Safety evaluation of Emamectin benzoate 5 WG against predatory coccinellid in Okra eco-system

P. Parthiban*, R.K. Murali Baskaran, D.S. Rajavel, C. Chinniah and A. Ravikumar

Department of Agricultural Entomology, Agricultural College and Research Institute,Tamil Nadu Agricultural University, Madurai 625 104, Tamil Nadu, India.

*Corresponding author's E-mail: parthitnau@gmail.com

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ABSTRACT

Two field experiments on okra (Cv: Shakti) were conducted, at Nathapatti (I season : July 2012 to October 2012) and Pazhayasukkampatti (II season : December 2012 to March 2013) of Tamil Nadu to evaluate the safety of new formulation Emamectin benzoate 5 WG at different doses (100, 125 and 150 g/ha) against the standard check, Emamectin benzoate 5 SG (135 and 170 g/ha), Lambda cyhalothrin 5 CS (300 ml/ha) and Pyridalyl 10 EC at 500 ml/ha for their safety to coccinellid predators in okra eco-system. Observation on the population of coccinellid was recorded prior to spraying and at 5 and 10 days after each spraying from ten randomly selected plants in each replication and untreated check. The results showed that Emamectin benzoate 5 WG was found to be safer to coccinellidat all concentrations tested. The highest population recorded in plots treated with Emamectin benzoate 5 WG at 100 g/ha followed by Emamectin benzoate 5 WG at 125 g/ha, respectively.

Key words: Coccinellid, Emamectin benzoate 5 WG, Okra, Safety

Okra is an important vegetable occupies major component of our food. India ranks first in the World production of okra which is 67 per cent of the total World production (India stat. 2015). Okra is infested by more than 72 species of insects (Srinivasa Rao and Rajendran, 2003), The major pests are leafhopper, *Amrasca biguttula biguttula* (Ishida), whiteflies, *Bemisia tabaci* (Gennadias), aphid, *Aphis gossypii* (Glover), mite, *Tetranychus cinnabarinus* (Boisduval), fruit borer, *Earia svittella* (Fabricius) and *Helicoverpa armigera* (Hubner). Among them, fruit borers are the most destructive pests (Mani *et al.*, 2005). Since high cost is incurred in the cultivation of high yielding okra, the farmers have to rely upon pesticides to get a high net income. The indiscriminate and irrational use of chemical insecticides at higher doses resulted in resurgence, resistance and residues. The indiscriminate usage had increased the cost of cultivation and also has led to some irreversible changes in our biosphere. It is important to adopt or use some newer insecticide molecule with high toxicity even at lower doses and should also be safer to the natural enemies present in the agro eco-system.

One of such insecticides is Emamectin benzoate which is a semi synthetic derivative of avermectin produced as fermentation metabolites of soil actinomycetes, *Streptomyces avermitilis* Burg. (Lasota and Dybas, 1991). This was discovered in 1984 and has both stomach and contact action effective against lepidopteran pests. Emamectin benzoate 5 SG is one of the formulations, being marketed in the name of Proclaim and its efficacy has been demonstrated on several lepidopteran pests of agricultural and horticultural crops (Kuttalam *et al.*, 2008; Sharma and Kausik, 2010; Ajanta Biraii and Raguraman 2011; Aulakh *et al.*, 2012; Parthiban *et al.*, 2014). Field efficacy of this formulation has been enhanced by developing new one with UV protectant *ie*.,Emamectin benzoate 5 WG. It has been developed by M/s Syngenta India Ltd. which is in pipeline for registration. Keeping in view, the present study was taken up to study the impact of Emamectin benzoate 5 WG to coccinellid predators in okra eco-system.

