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EFFECT OF DIFFERENT BIO-RATIONAL INSECTICIDES ON THE INFESTATION OF POD BORER ATTACKING YARD LONG BEAN

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ABSTRACT

The present study was conducted during March to July 2021 in the experimental field of the Department of Entomology of Bangabandhu Sheikh Mujibur Rahman Agricultural University (BSMRAU), Gazipur to evaluate the effect of some biorational insecticides on pod borer infestation in yard long bean. The study was laid out by Randomized Complete Block Design (RCBD) with 3 replications. The treatment comprised Vermitec 1.8 EC (Abamectin) @ 1.0 ml/L, Tracer 45 SC (Spinosad) @ 0.4 g/L, Bio-Action 1.5 SL (Matrine) @ 1.5 ml/L of water, Ecomec 1.8 EC (Azadiractin) @ 1.5 ml/L and Phytoclean (Potassium salt of fatty acid 40%) @ 1.5 ml/L of water at 15 days interval along with an untreated control for comparison. The study revealed that the lowest rate of inflorescence infestation, the highest reduction of flower shedding, lowest rate of pod infestation by pod borer as well as the highest fruit sets and marketable yield (10.7±0.3 MT/ha) was recorded with the bio-rational management approach comprising 3 sprays of Tracer 45 SC (Spinosad) @ 0.4 g/L of water.

Keywords: Botanicals, abamectin, spinosad, azadiractin, *Euchrysops cnejus*, *Maruca vitrata*

Introduction

Yard long bean is a trailing, long-stemmed vine, *Vigna unguiculata* subsp. *sesquipedalis* (L.), is a popular summer vegetable cum pulse crop profitably grown all over all over the world including Bangladesh (Srinivasan *et al*. 2019). In our country, it is mostly grown Kharif season in Chittagong, Chittagong Hill Tracts, Kustia, Dhaka, Khulna, Jessore and Rangpur districts (BBS 2020).

Yard long bean is extensively grown in Kharif season when there is shortage of vegetables supply in the market. The area occupied by this crop was 17307 ha and the production was 28469 MT during the year 2018-2019 (BBS 2019). Having a long green or violet colored pod, yard long bean contains high percentage of calories (50 g), digestible protein (3 g), carbohydrates (9 g), fat (0.2 g), minerals (0.8 g) like folate, calcium, phosphorus, sodium, potassium, zinc, magnesium, manganese, cobalt as well as vitamin A, thiamin, riboflavin and vitamins C (Ano and Ubochi 2008, Vaughan and Geissler 2008).

Despite the prospect of yard long bean high incidences of various insect pests' infestation have been limited the crop into its low yield and poor quality and cause significant yield losses. The yield loss in yard long bean due to insect pests is reported to be about 12-30%. It is especially attractive to pod borers, aphids, jassid, whitefly, epilachna bettle, green stink bug, hairy caterpillar and red spider mite (Hossain and Awrangzeb 1992). Dutta *et al*. (2004) also reported that the attack of pod borer, *Maruca vitrata* (Fab.) is one of the major constraints for bean production in Bangladesh. Butani and Jotwani (1984) found that *M. vitrata* is a serious insect pest of leguminous vegetables causing damage by boring tender or mature pods.

Bean pod borers are able to establish itself from vegetative to reproductive stage. At the early stage of plant growth, the bean pod borer attacks the crop making clusters of leaves, tendrils and young shoots of the plant and later at flowering and pod setting stages of plants. The insect bore into these reproductive organs, where the insect feeds internally (Karim 1993).

Farmers of Bangladesh are mostly depending on the toxic synthetic pesticides to combat the pests' attack. But in many cases the increasing and indiscriminate uses of synthetic insecticides have totally failed to control the

pests. These insecticidal controls of the insect pests are not only expensive but also left over residues on the sprayed surface of the crops or in the soils; destroying natural enemies which become a matter of great concern of human health and environmental pollution (Rikabdar 2000) and ultimately pest resurgence (Devi *et al*. 2017). Therefore, the present study was designed for the evaluation of the effectiveness of some bio-rational insecticides on pod borer infestation attacking yard long bean.

