The Pharma Innovation Journal 2023; 12(5): 2191-2193

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(5): 2191-2193

www.thepharmajournal.com
Received: 08-03-2023
Accepted: 20-04-2023

Dhananjay Venkatrao Patil
Department of Entomology, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India

Usha Yadav
Department of Entomology, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India

Corresponding Author:
Dhananjay Venkatrao Patil
Department of Entomology, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India

Efficacy of Bio-pesticides against *Helicoverpa armigera* (Hubner) on cowpea (*Vigna unguiculata* L.)

Dhananjay Venkatrao Patil and Usha Yadav

Abstract
A field experiment was conducted during *kharif* 2022 at Central Research Farm, SHUATS (Sam Higginbottom University of Agriculture, Technology and Sciences), Prayagraj, Uttar Pradesh (India). Randomized Block Design with eight treatments and replicated thrice. The Result showed that the effects of biopesticides against *Helicoverpa armigera*, among the different treatments, the lowest larval population of cowpea pod borer was recorded in *Bacillus thuringinsis* (1×10^8 CFU) (1.334*). Beauveria bassiana* 1.15% SG (1.445) was found as the next best treatment followed by Neem oil 1500ppm (1.511), *HaNPV* (1×10^9) (1.600) and NSKE10% (1.667), *Metarhizium anisopliae* 1×10^8 CFU (1.756) whereas Azadirachtin (10000ppm) (1.834) was found to be least effective against this pest. Among the treatments studied, *Bacillus thuringiensis* ($1x10^8$ CFU) gave the highest cost benefit ratio (1:4.30) and marketing yield (18.46 q/ha) followed by *Beauveria bassiana* 1.15% SG (1:3.84 and 16.78 q/ha), Neem oil 1500ppm (1:3.47 and 15 q/ha), *HaNPV* ($1x10^9$ POB) (1:2.90 and 12.20 q/ha), NSKE 10% (1:2.67 and 11.54 q/ha), *Metarhizium anisopliae* $1x10^8$ CFU (1:2.31 and 10.80 q/ha) and Azadirachtin (10000 ppm) (1:2.05 and 9.20 q/ha).

Keywords: Cost-benefit ratio, efficacy, insecticides, Helicoverpa armigera, larval population

Introduction

Cowpea [*Vigna unguiculata* (L.) Walp.] is an important grain legume mainly grown in tropical and subtropical regions for vegetables, grains, and fodder. Cowpea belongs to the family *Fabaceae* and sub-family *Faboidea*, and it is a self-pollinating crop with low and narrow genetic diversity, making it susceptible to various environmental factors (Horn *et al*., 2022) [4].
The protein of cowpea contains relatively high amount 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 (Konda and Kumar, 2022) [8]. The grain contains 26.61% protein, 3.99% lipid, 56.24% carbohydrates, 8.60% moisture, 3.84% ash, 1.38% crude fibre, 1.51% gross energy, and 54.85% nitrogen free extract (Oyewale *et al*., 2014) [14].
Cowpea is grown across the world on an estimated 14.5 million ha of land planted each year and the total annual production is 6.2 million metric tons. Over the last three decades, global cowpea production grew at an average rate of 5%, with 3.5% annual growth in area and 1.5% growth in yield, and the area expansion accounting for 70% of the total growth during this period. India accounts for about 0.5 MT production from around 1.5 m.ha. 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. (Lakshmikanth and Kumar 2018) [10]. (Kebede and Bekeko 2020) [7].
Cowpea is a hardy crop but it hosts many insect pests that attack vegetables. These include leaf miners, whiteflies (*Bemisia tabaci*), leafhoppers (*Empoasca sp*.), mites (*Tetranychus* spp.), thrips (*Megalurothrips sjostedti*), *Ootheca sp*., *Clavigralla sp*., *Maruca sp*. and aphids (*Aphis craccivora*) (Oyewale *et al*., 2014) [14].
Helicoverpa armigera is the major damaging pest in areas where cowpea is grown. It completes its life cycle (from egg to adult) in 4-5 weeks at an average temperature of 28 ^{0}C. Adult insects having stout bodies with broad thorax are named as moth. A female moth can lay up to 3000 eggs. Eggs are generally laid on leaves, pods and flowers. 1st to 3rd instarzlarvae generally feed on leaves, twigs and flowers (Mahmood *et al*., 2021) [11].
The attack of this pest begins right from vegetative stage and continue up to maturity. Young larvae of *Helicoverpa armigera* feeds on leaf lets, buds, flowers and pods of chickpea (Mandal and Roy, 2012) [12].

