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Efficacy and Economics of Selected Insecticides against Spotted Pod Borer, *Maruca vitrata* (Fab.) in Cowpea

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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 trail was conducted at Naini, Prayagraj during *Kharif* season 2023 at central research farm, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, in Randomized Block Design with eight treatments replicated thrice times were evaluated against *Maruca vitrata i.e*. Spinosad45%SC, Azadirachtin 0.03% WSP (300ppm), Profenofos 40%+ Cypermethrin 4%EC, Nisco sixer plus, *Beauveria bassiana*1.15%WP, Emamectin Benzoate 5%SG, Spinosad45%SC + Neem oil5% and Control. Results revealed that, among the different treatments lowest larval population of cowpea spotted pod borer was recorded in Emamectin Benzoate 5%SG (0.95), Spinosad45%SC (1.15) was found to be the next best treatment followed by Profenofos 40%+ Cypermethrin 4%EC (1.35), Spinosad45%SC + Neem oil5% (1.64) and Nisco sixer plus (1.75), *Beauveria bassiana*1.15 %WP, (1.95) whereas Azadirachtin 0.03% WSP (300ppm) (2.15) was found to be least effective against this pest. The plot treated with Emamectin Benzoate 5%SG show highest yield (36.66 q/ha) followed by Spinosad45%SC (34.83 q/ha), Profenofos 40%+

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Cypermethrin4%EC (33.66 q/ha), Spinosad45%SC + Neem oil5% (32.48q/ha), Nisco sixer plus (28.30 q/ha), *Beauveria bassiana*1.15 %WP (27.60q/ha) and Azadirachtin 0.03% WSP (26.05q/ha) as compared to control plot (16.85 q/ha). Among the treatments the best and most economical treatment was Emamectin Benzoate 5%SG (1:3.55) followed by Spinosad 45%SC (1:3.11), Profenofos 40%+ Cypermethrin4%EC (1:3.24), Spinosad45%SC + Neem oil5% (1:2.71), Nisco sixer plus (1:2.39), *Beauveria bassiana*1.15 %WP (1:2.34) and Azadirachtin 0.03% WSP (1:2.16) as compared to control plot (1:1.20).

Keywords: Cost- benefit ratio; cowpea; efficacy; insecticides; larval population; Maruca vitrata.

1. INTRODUCTION

"Cowpea *(Vigna unguiculata* L.) is an important legume crop that belongs to family leguminosae. It is having diploid number of chromosomes 2n= 22. It is named as black-eye bean or Southern pea, chola, lobia, barbati in various languages of in India. It is an annual herbaceous legume from the genus Vigna" [1].

"The amount of protein in cowpea contains relatively high amounts of the essential amino acids, lysine and tryptophan, and thus usefully compliments the protein supply by cereals, in which the contents of lysine and tryptophan are relatively high. The protein content may probably reach 35%, consisting of 90% water soluble globulins and 10% water soluble albumins"[2-4]. "It is therefore, a cheap source of protein and carbohydrates that can be afforded even by the poor among the population" [5].

"In India, the major area under grain cowpea is mainly confined to the states of Uttar Pradesh, Karnataka, Tamil Nadu, Andhra Pradesh and Kerala where, it is mainly sown as a mixed crop with other pulses and cereals" [6]. "In India cowpea is grown over an area about 58000 ha with an average production of 4.8 lakh tons and average productivity is 8.44 t/ha. During 2022-23 the total coverage under cowpea in Uttar Pradesh 16900 ha with a production will be around 113200 tones and the productivity 6.70t/ha" [7].

"The spotted pod borer which is also known as *Maruca vitrata* (Lepidoptera:Crambidae) is a serious pest of legumes in the tropics and subtropics because of its extensive host range, distribution and destructiveness, Which causes damage by webbing often leaf axils, flower buds and pods. There are about 21 insect pests of different groups that have been recorded damaging the cowpea crop from germination to maturity. Host range on various legume crops like pigeonpea, cowpea, mungbean and urdbean. greengram, blackgram, cowpea, pigeonpea and groundnut (legumes), daincha and sunhemp (green-manuring crops) have been reported to act as alternative hosts for *M. vitrata"* [8].

2. MATERIALS AND METHODS

Field experiment was carried out at the Central Research Farm of Sam Higginbottom University of Agriculture Technology and Sciences, Prayagraj, U.P. during *kharif* season 2023. Trail was laid out in randomised block design consisting of eight treatments including control. Each treatment was replicated three times using variety Kashi kanchan in a plot size of (2 m × 1 m) maintaining 30 cm borders as a bund with total gross area 153 m^2 along with a recommended package of practices excluding plant protection. In the experiment, eight different treatments used viz., Spinosad 45% SC (150 ml/lit), Profenofos 40% + Cypermethrin 4% EC (50 ml/lit) Nisco sixer plus (1000 ml/lit), *Beauveria bassiana*1.15 %WP (1500 gm/lit), Emamectin Benzoate 5% SG (150 gm/lit), Spinosad 45% SC + Neem oil 5% (150ml+1250ml/lit), Azadirachtin 0.03%WSP (300ppm) (1500ml/lit) and Control. were tested to compare the efficacy against *Maruca vitrata* and their influences on yield of Cowpea.

