SEASONAL VARIATION IN POPULATIONS OF *ANOPHELES MACULIPENNIS, ANOPHELES CLAVIGER* AND *CULEX PIPIENS* IN TURKEY

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ABSTRACT. Seasonal variation in larval populations of three species of mosquitoes, *Anopheles maculipennis, An. claviger* and *Culex pipiens*, common in the vicinity of Ankara, were studied. Populations of *An. maculipennis* and *Cx. pipiens* disappeared in larval habitats by December but *An. claviger*, overwintering as larvae remained until the middle of March. Animal footprints are densely populated and are preferred by *Cx. pipiens* and *An. claviger* over larger water bodies.

INTRODUCTION

Changes in environmental conditions affect the duration of life cycle and population density of mosquitoes. Populations reach a maximum level when environmental conditions are optimum. In south central Turkey, where most malaria cases occur in September and October, populations of *Anopheles sacharovi* Favre, the principal human malaria vector reach a peak before August, (Postiglione et al. 1973, Ramsdale and Haas 1978). Populations of *An. superpictus* Grassi, the second most important malaria vector in Turkey, reach a maximum level during the hot and dry summer, (Ramsdale and Haas 1978). *Anopheles maculipennis* Meigen and *An. claviger* (Meigen) are also of importance in malaria transmission. There have been malaria cases in the presence of each of these species alone, i.e., *An. maculipennis* in Biga Plain (Canakkale) and *An. claviger* in Mardin Province, (Postiglione et al. 1973, Ramsdale and Hass 1978). However, in most endemic malaria situations, vectorial importance of these two species is observed by the simultaneous occurrence with *An. sacharovi* and *An. superpictus*.

Culex pipiens (Linn.) is also very abundant and domestic and is usually responsible for most of the mosquito bites in urban areas. It is important as a possible vector of filariasis, which has been reported by Sipahioglu (1965) in southwestern Turkey.

More biological data are needed to assess the vectorial capacity of these species in Turkey and is the reason for this study.

MATERIAL AND METHODS

For studying the fluctuations of populations of mosquito larvae, 4 larval stations were chosen in different directions from Ankara.

Station I consisted of a series of small, sunlit pools without vegetation dug by tile and brick makers.

Station II was a small pool with abundant emergent water plants. The pool has water running through it in winter but becomes stagnant in summer.

Station III was a marsh outside a village. The marsh is large and deep in winter but small and shallow in summer. Emergent and submergent vegetation is found all year.

Station IV was a marsh outside a village, continuously fed by a spring. It was rich in vegetation and favored by cattle and other animals. This station had many hoof prints around the main water body of the marsh.

The seasonal abundance of the larvae was determined by dipping with a standard level dipper, 14 cm in diameter and 6 cm in depth. Counts were made every 4th night. At each station 10 dips were taken. For each dip the larvae were sorted into species and then counted regardless of instar.

RESULTS

The species of larvae found in stations I through III were *An. maculipennis* and *Cx. pipiens* but in station IV *An. claviger* and *Cx. pipiens* were found.

In station I, *An. maculipennis* larvae were present from June through November and *Cx. pipiens* larvae from July through December. Population density was lower for *Cx. pipiens* than for *An. maculipennis* (Fig. 1a). In station II *Cx. pipiens* larvae first appeared in June and *An. maculipennis* larvae in the middle of July but both persisted through December. Populations of *An. maculipennis* larvae were very low (Fig. 1b). In station III larvae of *An. maculipennis* and *Cx. pipiens* were found from mid-June through December; population density was higher for Cx. pipiens than for *An. maculipennis* (Fig. 1c). In station IV, larvae of *An. claviger* and *Cx. pipiens* first appeared in early June; *An. claviger* persisted through March while *Cx. pipiens* disappeared in mid-December. The number of *An. claviger* larvae was higher than that of *Cx. pipiens* (Fig. 1d).

Larval populations varied in all stations but generally were found in high numbers from June to the end of September. Larval populations of both *Anopheles* species reached a maximum level in June and July but that of *Cx. pipiens* in August and September (Fig. 1). A decrease was noticed from September through December. After the middle of December larvae were scarce, water and air temperatures were below zero in Ankara. On December 15 air temperature was −4°C and the water froze. After that no larval counts were made in stations I through III.

In station IV the counts were carried out until March, because *An. claviger* overwinters as larvae. The larval populations of this species also started to decrease in December but remained steady in January and February. In December, January, and February, the larvae could be collected by breaking the ice. Numerous larvae were found in the ice in these months. Ice prevented the larvae from breathing atmospheric air through their siphon. In this situation the larvae were found to assemble around the stems of water plants where the ice does not surround the stem tightly. Pupation of *An. claviger* took place in March and new adults hatched out in April.

