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Efficacy of Synthetic Insecticides against Pod Borer [*Helicoverpa armigera* (Hubner)] on Cowpea [*Vigna unguiculata* (L.) Walp]

K. N. Sahithi Sharma [a] and Anoorag R. Tayde [a*]

[a] Department of Entomology, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj-211007, India.

Authors' contributions

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

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ABSTRACT

The present investigation was conducted at Central Research Field, Department of Entomology, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj during the *Kharif* season of 2021. The field was laid in randomized block design (RBD) with six treatments Chlorantraniliprole 18.5% SC 0.5ml/L, Spinosad 45SC 1ml/L, Emamectin benzoate 5%SG 0.04G/Kg, Neem oil 5% 50ml/L, karanj oil 5% 50ml/L, NSKE 5% 50ml/L and control viz., The larval population per plant was taken before spraying and 3,7 and 14 days after each spray all the insecticides tested significantly reduced the pest infestation compared to control. The results of the efficacy showed that the minimum larval population was recorded in the treatment Chlorantraniliprole 18.5% SC (2.26%, 1.80%). The next effective treatments were Spinosad 45SC (2.80%, 2.23%), Emamectin benzoate 5%SG (3.23%, 2.80%), Neem oil 5% (3.63%, 3.30%), karanj oil 5% (4.20%, 3.60%.), NSKE 5% (4.56%, 4.10%.), which was found to be least effective among all treatments. The best and most economical treatment Chlorantraniliprole 18.5% SC (1:2.82) followed by Spinosad 45 SC (1:2.44), Emamectin benzoate 5% SG (1:2.10), Neem oil 5% (1:1.92), karanj oil 5% (1:1.68), NSKE (1:1.49) as compared to the control plot (1:1.01).

Keywords: Benefit-cost ratio; Chlorantraniliprole; Cowpea; Helicoverpa armigera; Karanj oil; Neem oil.

**Corresponding author: E-mail: anurag.tayde@shiats.edu.in;*

1. INTRODUCTION

Cowpea (*Vigna unguiculata* (L.) Walp.) is a tropical annual herbaceous legume of the Fabaceae family (Stoilova *et al*., 2013). It's also known as black-eyed pea or southern pea, and it's used for a variety of things like food, feed, forage, fodder, green manure, and vegetables. Cowpea is also useful as a cover crop and helps to improve soil fertility by fixing nitrogen [1]. Cowpea seeds are high in protein, calories, minerals, and vitamins [2]. A seed can include 23–25 percent protein, 50–67 percent carbs, 8–9% moisture, and very little fat (3.99 %). They also have a significant amount of micronutrients like vitamin A, iron, and calcium [3]. Africa, Nigeria, Brazil, Haiti, India, Myanmar, Sri Lanka, Australia, and the United States are all big cowpea producers. Cowpeas are grown all over the world, with an estimated yearly cultivation area of 12 to 14 million hectares and a global yield of around 4.5 million metric tonnes [4]. Cowpeas are farmed on 10 million hectares with a yield of 387 kg/ha (FAO, 2004). Cowpeas are grown on roughly 3.9 million hectares, with a yield of 567 kg/ha. Because of its wide host range, dispersion, and destructiveness, it is the most severe insect pest of grain legumes in the tropics and subtropics. *Helicoverpa armigera* is a polyphagous pest that has been designated as a national pest due to its destructiveness during critical stages of crop development, such as flowering and pod development, especially to economically valuable plant parts such as flowers and pods. As a result, it has become a significant constraint to grain legume productivity [4].

