Nature Environment and Pollution Technology
An International Quarterly Scientific Journal

Vol. 8	No. 4	pp. 777-780	2009

Original Research Paper

Effect of a Biocide on Different Stages of Mosquito, *Aedes aegypti* (Diptera: Culicidae)

K. Sithara, K. Kamalaveni and A. Sharon Rose Susannah
P.G. and Research Deptt. of Zoology, Kongunadu Arts and Science College, Coimbatore-641 029, T.N., India

Key Words:
Biocide
Aedes aegypti
Mosquito control

ABSTRACT

Plant products are capable of producing multiple effects in insects such as antifeedancy, growth regulation, fecundity suppression, sterilization, etc. Synthetic pesticides lead to serious problems like environmental pollution, health hazards and insect resistance to insecticides. Study of egg, larvae and pupae affected by the testing of different concentrations of some biocide showed an increased mortality over the control. The results have been discussed in the light of biopesticides as good alternative for the synthetic pesticides used in mosquito control.

INTRODUCTION

Mosquitoes play an important role in transmitting dreadful diseases. Present study has been highlighted on the control of *Aedes aegypti*. Much attention has been focused on the *Aedes aegypti*, which play a major role in transmission of dengue fever all over the world. Its human association is inseparable due to blood feeding habit of the female mosquito for the persistence of the progeny through egg formation.

The problem of using synthetic pesticides in agriculture leads to serious problems like environmental pollution, health hazards and insect resistance to insecticides. Some products cause environmental contamination, adverse effects on nontarget organisms and led to a build up of resistance in pest populations (Tremblay 1982, Schutterer 1990).

Use of botanicals like neem (*Azadiracta indica*) in management of vectors causing human diseases hold a great promise. Being a safe, cheap and effective (Singh & Singh 1995), neem products are ideal for management of vectors. Repellent action of extract of *Acorus calamus* has been reported by Deshmukh & Renapurkar (1989). Sighamony et al. (1986) found that the oil of certain plants (e.g., *Ocimum basilicum, Arum ajowanum, Bursera delpechiana, Coriandrum sativum, Mentha citrate, Mentha arvensis, Eucallyphis citriodora, Artemesia pallens, Acorus calamus*) can repel flies when used at 10-12% concentration, and are toxic (knock-down effect) at 20% concentration. The present work deals with the effects of extracts of some plants used as biocides on different life stages of mosquitoes.

MATERIALS AND METHODS

Eggs were collected in the early morning around 5:00 a.m. to 6.30 a.m. from stagnant water bodies and allowed to hatch in glass troughs containing 2 litres of tap water (8cm dia × 9cm height) in laboratory condition (29 ± 2°C). After 24 hours freshly hatched larvae were collected and maintained in separate containers and fresh food was given to them. Pupae were isolated from the culture follow-

ing the method of Ramakrishna et al. (1963) and allowed to emerge into adults in the mosquito net cages (42cm × 33cm × 39 cm). Emerged adult were fed with 3% sucrose solution soaked in cotton for male. Pigeon blood was given as the source of blood to female mosquitoes as detailed by Meola & Readio (1987).

For the present study, the leaves of *Vinca rosea, Vitex negundo, Aloe vera, Calotropis giganta* and *Azadirechta indica* were collected, shade dried and powdered. All five powdered materials were taken in same amount (50g), added with 250mL of cow urine, mixed well and incubation for 15 days. This mixture was weighed and different concentrations (0.1, 0.5, 1.0, 1.5, 2.0%) of the extracts were prepared using 2% acetone. The extracts were prepared by homogenizing and centrifugation at 5000 rpm for 15 min.

Eggs, larval instar and pupae of *Aedes aegypti* were harvested from the colony and placed in different concentrations of the biocides. Twenty insects were used for each concentration. Eggs, larval instar and pupae were checked for mortality every 24 hrs. In case of control only carrier solvent was added. Food was provided in all the test beakers. Each test was replicated five times.

RESULTS AND DISCUSSION

Study of egg hatchability in mosquitoes, treated with various concentrations of the biocides, viz., 0.1, 0.5, 1.0, 1.5, 2.0% in experimental eggs exhibited a significant increase in mortality rate of 4 (± 0.48), 8 (± 0.8), 12 (± 0.74), 13 (± 0.74) and 16 (± 0.74) respectively (Table 1). The chemicals diffuse into eggs and affect the vital physiological and biochemical processes associated with embryonic development, thereby inhibiting eclosion of eggs (Boeadbent & Pree 1984); penetration of ovicides through chorion was demonstrated earlier (Smith & Salkerd 1996).

