The Pharma Innovation Journal 2022; SP-11(5): 1395-1398

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; SP-11(5): 1395-1398

www.thepharmajournal.com
Received: 08-03-2022
Accepted: 13-04-2022

Jaya Sai Deepika Konda
M.Sc. (Ag.) Entomology,
Department of Entomology,
Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad,
Uttar Pradesh, India

Ashwani Kumar
Associate Professor,
Department of Entomology,
Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad,
Uttar Pradesh, India

Corresponding Author
Jaya Sai Deepika Konda
M.Sc. (Ag.) Entomology,
Department of Entomology,
Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad,
Uttar Pradesh, India

Efficacy and economics of selected biopesticides against pod borer [*Helicoverpa armigera* (Hubner)] on cowpea

Jaya Sai Deepika Konda and Ashwani Kumar

Abstract
A field experiment was conducted during *kharif* 2021 at Central Research Farm, SHUATS (Sam Higginbottom University of Agriculture, Technology and Sciences), Prayagraj, Uttar Pradesh (India). Field efficacy of Spinosad with six biopesticides were evaluated against pod borer, (*Helicoverpa armigera*) of Cowpea and two foliar applications were given. The efficacy results showed that the reduction per cent of larval population in Spinosad 45 SC (65.48% and 80.40%) found most effective followed by HaNPV 450LE (61.05% and 86.79%), Neem oil 5% (58.34% and 85.74%), Karanj oil 2% (55.89% and 83.98%), NSKE (52.69% and 80.90%) and Dhatura leaf extract (49.46% and 79.07%) was next effective treatment. Among all the treatments Tobacco leaf extract (46.66% and 76.76%) was found least effective but comparatively superior over the control Water spray (0.00%). The best and most economical treatment was Spinosad (1:214), followed by HaNPV (1:1.96), Neem oil (1:1.74), Karanj oil (1:1.54), NSKE (1:1.63), Dhatura leaf extract (1:1.27), Tobacco leaf extract (1:1.17) as compared to control (1:1.12). The highest yield was recorded in Spinosad (16.18 q/ha) followed by HaNPV (14.91 q/ha).

Keywords: Biopesticides, cowpea, cost benefit ratio, *Helicoverpa armigera*, percent population reduction, spinosad

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. Due to its tolerance for sandy soil and low rainfall it is an important crop in the semi-arid regions across Africa and other countries. It is known as vegetable meat due to high amount of protein in the grain with better biological value on dry weight basis. 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 (Soliman, 2012) [13]. 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 and Bamaiyi, 2014) [11].
The incidence of insect pests and diseases cause lower production and productivity of cowpea due to direct or indirect damage. There are about 21 insect pests of different groups have been recorded damaging the cowpea crop from germination to maturity. The avoidable losses in yield due to insect pests have been recorded in the range of 66 to 100 per cent in cowpea. *Helicoverpa armigera* Hubner is a major pest that attacks wide range of different vegetable crops and causes serious economic damage and yield loss. The neonate larvae feed on the surfaces of leaves or floral buds. However, the grown-up larvae prefer to feed on the contents of reproductive parts such as floral buds, flowers and developing pods. The major constraint in the cultivation of cowpea is insect pest attack which has been observed to have caused up to 70 per cent grain yield loss, out of this about 17.37 per cent pod damage was estimated due to cow pea pod borer. Pod borer also cause green vegetable loss of the crop. These losses together cause greater damage to the overall pulses production of the country.

Materials and Methods
The trial was conducted in *kharif* season 2021 at the Central Research Farm, SHUATS, Prayagraj (U.P.). Trail was laid out in a Randomized Block Design consisting of eight different treatments including control (water spray).

Each treatment was replicated thrice and cowpea variety, Ankur Gomoti V-8 was used for study. After observing a sufficient level of insect population, application of treatments for the management of pod borer was undertaken. The data was subjected to statistical analysis. The yield per plot was also recorded.

The population of cowpea pod borer was recorded before 1-day spraying and on 3rd day, 7th day and 14th day after insecticidal application. The populations of cowpea pod borer were recorded on 5 randomly selected and tagged plants from each plot and then it was converted into per cent of reduction by following formula.

$$\text{Percent reduction} = \frac{\text{Population in control} - \text{Population in treatment}}{\text{Population in control}} \times 100$$

(Jagtap *et al*., 2020) [6].

$$\text{Cost benefit ratio} = \frac{\text{Gross returns}}{\text{Total cost of cultivation}}$$

Results and Discussion

The data on per cent reduction of larval population of *Helicoverpa armigera* over control at 3rd, 7th and 14th day after first spraying revealed that all the treatments were significantly superior over control. Among all the treatments used, the maximum population reduction of *Helicoverpa armigera* was recorded in T_4-Spinosad 45SC (65.48%) as compared to the untreated control (T_0 – Water spray (0.00%) which was at par with T_1- HaNPV with (61.05%) percent reduction and T_3 -Neem oil (58.34%) while T_7- Karanj oil was recorded 55.89 per cent reduction of larval population over control. T_5- NSKE (52.69%) was at par with T_2- Dhatura leaf extract (49.46%) and T_6- Tobacco leaf extract was found to be least effective with 46.66 per cent reduction in population over control T_0- Water spray (0.00%).

