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Effectiveness of HaNPV for management of gram pod borer on chickpea

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Abstract

Field demonstrations were held during rabi 2018-19 on nine farmers' fields comprising 1.8 ha (0.2 ha/farmer) in Kumbhali village, Sakoli tahsil, Bhandara district, as well as 0.2 ha (ARS), Sakoli, Bhandara district. The demonstration plot was sprayed with HaNPV at a rate of 500 LE/ha at the ETL (Economic threshold Level) of *Helicoverpa armigera* (gram pod borer) crops, and it was compared to the farmer's practice plot (an untreated plot). The results revealed that, Spraying 500 LE/ha of HaNPV was found to be substantially more effective with lowest gram pod borer larval count (2.96 larvae/mrl), lower pod damage (14.46%) and higher grain yield (14.28 q/ha) in demonstration plots as compared to farmer practice plots (Untreated plots) with gram pod borer larval count of 4.67 larvae/mrl, at farmers field, grain yield of 9.71 q/ha was recorded with pod damage of 23.37 percent. Similarly, spraying of HaNPV @ 500 LE/ha was found significantly more effective with lowest gram pod borer larval count (2.03 larvae/mrl), lower pod damage (25.04%) and higher grain yield (16.72 q/ha) in demonstration plot as compared to farmer practice plot (Untreated plot) with gram pod borer larval count of 2.67 larvae/mrl, pod damage of 32.00% and grain yield of 12.58 q/ha at ARS, Sakoli farm. Hence, it is concluded that HaNPV @ 500 LE/ha should be applied effectively in order to control the chickpea gram pod borer and increase grain output.

Keywords: Chickpea, gram pod borer, effect, HaNPV

Introduction

The most significant pulse crop in the world is the chickpea (*Cicer arietinum* L.). India leads the globe in both chickpea production and consumption. Because it contains 21.5 percent protein, 64.5 percent carbs, and 4.5 percent fat which is comparatively deficient in grains and oilseeds. Chickpea is a rich source of nutritional benefits in the diet of Indians. People use its green leaves and pods in their everyday meals as green vegetables and germinated grains for breakfast and other delectable cuisines (Parmar *et al*., 2015) [1]. From seedling to its maturity, a variety of insect-pests thrives on the chickpea crop. Chickpeas suffer severe damage by the gram pod borer, *Helicoverpa armigera* Hubner, a key pest during the rabi seasons. According to reports from India, this insect has been shown to harm pods by 32–100 percent and reduce yields by 4.2–77 percent (Ujagir and Khare, 1988; Singh *et al*., 1990) [4, 3]. A single gram pod borer larva, according to Sharma (1978) [2], has the potential to destroy up to 25–30 chickpea pods throughout its lifetime. In recent years, it is more and more expensive to combat this polyphagous insect with the traditional strategy that mostly depends upon chemical pesticides and concerns about residue accumulation, safety, environmental effect, and resistance development have emerged as the primary causes of worry. Therefore, it is imperative that environmentally friendly gram pod borer control practices need to be developed. Nucleo polyhedron virus (NPV) is one of among the most promising substitutes for insecticides. HaNPV is an important and effective tool for management of gram pod borer. Scientists in India have conducted in-depth research on the assessment of NPVs and have created techniques to ensure the successful application of native NPV preparations to fight chickpea infestations by gram pod borer.

As a result, it is necessary to show the usage of HaNPV 500 LE/ha for the effective management of gram pod borer on chickpea. The farmer must also comprehend the use and significance of HaNPV in order to control the gram pod borer to increase farmer activity in learning about the use of HaNPV techniques to combat the infestation of gram pod borer in the field and to enhance skill in monitoring the presence or absence of pests on chickpea. Thus, the demonstrations on use of HaNPV 500 LE/ha for effective management of gram pod borer on chickpea were carried out on 9 farmers field at Kumbhali village of Sakoli tahsil in Bhandara district on 1.8 ha area (0.2 ha/farmer) and also on 0.2 ha area at Agriculture Research Station, Sakoli in Bhandara district during *rabi* 2018-19.

