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Safety of newer biological insecticide spinetoram 12 SC to natural enemies in the pigeonpea ecosystem of Tamil Nadu

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ABSTRACT

A field experiment was conducted at farmers' field in Dindigul district, Tamil Nadu, India during the year August 2012-April 2013 to study the effect of new biological insecticide spinetoram 12 SC to natural enemies of pigeonpea pests. Three foliar applications were carried out at an interval of fifteen days after pod borer larvae reached economic threshold level. The result showed that the overall mean population of coccinellids was found to be more in the untreated check followed by spinetoram 12 SC 27 g a.i/ha in the first, second and third foliar application. The overall mean population of coccinellids was high in the untreated check, followed by spinetoram 12 SC 27 g a.i/ha over the other treatments.

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INTRODUCTION

India accounts for 90 per cent of the world production and pulses are consumed by a large population as a protein rich staple food. The country annually imports 3-4 lakh tonnes of pigeonpea to meet the domestic demand. Pigeonpea (*Cajanus cajan* L.) is an important pulse or grain legume crop in semi-arid tropical and subtropical areas of the world. India is the largest producer and consumer of pigeonpea in the world, india is producing 183.4 lakh tonnes of pulses from an area of 96.26 lakh hectares. Pigeonpea is grown in 85.22 lakh hectares with an annual production of 88.33 lakh tonnes with an average productivity of 1036.00 kg/ha. In Tamil Nadu, it is cultivated in an area of 0.071 lakh hectares with 0.045 lakh tonnes of production and with a productivity of 645 kg/ha during 2012-13 (Anonymous, 2013). Major constraint in the production of pigeonpea is the damage caused by insect pests with avoidable losses extending up to 78 per cent. The pigeonpea attack of number of insect pests *viz*., *Helicoverpa armigera (Hubner), Maruca vitrata (Geyer), Lampides boeticus (Linnaeus), Exelastis atomosa (Walshinghan), Melanagromyza obtusa (Malloch)* and *S. litura* in Tamil Nadu responsible for considerable yield loss. The natural enemies, predators and parasitoids will imparts

the effect over the population of grapevine pests under favourable environmental conditions. The new biological insecticide spinetoram 12 SC was not evaluated against the major pests of pigeonpea and their performance was not studied on the natural enemies of the pigeonpea pod borers. Therefore, this study was undertaken with the objectives to investigate field toxicity of spinetoram 12 SC and other insecticides against coccinellids on pigeonpea during 2012-13 *Kharif* season.

MATERIAL AND METHODS

A field experiment was conducted at farmer's field at Jadhi Goundanpatti, Attur Block, Dindigul district, Tamil Nadu, India during September to March months of 2012-13 and 2013-14 in a Randomized Block Design with a plot size of 5 x 5m. Pigeonpea (var. CO1) was raised as per recommended package of practices except insect pest management practices. Effect of seven insecticidal treatments comprising spinetoram 12 SC @ 45, 36 and 27 g a.i. ha^{-1} along with emamectin benzoate 5 SG @ 11 g a.i. ha^{-1}, spinosad 45 SC @ 78 g a.i. ha^{-1} and monocrotophos 36 SL @ 500 g a.i. ha^{-1} was determined and each treatment was replicated thrice. Three sprays of each insecticide were applied with the help of knapsack hand sprayer up to the point of runoff at fortnightly intervals starting from 50 per cent flower initiation. Observations on the grubs and adults of coccinellids on number basis per plot from ten randomly selected plants were recorded at one day before and on 1, 3, 7 and 10 DAT after each spray. The experiment data obtained was subjected to analysis of variance (ANOVA) after square root transformation of data as per the procedure suggested by Gomez and Gomez (1984) and original values are given in Table 1. The observations on phytotoxicity symptoms (leaf injury, wilting, vein clearing, necrosis, epinasty and hyponasty) were recorded on 7 DAT after each spray by using visual scoring system.

RESULTS AND DISCUSSION

Population of grubs and adults of coccinellids on insecticide treated and control plots are given in the Table 1. The initial population of coccinellids ranged from 4.0 to 4.4 per plant before imposing the first spray. However, coccinellid population was 4.4, 4.4, 4.6 and 4.7 per plant at 1, 3, 7 and 10 DAT, respectively after first spray; 4.8, 5.0, 5.0 and 5.1 per plant at 1, 3, 7 and 10 DAT, respectively after second spray; and 5.1, 5.2, 5.4 and 5.6 per plant at 1, 3, 7 and 10 DAT, respectively after third spray in the untreated plot. There was negligible reduction on coccinellid population due to spinetoram 12 SC 27 g a.i./ha (3.8 to 4.6/plant; 4.4 to 4.7/plant and 4.3 to 4.6/plant from 1 to 10 DAT after first, second and third sprays, respectively). This was followed by spinetoram 12 SC 36 g a.i./ha, which resulted in coccinellid population of 3.8 to 4.2 per plant, 3.9 to 4.7 per plant and 4.0 to 4.6 per plant from 1 to 10 DAT after first, second and third sprays, respectively. Spinetoram 12 SC 45 g a.i./ha (3.7 to 4.3/plant; 4.0 to 4.5/plant and 4.0 to 4.4/plant from 1 to 10 DAT after first, second and third sprays, respectively) resulted in higher population of coccinellids followed by spinosad 45 SC 78 g a.i./ha (3.6 to 4.0/plant; 3.6 to 3.9/plant and 3.4 to 4.2/plant from 1 to 10 DAT after first, second and third sprays,