While the later instars make a more or less circular hole in the pods and insert its head and former portion of body into it and feed upon the developing grains. A single caterpillar of this insect can damage 25- 40 pods. It causes on average 30-40% damage to pods that can increase up to 80-90% under favourable environmental conditions (Chithraleka *et al*., 2018) [2].

In the concern of increasing the yield of vegetables by means of high demand, farmers rely on regardless usage of fertilizers and pesticides, it causes the impact on the environment and its sustainability in agro ecosystem. Due to these limitations, there was need to find alternative control measures with different modes of action that would be effective, user and environment ecofriendly. In attempt to curb the pests' population with synthetic pesticides evidence of irrational usage, the present investigation was undertaken to evaluate the efficacy of bio- pesticides against (*Helicoverpa armigera*) on cowpea (*Vigna unguiculata*).

Materials and Methods

The experiment was conducted at the experimental research plot of the Department of Entomology, Central Research Farm, Sam Higginbottom University of Agriculture Technolo gy and Sciences, during the *Kharif* season of 2022, in a Randomized Block Design with eight treatments replicated three times using variety Kashikanchan seeds in a plot size of 2m×2m at a spacing of 30cm×15cm with a recommended package of practices excluding plant protection. The soil of the experimental site was well drained and medium high. Research field situated at $25^{0}27$" North latitude $80^{0}05$" East longitudes and at an altitude of 98 meter above sea level. The maximum temperature reaches up to 47 ^{0}C in summer and drops down to 2 ^{0}C in winter.

Pest population was estimated by observing five plants selected randomly from each treatment for presence of Larval population 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 pod borer (*Helicoverpa armigera*) was calculated by considering the mean of three observations recordedat 3rd, 7th and 14th days after first and second spraying.

The healthy marketable yield obtained from different treatments was collected separately and weighed. The cost of insecticides used in this experiment was recorded during *kharif* season. The cost of botanicals used was obtained from nearby market. The total cost of plant protection consisted of cost of treatments, sprayer rent and labour charges for the spray. There are two sprays throughout the research period and the overall plant protection expenses was calculated. Total income was realized by multiplying the total yield per hectare by the prevailing market price, while 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. The B:C ratio was calculated by formula:

Gross return = Marketable yield × Market price
Net return = Gross return – Total cost

$$\text{Benefit cost Ratio} = \frac{\text{Gross return}}{\text{Total}}$$

Results and Discussion

The Data on larval population of *Helicoverpa armigera* on three days after first spray revealed that all the treatments were significantly superior over control. Among all the treatments, the plot treated with T2 *Bacillus thuringiensis* (1x10^{8} CFU) (1.556) proved most effective. T1 *Beauveria bassiana* 1.15% SG (1.667) was the next best treatment followed by T5 Neem oil 1500ppm (1.733), T3 *HaNPV* (1x10^{9} POB) (1.800), T7 NSKE 10% (1.867), T4 *Metarhizium anisopliae* 1x10^{8} CFU (1.933) and T6 Azadirachtin (10000 ppm) (2.022) which was least affective among all the treatments. After second spray, all the insecticide were found superior over untreated control. The overall mean analysis showed that *Bacillus thuringiensis* (1x10^{8} CFU) *(*1.334), *Beauveria bassiana* 1.15% SG (1.445), Neem oil 1500 PPM (1.511) *HaNPV* (1x10^{9} POB) (1.600), NSKE10% (1.667), *Metarhizium anisopliae*1x10^{8} CFU (1.756), Azadirachtin (10000 ppm) (1.834)

