JBiopest 6(2):96-100

Bioefficacy of certain insecticides and *Beauveria bassiana* against coccids in flower crops

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ABSTRACT

Coccids (Scales and mealy bugs) have attained serious pest status on a wide range of host plants. Coccids are persistent in nature, their small size makes them difficult to detect and identify in the field and during quarantine inspection. The toxicity studies indicated that profenophos 50 EC 2ml/lit, methyl parathion 50 EC 2ml/lit fish oil rosin soap 20g/lit, imidacloprid 70 WS 0.4 ml/lit, acephate 75 SP 2g/lit and dimethoate 30 EC 2 ml/lit were highly toxic to *Phenacoccus solenopsis*, *Coccidohystrix insolita*, *Parasaissetia nigra* and *Cerococcus indicus* and the efficacy persisted up to 10 days under field condition. *Beauveria* bassiana was found to be moderately effective at 10 days after treatment.

MS History: 5.4.2013 (Received)-22.8.2013 (Revised)-15.8.2013 (Accepted)

Key words: Bioefficacy of insecticides, coccids, flower crops

INTRODUCTION

Floriculture is a fast emerging major venture in the world, as a potential money -spinner for many third-world countries. Many flowers and ornamental plants are grown for domestic as well as for export market and provide more return / unit area than any other horticultural crop. Growing of cut flower, suited for flower arrangements / decorations and bouquets, has increased substantially and its share of the total trade has also improved (Patil, 2007). In comparison to other commercial crops large- scale cultivation of flower crops has many limitations. Depending on the growing conditions, a variety of pests attack the flower and medicinal crops by making holes and eating leaves, buds, flower and fruits, and cause curling, distortion, discoloration, browning and drying of plant parts. Cultivating flowers and gardening have been practised in India for many centuries. The total area under cultivation of different flowers in India is 80,000 hectare (Das, 2005).

Mealybugs and sacles (coccids) belong to the insect order homoptera and the super family coccoidea. They cause direct damage by way of feeding and in addition they also inject toxic saliva, excrete honey dew paving way for the growth of sooty mould fungus giving an ugly look resulting in poor quality of the produce. It also causes yellowing of leaves and malformation of affected portions due to salivary infection. They also cause indirect damage by way of spreading many viral diseases by acting as vector. The presence of red ants causes the nuisance while harvesting fruits/nuts in mango, coconut, citrus, Cotton, Ornamentals, flower and medicinal crops etc. The honey dew also causes the sooty mould due to capnodium growth and it reduces the photosynthesis. However, at times mealy bug infestation may occur within the vegetative shoot apex and may be extremely difficult to detect. This ability of mealybugs to form dense colonies particularly within the shoot apex cause a severe damage by reducing the photosynthesis of the plant due to honeydew secretion and sooty mould attack (Suresh, 2000).

MATERIALS AND METHODS

Crawler is the most susceptible stage at which coccids can easily be controlled. The trial was laid out in Randomized Complete Block Design (RBD) with three replications for kharif seasons beginning 2007-2008. Plot size was kept 6x5 m^2 and distance from row to row and plant to plant were maintained at 4X3 feet, respectively to evaluate the efficacy of certain newer insecticides against important coccids like *Phenacoccus solenopsis*, *C. indicus, P. nigra* and

Table 1. Bioefficacy of insecticides and *B. bassiana* against *P. solenopsis* on *H. rosasinensis*

Treatments	Dose (g or ml/lit)	PTC (Nos.)	Percentage mortality				
			1 DAT	2 DAT	3 DAT	7 DAT	10 DAT
Thiomethoxam 20WG	0.4	44.67	81.33[b]	97.87[a]	100.00[a]	100.00[a]	100.00[a]
Imidacloprid 70WS	0.4	47.00	96.12[a]	100.00[a]	100.00[a]	100.00[a]	100.00[a]
Triazophos 40EC	2.5	44.33	65.15[c]	91.95[b]	97.51[a]	100.00[a]	100.00[a]
Fish Oil Rosin Soap	20	47.00	97.89[a]	100.00[a]	100.00[a]	100.00[a]	100.00[a]
Dimethoate 30EC	2	43.33	97.98[a]	100.0[a]	100.00[a]	100.00[a]	100.00[a]
Profenophos 50EC	2	42.33	100.00[a]	100.00[a]	100.00[a]	100.00[a]	100.00[a]
Methyl parathion 50EC	2	47.00	100.00[a]	100.00[a]	100.00[a]	100.00[a]	100.00[a]
Acephate 75SP	2	43..33	81.35[b]	99.36[a]	100.00[a]	100.00[a]	100.00[a]
Beauveria bassiana ($2x10^8$ /ml)	5	48.67	8.85[d]	15.19[c]	24.14[b]	66.74[a]	76.54[a]
Untreated control		44.33	0.00[d]	0.00[d]	0.00[c]	0.00[b]	0.00[b]
CD Value (0.05)	-	-	3.2531	2.5207	1.7562	2.2991	1.8712

Pre treatment count (PTC); Days after treatment (DAT); Mean followed by same letter (s) in a column are not significantly different by DMRT (P=0.05)

