

Efficacy of different bio-fertilizers and bio-pesticides against pod bug in green gram

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ABSTRACT

Pod bug is an important hemipteran pest of green gram which not only damages the pod but also reduces the yield of the crop. Field studies on the crop green gram were conducted during the pre-Kharif season in 2013-2014 at the agricultural farm of Palli Siksha Bhavana (Institute of Agriculture), Visva-Bharati, Birbhum, West Bengal. Studies were made to find out the effect of different bio-fertilizers and bio-pesticides against the incidence of pod bug. The bug incidence gradually increased towards reproductive stage of the crop. It was found that variety V1 (VP1) showed highest pod bug incidence followed by V2 (SML-668) and V3 (Samrat). It was found that V3 (Samrat) resulted in lower incidence of pod bug as compared to others. All bio-fertilizer-treated plots showed significant differences in bug incidence as compared to bio-fertilizer-untreated plots. Among all the tested bio-pesticide combinations of *Beauveria bassiana* and *Verticillium lecanii* (15 g/3 l) gave better results against the bug. During the study combination of *Metarrhizium anisopliae* and *V lecanii* (15 g/3 l) and *V lecanii* and neem combinations at same dose were found moderately effective. The highest efficacy over control was recorded in imidachloprid (61.76%) followed by combination of *B bassiana* and *V lecanii* (42.64%).

Keywords: *Beauveria bassiana*; bio-fertilizers; bio-pesticides; green gram, *Metarrhizium anisopliae*; pod bug; varieties; *Verticillium lecanii*

INTRODUCTION

India is the largest producer and consumer of pulses in the world accounting for about 29 per cent of the world area and 19 per cent of the world's production (Singh et al 2015). The share of production of green gram is about 10.98 per cent among different pulses grown in the country. Mung bean, *Vigna radiata* (L) Wilczek, one of the important grain legume crops ranks third among the pulses grown in india after chickpea and pigeon pea. Like other legumes it also improves soil health by fixing the atmospheric nitrogen. Despite its high economic importance the productivity of green gram remains low due to insect pest incidence. On an average 2-2.1 MT of pulses with a monetary value of nearly Rs 6000 crores are lost annually due to ravages of insect pest complex (Reddy 2009).

In India 64 species of insect pests have been reported on green gram (Siddapaji et al 1979). Among

them pod bug is the most devastating pest at the reproductive stage of the crop. In early stages the nymphs suck sap from tender shoots while in advanced stage nymphs and adults suck sap from shoots and seeds. Seeds become shrivelled and lose germination. Bio-fertilizers help in decreasing the insect pest population by enhancing plant growth and vigour and provide eco-friendly organic agro-input and are most cost-effective than chemical fertilizers. Bio-fertilizers such as *Rhizobium*, *Azotobacter*, *Azospirillum*, blue green algae (BGA), phosphate solubilizing bacteria, *Psuedomonas* sp etc have been in use for a long time to act as a biological line of defence against insect pests and diseases of green gram.

Keeping in view the seriousness of the pest and the economic importance of the crop the present investigations were done to see the effect of different bio-fertilizers and bio-pesticides on pod bug under field conditions during pre-Kharif season of 2013-14.

MATERIAL and METHOD

The field studies were conducted during pre-Kharif season of the year 2013-2014 at agricultural farm of Palli Siksha Bhavana (Institute of Agriculture), Visva-Bharati, Sriniketan, Birbhum, West Bengal. The farm is situated at 23.39°N latitude, 87.42°E longitude and at an average altitude of 58.90 m amsl. The soil of the experimental site was sandy loam with high content of sand and low of clay.

The experiment 1 ie effect of different varieties and bio-fertilizers on the incidence of pod bug was laid out in a two-factorial randomized block design (RBD) with six treatments including control (untreated) using five replications. Three varieties grown were VP1, SML-668 and Samrat. These varieties mature in 110-120 days. The bio-fertilizers used contained *Rhizobium* (URH 5), phosphate solubilising bacteria (UBPS 9) and *Trichoderma viridae* (UBT 18) procured from Uttar Banga Krishi Vishwa Vidyalaya, Cooch Behar, West Bengal.

