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The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; SP-11(6): 1912-1916

www.thepharmajournal.com
Received: 14-04-2022
Accepted: 17-05-2022

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Field efficacy of chlorantraniliprole with some biopesticides against pod borer [*Helicoverpa armigera* (Hubner)] on chickpea (*Cicer arietinum* L.)

Jaimala Barwa and Ashwani Kumar

Abstract
The present field investigation was carried out against pod borer [*Helicoverpa armigera* (Hubner)] on chickpea. The experiment was conducted in *rabi* 2021-22 at Central Research Farm, SHUATS, Naini, Prayagraj district. The field laid in RBD with seven treatment and one controlled plot. The result of the efficacy of treatment Chlorantraniliprole 18.5% SC 0.5ml/lit (84.32%) found to be most effective. Followed by Spinosad 45% SC 0.5ml/lit (79.57%), Nisco sixer plus 1ml/lit (73.87%), *Bacillus thuringiensis* 5ml/lit (68.88%), HaNPV 1ml/lit (60.09%), *Beauveria bassiana* 4ml/lit (54.63%), and the Neem oil 3ml/lit (47.74%) found to be least effective in reducing the larval population of *Helicoverpa armigera* but comparatively superior over the control. In another parameter higher yield was recorded in Chlorantraniliprole 18.5% SC (27.08 q/ha) followed by Spinosad 45% SC (24.58 q/ha), Nisco sixer plus (21.66 q/ha), *Bacillus thuringiensis* (17.50 q/ha), HaNPV (15.83 q/ha), *Beauveria bassiana* (14.83 q/ha) and Neem oil (12.08q/ha) as compared to control (10.83q/ha). The highest cost benefit ratio was obtained in the treatment of Chlorantraniliprole 18.5% SC (1:3.35), followed by Spinosad 45% SC (1:3.06), respectively.

Keywords: Bio-pesticides, chickpea, chlorantraniliprole, cost benefit ratio, *Helicoverpa armigera*, pod borer

Introduction
Chickpea, *Cicer arietinum* (L.) family Leguminaceae (Fabaceae) is originated in South-eastern Turkey and spread to other parts of the world. According to De Candolle, the fact that gram has a Sanskrit name "Chanaka" which indicates that the crop was under cultivation in India longer than in any other country in the world (Gowda *et al.*, 2007) [4]. It is adapted to relatively cooler climates. The largest area of adaptation is in the Indian sub-continent. Gram commonly known as chickpea or Bengal gram is the most important pulse crop of India. In India it is also known as 'King of pulses' India is the largest producer with 75% of world acreage and production of gram. India produces 5.3 MT of chickpea from 6.67 million ha with an average production of 844 kg per ha. Chickpea is used for human consumption as well as for feeding to animals. Its seeds eaten as green vegetable, fried, roasted, as snack food and ground to obtain flour and dhal (Pachundkar *et al.*, 2013) [9].

In India, *Helicoverpa armigera* has been recorded in 181 plant species from 45 families (Manjunath *et al*., 1989) [7]. The gram pod borer, *Helicoverpa armigera* is a potential and polyphagous pest, with various characteristic features like high fecundity, migratory behavior, high adaptations to various agro climatic conditions and development of resistance to various insecticides, extensively damaging many crops including chickpea (Kambrekar *et al.*, 2009) [5]. The caterpillar not only defoliates the tender leaves but also makes holes in the pods and feed upon the developing seeds the anterior body portion of the caterpillar remains inside the pod and rest half or so hanging outside. When seeds of one pod are finished, it moves to the next. Unless the pest is controlled in the initial stages of infestation it takes the heavy toll of the crop. In addition, the monetary annual yield loss due to *Helicoverpa armigera* infestation in different crops in India was estimated to be $300 million per year (Reed and Pawar 1982) [10].

