IJPP

RESEARCH ARTICLE

Evaluation of bio-inoculants for ecofriendly management of major pests of mung bean (*Vigna radiata* L.)

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ARITCLE INFO

Received : 15.11.2012
Revised : 15.02.2013
Accepted : 15.03.2013

Key Words :
Mungbean, Bio inoculants, *Beauveria bassiana*, *Pseudomonas fluorescens*, Leafhopper, *Maruca vitrata*

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ABSTRACT

Field trial was conducted during two *Kharif* consecutive seasons 2008 and 2009 for testing the bioefficacy of bio-inoculants against major pests of mung bean at research farm of Centre of Excellence for Research on Pulses, S. D. Agricultural University, Sardarkrushinagar. Based on pooled results, seed treatment of imidacloprid (5 g/kg seeds) and foliar spray of profenophos (2 ml/lit.) were found effective against leafhopper and *Maruca vitrata*. Use of microbial bioinoculants can substitute the conventional pesticide use in short duration crops like mungbean and it reduces the pesticidal hazards. However, significant effect was also observed in the bioinoculants applied plots on the sucking insects and pod damage by *Maruca vitrata*. *Psuedomonas fluorescens* (10 g/kg seeds) seed treated plots and spraying of profenophos (2 ml/lit.) at 50 per cent flowering was found effective against leafhopper and *Maruca* as well as in achieving higher yield of mung bean.

How to view point the article : Panickar, Bindu, Patel, I.S. and Patel, P.S. (2013). Evaluation of bio-inoculants for ecofriendly management of major pests of mung bean (*Vigna radiata* L.). *Internat. J. Plant Protec*., **6**(1) : 108-110.

INTRODUCTION

Mung bean (*Vigna radiata* (L.) is one of the most important staple legume foods containing about 25 per cent protein, which is almost three times that of cereals. In addition to being an important source of human food and animal feed, it also plays an important role in sustaining soil fertility by improving soil physical properties and fixing atmospheric nitrogen. It is also drought resistant crop and suitable for dry land farming and predominantly used as an intercrop with other crop. Among the various insects pests, podborers like *Maruca vitrata* (Geyer) are the serious pest causing divert damage to buds, flowers and pods of green gram. It has been estimated that nearly 30% damage is caused by this pest (Sontakee and Mudali, 1990).

The sucking insect pests *viz*., leaf hopper, thrips, aphid and whitefly the are major pests limiting profitable cultivation of green gram in Gujarat state. Among the sucking pests, the nymphs and adults of leaf hopper suck the cell sap from underside of the leaves and inject their toxic saliva into the tissue causing toxaemia. In case of heavy infestation, field is adversely affected (Singh and Van Emden, 1979).

The health conscious and environmental friendly people are bending more towards organic concepts of farming. In this scenario, microbial insecticides such as entomopathogenic fungi can provide an alternataive, more environmentally friendly option to control this insect pest. Spraying of chemical insecticides prove to be costlier and environmentally and health hazardours in small duration pulse crop (Soundarajan and Chitra, 2011). Hence, seed treatment is one of the easy, economic and feasible methods for pest management . The present study was initiated keeping the above points in view and thereby to evaluate the efficacy of bio inoculants and some synthetic insecticides in mung bean.

MATERIALS AND METHODS

The field trial was conducted at the research farm of

Centre of Excellence for Research on Pulses, S. D. Agricultural University, Sardarkrushinagar during *Kharif* seasons 2008 and 2009. It was laid out in Randomized Block Design replicated thrice. Total ten treatments [T_1- *Beauveria bassiana* seed treatment (ST) @ 10g/kg of seed;T_2-*Pseudomonas fluorescens* seed treatment @ 10g/kg of seed; T_3 - *Beauveria bassiana* + *Pseudomonas fluorescens* each 5g/kg of seed ST; T_4– Imidacloprid 5 g/kg of seed ST; T_5 - *Beauveria bassiana* (ST) 10g/kg of seed + *Beauveria bassiana* Foliar spray (FS) 5g/ litre; T_6 – *Pseudomonas fluorescens* 10g/kg of seed (ST) + *Beauveria bassiana* 5g/lit. (FS); T_7 - *Beauveria bassiana* 10g/ kg of seed (ST) + Profenophos 2 ml/lit. (FS) ; T_8 - *Pseudomonas fluorescens*10g/kg of seed (ST) + Profenophos 2 ml/lit. (FS) ; T_9 -Imidacloprid 5 g/kg of seed (ST) + Profenophos 2 ml/lit. (FS) ; T_{10} - untreated control] were executed during the two years on mung bean variety GM-4. The foliar spraying of the chemicals and bio inoculants were imposed at 50 per cent flowering (40-55 DAS) stage of crop.