Experiment 2 ie evaluation of different bio-pesticides against pod bug was laid out in simple RBD with six treatments including control (untreated) using five replications. The variety used was PDM-

111 which is generally grown in Sriniketan, West Bengal conditions. The bio-pesticides used were *T viridae*, *Pseudomonas fluroscence*, *Beauveria bassiana*, *Verticillium lecanii*, *Metarrhizium anisopliae*, neem and the insecticides imidachloprid and acephate. The plot size was 3 × 4 m and row to row and plant to plant distance 30 x 20 cm. The crop was sown on 22 March 2014. Agronomical practices were followed as per recommendations adopted at agricultural farm, Visva Bharati. Immediately after appearance of insect pests observations were made at weekly interval till crop harvest. The pre-treatment observations on pest population were recorded 24 hours before and 3, 7 and 14 days after treatment on ten randomly tagged plants in each plot.

Data thus obtained were analysed using MSTAC package. Population reduction over control was worked out as per Fleming and Ratnakaran (1985) given below. The data pertaining to efficacy of different bio-pesticides were obtained on reduction in mean pod bug population and were analysed statistically and transformed into $x \pm 0.5$ values. Percentage on protection over control was worked out by slight modification of Abbott's formula (Abbott 1925) given hereunder:

$$\text{Protection over control (\%)} = \frac{\text{Protection in treatment (\%)} - \text{Protection in control (\%)}}{100 - \text{Protection in control (\%)}}$$

RESULTS and DISCUSSION

Effect of different variety and bio-fertilizer interactions on pod bug incidence infesting green gram: The data on effect of three different varieties (VP1, SML-668, Samrat) and bio-fertilizers on the incidence of pod bug of green gram are given in Table 1. The pod bug was mainly found in the reproductive stage on all three varieties tested. The bug incidence was highest (1.82 to 4.10) in VP1 followed by SML-668 and lowest (0.70 to 0.96) in Samrat. The population of pest gradually increased from first week to fourth week of observation which is evident in Fig 1. It was also found that bio-fertilizer-treated variety showed lesser incidence of bug incidence from bio-fertilizer-untreated variety as given in Fig 2. The variety Samrat resulted in higher reduction in population level of bug than SML-668 and VP-1 (Table 2). On the fourth week

of observation the population of pod bug was 1.12 in non-biofertilizer and 0.80 in bio-fertilizer-treated plots. PGPR have been shown to increase plant growth of a number of agronomically important crops and some PGPR strains have been found to induce systemic resistance against multiple pathogens including fungi, bacteria, viruses and in some cases nematodes (Kenney et al 1999, Yan et al 1999). Major objectives of bacterization include enchancement of symbiotic or associative nitrogen fixation, degradation of xenobiotic compounds, plant growth promotion and biological control of insect pests and pathogenic microorganisms (van Elsas and Heijnen 1990, Whipps 2001).

Reduction in the incidence of pod bug after spraying of bio-pesticides and insecticidal molecules: Bio-pesticides along with imidachloprid and acephate were sprayed twice, first at 30 and

Table 1. Effect of different variety and bio-fertilizer interactions on pod bug and pod borer of green gram

Parameter	Pod bug (number)			
	DOB 1	DOB 2	DOB 3	DOB 4
Variety				
V ₁ (VP1)	1.82	2.78	4.10	3.91
V ₂ (SML-668)	1.15	1.83	2.15	1.87
V ₃ (Samrat)	0.70	0.86	0.96	0.96
SEm±	0.08	0.10	0.08	0.07
CD _{0.05}	0.24	0.30	0.22	0.21
Biofertilizer				
B ₀ (Non-treated)	1.47	2.03	2.70	2.54
B ₁ (Treated)	0.98	1.62	2.10	1.95
SEm±	0.07	0.08	0.06	0.06
CD _{0.05}	0.20	0.25	0.18	0.17
A x B	S	NS	S	S
SEm±	0.12	-	0.11	0.10
CD _{0.05}	0.34	-	0.32	0.29

