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EVALUATION OF ECOFRIENDLY APPROACHES FOR MANAGEMENT OF GRAM POD BORER *H. ARMIGERA* IN CHICKPEA

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ABSTRACT

The research trial was conducted at Pulses Research Unit, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola (Maharashtra) during *Rabi* season 2023-24. The crop phenology-based application of insecticides was better alternative to take up plant protection measures by using different bio pesticides are being evolved to check infestation by this insect pest. The trail consisting of nine treatments with three replications in Randomized Block Design (RBD). Variety taken JAKI 9218 with plot size 5 × 4 m plot and spacing 30×10cm. In all two sprays were undertaken for management of *H. armigera* one at 50% flowering and the second at pod formation stage. The number *Helicoverpa* larval count were recorded per 5 plants, 7 and 10 days after each spraying. Per cent pod damage and yield was recorded at the time of harvest. The cumulative mean was calculated and the results revealed that the lowest larval population of *H. armigera* was recorded in the insecticide treatment Chlorantraniliprole 18.5SC @ 0.25 ml/L *i.e.* 1.00 larva per 5 plants and found at par with the biopesticide treatments BARC *Bt* formulation (ISPC-1 bacterium) @ 1.4g/L and Mahastra (DOR *Bt* 1%) @ 4g/L with 1.08 and 1.08 larvae per 5 plants, respectively. The lowest per cent pod damage was recorded in treatment, Chlorantraniliprole 18.5 SC (0.18 %) found at par with treatments Bacillus *thuringiensis* NBAIR Bt G4 @ 20 ml/L, *Ha*NPVNBAIR1@4 ml/L and Mahastra (DOR *Bt* 1%) @ 4g/L, with 1.07, 1.38 and 1.64 per cent pod damage, respectively. However, highest per cent pod damage was recorded in untreated control *i.e.* 7.16. The highest yield recorded in treatment, Chlorantraniliprole 18.5 SC (1773.03 kg/ha) and found at par with NBAIR *Bt* formulation (ISPC-1 bacterium) @ 1.4g/L (1490.61 kg/ha), Hear NPV NBAIR1 @ 4 ml/L (1524.67kg/ha), BARC *Bt* formulation (1582.22kg/ha) and Mahastra (DOR *Bt* 1%) @ 4g/L (1544.44kg/ha). The lowest yield recorded 1083.33 kg/ha in untreated control.

***Key words*:** Chickpea, *H. armigera*, Biocontrol, Biopesticides.

Introduction

Chickpea (*Cicer arietinum* L.) also known as gram, Bengal gram, Egyptian pea, and *chana*. It is an important legume crop among the various pulses which is also a good source of protein (21.5%), 64.5 per cent carbohydrate and 4.5 per cent fat which is comparatively deficient in cereals and oilseeds. Chickpea also improves the fertility of the soil by fixing the atmospheric nitrogen besides its importance as human and animal feed.

India ranks first in chickpea area (73%) and production (75%) at Global level followed by Australia, Turkey and Ethiopia. In Indiaproduction of chickpea is 135.44 Lakh Tons from area 107.40 lakh ha withyield 1261kg/ha. In major producing countries the highest productivity of 2170 kg/ha is observed in Ethiopia followed by Australia (1725 kg/ha), Russian Fed. (1358 kg/ha) and Myanmar (1315 kg/ha) to that of India's productivity is 1261 kg/ha (FAO Stat., 2022).

Different biotic and abiotic stresses lead to drastic reduction in the production and productivity of chickpea in India. This crop is vulnerable to a wide range of insect-pest and diseases. Among various pests Gram pod borer *Helicoverpa armigera* (Hubner) is a polyphagous cosmopolitan and widely distributed insect pest in the world which belonging to the family Noctuidae and order-Lepidoptera. It is also known as cotton bollworm, corn

earworm, tomato fruit borer, and false budworm. It attacks more than 180 cultivated species from cereals, legumes, vegetables, fruits, forage and wild species. Larvae of this pest initially feed on leaves, flowers and lateron developing pods. While feeding on the developing seeds the anterior body portion of the caterpillar remains inside the pod and rest half hanging outside. When seeds of one pod are finished, it moves to the next.

