Original Research Article

Efficacy of selected biopesticides with ~~Chlorantraniliprole~~ chlorantraniliprole against gram ~~Pod~~ pod borer, *Helicoverpa armigera* (Hubner) on chickpea

ABSTRACT

The present investigation was conducted at the research plot of Department of Entomology at CRF, Sam Higginbottom University of Agriculture Technology and Sciences, Prayagraj during the *Rabi* season of 2023-2024. The experiment was conducted in Randomized Block Design (RBD) using eight treatments each replicated thrice *viz.*, ~~Neem~~ neem oil 2~~-~~% @ 20.0 ml/l~~it~~, ~~Spinosad~~ spinosad 45~~-~~% SC @ 0.3 ml/l~~it~~, NSKE 5% @ 5.0 ml/l~~it.~~ , *Bacillus thurngiensis* @ 2.5 g~~m~~/l~~it~~, *Beauveria bassiana* @ 2.5 g~~m~~/l~~it~~, ~~e~~Emamectin benzoate 5% SG @ 2.0 ml/l~~it~~, ~~Chlorantraniliprole18~~chlorantraniliprole 18.5~~-~~S @ 1.5 ml/l~~it~~ and untreated control. Among the biopesticides and insecticides evaluated, ~~Chlorantraniliprole~~ chlorantraniliprole 18.5 SC recorded lowest mean population of pod borer population *i.e.* (1.79) which was significantly superior over control followed by ~~Spinosad~~ spinosad 45~~–~~% SC (2.02%), ~~Emamectin~~ emamectin benzoate 5% SG (2.23%), ~~Neem~~ neem oil 2% (2.41%), NSKE 5% SC (2.61%), *Bacillus thurngiensis* (1.83%) and *Beauveria bassiana* (2.99%) was least effective among all the treatments. Among the treatment studied the best and most economical treatment was ~~Chlorantraniliprole~~ chlorantraniliprole 18.5 SC with highest yielded and cost benefit ratio of 28.3 q/h and 1:3.1 followed by ~~Spinosad~~ spinosad 45~~-~~% SC~~-~~% SC with 26.7 q/h yield, 1:3.0 C:B ratio.~~, Emamectin benzoate 5%SG 25.8q/h and 1:2.9, Neem oil 2 % 22.5 q/h, 1:2.4, NSKE 5% 21.2 q/h , 1:2.2, *Bacillus thurngiensis* 17.0 q/h, and 1:1.9, *Beauveria bassiana* 11.7 q/h, and1:1.2 as compared to control 9.3 q/h and 1:1.1.~~

Keywords: Benefit Cost Ratio, Biopesticide, Chemical insecticide~~s~~, Chickpea, ~~Efficacy~~, *Helicoverpa armigera*

1. INRTODUCTION

Chickpea, *Cicer arietinum* (L.) family Leguminaceae (Fabaceae) ~~is~~ was originated in South-~~-~~Eeastern Turkey and spread to other parts of 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. It is adapted to relatively cooler climates. In India it is also known as 'King of pulses' 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. (Lavanya and Kumar, 2022).

The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) has reported that chickpea seeds contain on average 23% protein, 64% total carbohydrates (47% starch, 6% soluble sugars), 5% fat, 6% crude fiber and 3% ash. Studies have also shown that chickpea is helpful for lowering blood cholesterol (Pittaway *et al.*, 2008).

Chickpea (*Cicer arietinum)* is the world's third most important legume food and is currently grown on about 11 million hectors, with 96% cultivated in the developing countries. Chickpea production has increased during the past 30 years from 7.3 million tonnes to 8.4 mt because of increase in productivity from 693 to 786 kg/ha during this period~~.~~ (Ambule *et al.*, ~~(~~2015).

Helicoverpa armigera is a cosmopolitan and widely distributed insect pest in world. It is a serious pest of all the legumes. In India, it has been observed to feed on 181 cultivated and uncultivated species belonging to 45 families. *H. armigera* is found in the Palearctic, Oriental, Ethiopian and Australian provinces, south of a line at approximately 52^0N. This range occupied by the species includes tropical, dry and temperate climates~~.~~ (Choudhary *et al.*, ~~(~~2017).

This is an era of ~~Integrated~~ integrated pest management involving several eco-friendly approaches. Realizing the importance of chemical and botanicals in ~~Integrated~~ integrated pest management on sustainable basis the present investigation were undertaken to evaluate different Bio- pesticides and insecticidal combination against chickpea pod borer, *Helicoverpa armigera*.

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2. 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 Technology and Sciences, during the *rabi* season of 2023-24. The experimental design was laid in Randomized Block Design using PUSA 362 variety with 8 treatments, each replicated thrice. The plot size was 2m × 1m with a spacing of 30 cm × 10 cm. The treatments included – Neem oil 2% @20ml/lit., Spinosad 45 % SC @0.3ml/lit., NSKE 5% @5ml/lit., *Bacillus thuringiensis* $1x10^9$ CFU/ml @2.5gm/lit., *Beauveria bassiana* $1x10^8$ CFU/ml @2.5gm/lit., Emamectin benzoate 5% SG @ 2ml/lit., Chlorantraniliprole 18.5% SC @1.5ml/lit. and a control. Application of the two rounds of insecticidal treatments were applied at 15 days interval.

The numbers of larva were counted on 5 randomly selected plants in each plot. The pretreatment count was made a day before the spray whereas, the post-treatment counts were made on 3rd , 7th and 14th day after each spray. The larval population over control against gram pod borer was calculated by considering the mean of three observations recorded at 3rd , 7th , and 14th day after spray.

