

USE OF HEXAFLUMURON, AN INSECT GROWTH REGULATOR IN THE CONTROL OF *Aedes albopictus* (SKUSE)

Domingo Montada*, AR Rajavel and V Vasuki

Vector Control Research Centre (ICMR) Indira Nagar, Medical Complex, Pondicherry 605 006, India

Abstract. An attempt was made to assess the control potency of an insect growth regulator (IGR), hexaflumuron, against *Aedes albopictus*, a potent dengue vector, both in the laboratory and under field conditions. Emergence inhibition activity of this IGR against laboratory reared and field collected larvae of *Ae. albopictus* showed EI_{50} values of 1.9×10^{-4} and 1.80×10^{-4} mg(ai)/l respectively. Under field conditions, no appreciable reduction in immature density occurred at the lowest application rate of 0.001 mg(ai)/l whereas at the rate of 0.01 mg(ai)/l 100% reduction could be seen in earthen pots placed in a garden for 9 days. A reduction of 100% in pupal density was observed for 21 and 18 days at an application rate of 0.1 mg(ai)/l in pots and tyres respectively. Considering that this IGR was effective for about three weeks, it can be used successfully at the rate of 0.1 mg(ai)/l for controlling *Ae. albopictus* breeding in container habitats.

INTRODUCTION

Aedes albopictus (Skuse) has long been recognized as an important vector of dengue virus in Asia (Simmon *et al.*, 1931). Dengue and dengue hemorrhagic fever (DHF) infection are now probably the most important and widespread arthropod-borne virus to affect man as measured in terms of morbidity and mortality (Rosen, 1983). Epidemic outbreaks of dengue are not uncommon in India, where dengue type 4 virus has also been demonstrated by isolation of the virus from a number of cases during an epidemic in Kanpur (Chaturvedi *et al.*, 1970). Antibodies neutralizing dengue viruses were most frequent in sera from different parts of Tamil Nadu (Rao, 1971).

Ae. albopictus is prevalent in both urban (Pillai *et al.*, 1968) and rural (Gilotra *et al.*, 1967) areas in India where it had been found to breed in man made containers (Gilotra *et al.*, 1967) as well as in tree holes (Rao *et al.*, 1970). The widespread occurrence of this potential vector poses a threat of recurrent dengue epidemics and hence calls for measures for its effective control. As insect growth regulators (IGRs) have been identified as novel, safe and potent control agents, the efficacy of hexaflumuron in controlling *Ae. albopictus* was

assessed both in the laboratory and under field conditions.

MATERIALS AND METHODS

Hexaflumuron (XRD 473, OMS 3031) a substituted urea (acyl-urea) compound, chemically known as N-({[3,5-dichloro-4-(1,1,2,2-tetra fluoroethoxy) phenyl] amino}carbonyl)-2, 6-difluorobenzamide was obtained as 5% emulsifiable concentrate (EC) through WHO, Geneva.

Bioefficacy was determined against laboratory reared and field collected larvae of *Ae. albopictus* following the procedures recommended by WHO (1981). Control mortality, if any, was corrected by using Abbott's formula (Abbott, 1925). Emergence inhibition (EI_{50} and EI_{90}) was estimated by probit regression analysis (Sokal and Rohlf, 1981).

Preliminary surveys were carried out in different parts of Pondicherry to assess the prevalence of *Ae. albopictus*. A garden situated in Natesa Nagar, where this species was prevalent and *Ae. aegypti* absent, was selected for evaluation of the compound under field conditions. This garden spread over 1 ha had a rich compliment of shrubs and flowering plants besides a wide variety of trees.

Two types of container habitats (earthen pot

*Present address : Instituto de Medicina Tropical DR Pedro Kouri, Ave 15 y Calle 200 Siboney, Playa, Ciudad Habana, Cuba.

and tire) were used in the study. A total of 12 tire sections each holding about 6 liters of water were nailed to trees at different heights ranging from-ground level to 0.5 m. A total of 12 earthen pots of 8 liters capacity were positioned on the ground at a distance of 2 m apart from each other. Both tires and pots were filled with fresh water and the water level maintained. These containers were examined twice a week till all were found to be infested with *Ae. albopictus* larvae.

Assessment of pre-treatment larval density was carried out after the establishment of its breeding in these containers at 3 days interval for two weeks. A total of 5 dipper samples were taken from each container. The control efficacy of the compound in terms of emergence inhibition was assessed based on 100% reduction in pupal density.

Treatment with the three selected dosages (0.001, 0.01 and 0.1 mg/l) was done consecutively after observing for 100% reduction in pupal density following each treatment and when such reduction was not noticed. Post-treatment evaluation was done at an interval of 3 days. Ten replicates were maintained for each type of habitat and each dosage.

RESULTS AND DISCUSSION

Emergence inhibition activity (EI₅₀ and EI₉₀) of hexaflumuron against laboratory reared and field collected third instar larvae of *Ae. albopictus* are presented in Table 1. Similar levels of biological activity of this IGR in both the populations was observed.

