Legume Research, 39 (3) 2016 : 479-481
Print ISSN:0250-5371 / Online ISSN:0976-0571

AGRICULTURAL RESEARCH COMMUNICATION CENTRE
www.arccjournals.com/www.legumeresearch.in

Evaluation of biopesticides against gram pod borer *Helicoverpa armigera* (HUB.) on pigeonpea

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Recieved: 15-03-2015 Accepted: 10-12-2015 DOI:10.18805/lr.v0iOF.9484

ABSTRACT

A field experiment on evaluation of biopesticides against gram pod borer (*Helicoverpa armigera Hub.*) on pigeon pea was carried out during *kharif* season of 2012-13. The experiment was laid out in randomized block design with three replications. Gram pod borer is a major pest of pigeon pea in India. For the management of this pest seven biopesticides were tested along with control. Among the biopesticides, *Beauveria bassiana* @ 1 liter / ha ($1x10^{12}$ spores/ml) was found to be most effective biopesticide as it recorded lowest larval population (6.68 larvae / 5plants). The highest larval population was recorded in control (12.61 larvae /5 plants). The least effective treatment was *Paecilomyces fumosoreseus* (9.31 larvae /5 plants). Similar trend was observed in the grain yield as 1667.55 kg/ha, 709.41kg/ha and 1025.21kg/ha , respectively.

Key words: Biopesticides, Efficacy, *Helicoverpa armigera*.

INTRODUCTION

Pigeon pea is one of the important pulse crop of Madhya Pradesh. In the state it is extensively grown in Narsinghpur, Raisen Vidisha, Jabalpur,Gwalior, Bhind Morena, Sidhi Sahdole districts.It is attacked by various insect pests right from sowing to storage of the crop. Among the insect species infesting pigeon pea the pod borer complex is responsible to the yield loss upto 27.77 per cent (Sahoo and Senapati, 2000). The pod borer comlex comprises of *Helicoverpa armigera, Grapholitha critica, Maruca testulalis, Lampides boeticus, Exelastis atomosa and Melanagromyza obtusa*. Amongst them *Helicoverpa armigera* is a key pest inflicting 80-90% of loss caused by pod borers. It causes considerable yield loss of 250000 tonnes of grains/annum worth more than 3750 million rupees per year, (Banu *et al*. 2005). Various synthetic insecticides are used by the farmers for its control but due to undesirable effects on environment, alternate ecosafe biopesticides need to be developed. Microbial pathogens are considered for eco-friendly management strategy of the pests. Hence, a field trial consisting of seven microbial products was conducted to evaluate the efficacy against the gram pod borer in pigeon pea.

MATERIALS AND METHODS

The field trial was carried out at the experimental field of Department of Entomology, Live stock farm, Adhartal, J.N.K.V.V., Jabalpur (M.P.) during *Kharif* season 2012-13. The trial was laid out in randomized block design with three replications. Pigeon pea variety JA-4 was sown at 60 cm spacing (row to row) having plot size of 5mx4.2m. The recommended package of practices were followed except plant protection measures. The trial comprised eight treatments namely, *Beauveria bassiana*@1liter/ha ($1x10^{12}$ spores/ml), *Metarrhizium anisopliae* @1liter/ha ($1x10^{12}$ spores/ml), *Paecilomyces fumosoreseus* @1liter/ha($1x10^{12}$ spores/ml), *Verticillium lecanii* @1liter/ha($1x10^{12}$ spores/ml), *Bacillus thuringiensis* var. *kurstaki* (PDBC-BT-1) @1.5l/ha, neem soap@1kg/ha(10g/l), pongamia soap@ 1kg/ha (10g/l) and untreated control. Three sprays per treatment were given at pod formation stage. Observations on larval population of *H. armigera* were recorded on five 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 percent damage. The data were then subjected to square root and arcsine transformation values before statistical analysis. The seed yield of net plot was recorded separately and converted into per hectare. The results thus obtained are summarized in Table 1.

RESULTS AND DISCUSSION

Larval population: Data presented in Table 1 showed no significant differences in the *Helicoverpa armigera* larval population among different treatments recorded as pre-treatment observations, indicating more or less uniform distribution of the pest in the experimental field. Further, post treatment showed significant differences among various treatment after three days of spray . Among the treatments, *Beauveria bassiana* @ 1kg/ha ($1x10^{12}$ spores / ml) was found to be most effective, as it recorded the lowest larval population (7.87 larvae /5plants). This was followed by

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Table 1: Evaluation of biopesticides against gram pod borer, *Helicoverpa armigera* infesting pigeon pea

