International Journal of Plant & Soil Science

Volume 34, Issue 24, Page 249-253, 2022; Article no.IJPSS.90904
ISSN: 2320-7035

Comparative Efficacy of Certain Chemicals and Biopesticides against Pod Borer, *Helicoverpa armigera* (Hubner) on Chickpea

Yarumreddy Sunil Reddy [a*] and Anoorag R. Tayde [a]

[a] *Department of Entomology, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, India.*

Authors' contributions

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

Article Information

DOI: 10.9734/IJPSS/2022/v34i242636

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/90904

Original Research Article

Received: 29/07/2022
Accepted: 01/09/2022
Published: 23/12/2022

ABSTRACT

The present field investigation was carried out in the Prayagraj district of Uttar Pradesh. The experiment was conducted in *rabi* 2021 -22 at Central Research Farm, SHUATS, Naini, Prayagraj. The field replicated in RBD with seven treatments and one control plot. To check the comparative efficacy of certain chemicals and biopesticides against pod borer, *Helicoverpa armigera* (Hubner) on chickpea. The result of the efficacy of treatments showed that both chemicals and Biopesticides are effective against pod borer even if they have slight percent larval reductions. The different chemicals and Biopesticide treatments reveal that the most effective population infestation of pod borer, was recorded in, Chlorantraniliprole (0.46) followed by Spinosad (0.80), Emamectin benzoate (01.13), NSKE (01.46), *Beauveria bassiana* (01.66), *Metarhizium anisiopilae* (02.00), *Bacillus thurenginesis* (02.26) and the highest population of Pod borer was found in Control T_0 (5.2). In another parameter higher yield and benefit cost ratio was recorded in chlorantraniliprole (18.89 q/ha and 1:2.21) followed by Spinosad (17.30 q/ha and 1:2.18), Emamectin Benzoate (15.80 q/ha and 1:2.14), NSKE (14.90 q/ha and 1:1.88), *Beauveria bassiana* (13.50 q/ha and 1:2.01), *Metarhizium*

**Corresponding author: E-mail: ysunilreddy638@gmail.com;*

anisiopilae (11.63 q/ha and 1:1.50), *Bacillus thurenginesis* (9.80 q/ha and 1:1.62) as compared to control (7.42 q/ha and 1:2.01).

Keywords: Biopesticides; cost benefit ratio; efficacy; Helicoverpa armigera; insecticides.

1. INTRODUCTION

"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" [1]. "*H. armigera* is the major damaging pest in areas where chickpea is grown. The attack of this pest begins right from vegetative stage and continue up to maturity. Young larvae of *H. armigera* feeds on leaflets, buds, flowers and pods of chickpea" [2]. "Helicoverpa armigera, the gram pod borer, is a well-known pest of chickpeas. Pigeon pea, moong bean, lentil, soybean, okra, maize, berseem, sunflower, sorghum, tobacco, and tomato are also targets. It is also known as cotton bollworm, gram caterpillar, tomato fruit worm, and tobacco bud worm in addition to gram pod borer. " [3]. "In recent years, various types of insecticides belonging to different chemical group were used as spray to manage the pest complex Use of chemical pesticides has resulted in immediate high returns to farmers. However, their heavy and extensive use has created various health and environmental problems. To avoid these problems, use of environmentally safer bio-pesticides is gaining momentum these days" [4].

2. MATERIALS AND METHODS

The experiment was conducted during *rabi* season 2021 at Cental Research Farm, SHUATS, Naini, Prayagraj, Uttar Pradesh, India, in a Randomized Block Design with seven treatments along with controlled plot replicated three times using variety Ankur - Chirag in a plot size of (2m × 2m) at a spacing of (30×10cm) with a recommended package of practices excluding plant protection. The soil of the experimental site was well drained and medium high. The climate of the experimental site is sub-tropical characterized by normal rainfall.

The population of chickpea pod borer was recorded before 1-day before spraying and on 3rd day, 7th day and 14th day after insecticidal application. The populations of chickpea pod borer was recorded on 5 randomly selected and tagged plants from each plot. At each picking the total number of pods infested of five selected plants from each treatment replication wise was recorded.

The healthy marketable yield obtained from different treatments was collected separately and weighed. The cost of the insecticides employed in this experiment was reported for the 2021-2022 season. The cost of botanicals used was obtained from nearby market. The overall cost of plant protection included the cost of treatments, sprayer rental, and spray labour expenses. During the research period, there were two sprays, and the total plant protection expenses were computed. Total revenue was calculated by multiplying total yield per hectare by the current market price, while net benefit was calculated by subtracting total income from total income. By deducting the income of the control treatment from that of each sprayed treatment, the advantage over the control was calculated for each sprayed treatment.

