

Residual toxicity of three insecticides on predator of mustard aphid

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Abstract: The residual toxicity of oxydemeton methyl dimethoate and that of fenetrothion were evaluated on the basis of PT index and LT₅₀ values against grubs and adults of *Coccinella septempunctata* L. predating on aphid infesting rapeseed crop variety Binasharisha-9 during 2008-2009. It was found that dimethoate was relatively less toxic than corresponding formulation of oxydemeton methyl to all the stages of the beetles.

Key words: Toxicity, insecticides, predator, mustard, aphid.

Introduction

Field efficacy of three insecticides (Oxydemeton methyl, Dimethoate and Fenetrothion) against mustard aphid, *Lipaphis erysimi* (Kalt.) has been reported earlier (Anon 2002-2003). Grubs and adults of lady bird beetle *Coccinella septempunctata* (L.) are most important predator of mustard aphid. Prior to any insecticides control measures. It is therefore very essential to determine the degree of selectivity of an insecticide against the pest as well as its predator, so that proper choice of the insecticides with least disturbance to the food chain can be made. With this objective, the present investigations, deal with the residual toxicity of the above three insecticides against grubs and adults of the predatory beetle.

Materials and Methods

Mustard variety, Binasharisha-9 was grown in the experimental field, Bangladesh Institute of Nuclear Agriculture (BINA), Mymensingh. The unit plot size was 4m x 3m = 12sqm. The distance between row to row was 40cm and plant to plant was 15cm. The experiment was conducted during the rabi season, 2008-2009. All agronomic practices were followed during experimental period. Three foliar insecticides namely, oxydemeton methyl, dimethoate and fenetrothion were applied each at two different dosage of 0.05 percent and 0.025 percent. All the insecticides were applied twice (45 and 65 days after sowing) starting from the appearance of aphids on inflorescences and shoots. A buffer area of one meter width was left around each experimental plot to safeguard against any drift of the insecticides. No insecticides were applied on control plots. Grubs and adults of *C. septempunctata* were collected from the stock culture in the growth room of Entomology Division, BINA, Mymensingh. Grubs were preconditioned for 3-4 hours, whereas adults for 24 hours in the laboratory, during which period these were fed with aphids collected from stock culture.

After the insecticide applications, leaves from the respective treatment and control plots were sampled at regular intervals and leaf discs were cut out of it so as to fit in a petridish of 9cm diameter and also inside of its wire gauge lid. Five randomly selected grubs (Plate 1) and ten active uniformly sized adult beetles (Plate 2) were released in each petridish and covered with wire gauge lid. There were six replications in case of grubs and three in case of adults for all six insecticidal treatments and control.

All the petridishes with released grubs and adults inside, were kept at 27±1°C and 55 percent RH. Mortality counts of grubs were recorded after 12 hours and that of adult 24 hours of release. The natural mortality in each case was corrected using Abbott's formula (Abbott, 1925). The residual toxicity in terms of PT index (Pradhan, 1967) and LT₅₀ values of each insecticide to the grubs and adults was worked out.

