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RESEARCH ARTICLE

TOXICITY OF CERTAIN INSECTICIDES TO SPIDERS AND COCCINELLID BEETLES IN THE MANGO ECOSYSTEM

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ABSTRACT

A field experiment was done to evaluate the toxicity of certain insecticides with reference to number of sprays against predatory population of spiders and coccinellid beetles on mango. Azadirachtin (0.05%) was found to be safer to spider as well coccinellids i.e. *Menochilus sexmaculatus* and *Coccinella septumpunctata.* Endosulfan (0.07%) was relatively safe to coccinellid beetles followed by malathion (0.05%) and carbaryl (0.1%). Single spray was safe than two sprays and three sprays where as Cypermethrin (0.01%) showed distinct deleterious effect on spiders and coccinellid beetle population.

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INTRODUCTION

Mango is the most important fruit crop of India covering about 25.67-lakh hectares and the total production is 192.73 million tonnes with productivity of 7.5 million tonnes per hectar. In India Mango mainly grown Andhara Pradesh, Uttar Pradesh, Jharkhand, Karnataka and Bihar. In Andhra Pradesh it is cultivated in 3.04 lakh hectares with production of 9 milion tonnes per hectare. (www.Indiastat.com, 2013-14). Mango orchards are subjected to attack by a plethora of pests. Mango pests cause heavy losses especially during the flowering stage. The yield loss was estimated at 25 to 60 per cent (Kumar *et al*., 1985). In mango ecosystem, predators such as coccinellids, chrysopids, preying mantids, and spiders have been found to be predominant. Tandon and Lal (1983) recorded spiders as predators of nymphs of mango hopper *Idioscopus clypealis.* Coccinellid beetles (*Coccinella septumpunctata* L., and *Menochilus sexmaculatus* F.) are one of the most important predators of aphids (*Toxoptera odinae,* Vander goot) and mealy bugs (*Drosicha mangiferae,* Stebbins) in the mango ecosystem. The application insecticides produced a greater loss of beneficial arthropods than any other agricultural practice (Van Den Bosch, 1966).

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In order to conserve the natural enemies present in mango ecosystem, use of safer insecticides is essential. Hence, attempts were made to evaluate the toxicity of certain insecticides to spiders and coccinellid beetles in mango ecosystem.

MATERIAL AND METHODS

Studies on toxicity of insecticides with reference to number of sprays on predatory spiders and coccinellid beetles were carried out during January to May 2010 in the mango orchards of Narasingapuram, Chittoor district, Andhra Pradesh. The field experiment was laid out in a randomized block design with 19 treatments, including untreated control with three replications. Single spray of insecticides was given during flowering period, two sprays one at flowering and one at marble size fruit stage and three sprays one at flowering, one at marble size fruit stage and one at advanced fruit development stage. High volume rocker sprayer was used for spraying the trees. The untreated check received water spray.The observations on spider incidence were recorded before spraying and 2, 5, 8 and 11days after spraying on 12 twigs/panicles from each tree. The data before analysis were subjected to square root transformation.

RESULTS AND DISCUSSION

The results of the experiment revealed that all the insecticides tested caused different degrees of adverse effect on occurence of predatory spider and coccinellid beetles population. Among all the treatments maximum spider (10.0) and coccinellid beetles (8.05) population was noticed in untreated check.

Similar results were obtained by Jayaraj (1993) who reported that predatoroy spider population in neem treated plot can be comparable with untreated check. Markandeya and Divakar (1999) also reported that neem formulation, Morgoson did not

Table 1. Effect of Insecticides with reference to number of sprays on population of spiders

Insecticides	Population of spiders/12 pannicles*			Mean
	Number of Sprays			
	Single spray	Two sprays	Three sprays	
Endosulfan (0.07%)	9.3^{e} (3.051)	8.2^{k} (2.86)	7.3^{n} (2.70)	8.3^{c} (2.87)
Malathion (0.05%)	8.9^{g} (2.98)	7.2^{o} (2.72)	5.8^{s} (2.4)	7.3^{f} (2.69)
Carbaryl (0.1%)	9.0^{f} (3.00)	7.4^{m} (2.72)	6.2^{r} (2.4)	7.5^{e} (2.7)
Cypermethrin (0.01%)	8.6^{i} (2.93)	6.8^{q} (2.6)	5.3^{t} (2.30)	6.9^{g} (2.61)
Azadirachtin (0.05%)	9.7^{d} (3.11)	8.8^{h} (2.97)	8.3^{j} (2.88)	8.9^{b} (2.97)
Imidacloprid (0.005%)	9.3^{e} (3.051)	7.8^{l} (2.79)	7.1^{p} (2.64)	8.1^{d} (2.83
Untreated check	10.3^{a} (3.21)	9.8^{c} (3.13)	10.0^{b} (3.16)	10.0^{a}(3.17)
Mean	9.3^{a} (3.05)	8.0^{b} (2.82)	7.1^{c} (2.69)	

