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Persistent toxicity of insecticides against *Cheilomenes sexmaculata* (Fabricius), a predator of tobacco aphid, *Myzus nicotianae* Blackman

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ABSTRACT: Persistent toxicity of insecticides to *Cheilomenes sexmaculata* (Fabricius) was studied during 1994-95. Acephate, imidacloprid and carbosulfan exhibited considerable indirect toxic effect on the population of *C. sexmaculata*. However, oxydemeton methyl was relatively safe to *C. sexmaculata*.

KEY WORDS: *Cheilomenes sexmaculata*, insecticides, *Myzus nicotianae*, persistent toxicity

Tobacco aphid, *Myzus nicotianae* Blackman is one of the major pests of bidi tobacco causing significant loss to yield and quality. Several insecticides are reported to be effective against *M. nicotianae* (Anon., 1992; Naik and Lingappa, 1993; Sreedhar *et al.*, 1993; Yeole and Lingappa, 1995). Coccinellids often account for natural biosuppression of aphid. The population of *C. sexmaculata* become abundant from October onwards and devour large number of aphids. Present investigation was carried out to determine the persistent toxicity of insecticides against grubs and adults of *C. sexmaculata*. The principal objective of the investigation has been the identification of safer product to *C. sexmaculata* in comparison with oxydemeton methyl, a commonly used insecticide against tobacco aphid in the region.

MATERIALS AND METHODS

Studies were conducted during 1994-95 at Agricultural Research Station, Nipani, Karnataka. Tobacco plants (30 days old and variety Anand -119) raised in the field were enclosed in a nylon net. The plants were sprayed with desired concentration of insecticide by using pneumatic hand sprayer

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to the 'runoff' stage. Grubs and adults of *C. sexmaculata* were collected from tobacco field that did not receive any insecticidal application. Grubs were sorted out into two groups based on their relative size by following the method of Thomas and Phadke (1991, 1995). Eight hours prior to each sampling, treated-plants were infested with large number of aphids. Leaf discs with sufficient poisoned aphids as food were placed in Petri-plates lined with filter paper with moist cotton. Ten grubs/ adults starved for 6h, were released in each Petri-plate. Untreated leaf discs with aphids served as control to determine the mortality due to other factors. All the Petri-plates were covered with muslin cloth using rubber band and kept at 27 ± 1°C temperature and 70 ± 5per cent relative humidity. Mortality counts were recorded after 24h of exposure and natural mortality in each case was corrected using Abbott's (1925) formula. The persistent toxicity in terms of persistent toxicity index (Pradhan, 1967) and PT_{50} values of each insecticide to grubs and adults was worked out.

Insecticidal treatments included imidacloprid, carbosulfan, acephate and oxydemeton methyl. Former two were applied through plant hole treatment (PHT) whereas latter two as foliar sprays. In the plant hole treatment, insecticidal fluid (100 ml) was poured into the slanting hole made by a wooden peg to the root zone, 7 cm away from the plant base. The hole was then filled with soil. Mortality of *C. sexmaculata* exposed to treated-leaves was recorded on 1, 3, 5, 7, 10 and 14 days after treatment.

RESULTS AND DISCUSSION

Early instar grubs

Data on persistent toxicity of insecticides against early instar grubs are given in Table one. Acephate 0.075 per cent was highly toxic causing 100 per cent mortality of grubs one DAT. The product retained its toxicity upto 14 DAT to induce 9.16 per cent mortality of grubs. In a similar way, imidacloprid PHT (40g a. i. /ha) and carbosulfan PHT (800g a. i. /ha) which gave 86.83 per cent mortality at one DAT, continued to persist up to 10 DAT to cause 24.32 and 18.91 per cent mortality of grubs, respectively. Oxydemeton methyl (0.025%) was least toxic with 71.05 per cent mortality to grubs at one DAT and 15.78 at 5 DAT.

Based on PT index, the order of persistent toxicity of insecticides was acephate (833.8) > imidacloprid PHT (616.9) > carbosulfan PHT (527.2) > oxydemeton methyl (197.3). Persistent toxicity of the insecticides as evaluated from PT_{50} values is given in Table 2. Acephate recorded higher toxicity with PT_{50} value of 7.06 days followed by imidacloprid PHT (5.83 days), carbosulfan PHT (4.13 days) and oxydemeton methyl (1.63 days).

Late instar grubs

It could be seen from Table 2 that all the insecticides except oxydemeton methyl retained their persistent toxicity to late instar grubs up to 10 days after treatment. Acephate 0.075 per cent showed a fairly high persistent toxicity up to 5 DAT and

Table 1. Toxicity of selected insecticides to early instar grubs of *C. sexmaculata*

Insecticide	Conc./ Dose	Mean corrected mortality(%) (Days after treatment)						P	T	PT	PT_{50}
		1	3	5	7	10	14				
Imidacloprid PHT	40 g a.i./ha	86.83	78.94	68.41	49.99	24.32	0.00	10	61.69	616.9	5.83
Carbosulfan PHT	800 g a. i./ha	86.83	73.68	49.99	34.20	18.91	0.00	10	52.72	527.2	4.13
Acephate FS	0.075 %	100.00	89.47	73.68	52.62	32.42	9.16	14	59.55	833.8	7.06
Oxydemeton methyl FS	0.025 %	71.05	31.57	15.78	0.00	-	-	5	39.46	197.3	1.63

