OVIPOSITION ATTRACTANCY OF SOME SUBSTITUTED ESTERS AND THE PHEROMONE EXTRACTED FROM EGG RAFTS AGAINST *CULEX QUINQUEFASCIATUS*

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MOSQUITO control in urban area poses special problem due to the enormity of breeding habitats. The breeding habitats are so widely distributed that detection and treatment of each not only involves larger manpower but also not cost-effective. The oviposition attractant can play a useful role in such a situation by directing the ovipositing females to few desired sites which can conveniently be taken care of by appropriate control methods. Besides reducing the number of sites to be treated, the attractant can also play an important role in monitoring mosquito population.

The chemical factors involved in oviposition site choice by the mosquito have become the focus of interest in recent years. Bentley *et al*[1] found that p. cresol, a trace component of aqueous infusions of decayed paper birch, produced a highly selective oviposition response against *Aedes triseriatus*. The ovipositional activity of organic infusions against *Culex quinquefasciatus* has been studied by Mulla and co-workers[2]. The hexane extract of apical droplets of eggs of *C. quinquefasciatus* was found to attract gravid females to preferentially lay their eggs[3]. The present study examined how *C. quinquefasciatus*, the filaria vector's oviposition, is influenced by application of some substituted esters synthesized at VCRC to oviposition site.

The substituted esters (methyl, ethyl, isopropyl and butyl) were prepared by reacting the carboxylic acid with respective methanol, ethanol, isopropanol and butanol in the presence of sulphuric acid. The compounds were purified by vacuum distillation or crystallization.

A stock solution of each ester compound (0.3% or 3000 ppm) was made in ethanol. One ml from the stock solution when added to 199 ml of tapwater gave 15 ppm solution. A control was set up with tapwater (199 ml) and 1 ml of ethanol. The test and control solutions were taken in enamel bowls. The bowls were placed in a mosquito cage (55 × 55 × 55 cm) containing 100 gravid females of *C. quinquefasciatus* mosquitoes. Each day the experiment was started at 16 hr and the counting of egg rafts in both test and control solution was made at 10 a.m. on the next day. The positions of the bowls were changed every time and the experiment was repeated four times at 27 ± 2°C.

The oviposition active index[4] was then calculated using the formula,

$$\text{O.A.I.} = \frac{N_t - N_s}{N_t + N_s},$$

where N_t is the total number of egg rafts in test solution and N_s is the total number of egg rafts in control.

The oviposition active index would then indicate the oviposition attractancy or repellency by the positive or negative values. The significant attractancy will then be shown by O.A.I > +0.3.

A similar study was made on the ether extract of the apical droplets of the egg rafts of *C. quinquefasciatus*. About 1000 egg rafts of *C. quinquefasciatus* were extracted with 50 ml of diethyl ether at room temperature. The ether layer was filtered off and concentrated at reduced pressure to give a small residue. The ethanol solution was tested at 1 ppm for oviposition attractancy against *C. quinquefasciatus* (both lab strain and field strain) and *Aedes aegypti*.

The pheromone was also tested against each effective ester compound and the experiment was repeated three times for three possible positions of each bowl.

Among the 108 esters tested for oviposition attractancy against gravid females of *C. quinquefasciatus* only eight compounds showed consistent effects i.e. greater number of egg rafts in test solution during all the replicates are considered to have oviposition attractancy. These eight compounds viz butyl benzoate, methyl-3-amino benzoate, butyl-2-ethyl hexanoate, methyl-3,5-dinitro benzoate, butyl-3,5-dinitro benzoate, butyl-2,4-dihydroxy benzoate, ethyl crotonate and methyl phenoxyacetate showed consistent and significant oviposition attractancy at 15 ppm concentration. Table 1 shows the oviposition responses of gravid female *C. quinquefasciatus* when exposed to the ester solutions in ethanol.

The results showed that all the eight esters had OAI values more than 0.30. The butyl esters generally showed greater attractancy compared to

Table 1 *Oviposition attractancy of esters against C. quinquefasciatus*

Ester code No.	Name of the compound	No. of egg rafts		
		Test	Control	O.A.I.
E-12	Butyl benzoate	285	80	0.56
E-34	Methyl-3-aminobenzoate	273	123	0.38
E-40	Butyl-2-ethylhexanoate	248	129	0.31
E-42	Methyl-3,5-dinitrobenzoate	262	120	0.37
E-44	Butyl-3,5-dinitrobenzoate	297	58	0.67
E-52	Butyl-2,4-dihydroxybenzoate	283	89	0.52
E-57	Ethylcrotonate	156	45	0.55
E-70	Methyl phenoxyacetate	275	89	0.51

Table 2 *Oviposition attractancy of pheromone from apical droplet of C. quinquefasciatus*

Test species	No. of egg rafts		
	Test	Control	O.A.I.
C. quinquefasciatus (Lab strain)	522(9)	212	0.42
C. quinquefasciatus (Field strain)	161(3)	43	0.57
*A. aegypti**	1027(3)	1569	−0.20

The figures in parentheses indicate the no. of replicates.
*Number of eggs.