Jerusha and Thakur (2018) [6] and Meena *et al.*, (2018) who reported that *Bacillus thuringiensis* was the most effective treatment indicating recorded lowest population of pod borer (*Helicoverpa armigera*). *Beauveria bassiana* 1.15% SG (1.445) is found to be the next best treatment which is in line with the findings of Moosan and Kumar (2022) [13], Kumar *et al*., (2022) [9], Sai *et al.*, (2021) [16] and Hirapara *et al.*, (2019) [3] who reported that *Beauveria bassiana* 1.15% SG was found to be most effective in reducing population of *Helicoverpa armigera* as well as increasing the yield. The yields among the different treatments were significant. The highest yield was recorded in *Bacillus thuringiensis* (1x10^{8} CFU) (18.46 q/ha) these findings were supported by Yerrabala *et al.*, (2021) [18], Sai *et al.*, (2021) [16], Abbas *et al*., (2021) [1] and Singh *et al.*, (2016) [17] followed by *Beauveria bassiana* 1.15% SG (16.78 q/ha) these findings were supported by Hirapara *et al.*, (2019) [3], Kumar *et al*., (2022) [9], Jagtap *et al*., (2020) [5] and Choudhary *et al.*, (2017).

Table 1: Efficacy of Bio-pesticides against larval population on cowpea (overall mean)

S. No.	Treatments	Population of *H. armigera* /five plants								Yield (q/ha)	B:C ratio
		First spray				Second spray			Overall mean		
		1 DBS	3 DAS	7 DAS	14 DAS	3 DAS	7 DAS	14 DAS			
T_1	*Beauveria bassiana* 1.15% SG	2.200	1.733	1.600	1.667	1.533	1.200	0.933	1.445	16.78	1:3.84
T_2	*Bacillus thuringiensis* (1×10^{8} CFU)	2.267	1.667	1.467	1.533	1.400	1.133	0.800	1.334	18.46	1:4.30
T_3	*HaNPV* (1×10^{9} POB)	2.133	1.867	1.733	1.800	1.667	1.400	1.133	1.600	13.20	1:2.90
T_4	*Metarhizium anisopliae* 1×10^{8} CFU	2.200	2.000	1.867	1.933	1.800	1.600	1.333	1.756	10.80	1:2.31
T_5	Neem oil 1500ppm	2.333	1.800	1.667	1.733	1.600	1.267	1.000	1.511	15	1:3.47
T_6	Azadirachtin (10000 ppm)	2.267	2.133	1.933	2.000	1.867	1.667	1.400	1.834	9.20	1:2.05
T_7	NSKE 10%	2.400	1.933	1.800	1.867	1.733	1.467	1.200	1.667	11.54	1:2.67
T_8	Control	2.333	2.400	2.467	2.533	2.600	2.667	2.733	2.567	7.82	1:1.96

	F-test	NS	S	S	S	S	S	S	S		
	S. Ed (±)	-----	0.072	0.067	0.072	0.067	0.057	0.050	0.020		
	C.D. (P = 0.5)	-----	0.155	0.146	0.160	0.146	0.118	0.108	0.058		

DBS – Day before Spray
DAS – Day after Spray

Conclusion

From the analysis of the present findings, it can be concluded that *Bacillus thuringiensis* ($1x10^8$ CFU) is more effective in controlling population of cowpea pod borer followed by *Beauveria bassiana* 1.15% SG was found to be the next best treatment followed by Neem oil 1500ppm, *HaNPV* ($1x10^9$ POB), NSKE 10%, *Metarhizium anisopliae* $1x10^8$ CFU (1.756) and Azadirachtin (10000 ppm) in managing *Helicoverpa armigera*. Among the treatments studied, *Bacillus thuringiensis* ($1x10^8$ CFU) gave the highest cost benefit ratio (1:4.30) and marketing yield (18.46 q/ha) followed by *Beauveria bassiana* 1.15% SG (1:3.84 and 16.78 q/ha), Neem oil 1500ppm (1:3.47 and 15 q/ha), *HaNPV* ($1x10^9$ POB) (1:2.90 and 12.20 q/ha), NSKE 10% (1:2.67 and 11.54 q/ha), *Metarhizium anisopliae* $1x10^8$ CFU (1:2.31 and 10.80 q/ha) and Azadirachtin (10000 ppm) (1:2.05 and 9.20 q/ha) as such more trials are required in future to validate the findings.

