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Original Research Article

Efficacy of Selected Biopesticides against *Maruca vitrata* (Geyer) in Pigeonpea under Natural Condition

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Keywords

Biopesticides, *Maru cavitrata*, Pigeonpea

A B S T R A C T

The investigation of Efficacy of selected bio-pesticides against Pigeonpea (*Cajanus cajan* L.) pod borer complex under field conditions was conducted at International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) Hyderabad, during 2016-17 and 2017-18. These studies revealed Spinosad 45%SC treatment as the most effective against *Maru cavitrata.* Lower larval population of *Maru cavitrata* was observed when crop was treated with consortium of biopesticides which were statistically at par with neem fruit powder. In case of farmers field the treatments with Spinosad and consortium were found most effective and were statistically on par with each other in *M. vitrata*. The study concluded that neem seed powder highly recommends to the farmer for management of *Maru cavitrata* after the chemical insecticide Spinosad.

Introduction

Pigeonpea, (*Cajanus cajan* L.) is an important grain legume and occupies 2nd largest area among the various pulse crops grown in India. It is a staple diet and consumed as green peas as well as dry seeds (Tabo *et al.*, 1995). It is the preferred pulse crop in dryland areas where it is intercropped or grown in mixed cropping systems with cereals or other short duration annuals (Joshi *et al.*, 2001). In India, during 2015-16 pigeonpea was cultivated in an area about 3.80 million hectare with a production of 2.46 million tonnes and 656 kg/ha with an average productivity (FAOSTAT 2015-16). In the country, the crop is extensively grown in Uttar Pradesh, Madhya Pradesh, Maharashtra, Karnataka, Andhra Pradesh, Telangana and Gujarat. Uttar Pradesh has a unique distinction of contributing about 20% production in the country followed by Madhya Pradesh. Spotted pod borer, *Marucavitrata* is a very serious pest of pigeonpea and is a major constraints of yield loss in pigeonpea. However, to manage these endemic pests there are certain eco-friendly pests management practices have been implemented. Biopesticides are major components of integrated pest management and a potential alternative to their chemical pesticides. The biopesticide market is growing very rapidly. Bio-pesticides can be considered as the best possible substitutes of the chemically originated pesticides because they are highly efficient, target-specific, and also, they do not tend to impose any annihilating or deteriorating impact on the environment. A microbial pesticide compatible with commonly used biopesticides pesticide can be used simultaneously or sequentially with it. To harness the benefits of entomopathogenic fungi their compatibility other biopesticides become decisive for combined use, while the potential inhibitory effects of insecticides on the entomopathogenic fungi cannot be ignored. The use of incompatible insecticides may inhibit the development and reproduction of these pathogens affecting IPM. Microbial pathogens are considered for eco-friendly management strategy of the pests. Hence, a field trial consisting of different bio-pesticides such as *Beauveriabassiana*, *Metarrhizium anisopliae Paecilomyces fumosoreseus*, *Verticillium lecanii* and *Bacillus thuringiensis* var. *kurstaki* microbial products was conducted to evaluate the efficacy against the gram pod borer in pigeonpea. For the management of pod borer bio-pesticides were tested along with control. Among the bio-pesticides, *Beauveria bassiana*@ 1 liter / ha ($1x10^{12}$ spores/ml) was found to be most effective biopesticide as it recorded lowest larval population. (Pandey and Das 2016).

Materials and Methods

The field trial was carried out in the experimental field of department of Entomology at International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) Hyderabad, during 2016-2017 and 2017-2018. The trial was laid out in randomized block design with three replications. Pigeon pea variety ICPL-161 was sown at 120 cm spacing (row to row) having plot size of 20x20m.The trial comprised eight treatments namely, *Streptomyces* sp ($5.85x10^7$ colonies/ ml), HaNPV500LE/ha, *Metarhizium anisopliae* (39.2x104 spores/ml), Neem fruit powder (15-20kg/ha), Consortia (*Streptomyces* sp. (SAI-25) + HaNPV+ *Metarhizium anisopliae* + Neem fruit powder) @ ($5.85x10^7$ colonies/ml + 500LE/ha+$39.2x10^4$ spores/ml+15- 20kg/ha), Farmers practice (mostly chemical) Spinosad 45% SC and untreated control. Three sprays per treatment were given at 50% flowering stage and pod formation stage. Observations on larval population of *Marucavitrara* were recorded on seven plants per plot at 24 hours before spraying (pre treatment) and 3,7 and 10 days after each spray. At harvest, total number of healthy and borer damaged pods and grain were counted and expressed as per cent damage. The data were the subjected to square root and arcsine transformation values before statistical analysis.