3. RESULTS

The data larval population of *Helicoverpa armigera* over control after two sprays revealed that (Table 1)all the treatments were significantly superior over control The treatment Chlorantraniliprole18.5 % Sc(0.3ml/lit) recorded low overall mean infestation of pod borer population *i.e.*, (1.79) which was significantly superior over control followed by Spinosad 45 % Sc(2.02), Emamectin benzoate 5%SG (2.23), Neem oil (2.41%), NSKE (2.61), *Bacillus thurngiensis* (1.86) and *Beauveria bassiana* (2.99) was least effective among all the treatments.

The yield among the treatments was significant. The highest yield was recorded in T_7 Chlorantraniliprole 18.5 % SC (28.3q/ha) followed by T_2 Spinosad 45 %SC (26.7 q/ha), T_6 Emamectin benzoate 5% SG (25.8q/ha), T_1 Neem oil 2 %(22.5q/ha), T_3 NSKE (21.2q/ha), T_4 *Bacillus thurngiensis* (17.0q/ha), and T_5 *Beauveria bassiana* (11.7q/ha) as compared to T_0 Control (9.3q/ha).

When the benefit cost ratio was worked out, an interesting results was achieved. Among the treatment studied the best and most economical treatment was T_7 Chlorantraniliprole 18.5 % SC (1:3.1) followed by T_2 Spinosad (1:3.0), T_6 Emamectin benzoate 5% SG (1:2.9), T_1 Neem oil 2 % (1:2.4), T_3 NSKE 5% (1:2.2), T_4 *Bacillus thurngiensis* (1:1.9), and T_5 *Beauveria*

bassiana (1:1.2) as compared to control T_0 (1:1.1).

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Table 1. Efficacy and economics of different insecticide against gram ~~Pod~~ pod borer, *Helicoverpa armigera* (Hub.)"

S. No.	Treatments	Larval population									Yield (q/ha)	C:B ratio
		1st Spray					2nd Spray					
		1 DBS	3 DAS	7 DAS	14 DAS	Mean	3 DAS	7 DAS	14 DAS	Mean	Overall mean (1st and 2nd spray)	
T1	Neem oil 2% @20 ml/l	5.0	3.26	2.40	3.00	2.86	2.73	1.53	1.73	1.96	2.41	22.5	1:2.4
T2	Spinosad45 % SC@0.3 ml/l	5.4	3.00	1.93	2.66	2.42	2.26	1.26	1.53	1.63	2.02	26.7	1:3.0
T3	NSKE 5%@5 ml/l	4.87	3.53	2.66	3.26	3.10	2.96	1.66	1.93	2.13	2.61	21.2	1:2.2
T4	*Bacillus thurngiensis* 1× 10^9 CFU/ml@2.5gm/l	4.40	3.80	2.80	3.60	3.40	3.06	1.60	2.06	2.26	1.86	17.0	1:1.9
T5	*Beauveria bassiana* 1× 10^8 CFU/ml@2.5gm/l	4.0	3.93	2.93	3.66	3.53	3.26	1.86	2.40	2.46	2.99	11.7	1:1.2
T6	Emamectin benzoate 5% SG@2 ml/l	5.0	3.13	2.20	2.73	2.66	2.46	1.40	1.60	1.80	2.23	25.8	1:2.9
T7	Chlorantraniliprole 18.5 % SC@1.5ml/l	5.73	2.73	1.86	2.20	2.22	2.13	0.93	1.06	1.36	1.79	28.3	1:3.1
T0	Control	6.20	6.93	7.13	8.46	7.56	7.93	8.33	8.86	8.37	7.96	9.3	1:1.1
F- test		NS	S	S	S	S	S	S	S	S			
CD at 0.05%			0.93	0.93	0.81	0.51	0.93	0.40	0.65	0.53			
S. Ed. (+)			5.31	5.31	6.75	3.54	6.939	5.31	6.753	3.54			

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4-DISCUSSION

All the treatments were found to be significantly superior to control in reducing larval population. The minimum overall mean larval population was recorded in Chlorantraniliprole 18.5 SC (1.79). The results were similar to be findings reported by Nitharwal *et al.* (2017), Sushma *et al.* (2016), Roopa and Kumar (2014). Spinosad 45% SC was found to be next best treatment. The results of Spinosad (2.02) were supported by Pal *et al.* (2018), Singh *et al.* (2017) and Gautam *et al.* (2018). Emamectin benzoate 5%SG (2.23) found to be next best effective treatment. These results were similar finding of Khademul *et al.* (2020), Kumar and Sarada (2015).

Among all the treatments the higher yield (28.3q/ha) and higher cost benefit ratio was obtained from Chlorantraniliprole 18.5% SC and lowest in control plot (9.3q/ha). Similar findings made by Nitharwal *et al.* (2017) who recorded the highest cost benefit ratio in Chlorantraniliprole Pal *et al.* (2018) reported that the Spinosad was the best and most economical treatment recorded (26.7q/ha) and cost benefit ratio (1:3.0). Khademul *et al.* (2020) reported highest yield and cost benefit ratio in Emamectin benzoate.

From the above discussion it was found that, spraying of insecticides significantly reduced the pod borer population in chickpea. The present findings conclude that the new generation insecticides Chlorantraniliprole18.5 Sc were found effective against lepidopteran caterpillar *Helicoverpa armigera* along with an additional yield level in chickpea.

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