"Pest population was estimated by observing five plants selected randomly from each treatment for presence of egg masses and larvae at one day prior to insecticide application and at 3rd, 7th and 14th days after each application. The percent infestation over control against Spotted pod borer (*Maruca vitrata*) was calculated by considering the mean of three observations recorded at 3rd, 7th and 14th days after first and second spraying" [9].

For larval population record,

Larval population= $\frac{\text{Total no.of larva}}{\text{5 randomly selected plant}}$ (Mohanty and Tayde.[10])

Cost benefit ratio: "The net benefit is obtained by subtracting the total cost of plant protection from total income. Benefit over the control for each sprayed treatment was obtained by subtracting the income of the control treatment from that of each sprayed treatment" [9]. The B:C ratio was calculated by formula:

Gross return = Marketable yield × Market price

Net return = Gross return – Total cost

C: B Ratio = $\frac{\text{Net return}}{\text{Total cost of cultivation}}$(Jagtap et al.) [11]

Where**,**

CBR = Cost Benefit Ratio

3. RESULT AND DISCUSSION

The results of the field trial with biopesticides and chemicals revealed that all the treatments were significantly superior over the control. (Table no.1). The data on the mean larval of spotted pod borer moth *Maruca vitrata*in cowpea 3rd, 7thand 14th day after first spray revealed that the treatments were significantly superior over control. Among all the treatments lowest population was recorded in Emamectin Benzoate 5%SG (0.95), Spinosad45%SC (1.15) was found to be the next best treatment followed by Profenofos 40%+ Cypermethrin 4%EC (1.35), Spinosad 45%SC + Neem oil 5% (1.64), Nisco sixer plus (1.75), Beauveria *bassiana*1.15 %WP (1.95) and Azadirachtin 0.03%WSP (300ppm) (2.15) was found to be least effective but comparatively superior over the control. The highest yield was recorded in Emamectin Benzoate 5%SG (36.66q/ha) followed by Spinosad45%SC (34.83q/ha), Profenofos 40%+ Cypermethrin 4%EC (33.66q/ha), Spinosad45%SC + Neem oil 5% (32.48 q/ha), Niscosixer plus (28.30q/ha), *Beauveria bassiana*1.15 %WP (27.60q/ha) and Azadrachtin 0.03% WSP (300ppm) (26.05 q/ha) as compared to control plot (16.85q/ha). Among the treatments studied, the best and most economical treatment was Emamectin Benzoate 5%SG (1:3.55) followed by Spinosad45%SC (1:3.11), Profenofos 40%+ Cypermethrin 4%EC (1:3.24), Spinosad 45%SC + Neem oil 5% (1:2.71), Niscosixer plus (1:2.39), *Beauveria bassiana*1.15 %WP (1:2.34) and Azadirachtin 0.03%WSP (300ppm) (1:2.16) as compared to control plot (1:1.20).

Table1. Efficacy and economics of selected insecticides against larval population of spotted pod borer in cowpea (overall mean)

S. No.	Name of treatments	Dosages	Larval population	Larval population of *M. vitrata*/ 5 plants				Yield (q/ha)	(C:B) Cost benefit ratio
			(Day before spraying)	3rdDAS	7thDAS	14thDAS	Mean		
T1	Spinosad 45%SC	150 ml/lit	2.60	1.66	1.00	0.80	1.15	34.83	1:3.11
T2	Azadirachtin 0.03%WSP (300ppm)	1500ml/lit	2.53	2.66	2.00	1.80	2.15	26.05	1:2.16
T3	Profenofos 40% + Cypermethrin 4%EC	50ml/lit	2.67	1.86	1.20	1.00	1.35	33.66	1:3.24
T4	Niscosixer plus	1000ml/lit	2.80	2.26	1.60	1.40	1.75	28.30	1:2.39
T5	*Beauveria bassiana*1.15 %WP	1500gm/lit	2.60	2.46	1.80	1.60	1.95	27.60	1:2.34
T6	Emamectin Benzoate 5 %SG	150gm/lit	2.53	1.46	0.80	0.60	0.95	36.66	1:3.55
T7	Spinosad 45%SC + Neem oil 5%	150ml+1250ml/ lit	2.60	2.06	1.40	1.20	1.64	32.48	1:2.71
T8	control		2.93	3.13	3.53	3.73	3.46	16.85	1:1.20
F-test		……	**NS**	**S**	**S**	**S**	**S**		
C. D. (P= 0.05)		……	……	0.072	0.143	0.143	0.469	0.011.	

