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Evaluation of chemical insecticides and botanicals for its toxicity to *Cheilomenes sexmaculatus* Fabricius

Shanmugapriya V and Muralidharan CM

Abstract
Laboratory evaluation of chemical insecticides and botanicals against eggs and grubs of *Cheilomenes sexmaculatus* revealed that imidacloprid 0.005% produced highest mortality of followed by dimethoate 0.03% > thiamethoxam 0.05% > diafenthiuron 0.02% > acephate 0.075% > Neem oil 0.3%. Dimethoate 0.03%, the widely used chemical against sucking pests, showed a highest per cent mortality next to Imidacloprid 0.005 % which draws a serious attention and consideration for further pest management programmes. Out of the chemicals used, Acephate 0.075 % recorded minimum per cent mortality and the botanical insecticide neem 0.3% proved to be safest to all stages of *C. sexmaculatus.*

Keywords: Chemical insecticides, Botanicals, Ovicidal action, larval mortality

Introduction
Coleopterans are the most described group than any other life forms that exist on the planet and beetles represent the greatest proportion of described insects. Of class Insecta, Coleoptera contributes about 15,289 species in India (Robert and Peter, 2009) [3]. Crop ecosystems are diversified with different groups of insects. Out of which, coccinellids have been respected through the centuries with extremely diverse habitats. The majority of the coccinellids are beneficial in nature because of their predaceous nature. Application of insecticides with high toxicity and prolonged residual effects also cause mortality to the natural enemies found in ecosystem. However, not much attention is paid on toxicity of insecticides to the natural enemy complex in crop ecosystem, which forms an important component of modern IPM technologies for pest management. An attempt was therefore made to find out the toxicity of certain insecticides and botanicals on *C. sexmaculatus* under laboratory conditions.

Materials and methods
A laboratory study was conducted at Department of Entomology, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar to determine the toxicity of insecticides and botanicals against eggs and grubs of *C. sexmaculatus.* The study was carried out at a room temperature of 25.12 ± 1.68^0C and relative humidity 68.58 ± 4.28 per cent. Initial culture of *Lipaphis erysimi* was collected from mustard during Oct – Nov 2013. Adults of *C. sexmaculatus* were collected from different field crops of SDAU, Sardarkrushingar and reared on the aphid culture which were then mass cultured and used. The details of chemicals along with concentrations tested are given below.

Table 1: Details of insecticides tested on coccinellid, *C. sexmaculatus*

Treatment	Active ingredients	Conc. tested (%)	Dose (g or ml / 10lit.)	Trade name
T1	Imidacloprid 17.8 SL	0.005	5.0 ml	Confidor
T2	Thiomethoxam 25 WG	0.005	5.0 g	Regent
T3	Acephate 75 SP	0.075	10.0 g	Asataf
T4	Diafenthiuron 50 EC	0.02	4.0 ml	Polo 500
T5	Clothianidin 50 WDG	0.025	5.0 g	Dantotsu
T6	Dimethoate 30 EC	0.03	10.0 ml	Rogor
T7	Neem oil 1500 ppm	0.3	30.0 ml	Neemazal
T8	Control (Untreated check)	---	---	---

Ovicidal toxicity

To study the ovicidal effect, freshly laid eggs of uniform sizes were selected. The required concentration of each insecticide was prepared and sprayed over the eggs of *C. sexmaculatus*. The treated petri plates (15 X 2 cm) were kept at room temperature for observation. The control was maintained by spraying distilled water over the eggs. The observation on number of eggs hatched was recorded daily up to 5 days and per cent corrected mortality was calculated using Abbott's formula (1925).

$$Per\ cent\ mortality(\%) = \frac{T - C}{100 - C}\ X\ 100$$

Where,

T = Mortality per cent in treatment

C = Mortality per cent in control

Larvicidal action

The larval mortality due to above chemicals were determined by feeding treated aphids (*L. erysimi*) to uniform sized third instar larvae of *C. sexmaculatus*. Each insecticidal spray was uniformly sprayed over the aphid population with hand sprayer. Later, grubs of *C. sexmaculatus* were released on the treated mustard twigs with aphids and covered with muslin cloth. Each treatment was repeated thrice. A control without any treatment was also maintained to compare the mortality rates. Observations were recorded at 24, 48 and 72 hours after treatment.

