The Pharma Innovation Journal 2023; 12(5): 3199-3201

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(5): 3199-3201

www.thepharmajournal.com
Received: 05-03-2023
Accepted: 16-04-2023

Field efficacy of HaNPV for the management of pod borer, *Helicoverpa armigera* (Hubner) in chickpea

PN Magar, Mohammad Shamim, N Ravisankar and AS Chincholkar

PN Magar
Subject Matter Specialist, Department of Entomology, Krishi Vigyan Kendra, Yavatmal Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra, India

Mohammad Shamim
Indian Institute of Farming System Research, Modipuram, Meerut, Uttar Pradesh, India

N Ravisankar
Indian Institute of Farming System Research, Modipuram, Meerut, Uttar Pradesh, India

AS Chincholkar
M.Sc. Scholar, Department of Entomology, SHUATS, Prayagraj, Uttar Pradesh, India

Corresponding Author:
PN Magar
Subject Matter Specialist, Department of Entomology, Krishi Vigyan Kendra, Yavatmal Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra, India

Abstract
The present investigation was conducted on the thirteen beneficiary farmer fields of Chickpea crop in the Village- Kharda, Taluka Babhulgaon, District Yavatmal during Rabi 2019-2020 and laid out in Randomized Block Design with two treatments and thirteen replications. Sowing was done by dibbling following similar recommended agronomic practices to all the treatments from sowing to the harvesting. The ETL based spraying of Emamectin benzoate 5% SG 5 ml (T_1) and ETL based spraying of biopesticides HaNPV 2% AS 10 ml (T_2) in 10 litter water was done at 50% flowering stage. At 7 days before spraying of Emamectin benzoate 5% SG in farmers practice and HaNPV 2% AS in the technology intervened, the infestation of pod borer was recorded to be 1.23 and 1.38 larvae per meter row length, respectively. After sprayings, it was revealed that the treatment of HaNPV 2% AS was found to be the most effective treatments which recorded average 0.89 larvae per meter row length over farmers practice i.e. Emamectin benzoate 5% SG recorded average 1.08 larvae per meter row length. However, the data revealed that the average pod damage at harvesting in the farmers practice was recorded to be 9.88% and 8.01% in second treatment of HaNPV 2% AS. The lowest pod borer infestation and percent pod damage was observed in spraying of HaNPV 2% AS (T_2) over spraying of Emamectin benzoate 5% SG (T_1). The yield data revealed that higher yield of 12.35 q/ha was observed in T_2- spraying of HaNPV 2% AS over T_1 farmers practice i.e. spraying of Emamectin benzoate 5% SG recorded yield of 11.88 q/ha.

Keywords: Chickpea, pod borer, biopesticide, chemical pesticide, HaNPV

Introduction
Chickpea (*Cicer arietinum* L.) is grown widely in the world because the seeds are rich source of protein for the rapidly increasing population. Chickpea is a diploid (2n = 16) highly autogamous crop, with natural cross pollination. However, the production and productivity of chickpea have been experienced drastically because of biotic and abiotic stresses. Chickpea crop is vulnerable to a broad range of pathogens and eleven different insect-pests have been reported as the main damaging pests of the chickpea crop (Rahman *et al*. 1982) [6]. Among these, the pod borer, *Helicoverpa armigera* (Hubner), is considered to be the most serious insect-pest (Anwar and Shafique 1993) [1], causing on average 30–40% damage to pods (Luckmann and Metcalf 1975). The chickpea's economic threshold is one pod borer larva per meter row length (Sharma 1985; Zahid *et al*. 2008) [10, 11].
The pod borer exhibits a facultative diapause, which allows it to survive adverse weather conditions in both winter and summer seasons. The winter diapause is induced by exposure of the larvae to short photoperiods and low temperatures. In China and India, pod borer populations are composed of tropical, sub-tropical, and temperate ecotypes. In subtropical Australia, the pod borer undergoes diapause during the winter, when temperatures are low. High temperatures can also induce diapause. It enters a true summer diapause when the larvae are exposed to very high temperatures (43 °C for 8 h daily), although the proportion of females entering diapause is nearly half compared with that of males. At these temperatures, non-diapausing males are sterile. The 1st, 2nd, and 3rd instar larvae initially feed on the foliage (young leaves) of chickpeas and a few other legumes, but mostly on the flowers and flower buds of cotton, pigeon pea, etc. Larvae shift from foliar feeders to developing seeds and fruits as larval instar development progresses (Reed and Pawar 1982) [8]. The young chickpea seedlings may be destroyed completely, particularly under tropical climates in southern India. Larger larvae bore into pods/bolls and consume the developing seeds inside the pod.
Since pod borer, *H. armigera* is highly polyphagous and well adapted to several crops and wild hosts in India (Bhatnagar and Davies, 1978) [2] the screening and breeding for resistance to this insect pest is difficult.

