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Management of gram pod borer (*Helicoverpa armigera* L.) by bio-rational pesticides

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Abstract

Field studies were conducted on the efficacy of bio-pesticides against gram pod borer, (*Helicoverpa armigera* L.) at experimental field, Organic Research farm Karguwan Ji, Department of Entomology, Institute of Agricultural Sciences, Bundelkhand University, Jhansi (Uttar Pradesh) during *Rabi* Season of 2022-2023. Different bio-pesticides *viz.*: Neem oil, *Verticillium lecanii*, *Bacillus thuringiensis* (5% WP), *Metarrhizim anisoplae*, Garlic extract, NSKE 0.5%, Karanj oil 0.5%, *Beauveria bassiana*. Experimental results revealed that the plant treated with bio-pesticides registered a significant difference of gram pod borer *Helicoverpa armigera* L. over the treatment of untreated control. Among them, the treatment of *Bacillus thuringiensis* (8.30 larvae/5 plant) was found in significantly more effective against the pest as compared to other bio-pesticides Neem oil, *Verticillium lecanii*, *Bacillus thuringiensis*, *Metarrhizim anisoplae*, Garlic extract, NSKE, Karanj oil, *Beauveria bassiana*. were found moderately effective and proved significantly superior over and of *Bacillus thuringiensis*, *Beauveria bassiana* and Neem oil proved significantly less effective among the bio-pesticides evaluated against gram pod borer *Helicoverpa armigera* L.

Keywords: Gram, gram pod borer, *Helicoverpa armigera* L., bio-pesticides

Introduction

Pulses are a significant group of food crops that, due to their high protein content, hold a special place in the agricultural world. Chickpeas (Cicer) one of the significant pulses grown during the Rabi season is arietinum Linnaeus. It is mostly farmed in the Indian subcontinent, Western Asia, and many tropical nations. It is also known as "Bengal gram" or "Gram". It is a self-pollinating plant that is a member of the Leguminaceae family and sub-family Papilionaceae.

The most significant crop with wide spread acceptance is the chickpea. In addition to being high in protein, it has the ability to improve soil fertility by fixing huge amounts of atmospheric nitrogen with the aid of symbiotic bacteria, mostly Rhizobium species, making it more ecologically friendly and economically viable. In the diet, chickpeas are used whole, fried, or boiled as seeds and in split form as dal. India leads the globe in both chickpea (*Cicer arietinum* L.) production and consumption. The most significant pulse crop in India is the chickpea, which is often grown on dry, heavily clouded soil. Because it contains 21.5% protein, 64.5% carbs, and 4.5% fat-nutrients that are relatively low in grains and oilseeds-it is a rich source of nutritional benefits in the diet of Indians [4]. People use its green leaves and pods in their daily meals as green vegetables and germinated grains for delightful dishes including excellent breakfast dishes. This is in addition to the 56.6 per cent of includes a significant quantity of carbs, calcium, phosphorus, iron, and vitamin B complex.

In different regions of the world, it is harmed by more than 50 insect species, with the gram pod borer *Helicoverpa armigera* (Hübner) (Noctuidae: Lepidoptera) being the most significant biotic constraint. In India, it is said to feed and reproduce on 182 species of host plants from 47 families, making it a polyphagous, multi-voltine, and cosmopolitan pest [5]. The damage caused by this insect is responsible for reducing crop yield between 18-26 percent. The most conducive stage of crop for attack is 100 percent flowering. Seeing the importance of the crop and insects, present study was conducted at Agricultural Research Station, Sriganganagar with the following specific objectives; to study the population dynamics of *Helicoverpa armigera* in Gram and to ascertain the association of *Helicoverpa armigera* with l°Cal weather and K. parameters [3].

The early instar larva of gram pod borer devours the chlorophyll from the epidermis of the leaves which results in netty whitish patches in leaves. In their later stage, they nibble the leaf sheaths leaving their mid ribs only. In case of heavy infestation only bare stem and branches are left on the plants. During the podding stage early instar larvae make scratches on the green pods by feeding on its green matter, while the later instar makes a more or less circular hole in the pods and inserts its head and the former portion of the body into it and feed upon the developing grains. The larvae also feed on the flowers resulting in less pod setting. A single larva can infest several pods and neatly, eats away the developing grains resulting in substantial yield loss. In this scenario, pod borer can be considered as the major constraint in chickpea cultivation [2].