MATERIALS AND METHODS

Field experiments were conducted for two seasons, one at Nathapatti (I season : July 2012 to October 2012) at 30 ± 2° C and 79 ± 5 % RH and another at

Pazhayasukkampatti (II season : December 2012 to March 2013) at 27 ± 2° C and 83 ± 5 % RH to evaluate the safety of new formulation Emamectin benzoate 5 WG against coccinellid predators of okra (Cv: Shakti). The experiments were carried out in plots of 4 × 10 m size in a RBD with eight treatments and each was replicated thrice. During first season, three rounds of spraying were given on 11.09.2012, 21.09.2012 and 03.10.2012, respectively at ten days interval, starting from 45 days after sowing. During second season, three rounds of spraying were given on 06.02.2013, 18.02.2013 and 28.02.2013, respectively at ten days interval, starting from 43 days after sowing. Pneumatic knapsack sprayer (Aspee sprayer) using 500 litres of spray fluid per hectare was used to spray various doses of test insecticide. Population of coccinellid predators (number of coccinellid/ 10 plants) was recorded in all treatments and untreated check prior to spraying and at 5 and 10 days after each spraying from 10 randomly selected plants. Data were subjected to analysis of variance (ANOVA). Before analysis, data on population were transferred by square root transformation. In order to know the interaction between treatments, data from field experiment were subjected to factorial RBD analysis and the means obtained were separated by DMRT (Gomez and Gomez, 1984).

Table 1. Various doses of Emamectin benzoate 5 WG and check insecticides

S No.	Treatment	Dose (g ai/ha)	Dose Product (g/ml ha^{-1})
1.	Emamectin benzoate 5 WG	5.00	100
2.	Emamectin benzoate 5 WG	6.25	125
3.	Emamectin benzoate 5 WG	7.50	150
4.	Emamectin benzoate 5 SG	6.75	135
5.	Emamectin benzoate 5 SG	8.50	170
6.	Lambda cyhalothrin 5 CS	15.00	300
7.	Pyridalyl 10 EC	50.00	500
8.	Untreated check	--	--

RESULTS AND DISCUSSION

The population of coccinellids (number of coccinellid/plant) ranged from 14.67 to 16.67 nos. per 10 plants before imposing treatments in the first field experiment (Table 2).

Table 2. Population of Coccinellids on okra, as influenced by Emamectin benzoate 5 WG (II Season : December 2012 to March 2013)

Treatment*	Dose Product g/ml/ha	Pre-count Nos./10 plants	Population of Coccinellids (Nos./10 plants) (Days after treatment)						Mean
			1st spray		2nd spray		3rd spray		
			5	10	5	10	5	10	
T1 - Emamectin Benzoate 5 WG	100	14.67	12.00 (3.46)^{b}	13.67 (3.70)^{b}	11.33 (3.37)^{b}	15.33 (3.92)^{b}	12.33 (3.51)^{b}	14.33 (3.79)^{b}	13.17 (3.63)^{b}
T2 - Emamectin Benzoate 5 WG	125	15.00	11.33 (3.37)^{bc}	13.00 (3.60)^{bc}	10.67 (3.27)^{bc}	15.00 (3.87)^{b}	12.00 (3.46)^{b}	14.00 (10.74)^{bc}	12.67 (3.56)^{bc}
T3 - Emamectin Benzoate 5 WG	150	14.67	10.67 (3.27)^{cd}	12.33 (3.51)^{c}	10.00 (3.16)^{cd}	14.67 (3.83)^{b}	11.67 (3.42)^{bc}	13.33 (3.65)^{cd}	12.11 (3.48)^{c}
T4 - Emamectin Benzoate 5 SG	135	15.00	10.00 (3.16)^{de}	11.00 (3.32)^{d}	9.33 (3.05)^{d}	13.67 (3.70)^{c}	11.00 (3.32)^{cd}	12.67 (3.56)^{de}	11.28 (3.36)^{d}
T5 - Emamectin Benzoate 5 SG	170	14.00	9.33 (3.05)^{e}	10.67 (3.27)^{d}	8.33 (2.89)^{e}	13.00 (3.61)^{c}	10.33 (3.21)^{d}	12.33 (3.51)^{e}	10.67 (3.27)^{e}
T6 - Lambda cyhalothrin 5 CS	300	14.33	7.00 (2.64)^{f}	8.00 (2.83)^{e}	5.00 (2.23)^{g}	9.00 (3.00)^{d}	7.00 (2.64)^{e}	9.33 (3.05)^{f}	7.56 (2.78)^{f}
T7 - Pyridalyl 10 EC	500	13.67	7.67 (2.77)^{f}	8.67 (2.94)^{e}	5.67 (2.38)^{f}	9.67 (3.11)^{d}	7.67 (2.77)^{e}	9.67 (3.11)^{f}	8.17 (2.86)^{f}
T8 - Untreated check	--	13.00	14.33 (3.79)^{a}	15.67 (3.96)^{a}	18.00 (4.24)^{a}	19.67 (4.43)^{a}	21.00 (4.58)^{a}	23.00 (4.80)^{a}	18.61 (4.31)^{a}
SEd		--	0.0615	0.0579	0.0662	0.0534	0.0596	0.0544	0.0583
CD (0.05)		--	0.1319	0.1241	0.1410	0.1145	0.1277	0.1168	0.1250

