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Selective toxicity of some insecticides against tobacco aphid, *Myzus nicotianae* Blackman and its predator, *Cheilomenes sexmaculata* (Fabricius)

C. S. PATIL and S. LINGAPPA
Department of Agricultural Entomology
University of Agricultural Sciences
Dharwad 580 005, Karnataka, India

ABSTRACT: **Studies were conducted to assess toxicity of promising insecticides against tobacco aphid, *M. nicotianae* and its predator, C. *Sexmaculata* during 1995 at the Agricultural Research Station, Nipani (Karnataka). The selectivity ratio of *M. nicotianae* and *C. sexmaculata* grubs and adults was lowest for acephate followed by imidacloprid and oxydemeton methyl. However, endosulfan registered highest selectivity ratio and it could be used for aphid control along with the coccinellids in an integrated approach.**

KEY WORDS: Insecticides, *Cheilomenes sexmaculata, Myzus nicotianae,* selectivity

Cheilomenes sexmaculata (Fabricius) is the most common predacious coccinellid found in bidi tobacco ecosystem. The abundance of this predator is often seriously affected by insecticide applications directed to tobacco aphids, *M. nicotianae,* a most destructive pest of tobacco. In view of this, the selectivity of some new insecticides for *C. sexmaculata* preying on *M. nicotianae* was evaluated to facilitate proper selection and choice of the insecticides against tobacco aphid.

MATERIALS AND METHODS

Studies were conducted during 1995 at the Agricultural Research Station, Nipani. Toxicity tests were carried out by utilizing field collected grubs and adults (uniform size) of *C. sexmaculata.* The insecticides included oxydemeton methyl, acephate, imidacloprid and endosulfan. All the insecticides were tried at five concentrations to obtain mortality in the range of 20 to 80 per cent. One treatment with acetone alone was maintained as check.

Field collected grubs and adults were pre-conditioned in the laboratory for about six hours and used to assay the contact toxicity by dry film method suggested by Paul and Thyagarajan (1992). All the tests were carried out at 27± 1°C temperature and 70 ± 5 per cent relative humidity. The insects were kept in contact with treated surface for six hours after which they were transferred to Petri-plates containing tender aphid infested twigs of tobacco. The mortality counts were recorded at the end of post exposure period of 18h. All moribund insects were considered as dead. The mortality percentages were corrected

Table 1. Food chain toxicity of insecticides to predator, *C. sexmaculata*

Insecticide	Heterogeneity (χ^2)	Regression equation	LC_{50}	Fiducial limits	Relative toxicity
		GRUB			
Imidacloprid	0.415	Y = 1.7074x + 0.0422	0.00102	0.0013 0.0008	13.78
Acephate	0.587	Y = 1.6357 x -0.0429	0.00317	0.0043 0.0023	4.43
Oxydemeton methyl	0.302	Y = 1.6144x - 0.0494	0.01406	0.0193 0.0102	1.00
Endosulfan	0.035	Y = 1.6602 x -0.0924	0.02243	0.0308 0.0165	0.62
		ADULT			
Imidacloprid	1.987	Y = 1.6451x + 0.0073	0.00104	0.0014 0.0008	11.26
Acephate	0.468	Y = 1.7449 x -0.0430	0.00310	0.0041 0.0023	3.78
Oxydemeton methyl	0.374	Y = 1.5566x + 0.0066	0.01720	0.0159 0.0085	1.00
Endosulfan	0.168	Y = 1.6057 x -0.0472	0.01947	0.0266 0.0141	0.60

according to Abott (1925) and were subjected to Probit analysis (Finney, 1971).

Tobacco Aphid, *M. nicotianae* reared on caged tobacco plants was used for bioassay in the laboratory by residual deposit method of Devonshire and Rice (1989) with some modifications at 27 ± 1°C temperature and 70 ± 5 per cent relative humidity. Mortality of aphids was recorded after 24 hours and moribund ones were taken as dead. Corrected per cent mortality was computed according to Abott (1925) and data were subjected to Probit analysis (Finney, 1971).