Materials and Methods

The experiment was conducted in the experimental farm of Bangabandhu Sheikh Mujibur Rahman Agricultural University (BSMRAU), Gazipur, Bangladesh during March to July 2021 with Randomized Complete Block Design (RCBD) and 3 replications. The experiment was containing 18 plots (3×2 m^2) separated by 1 m and block to block distance was 2 m. The 6 treatments including an untreated control were evaluated in this study as follows:

T_1= 3 spays of Vermitec 1.8 EC (Abamectin) @ 1.0 ml/L of water, T_2= 3 spays of Tracer 45 SC (Spinosad) @ 0.4 g/L of water, T_3= 3 spays of Bio-Action 1.5 SL (Matrine) @ 1.5 ml/L of water, T_4= 3 spays of Ecomec 1.8 EC (Azadiractin) @ 1.0 ml/L of water and T_5= 3 spays of Phytoclean (Potassium salt of fatty acid 40%) @1.5 ml/L of water and T_6= Untreated control (comprised of the application of tap water).

The seeds of Toky variety from East-West Seed Company were collected and sown at 15 March 2021 in the well-prepared field After 7 days of plot preparation, seeds were sown in two rows maintaining 75 cm distance between row to row and 30 cm distance between plant to plant accommodating 9 pits in each row. At the same time, seeds were sown in poly bags for gap filling to obtain 100% plant population in the field. Application of manures and fertilizers was done according to the recommended fertilizer doses for yard long bean production (FRG, 2018). Intercultural operations like thinning and gap filling, staking, mulching, weeding and irrigation were done whenever necessary.

When the pests caused approximately 5% of inflorescence infestation, the application of treatments was started. Rate of inflorescence infestation was calculated by counting the number of infested inflorescence and total inflorescence per plot 1 day before treatment (DBT) and at 3, 5 and 7 days after treatment (DAT). Rate of flower shedding was calculated by counting the number of flower shedding and total number of flowers per plot 1 day before treatment (DBT) and at 3, 5 and 7 days after treatment (DAT). The number of pod sets per plot was counted at 7 DAT of each spray. The number of healthy and infested pod and their weight per plot were recorded after harvest. The cumulative yield in kg per plot of healthy, infested as well as total pods was computed and then it was converted to ton per hectare.

All the data analyses were performed for analysis of variance (ANOVA) using IBM SPSS 20.0 and the means were separated by Tukey HSD Posthoc test (at 5% level of significance).

Results and Discussion

The rate of infested inflorescence per plot at one day before treatment (DBT) of insecticides was recorded to compare among the treated and untreated plots and these were ranged from (37.0±5.7 to 31.0±4.4%). The infestation rates at 3, 5 and 7 DAT varied from 12.2±2.3 to 37.1±5.3%, 10.5±2.0 to 42.3±6.1% and 11.0±2.4 to 40.4±5.7%, respectively (Table 1). All the tested bio-rational insecticides revealed significantly lower rates of inflorescence infestation compared to untreated control. Among the insecticides Tracer 45 SC showed the lowest rate of infestation which is statistically similar to Bio-Action 1.5 SL and Vertimec 1.8 EC.

The effects of different bio-rational insecticides on the flower shedding of yard long bean due to pod borer infestation has presented in table 2. Results showed that the numbers of flower shedding per plot ranged from 16.0±2.1 to 61.6±4.0/plot, 21.1±2.1 to 63.6±4.3/plot and 23.2±3.1 to 63.9±4.9/plot at 3, 5 and 7 DAT, respectively. All the tested bio-rational insecticides revealed significantly lower numbers of flower shedding compared to untreated control. Among the insecticides Tracer 45 SC showed the lowest number of flower shedding which is statistically similar to Bio-Action 1.5 SL and Phytoclean.

Table 3 showed the effect of biorational insecticides against pod borer of yard long bean in terms of number

Table 1. Effects of different bio-rational insecticides pod borer of yard long bean in terms of rate of inflorescence infestation per plot

Treatments	Rate of inflorescence infestation (%)			
	1 DBT	3 DAT	5 DAT	7 DAT
Vertimec 1.8 EC	33.0±4.1	16.9±1.6c	15.6±1.6c	17.9±2.3c
Tracer 45 SC	37.0±5.7	12.2±2.3c	10.5±2.0c	11.0±2.4c
Bio-Action 1.5 SL	31.0±4.4	14.4±4.2c	14.5±4.1c	16.8±2.9c
Ecomec 1.8 EC	31.6±4.0	28.5±2.3b	28.8±2.3b	29.3±1.9b
Phytoclean	35.6±4.3	30.6±3.3b	30.0±3.0b	32.7±3.1b
Untreated control	36.0±5.0	37.1±5.3a	42.3±6.1a	40.4±5.7a