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). A single gram pod borer larva, according to Sharma (1978) has the potential to destroy up to 25–30 chickpea pods throughout its lifetime. Worldwide losses due to *H. armigera* have been estimated over US$300 million annually (Kaur *et al.,* 2007)

The management of this noxious pest is primarily based on synthetic insecticides. Preference of insecticides due to their easy availability, applicability and their excessive and indiscriminate use has resulted in the development of insecticidal resistance in the insectpest (Kranthi *et al.*, 2002; Yang *et al.*, 2013; Bird, 2018). Along with development of resistance, excessive use of insecticides is also harmful to different beneficial arthropods, non-target organisms and human health (Mesnage and Seralini, 2018). To overcome this problem use of various biopesticides play an important role in pest management.

Biopesticides are inherently less harmful than conventional pesticides. These are quickly biodegradable in addition to etiology that they can self-propagate and have long lasting control effect as opposed to chemical which can create residual problem in addition to resistance development in pest and pest resurgence. Therefore, now a days similar attempts were made in the present studies to evaluate the biopesticide as ecofriendly approach for the management of gram caterpillar in chickpea.

Material and Methods

The experiment was conducted at Pulses Research Unit, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola (Maharashtra) during *Rabi* season 2023-24. The trail consisting of nine treatments with three replications in Randomized Block Design (RBD). Variety taken JAKI 9218 with plot size 5 × 4 m plot and spacing 30×10cm. The treatment details were (T1) *Bacillus thuringiensis* NBAIR Bt G4 @ 20 ml/L (T2) Hear NPV NBAIR1 @ 4 ml/L (1.5x1012 OBs/ha) (T3)*Metarhiziumanisopliae* strain NBAIR Ma4 @ 1×108 conidia /g @ 5 g /l (T4) *Heterorhabtidis indica* strain NBAIR Hi 101 @ 12 kg/ ha (T5) BARC *Bt* formulation (ISPC-1 bacterium) @ 1.4g/L (T6) Homemade neem @ 10% (T7) Mahastra (DOR *Bt* 1%) @ 4g/L (T8) Chlorantraniliprole 18.5 SC @ 0.25 ml/L (T9) Untreated control only water spray was taken. In all two sprays were undertaken first at 50 per flowering and second on pod formation stage of crop as the gravid female lay down the eggs when the crop is in flowering sage. The number *Helicoverpa* larval count were recorded per 5 plants, on 7 and 10 days after each

Table 1: Effect of different treatments on larval population *H. armigera.*

Tr. no.	Treatment Detail	Larval population of *H. armigera*/ 5 plants					
		Pre Treatment	First sprayAT 50% Flowering		Second spray At pod formation stage		
			7 DAT	10 DAT	7 DAT	10 DAT	Mean
T1	*Bacillus thuringiensis* NBAIR Bt G4 @ 20 ml/L	5.33(2.31)*	5.67(2.48)	4.00(2.11)	0.67(1.05)	0.33(0.88)	2.67(1.78)
T2	Hear NPV NBAIR1 @ 4 ml/L (1.5x1012 OBs/ha)	4.33(2.08)	3.00(1.86)	3.00(1.86)	1.67(1.44)	1.00(1.22)	2.17(1.63)
T3	*Metarhiziumanisopliae* strain NBAIR Ma4 @ 1×108 conidia /g @ 5 g /l	5.00(2.23)	4.33(2.18)	4.00(2.12)	2.00(1.56)	1.00(1.17)	2.83(1.82)
T4	*Heterorhabtidis indica* strain NBAIR Hi 101 @ 12 kg/ ha	5.33(2.31)	5.00(2.34)	4.00(2.11)	1.33(1.34)	0.33(0.88)	2.67(1.78)
T5	BARC *Bt* formulation (ISPC-1 bacterium) @ 1.4g/L	4.00(2.00)	2.00(1.56)	1.00(1.17)	0.67(1.05)	0.67(1.05)	1.08(1.26)
T6	Home made neem @ 10%	4.33(2.08)	4.00(2.12)	3.00(1.86)	1.33(1.34)	0.67(1.05)	2.25(1.65)
T7	Mahastra (DOR *Bt* 1%) @ 4g/L	4.00(1.99)	2.00(1.56)	1.00(1.17)	1.00(1.17)	0.33(0.88)	1.08(1.23)
T8	Chlorantraniliprole 18.5 SC @ 0.25 ml/L	4.00(1.99)	2.00(1.48)	1.00(1.10)	0.67(1.05)	0.33(0.88)	1.00(1.19)
T9	Untreated control	5.67(2.38)	6.67(2.67)	6.67(2.67)	4.67(2.27)	3.33(1.95)	5.33(2.41)
	"F" test	**NS**	**Sig**	**Sig.**	**Sig.**	**Sig.**	**Sig.**
	SE m ±	-	0.17	0.16	0.16	0.13	0.08
	CD at 5%	-	0.51	0.48	0.49	0.38	0.24
	CV %	-	12.80	13.86	18.60	17.50	7.47

Figures in parentheses ()*are Square root transformed values; Figures in parentheses are√ x+0.5 transformed values.

spraying and cumulative mean of two sprays was calculated. Per cent pod damage and yield was recorded at the time of harvest.

