Ecofriendly Management of Spotted Pod Borer (*Maruca Vitrata* Fabricius) on Yardlong Bean in Chitwan, Nepal

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ABSTRACT:

Field experiment on the management of spotted pod borer was laid out in a Randomized Complete Block Design in Gunjanagar, Chitwan during January to July 2012 which included three replications and seven treatments. The treatments and their use were (i) Margosom 5 ml/liter of water, (ii) Derisom 2ml/liter of water, (iii) Anosom 2 ml/liter of water, (iv) Cow urine fermented botanical mixture in 1:5 ratio with water (v) Lipel 2g/liter of water, (vi) Emamectin benzoate 0.25g/liter of water and (vii) Untreated control. Emamectin benzoate treated plots (9373g) and Derisom treated plots (8727g) produced the highest weight of pods per plots. Similarly, Emamectin benzoate (5.76%) and Derisom (9.43%) had comparatively the lowest percent of damage pods, but the highest percent of damage was found in control plots (46.80%). The lowest larval population of spotted pod borer was found on Emamectin benzoate (1.0) and Derisom (1.13) sprayed plots. The least number of natural enemies and pollinators were observed in Emamectin benzoate sprayed plots (11.03) followed by Derisom (12.60) throughout the observation period. Control plot (19.40) had the highest number of natural enemies and pollinators followed by Cow urine fermented botanical mixture (14.53), Lipel (14.13), Margosm (13.77) and Anosom (13.63) treated plots respectively. Emamectin benzoate gave the highest net yield (18.45mt/ha) of green pods followed by Derisom (17.27mt/ha) and they were statically at par. Control plot gave the lowest net yield of green pod (11.29mt/ha), which was similar to that of Anosom (12.12mt/ha) treated plots. Derisom being botanical pesticides, effective like Emamectin benzoate against spotted pod borer can be incorporated for integrated management of spotted pod borer.

Key words: Yardlong bean, spotted pod borer, bio-pesticides, management

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INTRODUCTION

Yardlong bean (*Vigna unguiculata* L. subsp. *sesquipedalis* Verdc.) is cultivated subspecies of cowpea. It is also known as long-poded cowpea or Chinese long bean or snake bean. The production of yardlong bean is estimated 30,977 metric tons from an area of 2,772 ha with productivity of 11 mt/ha in Nepal (MoAD, 2012). It is a vigorous climbing annual vine crop grown primarily for its long immature pods for vegetable purpose. It is subtropical and tropical crop most widely grown in the warmer parts of Southeastern Asia, Thailand, and Southern China (Rubatzky and Yamaguchi, 1997). Yardlong beans are quick-growing and daily harvesting is often a necessity after beginning of pod production (Rubatzky and Yamaguchi, 1997). The tender green pods of yardlong bean are a good source of protein, iron, calcium, phosphorus vitamin A, vitamin C and dietary fiber (Singh *et al*., 2001)

Yardlong bean is being attacked by insect pests at flowering and post-flowering stage, which is a major factor to limit the production (Jackai *et al.*, 1992). Among them, spotted pod borer (*Maruca vitrata* Fabricius), pod sucking bug (*Clavigralla gibbosa* Stal.) and thrips (*Megalurothrips sjostedti* Trybom) reduce the productivity significantly. The spotted pod borer, *Maruca vitrata* Fabricius is one of the major pest of cowpea in the tropics (Jackai and Daoust, 1986). The loss due to this pest is estimated 54.4% in yardlong bean in Bangladesh (Ohno and Alam, 1989).

The pod borer larvae damage flower buds, flowers, green pods and seeds of cowpea (Singh and Jackai, 1988) thereby reducing production. The spotted pod borer is also important pest of yardlong bean grown in Chitwan. To reduce the crop loss, farmers are practicing indiscriminate use of chemical pesticides. The indiscriminate use of synthetic pesticide increase resistance of pest species, chemical residues in treated food material (Champ and Dyte, 1976; Snelson, 1987; Georghion and Lagumes, 1991) and health hazard to users and livestock. Thus, this study was carried out to find, eco-friendly measures rely heavily on the use of bio-pesticides to manage the pest population without causing any harm to the users, consumers and the environment.

