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Research Note

Toxicity of eco-friendly chemicals to coccinellid predators on Okra

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ABSTRACT: **Field experiments were carried out to study the relative toxicity of different groups of chemicals *viz.*, dichlorvos, Nimbecidine, *B.t.* (Delfin), novaluron (IGR), spinosad and imidacloprid (neonicotinoid) and combination of dichlorvos, spinosad and imidacloprid with novaluron and *B.t.* against predatory coccinellid beetles *Cheilomenes sexmaculata* (Fabricius) and *Micraspis univittata* (Hope). The results indicated that dichlorvos and imidacloprid alone were found to be toxic compared to their combination with eco-friendly chemicals. The treatments *B.t.* and nimbecidine were found to be relatively safe to coccinellids.**

KEYWORDS: *Cheilomenes sexmaculata*, Eco-friendly chemicals, *Micraspis univittata*

Okra (*Abelmoschus esculentus* (L.) Moench) is one of the largely cultivated vegetable crops in the country. The successful cultivation of okra is often hampered by an array of insect pests. Nearly 72 insect pests attack okra. Among these aphid, *Aphis gossypii* Glover; leafhopper, *Amrasca biguttula biguttula* (Ishida); whitefly, *Bemisia tabaci* (Gennadius) and shoot and fruit borer, *Earias vittella* (Fabricius) are quite serious (Uthamasamy and Balasubramanian, 1978).

Among the natural enemies of the okra aphid, coccinellid predators, *Cheilomenes sexmaculata* (Fabricius) and *Micraspis univittata* (Hope) are of considerable importance. Chemical insecticides sprayed on okra for the control of major insect pests affect adversely these coccinellid predators. Hence, a field experiment was conducted to study the toxicity of newer insecticides and eco-friendly bioagents alone and in combinations against predatory coccinellids on okra.

A field experiment was conducted at Agricultural College Farm, Bapatla during *rabi* 2002-2003. The experiment was laid out in randomized block design with three replications. The okra variety "Parbhani kranti" was sown in plots of 5x4m to test the toxicity of insecticides *viz.*, dichlorvos, imidacloprid, Nimbecidine, *Bacillus thuringiensis* (Delfin), novaluron (IGR) and spinosad and combination of dichlorvos, spinosad and imidacloprid with novaluron and *B.t.* Two sprays were given at fortnightly interval.

The counts of predatory beetles, *C. sexmaculata* and *M. univittata* present on the ten randomly selected tagged plants per plot were recorded one day before and one, five, ten and

fifteen days after each spray. The per cent reduction of coccinellids over untreated check in different treatments was calculated using the modified Abbot's formula (Fleming and Ratnakaran, 1985). These values were further transformed to the corresponding angular values and the data were subjected to statistical analysis.

The relative toxicity tests of different treatments against coccinellid predators revealed that dichlorvos alone recorded the highest mean reduction (47.39%) in coccinellid population and indicated its highest toxicity when compared to the rest of the treatments. The toxic nature of dichlorvos is in agreement with findings of Dhingra (1999) who

Table 1. Toxicity of the treatments to predatory coccinellid beetles on okra during *rabi*, 2002-2003 (Pooled data of two sprays)