Data expressed as mean±S.E. Means within a column followed by no common letter(s) are significantly different by Tukey Posthoc statistic at $P \leq 0.05$. DBT: Day before treatment, DAT: Days after treatment.

of pods setting per plot. Numbers of pod setting among the treatments varied from 68.0±1.1 to 103.0±2.8/plot, 89.3±1.8 to 144.6±3.8/plot and 95.3±0.8 to 165.6±3.2/, respectively. All the bio-rational insecticides revealed significantly higher numbers of pod setting compared to untreated control. Among the insecticides Tracer 45 SC showed the highest number of pod setting followed by to Bio-Action 1.5 SL.

The pod infestation rates among the treatments varied from 2.6 to 50.4%, and the results showed that the biorational insecticides had revealed significantly lower rates of infestation compared to untreated control (Figure 1). Among the insecticides Tracer 45 SC showed the lowest rate of infestation followed by Phytoclean, Bio-Action 1.5 SL, Vertimec 1.8 EC and Ecomec 1.8 EC. Amin *et al.* (2017) reported that cypermethrin had the lowest rate of pod infestation of yard long by pod borer and found the increased yield (47.7%) over untreated control. Tracer 45 SC revealed significantly lower rates of pod infestation of country bean and produced significantly higher amount of marketable yield compared to untreated control and some other biorational insecticides (Nur *et al.* 2020).

Chatterjee *et al*. (2009) revealed that the lowest mean shoots as well as fruit infestation (7.47 and 9.88%) in brinjal was recorded in the plots treated with Spinosad 2.5 SC (50 g a.i./ha). Sparks *et al.* (1995) reported that Spinosad has relatively broad-spectrum activity and has been effectively used for the control of many species

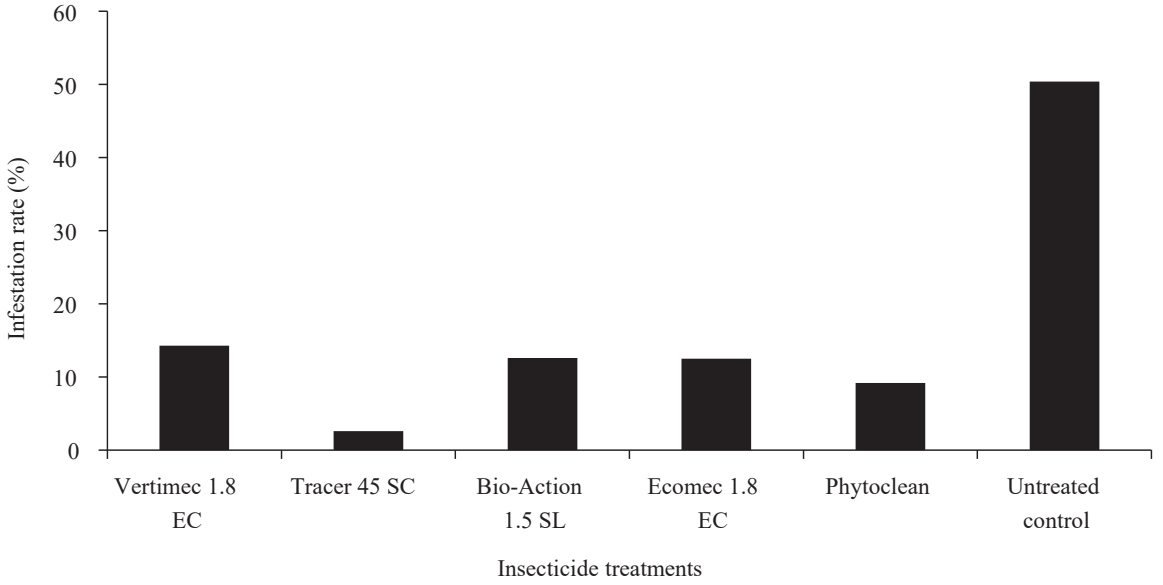


Figure 1. Effects of different bio-rational insecticides against pod borer of yard long bean on the rate of pod infestation.