Statistical analysis

The data was analysed by using computerized statistical software by using Gen-Stat 14th edition software, SPSS 15.0 windows@ and Microsoft Excel.

Results and Discussion

Efficacy of various biopesticides against spotted pod borer, *M. vitrata* infesting pigeonpea during 2016-17

Pre-treatment observation differences in the *M. vitrata* mean larval population per plant among different treatments were not significant, indicating more or less uniform distribution of the pest in the experimental field. Data presented in table 1 shows that at 3rd DAFS significantly lowest larval population was recorded in Spinosad 45 SC (0.14 larvae/7 plants) this was followed by consortium (0.24 larvae/7 plants) and neem fruit powder with (0.43 larvae/7 plants).

Maximum larval population was recorded in Streptomyces sp., HaNPV and *Metarhizium anisopliae* in compare with control (0.43 larvae / 7 plants)(Table 1). Similarly, earlier finding with Anitha and Parimala (2014) reported that Spinosad 45% SC as effective control with least pod damage (5.1%) and low seed damage (4.3 -4.5%) caused by *M. vitrata* in comparison with Chlorpyriphos 20EC.

Bhat *et al.*, (1988) reported neem seed extract as the next best treatment to monocrotophos against the pod borers *M. vitrata.* At 7th DAFS the larval population, were significantly low in plots treated with Spinosad 45 SC (0.00 larvae/7 plants) followed by consortium (0.47 larvae/7 plants) and *Streptomyces* sp. (0.42 larvae/7 plants). Compared to higher larval population (0.66 larvae/7plant) in untreated control and it was significantly different from all the other treatments (Table 1).

Significant difference was observed among treatment at 10th DAFS, the lowest larval population recorded in Spinosad 45 SC (0.05 larvae/7 plants) followed by *M. anisopliae*(0.19 larvae/7 plants) and HaNPV (0.29 larvae/7 plants). However, the neem fruit powder (0.67 larvae/7 plants) and *Streptomyces* sp. (0.76 larvae/7 plants) were on at par with each other.

Maximum larval population was recorded in control (0.57 larvae/7 plants) (Table 1). In second and third spray larval population was zero or decline. Ameta *et al.*, (2011) reported that Spinosad 45 SC @ 187.5 ml/ha were effective against spotted pod borer *M. vitrata* (L.) in pigeonpea. Srinivasan (2008) studied the Spinosad against spotted pod borer, *M. vitrata* showed lesser larval incidence compared to other treatments.

Efficacy of various biopesticides against spotted pod borer, *M. Vitrata* infesting pigeonpea during 2017-18

