



Efficacy of Selected Insecticides and Biopesticides against Spotted Pod Borer [*Maruca vitrata* (Geyer)] on Green Gram [*Vigna radiata* (L.) Wilczek]

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

A field trial was conducted at Central Research Farm (CRF), SHUATS, Prayagraj, Uttar Pradesh during the *Kharif* season of 2021. The field was laid in a Randomized Block Design (RBD) replicated thrice with seven treatments. The larval population per plant was taken as the first spray and second spray on one day before spraying and 3rd, 7th and 14th day after each spray all the treatments tested and found to significantly reduced the larval population compared to control. The results of the efficacy showed that the mean larval population recorded in the treatment Chlorantraniliprole 18.5 SC (3.45%), was most effective. The next effective treatments was Spinosad 45 SC (3.70%) followed by Emamectin benzoate (3.80%), *Metarhizium anisopliae* (4.00%), Neem oil (4.15%), Karanj oil (4.30%) as compared to Control (7.10%). The best and most economical treatment in terms of yield and B: C ratio was Chlorantraniliprole 18.5SC (20.98q/ha and 1:3.99). It was followed by Spinosad 45SC (20.62 q/ha and 1:3.92). Emamectin benzoate 5% SG (17.45 q/ha and 1:3.84), *Metarhizium anisopliae* (17.01 q/ha and 1:3.83), Neem oil 5% (16.6 q/ha and 1:3.61), Karanj oil 5% (15.13 q/ha and 1:3.46), as compared to control (9.5q/ha and 1:2.28).

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1. INTRODUCTION

Green gram is one of the main pulse crops in India, it is widely cultivated throughout Asia, including India. Green gram is an excellent source of high-quality protein (25%) having high digestibility. It is consumed as whole grains as well as "Dal" in a variety of ways in our food. Green gram is also used as a green manuring crop. It is a leguminous crop that has the capacity to fix atmospheric nitrogen (30-40 kg N/ha). It also helps in preventing soil erosion. These crops grow quickly, generate good profit for farmers and contribute to agricultural and environmental sustainability [1].

Green gram is highly nutritious pulse which contains 24 percent of high-quality protein, 1.3 percent fats, 56.6 percent carbohydrates, and 3 percent dietary fibers. It is rich in minerals having 140 mg calcium, 8.4 percent iron, and 280 mg phosphorous. It also contains 0.47 mg vitamin B1, 0.39 mg vitamin B2, and 2 mg niacin. It has a calorific value of 334 calories per 100 g of edible protein [2]. India is the world's largest producer as well as consumer of green gram. It produces about 1.5 to 2.0 million tons of mung bean annually from about 3 to 4 mha of area with average productivity of 500 kg per ha. Green gram output accounts for about 10-12 % of total pulse production in the country. Legume pod borer *Maruca vitrata* is the most formidable and potential pest that causes extensive damage to green gram under field conditions. The low yield of green gram is attributed to the regular outbreaks of spotted pod borer, *Maruca vitrata*. Because of its extensive host range and destructiveness, it became a persistent pest in green gram. It is known to cause an economic loss of 20 - 25 % and yield loss of 2- 84% in green gram and account for US \$ 30 million. It is also reported that 20– 30% of pod damage in green gram is caused due to spotted pod borer [3].

2. MATERIALS AND METHODS

The experiment was conducted during *Kharif* season 2021 at Central Research Farm (CRF), SHUATS, Prayagraj (U.P). The study was laid out in a Randomized Block Design (RBD) which was replicated thrice. Each main block was divided into 7 sub-plots of 2m x 2m size with maintaining 25cm borders as bunds and treatments were assigned randomly. The spraying of botanical and conventional

insecticides were applied at the initial incidence of spotted pod borer with two consecutive sprays. All the spraying was done by using a knapsack sprayer at 15 days intervals. The insecticides and biopesticides include T₃-Chlorantranilprole 18.5 SC @0.5ml/l, T₂-Spinosad 45 SC @1ml/l, T₄ -Emamectin benzoate 5% SG @0.04gm/l, T₁-*Metarhizium anisopliae* (1x10⁸CFU/ml) @5ml/l, T₅-Neem oil @5% 50ml/l, T₆-Karanj oil @5% 50ml/l and T₇-control. The green gram yield was recorded from the plot and converted into quintal per ha.

3. RESULTS AND DISCUSSION

After the application of the treatments, the spotted pod borer larval population was significantly decreased in all treated plots in comparison to untreated control. At the first spray, the effect of Chlorantranilprole 18.5 SC was found effective against *Maruca vitrata* with 3.63 percent larval population as compared to the untreated control (6.20%). It was followed by the next effective treatments of Spinosad 45 SC (4.03%), Emamectin benzoate 5% SG (4.06%), *Metarhizium anisopliae* (4.26%), Neem oil 5% (4.40%) and Karanj oil 5% (4.56%) which was the least effective among all the treatments.

The data on the larval population of spotted pod borer recorded at three, seven and fourteen days after the second spray revealed Chlorantranilprole 18.5 SC proved to be the most effective against *Maruca vitrata* with (3.30%) larval population as compared to the untreated control (8.00 %). The next effective treatments were Spinosad 45 SC (3.46%), Emamectin benzoate 5% SG (3.63%), *Metarhizium anisopliae* (3.80%), Neem oil 5% (3.96%) and Karanj oil 5% (4.16%) which was the least effective among all the treatments.