PHT - Plant hole treatment; FS - Foliar spray ; P - Period of observation in days; T - Average percentage mortality; PT - Persistent toxicity

Table 2. Toxicity of selected insecticides to late instar grubs of *C. sexmaculata*

Insecticide	Conc./ Dose	Mean corrected mortality(%) (Days after treatment)						P	T	PT	PT_{50}
		1	3	5	7	10	14				
Imidacloprid PHT	40 g a. i./ha	78.37	68.41	52.62	39.47	16.21	0.00	10	51.01	510.1	3.72
Carbosulfan PHT	800 g a. i./ha	83.78	71.05	57.89	28.94	10.80	0.00	10	50.49	504.9	3.73
Acephate FS	0.075 %	92.29	81.57	68.41	42.05	27.02	0.00	10	62.26	622.6	5.80
Oxydemeton methyl FS	0.025 %	64.25	23.67	10.58	0.00	-	-	5	32.83	164.1	1.34

PHT - Plant hole treatment; FS - Foliar spray; P - Period of observation in days; T - Average percentage mortality; PT - Persistent toxicity

Table 3. Toxicity of selected insecticides to adults of *C. sexmaculata*

Insecticide	Conc./ Dose	Mean corrected mortality(%) (Days after treatment)						P	T	PT	PT_{50}
		1	3	5	7	10	14				
Imidacloprid PHT	40 g a. i./ha	78.94	64.10	55.25	33.33	13.15	0.00	10	48.95	489.5	3.61
Carbosulfan PHT	800 g a. i./ha	76.31	64.09	52.62	25.63	6.67	0.00	10	45.06	450.6	3.06
Acephate FS	0.075 %	92.10	74.35	64.10	45.68	21.04	0.00	10	59.45	594.5	5.34
Oxydemeton methyl FS	0.025 %	65.78	18.91	10.52	0.00	-	-	5	31.73	158.6	1.35

PHT - Plant hole treatment; FS - Foliar spray; P - Period of observation in days; T - Average percentage mortality; PT - Persistent toxicity

induced 27.02 per cent mortality at 10 DAT. Imidacloprid PHT and carbosulfan PHT exhibited 78.37 and 83.78 per cent mortality of grubs at one DAT and persisted upto 10 DAT inducing 16.21 and 10.18 per cent mortality, respectively. Oxydemeton methyl 0.025 per cent was least toxic to late instar grubs with per cent mortality of 64.25 and 10.58 at one and 5 DAT, respectively.

Based on PT index the order of persistent toxicity was acephate (622.6) > imidacloprid PHT (510.1) > carbosulfan PHT (504.9) > oxydemeton methyl (164.1).

Adult beetles

Table 3 shows that all the insecticides except oxydemeton methyl retained their persistent toxicity to adult of *C. sexmaculata* upto 10 days after treatment. Acephate (0.075%) was the most persistent with 92.10, 74.35, 64.10, 45.68 and 21.04 per cent mortality on 1, 3, 5, 7 and 10 DAT, respectively. Imidacloprid PHT was almost comparable to carbosulfan PHT in its persistent toxicity upto 5 days, however, former was found to be more toxic. Oxydemeton methyl 0.025 per cent was least toxic to adult beetles.

The descending order of persistent toxicity of each insecticide based on its PT index and PT_{50} values were: acephate> imidacloprid PHT> carbosulfan PHT > oxydemeton methyl.

Studies on persistent toxicity of insecticides showed that acephate was highly toxic to grubs and adults of *C. sexmaculata* followed by imidacloprid PHT and carbosulfan PHT. Oxydemeton methyl was found to be safer 5 days after spray. Further, results indicated that persistent toxicity of all the insecticides was higher to early instar grubs, however, it did not differ much between late instar grubs and adults.

All the four insecticides except oxydemeton methyl were persistent in their toxicity to *C. sexmaculata* upto 10 DAT. In contrast, oxydemeton methyl lost its toxicity within 5 days. Acephate proved to be the most persistent and exhibited high persistent toxicity to early, late instar grubs and adults of *C. sexmaculata* followed by imidacloprid PHT and carbosulfan PHT. Higher residual toxicity of acephate to predator, as obtained in the present study is conceivable. In addition to preying poisoned aphids, direct contact with treated surface also contributed towards mortality of predator. However, residual toxicity of imidacloprid and carbosulfan that were administered through PHT could cause mortality only through the food namely poisoned aphids.

The relative safety of oxydemeton methyl to *C. sexmaculata* is in accordance with Satpathy *et al.* (1968). Field studies of Choudhary *et al.* (1983) and Babu (1988) also indicated the safety of methyl demeton to *C. sexmaculata*. In the identical studies by Manisegaran *et al.* (1991), methyl demeton (0.025%) was toxic to *Coccinella septempunctata* upto four days only. In contrast, results of Thomas and Phadke (1991) indicated the oxydemeton methyl (0.025%) was persistent against

grubs and adults of *C. septempunctata* preying on *Lipaphis erysimi* up to 15 days.

Higher persistent toxicity of imidacloprid PHT and acephate to *C. sexmaculata* could not be compared due to lack of literature. From these observations, it is inferred that acephate, imidacloprid and carbosulfan exhibit considerable persistent toxicity on the population of *C. sexmaculata.*

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