

## COMPARATIVE TOXICITY OF SOME INSECTICIDES ON 4<sup>th</sup> INSTAR GRUB OF *Coccinella septempunctata* L. UNDER LABORATORY CONDITIONS

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### ABSTRACT:

Studies on comparative toxicity of different insecticides against 4<sup>th</sup> instar grub of seven spotted beetle *Coccinella septempunctata* L. were carried out under laboratory conditions at Department of Entomology, Faculty of Crop Protection, Sindh Agriculture University Tandojam during the year 2005. Eight insecticides namely Confidor, Talstar, Sumialpha, Polo, Danitol, Steward, Tracer and Proclaim were evaluated at uniform dose of 2 ml in different concentrations i.e. 1,2,3,4 and 5 lit water. It was observed that all the insecticides caused higher mortality of the 4<sup>th</sup> instar grubs when applied at high concentration i.e. 2ml of insecticides in 1 lit. water. However, Denitol was found comparatively more toxic with 72% and 90% mortality at 96 hours and one week intervals respectively. While Tracer was less toxic with 30% and 38% mortality at 96 hours and one week intervals respectively.

**Keywords:** *Coccinella septempunctata* L., Grub, Instar, Toxicity

### INTRODUCTION

Chemical and biological control measures are often considered incompatible. However, latest research shows that integration of chemical, cultural and biological control measures are getting popular as integrated pest management (IPM), components, throughout the world. In this regard, biological control occupies a central position in Integrated Pest Management (IPM) Programmes. Because biological control of invertebrate pest and weeds has enormous and unique advantages, it is safe, permanent, and economical (Kilgore and Douth, 1967).

Pesticides are highly effective, rapid in action, convenient to apply, usually economical and most powerful tools in pest management. However, indiscriminate, inadequate and improper use of pesticides has led to severe problems such as development of pest resistance, resurgence of target species, outbreak of secondary pests, destruction of beneficial insects, as well as health hazards and environmental pollution. It is therefore, a high time to evaluate the suitable products to be used in plant protection strategy. In an integrated control programme, it was necessary to utilize some insecticides with minimal toxicity to natural enemies of pests. Such practice might help to alleviate the problems of pest resurgence, which is frequently associated with insecticide use in plant protection (Yadav, 1989).

*Coccinella septempunctata* L. ladybird beetle (Coleoptera: Coccinellidae) mainly free-living predatory species that consumes a large number of prey during lifetime. Therefore, it is considered to be beneficial to agricultural crops, and contributes to the regulation of population of insect pests on which it feeds (Liu and Stansly, 1996). Among others the 7-spotted lady bird beetle, *Coccinella septempunctata* L. has attracted considerable attention as biological control agent because of its

potential to control many soft-bodied insect pests particularly the aphid on which it feeds voraciously in the immature as well as mature stages (Samal and Misra, 1982). The fourth instar larvae of this predator are more voracious than larvae of other instars (Rizvi, *et al.* 1994).

Vostrel (1991) stated that most of times tested fungicide, acaricides, insecticides (carbamates & synthetic pyrethroids), exerted negative effects to varying degrees on all stages of *Coccinella septempunctata*. Average mortality was lowest for acaricides, while fungicides were slightly more toxic. Insecticides nearly always caused comparatively higher mortality of all development stages, but adults were more resistant in many cases.

Some studies suggested that the predatory efficiency of both adult and fourth instar larvae of *C. septempunctata* was significantly reduced, due to the sub-lethal effects of dimethoate residues and treated prey. Prey-choice experiments revealed that adult coccinellids consumed significantly fewer treated than untreated aphids over the 5-h experimental period. Fourth instar larvae preferentially consumed untreated aphids when given the choice of full rate dimethoate treated aphids or untreated aphids. The implications for post-treatment coccinellid survival and integrated pest management are considerable (Singh *et al.* 2004)

Based on many years of research, it is stated that bacterial and fungal biological preparations at rates recommended for use in agriculture show low toxicity to the predators *C. septempunctata* and *Chrysoperla carnea*, and to the parasitoids *Encarsia formosa* and *Trichogramma pintoi* (Mikul'skaya, 2000).

There is a great importance of biological control in integrated pest management strategy. The present research work is planned to determine the comparative toxicity of some insecticides to fourth instar of *C. septempunctata* L in the laboratory conditions. It is hoped that the results of present studies will be of benefit to agriculturists especially of Sindh Province.