Result and Discussion

All the biopesticide treatments along with insecticide showed better performance than the untreated control in terms of larval population, pod damage reduction and yield gain. The detailed results have been presented below:

Effect of different treatments on larval population of *H. armigera*

The cumulative effect of first and second spray on larval population of *H. armigera* (Mean)

Data based on the initial count of the *Helicoverpa* larvae before spray is given in Table 1. Larval population was homogeneously distributed throughout the experimental field at the time of application of biopesticides on the crop. All the treatments were found significantly superior over control with respect to larval population of pod borer. The lowest larval population of *H. armigera* was recorded in the treatment Chlorantraniliprole 18.5SC @ 0.25 ml/L i.e. 1.00 larva per 5 plants and found at par with BARC *Bt* formulation (ISPC-1 bacterium) @ 1.4g/L and Mahastra (DOR *Bt* 1%) @ 4g/L with 1.08 and 1.08 larvae per 5 plants, respectively. The next best treatment was Hear NPV NBAIR1 @ 4 ml/L (1.5x1012 OBs/ha) and Homemade neem @ 10% recorded 2.17 and 2.25 larva respectively and found at par with each other. The highest population recorded in untreated control (5.33 larvae/5pl).

Effect of different treatment on percent pod damage and yield of chickpea

Evaluation of ecofriendly approaches for management of gram pod borer *H. armigera* in chickpea. The data given in Table 2 indicated that the different treatment recorded a significant effect on per cent pod damage. The lowest per cent pod damage was recorded in treatment, Chlorantraniliprole 18.5 SC (0.18 %) found at par with treatments Bacillus *thuringiensis* NBAIR Bt G4 @ 20 ml/L, *Ha*NPVNBAIR1@4 ml/L and Mahastra (DOR *Bt* 1%) @ 4g/L, with 1.07, 1.38 and 1.64 per cent pod damage, respectively. However, highest per cent pod damage was recorded in untreated control *i.e.* 7.16

The highest yield recorded in treatment, Chlorantraniliprole 18.5 SC (1773.03 kg/ha) and found at par with NBAIR *Bt* formulation (ISPC-1 bacterium) @ 1.4g/L (1490.61 kg/ha), Hear NPV NBAIR1 @ 4 ml/L (1524.67kg/ha), BARC *Bt* formulation (1582.22kg/ha) and Mahastra (DOR *Bt* 1%) @ 4g/L (1544.44kg/ha). The lowest yield recorded 1083.33 kg/ha in untreated control.

The present findings are in conformity with the findings of Anil *et al.*, (2019) who reported that spray of NSKE @ 5% in chickpea proved significantly lower pod damage of 13.45 % and 12.76% in 2010-11 and 2011-12 followed by and Bt. 1 kg /ha 14.10 in the first year and 13.38% in the second year which support our findings.

Studies conducted by Chaudhari *et al.*, (2023) proved that the spraying of 500 LE/ha of *Ha*NPV 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 chickpea.

Bhushan and Nath (2011) reported that the Neem seed kernel extract (NSKE 5%) was found most effective in reducing the larval population and pod damage which supports our findings as the neem contain azadirectin which has antifeedant properties which affects pest population.

Table 2: Effect of different treatments on pod damage and yield of chickpea.

Tr.no.	Treatment Detail	Pod damage (%)	Yield (kg/ha)
T1	*Bacillus thuringiensis* NBAIR Bt G4 @ 20 ml/L	1.07(1.20)	1490.61
T2	Hear NPV NBAIR1 @ 4 ml/L (1.5x1012 OBs/ha)	1.38(1.25)	1524.67
T3	*Metarhiziumanisopliae* strain NBAIR Ma4 @ 1×108 conidia /g @ 5 g /l	6.15(2.54)	1291.92
T4	*Heterorhabtidis indica* strain NBAIR Hi 101 @ 12 kg/ ha	2.60(1.74)	1251.31
T5	BARC *Bt* formulation (ISPC-1 bacterium) @ 1.4g/L	4.43(2.19)	1582.22
T6	Home made neem @ 10%	4.00(2.04)	1466.67
T7	Mahastra (DOR *Bt* 1%) @ 4g/L	1.64(1.39)	1544.44
T8	Chlorantraniliprole 18.5 SC @ 0.25 ml/L	0.18(0.81)	1773.03
T9	Untreated control	7.16(2.77)	1183.33
	"F" test	**Sig.**	**Sig.**
	SE m ±	0.25	99.63
	CD at 5%	0.74	298.70
	CV %	21.35	10.61
Figures in parentheses are√ x+0.5 transformed values.			