Table 1: Efficacy of selected biopesticides against pod borer [*Helicoverpa armigera* (Hubner)] on cow pea [*Vigna unguiculata* (L.) Walp.]

Treatments		Per cent reduction of larval population (*H. armigera)*				
		1 DBS	After spray			
		No. of larvae/ 5 plants	3rdDay	7thDay	14thDay	Mean
T_1	HaNPV 450LE/ha	3.93 (11.43)*	46.85 (41.83)*	66.57 (54.69)*	69.73 (56.63)*	61.05 (51.49)*
T_2	Dhatura leaf extract 5%	4.26 (11.92)*	35.73 (36.68)*	54.04 (47.32)*	58.63 (49.98)*	49.46 (44.66)*
T_3	Neem oil 5%	3.73 (11.14)*	44.61 (43.19)*	63.44 (52.80)*	66.97 (54.93)*	58.34 (49.87)*
T_4	Spinosad 45% SC	4.13 (11.71)*	54.27 (47.45)*	69.70 (56.61)*	72.49 (58.38)*	65.48 (54.13)*
T_5	NSKE 5%	4.06 (11.63)*	39.44 (38.88)*	57.17 (49.13)*	61.46 (51.63)*	52.69 (46.55)*
T_6	Tobacco leaf extract	4.13 (11.71)*	32.04 (34.42)*	52.02 (46.15)*	55.95 (48.42)*	46.66 (43.01)*
T_7	Karanjoil2%	3.93 (11.43)*	43.15 (41.05)*	60.30 (50.95)*	64.22 (53.26)*	55.89 (48.42)*
T_0	Control	4.13 (11.72)*	0.00 (1.65)*	0.00 (0.28)*	0.00 (1.65)*	0.00 (0.28)*
F- test		NS	S	S	S	S
CV		7.68	11.16	2.21	2.35	8.72
C.D.(P=0.05)		-	7.23	2.05	2.31	7.44

DBS*= Days before spraying, *Figures in parenthesis are Arc sin transformed values.

The data on per cent reduction of larval population of *Helicoverpa armigera* over control at 3rd, 7th and 14th day after second spraying revealed that all the treatments were significantly superior over control. Among all the treatments used, the maximum population reduction of *Helicoverpa armigera* was recorded in T_4-Spinosad 45SC (89.40%) as compared to the untreated control (T_0 – Water spray (0.00%) which was at par with T_1- HNPV with (86.79%) reduction and T_3 -Neem oil (85.74%) which was also at par with T_7- Karanj oil with 83.98 per cent reduction of larval population over control. T_5- NSKE was recorded with 80.90 per cent reduction of larval population over control.T_2- Dhatura leaf extract (79.07%) was significantly at par with T_6- Tobacco leaf extract with 76.76 per cent reduction in population over control T_0- Water spray (0.00%).

Table 2: Efficacy of selected biopesticides against pod borer [*Helicoverpa armigera* (Hubner)] on cow pea [*Vigna unguiculata* (L.) Walp.]

Treatments		Per cent reduction of larval population (*H. armigera*)				
		1 DBS	After spray			
		No. of larvae/ 5 plants	3rdDay	7thDay	14thDay	Mean
T_1	HaNPV 450LE/ha	2.20 (8.52)*	82.74 (65.50)*	88.54 (70.21)*	89.09 (70.78)*	86.79 (67.56)*
T_2	Dhatura leaf extract 5%	3.00 (9.97)*	74.52 (59.70)*	80.13 (63.54)*	82.56 (65.35)*	79.07 (60.96)*
T_3	Neemoil 5%	2.40 (8.90)*	81.91 (64.85)*	87.68 (69.47)*	87.65 (69.45)*	85.74 (66.37)*
T_4	Spinosad 45% SC	2.00 (8.12)*	86.83 (68.75)*	90.83 (72.37)*	90.55 (72.13)*	89.40 (69.93)*

T_5	NSKE 5%	2.80 (9.62)*	76.98 (61.35)*	82.43 (65.23)*	83.30 (65.90)*	80.90 (62.84)*
T_6	Tobacco leaf extract	3.20 (10.30)*	72.06 (58.10)*	77.85 (61.93)*	80.39 (63.74)*	76.76 (59.96)*
T_7	Karanj oil 2%	2.60 (9.7)*	81.07 (64.30)*	85.39 (67.57)*	85.48 (67.62)*	83.98 (65.34)*
T_0	Control	7.26 (15.63)*	0.00 (1.65)*	0.00 (1.65)*	0.00 (1.65)*	0.00 (1.65)*
F-test		S	S	S	S	S
CV		3.59	2.46	1.33	1.30	1.97
C.D.(P=0.05)		0.20	3.00	1.72	1.71	2.51

DBS*= Days before spraying, *Figures in parenthesis are Arc sin transformed values.

