

INFLUENCES OF THE AQUATIC WEED *LEMNA* SPECIES ON MOSQUITO BREEDING

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ABSTRACT

Field surveys showed that mosquito larvae are rarely found in otherwise suitable breeding places when the water surface is densely covered with the duck weed, *Lemna* species. Laboratory tests using colonized *Culex pipiens* indicated that scattered mats of the plant attracted more females to oviposit and enhanced larval development but obstructed egg hatching. Dense plant cover seemed to prevent larval respiration and adult emergence. The results also indicated the absence of toxins or metabolic by-products harmful to larvae in the breeding water of *Lemna* plant.

INTRODUCTION

In an earlier study, (Hilmy et al., 1987) observed that the presence of extensive aquatic vegetation had a marked inhibitory effect on mosquito breeding. A possible reason for this phenomenon is that the plant may alter the chemical and/or physical properties of the breeding water. It is also possible that the plant may obstruct egg laying or prevents larval respiration (Hobbs and Molina, 1983). The possible influences were explored in the present work by studying the effect of the widely distributed duck weed, *Lemna* spp. on mosquito breeding.

MATERIALS AND METHODS

Eleven unused wells covered with the aquatic plant, *Lemna* species and four plantless control wells at Qalubiya Governorate were selected for field survey. These wells are more or less similar to each other, each with a surface area of about 12 m² and an average depth of about 2.8 meter. All wells were surveyed three times during April and May, 1992. Ten samples were taken from each well using an aluminum ladel, 15 Cm in diameter, provided with a short wooden handel. Plant density, water pH and temperature, were measured and recorded.

The laboratory work was carried out in an insectary at the Entomology Department, Faculty of Science in Benhha using a laboratory colony of *Culex pipiens*. Plastic cups (150 ml) were filled with tap water and divided into three groups; the first group was provided with about 35 *Lemna* plant/cm² of water surface "dense plant cover". The second group was provided with about 15 plant/cm² of water surface "low density", and the third group was left as a plantless control group. These groups were used to verify the effect of the plant on the following:

1. Selection of oviposition site: Three cups representing each group were placed in a wooden cage, 40x40x40cm, containing a number of gravid females of *Culex pipiens*. By the next day, the number of egg rafts deposited in each cup was counted.
2. Egg hatching: One egg raft was placed on the surface of each cup. After hatching, the number of first instar larvae found in each cup was recorded.
3. Duration of larval stage and adult emergence: Ten first instar larvae in the same age were placed in each cup of the different groups, the duration of larvae and percentage adult emergence were recorded.

RESULTS AND DISCUSSION

The data in table (1) show the results of larval sampling in the plantless and plant covered wells. There were significantly more larvae ($P > 0.01$) in the plantless control wells than in wells with dense plant cover. On the other hand, more larvae ($P > 0.05$) were found in wells covered with low plant density than in plantless control wells.

Table (1) Average number of mosquito larvae/dip. pH and temperature of water in plantless and plant covered wells during April and May, 1992.

Density of Plant	Average no. of larvae/dip ±S.D.		Water temperature ±S.D.	pH ±S.D.
	<i>Culex pipiens</i>	<i>Culexita longaeriolata</i>		
Zero	16.8±2.87	3.3±0.47	19.7±0.81	7.75±0.15
Low	19.4±2.49	4.1±1.82	19.7±0.71	7.73±0.26
High	1.4±0.94	0.7±0.25	19.6±0.69	7.61±0.6
Low : 15 plant/Cm ²		High : 35 plant/Cm ² of water surface		

The presence of high larval density in wells covered with low plant can only suppress breeding when it is found in high density. This finding also indicates the absence of toxins or metabolic by-products produced by *Lemna* which would be harmful to larvae and results in lower larval density in places with low plant density. Insignificant difference was found between the values of temperature and pH of the three groups.

Cage oviposition tests in the laboratory show that *Lemna* plant may provide a good oviposition substrate for *Culex pipiens*. A positive correlation was found ($P > 0.05$) between the number of egg rafts deposited and the density of plant cover (table, 2). Many investigators believed that

Table (2) Number of egg rafts deposited by caged *Culex pipiens* in containers with and without *Lemna* sp. under lab. conditions (water temp. : $21 \pm 2^\circ\text{C}$ and $55 \pm 5 \text{ R.H.}$).

Test no.	No. of gravid females	No. of egg rafts deposited in containers with diff. plant density		
		Zero	Low	High
1	30	2	6	5
2	75	4	2	11
3	41	3	5	8
Low : 15 plant/Cm ²		High : 35 plant/Cm ² of water surface		

emergent vegetation as well as floating wood or any matter placed in a manner similar to emergent vegetation may mechanically obstruct egg laying by Anopheline mosquitoes (Earle, 1932; Russell and Rao, 1942; de Zulueta and Bates, 1948; Furlow and Hays, 1972; Angerilli and Bairne, 1980 and Hobbs and Molina, 1983). This disagreement may be due to the difference in oviposition behavior between Anopheline and Culicine mosquitoes or due to other factors.

Egg hatchability data in tests where egg rafts of *Culex pipiens* were placed on *Lemna* plant covering water surface are presented in table (3). A negative correlation ($P > 0.05$) was found between the number of larvae produced and the density of plant cover. The decreased number of larvae produced in the presence of plant cover may be due to dryness of some eggs separated from water surface by the plant and/or the plant may mechanically obstruct hatching of larvae. Some larvae died may due to other mortality factors.

Table (3) Number of *Culex pipiens* larvae produced from the egg rafts placed on water surface covered with different densities of *Lemna* plant under lab. conditions (water temp. of $21 \pm 2^\circ\text{C}$).

Plant density	No. of eggs	No. of larvae found	dead larvae (%)
Zero	413	402	2.66
Low	541	301	44.36
High	710	22	96.6
Low : 15 plant/Cm ²		High : 35 plant/Cm ² of water surface	

The presence of *Lemna* plant also affected larval development. Development was faster in containers covered with low plant density than in plantless control containers (table, 4). Faster development may be due to a change in the kind and/or amount of particulate matters or micro-organisms eaten by larvae.

the results also indicated that dense plant mates completely inhibited larval breeding apparently because

Table (4) Development of *Culex pipiens* larvae in containers with and without *Lemna* plant under lab. conditions (water temp. of $21 \pm 2^\circ\text{C}$).

Plant density	% No. of larvae pupated after				Dead larvae (%)
	5 days	6 days	7 days	8 days	
Zero	0.0	36.7	43.3	10.0	10.0
Low	16.7	46.7	23.3	0.0	13.3
High	0.0	0.0	0.0	0.0	100.0

larvae failed to reach water surface for respiration. It is needless to say that the results obtained from these laboratory experiments may not necessarily be applicable to field conditions where many other factors may interfere with mosquito breeding.

It may be concluded that *Lemna* species and other similar floating vegetations must be taken in consideration in designing any mosquito control program. Transplanting the weed to selected permanent breeding places, as wells and old Sakia pits, that can not be dealt by other method, may be a good natural method of mosquito control.

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