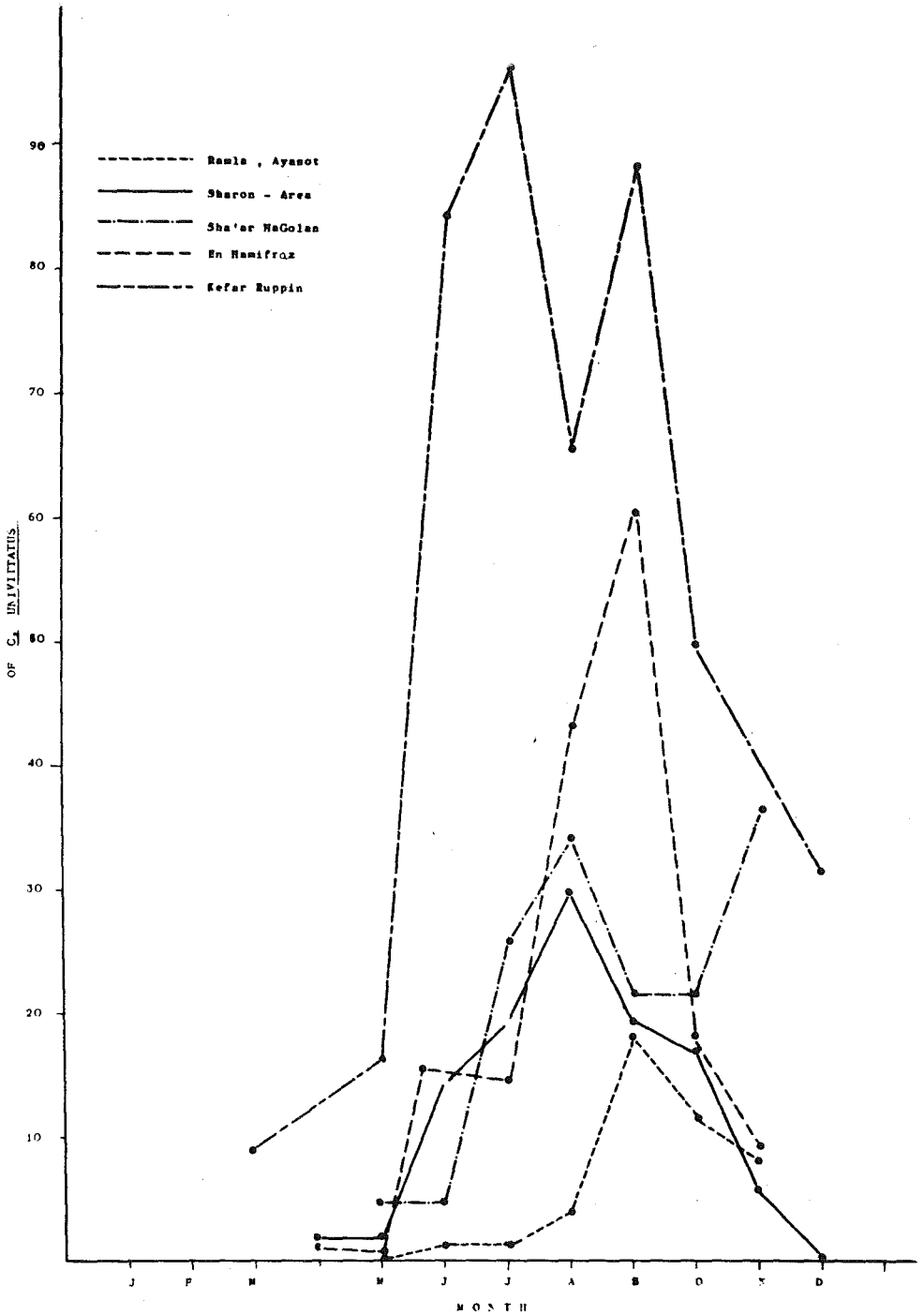

Fig. 3. Percentage of C. univittatus of total Culex population collected during 1955-58 according to month and collecting site.