Table 1 : Effect of spinetoram 12 SC against predatory coccinellids on pigeonpea – (Sep 2012 – Mar 2013)

Treatments and doses	Number of grubs and adult/plant on days after treatment													Mean
	Pre count	1st spray				2nd spray				3rd spray				
		1	3	7	10	1	3	7	10	1	3	7	10	
Spinetoram 12 SC 27 g a.i./ha	4.3	3.9^{bc}	3.8^{b}	4.0^{b}	4.6^{a}	4.5^{b}	4.4^{b}	4.4^{b}	4.7^{b}	4.6^{b}	4.5^{b}	4.4^{b}	4.3^{c}	4.3^{b}
Spinetoram 12 SC 36 g a.i./ha	4.4	4.2^{b}	3.8^{b}	3.9^{b}	4.2^{b}	3.9^{d}	4.2^{c}	4.2^{c}	4.7^{b}	4.4^{c}	4.3^{b}	4.0^{d}	4.6^{b}	4.2^{bc}
Spinetoram 12 SC 45 g a.i./ha	4.2	4.0^{bc}	3.8^{b}	3.7^{c}	4.3^{b}	4.2^{c}	4.0^{d}	4.0^{d}	4.5^{b}	4.4^{c}	4.3^{b}	4.2^{c}	4.0^{d}	4.1^{c}
Emamectin benzoate 5 SG 11 g a.i./ha	4.1	3.7^{bc}	3.5^{b}	3.4^{d}	3.7^{d}	3.6^{e}	3.5^{f}	3.3^{f}	3.6^{d}	3.5^{e}	3.4^{cd}	3.3^{f}	3.1^{f}	3.5^{e}
Spinosad 45 SC 78 g a.i./ha	4.0	3.9^{bc}	3.8^{b}	3.6^{c}	4.0^{c}	3.9^{d}	3.8^{e}	3.6^{e}	3.9^{c}	4.2^{d}	3.5^{c}	3.5^{e}	3.4^{e}	3.8^{d}
Monocrotophos 36 SL 500 g a.i./ha	4.1	3.6^{c}	3.4^{b}	3.3^{d}	3.6^{d}	3.5^{e}	3.4^{f}	3.2^{f}	3.5^{d}	3.4^{e}	3.3^{d}	3.2^{f}	3.4^{e}	3.4^{e}
Untreated check	4.2	4.4^{a}	4.4^{a}	4.6^{a}	4.7^{a}	4.8^{a}	5.0^{a}	5.0^{a}	5.1^{a}	5.1^{a}	5.2^{a}	5.4^{a}	5.6^{a}	4.9^{a}
C.D. (P=0.05)	-	0.52	0.56	0.15	0.16	0.17	0.14	0.16	0.20	0.15	0.19	0.14	0.21	0.16
S.E.±	-	0.24	0.25	0.07	0.07	0.07	0.06	0.07	0.09	0.07	0.09	0.06	0.09	0.07

Data are mean values of three replications

Figures were transformed by square root transformation and the original values are given

Means within columns lacking common lower case superscript are significantly different (P<0.05)

respectively). Population of coccinellids was 3.4 to 3.7 per plant, 3.3 to 3.6 per plant and 3.1 to 3.5 per plant from 1 to 10 DAT after first, second and third sprays, respectively due to emamectin benzoate 5 SG at 11 g a.i./ha; and 3.3 to 3.6 per plant, 3.2 to 3.5 per plant and 3.2 to 3.4 per plant from 1 to 10 DAT after first, second and third sprays, respectively due to monocrotophos 36 SL at 500 g a.i./ha.

Mean population of *Menochilus sexmaculatus* F. after three sprays revealed that coccinellid population was maximum in untreated check (4.9/plant). Coccinellid population was also higher in spinetoram 12 SC 27 g a.i./ha (4.3/plant), spinetoram 12 SC 36 g a.i./ha (4.2./plant) and spinetoram 12 SC 45 g a.i./ha (4.1/plant) treated plots. Spinosad 45 SC 78 g a.i./ha, emamectin benzoate 5 SG at 11 g a.i./ha and monocrotophos 36 SL at 500 g a.i./ha resulted in coccinellid population of 3.8 per plant, 3.5 per plant and 3.4 per plant, respectively. The present results are in corroboration with the findings of Kim *et al*. (2006) studies have shown that topically applied spinosad had no significant acute toxicity to *D. brevis* nymphs and adults. However, for instance, topical and/or residual exposure to spinosad had low toxicity or was harmless to anthocorid and coccinellid predators (Tillman and Mulrooney, 2000). Nawrocka (2008) reported that Spinosad and azadirachtin applied at recommended dosage for cabbage protection against cabbage aphid in field conditions did not show any harmful effect on syrphid larvae, coccinellid adults and larvae, chrysopid eggs as well as on aphid parasite - *Diaeretiella rapae*. Spinosad and azadirachtin showed no harmful effect on predators. Dhanalakshmi and Mallapur (2008) reported that spinosad @ 0.1ml lr^{-1} spared good number of coccinellid grubs and spiders.

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