Present study is in concurrence with observation made by Golvankar *et al.,* (2015) who reported that the treatments *Btk*, Azadirachtin, *B. bassiana*and *M. anisopliae*were observed to be the most effective treatments which recorded zero number of larvae. While on 7 days after second spray, the treatment *Btk* recorded least pod damage per five plants of 4.02 and found to be best treatment in order of efficacy. On 14 days after second spray, the treatment *Btk*recorded significantly minimum (4.42) per cent pod damage. Data revealed that the treatment *Btk*recorded highest yield of 1294.62 Kg ha^{-1} and found to be the best treatment which support our findings. Among microbials and botanical the maximum C: B ratio of 1:15.15 was obtained from Azadirachtin followed by *M. anisopliae* (1:13.73)

The present findings are corroborative with the findings of Jadhav, *et al*., 2012. They reported that the IPM module having hand collection of larvae, alternate spray of NSKE 5 per cent, *Btk*1 g l^{-1} and *HaNPV*250 LE ha^{-1} at 15 days interval after 50 per cent flowering recorded maximum yield of 28.09 q ha^{-1} which support our findings.

References

Anil, K., Tripathi M.K., Chandra Umesh and Ram V. (2019). Efficacy of botanicals and bio-pesticide against *Helicoverpaarmigera* in chickpea. *Journal of Entomology and Zoology Studies*. **7(1)**, 54-57.

Bhushan, S. and Nath P. (2011). Effect of cropping pattern and eco friendly insecticides on grain damage by insects in pigeonpea. *J. Exp. Zoo.*, **8(1)**, 175-180.

Bird, L.J. (2018). Pyrethroid and carbamate resistance in Australian *Helicoverpaarmigera* (Lepidoptera: Noctuidae) from 2008 to 2015: What has changed since the introduction of *Bt* cotton? *Bulletin of Entomological Research*. **108**, 781-791.

Chaudhari B.N., Dhepe V.R., Panchbhai P.R. and Tambe V.J. (2023). Effectiveness of HaNPV for management of gram pod borer on chickpea. *The Pharma Innovation Journal* **SP-12(12)**, 361-363.

FAO Stat (2022). Crop wise pulses global scenario.

Golvankar, G.M., Desai V.S. and Dhobe N.S. (2015). Management of Chickpea Pod Borer, *Helicoverpaarmigera* Hubner by Using Microbial Pesticides and Botanicals. *Trends in Biosciences*, **8(4)**, 887-890.

Jadhav, S.P., Patil R.S., Mehendale S.K. and Mule R.S. (2012). Effect of integrated pest management against *Helicoverpaarmigera* (Hubner) infesting chickpea, *Cicer arietinum* L. *Pestology*, **36(8)**, 25-29.

Kaur, R.P., Shalini B. and Arora A. (2007). Chickpea pod borer management and scope of transgenic strategy. *Indian Farmers Digest*, **40(9)**, 38-41.

Kranthi, K.R., Jadhav D.R., Kranthi S., Wanjari R.R., Ali S.S. and Russell D.A. (2002). Insecticide resistance in five major insect pests of cotton in India. *Crop Protection*. **21**, 449-60.

Mesnage, R. and Seralini G.E. (2018). Toxicity of pesticides on health and environment. *Frontiers in Public Health*. **5**, 268.

Sharma, S.K. (1978). Studies on biology and extent of damage by gram pod borer *H. armigera*. M. Sc. Thesis, H.A.U., Hissar, India.

Singh, J., Sandhu S.S. and Singla M.L. (1990). Ecology of *Heliothisarmigera* (Hb.) on chickpea in *Punjab*. *J. Ins.* Sci., **3**, 47-52.

Ujagir, R. and Khare B.P. (1988). Optimum insecticides regime for the control of the gram pod borer, *H. armigera* and *Spodoptera litura* and their natural enemies. Natural workshop on disease surveillence for IPM, 16-17 Sept. TNAU, Coimbatore.

Yang, Y., Li Y. and Wu Y. (2013). Current status of insecticide resistance in *Helicoverpaarmigera* after 15 years of *Bt* cotton planting in China. *Journal of Economic Entomology*. **106**: 375-81.