#### MATERIALS AND METHODS

The present research work on the comparative toxicity of insecticides to 4<sup>th</sup> instar "grub" of *Coccinella septempunctata* L. in laboratory were carried out in the Department of Entomology, Sindh Agriculture University Tandojam. The experiment was conducted during 15<sup>th</sup> January to 10<sup>th</sup> April 2005.

#### FIELD COLLECTION/REARING METHOD

The eggs of 7-spotted beetle *C. septempunctata* were collected from mustard field at Entomological section A.R.I. Tandojam. Mustard aphids were used as food for the grubs. The adults were immediately shifted to different cages for copulation and egg laying. Adults were fed with mustard aphids in the cages. Fresh food was given each day to both grubs and adults of the predator.

#### INSECTICIDES APPLICATION

Fourth instar grubs were used in pesticidal experiment. For the experiments mustard leaves having mustard aphids were dipped for five seconds in the different insecticide concentrations and were air dried. For control mustard leaves without aphids were dipped for five seconds into the different pesticide concentrations and afterwards air dried. The different pesticides tested are listed in Table-I. The predator of fourth instar grubs were introduced to untreated leaves (aphids) to feed for about 48 hours. After 48 untreated fresh feed was given to the grubs for one week. Thirty aphids were given to each grub daily for 48 hours. Each insecticide was tested in 5 different concentrations in the experiment.

The leaves were observed daily for mortality of the grubs after 96 hours and one week of treatment. The data were subjected to ANOVA using LSD test. For this purpose a microsoft computer package "MSTATC" was used.

#### RESULTS AND DISCUSSION

##### *Toxicity of various insecticides applied under various water levels against seven spotted beetle after 96 hours of three application*

The toxicity of various insecticides after 96 hrs of treatment is shown in the Table-II. It can be seen from the results that Danitol proved to be more toxic among the insecticides and reduced maximum population of predators (72%), followed

by Sumilpha (62%), Talastar (56%), Confidore (48%), Steward (46%), Tracer (30%), Polo (38%) while proclams found to be less toxic (44%) respectively.

It was further found that low use of water 2ml/lit of water resulting in greater mortality of predators (72.86%), followed by 2ml/ 2lit of water (55.71%), 2ml/3lit of water (52.86%), 2ml/4lit of water (40% and 2ml/5lit of water (27.14%).

##### *Toxicity of various insecticides applied with various water levels against seven spotted beetle recorded after one week of their application*

The results on toxicity of various insecticides applied with various water levels against 7-spotted beetle recorded after one week of their application are shown in the Table III. The results revealed that all insecticides increase their toxicity to predator when compared to 96 hours of their application. However the trend of insecticides was changed progressively over 96 hours. Comparatively Danitol showed greater mortality of predators (90.00%), followed by Talstar (76%), Sumialpha (74%), Confidor (64%), Polo (62%), Proclaim (54%) Steward (48%) and Tracer (38%). As for as water levels are concerned insecticides applied with low water level caused greater mortality of predator (84.29%), followed by 2ml/2liter of water (74.29%), 2ml/3liter of water (65.71%), 2ml/4liter of water (51.43%) and 2ml/5liter of water (40%) respectively. The results of present research work indicated that all insecticides reduced predator density when applied in different water level, however, the effect was more after one week of application concentrate in contrast to 96 hours. Eight insecticides tried at uniform dose of 2ml per 1,2,3,4 and 5 time 5 liter of water revealed that insecticide applied with high level of water resulted in less mortality of predator, while low use of water caused greater mortality of predator. Similarly the trend of effectiveness of insecticides also differed significantly. After 96 hours Tracer (30.00%) and Polo (38.00%) were found to be less toxic against predator while, Danitol (72%) and Sumialpha (62%) were found more toxic, while rest of four insecticide were moderate. However, it was noted that insecticides applied with high level of water (2ml/5liter or water) resulted in less mortality of predator (21.75%) it increases as water level reduced. After one week all products increased toxicity when applied in low water level. Comparatively danitol proved more toxic (90%) followed by Talstar (76%) and Sumialpha (74%) respectively. Further, it was noted that low level of water caused greater level of mortality (86.25%); it reduced as water level increased. The lowest mortality at 2ml/5 liter of water (38.75%) Research conducted by Singh *et al.* (2004) found that predatory efficiency of both adult and larvae *C. septempunctata* was significantly reduced