C. insolita on hibiscus at Tamil Nadu Agricultural University, Coimbatore.

The treatment details were as follows: Thiomethoxam 20 WG (0.4 g or ml / litre of water)-T1, Imidacloprid 70 WS (0.4 g or ml / litre of water)-T2, Triazophos 40 EC (2.5 g or ml / litre of water)-T3, FORS (Fish Oil Rosin Soap) (20 g or ml / litre of water)-T4, Dimethoate 30 EC (2 g or ml / litre of water)-T5, Profenophos 50 EC (2 g or ml / litre of water), -T6, Methyl parathion 50 EC (2 g or ml / litre of water)-T7, Acephate 75 SP (2 g or ml / litre of water)-T8, *Beauveria bassiana* ($2x10^8$ ml) (5 g or ml / litre of water)-T9 and Untreated control. Each host plant was sprayed with recommended dose of chemical and there were three replications. Pre and post treatment counts were taken on 1, 3, 5, 7 and 10 days after spray.

RESULTS AND DISCUSSION

The results of toxicity studies on the efficacy of different insecticides/ entomopathogen against *P. solenopsis* Tinsley are presented in Table 1. The insecticides profenophos and methyl parathion were found to be toxic and caused hundred per cent mortality one day after treatment while imidacloprid, fish oil rosin soap and dimethoate caused hundred per cent mortality two days after treatment. All the insecticides were found to be effective on 10 days. *Beauveria* was found to be moderately effective and caused 77 per cent mortality 10 days after treatment. The results of toxicity studies on the efficacy of different insecticides/ entomopathogen against *C. insolita* Green are presented in the Table 2. The insecticides profenophos and methyl parathion were found to be toxic and showed cent per cent mortality one day

Table 2. Bioefficacy of insecticides and *B. bassiana* against *C. insolita* on *H. rosasinensis*

Treatments	Dose (g or ml/lit)	PTC (Nos.)	Percentage mortality				
			1 DAT	2 DAT	3 DAT	7 DAT	10 DAT
Thiomethoxam 20WG	0.4	56.3	76.5[c]	94.8[b]	100.0[a]	100.0[a]	100.0[a]
Imidacloprid 70WS	0.4	56.7	90.1[b]	96.6[b]	100.0[a]	100.0[a]	100.0[a]
Triazophos 40EC	2.5	57.0	95.[a]	100.0[a]	100.0[a]	100.0[a]	100.0[a]
Fish Oil Rosin Soap	20	51.7	96.1[a]	100.0[a]	100.0[a]	100.0[a]	100.0[a]
Dimethoate 30EC	2	52.0	76.9[b]	93.6[b]	100.0[a]	100.0[a]	100.0[a]
Profenophos 50EC	2	55.0	100.0[a]	100.0[a]	100.0[a]	100.0[a]	100.0[a]
Methylparathion 50EC	2	58.3	100.0[a]	100.0[a]	100.0[a]	100.0[a]	100.0[a]
Acephate 75SP	2	57.0	97.1[a]	98.8[a]	100.0[a]	100.0[a]	100.0[a]
Beauveria bassiana ($2x10^8$ /ml)	5	54.3	2.4[d]	4.7[c]	22.5[b]	33.7[a]	40.3[a]
Untreated control		55.3	0.0[d]	0.0[c]	0.0[c]	0.0[b]	0.0[b]
CD Value (0.05)	-	-	2.8514	1.8873	0.7233	0.5977	0.9101

Pre treatment count (PTC), Days after treatment (DAT), Mean followed by same letter (s) in a column are not significantly different by DMRT (P=0.05)

after treatment while fish oil rosin soap and triazophos showed cent per cent mortality in two days after treatment. All the insecticides were found to be effective on 10 days. *Beauveria* caused 41 per cent mortality 10 days after treatment. This study indicated that all the systemic insecticides and fish oil rosin soap were found to be toxic and caused hundred per cent mortality in 24 - 48 hrs depending upon the insect species. In case of *P. solenopsis* and *C. insolita* methyl parathion and profenophos caused cent per cent mortality one day after treatment. The effectiveness may be due to the high penetrative reaction of the chemical while FORS and imidacloprid caused cent per cent mortality in two days after treatment which may be due to the asphyxiation and systemic reaction of the insecticides. Among different insecticides, profenophos was reported to be highly effective against the *Phenacoccus* spp. (Dhawan, 2007). Saeed *et al*. (2007) reported that recommended application rates of methomyl, profenofos and chlorpyrifos provided the best control of *Phenacoccus gossypiphilous*: the lethal time studies proved their efficiency for better and timely control of this sporadic pest. It might be due to the good penetrative reaction of the chemical. While in the case of entomopathogens such as *Beauveria* caused 70 per cent mortality of *P. solenopsis* and *C. insolita* in 10 days after treatment. The delayed reaction may be due to the poor penetration of the fungus. While Crane and Mossler (2006) reported *Beauveria bassiana* caused 90 per cent mortality against *Paracoccus marginatus*(Pappaya mealybug) during the summer month which might be due to the higher temperature and relative humidity which favour for the fungus growth and the difference in efficacy may be due to species variation. While in the case of *P. nigra* Nietner bioefficacy results are presented in Table 3. Significant mortality was observed two days after treatment. Profenophos and acephate caused cent per cent mortality 7 days after treatment. All the insecticides were found to be effective on 10^{th} day causing cent per cent mortality. *Beauveria* caused 35 per cent mortality 10 days after treatment. In case of soft scales, the mortality started three days after treatment and this might be due to thick waxy coating or hard covering around the body which prevented the penetrative reaction of the chemical. Suresh and Mohanasundaram (1996) reported that all the systemic insecticides were effective and caused about one hundred percent mortality against scales and mealybugs. While in