The pre-treatment observation differences in the *M. vitrata* mean larval population per plant among different treatments were not significant, indicating more or less uniform distribution of the pest in the experimental field. The significant difference was noticed by 3rdDAFS, the lowest population of *M.vitrata* larvae recorded in treatment neem fruit powder (0.95 larvae/7 plants) followed by treatment *M. anisopliae*(1.00 larvae/7 plants) and HaNPV (1.14 larvae/7 plants).While the maximum population was recorded in *Streptomyces sp.* (1.57 larvae/7 plants)in comparison with control (2.14 larvae/7 plants) (Table 2). Sunitha *et al.*, (2008b) found that Spinosad 48 SC (0.3 ml/l) caused more than 50 percent mortality of *M. vitrata* larvae. Studies of Pillai *et al.*, (2013) on various treatments against *M. vitrata* in pigeonpea. Revealed that larval reduction in *M. vitrata* was the least in NSKE 5 percent (5.3 larvae/25 shoots) followed by jatropha oil 1 percent (5.8 larvae/25 shoots) after two rounds of application. Sahoo and Senapathi (2000) reported that NSKE 5% significantly reduced the pod borer larvae of pigeonpea per plant (1.95) at 3 days after treatment. Das Mohapatra and Srivastava (2002) also indicated a significant reduction of larvae of *M. vitrata*on pigeonpea when NSKE was sprayed @ 5% concentration. At 7th DAFS the larval populations were significantly lowest pest population was observed with Spinosad 45 SC (0.76 larvae/7 plants) followed by HaNPV (0.91 larvae/7 plants) and neem fruit powder (0.67 larvae/7 plants). However, the least significant difference was observed in *M. anisopliae*(1.10 larvae/7 plants). Highest larval population (1.62 larvae/7plants) was recorded in untreated control (Table 2). The present study similar with Jagdish *et al.*, (2014) the field experiment conducted to evaluate the relative efficacy of eight biopesticides against legume pod borer, *M. vitrata* infesting pigeonpea shows significant effect of bio-pesticides on percent webbing by *M. vitrata*, at First spray application showed minimum (32.00/25shoots) in NSKE 5.0 % @ 50 g/lit. At 10th DAFS significantly lowest larval population recorded in neem fruit powder (0.57 larvae/7 plants)this was followed by Spinosad 45 SC (0.62 larvae / 7 plants) and *Streptomyces* sp. (0.90 larvae/7 plants). However, maximum larval population was recorded in untreated control (1.52 larvae/7plant) (Table 2).

Ganapathy (1996) found that NSKE 5 percent and neem oil 3 percent recorded low larval number (1.0 and 1.3/plant), flower damage (7.7 and 10.4%) webbing (1.6 and 1.5/plant) and pod damage (6.6 and 7.8%) due to *M. vitrata*. However, at 3rdDASS, in larvae of *M. vitrata* it was showed that non-significant results obtained with a lowest population in Spinosad 45 SC (0.19 larvae /7 plants) followed by consortium (0.43 larvae/7 plants) and neem fruit powder (0.52 larvae/7 plants)which was statistically at par with *Streptomyces* sp. and *Metarhizium anisopliae* and maximum population recorded with HaNPV (0.66 larvae/7 plants) in comparison to control (0.69 larvae/7 plants) (Table 2). Girhepuje *et al.*, (1997) reported while comparing treatments, neem seed kernel extract (5%) as the least effective botanical against *M.vitrata* in pigeonpea.

At 7thDASS the differences in the mean larval population among different treatments not significant. All the biopesticides treatments significantly reduced the larval population as compared to control (0.10 larvae/7 plants). Among the treatments, Spinosad 45 SC was found to be most effective as it recorded zero larval population (0.00 larvae/7 plants) which was statistically at par with consortia and *Streptomyces* sp. Maximum population was recorded in control (0.10 larvae/ 7 plants) (Table 2).At 10th DASS not significant difference in larval population was recorded in neem fruit powder (0.00 larvae/7 plants) followed by *Streptomyces* sp., consortia and Spinosad with 0.00, 0.00 and 0.00, respectively, which was statistically at par with each other. The maximum larval population was recorded in untreated control (0.25 larvae/7plant)(Table 2).

The larval population was zero in third spray. Ramasubramanian and Sundarabahu (1991) reported that among the insecticides tested on beans spraying of NSKE 5% were effective in reducing the larval population of *M.vitrata*. Srinivasan and Philip (2008) reported that application of NSKE, spraying of HaNPV and need based spraying of insecticides registered reduced pod borer damage (31.5-35.67%).

Pooled efficacy of various biopesticides against spotted pod borer, *M. vitrata* in pigeonpea during 2016 and 2017

The pooled mean data of 2016 and 2017 on larval population of *M. vitrata* larvae pre- and post-treatments are presented in the Table 3.The pooled mean population of both the year was recorded prior to first spray initiation in field condition.

It showed non-significant population among the treatments. It was recorded minimal larval population in treatment with *M. anisopliae* (1.43 larvae/7 plants)and maximum was recorded in consortium (2.10 larvae/7 plants)in comparison to control (1.62 larvae/7 plants) (Table 3). Randhawa and Saini (2015) showed that Spinosad 48 SC @ 150 ml/ha was found to be most effective against *M.vitrata* and it was closely followed by indoxacarb 15 EC and cypermethrin 25 EC.