The observations on sucking pests especially leafhopper incidence were recorded before, three and seven days after spray in randomly selected five plants and from each plant, population was recorded from three leaves one each from top, middle and bottom region. The pod borer damage by *Maruca vitrata* in the harvested pods were recorded in about 200 pods collected in each treatment and sorted out based on the damage hole by different borers. The data were expressed in per cent and cumulative damage was worked out. The yield from each plot of each treatment was recorded and expressed in kg/ha. The data collected were transformed into angular or square root values as per the standard procedures (Gomez and Gomez, 1984).

RESULTS AND DISCUSSION

The perusal of results presented in Table 1indicated that all the treatments were significantly superior in reducing the leafhopper as well as podborer damage in mung bean during both *Kharif* seasons of 2008 and 2009.

Leafhopper population :

Three days after spray(3 DAS) :

During first year, significantly minimum population of leafhopper was recorded in the seed treatment of imidacloprid alone (0.36/leaf) and imidacloprid ST + profenophos spray (0.36/leaf) at 3 DAS and it was at par with *B. bassiana* ST + profenophos spray (0.56 / leaf) .In remaining treatments the leafhopper population ranged from 1.66 and 3.83 per leaf. In *Kharif* 2009, imidacloprid ST+profenophos spray again recorded lowest leaf hopper population (0.13 / leaf). It was at par with *B. bassiana* ST + profenophos spray, imidacloprid ST, *B. bassiana* ST + *P. florescens* ST and *P. florescens* ST and profenophos spray which had 0.20, 0.20, 0.27 and 0.30 leaf hopper per leaf, respectively (Table 1).

Similarly in pooled results lowest leafhopper population was recorded in imidacloprid ST + profenophos spray (0.24/ leaf) which was at par with imidacloprid ST and *B. bassiana* ST + profenophos spray which exhibited leafhopper population 0.27 and 0.35 per leaf, respectively. In remaining treatments, the leafhopper population ranged from 0.87 to 8.03 per leaf .

Table 1 : Efficacy of various bio - inoculants on incidence of leafhopper, *Emrasca keri* infesting mungbean during 2008 and 2009

Sr. No.	Treatments	Leafhopper/ 3 leaves*					
		3 DAS			7 DAS		Pooled
		2008	2009	Pooled	2008	2009	
1.	T_1: *B. bassiana* ST	2.08* (3.83)	1.07* (0.67)	1.58 (2.00)	2.25 (4.56)	2.11* (4.00)	2.18 (4.25)
2.	T_2: *P. florescens ST*	1.60 (2.06)	0.98 (0.47)	1.29 (1.16)	1.67 (2.29)	1.96 (3.33)	1.82 (2.79)
3.	T_3: *B.b,(ST) +P.f.* (ST)	1.47 (1.66)	0.87 (0.27)	1.17 (0.87)	1.90 (3.11)	1.77 (2.67)	1.84 (2.87)
4.	T_4: Imidacloprid ST	0.93 (0.36)	0.83 (0.20)	0.88 (0.27)	1.71 (2.42)	1.58 (2.00)	1.65 (2.21)
5.	T_5: T_1+ *B.b. spray*	2.00 (3.50)	1.05 (0.60)	1.52 (1.81)	2.04 (3.66)	2.04 (3.67)	2.04 (3.66)
6.	T_6: T_2+ B.b. spray	2.04 (3.66)	1.98 (3.47)	2.01 (3.54)	2.42 (5.36)	2.48 (5.67)	2.45 (5.50)
7.	T_7:T_1+ Profenophos spray	1.03 (0.56)	0.82 (0.20)	0.92 (0.35)	1.90 (3.11)	1.73 (2.50)	1.82 (2.79)
8.	T_8: T_2+ Profenophos spray	1.57 (1.96)	0.89 (0.30)	1.23 (1.01)	1.96 (3.34)	1.90 (3.10)	1.93 (3.22)
9.	T_9:T_4+ Profenophos spray	0.93 (0.36)	0.79 (0.13)	0.86 (0.24)	1.45 (1.60)	1.57 (1.95)	1.51 (1.78)
10.	T_{10}: Control	3.13 (9.30)	2.71 (6.87)	2.92 (8.03)	2.75 (7.06)	3.03 (8.67)	2.89 (7.85)
	S.E.±	0.08	0.05	0.06	0.12	0.04	0.07
	C.D. at 5%	0.23	0.16	0.17	0.35	0.11	0.20
	C.V. %	14.34	13.18	11.98	17.71	5.37	9.81