Results & Discussion

A perusal of the data presented in table 2 indicated that per cent mortality varied from 0.5% in control treatment to the highest of 90.49% in Imidacloprid 0.005%. Neem oil 0.3% recorded the lowest ovicidal action which was at par with control and significantly superior to the rest treatments. Among the chemicals, Acephate 0.075% recorded lowest egg mortality of 40.49% which significantly differed from rest of the treatments. The chemicals Clothianidin 0.025% recorded 67.25% egg mortality which was at par with Diafenthiuron 0.02% (70.52%). The highest ovicidal action was observed in Imidacloprid 0.005% (90.49%) which was at par with Dimethoate 0.03% (84.16%). Thiomethoxam 0.005% produced 77.36% of egg mortality which was at par with Dimethoate 0.03%. Hence the order of toxicity of chemicals to eggs of *M. sexmaculatus* was Imidacloprid = Dimethoate = Thiomethoxam = Diafenthiuron = Clothianindin > Acephate > Neem.

The data depicted in the table 2 clearly indicated that all the chemicals were significantly different from one another except Thiamethoxam 0.005% and Dimethoate 0.03% which were at par in its toxic effect in bringing the mortality on III instar grubs. The lowest per cent mortality was observed in control treatment which was at par with neem oil 0.3%. Among the chemical treatments, Imidacloprid 0.005% produced highest per cent mortality of 77.36% after 24 hours of treatment which was significantly differed from rest of the treatments. Acephate 0.075% brought 43.8% mortality, which was the lowest among chemicals and significantly differed from the rest of the treatments. The order of toxicity 24 hours after treatment was Imidacloprid > Dimethoate > Thiamethoxam > Clothianidin > Diafenthiuron > Acephate > Neem oil.

Almost similar trend was observed 48 hours after treatment, Imidacloprid producing significantly highest cumulative per cent mortality of 87.49%. Acephate 0.075% recorded a cumulative mortality (53.84%) which significantly differed from the rest of the treatments and also the lowest among the chemicals. The cumulative mortality observed in treatments Clothianidin 0.025% (67.26%), Diafenthiuron 0.02% (70.52%) and Dimethoate 0.03% (73.98%) were at par in its effect. Neem oil produced a cumulative mortality of 2.45% which was at par with control. The cumulative mortality per cent after 72 hours were highest in Imidacloprid 0.005%, which was at par with Thiamethoxam (87.49%) and Dimethoate 0.03% (83.83%). Treatment Clothianidin 0.025% and Diafenthiuron 0.02% produced a cumulative per cent mortality of 77.17% and 73.83% respectively, which were statistically at par in its effect. Among the chemicals, the lowest per cent mortality was recorded in Acephate 0.075% (57.17%). Neem oil 0.3% which was at par with control treatment, produced a cumulative mortality of 10.5% which was significantly different in its effects after 72 hours of treatment.

Present observation of highly toxic nature of Imidacloprid is supported by Tank and Korat (2007) [4] and Pawar (2010) [2]. Comparatively, low toxic effect of Acephate 0.075% is also in agreement with earlier observations made by.

Table 2: Toxicity of insecticides against eggs and grubs of *C. sexmaculatus*

S. No.	Treatments	Conc. (%)	Per cent mortality of eggs	Per cent mortality of grubs		
				24 hours	48 hours	72 hours
1	Imidacloprid 17.8 SL	0.005	72.05** (90.49)*	61.56** (77.36)*	69.29 (87.49)	72.05 (90.5)
2	Thiamethoxam 25 WG	0.005	61.56 (77.36)	55.09 (67.25)	61.56 (77.36)	69.30 (87.49)
3	Acephate 75 SP	0.075	39.52 (40.49)	41.44 (43.8)	47.21 (53.84)	49.14 (57.17)
4	Diafenthiuron 50 EC	0.02	57.10 (70.52)	47.21 (53.9)	57.10 (70.52)	59.33 (73.83)
5	Clothianidin 50 WDG	0.025	55.09 (67.25)	51.06 (60.51)	55.09 (67.26)	61.56 (77.17)
6	Dimethoate 30 EC	0.03	66.55 (84.16)	57.10 (70.49)	59.33 (73.98)	66.55 (83.83)
7	Neem oil 1500 ppm	0.3	13.96 (5.82)	4.05 (0.5)	9.01 (2.45)	18.91 (10.51)
8	Control (Water spray)	--	4.05 (0.5)	4.05 (0.5)	4.05 (0.5)	4.05 (0.5)
	S.Em		1.85	1.85	2.04	1.55
	CD at 5 %		6.80	6.80	7.48	5.69
	C.V %		8.49	8.49	9.53	6.56

** Treatments are arcsine transformed values.

*Treatments are retransformed values.

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