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Toxicity of Different Groups of Insecticides Against First, Second and Third Instar Larvae of Cotton Bollworm, *Helicoverpa armigera* (Hub.) (Lepidoptera: Noctuidae)

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Abstract.- Four commercial insecticides *viz*. curacran 500 EC (Profenophos) @ 1.0 ml/100 ml, somialfa 110 EC (esfenvalerate) @ 0.25 ml/100 ml, decis 2.5 EC (deltamethrin) @ 2.25 ml/100 ml and denitol 30 EC (fenpropathrin) @ 0.25 ml/100 ml were tested at field dose under laboratory conditions for their toxicity against cotton bollworm, *H. armigera* (Hub.) larvae of (1st, 2nd and 3rd) instar. Insect mortality data were taken after 24, 48 and 72 hours exposure and then subjected to ANOVA. Results showed that curacron 500 EC and somialfa 110 EC were highly effective by causing 100 and 80% mortality after 24 hours exposure which reached to 100% each after 72 hours exposure. Both these insecticides caused 100% mortality after 24, 48 and 72 hours exposure of 2nd instar larvae. Only curacron was effective against 3rd instar larvae by causing 25, 100 and 100% mortality after an exposure of 24, 48 and 72 hours. Decis and denitol were effective on 1st instar larvae by causing mortalities of 43.3 to 83.3 and 45 to 85% after collective exposure of 72 hours, whereas no substantial mortality was observed in 2nd and 3rd instar larvae. It is concluded from the results that curacron was highly effective against 1st, 2nd an 3rd instar larvae followed by somialfa.

Key words: Insecticides, *H. armigera*, mortality, concentration, instars.

INTRODUCTION

Cotton (*gossypium hirsutum* L.) is a main cash crop of Pakistan and contributed about 2.8% of GDP to the national economy. It accounts for 11.5% of value added in agriculture (Anonymous, 2001). One of the main causes for its low yield has been due to the attack of insect pests and diseases and reduce the yield 20 to 30% every year. The hot and humid climate is conducive for the proliferation of insect pests, especially the cotton bollworm that causes considerable losses (Lohar, 1994).

Helicoverpa armigera is the most important species in the old world from Africa to the Pacific islands. It has been recorded from at leaf 160 cultivated and 67 wild host plants (Reed and Pawar, 1982). Pesticides have been the only way to avoid economic damage to this high value crop in United States (Knipling, 1979). In Pakistan also *H. armigera* is the serious pest of valuable agricultural crops particularly cotton as reported by Salim and Younis (1982). Total reliance for the control of this cosmopolitan pest has resulted in the development of resistance to insecticides especially pyrethroids (Gunning *et al*., 1984; Allen *et al*., 1987; Ahmed and McCaffery, 1988). The widespread and indiscriminate use of insecticides has given birth to the major problem of toxic residues in edible plant parts, health hazards and resistance development in pest against chemical insecticides (Makhdoom *et al*., 1997). Keeping in view the problem of resistance in mind, an experiment was conducted under laboratory conditions to know the mortality level of various instar larvae of *H. armigera* to different groups of insecticides, which are widely used in the field.

MATERIALS AND METHODS:

Four insecticides *viz.*, curacron 500 EC (profenophos), somialfa 110 EC (esfenalerate), decis 2.5 EC (deltamethrin) and denitol 30 EC (fenpropathrin) at recommended field dose were tested for their toxicity under laboratory conditions (Table I). F1 larvae of field collected population

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were used. Laboratory conditions were maintained at 27±2°C, 65±5% RH and 14.10 hrs Light : Dark. Leaf dip method was used to determine toxicity of insecticides (Busvine, 1971). Cotton leaves were dipped in the prepared concentrations for 10 seconds and then allowed to dry on blotting paper. Control leaf disc were immersed in distilled water only. Leaves were placed in Petri dishes having wet blotting paper at the bottom to avoid desiccation of leaves. Thirty larvae of 1st instar, sixteen larvae of 2nd and 3rd instar per treatment were released on leaves in Petri dishes, one larva in each Petri dish. Experiment was replicated thrice. Larvae were considered dead when they did not respond to stimulation by touch. Mortality data were taken after 24, 48 and 72 hours.