* Mean of three replications; Three rounds of spraying at 10 days interval starting from 43 DAS, Figures in parentheses are square root transfomed values, In a column means followed by same letter(s) are not significantly different by DMRT (P= 0.05)

Table 3. Population of Coccinellids on okra, as influenced by Emamectin benzoate 5 WG (II Season : December 2012 to March 2013)

Treatment*	Dose Product g/ml/ha	Pre-count Nos./10 plants	Population of Coccinellids (Nos./10 plants) (Days after treatment)						Mean
			1st spray		2nd spray		3rd spray		
			5	10	5	10	5	10	
T1 - Emamectin Benzoate 5 WG	100	14.67	12.00 (3.46)^{b}	13.67 (3.70)^{b}	11.33 (3.37)^{b}	15.33 (3.92)^{b}	12.33 (3.51)^{b}	14.33 (3.79)^{b}	13.17 (3.63)^{b}
T2 - Emamectin Benzoate 5 WG	125	15.00	11.33 (3.37)^{bc}	13.00 (3.60)^{bc}	10.67 (3.27)^{bc}	15.00 (3.87)^{b}	12.00 (3.46)^{b}	14.00 (10.74)^{bc}	12.67 (3.56)^{bc}
T3 - Emamectin Benzoate 5 WG	150	14.67	10.67 (3.27)^{cd}	12.33 (3.51)^{c}	10.00 (3.16)^{cd}	14.67 (3.83)^{b}	11.67 (3.42)^{bc}	13.33 (3.65)^{cd}	12.11 (3.48)^{c}
T4 - Emamectin Benzoate 5 SG	135	15.00	10.00 (3.16)^{de}	11.00 (3.32)^{d}	9.33 (3.05)^{d}	13.67 (3.70)^{c}	11.00 (3.32)^{cd}	12.67 (3.56)^{de}	11.28 (3.36)^{d}
T5 - Emamectin Benzoate 5 SG	170	14.00	9.33 (3.05)^{e}	10.67 (3.27)^{d}	8.33 (2.89)^{e}	13.00 (3.61)^{c}	10.33 (3.21)^{d}	12.33 (3.51)^{e}	10.67 (3.27)^{e}
T6 - Lambda cyhalothrin 5 CS	300	14.33	7.00 (2.64)^{f}	8.00 (2.83)^{e}	5.00 (2.23)^{g}	9.00 (3.00)^{d}	7.00 (2.64)^{e}	9.33 (3.05)^{f}	7.56 (2.78)^{f}
T7 - Pyridalyl 10 EC	500	13.67	7.67 (2.77)^{f}	8.67 (2.94)^{e}	5.67 (2.38)^{f}	9.67 (3.11)^{d}	7.67 (2.77)^{e}	9.67 (3.11)^{f}	8.17 (2.86)^{f}
T8 - Untreated check	--	13.00	14.33 (3.79)^{a}	15.67 (3.96)^{a}	18.00 (4.24)^{a}	19.67 (4.43)^{a}	21.00 (4.58)^{a}	23.00 (4.80)^{a}	18.61 (4.31)^{a}
SEd		--	0.0615	0.0579	0.0662	0.0534	0.0596	0.0544	0.0583
CD (0.05)		--	0.1319	0.1241	0.1410	0.1145	0.1277	0.1168	0.1250

Mean number of coccinellid predators was high in okra sprayed with Emamectin benzoate 5 WG @ 100 g/ha, resulting 14.45 nos./10 plants which was on a par with Emamectin benzoate 5 WG @ 125 g/ha (13.95 nos./10 plants) and 150 g/ha (13.44 nos./10 plants). Emamectin benzoate 5 SG @ 135 and 170 g/ha were equally safe to coccinellids, recording 12.61 and 11.94 nos./10 plants, respectively. Lambda cyhalothrin 5 CS @ 300 ml/ha and Pyridalyl 10 EC @ 500 ml/ha were moderately toxic to coccinellids, recording the lowest mean population of 9.00 and 9.61 nos./10 plants, as against 18.73 nos./10 plants in control.