Table.1 Efficacy of various biopesticides against spotted pod borer, *M. vitrata* infesting pigeon pea during 2016-17

Treatments	Dose g a.i./ha or spores/ml	Mean number of larvae/7 plants											
		DBFS	3DAFS	7DAFS	10DAFS	DBSS	3DASS	7DASS	10DASS	DBTS	3DATS	7DATS	10DATS
*Streptomyces*sp	5.85x10^{7}colonies/ml	1.71 (1.46)	0.57 (1.03)	0.42 (0.96)	0.76 (1.10)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)
HaNPV	500LE/ha	1.62 (1.45)	0.57 (1.01)	0.47 (0.97)	0.29 (0.87)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)
Metarhizium anisopliae	39.2x10^{4}spores/ml	1.28 (1.30)	0.57 (1.01)	0.61 (1.03)	0.19 (0.82)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)
Neem fruit powder	15-20kg/ha	1.71 (1.45)	0.43 (0.95)	0.61 (0.98)	0.67 (1.07)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)
Consortia	(Sr. no 1 to 4)	1.38 (1.34)	0.24 (0.84)	0.47 (0.98)	0.48 (0.96)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)
Spinosad 45 SC	73 g a.i./ha	2.05 (1.59)	0.14 (0.80)	0.00 (0.71)	0.05 (0.74)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)
Control		1.00 (1.22)	0.43 (0.96)	0.66 (1.07)	0.57 (1.03)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)
SE±m		0.14	0.09	0.08	0.07	0	0	0	0	0	0	0	0
CD at 5%		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Figures in parentheses are square root transformed values, NS- Non significant
DBFS= day before first spray, DAFS= day after first spray, DBSS=day before second spray, DASS= days after second spray,DBTS= day before third spray, DATS= day after third spray.

Table.2 Efficacy of various biopesticides against spotted pod borer, *M. vitrata* infesting pigeon pea during 2017-18

Treatments	**Dose g a.i./ha or spores/ml**	**Mean number of larvae/7 plants**											
		DBFS	**3DAFS**	**7DAFS**	**10DAFS**	**DBSS**	**3DASS**	**7DASS**	**10DASS**	**DBTS**	**3DATS**	**7DATS**	**10DATS**
Streptomyces sp.	5.85x10^{7}colonies/ml	2.00 (1.57)	1.57 (1.44)^{ab}	1.14 (1.28)	0.90 (1.18)^{ab}	0.71 (1.10)	0.62 (1.05)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)
HaNPV	500LE/ha	2.33 (1.67)	1.14 (1.28)^{a}	0.91 (1.17)	0.95 (1.19)^{ab}	0.43 (0.94)	0.66 (1.08)	0.05 (0.74)	0.09 (0.77)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)
Metarhizium anisopliae	39.2x10^{4}spores/ml	1.57 (1.44)	1.00 (1.22)^{a}	1.10 (1.25)	0.95 (1.19)^{ab}	0.52 (0.99)	0.62 (1.05)	0.14 (0.80)	0.05 (0.74)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)
Neem fruit powder	15-20kg/ha	1.95 (1.56)	0.95 (1.20)^{a}	0.95 (1.19)	0.57 (1.01)^{a}	0.57 (1.02)	0.52 (1.00)	0.10 (0.77)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)
Consortium	(Sr. no 1 to 4)	2.81 (1.82)	1.48 (1.40)^{ab}	1.43 (1.38)	1.00 (1.22)^{ab}	0.67 (1.07)	0.43 (0.96)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)
Spinosad 45 SC	73 g a.i./ha	1.81 (1.51)	1.19 (1.29)^{a}	0.76 (1.12)	0.62 (1.04)^{ab}	0.38 (0.90)	0.19 (0.83)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)
Control	-	2.24 (1.61)	2.14 (1.62)^{b}	1.62 (1.69)	1.52 (1.42)^{b}	1.24 (1.32)	0.69 (1.04)	0.10 (0.77)	0.25 (0.87)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)
SE±m		0.42	0.09	0.27	0.21	0.25	0.11	0.06	0.04	0	0	0	0
CD at 5%		NS	0.28	NS	0.64	NS	NS	NS	NS	NS	NS	NS	NS

Figures in parentheses are square root transformed values, NS- Non significant
The values denoted by a common letter are showing significant difference from each other as per DMRT.
DBFS= day before first spray, DAFS= day after first spray, DBSS=day before second spray, DASS= days after second spray, DBTS= day before third spray, DATS= day after third spray.