Materials and Methods

The present study entitled “Management of gram pod borer

(*Helicoverpa armigera* L.) by Bio-rational pesticides" undar Bundelkhand region of Jhansi` was carried out at the Experiment, Organic Research Farm Kargunwa Ji, Department of Entomology, Institute of Agricultural Sciences, Bundelkhand University, Jhansi (Uttar Pradesh) during *Rabi* season of 2022-2023. It is situated at 78o36E Longitude and 25o47N L. atitude and is about 178.37 m above mean sea level. The climate is subtropical and semi-arid.

Experimental details

Management of gram pod borer (*Helicoverpa armigera* L.) by Bio-rational pesticides. gram variety "RSG-44" was sown in the 15.11.2022 second week of Nov. in plots size 2.20 x 2.30 m2 size keeping row to row and plant to plant distance of 30 cm and 10 cm, respectively.

Agro-climatic condition: The general climate prevailing in the Bundelkhand region is dry sub- humid type with annual rainfall varying in mm. The temperature in 40 ℃ in the summer and minimum temperature during winter in degree 10 0C calibrated in Jhansi.

Preparation of spray solution

In all, two foliar sprays for each treatment were given at an interval of 15 days with the help of knapsack sprayer. The quantity of spray fluid required for spraying in each plot was calculated by spraying untreated control plot of 2.20 x 2.30 m^2 with water. The quantity of organic pesticide required was computed by using following formula and measured volume of the organic pesticide was dissolved in small quantity of water mixed well and required concentration of spray solution was prepared by adding require quantity of clean water to it. The sticker (0.5 ml/lit.) was added in spray fluid in spray tank to ensure wetting and spreading of organic pesticides on leaves at the time of application of pesticides in case of oils, soap was used as emulsifier.

$$\text{Quantity of Bio-pesticideal Formulation required} = \frac{\text{Desired strength x Quant it y of s pray}}{\text{\% of Bio-pesticideal formulation material required}}$$

Observations on pod borer

Observation on larval population of pod borer was be recorded on per plant basis. Infested pod was be recorded and percentage pod damaged were worked out. Observation on larval population of pod borer was be recorded on per plant basis. Infested pod was be recorded and percentage pod damaged were worked out.

$$\text{Percentage pod infestation} = \frac{\text{No. of insfested pod}}{\text{Total no. of pod}} 100$$

Results and Discussion

To study the Management of gram pod borer (*Helicoverpa armigera* L.) during rabi 2022-23.

The larval population in all the treatments were taken a day before imposition of treatments as indicated in table.

All treatments used against *Helicoverpa armigera* L. were effective and significantly superior to control.

The minimum fruit infestation after 1st spray was recorded in per cent was recorded in Bt. 2 kg/ha treated plot i.e., (10.40, 9.50 and 8.90) per cent fruit infestation followed by Beauveria bassiana 2.0 kg/ha (12.45, 11.55 and 9.90) < Neem oil 5% (12.70, 11.70 and 10.10) < Metarizium anisoplae 2×108 cuf (12.64,11.55,11.17) < *Verticillium lecanii* 2×108 cuf (14.60, 13.20, 12.10) < NSKE 5% (16.60, 15.10, and 13.00) < Garlic extract 5% (16.90, 14.90 and 14.10) < Karanj oil 0. 5% (18.70, 16.60 and 15.10) compared to control (21.90, 23.10 and 24.10), all the treatments were found effective and significantly superior over the control at 3rd, 7th, and 14th days after spraying respectively. The minimum fruit infestation after 2nd spray was recorded in per-cent was recorded in Bt. 2kg/ha treated plot i.e. (9.10, 8.50 and 7.30) per cent fruit infestation followed by Beauveria bassiana 2.0 kg/ha (10.80, 10.10 and 8.80) < Neem oil 5% (11.80, 11.10 and 9.80) < Metarizium anisoplae 2×108 cuf (12.20, 11.11, 10.00) < *Verticillium lecanii* 2×108 cuf (13.00, 12.20, 10.20) < NSKE 5% (14.70, 13.80, and 12.90) < Garlic extract 5% (14.90, 13.90 and 13.20)< Karanj oil 0. 5% (16.90, 15.80 and 14.70) compared to control (23.90, 24.80 and 25.70), all the treatments were found effective and significantly superior over the control at 3rd, 7th, and 14th days after spraying respectively. This study substantiates with the findings of {1} Bt. 1 kg/ha, Neem oil @ 2%, Nimbecidine @ 2%, HaNPV @ 450LE/ha and Neem leaf Extract @ 5% with 1.90, 4.70, 4.80, 4.90, 5.20, 5.30, and 5.4 mean larval population of *Helicoverpa armigera* larvae per meter length, respectively in that order NSKE @5% were significantly superior over other treatments. The efficacy of various treatments at this stage was in order of Neem Seed Kernel Extract @5% > Bt. 01 Kg/ha > Neem oil @ 2%> Nimbecidine @ 2% > Neem leaf extracts @5% > NPV@ 450LE/ha. Spray of NSKE @ 5% proved significantly lower pod damage of 13.45% and 12.76% in 2010-11and 2011-12 followed by and Bt. 1 kg /ha 14.10 in the first year and 13.38% in the second year.