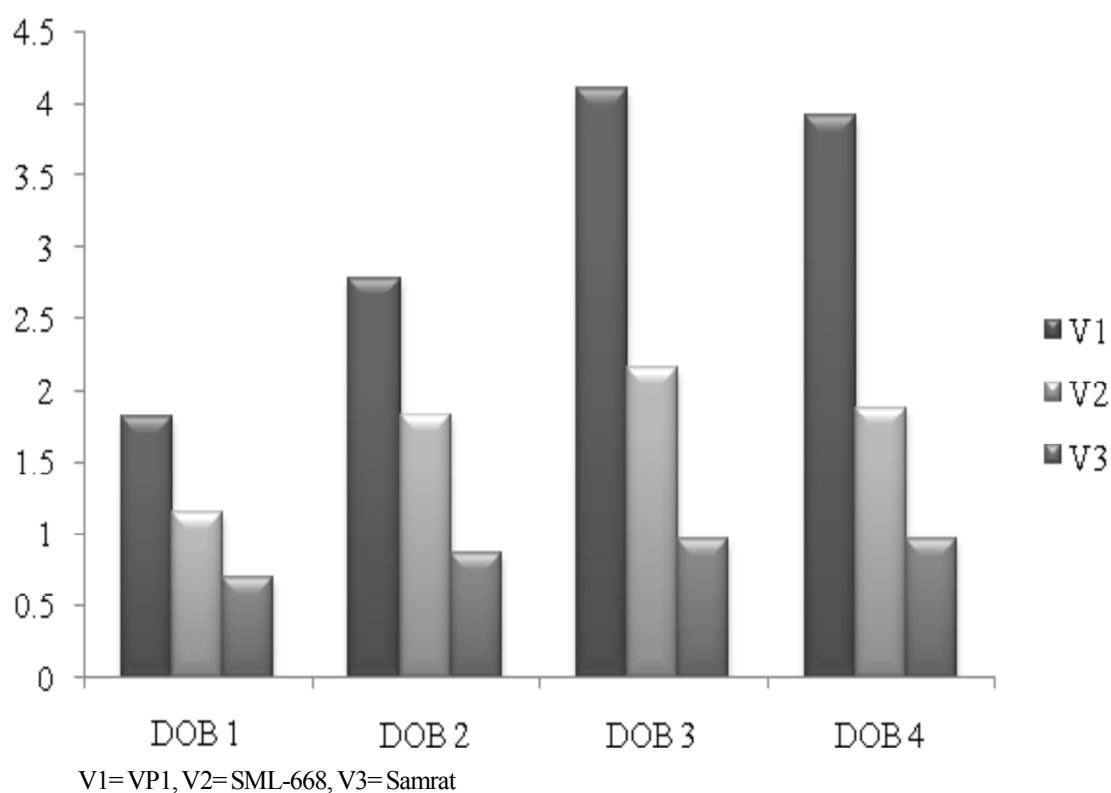


Fig 1. Effect of different varieties on pod bug of green gram

second at 45 DAS. Insect pest incidence was comparatively low at 3, 7 and 14 DAS as compared to pre-count. The incidence of bug decreased more after 7 days after spraying as compared to 3 and 14 days (Table 3). T4 (imidachloprid) showed maximum efficacy (61.76%) over other treatments. T1 (Pf + Tv

+ Bb + VI) gave better results against bug and its efficacy over control was 42.64 per cent followed by T2 and T3. T5 (acephate) was found least effective with 16.66 per cent efficacy over control. The treatment containing *B. bassiana* and *V. lecanii* gave better results as compared to other bio-pesticide combinations.

Table 2. Interaction effect of varieties and bio-fertilizers on pod bug number (DOB4)

Biofertilizer	Variety		
	V1 (VP1)	V2 (SML-668)	V3 (Samrat)
B0	4.12	2.38	1.12
B1	3.69	1.36	0.80
SEm	-	0.10	-
CD	-	0.29	-

B0= Biofertilizer-non-treated, B1= Biofertilizer-treated

M anisopliae on *Oryctes rhinoceros*, *Fusarium oxysporum* on *N lugens*, *V lecanii* on *Coccus viridis* and *B bassiana* on *S litura* have been used for the control of crop pests in India (Jayaraj 1986). *B bassiana* induced 58.1 per cent mortality in the 1st instar grubs of *Henosepilachna vigintioctopunctata* at 2×10^8 conidia/cm² followed by 53.3, 47.1 and 40.8 per cent mortality in 2nd, 4th and 3rd instar grubs respectively (Rajendran and Gopalan 1999). Irulandi and Balasubramanian (2000) conducted a field experiment in Tamil Nadu in 1995-96 to determine the

effectiveness of a number of botanical insecticides against *Megalurothrips distalis* and *Lampides boeticus* on green gram (*V radiata*) in comparison to monocrotophos. Neem seed kernel extract at 5 per cent was most effective against *M distalis* followed by neem oil at 2 per cent. Monocrotophos at 0.05 per cent was the most effective treatment against *L boeticus* followed by neem seed kernel extract and neem oil. The highest yield was recorded in the monocrotophos-treated plots but the highest mean cost-benefit ratio was recorded in neem seed kernel extract.