Since then the literature on *H. armigera* resistance in legumes has expanded rapidly. Studies on host plant resistance in chickpea crop to pod borer have identified sources with lower susceptibility or those which can tolerate the pest incidence. The complex nature of resistance makes it very difficult to predict a definite IPM strategy

Biopesticides based on the baculovirus group, the nuclear polyhedrovirus (NPV), offer a great scope against *H. armigera*. Successful utilisation of *H. armigera* NPV (HaNPV) under field conditions was reported on chickpea (Rabindra *et al*. 1989) [7] and cotton (Sathiah & Rabindra 2001) [9]. As this insect pest is a serious obstacle and become a global concern for the production of chickpea, eco-friendly and effective pest management options should be practiced. HaNPV is Entomopathogenic Virus which is the most promising biological agent for the management of Pod borer, *H. armigera* in various crops. Therefore, an investigation is planned to monitor pod borer infestation and also to study the effectiveness of HaNPV for the management of pod borer in chickpea over farmers practice.

Material and Methods

The experiment was conducted on the thirteen beneficiary farmers field of Chickpea crop in the Village- Kharda, Taluka Babhulgaon, District Yavatmal during Rabi 2019 -2020 and laid out in Randomized Block Design with two treatments and three replications. Sowing was done by dibbling following similar recommended agronomic practices to all the treatments from sowing to the harvesting. The ETL based spraying of biopesticide HaNPV2% AS 10 ml in 10 liter water was done at 50% flowering stage. Details of experiment are as below Table 1.

Table 1: Details of experiment

S. No	Parameters		Information's
1.	Location	:	Yavatmal District
2.	Treatments (nos.)	:	Two
3.	Replication	:	Thirteen
4.	Season	:	*Rabi*
5.	Design	:	Randomized Block Design

Treatments

1. Farmers practices- Spraying of Emamectin benzoate 5% SG @ 4.4 g in 10 litre water
2. ETL based two sprayings of *Helicoverpa armigera* Nuclear Polyhedrosis Virus (HaNPV) 2% AS @ 10 ml in 10 litre water (first spraying at 50% flowering and second at 15 days after first spray)

Observations

Five locations of 1 meter row length per plot per replication were selected randomly to record the observations on the incidence of chickpea pod borer, *H. armigera*. The observations on the number of larvae observed per plant recorded from the five randomly selected plants whereas, on percent pod damage, the number of healthy and infested pods per plant were counted and on the basis of this, percent pod damage was calculated by using following formula;

$$\text{Percent pod damage (\%)} = \frac{\text{No. of damaged pods}}{\text{Total No. of pods}} \times 100$$

The observations on the number of larvae observed per meter row length, percent pod borer incidence on chickpea was recorded before biopesticide spray and 07, 15 days after spray. Fortnightly observations pod borer infestation was recorded and Cost of plant protection, yield data along with net return, Gross return and B:C ratio (Cost: Benefit Ratio) was estimated. The data obtained was analyzed statistically in RBD.

Results and Discussion

Data presented in Table 2 revealed that, before applications of scheduled treatments, observations on pre-count of pod borer infestation was reported and it was revealed that 1.23 larvae per meter row length was recorded before application of T1 (spraying of Emamectin benzoate 5% SG) and 1.38 larvae per meter row length was recorded before application of T1 (Spraying of HaNPV 2% AS).

At 7 days before spraying of Emamectin benzoate 5% SG in farmers practice and HaNPV 2% AS in the technology intervened, the infestation of pod borer was recorded to be 1.23 and 1.38 larvae per meter row length, respectively. Results were in close conformity with Dabhi and Patel (2004) [3] reported population peaks of H. armigera occurred between the first and fourth weeks of February and the second week of May, respectively (2.1, 2.8 and 1.2 larvae /m). After sprayings, it was revealed that the treatment of HaNPV 2% AS was found to be the most effective treatments which recorded average 0.89 larvae per meter row length over farmers practice i.e. Emamectin benzoate 5% SG recorded average 1.08 larvae per meter row length. Howeve the data revealed that the average pod damage at harvesting in the farmers practice was recorded to be 9.88% and 8.01% in second treatment of HaNPV 2% AS.

The lowest pod borer infestation and percent pod damage was observed in spraying of HaNPV 2% AS (T_2) over spraying of Emamectin benzoate 5% SG (T_1). Results were conformity with Sharma *et al*. (1997) [10] reported high pod borer larval mortality in bioagent and chemical insecticide treatments. NPV at 300 LE ha^{-1} caused a 78.7% reduction in larval population, resulting in 10% pod damage and high grain yield (1.86 t ha^{-1}), whereas the chemical insecticide Endosulfan 35 EC at 1200 ml ha^{-1} caused a 70.9% reduction in larval population, resulting in 11.2% pod damage and 1.86 t ha^{-1} grain yield.

