



## Field-weathered toxicity of insecticides to aphid predator, *Coccinella septempunctata* Linnaeus

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**ABSTRACT:** Field-weathered toxicity of insecticides was studied on rapeseed leaves to aphid predator, *Coccinella septempunctata* Linnaeus at different intervals after spray during the years 1999 and 2000. At the recommended concentrations, higher mortality of the predator was observed with cypermethrin and malathion than dimethoate and methyl demeton up to 3 days after spraying. On the 7<sup>th</sup> day after spray, residues of cypermethrin and malathion did not cause any mortality to the predator. On the 15<sup>th</sup> day after spray, all the insecticides did not cause any mortality to the predator except dimethoate, which resulted in 6.67 per cent mortality during the 2<sup>nd</sup> year. The descending order of toxicity to the adult predator was dimethoate > methyl demeton > cypermethrin > malathion.

**KEY WORDS:** *Coccinella septempunctata*, field-weathered toxicity, insecticides, rapeseed

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Mustard aphid, *Lipaphis erysimi* (Kalt.) is a key pest of rapeseed (*Brassica campestris* L.) and mustard (*Brassica juncea* L.). A number of insecticides have been recommended for the control of this pest. But so far as the farmers are concerned, they are using insecticides repeatedly at higher doses and frequencies than the recommended ones without knowing their ill-effect on consumers and natural enemies complex of the pest operating in the mustard eco-system. Among the natural enemies of mustard aphid, *Coccinella septempunctata* Linnaeus is an important predator. The information on the toxicity of insecticides to this predator is scanty. So, studies were undertaken to assess the field-weathered toxicity of some

insecticides used for the control of mustard aphid to the adults of this important predator.

The field experiments were laid out during Rabi season of 1999 and 2000 at the Experimental Farm of Department of Entomology, Palampur and the laboratory experiments were conducted in the Toxicology Laboratory of the Department. The rapeseed crop (cv. BSH-1) was raised as per recommendation in 'Package of Practices for Rabi Crops' of Choudhary Sarwan Kumar Himachal Pradesh Krishi Vishvavidyalaya, Palampur (Anonymous, 1998). The experiments were conducted in randomised block design with three replications and the plot size was 3 x 9 m. Adults of

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**Table 1. Field-weathered toxicity of insecticides to *C. septempunctata* on rapeseed leaves**

Insecticide (Conc. %)	Year	Mean corrected per cent mortality (days)*					Relative toxicity			
		0	1	3	7	15	P	T	PT	ORT
Cypermethrin (0.01)	1999	96.67 (83.82)	85.93 (71.74)	60.00 (50.83)	0.00 (0.00)	0.00 (0.00)	3	48.52	145.56	1.07
	2000	93.33 (77.68)	86.67 (72.75)	65.56 (54.37)	0.00 (0.00)	0.00 (0.00)	3	49.11	147.33	1.09
Dimethoate (0.03)	1999	75.93 (61.38)	51.85 (46.04)	43.33 (41.14)	13.33 (21.14)	0.00 (0.00)	7	64.55	451.85	3.33
	2000	76.67 (61.19)	60.00 (50.83)	47.78 (43.66)	16.67 (23.84)	6.67 (12.28)	15	124.67	1870.05	13.79
Malathion (0.05)	1999	90.00 (74.97)	79.26 (63.38)	56.67 (48.83)	0.00 (0.00)	0.00 (0.00)	3	45.19	135.57	1.00
	2000	90.00 (74.97)	83.33 (66.61)	65.56 (54.08)	0.00 (0.00)	0.00 (0.00)	3	47.78	143.34	1.06
Methyl demeton (0.025)	1999	65.56 (54.08)	37.78 (37.81)	30.00 (32.99)	6.67 (12.28)	0.00 (0.00)	7	49.00	343.00	2.53
	2000	63.33 (52.75)	46.67 (43.06)	37.78 (37.89)	10.00 (14.99)	0.00 (0.00)	7	55.22	386.54	2.85
CD (P = 0.05)	1999	(13.90)	(18.16)	(10.76)	(12.97)	(-)				
	2000	(16.86)	(14.40)	(10.63)	(14.70)	(-)				

Figures in parentheses are angular-transformed values.

P = Period for which toxicity persisted

T = Average residual toxicity

ORT = Order of relative toxicity based on PT

*C. septempunctata* were collected in the plastic vials from the untreated fields. They were conditioned in a cage in the laboratory. The crop was sprayed with cypermethrin (0.01%), dimethoate (0.03%), malathion (0.05%) and methyl demeton (0.025%). Leaves from the respective treatment and control plots were sampled at 0, 1, 3, 7 and 15 days after spray without disturbing the deposits during the handling and leaf disks were cut out of it so as to fit in a Petri-plate of 9cm diameter. Uniform sized 10 adults of coccinellids along with laboratory cultured adults of *L. erysimi* were released in each Petri-plate. These Petri-plates were placed in an incubator for 24 hours at  $26 \pm 1^\circ\text{C}$  temperature and  $70 \pm 5$  per cent relative humidity. There were five treatments including control with three replications. Mortality data were recorded after 24 hours. The corrected

mortality was calculated as per Abbott's formula (1925) and statistically analysed after angular transformation. The relative toxicity was calculated as per Upadhyay and Agrawal (1995).

The results of the field-weathered toxicity of four insecticides viz. cypermethrin, dimethoate, malathion and methyl demeton on rapeseed leaves to the adults of aphid predator, *C. septempunctata* is presented in Table 1. The mortalities obtained with cypermethrin, malathion, dimethoate and methyl demeton on zero day of application during first year were 96.67, 90.00, 75.93 and 65.56 per cent, respectively. So far as mortality is concerned, the first two and last two insecticides were on par with each other but the mortality caused by second group was significantly low. Almost similar results were

obtained during the second year. One day after spray, the per cent kill caused by methyl demeton and dimethoate was 37.78 and 51.85 per cent, respectively and was on par with each other. However, the mortality caused by malathion and cypermethrin was 79.26 and 85.93 per cent, respectively and both were on par with each other. Similar results were obtained during the second year. On 3rd day after spray, malathion and cypermethrin caused significantly higher mortality than methyl demeton and dimethoate during both the years. The mortality caused by methyl demeton and dimethoate during first and second (in brackets) years on 7<sup>th</sup> day were 6.67 (10.00) and 13.33 (16.67) per cent, respectively, while cypermethrin and malathion did not give any kill. All the treatments were ineffective in causing mortality to predator on the 15th day of spray except dimethoate which caused only 6.67 per cent mortality during the second year. The descending order of relative toxicity based on PT (period and toxicity index) values was dimethoate > methyl demeton > cypermethrin > malathion. From the present studies, it is clear that dimethoate was more toxic (Av. PT value: 2321.9) insecticide to *C. septempunctata* than methyl demeton both being systemic in nature and is more persistent. However, malathion and cypermethrin were less toxic because these insecticides remained biologically active up to 3 days only. The average PT value of cypermethrin (292.9) is in close association with that of malathion. Up to 3 days, highest mortality of the predator was noticed by cypermethrin followed by malathion, dimethoate and methyl demeton. Gupta *et al.* (1971) reported that dimethoate (0.03%) and methyl

demeton (0.025%) as moderately toxic and malathion as highly toxic to the adults of *C. septempunctata*. Mishra and Satpathy (1984) and Thomas and Phadke (1996) also reported that methyl demeton as least toxic to *C. septempunctata*.

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