Table 3 *Comparative study of oviposition attractancy of pheromone vs ester*

Name of the ester	Number of egg rafts				
	Pheromone solution	Ester solution	Control	O.A.I. pheromone	O.A.I. ester
Butyl benzoate	172	57	61	+0.47	−0.03
Methyl-3-aminobenzoate	144	107	96	+0.24	+0.05
Butyl-2-ethyl hexanoate	161	72	99	+0.24	−0.15
Methyl-3,5-dinitrobenzoate	132	78	88	+0.20	−0.06
Butyl-3,5-dinitrobenzoate	167	77	46	+0.57	+0.25
Butyl-2,4-dihydroxybenzoate	172	124	63	+0.46	+0.32
Ethylcrotonate	153	170	55	+0.47	+0.51
Methyl phenoxyacetate	142	96	95	+0.20	−0.001

the other substituted esters as shown by the OAI values of 0.31, 0.52 and 0.67.

The oviposition attractancy of ether extract of the pheromone obtained from the apical droplets of egg rafts also showed attractancy in different replicates. When the pheromone was tested against *A. aegypti*, a greater number of eggs were laid in control showing the species specificity. The pheromone was also tested against the gravid females of *C. quinquefasciatus* from field and was found to have significant attractancy as shown by the OAI value of 0.57 (table 2).

The comparative study of the pheromone against each effective ester was done at 1 ppm level of both pheromone and ester. The results are shown in table 3. Four of the esters failed to attract which were originally showing attractancy in the presence of pheromone. The pheromone has been consistently

showing attractancy in all the tests. The two butylesters, butyl-3,5-dinitro benzoate and butyl-2,4-dihydroxybenzoate had their OAI values reduced to 0.25 and 0.32 from 0.67 and 0.52 in presence of pheromone. Only ethyl crotonate is found to retain its attractancy with an OAI value of 0.51 even in the presence of pheromone. This study shows that ethyl crotonate can stimulate the oviposition response of gravid *C. quinquefasciatus*. These effective ester compounds may play a useful role in control operations as baits and to monitor vector population.

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A NEW HOST RECORD FOR THE TEAK DEFOLIATOR, HYBLAEA PUERA (LEPIDOPTERA: HYBLAEIDAE)

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HYBLAEA PUERA is an important defoliator of teak (*T. grandis*) in India. Beeson[1] recorded 28 host tree species of *H. puera* belonging to the families Araliaceae (1 sp), Bignoniaceae (13 spp), Juglandaceae (1 sp), Oleaceae (1 sp) and Verbenaceae (12 spp)

Vitex altissima (Verbenaceae) is newly recorded as a host plant of *H. puera*, an important defoliator of *Tectona grandis* (Verbenaceae). *V. altissima* is a large deciduous tree found growing naturally, commonly in semi-evergreen, occasionaly in evergreen and sporadic in moist deciduous forest type up to an altitude of 1200 m.

In April 1984, larvae of *H. puera* were first noticed feeding on tender foliage of saplings of *V. altissima* (Verbenaceae) growing naturally near a teak seed orchard at Arippa, Trivandrum (Kerala State). Larvae collected from the field were reared successfully on *V. altissima* leaves. Subsequent experiments in the laboratory confirmed that *H. puera* completed developments successfully from egg to adult on *V. altissima* leaves. To compare the developments, newly emerged larvae were released simultaneously on tender leaves of *V. altissima* and *T. grandis*. Two replicates with 20 larvae each were used and the leaves were changed daily. The larval and pupal development periods and pupal weights were determined and compared statistically.

The data (table 1) showed that there was no significant difference in the developmental periods between insects reared on the two hosts. However pupal weight was slightly smaller in insects reared on

Table 1 *Development of H. puera on leaves of T. grandis and V. altissima*

Tree species	Mean larval period days ± SE	Mean pupal period days ± SE	Mean pupal weight g ± SE	% survival of: larva to pupa	% survival of: pupa to adult
Tectona grandis	10.7 ± 0.2^a	5.7 ± 0.2^a	23.49 ± 1.01^a	100	88
Vitex altissima	11.2 ± 0.2^a	5.9 ± 0.1^a	19.02 ± 0.96^b	95	76

[a, b] significantly different at 1% level.