Materials and Methods

Field demonstrations were conducted on 9 farmers fields at Kumbhali village of Sakoli tahsil in Bhandara district on 1.8 ha area (0.2 ha/farmer) and also on 0.2 ha area at Agriculture Research Station, Sakoli in Bhandara district during *rabi* 2018-19 with two treatments viz., demonstration plots consisting spraying of HaNPV @ 500 LE/ha and farmer practice plots (Untreated plots). Sowing was done by dibbling at ARS farm and by broadcasting on farmers fields following similar recommended agronomic practices to all the treatments from sowing to harvesting. Treatments wear initiated after attaining the Economic Threshold level (ETL) by the pest. Observations were fixed on 5 randomly selected spots from each plot and larval count of gram pod borer for per meter row length and natural enemies count for per plant were noted from pretreatment and three, seven, ten and fourteen days after spraying. At the time of crop maturity, observations of pod damage (%) was recorded by collecting pods from 5 plants selected at random, counting healthy and damaged pod separately. Also, observations of yield were recorded after harvesting. Economics of each treatment application at ARS farm was workout.

Results and Discussion

1. Effect of different treatments on incidence of gram pod borer and yield of chickpea on farmers field

Spraying of HaNPV @ 500 LE/ha was found significantly more effective and the lowest gram pod borer larval count (2.96 larvae/mrl), The minimal amount of pod damage (14.46%), and significant amount of grain yield (14.28 q/ha) in demonstration plots as compared to farmer practice plots (Untreated plots), which had the highest gram pod borer larval count (4.67 larvae/mrl), lowest pod damage (23.37%), and lowest grain yield (9.71 q/ha) at farmers fields (Table no. 1).

Table 1: Effect of different treatments on incidence of gram pod borer and yield of chickpea on farmers field.

Treatment No.	Treatment	*H. armigera* larval count/MRL	Pod damage (%)	Yield (q/ha)
T_1	Demonstration Plot	2.96	14.46	14.28
T_2	Farmer Practice	4.67	23.37	9.71
T_1 Vs. T_2	‘t’ test	Sig.	Sig.	Sig.
	‘t’ cal	6.31	2.57	4.10

t_{tab} value at 5% level of significance and 16 degrees of freedom = 2.12

2. Effect of different treatments on incidence of gram pod borer and yield of chickpea on ARS, Sakoli Farm.

Spraying of HaNPV @ 500 LE/ha was observed to be significantly better with the lowest gram pod borer larval count (2.03 larvae/mrl), lower pod damage (25.04%) and higher grain yield (16.72 q/ha) in demonstration plot as compared to farmer practice plot (Untreated plot) with gram pod borer larval count of 2.67 larvae/mrl, pod damage of 32.00% and grain yield of 12.58 q/ha at ARS, Sakoli farm (Table no. 2).

In comparison to the farmer practice plot (Untreated plot) at the ARS, Sakoli farm, spraying of HaNPV @ 500 LE/ha was found to be significantly more effective, resulting in lower gram pod borer larval counts (2.03 larvae/mrl), lower pod damage (25.04%), and higher grain yield (16.72 q/ha) in the demonstration plot while untreated plot recorded gram pod borer larval count of 2.67 larvae/mrl, pod damage of 32.00% and grain yield of 12.58 q/ha at ARS, Sakoli farm (Table no. 2).

Table 2: Effect of different treatments on incidence of gram pod borer and yield of chickpea on ARS, Sakoli Farm.

Treatment No.	Treatment	*H. armigera* larval count/MRL	Pod damage (%)	Yield (q/ha)
T_1	Demonstration Plot	2.03	25.04	16.72
T_2	Farmer Practice	2.67	32.00	12.58
T_1 Vs. T_2	‘t’ test	Sig.	Sig.	Sig.
	‘t’ cal	4.69	2.56	5.47