Table 2: Field efficacy of treatments in the management of pod borer, *Helicoverpa armigera* (hubner) in chickpea

Treatments	Pod borer infestation			Cost of plant protection (Rs./ha)	Cost of cultivation	Yield (q/ha)	Gross Return (Rs/ha)	Net Return (Rs/ha)	B:C Ratio
	Pre-count (L/MRL)	Pod borer infestation (L/MRL)	% pod borer damage						
T1- Emamectin benzoate 5% SG	1.23	1.08	9.88	1778	31278	11.88	57938	26660	1.85
T2- HaNPV 2% AS	1.38	0.89	8.01	784	30284	12.35	60188	29904	1.98
T test	NS	NS	NS			NS			
SE (m)	0.16	0.13	1.10			0.27			
CD 5%	0.48	0.39	3.38			0.83			

Rate: Chickpea- Rs. 4875/ q

The yield data presented in Table 2 revealed that higher yield of 12.35 q/ha was observed in T_2- spraying of HaNPV 2% AS over T_1 farmers practice i.e. spraying of Emamectin benzoate 5% SG recorded yield of 11.88 q/ha. The data on cost of cultivation including the plant protection revealed that total cost of cultivation for T_1 Farmers practice (Spraying of Emamectin benzoate 5% SG) was Rs. 31,278 (Thirty one thousand two hundred seventy eight) which was slightly higher than that of Rs. 30,284 (Thirty thousand two hundred eighty four Rupees) T_2 Spraying of HaNPV 2% AS.
The data on gross return and Net Return presented in Table 2 revealed that T_1- Farmers practice recorded lowest Gross return and Net return i.e. Rs. 57,938 and Rs. 26,660, respectively. However, T_2- Spraying of HaNPV 2% AS recorded higher Gross return and Net return i.e. Rs.60,188 and Rs. 29,904, respectively. However, higher Benefit Cost ratio (1:1.98) was obtained in T_2 (Sprarying of HaNPV 2% AS) than T_1 (Spraying of Emamectin benzoate 5% SG) i.e. 1:1.85. Present findings are in line with Hossain *et al*. (2010) [4] studied the IPM module consisting of sowing chickpea on November 15 and first spraying with HaNPV at 500 LE ha−1 at the 100% plant pod formation stage and second spraying after 7 days with cypermethrin at 1 ml l^{-1} ensures higher yield and return.

Conclusion
From results and discussion of the experiment, it is concluded that the pod borer, *H. armigera* remained active throughout the crop season with one peak coincided with the reproductive phase of the crop. Application of HaNPV (*Helicoverpa armigera* Nuclear Polyhedrosis Virus) was found cost effective for the management of pod borer in chickpea than use of chemical pesticide Emamectin benzoate 5% SG and also minimizes the effect on natural enemies.

References
1. Anwar M, Shafique M. Integrated control of gram pod borer, *Helicoverpa armigera* (Hubner) in Sindh. In: Proceedings of Pakistan Congress of Zoology; c1993. p. 215-222.
2. Bhatnagar VS, Davies JC. Factors affecting population of gram pod borer, *Heliothis armigera* (Huhner) (Lepidoptera: Noctuidae) in the period 1974-77, ICRISAT, Patancheru, Andhra Pradesh, India; c1978.
3. Dabhi MV, Patel CC. Population dynamics of gram pod borer *H. armigera* in chickpea at Anand, Gujrat, India. Insect Environment. 2004;10(4):161-162.
4. Hossain MA, Haque MA, Ahmad M, Prodhan MZH. Development of an integrated management approach for pod borer, *Helicoverpa armigera* (Hubner) on chickpea. Bangladesh J Agril. Res. 2010;35(2):201-206. DOI:10.3329/bjar.v35i2.5882
5. Luckmann WH, Metcalf L. Introduction to insect-pest management. Wiley, New York; c1975. p. 3-35.
6. Rahman MM, Mannan MA, Islam MA. Pest survey of major summer and winter pulses in Bangladesh. In the Proceedings of the National Workshop on Pulses. Bangladesh Agril. Res Institute, Joydebpur, Dhaka; c1982. p. 265-273.
7. Rabindra RJ, Sathiah N, Muthiah C, Jayaraj S. Controlled droplet application of nuclear polyhedrosis virus with adjuvants and UV protectants for the control of *Heliothis armigera* (Hbn.) on chickpea, J of Biol. Contr. 1989;3:37-39.
8. Reed W, Pawar CS. Heliothis: a global problem. In: Reed W, Kumble V Proceedings of International Workshop on *Heliothis* Management, 15–20 November 1981. ICRISAT, Patancheru; c1982 p. 9-14.
9. Sathiah N, Rabindra RJ. Field efficacy of certain improved formulations of the nuclear polyhedrosis virus against the bollworm, *Helicoverpa armigera* (Hübner) on cotton. In: Proceedings of Symposium on Biocontrol Based Pest Management for Quality Crop Protection in the Current Millennium. Punjab Agricultural University, Ludhiana, India; c2001. p. 82.
10. Sharma HC. Screening for host Plant Resistance to Mirid head bugs in Sorghum In: Proceedings, international Sorghum Entomology Workshop 15-21 July 1984 Texas A&M University College Station, Texas International Crops Research Institute for the Semi-Arid Tropics, Patancheru, Andhra Pradesh 502 324 India; c1985. p. 317-337.
11. Zahid MA, Islam MM, Reza MH, Prodhan MHZ, Rumana Begum M. Determination of economic injury levels of *Helicoverpa armigera* (Hubner) in chickpea. Bangladesh J of Agril. Res. 2008;33(4):555-563.