In summer, where *An. claviger* and *Cx. pipiens* coexisted in footprints as in station IV, shady footprints were densely occupied by *An. claviger* (Fig. 2) and sunny footprints by *Cx. pipiens* (Fig. 3). The water temperature in sunny footprints was 1–3°C higher than in shady footprints. The footprints harbored more larvae than the main body of marsh (Figs. 4, 5).

DISCUSSION AND CONCLUSIONS

The density of mosquito populations differs according to the species and habitats they live

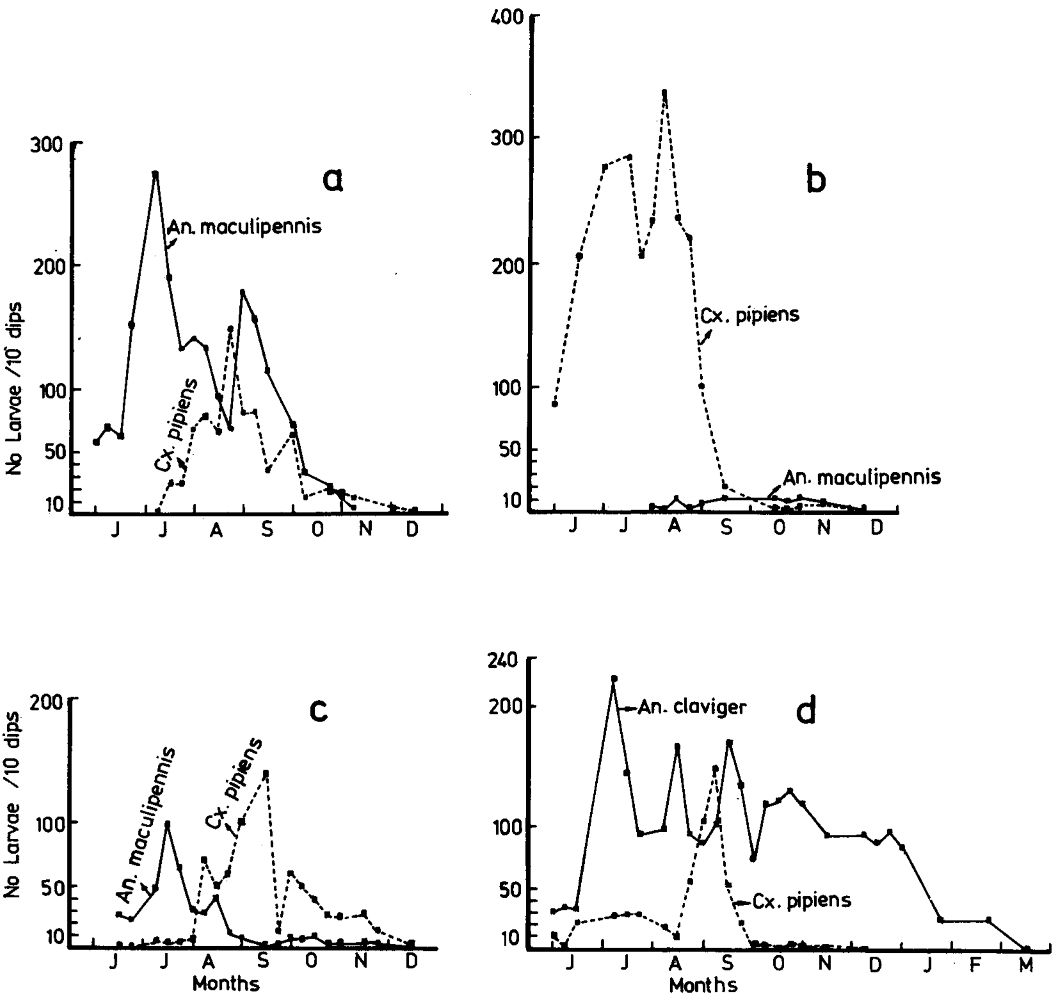

Fig. 1. Larval populations of *Anopheles* and *Culex* in stations I (a), II (b), III (c) and IV (d).

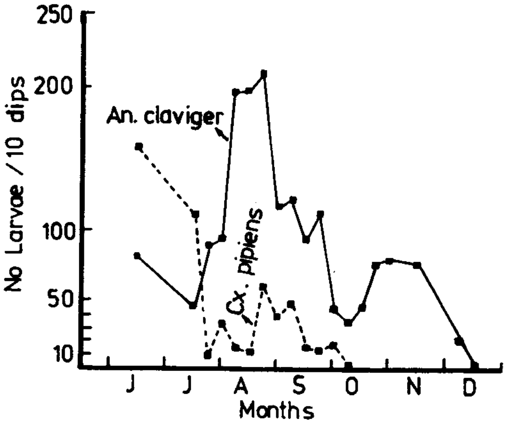

Fig. 2. Larval populations of *Anopheles claviger* and *Culex pipiens* in shady footprints.