Treatment	Dose	Mean *H. armigera larval* population/ 5 plant				Over all mean	Damage (%) ***		Grain Yield (kg/ha)
		Pre-treatment	Days after spraying*				Pod	Grain	
			3	7	10				
Beauveria bassiana	1liter/ha	9.37 (3.06)**	7.87 (2.80)	6.30 (2.51)	5.87 (2.42)	6.68 (2.58)	13.64 (21.64)	6.71 (15.00)	1667.55
Metarrhizum anisopliae	1liter/ha	9.69 (3.11)	9.27 (3.04)	9.28 (3.05)	9.09 (3.02)	9.21 (3.03)	15.86 (23.42)	8.58 (16.95)	1272.74
Paecilomyces fumosoreseus	1liter/ha	9.76 (3.12)	9.31 (3.05)	9.25 (3.04)	9.37 (3.06)	9.31 (3.05)	17.18 (24.43)	9.28 (17.66)	1025.21
Verticillium lacanii	1liter/ha	9.45 (3.07)	8.17 (2.86)	7.90 (2.81)	7.87 (2.80)	7.98 (2.82)	13.51 (21.56)	7.03 (15.34)	1604.30
Bacillus thuringiensis var. kurstaki (PDBC-BT-1)	1.5liter/ha	9.50 (3.08)	8.26 (2.87)	8.16 (2.86)	8.22 (2.87)	8.21 (2.87)	14.76 (22.55)	7.55 (15.89)	1504.13
Neem Soap	1kg/ha	9.57 (3.09)	8.34 (2.89)	8.25 (2.87)	8.30 (2.88)	8.30 (2.88)	15.20 (22.95)	7.70 (16.11)	1486.55
Pongamia Soap	1kg/ha	9.61 (3.10)	9.14 (3.02)	8.32 (2.88)	8.31 (2.88)	8.59 (2.93)	15.24 (22.95)	8.09 (16.43)	1374.86
Control	-	9.79 (3.13)	10.84 (3.29)	15.77 (3.97)	11.21 (3.35)	12.61 (3.55)	20.70 (27.06)	14.65 (22.46)	709.41
SEm+	-	0.002	.002	.003	0.008	0.003	0.58	0.40	12.04
CD at 5%	-	NS	.007	.008	0.23	0.10	1.77	1.24	36.53

* Mean of three spraying NS-Non significant
** Figures are square root transformed values
(%) *** Figures are arcsine transformed values

Verticillium lecanii) @ 1kg/ha (1x10^{12} spores / ml) (8.17 larvae /5 plants) , *Bacillus thuringiensis* var.*kurstaki* (PDBC-BT-1) @1.5 l/ha (8.26 larvae / 5 plants), neem soap @1kg/ha (10g/l) (8.34 larvae/5 plants), pongamia soap@1kg/ha (10g/l) (9.14larvae/plants),*Metarrhizium anisopliae* @1kg/ ha(1x10^{12}spores/ml) (9.25 larvae/5plants) and *Paecilomyces fumosoresus* @ 1kg/ha (1x10^{12} spores/ml) (9.31 larvae/ 5 plants), but all of them differed significantly from each other. The highest larval population was recorded in control (10.84 larvae/5 plants).

At seven days after treatment, the differences in the mean larval population among different treatments were significant. All the biopesticide treatments significantly reduced the larval population as compared to control (15.77 larvae/5 plants). Among the treatments, *Beauveria bassiana* @ 1kg/ha(1x10^{12} spore /ml) was found to be the most effective as it recorded the lowest larval population (6.30 larvae/5 plants).This was followed by *Verticillium lecanii* @ 1kg/ha (1x10^{12} spores/ml) (7.9 larvae/ 5 plants) , PDBC-BT-1 @1.5 l/ha (8.16 larvae/5 plants), neem soap @ 1kg/ha(10g/l) (8.25 larvae/5 plants), pongamia soap @ 1kg/ha(10g/l) (8.32 larvae/plants), *Metarrhizium anisopliae* @1kg/ha(1x10^{12} spores/ml) (9.28 larvae/5plants) and *Paecilomyces fumosoresus* @ 1kg/ha (1x10^{12} spores/ml) (9.25 larvae/5 plants), but all of them differed significantly from each other. The highest larval population was recorded in control (15.77 larvae/5plants).

At ten days after treatment, the differences in the mean larval population among different treatments were significant. All the biorational treatments significantly reduced the larval population as compared to control (11.21 larvae/5plants). Among the treatments, *Beauveria bassiana* @ 1kg/ha (1x10^{12} spores/ml) was found to be the most effective as it recorded the lowest larval population (5.87 larvae / 5 plants). The next group of treatments were *Verticillium lecanii* @ 1kg/ha (1x10^{12} spores / ml) (7.87 larvae / 5 plants), PDBC-BT-1 @1.5l / ha (8.22 larvae / 5 plants), neem soap @1kg/ha(10 g /l) (8.30 larvae / 5 plants), pongamia soap @ 1kg/ha (10g/l) (8.31 larva/plants) and *Metarrhizium anisopliae* @ 1kg/ha (1x10^{12} spores/ml) (9.09 larvae / 5plants),with no significant differences among them. The least effective treatment was *Paecilomyces fumosoresus* @ 1kg /ha (1x10^{12} spores / ml) (9.37 larvae/5 plants) which was significantly superior to control. The highest larval population was recorded in control (11.21 larvae / 5 plants).

