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Influence of insect growth regulators, Novaluron and Buprofezin treatment on oviposition of mosquitoes

P.Rajasekar, A.Jebanesan*

Department of Zoology, Annamalai University, Annamalainagar - 608 002, Tamilnadu, (INDIA)

E-mail: drjeban@rediffmail.com

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ABSTRACT

The mosquitoes are the principal vector for many of the vector –borne diseases affecting human beings and other animals. The aim of the present study is to evaluate the oviposition attractancy of Insect Growth Regulator (IGR) Novaluron and Buprofezin, on the oviposition of three species of mosquitoes, viz., *Culex quinquefasciatus* (Say), *Aedes aegypti* (L.) and *Anopheles stephensi* (Liston). © 2011 Trade Science Inc. - INDIA

KEYWORDS

Buprofezin;
Novaluron;
Oviposition attractancy;
Cx. quinquefasciatus;
Ae. aegypti;
An. stephensi.

INTRODUCTION

Mosquito spreads various vector-borne diseases such as malaria, filariasis, Japanese encephalitis and dengue fever, which are transmitted by the three genera of mosquitoes namely *Anopheles*, *Culex* and *Aedes*. 40 million people in India suffer from mosquito borne diseases annually. There are over 3000 mosquito species belonging to 34 genera in the world. Of these, only about 300 transmit human and animal diseases. These diseases devastate Indian economy on every year[1]. Dengue, dengue heamorrhagic fever and chikungunya are transmitted by *Ae. aegypti*. *An. stephensi* transmits Malaria in the plains of rural and urban areas of India. *An. stephensi* predominantly breeds in wells, over head tanks, ground level water tanks and artificial containers[2]. All over the world, more than 50% of persons with filariasis receive their infections from the bites of *Cx. quinquefaseiatus* mosquitoes[3]. It has a wide distribution and is a major vector in India as well as in some of the West Asian countries[4]. Which initiated a search for alternative control measures, IGRs are now increasingly used to control mosquitoes. These compounds have unique mode of action and are often selective and do not persist in the environment. Such attributes are desirable when dealing with the problem of pest resurgence, secondary pest out breaks and insecticides resistance[5]. The present work has been designed to study the oviposition attractancy of IGR, Novaluron and Buprofezin against the mosquitoes *Cx. quinquefaseiatus, Ae. aegypti* and *An. stephensi*.

MATERIALS AND METHODS

Test insects

Cx. quinquefaseiatus, *Ae. aegypti* and *An. stephensi* mosquitoes were obtained from a stock colony being maintained in the insectary at 27±1ºC and 75±5% relative humidity at laboratory, Department of Zoology, Annamalai University. 10% sucrose was provided to females. Female mosquitoes were fed on rabbit blood for 4-5 days. Five days after blood feeding, the gravid female mosquitoes were used for bio assay experiments.

Test chemicals

IGR compounds namely Novaluron chemically known as 1-(3-chloro-4- (1,1,2-trifluro-2-trifluoromethoxy-ethoxy) phenyl) -3-(2,6-difluoro benzoyl) urea was received as gratis (10% EC formulation Makhteshim Agan of North America). Buprofezin 25% EC chemically known as 2-tert-butylimino-3-isopropyl-5-phenylperhydro 1-3, 3, 5-thiadiazin-4-one. Supplied by Coromendal fertilizer limited, Secunderabad, India.

Bioassay

Oviposition behaviour tests were carried out[6]. Fifteen gravid female mosquitoes (10 days old 5 days after blood feeding) were transferred to each mosquito cage (45x38x38cm). concentrations of 0.0010, 0.0015 and 0.0020 mg/L were made from each compounds in 100 ml of water. Two enamel bowls holding 100 ml of water were placed in opposite corners of each cage, one treated with the test material and the other one was ethanol control. The positions of the bowls were alternated between the different replicates, so as to nullify any effect of position on oviposition. Five replicates for each concentration were run, with cages placed side by side for each bioassay. The percent effective attractancy (%EA) for each oviposition concentration was calculated[7] and Oviposition Active Index (OAI) were assessed[8].

$$\mathbf{OAI} = \frac{\mathbf{NT - NS}}{\mathbf{NT - NS}}$$

Where NT - Total number of eggs in the treated water and NS - Total number of eggs laid in the control water.