RESULTS AND DISCUSSION

Food chain toxicity of insecticides to coccinellid, *C. sexmaculata*

From the LC_{50} values given in Table 1, it could be seen that imidacloprid was highly toxic to *C. sexmaculata* grubs (0.0012) followed by acephate (0.00317), oxydemeton methyl (0.01406) and endosulfan (0.02243). Similarly, for adults, the descending order of toxicity was imidacloprid (0.00104), acephate (0.00310) oxydemeton methyl (0.01172) and endosulfan (0.01947).

Considering the relative toxicity of insecticides to grubs, imidacloprid and acephate were found to be about 13.78 and 4.43 times more toxic than oxydemeton methyl. On the other hand, endosulfan was found to be 0.62 times less toxic. Similar trend was noticed in case of adults. It could be noticed that all the insecticides were more toxic to adult than grub, while it was reverse in the case of imidacloprid.

Table 2. Food chain toxicity of insecticides to *M. nicotianae*

Insecticide	Heterogeneity (χ^2)	Regression equation	LC_{50}	Fiducial limits
Oxydemeton methyl	3.195	Y = 1.498x - 0.129	0.00804	0.0093 0.0070
Acephate	1.034	Y = 1.555x - 0.041	0.00334	0.0038 0.0029
Imidacloprid	1.085	Y = 1.582x - 0.011	0.00064	0.0007 0.0006
Endosulfan	0.162	Y = 1.576 x -0.058	0.00884	0.0101 0.0077

Food chain toxicity of insecticides to tobacco aphid, *M. nicotianae*

It could be seen from the LC_{50} values given in Table 2 that imidacloprid was highly toxic to *M. nicotianae* (0.00064) followed by acephate (0.00334), oxydemeton methyl (0.00804) and endosulfan (0.00884). The order of toxicity of insecticides for tobacco aphid was imidacloprid > acephate > oxydemeton methyl > endosulfan.

Selectivity

Evidently grubs and adults of *C. sexmaculata* were more tolerant than *M. nicotianae* to all the insecticides. The safety limit was lowest in the case of acephate followed by imidacloprid, oxydemeton methyl and endosulfan. The insecticide, endosulfan exhibited highest safety limit of 2.53 and 2.20 for grubs and adults, respectively (Table 3.).

Pfluger and Schmuck (1991) reported that toxic effect of imidacloprid to ladybird beetle resulted in decrease of half of the population. Lingappa *et al.* (1978), Maker and Jadhav (1981) and Babu (1988) endorsed the safety of endosulfan to *C. sexmaculata.* Methyl demeton (0.02%) was found to be less toxic to the beetle according to Satpathy *et al.* (1968), Rathore and Pathak (1983) and Choudhary *et al.* (1983). Bioassay studies of Patil *et al.* (1994) and Dhingra *et al.* (1995) indicated that endosulfan and methyl demeton were relatively less toxic to grubs and adults of *C. sexmaculata.* It may be pointed out that grubs were more tolerant than adults to all the insecticides except imidacloprid. Maker and Jadhav (1981)

Table 3. Selectivity of insecticides to *C. sexmaculata*

Insecticide	LC_{50} value			Selectivity ratio	
	C. sexmaculata		*M. nicotianae*	Grub	Adult
	Grub	Adult			
Imidacloprid	0.00102	0.00104	0.00064	1.59	1.62
Acephate	0.00317	0.00310	0.00334	0.94	0.92
Oxydemeton methyl	0.01406	0.01172	0.00804	1.74	1.46
Endosulfan	0.02243	0.01947	0.00884	2.53	2.20

also observed less susceptibility of grubs to endosulfan and methyl demeton than adults. Further, grubs and adults of *C. sexmaculata* were less sensitive to the action of insecticides than *M. nicotianae*. Hodek (1973) reported that among aphidophagous insects, coccinellids were more tolerant to insecticides.

In the present studies, selectivity-ratio for *M. nicotianae* and *C. sexmaculata* grubs and adults was lowest for acephate (0.94 and 0.92) followed by imidacloprid and oxydemeton methyl. On the contrary endosulfan registered highest selectivity ratio (2.53 and 2.20). Next choice in this regard could be oxydemeton methyl and imidacloprid as last one. Imidacloprid, which was highly toxic to tobacco aphid, showed some safety margin. However, acephate should not be applied when the population of *C. sexmaculata* is actively preying upon the aphid.

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