3. RESULTS AND DISCUSSION

All the treatments were significantly superior to the untreated control in reducing the population of *Helicoverpa armigera* on chick pea crop in both of insecticidal application. The larval population recorded one day prior to the 1st spray was in a range of 4.06 to 4.8 / 5 plants (Table 1). After 3 days of spray, T_1Chlorantraniliprole was recorded minimum larval count of pod borer (*Helicoverpa armigera*) (2.26) followed by T_3 Spinosad (2.6), T_2 Emamectin Benzoate (3.06), T_4 NSKE (3.26), T_7 *Beauveria bassiana* (3.53), T_5 *Metarhizium anisiopilae* (3.66), *Bacillus thurenginesis* (4) and the highest population of Pod borer was found in Control T_0 (6.13).

A significant reduction in mean larval population was observed on 7th and 14th days after 1st spray. In all treated plots mean larval population was minimum in T_1 Chlorantraniliprole (1.86 and 1.73 respectively) followed by Spinosad 45 SC (2.06 and 1.93). The overall mean of larval population after first insecticidal spray was lowest in T_1, Chlorantraniliprole 18.5% SC (1.95).

Table 1. Efficacy of insecticides, NSKE and bio-pesticides on Larval Population of Gram pod borer at different days interval

S. no	Treatments	Larval Population of Gram pod borer at different days interval									Yield (q/ha)	B:C Ratio
		First Spray					Second Spray					
		1 DBS	3 DAS	7 DAS	14DAS	Mean	3 DAS	7 DAS	14DAS	Mean		
T_0	Control	4.33	06.13	06.53	6.8	6.48	6.93	7.13	7.33	7.13	7.42	1:1.22
T_1	Chlorantraniliprole 18.5% SC	4.06	03.26	01.86	1.73	1.95	01.00	0.8	0.46	0.75	18.89	1:2.21
T_2	Emamectin Benzoate 5% SG	4.26	3.06	02.26	2.00	2.44	1.6	1.26	1.13	1.33	15.80	1:2.14
T_3	Spinosad 45 SC	4.6	2.6	02.06	1.93	2.19	1.26	1.13	0.8	1.06	17.30	1:2.18
T_4	NSKE 5%	4.4	3.26	2.73	2.13	2.70	1.8	1.66	1.46	1.64	14.90	1:1.88
T_5	*Metarhizium anisiopilae*	4.8	3.66	3.4	3.26	3.44	2.6	2.33	02.00	2.31	11.63	1:1.50
T_6	*Bacillus thurenginesis*	4.46	4	3.66	3.8	3.82	2.73	2.53	2.26	2.50	9.80	1:1.62
T_7	*Beauveria bassiana 1.5% L.F*	4.46	3.53	3	3.2	3.24	2.06	1.86	1.66	1.86	13.50	1:2.01
	C.D.(5%)	-	0.41	0.80	1.11	0.51	0.41	0.22	0.32	0.28	….	….
	SE.d ±	-	0.19	0.37	0.51	0.24	0.19	0.10	0.15	0.13	….	….

Over all mean analysis of 3rd, 7th and 14 days after 1st insecticidal application indicated that all the insecticidal treatments were significantly effective in reducing the larval population of *Helicoverpa armigera* as compared to untreated plots. Chlorantraniliprole (1.73%) was found significantly superior these findings are supported by Chitralekha et al. [5]. Followed by Spinosad (1.93) similar findings also reported in chickpea by Nitharwal et al. [6]. Emamectin benzoate (57.74%) is the next best treatment for reducing the population of gram pod borer. Similar reports were made by Turkhade et al. (2015). The treatment was showed by T4 NSKE 0.15% (2.37) and the similar reported by Kumar et al. [7]. The next best was which is in line with findings of Devi and Tayde [8] *Beauveria bassiana* (3.2). T_5 *Metarhizium anisiopilae* (3.26) was next best treatment. T_6 *Bacillus thurenginesis* (3.8) which are supported by Harika et al. [9].

3 days after second spray, all the treatment were superior with control plots and differed significantly with each other. Among all the treatments T_1 Chlorantraniliprole was recorded minimum larval count of pod borer (*Helicoverpa armigera*) (1.0) followed by T_3 Spinosad (1.26), T_2 Emamectin Benzoate (1.60), T_4 NSKE (1.8), T_7 *Beauveria bassiana* (2.06), T_5 *Metarhizium anisiopilae* (2.60), T_6 *Bacillus thurenginesis* (2.73) and the highest population of Pod borer was found in Control T_0 (6.13). A significant reduction in mean larval population was observed on 7th and 14th days after 2nd spray. In all treated plots mean larval population was minimum in T_1 Chlorantraniliprole (0.8 and 0.46 respectively) followed by Spinosad 45 SC (1.13 and 0.8). The overall mean of larval population after 2nd insecticidal spray was lowest in T_1, Chlorantraniliprole 18.5% SC (0.75).

