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RESEARCH ARTICLE

ANTIFEEDANT AND GROWTH INHIBITORY EFFECTS OF CHLORPYRIFOS AND DELTAMETHRIN ON THE TOBACCO GRASS HOPPER, *ATRACTOMORPHA CRENULATA* (*FABRICIUS 1973*)

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Abstract

The effect of two pesticides, chlorpyrifos and deltamethrin individually and in combination were evaluated against *Atractomorpha crenulata* nymph to determine antifeedant and Growth inhibitory effects. The antifeedant activity of pesticides was tested by leaf disc choice method against the Fourth-instar nymphs. The combination of Chlorpyrifos and deltamethrin showed the highest antifeeding activity at concentrations of 100 ppm/cm^2 with antifeeding percentages of 82.10%. The two compounds deterred inhibited the nymphal growth in a concentration-dependant manner. Chlorpyrifos showed stronger growth inhibition activity than deltamethrin at the four tested concentrations (25, 50, 100 and 200 ppm/cm^2). The results indicate that chlorpyrifos and deltamethrin could potentially substitute broad-spectrum synthetic toxins for *A. crenulata* control.

Keywords: *A. crenulata*, antifeedant, No-choice test bioassay, chlorpyrifos and deltamethrin

Introduction

Acridoidea is the largest group of herbivorous insects; contributing 30% - 60% of the total biomass of all insect species put together (Mulkern and Toczek, 1970). It is the non – migratory grasshoppers and the gregarious locusts, that both cause considerable damage to agricultural and forest ecosystem. Acridoidea, as a superfamily under the order Orthoptera, has been subdivided into fourteen families (Dirsh, 1975). In India, only three families namely Eumastacidae, Pyrgomorphidae and Acrididae have so far been identified. *Atractomorpha crenulata* is a highly polyphagous pyrgmorphid, forming the dominant speices among Acridoids in agroecosystem of Tamil Nadu. *A. crenulata*, being a multivoltine grasshopper has a great hidden potential to transform into a major pest if their population is not monitored and controlled below the damage threshold levels.

Chlorpyrifos belong to a broad spectrum organophosphorus insecticide with fairly low mammalian toxicity. It is used for controlling flies, storage insects, soil and foliar insects (Rigterink and Kenaga, 1966). It is also a commonly recommended insecticide for controlling leafminers in Iran (Mosallanejad *et al.*, 2003). Deltamethrin is in the chemical class of pyrethroids registered for use on various crops including cotton, corn, cereals, soybeans, and vegetables for pests such as mites, ants, weevils, and beetles.

Determining the residual activity of insecticides used for controlling pests will be useful in avoiding unnecessary chemical treatments. In this study the residual effect of two conventional compounds

chlorpyriphos and deltamethrin on *A. crenulata* was assessed.

Materials and Methods

A. crenulata was reared at room temperatures of 30-35^{0}C in wooden cages of about 25 litres capacity. First instar nymphs and subsequent instars were mass reared in fish tanks of about 100 litres capacity. They were reared on fresh *R. communis* leaves. Fresh leaves were provided on every alternate day. Wax coated paper ice cream cups filled with sieved, moist garden soil were provided for oviposition.

The antifeedant effect of chlorpyrifos and deltamethrin against Fourth-instar nymph of *A. crenulata* was determined using a No-choice test bioassay method. Serial dilutions of test insecticides expressed as ppm of active ingredient were prepared using acetone. Circular discs (140 cm^2) were cut from the leaves of *Ricinus communis* (L.) and 2 ml of the test compounds (at 25, 50, 100 and 200 ppm concentrations/cm^2 area of leaf) was spread using a fine pipette on the leaf. The discs were left to dry, and then weighed. Twenty nymphs were placed in the center of each Petri dish and the experiment was conducted within the wooden cage. The quantity of leaf consumed after 24 hours was determined. Three replicates of each concentration were carried out. The antifeedant percentage was calculated from the following equation:

$$\% \text{ antifeedant} = 100 (C – T/C),$$

Where *C* is the weight of leaf discs consumed in the control and

T is the weight of leaf discs consumed in the treatment.

Growth inhibitory test

The pesticides, chlorpyrifos and deltamethrin were incorporated on the leaf (Bakry *et al*., 1973) to give concentrations of 25, 50, 100 and 200 ppm. Control diet was prepared with acetone alone. After evaporation of acetone, twenty fourth instar larvae were exposed to the leaves for feeding. Three replicates were carried out at each concentration. The leaf consumed by each larva after every 24 hrs was determined by weighing the remaining leaf of each treatment. Fresh treated leaves were give every day for five days. Nymphal growth inhibition was assayed relative to control based on larval weight gain through 5 days of feeding on the treated diet. The growth inhibition was calculated from the equation:

$$\text{Growth inhibition} = [(CL - TL)/CL] \times 100$$

where *C*L is the larval weight gained in the control and

*T*L is the larval weight gained in the treatment.

The data were subjected to analysis of variance (ANOVA) and the differences between treatments and compounds were determined by the DMRT

Results and Discussion

Discovery of novel toxins and/or antifeedants has been recently emphasized as a potential method for the development of “ecologically safe pesticides” (Wheeler and Isman, 2001).