Table 1: Efficacy of different treatments against gram pod borer (*Helicoverpa armigera* L.) during 1st spray (No. of Larvae/ 5 Plants)

T. No.	Treatments	Before spray	Per cent pod damage			Overall mean
			3 DAS	7 DAS	14 DAS	
T_1	Neem oil	14.50	12.70	11.70	10.10	11.50
T_2	*Verticillium lecanii*	16.50	14.60	13.20	12.10	13.30
T_3	*Baccilus thrungensis*	12.30	10.40	9.50	8.90	9.60
T_4	*Metarizium anisoplae*	14.00	12.60	11.95	11.15	11.90
T_5	Garlic extract	19.10	16.90	14.90	14.10	15.30
T_6	NSKE	17.50	16.60	15.10	13.00	14.90
T_7	Karanj oil	19.50	18.70	16.60	15.10	16.80
T_8	*Beaveria bassaina*	13.60	12.45	11.55	9.90	11.30
T_9	Water control	20.40	21.90	23.10	24.30	23.10
	CD	1.466	1.647	0.975	1.926	2.107
	S.E(m)	0.485	0.545	0.322	0.637	0.697

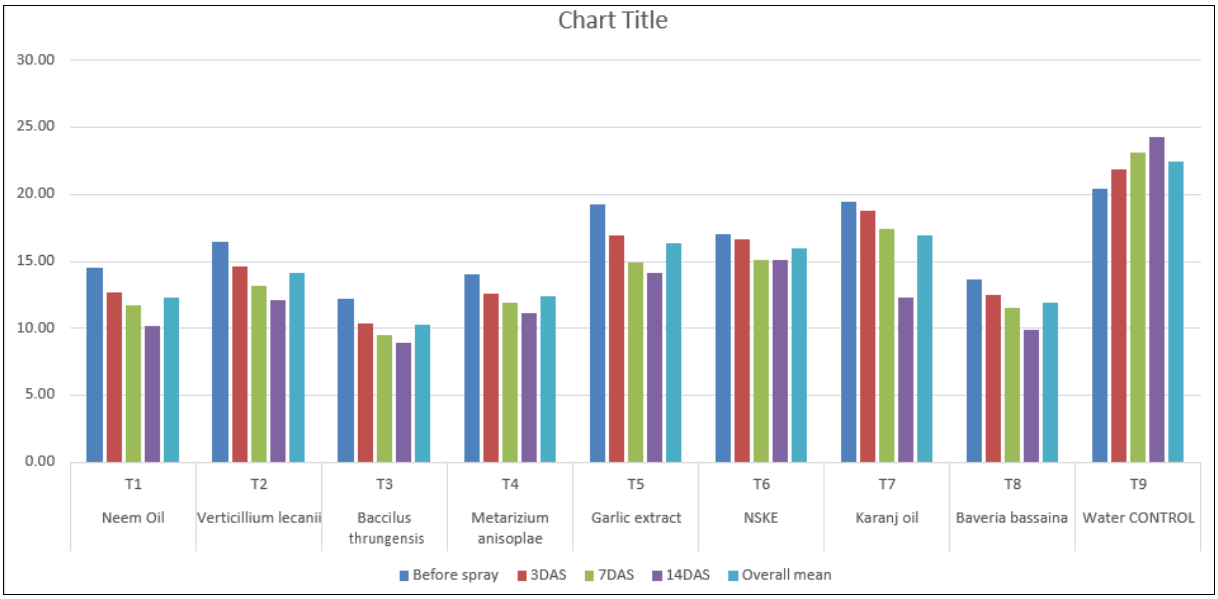

Fig 1: Graphical representation of effect of bio-pesticides against pod damage by gram pod borer (*Helicoverpa armigera* L.*)* during *rabi* 2022-2023

Second spray: pod infestation

Table 2: Effect of bio-pesticides against pod damage by gram pod borer (*Helicoverpa armigera* L.) during *Rabi* 2022-23