Table 3. Bioefficacy of insecticides and *B. bassiana* against *P. nigra* Nietner on *H. rosasinensis*

Treatments and dose (g or ml/lit)	PTC (Nos.)	Percentage mortality				
		1 DAT	2 DAT	3 DAT	7 DAT	10 DAT
Thiomethoxam 20WG (0.4)	35.0	2.7	11.7[b]	29.7[c]	81.9[c]	100.0
Imidacloprid 70WS (0.4)	38.0	2.7	12.8[d]	32.0[d]	85.7[b]	100.0[a]
Triazophos 40EC (2.5)	35.3	2.76	13.4[b]	24.0[d]	80.6[c]	100.0[a]
Fish Oil Rosin Soap- (20)	33.0	2.76	10.9[b]	20.5[d]	90.1[b]	100.0[a]
Dimethoate 30EC (2)	36.0	2.76	16.8[b]	25.7[d]	80.2[c]	100.0[a]
Profenophos 50EC (2)	35.0	2.76	31.9[a]	40.1[a]	100.0[a]	100.0[a]
Methyl parathion 50 EC (2)	34.7	2.7	26.1[a]	33.4[b]	82.6[a]	100.0[a]
Acephate 75SP (2)	35.0	2.7	29.6[a]	47.3[a]	100.0[a]	100.0[a]
Beauveria bassiana ($2x10^8$ /ml)- (5)	34.0	2.76	5.4[b]	7.8[e]	17.6[d]	35.2[b]
Untreated control	35.3	0.0	0.0[d]	0.0[d]	0.0[c]	0.0[c]
CD Value (0.05)	-	3.7742	3.0490	2.7052	2.9417	3.1162

Pre treatment count (PTC),Days after treatment (DAT), Mean followed by same letter (s) in a column are not significantly different by DMRT (P=0.05)

the case of *C. indicus* Maskell bioefficacy results are presented in Table 4. Significant mortality was seen from two days after treatment. Profenophos and acephate showed cent per cent mortality 7 days after treatment. All the other insecticides recorded hundred per cent mortality on the tenth day after treatment. *Beauveria* caused 49 per cent mortality 10 days after treatment.

Josephrajkumar *et al*. (2002) reported that the efficacy of biorationals against mussel scale, the neem formulations 0.5 per cent and fish oil insecticidal soap (3%) when applied four times at fortnight intervals and sprayings of either dimethoate 0.05 per cent or monocrotophos 0.05 per cent at fortnightly intervals after the harvest of berries effectively controlled black pepper mussel scale.

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Table 4. Bioefficacy of insecticides and *Beauveria bassiana* against *C. indicus* on *H. rosasinensis*

Treatments	Dose (g or ml/lit)	PTC (Nos.)	Percentage mortality				
			1 DAT	2 DAT	3 DAT	7 DAT	10 DAT
Thiomethoxam 20WG	0.4	35.67	3.73	14.21^{b}	31.76^{b}	83.83^{c}	100.00^{a}
Imidacloprid 70WS	0.4	34.67	3.73	11.75^{b}	28.95^{c}	84.87^{c}	100.00^{a}
Triazophos 40EC	2.5	36.33	3.73	16.73^{b}	29.62^{c}	82.66^{c}	100.00^{a}
Fish Oil Rosin Soap	20	34.67	3.73	16.31^{b}	26.28^{c}	92.79^{b}	100.00^{a}
Dimethoate 30EC	2	35.33	3.73	15.75^{b}	24.91^{c}	81.36^{c}	100.00^{a}
Profenophos 50EC	2	35.00	3.73	32.08^{a}	45.24^{a}	100.00^{a}	100.00^{a}
Methyl parathion 50 EC	2	34.33	3.73	26.32^{a}	35.27^{b}	83.21^{c}	100.00^{a}
Acephate 75SP	2	34.00	3.73	28.37^{a}	44.49^{a}	100.00^{a}	100.00^{a}
Beauveria bassiana ($2x10^{8}$ /ml)	5	35.33	3.73	7.26^{c}	13.19^{d}	44.93^{d}	48.59^{b}
Untreated control		34.67	0.00	0.00^{c}	0.00^{e}	0.00^{c}	0.00^{c}
CD Value (0.05)	-	-	2.3156	2.8264	2.5379	2.8264	2.5379

Pre treatment count (PTC), Days after treatment (DAT), Mean followed by same letter (s) in a column are not significantly different by DMRT (P=0.05)

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