Two commercial pesticides, chlorpyrifos and deltamethrin alone and in combination at 4 different concentrations (25, 50, 100 and 200 ppm/cm^2) were assayed for their antifeedant effect on Fourth-instar nymph of *A. crenulata* by using a no-choice feeding test. The results indicated that the combination of chlorpyrifos and deltamethrin showed maximum antifeedant activity at concentration of 100 ppm/cm^2 (82.10%) as compared to the control (5.30%) (Fig. 1). Similarly Kalpana (2005) reported that the compounds of osthole and pregnenolone showed significant reduction in feeding index at 10 µg/cm^2 against *S. litura*.

The growth inhibition activities of chlorpyrifos and deltamethrin is presented in table -1 at production rate against the Fourth-instar nymph of *A. crenulata* by diet-non-choice method. The two compounds inhibited the nymphal growth in a concentration-dependant manner. Chlorpyrifos showed stronger growth inhibition activity than deltamethrin at all the four tested concentrations (25, 50, 100 and 200 ppm/cm^2).

Figure 1. Food consumption of 24 hours treated *A.crenulata* 4th Instar Nymphs - I

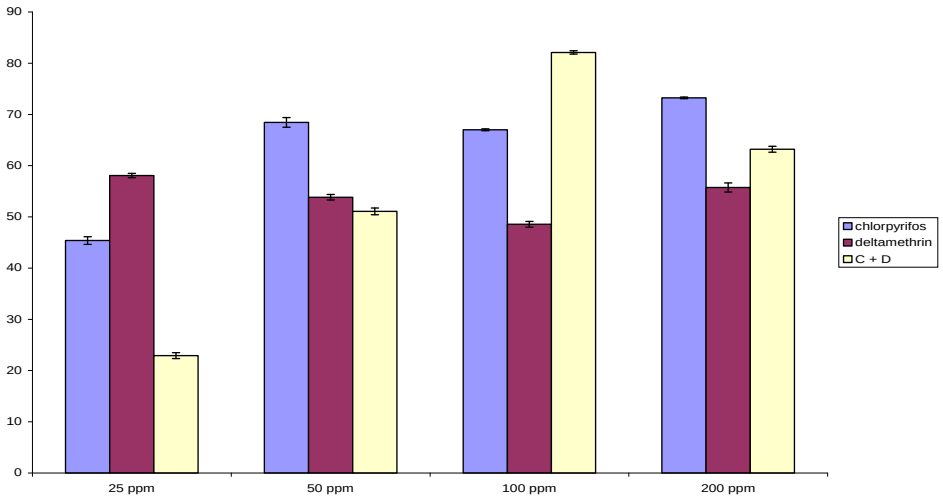

Table 1. Production of 24 hours treated *A.crenulata* 4th Instar nymphs - II

Dose (ppm)	Chlorpyrifos	Deltamethrin	C + D
control	46.9±0.11	-	-
25	40.2±0.11^{d}	42.4±0.43^{c}	45.3±0.66^{d}
50	28.1±0.20^{c}	43.5±0.45^{c}	41.6±0.33^{c}
100	21.8±0.48^{b}	36.8±0.92^{b}	38.1±0.47^{b}
200	20.4±0.06^{a}	28.2±0.33^{a}	34.9±0.11^{a}

In summary, our results demonstrated that both the commercial pesticides, chlorpyrifos and deltamethrin revealed strong antifeedant activity in the leaf disc choice test. Furthermore, chlorpyrifos exhibited potent inhibitions of adult emergence when added to diet at concentration of 200 ppm/cm^2, indicating that this compound may act as potent chemo-sterilizing agent.

References

Bakry, N., Taman, F. and Zeid, M. 1973. Effect of nutrition, age and temperature on toxicity of insecticides to *Spodoptera littoralis* (Boisd). I. *Egypt. Pest Cont. Cong., Assiut*. 105-115.

Dirsh, V.M. 1975. *Classification of Acridomorphoid Insects.* Faringdon, Oxon, E.W. Classey, 171pp.

Kalpana, R. 2005. Feeding deterrent and growth inhibitory properties of Coumarin and Sterol against *Spodoptera litura* (Fab.) (Lepidoptera : Noctuidae). M. Phil. Thesis. University of Madras, Chennai. India.

Mosallanejad, H., Norouzian, M. and Mohammadbeigi, A. 2003. List of important plant pests, diseases, weeds and recommended pesticides. Agricultural Training Publishing, Tehran, Iran [In Persian]. pp. 1-112.

Mulkern, G. B. and Toczek, D. R. 1970. Bioassays of plant extracts for growth-promoting substances for *Melanoplus femurrubrum* (Orthoptera: Acrididae). *Ann. Entomol. Sac. Amer.* 63: 272-284.

Rigterink, R.H. and Kenaga, E.F. 1966. Synthesis and Insecticidal activity of some O,O-dialklyl-O-3,5,6-trichloro- 2-pyridyl phosphates and phosphorothioate. *Journal of Agriculture and Food Chemistry*, 14: 304-306..