Gram pod borer, *Helicoverpa armigera* (Hubner) (Lepidoptera: Noctuidae) is considered as a notorious pest of chickpea. It also attacks pigeon pea, moong bean, lentil, soybean, okra, maize, berseem, sunflower, sorghum, tobacco and tomato. Besides gram pod borer, it is also known as cotton bollworm, gram caterpillar, tomato fruit worm and tobacco bud worm. Pod borer is the most serious insect pest of Chickpea.

Percent larval survival and pupation were the maximum on chickpea as compared to other host plants (Ullah *et al.*, 2015) [11]

Materials and Methods

The experiment was conducted during *rabi* season 2021-22 at Central Research Farm (CRF) of Sam Higginbottom University of Agriculture, Technology and Sciences, Naini, Prayagraj, Uttar Pradesh, India, in a randomized block design with eight treatments replicated three times using veriety-Ankur chirag, in a plot size of 2m×2m at a spacing of 30cm ×10cm with a recommended package of practices excluding plant protection. The soil of the experimental site was well drained and medium high.

The pre and post treatment observations on larval population of *Helicoverpa armigera* were taken in randomly selected 5 plants in each treatment. The population of *Helicoverpa armigera* was recorded one day before of spray as pre-treatment observation and post treatment observations were taken at 3, 7, and 14 days after spray. The percentage reduction of larval population was determined for each treatments using following formula**.**

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

(Kumar and bisht *et al.*, 2018) [6]

Benefit Cost Ratio

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 value of C: B of different treatments will be calculated by the following formula.

$$\text{C:B} = \frac{\text{Gross return (Production)}}{\text{Cost of treatment (Total expenditure)}}$$

(Nitharwal *et al.*, 2017) [8]

Results and Discussion

The data on the mean per cent population reduction of first spray, second spray and overall mean revealed that all the treatments except untreated control are effective and at par. Among all the treatments lowest per cent reduction of chickpea pod borer was recorded in Chlorantraniliprole 18.5% SC 18.5% SC was more effective in per cent reduction of pod borer with (84.32 %). Similar finding was reported by Chitralekha *et al.*, (2018) [1] resulting (82.59%). Spinosad 45% SC was effective in reducing the population of *Helicoverpa armigera* (79.57%). Similar finding was reported by Gayathri and Kumar (2021) [3] resulting (78.23%).

Nisco sixer plus was effective in controlling *Helicoverpa armigera* (73.87%). *Bacillus thuringiensis* (68.88%) Similar finding was reported by Chitralekha *et al.*, (2018) [1] resulting (69.82%). Followed by HaNPV (60.09%) which is in line with findings of Dinesh *et al.*, (2017) [2] resulting (48.67%). Followed by treatment *Beauveria bassiana* 1.5% LF (54.63%) this results are in supported by Kumar and bisht *et al.*, (2018) [6] resulting (60.58%). Neem oil (47.74%) is found to be least effective but comparatively superior over the control.

Economics of various treatments

The increased percent yield over control treatment was different. All the treatments were superior over control. The highest yield was recorded in Chlorantraniliprole 18.5% SC (27.08 q/ha) followed by Spinosad 45% SC (24.58 q/ha), Nisco sixer plus (21.66 q/ha), *Bacillus thuringiensis* (17.50 q/ha), HaNPV (15.83 q/ha), *Beauveria bassiana* (14.83 q/ha), Neem oil (12.08 q/ha), as compared to control plot (10.83 q/ha).

When cost benefit ratio was worked out, interesting result were achieved. Among the treatment studied, the best and most economical treatment was Chlorantraniliprole 18.5% SC (1:3.35), followed by Spinosad 45% SC (1:3.06) this results are in supported by Nitharwal *et al.*, (2017) [8] and Nisco sixer plus (1:2.96), followed by *Bacillus thuringiensis* (1:2.39), and HaNPV (1:2.06) this results are in supported by Dinesh *et al.*, (2017) [2]. *Beauveria bassiana* (1:2.02) this results are in supported by Yerrabala *et al.*, (2021) [12]. Followed by Neem oil oil (1:1.64) Similar finding are made by Yerrabala *et al.*, (2021) [12], as compared to control (1:1.55).

