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Impact of insecticides and botanicals on population build-up of predatory coccinellids in mulberry

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ABSTRACT

A field experiment was conducted to study the impact of application of certain commonly used insecticides and botanicals in mulberry fields on the population built-up of predatory coccinellid beetles. The results revealed that the population of coccinellid beetles was drastically reduced 1 day after spray (DAS) in the plots treated with dichlorovos (88.63%), followed by phosalone (78.56%), dimethoate (72.19%) and metasystox (68.97%) whereas in the plots treated with pungam oil there was least reduction (29.72%) followed by neem oil (35.20%). The predators regained significant built up of their population at 5 DAS in plots treated with pungam oil and 10 DAS in the plots treated with neem oil, dichlorovos and phosalone whereas it continued to be at reduced levels (44.35%) in dimethoate followed by metasystox (32.61%) treated plots even at 10 DAS.

Key words: Insecticides, Botanicals, Mulberry, Toxicity, Coccinellid Beetles

INTRODUCTION

Silkworm rearing is taken up by harvesting mulberry shoots at regular intervals which is followed by cultural operations, manuring, foliar fortification etc., in mulberry garden to enhance the growth of the plants and obtain optimum leaf yield and quality (Dandin *et al.*, 2003). However luxuriant growth of mulberry plants invite infestation of number of insect species resulted with considerable reduction in leaf yield and quality which reflects adversely on quantum of silkworm rearing and cocoon productivity. Hence routine application of insecticides is unavoidable to protect the plants from pests with in short period to take up silkworm rearing in time. Application of insecticides with high toxicity and prolonged residual effects in mulberry gardens is restricted because of high sensitivity of silkworms. Therefore any recommendation of chemicals' against mulberry pests is drawn only after considering their safety to silkworms. The biopesticidal action was also studied by Sahayaraj and Karthickraja (2003) on the reduviid predator, *Rhynocoris marginatus*. However, not much attention is paid on toxicity of these chemicals to the natural enemy complex in mulberry ecosystem, which form an important component of modern IPM technologies for pest management. An attempt was therefore made to find out the impact of application of certain insecticides and botanicals on population build-up of predatory coccinellid beetles in mulberry garden.

MATERIALS AND METHODS

The experiment was conducted in a completely randomized block design replicated three times with the irrigated V1 mulberry field at Regional Sericultural Research Station, Salem, during October-December' 2006 when large number of coccinellid beetles especially *Scymnus* sp. were observed coinciding with an out break of spiraling whitefly (*Aleurodicus dispersus*). The mulberry plantation was maintained following recommended package of practices (Dandin *et al.*, 2003) and divided into plots which measured 7.3 X 3.6 m each with 42 plants at a spacing of (3 + 5) feet X 2 feet in a paired row system. The treatments, seven in number, comprised of selected pesticides / botanicals reported by various workers for the management of different pests of mulberry (Dandin *et al.*, 2003; Rajadurai and Thiagarajan, 2003; Rama Mohan Rao *et al.*, 2003; Samuthiravelu *et al.*, 2003) are dichlorovos (EC 76%), phosalone (EC 35%), dimethoate (EC 30%), metasystox (EC25%), neem oil (*Azadirachta indica*), pungam (*Pungamia glabra*) oil at recommended doses and the control with water spray. The population of all predatory coccinellid beetles irrespective of species was recorded a day prior to the spray of insecticides (pretreatment population) and 1, 3, 5, 7, 10 days after spray (post treatment population) from five randomly selected plants per plot. The counting was taken up during early hours preferably 6AM-7AM when the temperature is normally low (Naranjo and Flint, 1995). Percent reduction in population over control was calculated and analyzed statistically.