* $\sqrt{x+0.5}$ transformation Figures in parentheses are retransformed values

Table 2: Efficacy of various bioinoculants and synthetic insecticides on *Maruca vitrata infesting* mung bean during *Kharif* 2008 and 2009

Sr. No.	Treatments	Per cent pod borer damage			Yield(kg/ha)		
		2008	2009	Pooled	2008	2009	
1.	T_1: *Beauveria bassiana* ST	10.12* (3.09)	20.69 (12.50	15.41 (7.06)	482	501	492
2.	T_2: *Psuedomanas florescens ST*	9.82 (2.91)	17.33 (8.88)	13.58 (5.51)	562	472	517
3.	T_3: *B.b,(ST) +P.f.* (ST)	9.84 (2.92)	19.14 (10.75)	14.49 (6.26)	473	499	486
4.	T_4: Imidacloprid ST	9.15 (2.53)	17.12 (7.07)	13.14 (5.17)	577	515	546
5.	T_5: T_1+ *B.b. spray*	8.69 (2.28)	17.03 (8.58)	12.86 (4.95)	497	509	503
6.	T_6: T_2+ B.b. spray	7.34 (1.63)	14.49** (6.26)	10.92 (3.59)	523	535	529
7.	T_7:T_1+ Profenophos spray	7.21 (1.58)	11.41 (3.93)	9.31 (2.62)	620	547	584
8.	T_8: T_2+ Profenophos spray	6.47 (1.27)	10.07 (3.11)	8.27 (2.07)	680	568	624
9.	T_9:T_4+ Profenophos spray	1.15 (0.04)	9.75 (2.88)	5.45 (0.90)	753	673	713
10.	T_{10}: Control	11.70 (4.11)	25.54 (18.77)	18.62 (10.19)	367	347	357
	S.E.$\pm$	0.36	0.56	0.43	19.54	11.01	15.03
	C.D. at 5%	1.07	1.68	1.27	58.06	32.73	44.66
	C.V. %	13.25	10.41	10.48	10.97	6.52	8.43

*Arcsin transformation, Figures in parentheses are retransformed values

Seven days after spray (7 DAS) :

During *Kharif* 2008, seed treatment of imidacloprid and profenophos spray was found better in minimising the leafhopper population (1.60 per leaf). It was statistically at par with seed treatment of *P. fluorescens* and imidacloprid at 7 DAS. Similarly in *Kharif* 2009, combination of seed treatment and profenophos proved highly effective against leafhopper (1.95/leaf) as compared to rest of the treatments except seed treatment of imidacloprid. Pooled results of two years at 7 DAS revealed that imidacloprid ST + profenophos (1.78/leaf) spray was found effective in reducing leafhopper population. However, significantly it did not differ from imidacloprid seed treatment (2.21/leaf). According to Murugesan and Kavita (2009), imidacloprid was very effective against leafhopper in cotton crop (Table 1).

Pod borer damage, *M. vitrata* :

All the treatments were found significantly superior in minimizing the pod damage as compared to control. Significantly lowest pod damage was observed in imidacloprid ST + profenophos spray (0.04%) as compared to the rest of treatments during *Kharif* 2008. In *Kharif* 2009, again imidacloprid ST + profenophos spray (2.88 %) managed the pod damage in mung bean and was at par with seed treatment of *P. fluorescens* + profenophos spray (3.11%) and ST of *B. bassiana* + profenophos spray (3.93%). The same results were also reflected in the pooled results (Table 2).

Significantly maximum yield of green gram was recorded in the seed treatment of imidacloprid and profenophos spray in both years *i.e.,* 2008 and 2009 as well as in pooled results as compared to the rest of treatments. However, it was followed by seed treatment of *P. fluorescens* and profenophos spray.

Based on results of two years, it can be concluded that seed treatment of imidacloprid and spray of profenophos was effective in checking the leafhopper population and pod borer damage as well as obtaining higher the yield of green gram. However, seed treatment with *P. fluorescens* and profenophos spray was found next best combination to manage the leafhopper and podborer damage and also increasing the yield of green gram (Table 2). Soudararajan and Chitra (2011) also found that bioinoculant had significant influence on the sucking pests as well as pod borer in urdbean.

Acknowledgement :

The authors acknowledge the All India Co-ordinated Research Project on MULLaRP for providing financial support for conducting experiments.

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