Efficacy of selected chemicals and biopesticides against chickpea gram pod borer

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ABSTRACT

The field experiment was carried out in the *Rabi* season of 2022-2023 at Central Research Farm (CRF), Sam Higginbottom University of Agriculture, Technology And Sciences, Prayagraj. The field was replicated with three randomised block design (RBD) of eight treatments including control (water spray) *viz*., Indoxacarb 14.5% SC, Chlorantraniliprole 18.5% SC, Emamectin benzoate 5% SG, Emamectin benzoate 5% SG+Indoxacarb14.5% SC, *Beauveria bassiana* 1.5% WP, NSKE 5%, Neem oil 5% and one control plot (water spray). The maximum reduction of larval population was recorded in T_3 Emamectin benzoate 5% SG (78.9%) followed by T_2 Chlorantraniliprole 18.5% SC (76.2%), T_4 Emamectin benzoate 5% SG + Indoxacarb 14.5% SC (68.2%), T_1 Indoxacarb 14.5% SC (65.8%), T_6 NSKE 5% (59.3%), T_5 *Beauveria bassiana* 1×10^8 CFU\G (54.7%) was found next effective treatments. Among all the treatments T_7 Neem oil 5% (49.4%) was found least effective but comparatively superior over untreated plot (0%).

Keywords: *Beauveria bassiana,* biopesticide, efficacy, emamectin benzoate, chlorantraniliprole, *Helicoverpa armigera*.

1. INTRODUCTION

"Historically, the leguminous crop known as the chickpea (*Cicer arietinum* L.), a member of the Fabaceae family, was self-pollinated. The majority of chickpea farms use soils with low fertility and moisture retention capabilities. The most significant pulse crop grown in India during the *Rabi* season is the gram, also known as chickpea, Bengal gram, or garbanzo. It also goes by the name "King of Pulses" in India" [1].

"Nutritional value per 100g of chickpea contains carbohydrates (27.42 g), protein (8.86g), total fat (2.59 g), dietary fibre (7.6g), folates (172 mcg), niacin (0.526 mg), pantothenic acid (0.245 mg), pyridoxine (0.215 mg), riboflavin (0.063), thiamine (0.200 mg), vitamin C (1.3 mg), vitamin A (27 IU), vitamin E (0.35 mg), vitamin K (4.0 mcg), sodium (7.0 mg), potassium (291 mg), calcium (49 mg), iron (2.89 mg), magnesium (48 mg), phosphorous (168 mg), zinc (1.53 mg)" [2].

"The output of chickpeas reached 15 million tonnes in 2020, with 73% of the global total coming from India. Other major producers included Turkey (0.6 million tonnes), Myanmar (0.5 million tonnes), and Pakistan (0.5 million tonnes). There are 11.1 million tonnes produced in India" [3].

"Over 180 cultivated species, including those of cereals, legumes, vegetables, fruits, forage, and wild species, are attacked by *Helicoverpa armigera*. From the time the crop is a seedling until it is fully grown, a variety of insect-pests assault the chickpea crop. *Helicoverpa armigera*, *Spodoptera litura*, *Agrotis ipsilon*, *Plusia orichalchea*, and *Bemisia tabaci* are the main insect pests that affect the chickpea crop in the winter and summer. Gram pod borer, Gram cutworm, Termites, Semilooper, Wilt/Root rot, Ascochyta blight, and Botrytis grey mould are estimated to cause losses of between 10 and 90 percent (%) in chickpea crops. The chickpea pod borer, *Helicoverpa armigera*, is polyphagous in nature and damages a variety of crops, including pigeon-pea, groundnut, cotton, vegetables, pearl millets, sorghum, maize, sunflower, etc" [4].

According to reports from India, this insect has been shown to harm pods by 32–100% and reduce yields by 4.2–77%. Up to 25–30 chickpea pods can be harmed by a single *Helicoverpa armigera* larva during its lifetime [5].

2. MATERIALS AND METHODS

The experiment was performed in *Rabi* season of 2022–2023 using the Shulab–45 chickpea variety in a plot size of (2m×2m) at a spacing of (30cm×10cm), using a Randomised Block Design with 8

treatments duplicated three times, eliminating plant protection. *Beauveria bassiana* $(1\times10^{8}CFU/G)$, NSKE 5%, Neem oil 5%, and one control plot were used along with Indoxacarb 14.5% SC, Chlorantraniliprole 18.5% SC, Emamectin benzoate 5% SG, Emamectin benzoate 5% SG+Indoxacarb14.5% SC. All treatments, with the exception of untreated plot, received two sprays. The larval population of chickpea pod borer was recorded on 5 randomly selected plants from each plot at one day before spraying and 3rd, 7th and 14th days after spraying with an interval of 1 day between 1st and 2nd Spray. Percent reduction was calculated by following formula:

$$\% \text{ Reduction} = \frac{\text{Control}-\text{treatment}}{\text{Control}} \times 100 \quad [6]$$