On the basis of overall mean, the differences in the mean overall larval population per 5 plants among different treatments were significant. All the biorational treatments significantly reduced the larval population as compared to control (12.61 larvae/5 plants). Among the treatments, *Beauveria bassiana* @ 1kg/ha (1x10^{12} spores /ml) was found to be the most effective as it recorded the lowest larval population (6.68 larvae/5 plants). The next group of treatments were *Verticillium lecanii* @ 1kg/ha (1x10^{12} spores / ml)

(7.98 larvae / 5 plants), PDBC-BT-1 @1.5l / ha (8.21 larvae / 5 plants), neem soap @ 1kg/ha(10g/l) (8.30 larvae /5 plants), but were all at par with each other. The next effective group of treatments were pongamia soap @ 1kg/ha (10g/l) (8.59 larvae/plants) and *Metarrhizium anisopliae* @ 1kg/ ha ($1x10^{12}$ spores / ml) (9.21 larvae/5 plants). The least effective treatment was *Paecilomyces fumosoresus* @ 1kg/ ha($1x10^{12}$ spores/ml) (9.31 larvae /5 plants), but was significantly superior to control. The highest larval population was recorded in control (12.61 larvae /5 plants). Hence, it is clear that all the treatments effectively reduced the larval population. These findings are in general agreement with those of Madan lal and Mishra (2003), Mohapatra and Shrivastava (2008) and Prasad *et al*.,(2010).

Pod and grain damage: The results indicated in the Table-1 showed that all the treatments significantly reduced the pod and grain damage by gram pod borer as compared to control i.e.20.70 and 14.65%, respectively. Among the treatments, *V. lecanii* @1kg/ha($1x10^{12}$ spores/ml) was found to be most effective as it recorded lowest pod damage (13.41%) followed by treatments *B. bassiana* @1kg/ha ($1x10^{12}$ spores/ml) (13.64%), Bt (PDBC-BT-1) @ 1.5l/ha (14.76%), neem soap @ 1kg/ha (10g/l) (15.2%) and pongamia soap @ 1kg/ha (10g/l) (15.24%) but they were all at par with each other. However, in case of grain damage *B. bassiana* @ 1kg/ha ($1x10^{12}$ spores/ml) was found to be most effective as it recorded lowest grain damage (6.71%) followed by *V. lecanii* @1kg/ha ($1x10^{12}$ spores/ml) (7.03%), Bt (PDBC-BT-1) @ 1.5l/ha (7.55%) and neem soap @ 1kg/h (10g/l) (7.70%) but they were all at par with each other. The least effective treatments were pongamia soap @ 1kg/ha (10g/l) (8.09%), *M. anisopliae* @ 1kg/ha ($1x10^{12}$ spores/ml) (8.58%) and *P.fumosoreseus* @ 1 kg/ha ($1x10^{12}$ spores/ml) (9.28%), however all the three treatments were at par with each other. The results obtained are in accordance with the findins of Reddy *et al*., (2001) and Prasad *et al*., (2010).

Grain yield: All the treatments registered significantly higher grain yields as compared to the control. The highest grain yield was recorded in *B. bassiana* @ 1kg/ha ($1x10^{12}$ spores / ml) treated plots (1667.55kg/ha) which was significantly superior to the rest of the treatments. This was followed by *Verticillium lecanii* @ 1kg/ha ($1x10^{12}$ spores/ml) (1604.3 kg/ha) and Bt (PDBC-BT-1) 1.5 l/ha (1504.13 kg/ha) but were at par with each other. The next effective treatments were neem soap @ 1kg/ha (10g/l) (1486.55 kg/ha) followed by pongamia soap @ 1kg/ha (10g/l) (1374.86 kg/ha), *M. anisopliae* @ 1kg/ha ($1x10^{12}$ spores / ml) (1272.74 kg/ha) and *P.fumosoreseus* @ 1kg/ha ($1x10^{12}$ spores / ml) (1025.21 kg/ha) and lowest yield was recorded in control plot (809.41 kg/ha) and they differed significantly from each other. The present findings are in conformity with the findings of Prabhakara and Srinivasa (1998), Khanpara *et al.*,(2012) and Sreekanth and Seshamahalakshmi(2012).

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