Ekesi et al (2001) reported the time of application of entomopathogenic fungus, *Manisopliae sjostedti* on cowpea at Nairobi, Kenya. Dar et al (2002) evolved effective and economic control of insect pest complex of green gram cultivar K-851 by using neem seed kernel extract (NSKE) and some insecticides.

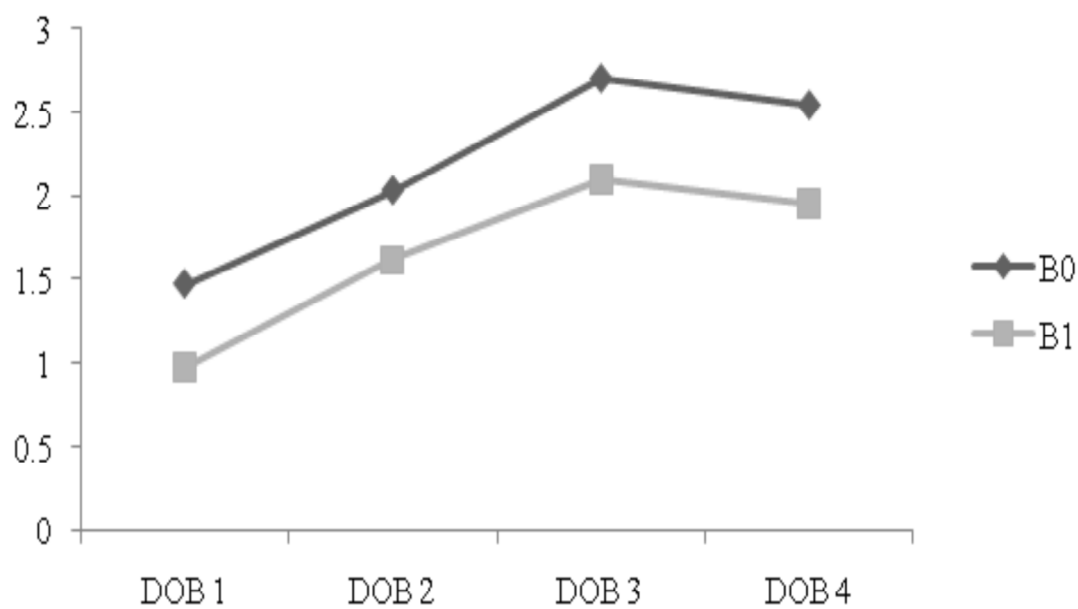
CONCLUSION

All the three varieties screened with bio-fertilizer-treated plots gave better results as compared

Table 3. Per cent reduction in the incidence of pod bug after spraying of bio-pesticides and insecticidal molecules