Table.3 Pooled efficacy of various biopesticides against spotted pod borer, *M. vitrata* in pigeon pea during 2016 and 2017.

Treatments	Dose g a.i./ha or spores/ ml	Pooled Mean number of larvae/7 plants									
			First spray			Second spray			Third spray		
		DBFS	3DAS	7DAS	10DAS	3DAS	7DAS	10DAS	3DAS	7DAS	10DAS
Streptomyces sp.	5.85x10^7colonies/ml	1.86 (1.52)	1.07 (1.24)	0.78 $(1.12)^{ab}$	0.83 $(1.14)^{ab}$	0.31 (0.88)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)
HaNPV	500LE/ha	1.98 (1.56)	0.85 (1.15)	0.69 $(1.07)^{ab}$	0.62 $(1.03)^{ab}$	0.33 (0.90)	0.03 (0.73)	0.05 (0.74)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)
Metarhizium anisopliae	39.2x10^4spores/ml	1.43 (1.37)	0.79 (1.12)	0.86 $(1.14)^{ab}$	0.57 $(1.01)^{ab}$	0.31 (0.88)	0.07 (0.76)	0.03 (0.73)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)
Neem fruit powder	15-20kg/ha	1.83 (1.51)	0.69 (1.08)	0.78 $(1.09)^{ab}$	0.62 $(1.04)^{ab}$	0.26 (0.86)	0.05 (0.74)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)
Consortium	(Sr. no 1 to 4)	2.10 (1.58)	0.86 (1.12)	0.95 $(1.18)^{ab}$	0.74 $(1.09)^{ab}$	0.22 (0.84)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)
Spinosad 45SC	73 g a.i./ha	1.93 (1.55)	0.67 (1.05)	0.38 $(0.92)^{a}$	0.34 $(0.89)^{a}$	0.10 (0.77)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)
Control	-	1.62 (1.42)	1.29 (1.29)	1.14 $(1.38)^{b}$	1.05 $(1.23)^{b}$	0.35 (0.88)	0.05 (0.74)	0.13 (0.79)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)
SE±m		0.09	0.06	0.08	0.05	0.04	0.02	0.02	0	0	0
CD at 5%		NS	NS	0.26	0.16	NS	NS	NS	NS	NS	NS

Figures in parentheses are square root transformed values, NS- Non significant

The values denoted by a common letter are showing significant difference from each other as per DMRT.

DBFS= day before first spray, DAS= days after spray

Present finding are in agreement with Ankali (2002) where insecticides and biopesticides against *M. vitrata*, and reported that *M. anisopliae* was most promising against *M. vitrata*, among biopesticides. 3rd DAFS pooled mean larval population of *M.vitrata* showed no significant differences among treatments.