Table 2. Effects of different bio-rational insecticides against pod borer of yard long bean in terms of number of flower shedding per plot

Treatments	Number of flower shedding per plot			
	1 DBT	3 DAT	5 DAT	7 DAT
Vertimec 1.8 EC	66.4±3.6	38.0±4.0b	39.4±1.4b	40.8±2.7b
Tracer 45 SC	54.6±5.0	16.0±2.1c	21.1±2.1c	23.2±3.1c
Bio-Action 1.5 SL	60.5±6.7	20.6±3.9c	23.3±2.8c	26.1±3.5c
Ecomec 1.8 EC	68.4±4.1	42.0±3.5b	44.5±1.1b	46.5±7.4b
Phytoclean	63.9±5.9	24.3±4.7c	27.1±2.1c	29.0±5.1c
Untreated control	64.0±5.2	61.6±4.0a	63.6±4.3a	63.9±4.9a

Data expressed as mean±S.E. Means within a column followed by no common letter(s) are significantly different by Tukey Posthoc statistic at $P \leq 0.05$. DBT: Day before treatment, DAT: Days after treatment. Plot size: (3m × 2 m).

Table 3. Effects of different bio-rational insecticides against pod borer of yard long bean in terms of number of fruit (pod) set per plot

Treatments	Pods/plot by number at 7 DAT		
	1st Spray	2nd Spray	3rd Spray
Vertimec 1.8 EC	77.6±3.2c	108.3±1.9c	123.9±2.5c
Tracer 45 SC	103.0±2.8a	144.6±3.8a	165.6±3.2a
Bio-Action 1.5 SL	90.2±3.3b	126.6±2.8b	144.9±3.7b
Ecomec 1.8 EC	80.2±2.6c	112.0±2.0c	128.0±3.9c
Phytoclean	79.0±2.7c	111.3±1.4c	127.3±4.0c
Untreated control	68.0±1.1d	89.3±1.8d	95.3±0.8d

Data expressed as mean± S.E. Means within a column followed by no common letter(s) are significantly different by Tukey Posthoc statistic at $P \leq 0.05$. DAT: Days after treatment. Plot size: (3m × 2 m).

of insect pests of Lepidoptera attacking various crops without any harmful effect to other arthropods.

There were found negative correlation between the infestation rates and the yields of yard long bean, obtained from different treatments (Figure 2). The untreated control plots had the lowest marketable yield (4.2±0.3 MT/ha), while the Tracer 45 SC treated plots had the highest marketable yield (10.7±0.3 MT/ha). Plots those were treated with Bio-Action 1.5 SL, Phytoclean, Ecomec 1.8 EC, and Vertimec 1.8 EC produced 8.4±0.3 MT/ha, 7.7±0.3 MT/ha, 7.5±0.2 MT/ha and 7.1±0.3 MT/ha, respectively (Table 4). In the untreated control plot, the weight of the infested pod was the highest (5.0±0.3 MT/ha); in contrast, the plant treated with Tracer 45 SC (0.4±0.0 MT/ha) produced the least amount of infested pod. Vertimec 1.8 EC, Bio-Action 1.5 SL, Ecomec 1.8 EC, Phytoclean treated plots showed 1.5±0.1, 1.5±0.0, 1.3±0.0 and 1.0±0.0 MT/ha infested pod. Hossain (2011) studied the relationship between pod borer infestation and yield (healthy pods) of yard-long bean. The result revealed that pod borer infestation was negatively correlated with yield of yard-long bean. The relationship was significant and about 15% yield would be affected due to pod borer infestation.