Table 1: Field efficacy of chlorantraniliprole with some biopesticides on the larval population of pod borer *Helicoverpa armigera* (Hubner) on chickpea (1st Spray) (% reduction in larval population):

Treatments		Per cent reduction in larval Population/ 5 plants				
		Larval Population				
		per 5 plants at	3 DAS*	7 DAS*	14 DAS*	Mean
		1DBS*				
T0	Control	3.73	00	00	00	00
T1	Chlorantraniliprole 18.5% SC	3.87	75	77.86	80.95	77.95
T2	HaNPV 1× 10^9 P.O.B./ml	3.67	45	54.04	57.14	52.14
T3	Spinosad 45% SC	3..87	70	73.09	76.19	73.12
T4	Neem oil	3.73	31.67	38.09	44.52	38.15
T5	Nisco sixer plus	3.93	60	68.33	71.43	66.65
T6	*Bacillus thuringiensis*	3.73	55	61.90	66.67	61.28
T7	*Beauveria bassiana* 1.5% L.F.	3.67	38.25	46.02	52.38	45.70
F- test		NS	S	S	S	S
S. Ed. (±)		0.10	0.08	0.09	0.07	0.09
C. D. (P = 0.05)		0.25	0.17	0.19	0.15	0.20

DBS*- Day before spray
DAS*- Day after spray

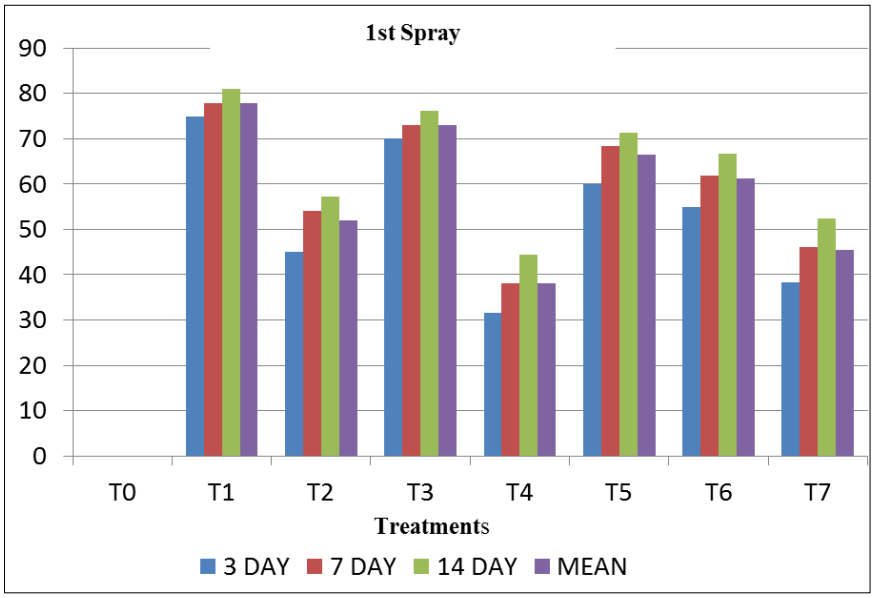

Fig 1: Graphical representation of field efficacy of chlorantraniliprole with some biopesticides on the larval population of pod borer *Helicoverpa armigera* (Hubner) on chickpea (1st Spray) (% reduction in larval population).