Study of IV instar larvae of mosquito treated with various concentrations of biocide viz., 0.1, 0.5, 1.0, 1.5, 2.0% exhibited a significant increase in mortality rate of 3 (± 0.48), 6 (± 0.97), 11 (± 0. 48), 15 (± 0.97) and 18 (± 0.48) respectively (Table 2). The larvicidal activity of neem leaves was reported by Chavan et al. (1979). Analysis of pupa of mosquitoes treated with these concentrations of the biocide exhibited a significant increase in mortality rate of 3 (± 0.48), 6 (± 0.74), 9 (± 0.97), 13 (± 0.4) and 15 (± 0.63) respectively (Table 3). Though the insecticidal action was reduced at the lower concentrations, it becomes progressive and pronounced at each higher concentrations.

Study of egg hatchability using biocide can be explained in the inhibition of chitin synthesis, interfering with the formation of endocuticular deposition (Miura et al. 1976). A similar mode of action may be suggested for neem products as they were observed to affect chitin synthesis (Sharma & Chandra Shekher 1999).

Aqueous and alcoholic extracts of deoiled neem seed kernel were reported to extend the larval periods of *Aedes aegypti* by several days (Zebitz 1986). Plant of *Lantana camera* is also known for its various bioactive actions (Lal & Krishnaprasad 1980). Supavarn et al. (1974) tested 36 vegetable extracts on *Aedes aegypti* and found that 11.1% were capable of producing mortality at a concentration of 500 ppm but only 2.8% produced the same effect at a concentration of 100 ppm.

The methanolic extract of the leaves of the plant *Atlantia monophylla* has been found to possess various activities, such as lavicidal, pupicidal and insect growth regulation properties against the three mosquito species tested. Methanolic extract of the leaves of *Atlantia monophylla* (Rutaceae) were evaluated for mosquitocidal activity against immature stages of three mosquito species, *Culex quinquefaciatus, Anopheles stephensi* and *Aedes aegypti* in the laboratory (Sivagnaname &

Table 1: Effect of different concentrations of biocide on egg hatchability of mosquito.

S.No	Concentration	Control (mean + SD)	Experimental (mean + SD)	% Change
1	0.1	6 ± 0.74	4 ± 0.48	33.33
2	0.5	9 ± 1.16	8 ± 0.80	11.11
3	1.0	14 ± 0.80	12 ± 0.74	14.28
4	1.5	15 ± 0.89	13 ± 0.74	13.30
5	2.0	18 ± 0.74	16 ± 0.74	11.11

Table 2: Effect of different concentrations of biocide on IV instar larvae of mosquito.

S.No	Concentration	Control (mean + SD)	Experimental (mean + SD)	% Change
1	0.1	5 ± 0.74	3 ± 0.48	-40.00
2	0.5	8 ± 0.89	6 ± 0.97	-25.00
3	1.0	13 ± 0.74	11 ± 0.48	-15.38
4	1.5	17 ± 1.46	15 ± 0.97	-11.76
5	2.0	19 ± 0.63	18 ± 0.48	-5.26

Table 3: Effect of different concentrations of biocide on pupae of mosquito.

S.No	Concentration	Control (mean + SD)	Experimental (mean + SD)	% Change
1	0.1	6 ± 0.80	3 ± 0.48	-50.00
2	0.5	8 ± 1.01	6 ± 0.74	-25.00
3	1.0	11 ± 1.16	9 ± 0.97	-18.18
4	1.5	14 ± 0.74	13 ± 0.40	-7.14
5	2.0	17 ± 0.89	15 ± 0.63	-11.76

Kalyanasundaram 2004). The potential of three piper species, *Piper longum, Piper ribesoides* and *Piper sarmentesum* against *St. aegypti* was strong and found to have various degrees of adulticides. *St. aegypti* adults were most susceptible to *Piper sarmentosum* (Wej et al. 2006).

The significant increase in the mortality of egg hatchability, larvicidal and pupicideal activity of the biocide indicates the potentially of biocide in controlling the mosquito population. As the conventional insecticides are becoming less popular due to rapid development of resistance and their ability to pollute the environment, the present study clearly indicates that the botanical pesticides are good alternatives for the synthetic pesticides that can be effectively used in mosquito control programmes.

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