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RESEARCH ARTICLE

EFFICACY OF SELECTED INSECTICIDES WITH NEEM PRODUCTS AGAINST GRAM POD BORER [*HELICOVERPAARMIGERA* (HUBNER)] IN CHICKPEA [*CICERARIETINUM* (L.)]

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Abstract: The field trial conducted at SHUATS, Prayagraj during *Rabi* 2022-23. Eight treatments were evaluated against *Helicoverpa armigera* i.e., T_1 Flubendiamide 48% SC, T_2 Emamectin benzoate 5%SG, T_3 NSKE 5%, T_4 Spinosad 45% SC, T_5 Neem oil 2%, T_6 Chlorantraniliprole 18.5% SC, T_7 Neem leaf extract 10% and T_0 untreated control. Results revealed that, among different treatments lowest population of chickpea pod borer was recorded in T_6 Chlorantraniliprole 18.5% SC (1.58). T_4 Spinosad 45SC (1.72) is found to be next best treatment followed by, T_1 Flubendiamide 48% SC (1.93), T_2 Emamectin benzoate 5% SG (2.04), T_3 NSKE 5% (2.33), T_5 Neem oil @ 2% (2.43), whereas T_7 Neem leaf extract 10% (2.48) found to be least effective against this pest. The highest yield was recorded in T_6 Chlorantraniliprole 18.5% SC (22.13q/ha) followed by T_1 Flubendiamide 48% SC (20.63q/ha), T_4 Spinosad 45% SC (20.24q/ha), T_2 Emamectin benzoate 5% SG (19.47q/ha), T_5 Neem oil 2% (18.32q/ha), T_3 Neem Seed Kernel Extract (17.82q/ha), T_7 Neem leaf extract 10 % (16.74q/ha) and T_0 Control (11.43q/ha).among all the treatments studied, the best and most economical treatment was T_6 Chlorantraniliprole 18.5% SC (1: 2.76) followed by T_1 Flubendiamide 48% SC (1: 2.75), T_4 Spinosad 45% SC (1:2.61), T_2 Emamectin benzoate 5% SG (19.47q/ha and1:2.59), T_5 Neem oil 2% (1:2.48), T_3 Neem Seed Kernel Extract (1:2.46) T_7 Neem leaf extract 10 % (1:2.27) and Control (1:1.67).

Keywords: Cost benefit ratio, Chickpea, *Helicoverpa armigera*, Insecticides, Larval population, Neem products

INTRODUCTION

Chickpea, *Cicer arientinum* Linn. Constitutes as world's third most important pulse crop and India contributes 80 per cent of the total world's production. Due to its richness in proteins and amino acids, it plays vital role in vegetarian diet. Southern and central part of India one of the major constrains for lower yield of crop is the damage caused by the pod borer, *Helicoverpa armigera* (Hub.) right Most of the insecticides belonging to organophosphates, carbamates and synthetic pyrethroids etc (Adsure *et al*., 2015).

It has been reported 3.6 - 72.8 per cent pod damage in chickpea. Chickpea is one of the major pulse crops in India and widely grown in Saurashtra region of Gujarat State. This crop is attacked by *H. armigera* which causes the economic damage, this pest has created a serious threat to the agricultural industry in the recent years and has resulted in lack of confidence in insecticides for the control of the pest. It is necessary to develop IPM module which helps to manage the population of *H. armigera* below ETL and conserve the bio-agent and also helps in reducing the pollution. (Khorasiya *et al*., 2018)

In India, chickpea crop is mainly known for protein source, grown in tropical, subtropical and temperate regions. India ranks first among the chickpea growing nations in terms of production and cultivated area. In India, chickpea occupies 7.1 million hectares with a production of 5.75 million tonnes accounting for 30.9% and 39.9% of total pulse area andproduction respectively. (Kumar *et al*., 2018) listed 54 species of insect pests on chickpea of these the gram pod borer, *Helicoverpa armigera* (Hub), a pest of national importance in India, is one of the limiting factor in the successful cultivation of chickpea pod borer larvae feed on both foliage and pods of chickpea, yield losses are mainly due to pod damage.

In Karnataka, the crop is grown in an area of 6.05 lakh hectares with a productivity of 937 kg/ha. Among biotic factors chickpea is infested by nearly 60 insects' species in which cutworm, *Agrotis ipsilon*, gram pod borer, *Helicoverpa armigera* (Hub.), semilooper, *Autographa nigrisigna*, and

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aphid, *Aphis craccivora*, are the pests of major importance. Among these, the major damage is caused by gram pod borer which is polyphagous in nature; *H. armigera* is one of the serious pests of chickpea, feeds more than 150 crops throughout the world (Rajendra and Kumar 2022).