Muchhadiya et al. [4] and Dadas et al. [5] reported that chlorantranilprole was superior in reducing the larval population of spotted pod borer. Spinosad 45 SC is found to be the next best treatment which is in line with the findings of Umbarkar and parsana [6] and Lakshmi et al. [7] who reported that Spinosad 45 SC was found most effective in reducing the larval population of Greengram spotted pod borer as well as increasing the yield. Emamectin benzoate 5% SG is found to be the next best treatment which is in line with the findings of Kishor et al. [8] and Haripriya et al. [9]. *Metarhizium anisopliae* is found to be the next effective treatment which is in

Table 1. Efficacy of selected insecticides and biopesticides against spotted pod borer, *Maruca vitrata* on green gram during Kharif 2021

S. No.	Treatments	No. of Larval population of <i>M. vitrata</i>								Overall Mean	Yield (q/ha)	B: C ratio	
		First spray				Second spray							
		1DBS	3DAS	7DAS	14DAS	MEAN	3DAS	7DAS	14DAS				MEAN
T1	<i>Metarhizium anisopliae</i> (1X10 ⁸ CFU/ml) @ 5ml/l	4.8	4.6 ^{bcd}	4.0 ^{bc}	4.2 ^{cd}	4.26 ^{bc}	4.1 ^{cd}	3.5 ^{cd}	3.8 ^c	3.80 ^{bcd}	04.00	17.01	1:3.83
T2	Spinosad 45SC @ 1ml/l	4.8	4.3 ^d	3.8 ^c	4.0 ^e	4.03 ^{cd}	3.7 ^e	3.2 ^e	3.5 ^{de}	3.46 ^{cd}	03.70	20.62	1:3.92
T3	Chlorantraniliprole 18.5SC @0.5ml/l	4.8	3.8 ^e	3.4 ^d	3.7 ^f	3.63 ^d	3.5 ^e	3.1 ^e	3.3 ^e	3.30 ^d	03.45	20.98	1:3.99
T4	Emamectinbenzoate 5% SG @ 0.04gm/l	4.6	4.4 ^{cd}	3.8 ^c	4.0 ^{de}	4.06 ^{bcd}	4.0 ^d	3.3 ^{de}	3.6 ^d	3.63 ^{bcd}	03.80	17.45	1:3.84
T5	Neem oil 5% @ 50ml/l	5.0	4.6 ^{bc}	4.2 ^b	4.4 ^{bc}	4.40 ^{bc}	4.3 ^{bc}	3.7 ^{bc}	3.9 ^{bc}	3.96 ^{bc}	04.15	16.6	1:3.61
T6	Karanj oil 5% @ 50ml/l	4.8	4.8 ^b	4.3 ^b	4.6 ^b	4.56 ^b	4.5 ^b	3.9 ^b	4.1 ^b	4.16 ^b	04.30	15.13	1:3.46
T7	Control	4.9	5.6 ^a	6.2 ^a	6.8 ^a	6.20 ^a	7.4 ^a	8.0 ^a	8.6 ^a	8.00 ^a	07.10	9.5	1:2.28
	F- test	NS	S	S	S	S	S	S	S	S	S	-----	-----
	C. D. (P = 0.05)	-	00.27	00.27	00.25	00.52	00.20	00.24	00.23	00.54	00.52	-----	-----
	C.V	04.58	03.32	03.56	03.10	06.61	02.58	03.31	03.01	07.05	13.78	-----	-----

line with the findings of Singh and Singh. [10]. Neem oil 5% is found to be the next effective treatment which is in line with the findings of Berani et al. [11] and Srinivasan and Sridhar [12]. Karanj Oil 5% (4.16%) was the least effective among all the treatments and these findings were supported by Mandawi et al. [13].

The data on grain yield of green gram obtained from various treatments revealed that the highest yield (20.99 q/ha) was obtained from the treatment of Chlorantraniliprole 18.5 SC followed by Spinosad with 20.62 q/ha, Emamectin benzoate, *Metarhizium anisopliae*, Neem oil and Karanj oil which recorded the yield 17.48q/ha, 17.01q/ha, 16.6 q/ha and 15.13 q/ha, respectively. Considering the cost-benefit ratio of these treatments, Chlorantraniliprole 18.5 SC gave the highest cost-benefit ratio of 1:3.99 followed by Spinosad 45 SC with 1:3.92, Emamectin benzoate with 1:3.84, *Metarhizium anisopliae* with 1:3.83, Neem oil with 1:3.61 and Karanj oil with 1:3.46.

The Yield and Benefit ratio of green gram shows the highest efficiency in Chlorantraniliprole 18.5SC was supported by Sreekanth et al. [14] followed by Spinosad 45SC was supported by Lakshmi et al. [7] and Meena et al. [15]. Emamectin benzoate and *Metarhizium anisopliae* were supported by Singh and Singh [10] and the results of Neem oil 5% and Karanj oil 5% were supported by Malik et al. [16].

4. CONCLUSION

It concluded that among the insecticides and biopesticides Chlorantraniliprole 18.5 SC proved to be most effective and can be recommended for the management of *Maruca vitrata* on a Green gram as the most effective and economical. Similarly, the use of Spinosad 45 SC, Emamectin benzoate 5 SG, *Metarhizium anisopliae* and Neem oil 5% can be recommended for management. Using Karanj oil 5% did not appear to be an effective means of managing green gram spotted pod borer. As a result, this plant product can also be effective as a treatment from an IPM point of view since it reduces pollution.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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