T. No.	Treatments	Before spray	Per cent of pod damage			Overall mean
			3 DAS	7 DAS	14 DAS	
T_1	Neem Oil	13.50	11.80	11.10	9.80	10.90
T_2	*Verticillium lecanii*	14.80	13.00	12.2	10.20	11.80
T_3	*Baccilus thrungensis*	10.10	9.10	8.5	7.30	8.30
T_4	*Metarizium anisoplae*	13.10	12.20	11.11	10.00	11.10
T_5	Garlic extract	18.10	14.90	13.9	13.20	14.00
T_6	NSKE	16.20	14.70	13.8	12.90	13.80
T_7	Karanj oil	17.90	16.90	15.8	14.70	15.80
T_8	*Beaveria bassaina*	11.40	10.80	10.1	8.80	9.90
T_9	Water control	20.80	23.90	24.8	25.70	24.80
	CD	1.352	1.469	1.018	1.078	1.184
	SE(m)	0.447	0.486	0.337	0.357	0.392

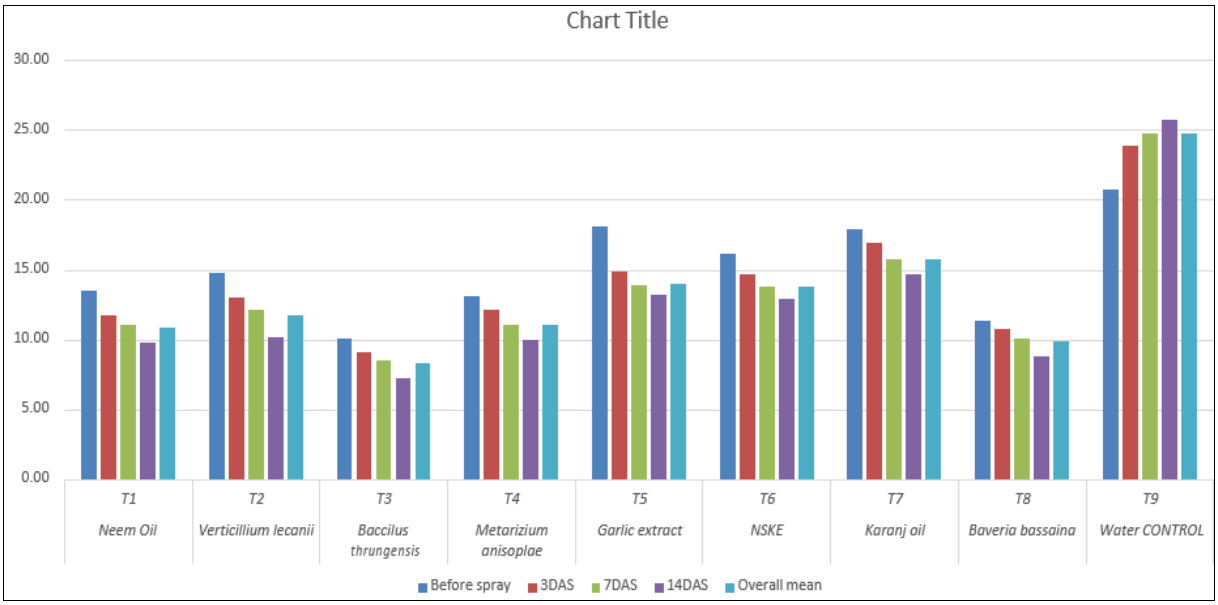

Fig 2: Graphical representation of effect of bio-pesticides against pod damage by gram p od borer (*Helicoverpa armigera* L.) during *rabi* 2022-2023

Conclusion

On the basis of per cent pod infestation T_3 *Bt.* 2.0 kg/ha, T_8 *Beauveria bassiana* 2.0 kg/ha, T_1 Neem oil 5%, T_4 *Metarizium anisoplae* 2.5 lit/ha, T_2 *Verticillium lecanii* 2.5lit/ha, T_6 NSKE 5%, T_5 Garlic extract 5%, T_7 Karanj oil 0.5%, as compare to T_9 control. All the treatments were found effective and significantly superior over the control. Yield data among different treatments revealed that the T_3 *Bt.* 2.0 kg/ha, T_8 *Beauveria bassiana* 2.0 kg/ha, T1 Neem oil 5%, T_4 *Metarizium anisoplae* 2.5 lit/ha, T_2 *Verticillium lecanii* 2.5lit/ha, T_6 NSKE 5%, T_5 Garlic extract 5%, T_7 Karanj oil 0.5%, as compare to T_9 control as compare to T_9 control.

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