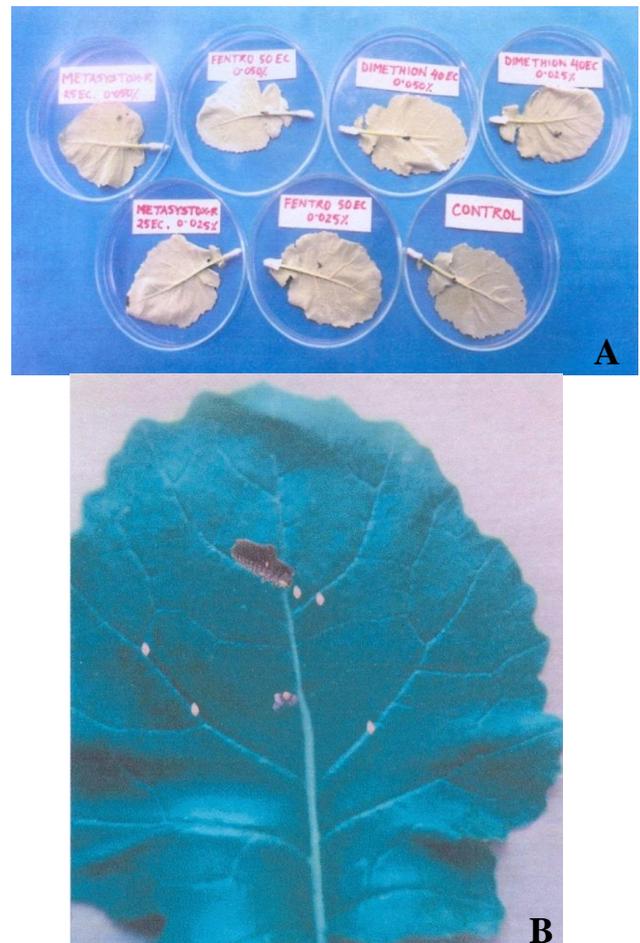


Plate 1. Mortality test of three insecticides on grub of *C. septempunctata* feeding on aphids (A, B)

Results and Discussion

The average percentage mortality after different interval of treatment persistent toxicity and LT₅₀ values of the grubs and adult beetles are given in Table 1 and 2.



Plate 2. Mortality test of three insecticides on the adult of *C. septempunctata* feeding on aphids (A, B)

It was observed that all the insecticides were found to deposit toxic residues to give hundred percent mortality of grubs at one day with fairly high persistent toxicity up to 10 days after application. Oxydemeton methyl, in general was more toxic than dimethoate and fenetrothion. Thus, oxydemeton methyl at 0.050 percent concentration gave initially hundred percent mortality at 1 to 7 days and 86.7 and 50.2 percent at 10 and 15 days after treatment (DAT). Dimethoate, 0.050, showed relatively less percent mortality up to 100, 96.7, 80.1, 66.7 and 48.2 at 1, 3, 7, 10 and 15 DAT. The same trend was observed in case of oxydemeton methyl and dimethoate at 0.025 percent indication that oxydemeton methyl was more toxic than dimethoate. Fenetrothion was least persistent upto 76.7, 50.0, 33.3, 13.3 and 6.7 at 1, 3, 7, 10 and 15 DAT, respectively.

The overall relative persistent toxicities based on PT index values (given in parentheses) in the descending order was oxydemeton methyl 0.050 (1365.6), dimethoate 0.050 (950.6), fenetrothion 0.050 (950.6), oxydemeton methyl 0.025 (950.0) and fenetrothion 0.095 (700.1).

Persistence of the insecticides as evaluated from LT_{50} value is also given in Table 1. The results indicated that oxydemeton methyl 0.05 percent recorded higher residual toxicity to grub with LT_{50} value of 10.35. The descending order of the residual revealed by LT_{50} value (given in parenthesis) was oxydemeton methyl 0.05 (10.35), dimethoate 0.05 (10.08), dimethoate 0.025 (8.44), oxydemeton methyl 0.025 (6.95), fenetrothion 0.050 (5.92) and fenetrothion 0.025 (3.40). Considering the last LT_{50} value of fenetrothion as unity, oxydemeton methyl at 0.05 percent 2.96 times more toxic to grubs. In the same way, dimethoate was 2.48 times more toxic than fenetrothion which was found to be relatively safe.

Table 1. Relative toxicity of insecticides against *C. septempunctata*, grubs based on PT index and LT_{50} values.