References

1. Abbas A, Usman M, Arshad F, Ali M, Arshad MW, Iqbal A, *et al*. Efficacy of different insecticides against gram pod borer (*Helicoverpa armigera*) and their safety to the beneficial fauna, International Journal of Biosciences. 2021;18(2):82-88.
2. Chitralekha, Yadav GS, Verma T. Efficacy of insecticides against *Helicoverpa armigera* on chickpea Journal of Entomology and Zoology Studies. 2018;6(3):1058-1061.
3. Hirapara IM, Jethva DM, Patel DS, Desai AV. Bio-efficacy of *Beauveria Bassiana* (Balsamo) vuillemin against *Helicoverpa armigera* (hubner) and *Spodoptera litura* (Fabricius) in groundnut under laboratory condition. International Journal of Conservation Science. 2019;7(6):2409-2412.
4. Horn LN, Selma NN, Ueitele I. Cowpea Production Challenges and Contribution to Livelihood in Sub-Saharan Region. Agricultural Sciences. 2022;13:25-32.
5. Jagtap TB, Ugale MV, Chavan VT. Incremental Cost Benefit Ratio (ICBR) and Economics of different biopesticides and insecticides treatments on chickpea (*Cicer arietinum*) for management of *Helicoverpa armigera* (Hubner). Journal of Pharmacognosy and Phytochemistry. 2020;9(5):373-378.
6. Jerusha E, Thakur S. Integrated approaches for the management of gram pod borer *Helicoverpa armigera* (Hubner) in chickpea. Journal of Entomology and Zoology Studies. 2018;6:1748-1750.
7. Kebede E, Bekeko Z. Expounding the production and importance of cowpea (*Vigna unguiculata* (L.) Walp.) in Ethiopia. Cogent Food and Agriculture. 2020;6(1):769-805.
8. Konda JSD, Kumar A. Efficacy and economics of selected biopesticides against pod borer [*Helicoverpa armigera* (Hubner)] on cowpea. The Pharma Innovation Journal. 2022;11(5):1395-1398.
9. Kumar ST, Kumar A. Field efficacy of insecticides with neem products against chickpea pod borer [*Helicoverpa armigera* (Hubner)]. The Pharma Innovation Journal. 2022;11(6):1238-1241.
10. Lakshmikanth R, Kumar A. Comparative efficacy of selected chemicals and Biopesticides against gram pod borer [*Helicoverpa armigera* (Hubner)] (Lepidoptera: Noctuidae) on cowpea [*Vigna unguiculata* (L.) Walp.]. Journal of Pharmacognosy and Phytochemistry. 2018;7(3):3307-3309.
11. Mahmood MT, Akhtar M, Ahmad M, Saleem M, Aziz A, Rasool I, *et al*. An Update on Biology, Extent of Damage and Effective Management Strategies of Chickpea Pod Borer (*Helicoverpa armigera*), Pakistan Journal of Agricultural Research. 2021;34(1):91-101.
12. Mandal SK, Roy SP. Impact of environmental factor (s) on certain pulse crops of north-eastern Bihar (India) with reference to resource management. The Ecoscan. 2012;1:35-40.
13. Moosan M, Kumar A. Efficacy and economics of different insecticides against gram pod borer, *Helicoverpa armigera* (Hubner). The Pharma Innovation Journal. 2022;11(7):4471-4474.
14. Oyewale RO, Bamaiyi LJ, Oparaeke AM, Adamu RS. Evaluation of four insecticide formulations for the management of insect pests of cowpea. African Journal of Food Science and Technology. 2014;5(8):180-188.
15. Rahman AKMZ, Haque MA, Alam SN, Dutta NK. Efficacy of Microbials as Insecticides for the management of Tomato (*Lycopersicon esculentum*) Fruitworm, *Helicoverpa armigera* (Hubner). The Agriculturists. 2014;12(1):68-74.
16. Sai KP, Tayde AR, Reddy RD, Srivastava VK. Management of gram pod borer *Helicoverpa armigera* (Hubner) in chickpea with bio-pesticides and combination. Journal of Entomology and Zoology Studies. 2021;9(1):561-563.
17. Singh H, Kumar A, Kumar N, Singh HR, Yadav RN. Efficacy and economics of some bio-pesticide in management of *Helicoverpa armigera* (hub) on chickpea. Annals of Entomology; c2016. p. 32-34.
18. Yerrabala S, Kumar HS, Yadav U. Comparative efficacy of *Bacillus thuringiensis* with botanicals and chemicals against gram pod borer *Helicoverpa armigera* (Hubner) (Lepidoptera: Noctuidae) on cowpea [*Vigna unguiculata* (L.) Walp.]. The Pharma Innovation Journal. 2021;10(5):709-712.