Treatment/ Conc.%	Mean coccinellid population/ 10 plants before spray	Mean per cent reduction over untreated control				Over all Toxicity
		1 DAT	5 DAT	10 DAT	15 DAT	
Dichlorvos 0.1	5.00	50.63 (45.36)^{a}	53.44 (47.01)^{a}	47.24 (43.41)^{a}	38.27 (38.21)^{a}	47.39 (43.13)^{a}
Nimbecidine 1	8.33	18.37 (25.35)^{i}	21.30 (27.47)^{j}	16.60 (24.02)^{j}	12.30 (20.49)^{g}	17.14 (24.43)^{j}
Delfin WG 0.2	8.00	19.15 (25.93)^{i}	22.43 (28.26)^{i}	18.67 (25.57)^{ij}	12.52 (20.67)^{g}	18.19 (25.22)^{ij}
Spinosad 0.015	6.67	27.60 (31.68)^{ef}	30.11 (33.22)^{fg}	25.52 (30.32)^{fg}	19.28 (26.03)^{de}	25.62 (30.43)^{ef}
Novaluron 0.01	7.33	25.40 (30.25)^{fg}	28.47 (32.24)^{g}	23.55 (29.01)^{gh}	18.62 (25.54)^{e}	24.01 (29.32)^{fg}
Imidacloprid 0.006	6.33	36.53 (37.18)^{c}	39.68 (39.04)^{d}	34.46 (35.94)^{d}	28.65 (32.35)^{c}	34.83 (36.16)^{c}
Delfin 0.1 + Novaluron 0.005	6.67	20.68 (27.03)^{hi}	24.59 (29.71)^{hi}	19.54 (26.21)^{ij}	16.64 (24.03)^{ef}	20.36 (26.74)^{hi}
Delfin 0.1+ Spinosad 0.0075	7.67	23.58 (29.04)^{gh}	25.46 (30.29)^{h}	20.40 (26.83)^{hi}	16.65 (24.04)^{e}	21.52 (27.61)^{gh}
Delfin 0.1 + Dichlorvos 0.05	5.33	40.42 (39.47)^{b}	45.71 (42.54)^{c}	38.51 (38.43)^{c}	31.07 (34.56)^{b}	38.92 (39.04)^{b}
Delfin 0.1 + Imidacloprid 0.003	6.67	29.39 (32.82)^{e}	31.38 (34.06)^{f}	27.43 (31.57)^{ef}	21.63 (27.70)^{d}	27.45 (31.59)^{de}
Novaluron 0.005 + Dichlorvos 0.05	6.00	44.23 (41.30)^{b}	48.62 (44.94)^{b}	42.51 (40.97)^{b}	32.89 (34.99)^{b}	42.11 (40.37)^{b}
Novaluron 0.005 + Spinosad 0.0075	8.33	25.35 (30.22)^{fg}	28.51 (32.17)^{g}	21.75 (27.78)^{hi}	16.41 (23.88)^{f}	23.01 (28.57)^{fgh}
Novaluron 0.005 + Imidacloprid 0.003	7.00	33.47 (35.34)^{d}	36.53 (37.14)^{e}	29.73 (33.03)^{e}	22.42 (28.24)^{d}	30.53 (33.61)^{d}
Untreated control	8.66					
SE M±		1.07	0.86	1.10	1.06	0.98
CD (P=0.05)		2.20	1.76	2.27	2.17	2.02

reported the toxicity of dichlorvos to *Coccinella septempunctata* Linnaeus in relation to aphid species.

The combination of dichlorvos with eco-friendly agents novaluron and *B. t.* were less toxic compared to the individual treatment of dichlorvos against predatory beetles. The present findings are in accordance with the observations of Sasikala *et al.* (1999) who reported less toxicity of combination treatment, lufenuron + carbaryl over carbaryl alone against coccinellid predators on brinjal.

The moderate toxicity (34.83%) observed with imidacloprid in the present study is in contrast with Daghe and Kadam (2001) who reported the less toxicity of imidacloprid to ladybird beetles and chrysopid eggs. However, Rathod and Bapodra (2002) observed toxicity of imidacloprid to coccinellid predators.

The eco-friendly chemicals namely, spinosad, novaluron and combination treatments, novaluron + spinosad and *B. t.* + spinosad were found to be relatively less toxic to coccinellids when compared to the insecticides, dichlorvos and imidacloprid. In agreement with the present study, Patil *et al.* (2001) reported that all IGR treatments including novaluron were less toxic to spiders, *chrysoperla* eggs and larvae and coccinellid grubs and adults.

Among all the treatments *B. t.*, Nimbecidine and the combination treatment, *B. t.*+ novaluron were found to be less toxic to coccinellid population when compared to other treatments. The present findings of *B. t.* are in concurrence with Malathi *et al.* (1999) who reported the safety of *B. t.* against coccinellids.

The results, thus, indicate the integration of some of the less toxic molecules *viz.*, spinosad, novaluron, *B. t.* and Nimbecidine instead of highly toxic conventional insecticides like dichlorvos and imidacloprid in the management programme of major insect pests of okra so that residue problem can be minimized and coccinellid predators can be conserved.

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