ANOVA table for Effect of Insecticides with reference to number of sprays on population of spiders

	SEM	CD	-test
Insecticides(F_1)	0.0031	0.0081	**
Number of Sprays(F_2)	0.0021	0.0051	**
InsecticidesX Number of Sprays (F_1XF_2)	0.0051	0.0141	**

*Mean of four observations
Figures in parentheses are square root transformed values
Means followed by same letters are not statistically different

Table 2. Effect of insecticides with reference to number of sprays on population of coccinellid beetles

Insecticides	Population of coccinellid beetles/12 panicles*			Mean
	Number of sprays			
	Single spray	Two sprays	Three sprays	
Endosulfan (0.07%)	7.6^{c} (2.751)	7.1^{e} (2.659)	6.4^{g} (2.529)	7.0^{c} (2.640)
Malathion (0.05%)	7.2^{e} (2.683)	6.5^{g} (2.549)	5.4^{i} (2.324)	6.4^{e} (2.519)
Carbaryl (0.1%)	6.8^{f} (2.608)	5.5^{i} (2.345)	4.2^{k} (2.049)	5.5^{f} (2.334)
Cypermethrin (0.01%)	6.5^{g} (2.549)	4.8^{j} (2.191)	3.3^{l} (1.816)	4.9^{g} (2.185)
Azadirachtin (0.05%)	7.8^{b} (2.793)	7.5^{c} (2.745)	7.5^{c} (2.739)	7.6^{b} (2.759)
Imidacloprid (0.005)	7.4^{d} (2.720)	6.8^{f} (2.608)	5.9^{h} (2.429)	6.7^{d} (2.585)
Untreated check	8.0^{a} (2.828)	8.1^{a} (3.13)	8.1^{a} (2.846)	8.0^{a} (2.838)
Mean	7.3^{a} (2.705)	6.6^{b} (2.562)	5.8^{c} (2.690)	

ANOVA table for Effect of insecticides with reference to number of sprays on population of coccinellid beetles

	SEM	CD	-test
Insecticides(F_1)	0.0041	0.0115	**
Number of Sprays(F_2)	0.0062	0.0176	**
InsecticidesX Number of Sprays (F_1XF_2)	0.0107	0.0305	**

*Mean of four observations
Figures in parentheses are square root transformed values
Means followed by same letters are not statistically different

Azadirachtin (0.05%) recorded highest population of 8.9 spiders and 7.6 coccinellid beetles in all the three spray schedules and was significantly superior over the other treatments and could be considered safe to the spiders and coccinelld beetles. Next safer treatments were endosulfan (0.07%) and imidacloprid (0.005%) which recorded 8.3 and 8.1 spiders and 7.0 and 6.7 coccinellid beetles respectively.

affect survival of wolf spider, *Lycosa pseudoannulata*. Neem and abamectin were found to be relativerly safe to beneficial spiders on watermelon (Giribabu *et al*., 2002). Schmutter and Ascher (1984) reported that extracts from neem seeds have shown slight or no deleterious effects on beneficial insects. The safety of endosulfan to coccinellid predators was reported by Singh and Malhotra (1975), Sharma and Adlakha (1981) Shukla *et al*., (1990) is in confirmation with the findings of the present investigation. Malathion and carbaryl exhibited moderate toxicity to the beetles which is in accordance with the findings of Singh and Malhotra (1975), who reported that malathion and carbaryl should not be applied when the coccinellids are actively predating upon the aphids.

In the present study cypermethrin (0.01%) recorded the lowest population of spiders in all the three spray schedules and was highly toxic to the spiders. The results are in confirmty with the work of Croft and Whalon (1992) who reported that spider from three families on apple and the entire complex on cotton showed moderate to high mortality to field rate of synthetic pyrethroids. Among all the insecticides cypermethrin (0.01%) had an adverse effect on the beetle population. Susceptibility of coccinellids to pyrethroids had already been established by many workers on different hosts (Croft and Whalon, 1982; Sreedharan and Chackon, 1982; Tewari and Krishnamoorthy, 1985; Ramesh Babu and Azam, 1987; Mani and Krishnamoorthy, 1991).

Two or three sprays of azadirachtin maintained higher beetle population than single spray of synthetic insecticides. Single spray of cypermethrin (0.01%), two sprays of malathion (0.05%) and three sprays of endosulfan (0.07%) were equally toxic to to the beetles. The result clearly indicated that endosulfan (0.07%) was safer to coccinellid beetles than malathion and cypermethrin. Two sprays of imidacloprid (0.005%) and single spray of carbaryl maintained similar population level, which indicated that imidacloprid (0.005%) was comparatively safer than carbaryl to coccinellid beetles. It is concluded that azadirachtin (0.05%) and endosulfan (0.07%) could be applied when the coccinellid beetles are active in the field. Since cypermethrin showed toxicity to the beetles, its application could be avoided. Significant difference was found among the three spray schedules. Maximum spider and coccinellid beetle population was recorded in single spray schedule and was safer to other two spray schedules.

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