MATERIALS AND METHODS

The experiment was conducted during the *Rabi* season 2022 at Crop Research Farm (CRF), Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh. The experiment was conducted at the Central Research Farm of Sam Higginbottom University of Agriculture, Technology and Sciences, Naini, Prayagraj, (U.P.). The research field is situated at the right side of Rewa road at 25° 22' 15.888" North Latitude and 81°51' 31.4712" East Longitude and is about 98m above mean sea level. The climate at Prayagraj is typical subtropical which prevails in the eastern part of UP.

The experiment was carried out in a Randomized block design (RBD) with three replications. A good tilth area was divided into three main blocks. Each main block was sub-divided into 8 sub-plots of 2m×1m size with maintaining 30 cm borders as a bunds and treatments was assigned randomly.

The insecticides used in this field trial are Flubediamide 48% SC, Emamectin benzoate 5% SG, NSKE 5%, Spinosad 45 % SC, Neem oil 2%, Chlorantraniliprole 18.5% SC, Neem leaf extract 10%. The basal application of fertilizers was done manually and insecticides were applied with the help of knapsack sprayer by considering ETL level for making spray decisions.

Observations and calculations on population of *Helicoverpa armigera*, grain yield and cost benefit ratio were made on five randomly selected tagged plants in each plot along with untreated control. Post treatments observations on number of larvae were recorded on 3rd ,7th and 14thdays after each spray. Observations were made on the amount of larvae present on selected plants in each plot subjected to statistical analysis.

Preparation of insecticidal spray solutions

The Insecticidal spray solution of desired concentration as per treatment was freshly prepared every time at the site of experimentation just before the start of spraying operations. The spray solution of a desired concentration was prepared by adopting the following formula.

$$V = \frac{C \times A}{a.i\ \%}$$

Where,

V = Volume/ weight of formulated insecticide required. C = Concentration required.

A = Volume of solution to be prepared.

% a.i. = Given percentage of active ingredient.

Cost Benefit Ratio: Gross returns were calculated by multiplying total yield with market price of the produce. Cost of cultivation and cost of treatments was deducted from the gross returns, to find out returns and cost benefit of ratio by following formula,

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

$$BCR = \frac{Gross\ returns}{Total\ cost\ of\ cultivation}$$

Where,

BCR = Benefit Cost Ratio (Chitralekha *et., al* 2020)

RESULTS AND DISCUSSION

The present field investigation was carried out on "Efficacy of selected insecticides with neem products against gram pod borer [*Helicoverpa armigera* (Hubner)] in chickpea [*Cicer arietinum* (L.)]" The data so obtained through observation on various aspects were subjected to statistical analysis where ver necessary and the data was compiled. Results, thus obtained are presented aspect wise here under, DBS(Day before spraying).

The data revealed on population of *Helicoverpa armigera* over control on overall mean revealed that all the treatments were significantly superior over T_8 control (3.36). Among all the treatments minimum population of infestation was recorded T_6 Chlorantraniliprole 18.5% SC (1.58) similar to the findings of (Jadhav *et al*., 2021), recorded least larval population as compared to the remaining followed by T_4Spinosad 45% SC (1.73), (Deshmukh *et al*., 2010), T_1 Flubendiamide 48% SC (1.93) (Santhosh and Kumar 2022), T_2 Emamectin benzoate 5% SG (2.04)(Singh *et al*., 2012) ,T_3 NSKE 5% (2.33), T_5 Neem oil @ 2% (2.43) In this the maximum population of infestation was recorded in T_7Neem leaf extract 10% (2.48) (Reddy and Tayde 2022).

The yields among the treatment were significant. The highest yield and benefit cost ratio was recorded in T_6 Chlorantraniliprole18.5% SC(22.13q/ha and 1: 2.76 respectively) Similar reports were given by Hanumant and Kumar (2022),followed by T_1 Flubendiamide 48% SC (20.63q/ha and1: 2.75) Santhosh and Kumar (2022), T_4 Spinosad 45% SC (20.24q/ha and 1:2.61) Upadhyay *et al*.,(2020), T_2 Emamectin benzoate 5% SG (19.47q/haand1:2.59) Chiranjeevi and Sarnaik (2017) , T_5Neem oil 2%(18.32q/ha 1:2.48) Bhushan *et al*.,(2011), T_3 Neem Seed Kernel Extract (17.82q/ha and1:2.46) Santhosh and Kumar (2022) T_7 Neem leaf extract 10 % (16.74q/ha and 1:2.27) Kumar *et al*., (2019).