2. MATERIALS AND METHODS

The trial took place in *Kharif*, season 2021, at SHUATS, Prayagraj (U.P.). The study was set up in a randomized block design with eight different treatments. The Cowpea variety Ankur Gomati was employed in the study, and each treatment was replicated three times. Treatments for the management of the gram pod borer were applied after a sufficient level of insect population was seen. The data was statistically analyzed. In addition, the yield per plot was recorded**.**

3. RESULTS AND DISCUSSION

The results of the field trial revealed that among the insecticides treated against *Helicoverpa armigera* after the first spray Chlorantraniliprole was found significantly superior in reducing the pod borer population which was followed by Spinosad, Emamectin benzoate, neem oil, Karanj oil, and NSKE. After the second spray, all the insecticides were found superior to untreated control. The overall mean analysis showed that Chlorantraniliprole and Spinosad were significantly superior to other treatments followed by Emamectin benzoate, neem oil, Karanj oil, and NSKE. The treatments were found to be significant to each other.

Chlorantraniliprole was found to reduce the Cowpea pod borer population to a tune of (2.03). Regarding the yield of cowpea, Chlorantraniliprole registered a significantly higher yield (22.08 q/ha) and B:C ratio of 2.82 (Table 1). The present finding is in line with the observation of field application of Chlorantraniliprole 18.5% SC 0.5ml/L. against pod borer and recorded the lowest *Helicoverpa armigera* population in cowpea crop [6,7].

Diamide is highly effective against some Lepidopteran pests including pod borers selectively activating the insect ryanodine receptor (RyR). Contraction of both cardiac and skeletal muscle results in excitation followed by death [7]. Spinosad 45% SC and Emamectin benzoate 5%SG were found effective in reducing the Larva population [8,9]. The present finding conforms reported that the Spinosad performed as the most effective bio-insecticide in reducing the highest percent infestation of pod borer population and also reported that yield and quality parameters recorded, were higher in treated plots compared to control plots.

[10] Who reported maximum control of *Helicoverpa armigera* of cowpea with the application of a Chlorantraniliprole 18.5% SC 0.5ml/L. followed by Spinosad 45SC 1ml/L reported that Chlorantraniliprole 18.5% SC gave the best performance with a minimum (0.055%) number of Larvae followed by Spinosad (0.018%), which were at par with each other [11] reported that the efficacy of newer insecticides for the management of cowpea pod borer, most effective was Spinosad 45SC followed by Emamectin benzoate 5%SG.

From the above discussion, it may be concluded that among the tested insecticides, Chlorantraniliprole 18.5%SC 0.5ml/L. maybe recommended for most economic and effective management of pod borer, *Helicoverpa armigera* on cowpea.

Table 1. Efficacy of botanicals and synthetic insecticides on the population of pod borer (*Helicoverpa armigera*) on cowpea in *Kharif* season 2021

S.No.	Treatments	Larval population (*Helicoverpa armigera*)							Overall Mean	Yield (q/ha)	B:C ratio
		First spray				Second spray					
		1DBS	3DAS	7DAS	14DAS	3DAS	7DAS	14DAS			
T_1	Emamectin benzoate 5% SG 0.04g/kg	4.66	3.53^{e}	3.00^{e}	3.20^{d}	3.06^{e}	2.66^{d}	2.86^{e}	3.01^{bcd}	16.80	1:2.10
T_2	Spinosad 45% SC 1ml/L	4.60	3.13^{f}	2.53^{f}	2.80^{e}	2.53^{f}	2.06^{e}	2.26^{f}	2.51^{cd}	19.20	1:2.44
T_3	Chlorantraniliprole 18.5%SC 0.5ml/L	4.53	2.80^{g}	1.80^{g}	2.20^{f}	1.93^{g}	1.73^{f}	1.80^{g}	2.03^{d}	22.08	1:2.82
T_4	Karanj oil 5% 50ml/L	4.60	4.40^{c}	4.00^{c}	4.20^{b}	3.86^{c}	3.40^{c}	3.66^{c}	3.90^{bc}	13.20	1:1.68
T_5	Neem oil 5% 50ml/L	4.86	3.86^{d}	3.53^{d}	3.63^{c}	3.53^{d}	3.13^{c}	3.33^{d}	3.46^{bcd}	14.80	1:1.92
T_6	NSKE 5% 50ml/L	5.06	5.00^{b}	4.33^{b}	4.40^{b}	4.33^{b}	3.93^{b}	4.13^{b}	4.33^{b}	11.80	1:1.49
T_0	Untreated	5.10	5.60^{a}	6.20^{a}	6.8^{a}	7.40^{a}	8.00^{a}	8.60^{a}	7.10^{a}	7.3	1:1.01
	F-test	NS	S	S	S	S	S	S	S	-	-
	CV	5.21	2.71	4.73	4.12	4.33	4.77	3.91	16.23	-	-
	C.D. (P = 0.5)	-	0.19	0.30	0.28	0.29	0.30	0.26	1.49	-	-