Name of Insecticides		Dose (%)	Corrected percentage mortality (days after treatment)					Period days (P)	Mortality (%) (T)	Persistence toxicity (PT)	Order of relative toxicity (ORT)	LT_{50} (days)	Relative persistence	Order of relative persistence
Trade name	Common name		1	3	7	10	15							
Metasystox-R 25EC	Oxydemeton Methyl	0.025	100.0	100.0	86.7	53.3	26.7	15	63.3	950.0	6	6.95	2.04	5
		0.050	100.0	100.0	100.0	86.7	50.2	20	68.2	1363.6	2	10.08	2.96	2
Dimethion 40EC	Dimethoate	0.025	100.0	86.7	74.6	52.3	40.0	15	63.4	950.6	5	5.92	1.74	6
		0.050	100.0	96.7	80.1	66.3	48.2	20	61.5	1229.2	3	8.44	2.48	3
Fenetrothion 50EC	Fenetrothion	0.025	100.0	76.7	50.0	33.3	13.3	15	46.7	700.1	7	3.40	1.00	7
		0.050	100.0	100.0	96.7	73.4	60.4	20	70.1	1151.8	1	10.35	3.04	1

Table 2. Residual toxicity of insecticides against *C. septempunctata* adult beetles based on PT index and LT_{50} values.

Name of Insecticides		Dose (%)	Corrected percentage mortality (days after treatment)					Period days (P)	Mortality (%) (T)	Persistence toxicity (PT)	Order of relative toxicity (ORT)	LT_{50} (days)	Relative persistence	Order of relative persistence
Trade name	Common name		1	3	7	10	15							
Metasystox-R 25EC	Oxydemeton Methyl	0.025	86.7	63.3	43.3	33.3	24.2	10	50.2	501.7	5	2.33	2.42	5
		0.050	93.3	86.7	63.3	44.7	28.6	10	63.3	633.3	3	4.95	5.15	3
Dimethion 40EC	Dimethoate	0.025	73.3	56.7	90.7	27.3	6.7	10	40.9	409.3	6	1.36	1.42	6
		0.050	80.7	68.4	55.8	36.7	19.3	10	52.2	521.8	4	2.74	2.88	4
Fenetrothion 50EC	Fenetrothion	0.025	70.0	58.3	36.6	20.4	10.0	10	39.1	390.7	7	0.96	1.00	7
		0.050	93.3	86.7	66.7	46.5	35.7	20	51.0	1019.4	1	2.25	5.44	2

Leaves treated with Oxydemeton methyl, 0.025 and 0.050 percent retained their residual toxicity to adult predator beetle only upto 10 DAT (Table 2). Oxydemeton methyl, 0.05 percent gave 93.3, 86.7, 63.3, 44.7 and 28.6 percent mortality on 1, 3, 7, 10 and 15 DAT while oxydemeton

methyl, 0.025 gave relatively lower percentage of mortality ranging from 86.7 to 24.2 during the same interval. Dimethoate 0.050, showed higher persistent toxicity than at its 0.025 percent concentration. Oxydemeton methyl showed consistently higher residual

toxicity upto 10 days but there after dimethoate was found to be more toxic than oxydemeton methyl. Fenetrothion, 0.025 was persistently least toxic against adult beetle.

The descending order of residual toxicity of each insecticides based on its PT index and LT₅₀ values (respectively given in parenthesis) was Oxydemeton methyl, 0.05(633.3, 4.94), dimethoate 0.025(409.3, 1.36 and fenetrothion (390.7, 0.96). Thus fenetrothion was found to be least toxic followed by dimethoate.

The residual toxicity of these insecticides thus showed that dimethoate was much safer than oxydemeton methyl to all the stages of the beetles. Fenetrothion was found to be the most safe insecticides against all the stages of the beetle. The relative safety of fenetrothion with its low residual toxicity to all the stages of the predatory beetles has also been reported by Verma (1980), Sharma and Adlakha (1981), Choudhari and Ghosh (1982), Tripathi *et al.* (1988), Shukla, *et al.* (1990), Thomas and Phadke (1991), Thomas and Phadke (1996) and Monjure Maula (2002).

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