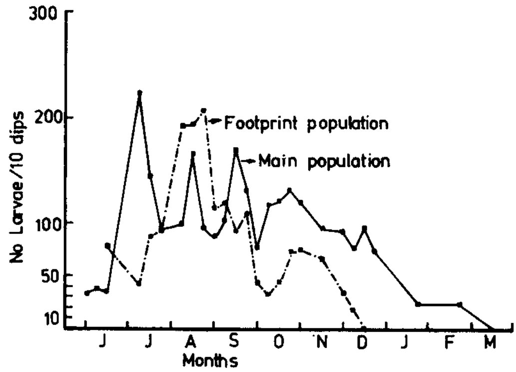

Fig 4. Comparisons of larval populations of *Anopheles claviger* in footprints and main habitat.

in. In Ankara, the larval populations of both *An. maculipennis* and *An. claviger* reached a maximum level in June and July while that of Cx. pipiens reached a peak in August and September. A species living in different environments may reach a maximum density at different times, (Trpis 1972, Southwood et al. 1972, Service 1973). In Ankara *Cx. pipiens* reached a maximum density in August in Stations I and II but in September maximum densities were attained in stations III and IV.

In this study greater population densities of both *Culex* and *Anopheles* larvae occurred in the footprints. Footprints, which were small water bodies, shallow, without vegetation and rather warm usually harbored only the mosquito species *An. claviger* and *Cx. pipiens*. Other organisms such as long lived animals which may be predators of mosquito larvae were not found. This may imply that such conditions, especially the absence of predators favor mosquito breeding in these habitats. The warmer water shortens the duration of the immature stages resulting in a rapid population increase.

Anopheles claviger overwinters as larvae in Turkey as in other countries where it is found,

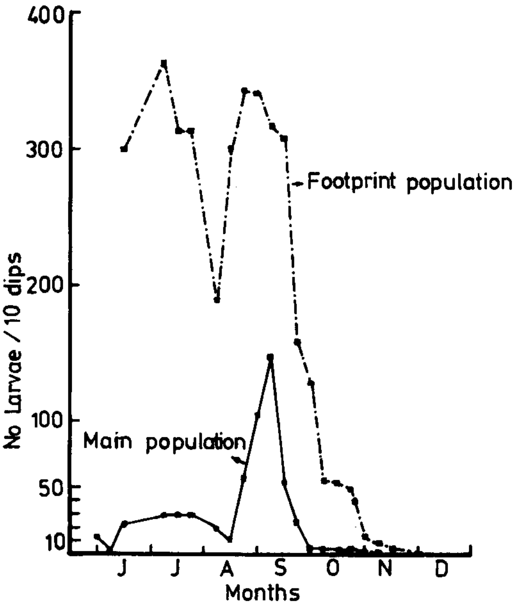

Fig. 3. Larval populations of *Anopheles claviger* and *Culex pipiens* in sunny footprints.

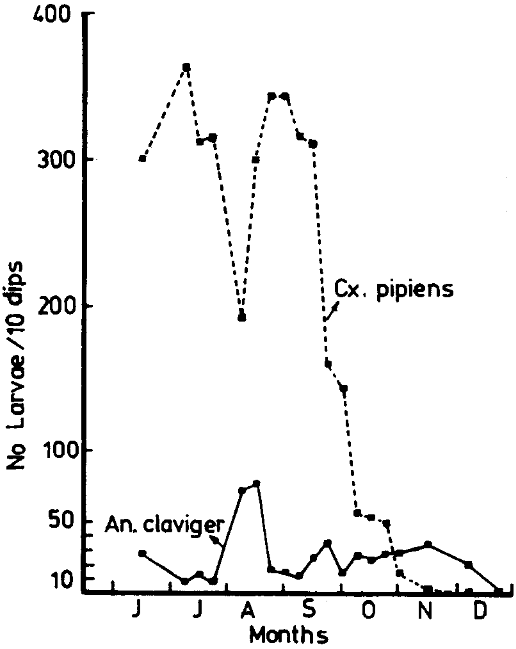

Fig. 5. Comparisons of larval populations of *Anopheles claviger* and *Culex pipiens* in footprints and main habitat.

(Postiglione et al. 1973, Service 1973, Marshall 1938, Shute 1933). It seems that in Turkey breeding of *An. claviger, An. maculipennis* and *Cx. pipiens* stops in October (Fig. 1). For *An. claviger* overwintering larval population density is expected to remain more or less steady from October to December when the water surface freezes. Then the number of larvae drops because some larvae are captured in ice. It also seems that habitats with emergent plants are more suitable for hibernating sites of *An. claviger* as larvae can freely breathe through holes around the stems of water plants where most of the hibernating larvae were collected in the study.

This study has obtained information regarding population size of mosquito larvae that should be known before any chemical or other control measures are applied. Small water bodies are important mosquito breeding sites which cannot be ignored during mosquito control programs.

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