3. RESULTS AND DISCUSSION

"The data on per cent reduction of larval population of *Helicoverpa armigera* over control at 3rd, 7th and 14th day after first spraying revealed that all the treatments were significantly superior over control. Among all the treatments, the maximum larval population reduction of *Helicoverpa armigera* was recorded in T_3 Emamectin benzoate 5% SG (67.2%), followed by T_2 Chlorantraniliprole 18.5% SC (57.3%), T_4 Emamectin benzoate 5% SG + Indoxacarb 14.5% SC (53.9%), T_1 Indoxacarb 14.5% SC (46.8%), T_6 NSKE 5% (42.8%), T_5 *Beauveria bassiana* (33.9%) and T_7 Neem oil 5% (30.5%) was found least percentage reduction on larval population over T_8 untreated plot (0%)". [14]

The data on per cent reduction of larval population of *Helicoverpa armigera* over control at 3rd, 7th and 14th day after spraying revealed that all the treatments were significantly superior over control. Among all the treatments, the maximum larval population reduction of *Helicoverpa armigera* was recorded in T_3 Emamectin benzoate 5% SG (78.9%), followed by T_2 Chlorantraniliprole 18.5% SC (76.2%), T_4 Emamectin benzoate 5% SG + Indoxacarb 14.5% SC (68.2%), T_1 Indoxacarb 14.5% SC (65.8%), T_6 NSKE 5% (59.3%), T_5 *Beauveria bassiana* (54.7%) and T_7 Neem oil 5% (49.4%) was found least percentage reduction on larval population over T_8 untreated plot (0%).

"The data on per cent reduction of larval population of *Helicoverpa armigera* over control of first and spray revealed that all the treatments were significantly superior over control. Among all the treatments used, the maximum larval population reduction of *Helicoverpa armigera* was recorded in T_3 Emamectin benzoate 5% SG (72.3%) [7], followed by T_2 Chlorantraniliprole 18.5% SC (67.9%) [8][9], T_4 Emamectin benzoate 5% SG + Indoxacarb 14.5% SC (61.8%) [10], T_1 Indoxacarb 14.5% SC (57.3%) [11], T_6 NSKE 5% (51.9%) [12], T_5 *Beauveria bassiana* (45.4%) and T_7 Neem oil 5% (40.9%) [13], was found least percentage reduction on larval population over T_8 untreated plot (0%)".

Fig.1. An overview of early larva infestation

Fig.2. An overview of Spraying

4 CONCLUSION

recorded maximum larval reduction followed by T_2 Chlorantraniliprole 18.5% SC, T_4 Emamectin benzoate 5% SG + Indoxacarb 14.5% SC, T_1 Indoxacarb 14.5% SC, T_6 NSKE 5%, T_5 *Beauveria bassiana* and T_7 Neem oil 5% was found least percentage reduction on larval population over T_8 control (water spray). Biopesticides are also to be incorporated in pest management in order to avoid indiscriminate use of pesticides causing pollution in the environment and not much harmful to beneficial insects. Chemicals are better than botanicals in reducing larval population levels. Future research may be recommended to achieve a better performance against *Helicoverpa armigera*.

Table 1. Efficacy of treatments on percentage reduction of larval population against gram pod borer on chickpea during *Rabi* season.

S. No	Treatments	Dose	Percent reduction of *Helicoverpa armigera* / 5 plants (%)										
			First spray					Second spray					
			1DBS	3DAS	7DAS	14DAS	Mean	1DBS	3DAS	7DAS	14DAS	Mean	Overall mean
T_1	Indoxacarb 14.5%SC	0.5ml/lit	20.2	35.9	51.0	52.4	46.8	53.8	60.2	69.5	67.5	65.8	57.3
T_2	Chlorantraniprole 18.5% SC	0.5ml/lit	28.5	47.3	63.1	60.5	57.3	61.6	72.1	80.6	75.6	76.2	67.9
T_3	Emamectin benzoate 5% SG	0.4gm/L	30.6	52.9	70.2	67.2	63.9	64.6	75.0	83.3	78.4	78.9	72.3
T_4	Emamectin benzoate5% SG +Indoxacarb 14.5% SC	0.4gm/L + 0.5ml/L	24.5	45.3	56.3	59.1	53.9	58.4	64.6	70.8	68.9	68.2	61.8
T_5	*Beauveria bassiana* (1×10⁸CFU\G)	5gm/L	16.2	26.3	36.8	37.6	33.9	39.9	48.5	58.3	56.7	54.7	45.4
T_6	NSKE 5%	50ml/lit	18.4	33.9	49.2	44.3	42.8	43.1	54.5	62.5	60.8	59.3	51.9
T_7	Neem oil 5%	50ml/lit	14.11	22.6	33.4	34.4	30.5	35.3	42.6	54.1	51.3	49.4	40.9
T_8	Control	-	0	0	0	0	0	0	0	0	0	0	0
	F-test	-	NS	S	S	S	S	S	S	S	S	S	S

%= Percentage, DBS= Day Before Spray, DAS=Day After Spray.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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