Table 2: Field efficacy of chlorantraniliprole with some biopesticides on the larval population of pod borer *Helicoverpa armigera* (Hubner) on chickpea (2nd Spray) (% reduction in larval population):

Treatments		Per cent reduction in larval Population/ 5 plants				
		Larval population per 5 plants At 1DBS*				
			3 DAS*	7 DAS*	14 DAS*	Mean
T0	Control	4.2	00	00	00	00
T1	Chlorantraniliprole 18.5% SC	0.8	85.71	90.76	95.38	90.62
T2	HaNPV 1× 10^9 P.O.B./ml	1.8	63.5	67.66	72.28	67.81
T3	Spinosad 45% SC	1	80.95	86.14	90.76	85.95
T4	Neem oil	2.33	50.79	56.88	63.04	56.90
T5	Nisco sixer plus	1.2	74.59	81.52	86.14	80.75
T6	*Bacillus thuringiensis*	1.4	69.83	76.90	81.52	76.08
T7	*Beauveria bassiana* 1.5% L.F.	2	58.74	63.04	67.66	63.15
F- test		S	S	S	S	S
S. Ed. (±)		0.07	0.08	0.09	0.09	0.08
C. D. (P= 0.05)		0.15	0.18	0.19	0.19	0.18

DBS*- Day before spray
DAS*- Day after spray

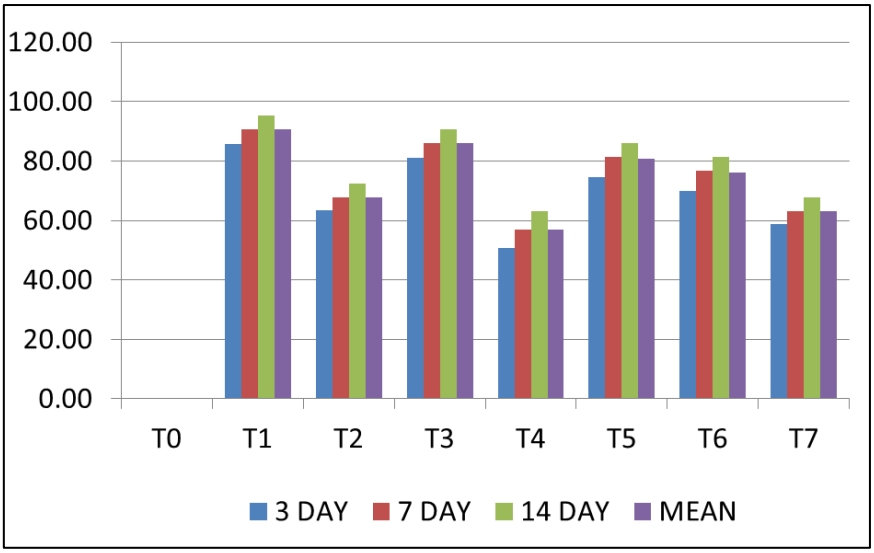

Fig 2: Graphical representation of field efficacy of chlorantraniliprole with some biopesticides on the larval population of pod borer *Helicoverpa armigera* (Hubner) on chickpea (2nd Spray) (% reduction in larval population):

Table 3: Field efficacy of chlorantraniliprole with some biopesticides on the larval population of pod borer *Helicoverpa armigera* (Hubner) on chickpea (1st and 2nd Spray) (% reduction in larval population):

Treatments		Per cent reduction in Larval population/ 5 plants		
		1st Spray	2nd Spray	Mean
T0	Control	00	00	0.00
T1	Chlorantraniliprole 18.5% SC	77.95	90.62	84.32
T2	HaNPV 1× 10^9 P.O.B./ml	52.14	67.81	60.09
T3	Spinosad 45% SC	73.12	85.95	79.57
T4	Neem oil	38.15	56.90	47.74
T5	Nisco sixer plus	66.65	80.75	73.87
T6	*Bacillus thuringiensis*	61.28	76.08	68.88
T7	*Beauveria bassiana* 1.5% L.F.	45.70	63.15	54.63
F- test		S	S	S
S. Ed. (±)		0.09	0.08	0.08
C. D. (P = 0.05)		0.19	0.18	0.18