DBS- Day Before Spraying, DAS- Day After Spraying, NS- Non- Significant, S- Significant

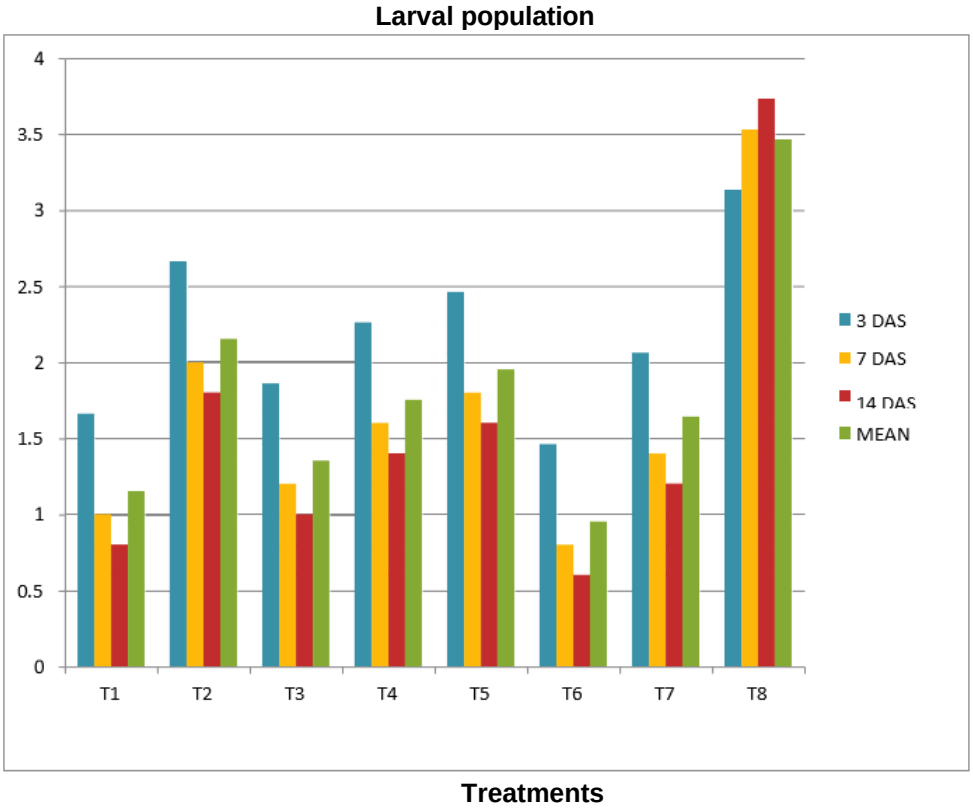

Fig. 1. Efficacy and economics of selected insecticides against larval population of spotted pod borer in cowpea

Among all the treatments lowest population of *Maruca vitrata* was recorded in Emamectin Benzoate 5%SG (0.95) Similar findings were made by Patel et al. [12] Spinosad45%SC (1.15) is found to be the next best treatment which is in line with the findings of Yadav et al. [13] who reported that Spinosad45%SC was found to be most effective in reducing larval population of *Maruca vitrata.* Profenofos 40%+ Cypermethrin 4%EC (1.35) was the next effective treatment in reducing the population of *larva* which is in line with the findings of Salunkhe and Dodia[14] Muchhadiyaet al.[15] and *Beauveria bassiana*1.15 %WP found to be least effective was found in findings of Kumar and Tayde [6] Azadirachtin0.03%WSP (300ppm) (2.15) findings are supported by Krishna and Kumar [16] but comparatively superior over the control.

Among all the treatments studied, the best and most economical treatment was Emamectin Benzoate 5%SG (1:3.55) similar findings made by by Singh et al.[17] Patel et al. [18] followed by Spinosad 45%SC (1:3.11) which is in line with the findings of Meena et al. 19] The least benefit cost ratio was observed in Azadirachtin 0.03%WSP (300ppm) (1:2.16) similar findings made by Kumar and Kumar [20] and but superior as compared to control plot (1:1.20).

From the above discussion, it concluded that among the tested insecticides, Emamectin Benzoate 5%SG recommended for most economic and effective management of the spotted pod borer, *Maruca vitrata*in cowpea.

4. CONCLUSION

From the analysis of the present findings, it can be concluded that Emamectin Benzoate 5%SG is more effective in controlling population of cowpea spotted pod borer and provide reliable results, followed by Spinosad 45%SC was found to be the next best treatment followed by, combination of Profenofos 40%+ Cypermethrin 4%EC effective, Spinosad45% SC + Neem oil 5% these both components enhance the pest control, Nisco sixer plus, *Beauveria bassiana*1.15 %WP and Azadirachtin 0.03%WSP (300ppm) in managing *Maruca vitrata.* Among all the treatments, Emamectin Benzoate 5%SG gave the highest cost benefit ratio (1:3.55) and marketing yield (36.66q/ha) followed by Spinosad45%SC(1:3.11) and yield (34.83q/ha)

Profenofos 40%+ Cypermethrin 4%EC (1:3.24 and 33.66q/ha), Spinosad45%SC+ Neem oil 5% (1:2.71 and 32.48 q/ha), Nisco sixer plus (1:2.39 and 28.30 q/ha), *Beauveria bassiana*1.15 %WP (1:2.34 and 27.60 q/ha) and Azadirachtin 0.03% WSP (300ppm) (1:2.16 and 26.05 q/ha) as such more trials are required in future to validate the findings.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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