The overall yield achieved from the treated plots, including the untreated control, did not differ statistically. The results showed that the overall yield of yard long bean ranged from 8.6±0.5 to 11.1±0.6 MT/ha. The plots treated with Tracer 45 SC had the highest increase in marketable yield over untreated control (106.6%), followed by Bio-Action 1.5 SL (62.2%). The Vertimec 1.8 EC treated plot had the lowest increase (36.2%) in marketable yield compared to the untreated control, followed by the Ecomec 1.8 EC (44.1%) and Phytoclean (48.7%) treated plots. Yield loss

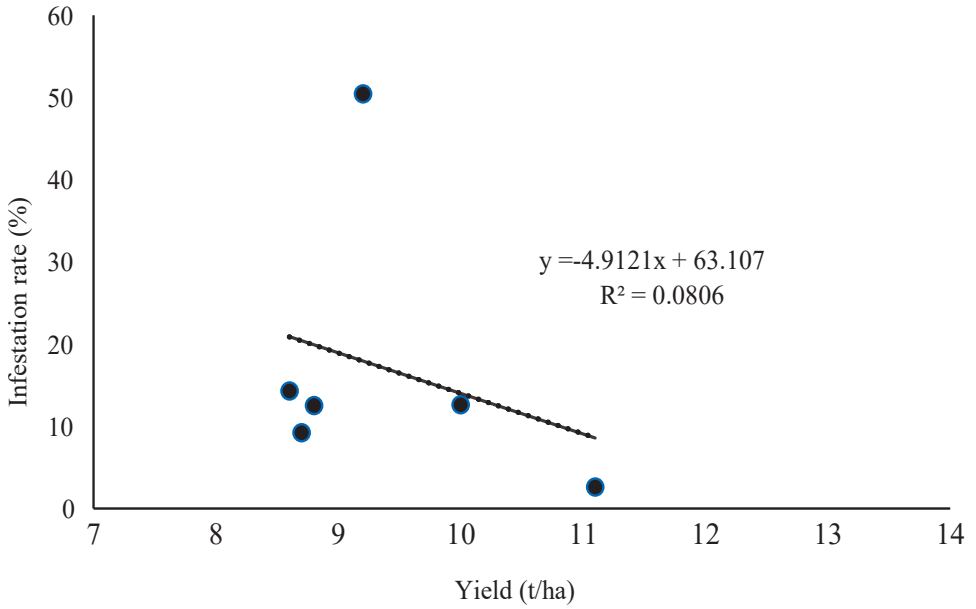


Figure 2. Relationship between the yield of different treatments and infestation rate.

Table 4. Effect of different bio-rational insecticides against pod borer of yard long bean in terms of yield (MT/ha)

Treatments	Yield (MT/ha)			Marketable yield increase over untreated control (%)
	Marketable	Infested	Total	
Vertimec 1.8 EC	7.1±0.3b	1.5±0.1b	8.6±0.5a	36.2
Tracer 45 SC	10.7±0.3a	0.4±0.0c	11.1±0.6a	106.6
Bio-Action 1.5 SL	8.4±0.3ab	1.5±0.0b	10.0±0.4a	62.2
Ecomec 1.8 EC	7.5±0.2b	1.3±0.0b	8.8±0.3a	44.1
Phytoclean	7.7±0.3b	1.0±0.0bc	8.7±0.3a	48.7
Untreated control	4.2±0.3c	5.0±0.3a	9.2±0.6a	-

Data expressed as mean±S.E. Means within a column followed by no common letter(s) are significantly different by Tukey Posthoc statistic at $P \leq 0.05$.

of yard long bean due to insect pests is reported to be about 12.3% (Hossain and Awrangzeb, 1992). Hossain (2011) found that the insecticide Ripcord 10 EC (Cypermethrin) @ 1 ml/L of water at 15 days interval revealed significantly higher amount of healthy yield of yard long bean (12.6 MT/ha) compared to untreated control.

Biorational insecticides are used to control insects by killing them or preventing them from engaging in undesirable or destructive behaviors. In the present study, the tested biorational insecticides: Vermitec 1.8 EC (Abamectin), Tracer 45 SC (Spinosad), Bio-Action 1.5 SL (Matrine), Ecomec 1.8 EC (Azadiractin) and Phytoclean (Potassium salt of fatty acid 40%) did not kill the insects just after spraying but reduced the infestation at 3 days after treatment. These insecticides have a long-time residual effect that is why infestation rates at 5 and 7 days after treatment of the biorational insecticides were significantly lower compared to untreated control. Among the tested biorational insecticides, Tracer 45 SC exerted the lowest rates of inflorescence and pod infestation, and depicted the highest yield. Therefore, management approach comprising of 3 spray of Tracer 45 SC (Spinosad) @ 0.4 g/L of water might be an effective, suitable and viable tool for suppressing pod borer attacking yard long bean.

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