

Susceptibility status of some culicine mosquitoes to insecticides in Rajahmundry town of Andhra Pradesh, India

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Since long Rajahmundry town, East Godavari district of Andhra Pradesh, India is endemic for transmission of lymphatic filariasis¹. Due to unplanned rapid urbanisation, unreliable water supply, open drainage system and water storage practices among the people of Rajahmundry town, heavy breeding of *Culex quinquefasciatus* (Diptera : Culicidae), the vector of filariasis and *Aedes aegypti* (Diptera : Culicidae), the vector of dengue/DHF noted in the town^{1,2}. No recent data is available on the susceptibility status of vector culicine mosquitoes to commonly used organochlorine (OC) and organophosphorous (OP) insecticides in this area. An attempt was, therefore, made to generate baseline data on susceptibility status of adult and larvae of *Cx. quinquefasciatus* and *Ae. aegypti* to commonly used OP and OC insecticides between October 2004 and January 2005.

Rajahmundry town is situated on the eastern bank of the River Godavari. The surface is more or less plain with some undulations and the subsoil water is high. The town is divided into 44 wards with a population of 4.2 lacs (2001 census). The town is with open drainage and septic tank systems. The drinking water supply by the Municipal Corporation of Rajahmundry (MCR) is erratic and almost every house has wells and underground reservoirs, thus causing mosquito-genic conditions. Larvae of *Cx. quinque-*

fasciatus and *Ae. aegypti* were collected from different breeding places in Seetampeta, Weavers' Colony and Kambalapeta areas of the town. The larvae were brought to the laboratory, identified and reared species-wise separately to adults.

Twenty laboratory bred, bloodfed healthy adult female *Cx. quinquefasciatus* and *Ae. aegypti* were exposed separately to 4% DDT and 5% malathion (diagnostic dose) impregnated papers supplied by WHO along with control, following standard WHO technique^{3,4}, using WHO test kits. The exposure time of mosquitoes was 60 min⁴ (standard recommended time) both for DDT and malathion along with control. Mortality was noted after 24 h of holding period. Temperature and relative humidity were maintained as $24 \pm 2^\circ\text{C}$ and $65 \pm 5\%$, respectively. Three replicates were done against each insecticide.

Twenty-five III and early IV instar larvae of *Cx. quinquefasciatus* and *Ae. aegypti* were tested separately against temephos (0.125 and 0.625 mg/l concentration), fenthion (0.025 and 0.125 mg/l conc.) fenitrothion (0.025 and 0.125 mg/l conc.) and malathion (0.125 and 3.125 mg/l conc.) supplied by WHO, along with controls with the help of WHO test kits following standard WHO technique³. Four replicates were used against each concentration along with control. Mortality rates were cal-

culated after 24 h. Temperature was maintained as $24 \pm 2^\circ\text{C}$.

Results on the susceptibility status of *Cx. quinquefasciatus* and *Ae. aegypti* adults to 4% DDT and 5% malathion impregnated WHO papers are shown in Table 1. As per the table, in one hour exposure, zero percent mortality of *Cx. quinquefasciatus* adults was noted for both DDT and malathion. Only 20 and 76.6% mortality was observed among *Ae. aegypti* adults when exposed to DDT and malathion respectively. In India, first evidence of development of DDT resistance in *Cx. quinquefasciatus* was observed in 1952 from a village near Delhi⁵. Later, several areas like Nagpur, Pune, Patna⁶, reported resistance in *Culex* mosquitoes to DDT and dieldrin. Rajagopalan⁷ in 1954 noted resistance to BHC in *Cx. quinquefasciatus* in India. As per Urban Malaria Scheme (UMS) and National Filariasis Control Programme (NFCP) norms, there is no spraying of DDT in Rajahmundry town since 1971, except one round of DDT spray in July 2003 during *Pushkaram* festival. MCR is undertaking irregular spraying operation with malathion by thermal fogging method since last six years (personal communication with MCR and NFCP unit, Government of Andhra Pradesh). Rao *et al*⁸ in 1988 noted 3.5 and 94.4% mortality in *Cx. quinquefasciatus* mosquitoes to 4% DDT and 5% malathion respectively from Rajah-

Table 1. Susceptibility status of *Cx. quinquefasciatus* and *Ae. aegypti* adults to DDT and malathion in Rajahmundry town, Andhra Pradesh during 2004–05

Insecticides (Conc.)	No. exposed*	% mortality
<i>Cx. quinquefasciatus</i>		
DDT (4%)	60	0
Control	60	0
Malathion (5%)	60	0
Control	60	0
<i>Ae. aegypti</i>		
DDT (4%)	60	20
Control	50	0
Malathion (5%)	60	76.6
Control	50	2

*Exposure time: 60 min.

mundry town. In the present investigation no mortality was observed in *Cx. quinquefasciatus* adults against both the insecticides. However, 76.6% mortality was observed in *Ae. aegypti* when exposed to 5% malathion.

Susceptibility status of mosquito larvae is shown in Table 2. The NFCP unit, Rajahmundry, Govt. of Andhra Pradesh is carrying out antilarval operations with temephos and fenthion since 1978⁸. As per the Department of Agriculture (personal communication) commonly used pesticides in the agricultural

Table 2. Susceptibility status of *Cx. quinquefasciatus* and *Ae. aegypti* larvae to organophosphorous larvicides in Rajahmundry town, Andhra Pradesh during 2004–05

Insecticides (Conc. in mg/l)	Mortality (%)			
	<i>Cx. quinquefasciatus</i>	Control	<i>Ae. aegypti</i>	Control
Temephos (0.125)	100	0	100	0
	100	0	100	0
Fenthion (0.025)	100	0	100	0
	100	1.2	100	0
Fenitrothion (0.025)	0	0	48	0
	8	0	100	1.2
Malathion (0.125)	0	1.2	0	0
	14	0	100	0

fields around Rajahmundry town are malathion, fenitrothion along with other OP compounds and synthetic pyrethroids. As per Table 2 larvae of *Cx. quinquefasciatus* and *Ae. aegypti* were found highly susceptible to temephos and fenthion. About 8 and 14% mortality found in *Cx. quinquefasciatus* larvae in 0.125 and 3.125 mg/l concentration of fenitrothion and malathion respectively. Patnaik *et al*⁹ in a field trial recorded that temephos 50% EC is not effective for culicine larvae control even in the dose four times higher (0.05%) than the recommended doses and suggested urgent monitoring of susceptibility status of culicine larvae. The present study concludes that the larvae of both the species—*Cx. quinquefasciatus* and *Ae. aegypti* in Rajahmundry town are highly susceptible to temephos and fenthion.

Therefore, as a baseline study it may be concluded that in Rajahmundry town *Cx. quinquefasciatus* mosquitoes, the vector of lymphatic filariasis are not responding to the recommended doses of DDT and malathion, whereas adult *Ae. aegypti* the vector of dengue/DHF are susceptible to malathion. Temephos and fenthion which are used by UMS/NFCP units for urban malaria and filariasis control are highly effective larvicides against *Cx. quinquefasciatus* and *Ae. aegypti*.

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