Susceptibility Status of Immature and Adult Stages of *Aedes aegypti* Against Conventional Insecticides in Delhi, India

by

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Abstract

Insecticide-susceptibility tests were carried out using WHO standard test kits against various organophosphates, organochlorines, carbamates and synthetic pyrethroid compounds under ambient room temperature of 27 $\pm$ 1 ºC and relative humidity of 75-80%. The results revealed that adult *Aedes aegypti* was resistant to DDT and dieldrin, tolerant to propoxur and fenitrothion, but was susceptible to malathion, deltamethrin, permethrin and lambdacyhalothrin. However, the larvae were found to be susceptible to all the three larvicides tested, viz. temephos, fenthion and malathion.

Keywords: *Aedes aegypti*, susceptibility, resistance, Delhi.

Introduction

India is endemic for DF/DHF. During September 1996 a major outbreak of dengue/DHF occurred in Delhi, the Capital city of India, when 10,252 cases and 423 deaths were recorded[1]. Since insecticides are being used for controlling malaria and other vectors of public health importance in Delhi, it was considered essential to know the current susceptibility status of *Aedes aegypti* against insecticides commonly used in the public health programmes in Delhi. The studies were undertaken during 1999-2000.

Materials and methods

Insecticide-susceptibility tests were carried out using the WHO standard test kits against various organophosphates, organochlorines, carbamates and synthetic pyrethroid compounds under ambient room temperature of 27+1ºC and relative humidity of 75-80%. The procedures adopted for adult and larval assays were as follows:

Adult Bioassay: One-to-two-day-old mosquitoes emerging from the field-collected larvae and pupae under laboratory conditions were allowed to feed on 10% glucose solution soaked in cotton pads and

were exposed against the discriminating dosages of adulticides for 1 hour to DDT – 4%, dielderin – 0.4%, malathion – 5%, deltamethrin – 0.025%, permethrin – 0.25% and lambdacyhalothrin – 0.1% and for 2 hours to fenitrothion – 1.0% and propoxur – 0.1%, as per standard WHO technique (WHO, 1981)(2a, 2b). For each adulticide, four replicates were run concurrently, each containing 25 female mosquitoes. After the requisite exposure period, the mosquitoes were transferred to the recovery chambers and cotton pads soaked in 10% glucose solution were given as food during the recovery period. Mortality counts were made after 24 hours of the recovery period.

Larval Bioassay: For larval bioassay, the late-third or early-fourth instar larvae collected from the field were separated. The selected larvae were washed in tap water to remove debris and kept under observation for a period of 24 hours to detect and remove unhealthy or dead larvae. The larvae were tested against the discriminating dosages of larvicides, viz. temephos (Abate) – 0.02 mgm/litre, fenthion (Baytex) – 0.05 mgm/litre and malathion – 1.0 mgm/litre. Four replicates and a control, each containing 50 larvae, were run for each experiment. Brewer's yeast was given as food during the treatment period. The adult and larval tests showing more than 20% control mortality were discarded and repeated. In case control mortality ranged from 5% to 20%; the corrected mortality was calculated using Abbot's Formula.

Results and discussions

Adult Bioassay: The results of the adult susceptibility test revealed that this species was resistant to DDT and dieldrin as only 74% and 46% mortality, respectively, could be obtained (Table 1). This might be due to the extensive use of these insecticides for the control of malaria and other vector species. Discriminating dosages of propoxur and fenitrothion, however, caused 85% and 91% mortality, indicating tolerance of the species to these insecticides. Exposure of adults to the discriminating dosages of malathion, deltamethrin, permethrin and lambdacyhalothrin induced 100% mortality indicating that the species was susceptible to these insecticides.

Azeez (1967)[3] was the first to record DDT resistance in the adult *Aedes aegypti* in Jharia, Bihar, India. Raghavan et al. (1967)[4], Madhukar and Pillai (1968)[5], Kaul (1976)[6] and Mahadev et al. (1993)[7] also reported the resistance of the species to DDT in different part of the country but found it susceptible to malathion and deltamethrin.

Larval Bioassay: The results of the larval susceptibility tests revealed that all the three larvicides, viz. temephos, fenthion and malathion, induced 99%, 99.5% and 100% mortality within 24 hours of the treatment, indicating the susceptible status of these larvae (Table 2). The present observations are in conformity with the research work of Bhatnagar et al. (1969)[8], Biswas et al. (1988)[9] and Mourya et al. (1993)[10]. Das and Rajagopalan (1979)[11] reported 100% mortality of these larvae at much lower dosages of temephos – 0.0078 mgm/litre, fenthion – 0.008 mgm/litre and malathion – 0.48 mgm/litre.

Table 1. *Results of susceptibility tests carried out against the adults of Aedes aegypti mosquito using various insecticides*

Insecticide	Dis-criminating dosages used (%)	Exposure period in hours	No. of mosquitoes exposed	No. of mosquitoes died	Percent mortality obtained	Susceptibility status
DDT	4.0	1	100	74	74	Resistant
Dieldrin	0.4	1	100	6	46	Resistant
Fenitrothion	1.0	2	100	91	91	Tolerant*
Propoxur	0.1	2	100	85	85	Tolerant*
Malathion	5.0	1	100	100	100	Susceptible
Deltamethrin	0.025	1	100	100	100	Susceptible
Permethrin	0.25	1	100	100	100	Susceptible
Lambdacyhalo-thrin	0.1	1	100	100	100	Susceptible

* So far there is no report of tolerance or resistance in *Aedes aegypti* from any part of the world. Present study does not indicate number of populated tested. More tests based upon different populations and sample size are required for validation and confirmation of results -Editor

Table 2. *Results of susceptibility tests carried out against the larvae of Aedes aegypti mosquito against various larvicides*

Insecticide	Dis-criminating dosages used (mgm/lit.)	Exposure period in hours	No. of larvae exposed	No. of larvae died	Percent mortality obtained	Susceptibility status
Temephos	0.02	24	200	198	99	Susceptible
Fenthion	0.05	24	200	199	99.5	Susceptible
Malathion	1.0	24	200	200	100	Susceptible

The present findings thus revealed that for the control of Aedes larvae, temephos (Abate), and for the adult *Aedes aegypti*, malathion, could be used for effective control of dengue/DHF as per the WHO recommended dosages in a cost-effective manner.

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