The data on the per cent reduction of larval population of cow pea pod borer (*Helicoverpa armigera*) on 3rd, 7th 14th day after first spray revealed that all the treatments were significantly superior over control. Among all the treatments the maximum percent reduction of larval population was recorded in Spinosad 45SC (65.48%) Lakshmikanth and Kumar (2018) [9] followed by next effective treatment HaNPV (61.05%) Cherry *et al.,* (2000) [3], Kambrekar *et al.,* (2009) [7], Byrappa *et al.,* (2012) [2] and Neem oil 5% (58.34%) Ahmad *et al.,* (2009) [1], Guatam *et al.,* (2018) [4], Karanj oil 2% with (55.89%) Bajpai *et al*., (1999), Gautam *et al*. (2018) [4] which was followed by NSKE 5% (52.69%) Meena *et al.,* (2018), Yerrabala *et al.,* (2021) [16], Dhatura leaf extract 5% (49.46%) Gautam *et al.,* (2018) [4]. Treatment Tobacco leaf extract with (46.66%) Ahmad *et al.,* (2009) [1], Rahman *et al*. (2014) [12] found be least effective but significantly superior over the control (0.00%).

The data on the per cent reduction of larval population of cow pea pod borer (*Helicoverpa armigera*) on 3rd, 7th 14th day after second spray revealed that all the treatments were significantly superior over control. Among all the treatments maximum per cent reduction of larval population was recorded in Spinosad 45SC (89.40%) Lakshmikanth and Kumar (2018) [9], Gayatri and Kumar (2021) [5] followed by next effective treatment HaNPV (86.79%) Byrappa *et al.,* (2012) [2], Mahmudunnabi *et al.,* (2013) [10] and Neem oil 5% (85.74%) Gautam *et al.,* (2018) [4], Karanj oil 2% (83.98%) Gautam *et al.,* (2018) [4] which was followed by NSKE 5% (80.90%) Yerrabala *et al.,* (2021) [16] and Dhatura leaf extract 5% (79.07%) Tanwar *et al.,* (2018) [15]. Treatment Tobacco leaf extract (76.76%) Rahman *et al.,* (2014) [12] which was found be least effective but significantly superior over the control (0.00%).

Cost benefit ratio

The yields among the treatment were significant. The highest yield was recorded in Spinosad 45SC (16.18 q/ha) followed by HNPV (14.91 q/ha), Neem oil 5% (12.81 q/ha), Karanj oil 2% (11.45 q/ha), NSKE 5% (10.35q/ha), Dhatura leaf extract (9.21 q/ha) and Tobacco leaf extract (8.98 q/ha) as compared to control (7.75 q/ha). When cost benefit ratio was worked out, interesting result was achieved. Among the treatment studied, the best and most economical treatment was Spinosad 45SC (1:2.14), followed by HaNPV (1:1.96), Neem oil 5% (1:1.74), Karanj oil 2% (1:1.54), NSKE 5% (1:1.39), Dhatura leaf extract (1:1.27) and Tobacco leaf extract (1:1.17) as compared to control (1:1.12).

Table 3: Economics of cowpea pod borer, [*Helicoverpa armigera* (Hub.)] management using certain chemical insecticides:

S. No.	Tr. No.	Treatment	Yield q/ha	Cost of yield Rs/q	Total cost of yield Rs.	Common cost Rs.	Treatment cost Rs.	Total cost Rs.	C:B ratio
1.	T_1	HaNPV 450LE/ha	14.91	4200	62622	28888	2900	31788	1:1.96
2.	T_2	Dhatura leaf extract 5%	9.21	4200	38682	28888	1440	30328	1:1.27
3.	T_3	Neem oil 5%	12.81	4200	53802	28888	2000	30888	1:1.74
4.	T_4	Spinosad 45% SC	16.18	4200	67956	28888	2800	31688	1:2.14
5.	T_5	NSKE 5%	10.35	4200	43470	28888	2360	31248	1:1.39
6.	T_6	Tobacco leaf extract	8.98	4200	37716	28888	3200	32088	1:1.17
7	T_7	Karanj oil 2%	11.45	4200	48090	28888	2175	31063	1:1.54
8.	T_0	Control	7.75	4200	32550	28888	-	28888	1:1.12