The results obtained for hexaflumuron in the present study is comparable with that of earlier reports against *Cx. quinquefasciatus*, *An. stephensi*, *Ae. aegypti* and *Toxorhynchites splendens* with 50% emergence inhibition (EI₅₀) values of 9×10^{-5} , 1.09×10^{-4} , 2.22×10^{-4} and 2.14×10^{-4} mg(ai)/l respectively (Amalraj and Velayudhan, 1989). EC formulation of this IGR when tested under similar conditions against *Ae. aegypti* and *Cx. quinquefasciatus* gave LC₅₀ values of 0.47 and 0.45 ppb respectively (Mulla *et al*, 1989).

Results of field evaluation of hexaflumuron against *Ae. albopictus* breeding in tires and earthen pots at different rates of application viz 0.001, 0.01 and 0.1 mg/l are shown in Fig 1. There was no reduction in the pupal density following treatment at 0.001 mg/l in pots while only 60 - 70% reduction was observed in tires treated at the same dose. When treated at 0.01 mg/l, effective reduction in pupal density was observed for 9 days in pots. Treatment at 0.1 mg/l showed a sharp decline in pupal density and both pots and tires were totally free from pupae up to 21 and 18 days respectively. Effective reduction was achieved in both these habitats for about three weeks.

This compound was reported to be effective in controlling *Cx. quinquefasciatus* in cess pits for 6, 11 and 26 days at 0.02, 0.2 and 2.0 kg(ai)/ha respectively, whereas in cement tanks its effectiveness was observed for 17 days at 0.2 kg(ai)/ha against *Cx. quinquefasciatus* and *Ae. aegypti* (Amalraj and Velayudhan, 1989). Comparison of the effectiveness of other IGRs such as methoprene (OMS - 1697, Altosid), diflubenzuron

Table 1

Biological activity of hexaflumuron against laboratory reared and field collected third instar larvae of *Ae. albopictus*.

Species	EI50	EI90	Regression equation		95% fiducial limits	
			Y = a + b ln x	X ²	LCL - UCL	
<i>Ae. albopictus</i> (lab)	1.91×10^{-4}	6.15×10^{-4}	Y = 14.39 + 1.10 ln x	0.001	$5.13 \times 10^{-4} - 7.38 \times 10^{-4}$	
<i>Ae. albopictus</i> (field)	1.80×10^{-4}	9.43×10^{-4}	Y = 11.67 + 0.77 ln x	0.020	$7.01 \times 10^{-4} - 1.27 \times 10^{-3}$	

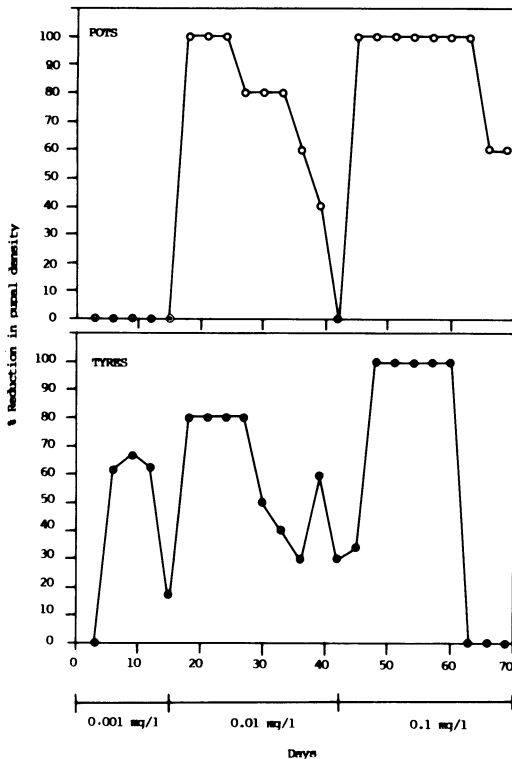


Fig 1—Control efficacy of hexaflumuron against *Aedes albopictus*.

(OMS-1804, Dimilin TM) and OMS-1841 (MV-678) against *Ae. albopictus* in bamboo cups showed that there was complete control of emerging adults for 4, 4 and 3 weeks respectively at 0.1 mg/l and it was one week when treated at 0.01 mg/l (Aminah and Ten Houten, 1980). In dairy waste-water lagoons hexaflumuron was found to be effective for 7 days at 0.056 kg(ai)-ha against *Cx. quinquefasciatus* (Mulla and Darwazeh, 1988). In another study, this IGR was observed to be effective at higher concentrations of 0.025 and 0.05 lb(ai)/acre for one week against *Cx. tarsalis* (Mulla *et al*, 1989).

The present study indicates that hexaflumuron at a dose of 0.1 mg/l could effectively control breeding of *Ae. albopictus* in container habitats.

ACKNOWLEDGEMENTS

This study was carried out while the first author was in receipt of WHO visiting scientist grant

for which he is thankful to the UNDP/World Bank/WHO Special Programme for Research and Training in Tropical Diseases (TDR) for giving an opportunity to undertake this study at Vector Control Research Centre, Pondicherry, India, a WHO collaborating centre for integrated control methods. Authors thank DR V. Dhanda, Director, VCRC, for the encouragement and critical comments and Dr P K Das, Deputy Director, VCRC, for his valuable suggestions. The technical assistance of the staff of Insecticides and Mass rearing and colonization is gratefully acknowledged.

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