MATERIAL AND METHODS

The field experiment was conducted at Gujanagar VDC; Ward No 5, Chitwan from January to July 2012. The site is located at 27˚37′ latitude, 84˚25′ longitude and altitude of 256 msl. The experiment was laid out in Randomized Complete Block Design (RCBD) consisting of seven treatments and three replications. The C-324 variety of yardlong bean was used in field experiment. Individual plot size was 4m*3m and crop was grown in spacing of 100cm*30 cm. The distance between replication was 1m and within

replication was 0.5m. The details of treatment were as given below:

Treatments	Common name	Chemical name/ Scinetific name	Trade Name	Formulation	Dose
1	Margosom	Azadirachtin	Margosom	EC	5ml/lit of water
2	Derisom	Karanjin	Derisom	EC	2 ml /lit of water
3	Anosom	Annonin	Anosom	EC	2 ml/lit of water
4	Cow urine fermented botanical mixture				1:5 with water
5	Lipel	Bacillus thuriengensis	Lipel	SP	2 g/lit of water
6	Kingstar	Emamectin benzoate	Kingstar	SG	0.25g/lit of water
7	Control				Water spray

First of all deep ploughing was done on 13th January 2012 using tractor after application of FYM and immediately field was irrigated before sowing. After second ploughing land is thoroughly labeled and field layout was done. The calculated amount of Urea, DAP and Muriate of Potash were broadcasted in each plot and mixed thoroughly using spade. Seed was sown at 2-3cm deapth and each hole cosist of 2-3 seeds. Re-filling of seed was also done to fill the gap. Leaf hopper was appeared as problematic pest in seedling stage and managed by spraying Neemix 2ml/ltr of water. Similarly, after seed germination only one seedling per pit was maintained. The first weeding was done on 25th February 2012 which was repeated at 20 days interval. The irrigation, fertilization and staking was done as per the necessities in the plot.

Treatments were sprayed on yardlong bean with the help of 16 liter capacity Knap Sack Sprayer. The plant was throughouly sprayed and it was repeated in each 10 days. Ten sample plants were randomly selected from inner rows from each plot. Sample plant in each plot was tagged by using small red rope. The larva of spotted pod borer was sampled by counting number of larva from 20 sample pod. Number of natural enemies (Hover fly, spider, wasp, Robber fly, Tachinid fly, Dragon fly), flower visitors and pollinators (Bees, bumble bees) visiting in individual plots were counted. Weight of total pods per plant, weight of total damage pods per plant, percent of pod damage were recorded. Data were recorded one day before spray, 3rd day, 6th day and 9th day after spray.

The collected data were arranged in MS-Excel and statistically analyzed with the help of MSTATC. Mean separation was done by DMRT at 5% level of significance (Gomez and Gomez, 1984).

RESULTS AND DISCUSSION

The highest weights of produced pods were recorded in Emamectin benzoate (9373g) sprayed plots followed Derisom (8727g). Craig *et al*. (1996) reported emamectin benzoate effective for controlling Lepidopteran pest species on vegetable crops. Neupane (2008) reported that Derisom had Karanjin compound, which is effective against Lepidopteran pest.

Table 1. *Effect of treatments on weight of pods produced, percent of damage pod, number of M. vitrata Fabricius larva and the number of natural enemies and pollinator in Gunjanagar, Chitwan, Nepal, 2012*

Treatments	Weight of pod produced (g)	Percent of damage pods	Av. no. of *Maruca vitrata* Fab. larva	Av. no. of pollinator and natural enemies
Margosom 5ml/ltr	6053.0^{c}±49.10	16.90^{b}±0.35	2.07^{b}±0.07	13.77^{c}±0.13
Derisom 2ml/ltr	8727.0^{b}±3.33	9.43^{e}±0.16	1.13^{c}±0.09	12.60^{d}±0.06
Anosom 2ml/ltr	5617.0^{d}±123.88	15.85^{cd}±0.17	2.00^{b}±0.12	13.63^{c}±0.07
Cow urine fermented botanical mixture (1:5)	6093.0^{c}±78.39	15.20^{d}±0.38	2.167^{b}±0.09	14.53^{b}±0.07
Lipel 2g/ltr	5940.0^{c}±85.05	16.38^{bc}±0.43	2.00^{b}±0.12	14.13^{bc}±0.24
Emamectin benzoate 5% SG 0.25g/ltr	9373.0^{a}±49.10	5.76^{f}±0.19	1.00^{c}±0.10	11.03^{e}±0.19
Control	4937.0^{e}±56.08	46.80^{a}±0.19	4.57^{a}±0.20	19.40^{a}±0.17
CV	1.86%	2.43%	9.81%	1.91%
LSD (0.05)	220.60	0.7795	0.3732	0.4807
F-Test	**	**	**	**