Conclusion

It could be concluded that for the management of *Helicoverpa armigera* on Cowpea crop with Spinosad and six biopesticides. Spinosad 45SC@ 220ml/lit. proved to be most effective and economical. Similarly, the use of HaNPV 250 LE/ha, Neem oil 5%@2lt/ha, Karanj oil 2%@2lt/ha, NSKE 5%@10lt/ha, Dhatura leaf extract 5%@7.5lt/ha can also be thought for the management of cowpea pod borer. However, the application of Tobacco leaf extract @ 5lt/ha. could not exert encouraging role for Cowpea pod borer management. This plant products also helps in reducing pollution in the environments. Hence it can be suitably incorporated as treatments in IPM programme.

Acknowledgement

The authors are grateful to Prof. (Dr.) Rajendra B. Lal Hon'ble Vice Chancellor SHUATS, Prof. (Dr.) Shailesh Marker, Director of research, Dr. Deepak Lal, Dean of Pg studies, Prof. (Dr.) Gautam Gosh, Dean, Naini Agricultural Institute and Dr. (Mrs) Sobita Simon, Prof and Head, Department of Plant pathology and Entomology, Sam Higginbottom University of Agriculture Technology and Sciences, for taking their keen interest and encouragement to carry out this research work.

References

1. Ahmed BI, Onu I, Mudi L. Field bioefficacy of plant extracts for the control of post flowering insect pests of

cowpea (*Vigna unguiculata* (L.) Walp.) in Nigeria. Journal of Biopesticides. 2009;2(1):37-43.
2. Byrappa AM, Kumar NG, Divya M. Impact of biopesticides application on pod borer complex in organically grown field bean ecosystem. Journal of Biopesticides, 2012;5(2):148.
3. Cherry AJ, Rabindra RJ, Parnell MA, Geetha N, Kennedy JS, Grzywacz D. Field evaluation of *Helicoverpa armigera* Nucleo polyhedron virus formulations for control of the chickpea pod-borer, *H. armigera* (Hubn.), on chickpea (*Cicer arietinum* var. Shoba) in southern India. Crop Protection. 2000;19(1):51-60.
4. Gautam MP, Chandra U, Singh SN, Yadav SK, Giri SK. Studies on efficacy of botanicals against *Helicoverpa armigera* (Hubner) on chickpea (*Cicer arietinum* L.). International Journal of Current Microbiology and Applied Sciences. 2018;7:612-618.
5. Gayathri L, Kumar A. Field efficacy of certain insecticides against pod borer, *Helicoverpa armigera* (Hubner) on chick pea in Prayagraj. Journal of Entomology and Zoology Studies. 2021;9(3):280-283.
6. 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.
7. Kambrekar DN, Kulkarni KA, Giraddi RS, Kulkarni JH, Fakrudin B. Management of chickpea pod borer, *Helicoverpa armigera* (Hubner) through Nuclear Polyhedral Virus isolates. Precision agriculture. 2009;10(5):450-457.
8. Kumar K, Tayde AR. Comparitive efficacy of selected botanicals and Novaluran against spotted pod borer [*Maruca vitrata* (Fabricius)] (Lepidoptera: Crambidae) on cowpea [*Vigna unguiculata* (L.) Walp.]. Journal of Pharmacognosy Phytochemistry. 2017;6(5):540-542.
9. 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.
10. Mahmudunnabi M, Dutta NK, Rahman AKMZ, Alam SN. Development of biorational-based integrated pest management package against pod borer, *Helicoverpa armigera* Hubner infesting chickpea. Journal of Biopesticides. 2013;6(2):108-111.
11. 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. (ISSN: 2141-5455). 2014;5(8):180-188.
12. 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.
13. Soliman MMM. Performance of certain insecticides and their mixtures against, *Tuta absoluta* (Meyrick) and *Helicoverpa armigera* (Hubner) insects on tomato crop at south valley region. Journal of Plant Protection and Pathology. 2012;3(3):197-209.
14. Sreekanth M, Seshamahalakshmi M. Studies on relative toxicity of biopesticides to *Helicoverpa armigera* (Hubner) and *Maruca vitrata* (Geyer) on pigeonpea (*Cajanus cajan* L.). Journal of Biopesticides. 2012;5(2):191-195.
15. Tanwar K, Jatav L, Simon S. Efficacy of Datura leaf extract against fruit borer, *Helicoverpa armigera* (Hubner) on Tomato, *Lycopersicon esculentum* (Mill). Journal of Pharmacognosy and Phytochemistry, 2018;SP1:1501-1503.
16. 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 Phaema Innovation Journal. 2021;10(5):709-712.