following encounter with Dimethtoate residues and treated prey. However, Liu and Sengonca (2002) observed that GCSC-BTA was highly toxic to the 3<sup>rd</sup> instar of *P. xylostella* with 91.18% Tebufenozide with 75.57% Lambacyhalothrin with 63.75% and Dichlorvos with 50.86% mortality. They further found that GCSS-BTA was less toxic to the predators causing 31.11%, 13.33%, 11.54% and 6.00% mortality in *A. longispinosus*, *E. graminicola*, *O. similes* and *C. septumpunctata* respectively. The Lambda cyhalothrin was highly toxic to the predators with 78.83% mortality on average (highest 98.85% and lowest 41.70%). Further, Mecia *et al.* (2002) reported that the treatments with 2 sprays each of Karanj

pongamumpinnata pod extract 1.0% azadrachtin 0.5% Malathion 0.05% and endosulfan 0.07% were found to be relatively safe to the coccinelled beetles.

### CONCLUSIONS

On the basis of present research work it may be concluded, that among the eight insecticides evaluated Tracer, steward and Proclaim were found to be less toxic, while Danitol, Talstar, confidor, Sumilpha and Polo were toxic against seven spotted beetle. It is further concluded that insecticides applied with low level of water resulted in greater mortality of predator, while high level of water caused low mortality of predator.

**Table I** Trade Name, Common Name, chemical group, Dose per acre, Concentration of the different pesticides tested in the experiment

Trade Name	Common Name	Chemical group	Dose per acre	Concentration %
Confidor	Imidachloprid	Choloronicotinyl	80 ml	0.04%
Talastar	Biphenthrin	Pyrethroid	300 ml	0.02%
Sumialpha	Esfenvalerate	Pyrethroid	150 ml	0.022%
Polo	Diafenthuran	New chemistry	200 ml	0.1%
Danitol	Fenpropathrin	Pyrethroid	200 ml	0.06%
Steward	Indoxacarb	Oxididinane	175 ml	0.096%
Tracer	Spinosad	Naturalyte	80 ml	0.096%
Proclaim	Emamectin benzoate	Avermectin	200 ml	0.0038%

**Table II** Toxicity (%) of various insecticides against 4<sup>th</sup> instar grub of coccinella septempunctata L. after 96 hrs under laboratory conditions at 26 ± 2 °C and 65±5% R.H.

Dose	Percent mortality of different insecticides after 96 hours								
	Confidor	Talastar	Sumiapha	Polo	Danitol	Steward	Tracer	Proclaim	Mean
2ml/ 1liter of water	80%	80%	80%	60%	90%	70%	50%	80%	73.75%
2ml/2 liter of water	60%	70%	60%	40%	80%	50%	30%	60%	56.25%
2ml/3 liter of water	40%	60%	70%	40%	80%	50%	30%	40%	51.25%
2ml/4 liter of water	40%	50%	60%	30%	60%	40%	20%	20%	40.00%
2ml/5 liter of water	20%	20%	40%	20%	50%	20%	20%	20%	21.25%
Mean	48.00%	56.00%	62.00%	38.00 %	72.00%	46.00%	30.00%	44.00%	

	Insecticides	Water levels
S.E ±	3.251	2.570
LSD1 0.05	6.697	6.236
LSD2 0.01	9.103	7.218

**Table III** Toxicity (%) of various insecticides against 4<sup>th</sup> instar grub of *coccinella septempunctata* L. after one week under laboratory conditions at 26 ± 2 °C and 65 ± 5% R.H.

Dose	Percent mortality of different insecticides after 96 hours								
	Confidor	Talastar	Sumialpha	Polo	Danitol	Steward	Tracer	Proclaim	Mean
2ml/ 1liter of water	100%	100%	100%	80%	100%	70%	60%	80%	86.25%
2ml/2 liter of water	70%	100%	80%	80%	100%	60%	40%	60%	73.75%
2ml/3 liter of water	70%	80%	70%	70%	90%	50%	40%	60%	66.25%
2ml/4 liter of water	50%	60%	60%	50%	80%	40%	30%	40%	51.25%
2ml/5 liter of water	30%	40%	60%	30%	80%	20%	20%	30%	38.75%
Mean	64.00%	76.00%	74.00%	62.00 %	90.00%	48.00%	38.00%	54.00%	-

	Insecticides	Water levels
S.E ±	3.365	2.660
LSD1 0.05	6.932	5.485
LSD2 0.01	9.422	7.450

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