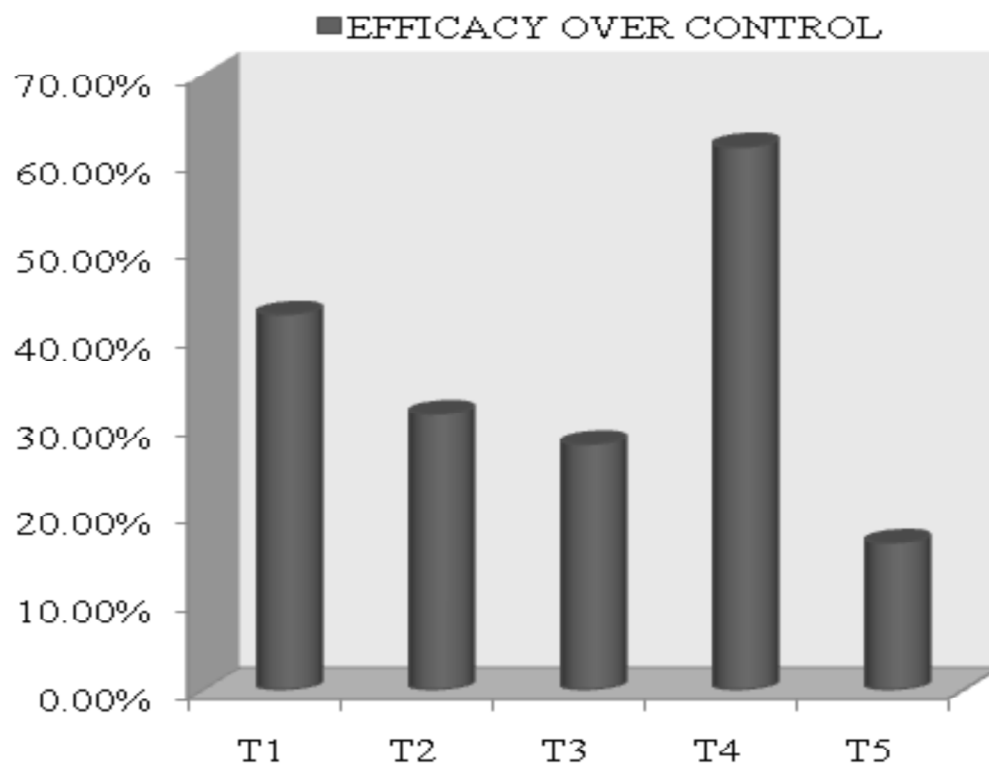
Treatment	Dose	Pre-count of insect/ plant	DAS			Average overall efficacy	Efficacy over control (%)
			3	7	14		
T1	15 g/3 l	2.12 (1.616)	0.98 (1.21)	1.14 (1.28)	1.4 (1.374)	1.17 (1.288)	42.64%
T2	15 g/3 l	2 (1.576)	1.22 (1.31)	1.3 (1.34)	1.68 (1.47)	1.4 (1.37)	31.37%
T3	15 g/3 l	1.96 (1.564)	1.2 (1.3)	1.4 (1.37)	1.82 (1.516)	1.47 (1.39)	27.94%
T4	1 ml/5 l	2.18 (1.634)	0.36 (0.92)	0.82 (1.14)	1.16 (1.284)	0.78 (1.11)	61.76%
T5	3 g/3 l	2.14 (1.622)	1.42 (1.38)	1.82 (1.52)	1.86 (1.53)	1.7 (1.47)	16.66%
T6	-	2.12 (1.616)	1.98 (1.57)	2.02 (1.58)	2.14 (1.622)	2.04 (1.59)	-
SEm±	-	-	0.041	0.017	0.012	-	-
CD _{0.05}	-	-	0.122	0.052	0.036	-	-

DAS=Days after spraying, Data in parentheses are square root transformed values, T1= *Trichoderma viridae* (Tv) + *Pseudomonas fluorescense* (Pf) + *Beauveria bassiana* (Bb) + *Verticillium lecanii* (Vl), T2= Pf + Tv + *Metarhizium anisopliae* (Ma) + Vl, T3= Tv + Pf + Vl + neem, T4= Imidachloprid 17.8% SL, T5= Acephate 75% SP, T6= Control



B0= Biofertilizer-non-treated, B1= Biofertilizer-treated

Fig 2. Effect of different bio-fertilizers on pod bug of green gram



T1= *Trichoderma viridae* (Tv) + *Pseudomonas fluroscence* (Pf) + *Beauveria bassiana* (Bb) + *Verticillium lecanii* (Vl), T2= Pf + Tv + *Metarhizium anisopliae* (Ma) + Vl, T3= Tv + Pf + Vl + neem, T4= Imidachloprid 17.8% SL, T5= Acephate 75% SP, T6= Control

Fig 3. Reduction in the incidence of pod bug after spraying of bio-pesticides and insticidal molecules

to biofertilizer-untreated varieties with respect to the incidence of pod bug. Among the three varieties Samrat showed less incidence of bug followed by SML-668 and VP1. The treatment containing *B. bassiana* and *V. lecanii* gave maximum efficacy ie 42.64 per cent as compared to others.

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