CV: Coefficient of Variation; LSD: Least Significance Difference; Values with the same letter in a column are not significantly different at 5% DMRT; Figure after ± indicate standard error; Av. no.: Average number

Emamectin benzoate (5.76%) had the lowest percent of pod damage followed by Derisom (9.43%). Seed extract of *Pongamia glabra* Vent. showed an antifeedant effects on *Spodopter litura* Fab. (Prakash and Rao, 1997). Repellent and antifeedant effect are often connected with pest reduction or oviposition detterents (Deka *et al.*, 1998, Pavela and Herda, 2007). Cow urine fermented botanical mixture (15.20%), Anosom (15.85%), Lipel (16.38%) and Margosom (16.90%) had intermediate percent of pod damage. The lowest percent of leaf damage of bittergourd by Epilana beetle were recorded in Derisom sprayed plots followed by chemical (Dichlorovos), Multineem and *Bacillus thuringiensis* Berliner (Yadav *et al.*, 2010). Shrestha *et al.* (2009) also reported that Derisom and Margosom were effective against peach aphid in potato after chemical pesticide Endosulfan. Sapkota *et al.* (2008) reported that cow urine fermented botanical mixture was effective against fruit fly in cucumber. The *B. thuringensis* Berliner based

insecticides have been proved to be effective against *M. vitrata* Fabricius (Wang *et al.*, 1989). The mixture of neem leaf extracts with other plant species was found effective in management of *M. vitrata* Fabricius (Oparaeke *et al.*, 2005). Extract of *Melia azaderach* Linn. (Pandey *et al.*, 1981), *Azadirachta indica* A. Juss (Olaifa and Adenuga, 1988), *Allium sativum* L. (Oparaeke *et al*., 2001) have been reported to possess insecticidal activity against number of insect pest species. Neem seed powder and neem kernel extract were effective against legume pod borer (Hongo and Karel, 1986; Jackai *et al.*, 1992).

Comparatively higher reduction in larval population of *M. vitrata* Fabricius was found with Emamectin benzoate (1.0) and Derisom (1.13) sprays plot. Derisom were satatically similar to chemical pesticide Dimethoate for reduction of *Lipapis erysimi* Kaltenbach in mustard (Kafle *et al.*, 2009). Other biological measures like Cow urine fermented botanical mixture (2.0), Lipel (2.0), Margosom (2.07) and Anosom (2.17) were statically similar to reduce larval population, but were comparatively superior to control plots. Rajbhandari *et al.* (2009) reported that the highest population reductions of diamond back moth in cabbage were observed in Derisom treated field followed by *B. thuringiensis* Berliner, fenvalerate and Margosom.