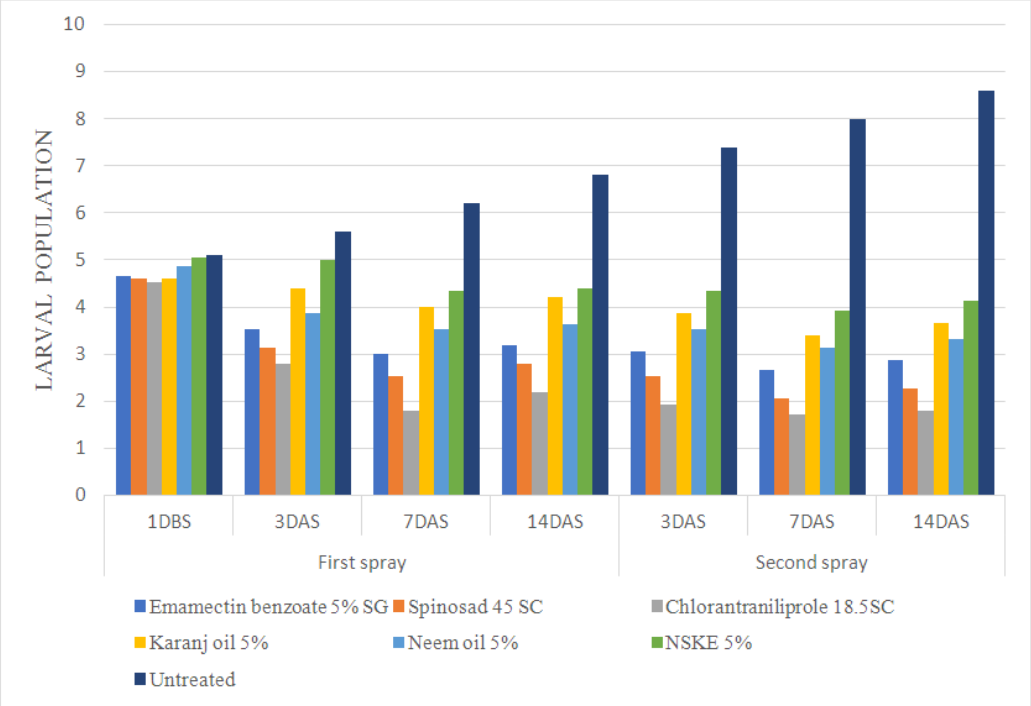

Fig. 1. Efficacy of botanicals and synthetic insecticides on the population of pod borer (*Helicoverpa armigera)* on cowpea in *Kharif* season 2021

The above graph explains that the lowest mean larval population of *Helicoverpa armigera* of first and second spray was recorded in Chlorantraniliprole 18.5%SC followed by Spinosad 45% SC, Emamectin benzoate 5%SG, Neem oil 5%, Karanjoil 5%, and the highest mean larval population is seen in NSKE 5%.

4. CONCLUSION

It may be stated that the synthetic insecticides and botanicals Chlorantraniliprole 18.5 percent SC. suggested for the management of Helicoverpa armigera on Cowpea crop proved to be the most effective and economical. Similarly, the use of Spinosad 45 % SC, Emamectin benzoate 5% SG, Neem oil 5%, and Karanj oil 5% can also be thought of for the management of cowpea pod borer. However, the application of NSKE 5% could not exert an encouraging role for Cowpea pod borer management. This plant product also helps in reducing pollution in the environment. Hence it can be suitably incorporated as a treatment from an IPM perspective.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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