Compounds with OAI of + 0.30 and above are considered as attractants, while those with -0.30 and below are considered as repellents[8].

RESULTS

The results of IGR compounds viz., Novaluron and Buprofezin tested against gravid females of *Cx. quinquefaseiatus, Ae. aegypti* and *An. stephensi* are presented in TABLE 1 and TABLE 2. The results indicate that the number of eggs laid by the females were higher in control than treated with IGR compound were also found to vary at different dosages. The OAI values calculated from the standard formula revealed that this IGR has compound repelling activity at higher dosages. Comparing the OAI values of two IGR and three species against Novaluron showed that the *An. stephensi* and *Cx. quinquefaseiatus* exhibited considerable negative response (-0.40, -0.38) the dose concentration of 0.0010 mg/L respectively (TABLE 2). At the dose of 0.0015 mg/L *Cx. quinquefaseiatus* (-0.41), *Ae. aegypti* (-0.32) and *An. stephensi* (-0.44), showed a higher negative response. However, in the concentration of 0.0020 mg/l, all the three species exhibited remarkable negative response.

TABLE 1 : Oviposition response of mosquitoes to Novaluron treated water

Concentration (mg/L)	*Cx. quinquefasciatus*			*Ae. aegypti*			*An. stephensi*		
	Treated	Control	OAI	Treated	Control	OAI	Treated	Control	OAI
0.010	45.66±1.21	101.16±3.97	- 0.38	52.0±2.52	95.83±1.47	- 0.29	39.33±1.87	93.83±2.13	- 0.40
0.015	41.16±1.16	100.16±2.92	- 0.41	48.66±1.21	95.55±1.51	- 0.32	36.83±1.16	94.5±1.04	- 0.44
0.020	37.66±1.03	102.21±3.04	- 0.46	45.66±1.21	94.32±1.28	- 0.35	33.53±1.94	94.16±1.63	- 0.48

TABLE 2 Showed the oviposition response of mosquitoes on Buprofezin treated water. Buprofezin at the dose concentration of 0.0010mg/L, showed higher OAI Values *Cx. quinquefaseiatus* (-0.38), *Ae. aegypti* (-0.33) and *An. stephensi* (-0.34). In addition a higher negative responses were observed at 0.0015 and 0.0020 mg/L. Three species exhibited remarkable negative response.

TABLE 2 : Oviposition response of mosquitoes to Buprofezin treated water

Concentration (mg/L)	*Cx. quinquefasciatus*			*Ae. aegypti*			*An. stephensi*		
	Treated	Control	OAI	Treated	Control	OAI	Treated	Control	OAI
0.010	92.16±3.04	207.53±6.71	- 0.38	105.5±4.03	205.71±3.67	- 0.33	98.14±2.44	203.83±3.43	- 0.34
0.015	81.33±3.65	210.13±5.94	- 0.44	90.16±3.94	208.16±4.08	- 0.39	81.83±2.94	208.56±4.32	- 0.43
0.020	70.5±2.86	212.64±6.48	- 0.50	79.5±4.08	209.7±4.32	- 0.45	54.83±3.71	216.16±4.07	- 0.60

DISCUSSION

Oviposition is an important components of most of the life cycle of mosquitoes. The substances involved in oviposition site choice by the mosquito have become recently focusing interest on the concept of integrated vector management[8]. The oviposition deterrent activity exhibited by this IGR compounds were relatively higher when compared to that of few insecticides like Dursban (125 ppm) against *An. triseriatus*[9]. These preliminary studies are the basic step for the implementation of attract- and – kill strategy. Synthetic pyrethroids like cypermethrin, fenvalerate, deltamethrin and permethrin have also shown some repellency against *Cx. quinquefaseiatus, Ae. aegypti* and *An. stephensi* in laboratory oviposition experiments[10]. Previous work indicated that the combination of temephos with the pheromone could result in the implementation of the attract and kill strategy[11]. IGR in general have shown high level of activity and efficacy against a variety of pests of public health importance. They possess a high level of specificity as compared with other classes of pesticides such as organochlorine, organophosphate, carbamete and pyrethroid insecticides[12].

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