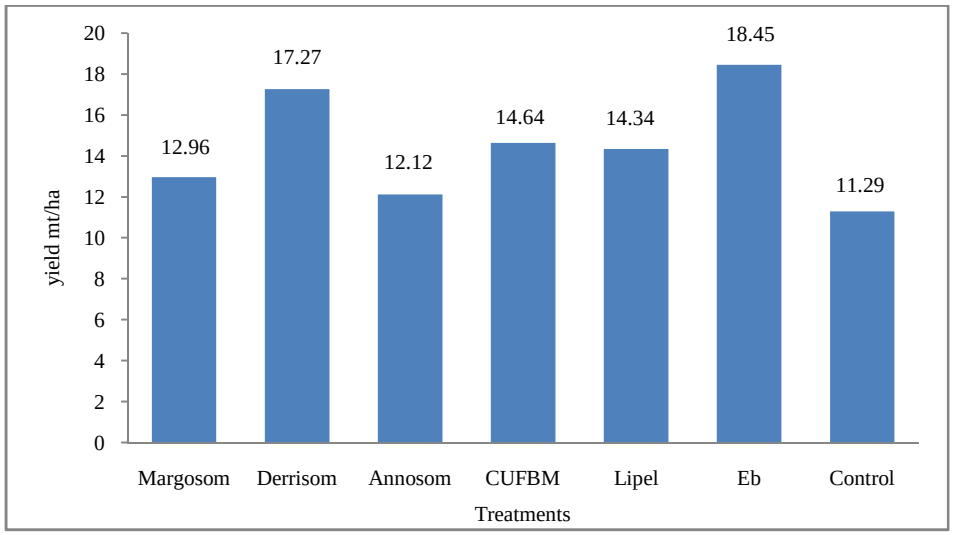
The highest numbers of natural enemies and pollinators were observed in control plots (19.40) followed by Cow urine fermented botanical mixture (14.53), Lipel (14.13), Margosom (13.77), Anosom (13.63) and Derisom (12.60) sprayed plot. Shrestha *et al.* (2009) also reported that natural enemies were higher in bio-pesticide treated plots. Emamectin benzoate (11.03) sprayed plot had the lowest number of natural enemies and pollinators which was supported by the findings of Singh *et al.* (2001) that natural enemies exposed to insecticides residues on plant surface resulted into mortality by decreasing their searching ability. Emamectin benzoate is broader spectrum insecticides, which caused toxicity to natural enemies and pollinators (Studebaker and Kring, 2003). Among biological treatments Derisom treated plot had the lowest number of natural enemies and pollinator. Cow urine fermented botanical mixture, Lipel, Margosom, Anosom sprayed plots had comparatively more number of natural enemies and pollinators visiting to the plots in comparison to Emamectin benzoate and Derisom sprayed plots. Bt based bio-pesticide has few or no side effect on natural enemies and pollinators (Wang *et al.* 1989). The chemical pesticides increase the resistance of pest toward pesticides, cause health hazards, environmental effects, adverse effects on non-target organisms and destruction of natural enemies and pollinators (Subedi and Vaidya, 2003).

Table 2. Effect of treatments on yield of fresh green pods of yardlong bean in Gunjanagar, Chitwan, Nepal, 2012

Treatments	Net yield (mt/ha)	Increase in yield over control (%)
Margosom 5ml/ltr	12.96^{bc}±0.86	14.79
Derisom 2ml/ltr	17.27^{a}±0.58	52.97
Anosom 2ml/ltr	12.12^{c}±0.52	7.35
Cow urine fermented botanical mixture (1:5)	14.64^{b}±1.17	29.67
Lipel 2g/ltr	14.34^{b}±0.29	27.02
Emamectin benzoate 5% SG 0.25g/ltr	18.45^{a}±0.61	63.42
Control	11.29^{c}±0.12	
CV	8.51%	
LSD (0.05)	2.185	
F-Test	**	

CV: Coefficient of Variation; LSD: Least Significance Difference; Values with the same letter in a column are not significantly different at 5% DMRT; Figure after ± indicate standard error; mt/ha: metric ton/hectar

The yield of green pods were the highest at Emamectin benzoate sprayed (18.45mt/ha) plots which is statically as par with Derisom sprayed plots (17.27mt/ha). Emamectin benzoate and Derisom prevents flower damage and pod damage as it is effective against Lepidopteran pests. The yield of fresh green pod produced at Cow urine fermented botanical mixture (14.64mt/ha), Lipel (14.34 mt/ha), Margosom (12.96 mt/ha) sprayed plot were although lower to Emamectin benzoate and Derisom sprayed plots but comparatively higher to Controls plots. Rajbhandari *et al.* (2009) reported the highest yields of cabbage heads in Derisom sprayed field followed by *B. thuriengesis* and fenvalerate.



CUFBM:Cow urine fermented botanical mixture; Eb: Emamectin benzoate

Figure 1: Effect of treatments on the yield of green pod of yardlong bean in Gungananar, Chitwan 2012

CONCLUSIONS

Emamectin benzoate and Derisom were the most effective among the different treatments. Emamectin benzoate and Derisom reduced *Maruca vitrata* Fabricius population, thus by reducing the pod damage and increasing net yield of green pod. Emamectin benzoate being chemical measure reduced the natural enemies and pollinators. Derisom being botanical and effective against *Maruca vitrata* Fabricius may be the most viable alternative to chemical pesticides in eco-friendly management of *Maruca vitrata* Fabricius.

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