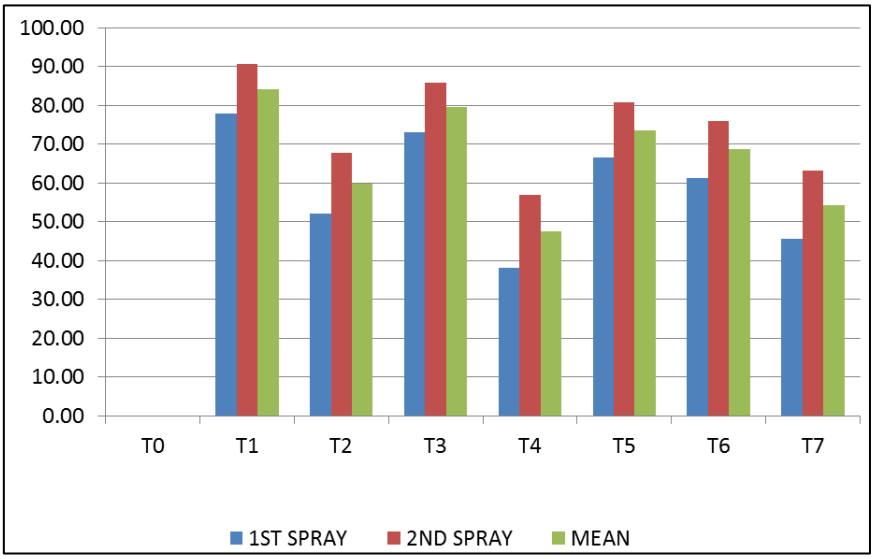

Fig 3: Graphical Representation of (1st and 2nd Spray) (% reduction in larval population):

Table 4: Economics of Cultivation

S. No:	Treatment	Yield of q/ha	Cost of yield (₹)/ha	Total cost of yield (₹)	Common cost (₹)	Treatment cost (₹)	Total cost (₹)	C: B Ratio
00	Control	10.83	4500	48,735	31,390	------	31,390	1:1.55
01	Chlorantranilipr ole 18.5 SC @0.5 ml/lit	27.08	4500	1,21,860	31,390	4950	36,340	1:3.35
02	HaNPV 1×10^9 POB @ 1ml/lit	15.83	4500	71,235	31,390	3200	34,590	1:2.06
03	Spinosad 45% SC @0.5 ml/lit	24.58	4500	1,10,610	31,390	4700	36,090	1:3.06
04	Neem oil@ 5ml/lit	12.08	4500	54,360	31,390	1760	33,150	1:1.64
05	Nisco sixer plus@ 1ml/lit	21.66	4500	97,470	31,390	1500	32,890	1:2.96
06	*Bacillus thuringiensis*	17.50	4500	78,750	31,390	1550	32,940	1:2.39
07	*Beauveria bassiana* 1.5% L.F.	14.83	4500	66,735	31,390	1700	33,090	1:2.02

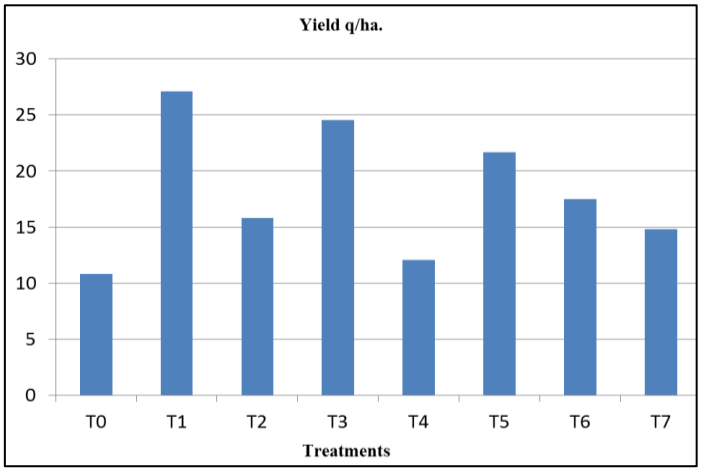

Fig 4: Graphical representation on effect of treatment production of chickpea.