t_{tab} value at 5% level of significance and 24 degrees of freedom = 2.06

Biopesticides are practically most viable tools of biological management of pests and indispensable in organic plant protection. HaNPV is a vital and Important tool for controlling the gram pod borer. Most natural populations have at least some degrees of nuclear polyhedrosis virus (NPV) infection is present in *H. armigera*. without negatively affecting any other organisms, the helicoverpa larval population can be completely destroyed if the level of NPV infection is increased then it is possible to complete control out the Helicoverpa larval population without endangering any other organisms. HaNPV has proven to be is a good way to keep *H. armigera* under control in chickpeas. Scientists in India have conducted in-depth research on the evaluation of NPVs and created technology for the effective use of locally developed NPV formulas to treat *H. armigera*-infested chickpea. In India presently NPV of *Helicoverpa armigera* (HaNPV) are used in some areas and giving encouraging results. HaNPV are highly host specific. The pest died due to virosis initiate and accelerates epizootic in pest populations. The virus infected insects stop feeding within a day and prior to death the larvae climb to upper portion of the plants and hang upside down.

For helicoverpa larvae to become infected, they have to ingest NPV particles. Polyhedral inclusion bodies (PIBs) are the name given to these particles. It needs just one PIB for NPV to effectively infect and kill the host. After ingestion, the PIB triggers the virus to infect the caterpillar's gut cells. Within 24 hours, the virus spreads to the blood, and eventually it reaches nearly every tissue in the body. Depending on the dose and temperature, NPV can kill young larvae within 4 days of ingestion and older larvae within 5 to 7 days. The rate of infection and death increases with increasing dose and/or temperature. On the other hand, NPV can take up to 10 days to kill its host in cool to cold temperatures. These findings are in agreement with the findings of Dhamdhere and Khaire (1986) [6] who evaluated different doses of HaNPV on *Cicer* *arietinum* against *H. armigera* and concluded that The best results were obtained with two applications at 10-day intervals, applying 450 larval equivalents hectare-1, which also reduced damage and resulred in maximum yield. Pawar *et al.* (1987) [9] compared the bioefficacy of HaNPV with endosulfan against pod borer on chickpea and observed that two applications of NPV at 500 larval equivalents hectare-1 were just as successful in decreasing *H. armigera* (Hubner) larvae infestation, minimizing pod damage, and boosting seed yield as two applications of 0.05% endosulfan. With the highest concentration of 500 LE ha-1 of nuclear polyhedrosis virus against *H. armigera* on chickpea, the lowest pod damage and highest yields were obtained (Pawar *et al*., 1990) [10]. Subsequently assessing multiple biopesticides for the management of *H. armigera* (NPV) in chickpeas, Sharma *et al*. (1997) [11] reached the conclusion that nuclear polyhedrosis virus offered the best pest control. The most feasible way to manage *Helicoverpa armigera*, commonly referred as the gram pod borer, that has become a serious pest of pulses in India and damages chickpeas. It has proven effective in both research farms and laboratories.

In order to popularize this technique, Ahmad and Chandel (2004) [5] were laid out large-scale farmers' field demonstrations during 2000–01 and 2001–02 in villages around IIPR Kanpur, spread over six villages in three districts in chickpea. The outcome showed great promise. The reduction percentage for 2000–01 was 77.6. 36 percent rise in yield were obtained in the plots treated with HaNPV (ranging from 32.0 to 38.6%). The cost-benefit ratio was 1:3.3 on average. The avoidable loss resulting from HaNPV treatment in 2001–02 had a mean value of 8.8% and ranged from 2.4 to 14.0%. Treated plots gave 44% increase in yield (range 10 to 70%). The average cost–benefit ratio was 1:3.4. According to Kumar *et al*. (2018) [7], when compared to a control, HaNPV was found to be significantly effective in reducing pod borer infestation and increasing yield. Similarly, among biopesticides, HaNPV @ 500 LE was found more effective with highest net profit. Meena *et al*. (2018) [8] reported that the HaNPV (250 LE/ha) was found moderately effective in reducing pod borer population.

Conclusion

All the above findings confirmed that HaNPV effectively manage the *H. armigera* larval population on chickpea. These outcomes endorse current research showing that treating *H. armigera* with HaNPV as an independent therapy can effectively manage the infection. The larval population of *H. armigera* on chickpea. The present findings conclude that the application of HaNPV @ 500 LE/ha was found effective for management of gram pod borer on chickpea and achieving the higher grain yield.

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