Table 1. Efficacy of treatments on larval population of *Helicoverpa armigera* in chickpea(overall mean)

S.N.	Treatments	1st Spray	2nd Spray	Mean
T_1	Flubendiamide48% SC	2.08	1.79	1.93
T_2	Emamectin benzoate 5% SG	2.21	1.81	2.04
T_3	Neem seed kernel extract 5%	2.49	2.18	2.33
T_4	Spinosad 45% SC	1.89	1.54	1.72
T_5	Neem oil 2%	2.53	2.32	2.43
T_6	Chlorantraniliprole18.5% SC	1.78	1.36	1.58
T_7	Neem leaf extract 10%	2.61	2.36	2.48
T_0	Control	3.08	3.64	3.36

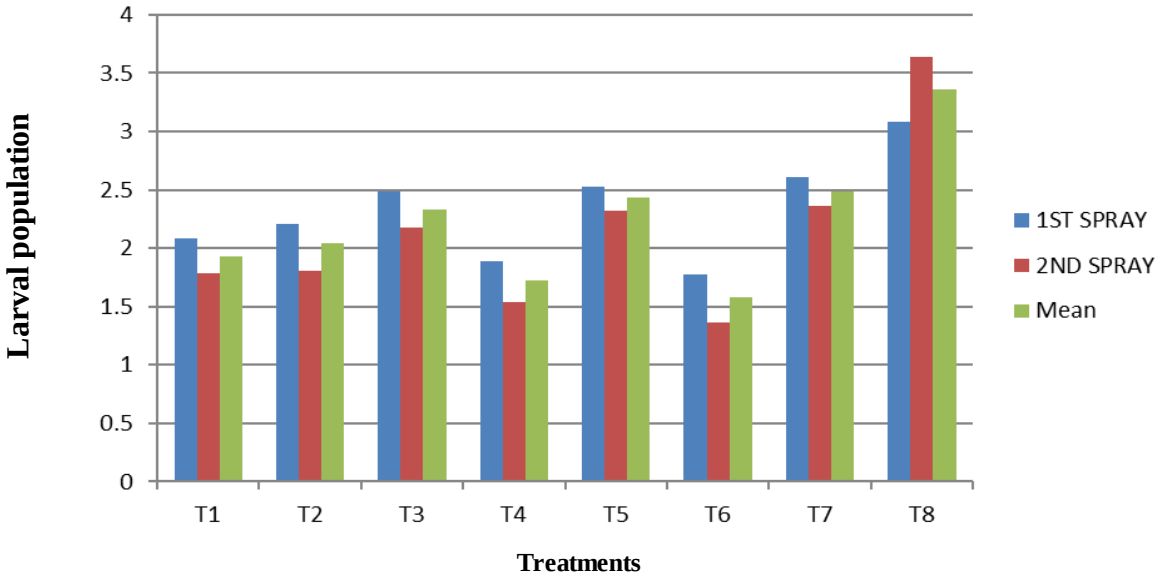

Fig 1. Efficacy of treatments on larval population of *Helicoverpa armigera* in chickpea (overall mean)

Table 2. Economics of Cultivation and Cost Benefit Ratio

S.No.	Treatments	Yield (q/ha)	Cost of yield/q (□)	Total cost of yield (Gross returns) (□)	Cost of cultivation (□)	Cost of treatments (□)	Total cost of treatments (□)	C:B Ratio
T_1	Flubendiamide 48% SC	20.63	5500	113,465	37550	3760	41310	1:2.75
T_2	Emamectin benzoate 5% SG	19.47	5500	107,085	37550	3760	41310	1:2.59

T_3	Neem seed kernel extract 5%	17.82	5500	98,010	37550	2160	39710	1:2.46
T_4	Spinosad 45% SC	20.24	5500	111,320	37550	4960	42510	1:2.61
T_5	Neem oil 2%	18.32	5500	100,760	37550	2960	40510	1:2.48
T_6	Chlorantraniliprole 18.5% SC	22.13	5500	121,715	37550	6460	44010	1:2.76
T_7	Neem leaf extract 10%	16.74	5500	92,070	37550	2860	40410	1:2.27
T_0	Control	11.43	5500	62865	37550	–	37550	1:1.67

CONCLUSION

From the present study, the results it showed that T_6 Chlorantraniliprole 18.5 % SC (1.58) is most effective treatment against gram pod borer of Mean larval population producing maximum yield and recorded highest Cost-Benefit ratio compared to other treatments. While, T_4 Spinosad 45% SC (1.72), T_1 Flubendiamide48% SC (1.93), T_2 Emamectin benzoate 5% SG (2.04) has shown average results has proved to be least effective chemicals. T_5 Neem oil 2% (18.32q/ha), T_3 Neem Seed Kernel Extract (17.82q/ha), T_7 Neem leaf extract 10 % (16.74q/ha) found to be least effective in managing *Helicoverpaarmigera*. Botanicals are the 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.