Conclusion

From the analysis of present findings it is concluded that among all the treatments Chlorantraniliprole 18.5% SC was found most effective against chickpea pod borer followed by Spinosad 45% SC, Nisco sixer plus are resulted higher yield. while *Bacillus thuringiensis* and HaNPV ranked middle in order of their efficacy, then *Beauveria bassiana* and Neem oil found to be least effective in managing *Helicoverpa armigera* and it can be a part of Integrated pest management in order to avoid indiscriminate use of pesticides causing pollution in the environment and not much harmful to beneficial insects.

Among the treatments studied T_1- gave the highest cost benefit ratio (1:3.35) and marketing yield (27.08 q/ha).

Acknowledgements

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, Dr. Gautam Gosh, Dean, Naini Agricultural Institute and Dr. (Mrs) Sobita Simon, Prof and Head, Department of Plant pathology and Entomology, who allotting field for this research work at central field of Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad, U.P

References

1. Chitralekha Yadav GS, Verma T. Efficacy of insecticides against *Helicoverpa armigera* on chickpea. Journal of Entomology and Zoology Studies. 2018;6(3):1058-1061
2. Dinesh K, Singh RB, Kavita K, Choudhary RS. Relative efficacy of newer insecticides and biopesticides against *Helicoverpa armigera* (Hub.) in chickpea. Journal of Entomology and Zoology Studies. 2017;5(3):455-462.
3. Gayathri L, Kumar A. Field efficacy of certain insecticides against pod borer, *Helicoverpa armigera* (Hubner) on chickpea in Prayagraj. Journal of Entomology and Zoology Studies. 2021;9(3):280-283.
4. Gowda DKS, Patil BV, Yelshetty S. Evaluation of comparative efficacy of Dusts and Emulsifiable concentration formulations against gram pod borer in chickpea ecosystem. Karnataka Journal Agriculture Science. 2007;20(2):276-278.
5. 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;10:450-457.
6. Kumar L, Bisht RS, Singh H, Kumar A, Pandey N, Kumar M. Bioefficacy and economics of some newer insecticides and bio-pesticides against *Helicoverpa armigera* (Hub.) on chickpea (*Cicer arietinum* L.) crop. Journal of Pharmacognosy and Phytochemistry. 2018;SP 1:1739-1744.
7. Manjunath TM, Bhatnagar VS, Pawar CS, Sithanantham S. Economic importance of *Heliothis* spp., in India and assessment of their natural enemies and host plants. In: Proc. of the Workshop on Biological Control of *Heliothis*: Increasing the Effectiveness of Natural Enemies. (Eds.): E.G. King and R.D. Jackson. Far Eastern Regional Research Office, U. S. Department of Agriculture, New Delhi, India, 1989, 197-228.
8. Nitharwal RS, Kumar A, Jat SL, Chula MP. Efficacy of newer molecules against gram pod borer, *Helicoverpa armigera* (Hub.) on chickpea (*Cicer arietinum* L.). Journal of Pharmacognosy and Phytochemistry. 2017;6(4):1224-1227.
9. Pachundkar N, Kamble P, Patil P, Gagare P. Management of Gram Pod Borer *Helicoverpa armigera* in Chickpea With Neem Seed Kernel Extract as a Natural Pest Management Practice in Bhojdari Village. International Journal of Current Research. 2013;5(10):2934-2935.
10. Reed W, Pawar CS. Heliothis: A global problem. 1982, 9-14.
11. Ullah F, Ali M, Ahmad S, Badshah H. Impact of light traps on population density of gram pod borer, *Helicoverpa armigera* (Hub)(Lepidoptera: Noctuidae) and its larval parasitoid (*Campoletis chlorideae* Uchida) in Rod Kohi area of Dera Ismail Khan, Pakistan. Journal of Entomology and Zoology studies. 2015;3(2):203-207.
12. 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;SP-10(5):709-712.