RESULTS AND DISCUSSION

The population of coccinellid beetles was drastically reduced 1 DAS in the plots treated with dichlorovos followed by phosalone, dimethoate and metasystox where as in the plots treated with pungam oil there was least reduction followed by neem oil as could be seen from Table1. The predators regained built up of improvement in their population significantly at 5 DAS in plots treated with pungam oil and 10 DAS in the plots treated with neem oil, dichlorovos and phosalone whereas it continued to be at reduced levels of 44.35% in dimethoate followed by metasystox treated plots even at 10 DAS. The pooled data of population built-up of predatory coccinellid beetles revealed that dimethoate and metasystox exhibited higher toxicity compared to that of dichlorovos and phosalone. The fumigant and penetrant action of dichlorovos cause quick knock down effect but the toxic substances decompose and evaporate soon after application without leaving any residual effects (David and Kumaraswami, 1975). Hence the abrupt decline in coccinellid population in dichlorovos treated plots at 1 DAS was shortly reversed compared to others. However, low and persistent toxicity of phosalone to coccinellids observed in this study has also been reported earlier by Raudonis *et al.* (2004). In contrary, Olszak (1999) reported highest toxicity and residual effect of phosalone even 28 days after application to aphidophagous coccinellid. Tank *et al.* (2007) reported comparatively lower toxic effects of dimethoate and metasystox compared to dichlorovos under laboratory conditions. The post treatment population count at 1 DAS in the present study are in agreement with these findings. But prolonged persistency of these chemicals inhibits the population built-up of predatory coccinellids for more than 10 DAS.

Of the two botanicals tested the population reduction was minimum in plots treated with pungam oil than neem oil indicating low toxicity of botanicals to coccinellid beetles compared to their chemical counterparts. The results of this study are therefore in conformity with the findings of Tanwar *et al.* (2007). Neem products are reported to be harmless to natural enemies, pollinators and other non-target organisms (Ranga Rao *et al.*, 2007; Singh and Singh, 1996). In the present study, the botanicals were perceived as slight or least toxic towards the population build up of predatory coccinellids. It is therefore, concluded from the present study that field application of chemicals like dichlorovos having short persistence and botanicals like pungam / neem oils against mulberry pests could help conserve the natural enemy population in mulberry garden.

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Table 1. Effect of insecticides and botanicals on the population build-up of predatory coccinellid beetles in mulberry garden

Treatment	Conc. (%)	Pre treatment Population /plant	Post treatment Population/plant					
			1 DAS	3 DAS	5 DAS	7 DAS	10 DAS	Mean
Dichlorovos (76 EC)	0.15	14.20	1.66 (88.63)	3.20 (77.67)	6.46 (55.32)	10.73(27.79)	12.26(20.02)	6.86(53.36)
Phosalone (35 EC)	0.05	13.66	3.13 (78.56)	3.86 (73.06)	6.20 (57.12)	8.46 (43.06)	12.33 (19.57)	6.80 (53.77)
Dimethoate(30 EC)	0.05	14.00	4.06 (72.19)	3.40 (76.27)	4.40 (69.57)	5.93 (60.09)	8.53 (44.35)	5.26 (64.24)
Metasystox (25 EC)	0.10	13.46	4.53 (68.97)	3.80 (73.48)	4.46 (69.15)	6.66 (55.18)	10.33 (32.61)	5.95 (59.55)
Neem oil (Crude)	3.00	13.80	9.46(35.20)	9.66 (32.58)	10.80 (25.31)	11.46 (22.88)	13.66 (10.89)	11.00 (25.22)
Pungam oil (Crude)	3.00	14.40	10.26(29.72)	11.13 (22.33)	13.33 (7.81)	14.20 (4.44)	14.66 (4.37)	12.71 (13.59)
Control (Water spray)	-	13.93	14.60	14.33	14.46	14.86	15.33	14.71
CD @ 5% level	-	2.23	1.13	1.20	0.97	1.19	1.20	—
CV%	-	9.01	9.32	9.58	6.36	6.49	5.42	—

DAS: Days After Spray; Figures in the parentheses are percent reduction over control

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