It was recorded lowest larval population in Spinosad 45 SC (0.67 larvae/7 plants) and highest was recorded in *Streptomyces sp.* (0.00 larvae/7 plants) in comparison to control (1.29 larvae/7 plants)(Table 3).At 7th DAFS, the pooled two years data showed a gradual decline in the population *M. vitrata* larvae in filed condition, it showed that the Spinosad 45 SC evidenced to be a potent are with minimum larval population of (0.38 larvae/7 plants)followed by HaNPV (0.69 larvae/7 plants)and maximum population recorded in consortium (0.95 larvae/7 plants) in comparison to control (1.14 larvae/7 plants) (Table 3). Highly significant difference among treatments was noticed by 10th DAFS, the pooled mean of the lowest population recorded in Spinosad 45 SC (0.34 larvae/7 plants) followed by *M. anisopliae* (0.57 larvae/7 plants) and while the highest population was recorded with *Streptomyces* sp.(0.00 larvae/7 plants) in comparison to control (1.05 larvae/7 plants). (Table 3).Pooled results of two years on second spray, at 3rdDASS revealed that the lowest (0.10 larvae/7 plants) larval population when crop was treated with Spinosad 45 SC followed by consortium (0.22 larvae/7 plants) while the maximum population was observed in HaNPV (0.33 larvae/7 plants) in comparison to control (0.35 larvae/7 plants). (Table 3) Ranga Rao *et al.*, (2007) concluded that the greatest reduction in larval population of *M. vitrata* (82.0%) was obtained with Spinosad within 2 days after application and at 5 days after application. At 7th DASS, the pooled two years data it revealed a similar trend of gradual decline in the population of *M. vitrata* larvae in field condition, it showed that the lowest population in Spinosad 45 SC (0.00 larvae/7 plants) followed by *Streptomyces* sp. (0.00 larvae / 7 plants) and consortium (0.00 larvae/7 plants) which was statistically at par with each other. The maximum population was recorded in control (0.05 larvae / 7 plants) (Table 3). At 10th DASS, the pooled mean of both the years, showed no significant difference in population of larvae among the treatments. It was ascertained that, the lowest population in Spinosad 45 SC (0.00 larvae/7 plants) followed by *Streptomyces* sp., Neem fruit powder and consortium with 0.00, 0.00 and 0.00 respectively which was statistically at par with each other. While highest observed in HaNPV (0.05 larvae/7 plants) in comparison to control (0.13 larvae/7 plants) (Table 3). Among the all biopesticides neem fruit powder was found most effective followed by consortium as against with standard check Spinosad 45 SC. During third spray the population was low and zero population in the field (Table 3). Jagdish *et al.*, (2013) reported that *M. vitrata* was found lowest in Spinosad 45%ww @73g.ai/ha (4.50%), followed by NSKE 5 % (4.81%) and *B. bassiana* DOR SC @ 1.5gm/lit (5.39%) as compared to control (14.49%). Rao *et al.*, (2007) reported reduction in larval population of *M. vitrata* by 82 and 72 percent with Spinosad 45 SC (0.4 ml/l) and indoxacarb 14.5 SC (1 ml/l), respectively. Above findings clearly attested the pest observation indicating Spinosad 45 SC as the most effective treatment against *M. vitrata*

Babu (2002) reported that 44.87 percent reduction of *M. vitrata* larvae when spinosad 45 SC @ 0.0144%. Mittal and Ujagir, (2005) spinosad (Tracer) 45% SC a.i./ha lower pest population of *M. vitrata* was recorded as compared to other standard insecticides and untreated control. Similar study with Yule and Shrinivasan (2013) the pod damage of *M. vitrata* pigeonpea crop showed no significant difference between other treatments viz. *B. bassiana*, neem111®, *M. anisopliae* and combination of six biopesticides in field condition. The finding of Sreekanth and Seshamahalakshmi (2012) pod damage due to *M. vitrata* was lowest in Spinosad (17.38%), followed by Bt-1 (27.57%) and *B. bassiana* SC formulation @ 300 mg / l (33.82%) as against control (45.84%) with 62.1,39.9 and 26.2 percent reduction over control respectively. Singh *et al.*, (2011) showed that two sprays of NSKE 5% was found to be the most effective in reducing the larval population in pigeonpea pod borer complex (0.20 larvae/plant). Present finding agree with Sreekanth and Seshamahalakshmi (2010) studies on the percent inflorescence damage due to *M. vitrata* was lowest in Spinosad 45% SC @ 73 g a.i/ha (4.7%), followed by *B. thuringiensis*-1 @ 1.5 kg/ha (10.5%) and *B. bassiana* SC formulation @ 300mg/lit (14.1%) with 80.9, 57.6 and 42.9 percent reduction over control respectively as against control (24.7%). Rao *et al.*, (2007) studied the efficacy of Spinosad 45 SC (0.4 ml/litre) and *Metarhizium* (1.0x 10^8 spores/g) effective against spotted pod borer, *M. vitrata* infesting pigeonpea (cv. ICPL-88034).

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