After the first round of spray, Emamectin5 WG @ 100 g/ha, resulting 13.67 and 15.33 nos./10 plants on 5th and 10th day respectively, which was on a par with Emamectin benzoate 5 WG @ 125 g/ha (13.00 and 14.67 nos./10 plants on 5th and 10th day) and 150 g/ha (12.33 and 14.00nos./10 plants on 5th and 10th day). Emamectin benzoate 5 SG @ 135 and 170 g/ha were equally safe to coccinellids, recording 11.67 and 12.67 and 11.00 and 12.33 nos./10 plants on 5th and 10th day, respectively. Lambda cyhalothrin 5 CS @ 300 ml/ha and Pyridalyl 10 EC @ 500 ml/ha were moderately toxic to coccinellids, recording the lowest mean population of 8.67 and 9.67 and 9.33and 10.33 nos./10 plants on 5th and 10th day, as against 15.67 and 16.67 nos./10 plants on 5th and 10th day respectively, in control. The same trend was noticed in the second and third round also.

In the second field experiment, the pretreatment population of coccinellid (number of coccinellids/plant) ranged from 13.00 to 15.00 nos. per 10 plants (Table 3). Mean number of coccinellid predators was high in okra sprayed with Emamectin benzoate 5 WG @ 100 g/ha, resulting 13.17 nos./10 plants which was on a par with Emamectin benzoate 5 WG @ 125 (12.67 nos./10 plants) and 150 g/ha (12.11 nos./10 plants). Emamectin benzoate 5 SG @ 135 and 170 g/ha were equally safe to coccinellids, recording 11.28 and 10.67 nos./10 plants, respectively. Lambda cyhalothrin 5 CS @ 300 ml/ha and Pyridalyl 10 EC @ 500 ml/ha was moderately toxic to coccinellids, recording the lowest mean population of 7.56 and 8.17 nos./10 plants, as against 18.61 nos./10 plants in control.

The similar trend was noticed in the first, second and third round also.

Field evaluation of Emamectin benzoate 5 WG for toxicity against coccinellid predators in okra eco-system showed that there was a considerable decrease in coccinellid predators population initially in all the treatments. Later it started increasing, but it was less than the population recorded in untreated check. Emamectin benzoate 5 WG and Emamectin benzoate 5 SG treatments were safer to coccinellid predators when compared with Lambda cyhalothrin 5 CS and Pyridalyl 10 EC. This result was supported by Acharya *et al.* (2002) and Udikeri *et al.* (2004) who reported that Avermectins were generally safe to coccinellids. Standard check, Lambda cyhalothrin 5 CS and Pyridalyl 10 EC @ 15 (300 ml/ha) and 50 (500 ml/ha) g ai/ha, respectively, used in the present study were moderately toxic to coccinellids as indicated by Sharma *et al.* (1991) in cypermethrin, dimethoate, methyl dematon and fenvalerate which were toxic to *Menochilus sexmaculatus*. Avermectins were safe to non-target organisms *viz.*, *Dolycoris bauarum* (L.), *Pentatoma rufipes* (L.), *Adalia bipunctata* (L.) and *Coccinella septempunctata* (L.) (Jyoti and Goudbasavana, 2008, Yogesh Patel *et al.*, 2009 and Govindan *et al.*, 2012). The populations of lacewings and coccinellids were not significantly different between insecticide treated (emamectin benzoate, indoxacarb, and spinosad) and untreated plots (Anwar Ruly, 2008).

CONCLUSION

The present study concludes that three rounds of application of Emamectin benzoate 5 WG and Emamectin benzoate 5 SG were recorded more or less equal population of coccinellid predators in all treatments and were safer when compared with Lambda cyhalothrin 5 CS and Pyridalyl 10 EC.

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