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REFERENCES

Adsure, S. P. and Mohite, P. B. (2015). Efficacy of entomopathogenic fungi against gram pod borer, *Helicoverpa armigera* (Hub.) on chickpea. *Journal of Global Biosciences*, **4**(8), 3154-3157.

Google Scholar

Bhushan, S., Singh, R. P. and Shanker, R. (2011). Bioefficacy of neem and Bt against pod borer, *Helicoverpa armigera* in chickpea. *Journal of Biopesticides*, **4**(1), 87.

Google Scholar

Chiranjeevi, B. and Sarnaik, S. V. (2017). Bioefficacy of promising insecticides against maggot population of pigeonpea pod fly, *Melanagromyza obtusa* (Malloch). *Journal of Entomology and Zoology Studies*, **5**(3), 159-162.

Google Scholar

Chitralekha, Yadav G.S. and Verma, T. (2018). Efficacy of insecticides against *Helicoverpa armigera* on chickpea. *Journal of Entomology and Zoology Studies*, **6**(3):1058-1061.

Google Scholar

Deshmukh, S. G., Sureja, B. V., Jethva, D. M. and Chatar, V. P. (2010). Field efficacy of different insecticides against *Helicoverpa armigera* (Hubner) infesting chickpea. *Legume Research*, **33**(4), 269-273.

Google Scholar

Hanumant, P. A. and Kumar, A. (2022). Field evaluation of chemicals and bio-pesticides against chickpea pod borer [*Helicoverpa armigera* (Hubner)].

Google Scholar

Jadhav, K. U., Chavan, A. P., More, S. A., Kulkarni, S. R. and Karande, R. A. (2021). To study the efficacy of molecule combinations against gram pod borer (*Helicoverpa armigera*, Hubner) in chickpea (*Cicer arietinum* L.). *J. Entomol Zool Stud.*, **9**(6), 164-70.
Google Scholar

Khorasiya, S. G., Raghvani, K. L., Bharadiya, A. M., Jethva, D. M. and Bhut, J. B. (2018). Efficacy of bio-pesticides, insecticides alone and their combination against pod damage caused by *Helicoverpa armigera* in chickpea. *Journal of Entomology and Zoology Studies*, **6**(1), 928-933.
Google Scholar

Kumar, A., Tripathi, M. K., Chandra, U. and Veer, R. (2019). Efficacy of botanicals and bio-pesticide against *Helicoverpa armigera* in chickpea. *Journal of Entomology and Zoology Studies*, **7**(1), 54-57.
Google Scholar

Kumar, L., Bisht, R. S., Singh, H., Kumar, A., Pandey, N. and Kumar, M. (2018). 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*, **7**(1S), 1739-1744.
Google Scholar

Rajendra, G. S. and Kumar, A. (2022). Field efficacy and economics of different insecticides against pod borer [*Helicoverpa armigera* (Hubner)] on chickpea (*Cicer arietinum* L.).
Google Scholar

Reddy, Y. S. and Tayde, A. R. (2022). Comparative Efficacy of Certain Chemicals and Biopesticides against Pod Borer, *Helicoverpa armigera* (Hubner) on Chickpea. *International Journal of Plant and Soil Science*, **34**(24), 249-253.
Google Scholar

Santhosh, K. and Kumar, A. (2022). Comparative efficacy of selected insecticides and neem products against chickpea pod borer [*Helicoverpa armigera* (Hubner)]. The *Pharma Innovation Journal*, **11**(6), 1558-1562.
Google Scholar

Singh, P. S., Shukla, R. K. and Yadav, N. K. (2012). Bio-efficacy of some insecticides against *H. armigera* (Hubner) on chickpea (*Cicer arietinum* L.). *Journal of Food Legumes*, **25**(4), 291-293.
Google Scholar

Upadhyay, R. R., Singh, P. S. and Singh, S. K. (2020). Comparative efficacy and economics of certain insecticides against gram pod borer, *Helicoverpa armigera* (Hübner) in chickpea. *Indian Journal of Plant Protection*, **48**(4), 403-410.
Google Scholar