14th days after insecticidal application indicated that all the insecticidal treatments were significantly effective in reducing the larval population of *Helicoverpa armigera* as compared to untreated plots. Chlorantraniliprole (0.46) was found significantly superior these findings are supported by Kumar and Sarada [10]. Followed by Spinosad (0.80) similar findings also reported in chickpea by. followed by NSKE (1.46) in controlling gram pod borer similar results are recorded by Vikrant et al. [11]. The next best was *Beauveria bassiana* (1.66) which is in line with findings of. T_5 *Metarhizium anisiopilae* (2) was next best treatment. T_6 *Bacillus thurenginesis* (2.26) which are supported Chandravanshi et al. [12].

The highest yield and cost benefit ratio was recorded in chlorantraniliprole (18.89 q/ha) and (1:2.21) as respectively, followed by spinosad (17.30 q/ha) and (1:2.18) this result supported by khare et al. [13], followed by emamectin benzoate (15.80 q/ha) and (1:2.14), followed by *beauveria bassiana* (1:2.01) this result is supported by carneiro et al. [14]. Followed by nske (14.90 q/ha) and (1:1.88) similar findings were supported by bhushan et al. [15]. The next superior was t_6 bacillus thurenginesis (1:1.62) and metarhizium anisiopilae (11.63 q/ha) and (1:1.50).

4. CONCLUSION

From the analysis of present findings it is concluded that among all the treatments Chlorantraniliprole was found most effective against chickpea pod borer followed by Spinosad and Emamectin benzoate are resulted higher yield, while NSKE and *Beauveria bassiana* ranked middle in order of their efficacy, then *Metarhizium anisiopilae* and *Bacillus thurenginesis* 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.

ACKNOWLEDGEMENT

The author expresses his heartful gratitude to Dr. Anoorag R. Tayde, Assistant Professor, Department of Entomology, Dr. Ashwani Kumar, Associate Professor and Head, Department of Entomology and I am greatful 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, Sam Higginbottom University of Agriculture, technology and Sciences, Prayagraj for making their keen interest and encouragement to carry out this research work.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. 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):234-235.
2. Mandal SK, Roy SP. Impact of environmental factors on certain pulse crops of north-eastern Bihar (India) with reference to resource management. The Ecoscan. 2012;1:35-40.
3. Ullah F, Ali M, Ahmad S, Badshah H. Impact of light traps on population density of gram pod borer, *Helicoverpa armigera* (Hub.) 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.
4. Kaur L, Sandhu JS, Gupta SK. Inter and Intra-accession variation for resistance to botrytis gray mold of chickpea in wild Cicer species. Indian Journal of Agricultural Sciences. 2007;77:786-788.
5. Chitralekha, Yadav GS, Verma TEfficacy of insecticides against *Helicoverpa armigera*on chickpea. Journal of Entomology and Zoology Studies. 2018;6(3):1058-1061.
6. 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.
7. 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;SP1:1739-1744.
8. Devi HD, Tayde AR. Comparative Efficacy of Bio-Agents and Botanicals on the Management of Diamondback Moth (*Plutella xylostella* Linn.) on Cabbage under Allahabad Agroclimatic Conditions. Intenational Journal of Current Microbiology and Applied Sciences. 2017; 6(7):711-716.
9. Harika G, Dhurua S, Suresh M, Sreesandhya N. Evaluation of Certain Insecticides against Diamondback Moth (DBM) *Plutella xylostella* on Cauliflower. International Journal of Bio-resource and Stress Management. 2019;10(1):070-076.
10. Kumar SGV, Sarada O. Field efficacy and economics of some new insecticide molecules against lepidopteran caterpillars in chickpea. Current Biotica. 2015;9(2): 153-158.
11. Vikrant, Singh DR, Kumar S, Kishor K, Kewal R. Bio-efficacy of Insecticides against *Helicoverpa armigera* in Chickpea. Legume Research. 2018;6(4):1224-1227.
12. Chandravanshi KD, Tomar RKS, Awasthi AK, Kerketta A. Field Efficacy of Different Insecticides and Biopesticides against Okra Shoot and Fruit Borer Journal of Pharmacognosy and Phytochemistry. 2019;8(1):2623-2625.
13. Khare KV, Sneha. (Spinosad for Control of Brinjal Shoot and Fruit Borer Efficacy and Economics. Journal of Entomology and Zoology Studies. 2021;9(1):1843-1845.
14. Carneiro E, Silva LB, Maggioni K, Santos VBD, Rodrigues TF, Reis SS, Pavan BT. Evaluation of Insecticides Targeting Control of *Helicoverpa armigera* (Hubner) (Lepidoptera: Noctuidae). American Journal of Plant Sciences. 2014;5:2823-2828.
15. Bhushan S, Singh RP, Shanker R. Bioefficacy of neem and Bt against pod borer, Helicoverpa armigera in chickpea. Journal of Biopesticides. 2011;4 (1):87–89.

Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/90904