Table I.- List of insecticides with their formulation, active ingredient, groups, recommended doses and calculated doses.

Treatments	Insecti-cide group	Recommen-ded group (ml/acre)	Calculated doses (ml/100 ml)
Curacron™ 500 EC (Profenophos)	Organo-phosphate	1000	1.0
Somialfa™ 110 EC (Esfenvalerate)	Pyrethroid	175	0.25
Decis™ 2.5 EC (Deltamethrin)	Pyrethroid	250	0.25
Control (Distilled water)	Pyrethroid	250	0.25

RESULTS AND DISCUSSION

The results in Table II showed that toxicities of all insecticides showed various degree of effectiveness at 24, 48 and 72 hours after exposure. Mean percent mortality of 1st instar larvae with curacron and somialfa was 100 and 80% after 24 hours, whereas with decis and denitol it was 43.3 and 45%. Mortality increased gradually after 48 hours and non-significant (P>0.05) trend was observed in curacron, somialfa, decis and denitol. No significant difference (P>0.05) was observed in mortality data for 1st instar larvae after 72 hours.

Mortality of 2nd instar larvae for curacron and somialfa were 100% after 24 hours. Denitol remained non-toxic as no mortality was observed. Mortality increased gradually for all the treatments after 48 hours (Table II). Mortality data after 72 hours showed that curacron, somialfa and decis were highly toxic by causing 100, 100 and 75% mortality, respectively and remained non-significant (P>0.05) among each other but showed significant difference (P<0.05) with danitol.

Table II.- Toxicity of various groups of insecticides on different instar larvae of *H. armigera*.

Insecticides	Mean percentage mortalities after		
	24 hrs	48 hrs	72 hrs
1st instar larvae			
Curacron™ 500 EC	100a	100a	100a
Somialfa™ 110 EC	80ab	85ab	100a
Decis™ 2.5 EC	43.3c	78.3ab	83.3a
Danitol™ 30 EC	45.0c	78ab	85a
Control (Distilled water)	0.0d	0.0c	0.0b
2nd instar larvae			
Curacron™ 500 EC	100a	100a	100a
Somialfa™ 110 EC	100a	100a	100a
Decis™ 2.5 EC	50b	50b	75a
Danitol™ 30 EC	0.0c	25bc	25b
Control (Distilled water)	0.0c	0.0c	0.0b
3rd instar larvae			
Curacron™ 500 EC	25a	100a	100a
Somialfa™ 110 EC	0.0a	0.0c	50b
Decis™ 2.5 EC	0.0a	0.0c	0.0c
Danitol™ 30 EC	0.0a	0.0c	0.0c
Control (Distilled water)	0.0a	0.0c	0.0c

Means sharing the same letter(s) in columns are not significantly different at P=0.05.

Mortality of 3rd instar larvae after 24 hours remained statistically non-significant among each other for all the insecticides. Mortality after 72 hours reached 50% in somialfa, whereas no mortality was observed in decis and danitol.

Studies conducted in Pakistan to investigate the pattern of organophosphate resistance from 1994 to 1997 using an IRAC leaf dip indicated very low resistance (Ahmed *et al*., 1999) to profenophos. It confirmed our results of high effectiveness of profenophos. Mortality of *H. armigera* with Pyrethroids was low in the present studies and also reported by (Han *et al*., 1999) when used repeatedly. Resistance of *H. armigera* to deltamethrin was also documented by (Iqbal *et al*., 1997). Similar to our

findings deltamethrin remained less effective as compared to fenvalerate (Subbarayudu, 1997). In our experiment esfenvalerate remained highly toxic to 2nd instar larvae of the *H. armigera* and this effectiveness is confirmed by the work of (Martin *et al*., 2000) who investigated the high effectiveness of pyrthroids on small larvae and reduced quickly in successive instars.

It is concluded that curacron 500 EC was toxic followed by somialfa 110 EC to 1st, 2nd and 3rd instar larvae of *H. armigera* at used concentration under lab. conditions.

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