IJPS INTERNATIONAL JOURNAL OF PLANT SCIENCES
ISSN-0973-1547 Volume 18 | Issue 1 | January, 2023 | 40-44
DOI: 10.15740/HAS/IJPS/18.1/40-44
Visit us - *www.researchjournal.co.in*

RESEARCH ARTICLE

Evaluation the efficacy of bio pesticides against gram pod borer *Helicoverpa armigera* (Hubner) on chickpea (*Cicer arietinum* L.).

■ **S. Patel, V. K. Garg and S. Balpande**

SUMMARY

Evaluation of six insecticides *viz., Azadiractin* 1% (1000ppm) *Neem* oil, *Baeuveria bassiana* 1% WP, *Bacillus thuriengiensis* var *kurstaki* 5% WP, *Metarhizium anisopliae* 1.0% WP, *Verticillium lecanii* 1.15% WP and *Ha* NPV 250 LE were evaluated against Gram Pod Borer (*Helicoverpa armigera* Hubner) larvae. The Gram Pod Borer (GPB) larval population was counted on 5 randomly selected plants at 24 hr. before spray and at 3, 7 and 10 days after spray. The two-years experiment was conducted during *Rabi* 2018-19 and 2019-20 at the Rehti Farm of school of Agriculture, Mhow, experimental field of Department of Entomology, BRAUSS, (MP). All the biopesticides significantly reduced the GPB larval population. The Pooled GPB population varied from 2.30 to 2. 50 larvae/plant during *Rabi* season one day prior tothe first spray. The population was significantly lower with *Bacillus thuriengiensis* var *kurstaki* 5% WP, followed by *Ha* NPV 250 LE, *Baeuveria bassiana* 1% WP, *Metarhizium anisopliae* 1.0% WP and *Azadiractina* 1% (1000ppm) *Neem* oil, these five biopesticides are showing best management effects on the GPB larvae and pod damaging per cent and remain, and least effective treatment was *Verticillium lecanii* 1.15% WP. The maximum reduction of larval population and pod damaging per cent. In *Rabi* season, the highest chickpea grain yield was obtained with *Bacillus thuriengiensis* var *kurstaki* at 5% WP.

Key Words : Chickpea, Gram pod borer, Grain yield *Ha* NPV, *Azadiractina, Bacillus thuriengiensis* var *kurstaki*

How to cite this article : Patel, S., Garg, V. K. and Balpande, S. (2023). Evaluation the efficacy of bio pesticides against gram pod borer *Helicoverpa armigera* (Hubner) on chickpea (*Cicer arietinum* L.). *Internat. J. Plant Sci.*, **18** (1): 40-44, **DOI: 10.15740/HAS/IJPS/18.1/40-44,** Copyright@ 2023:Hind Agri-Horticultural Society.

Article chronicle : Received : 25.09.2022; **Revised :** 13.11.2022; **Accepted :** 17.12.22

MEMBERS OF THE RESEARCH FORUM

Author to be contacted :
S. Patel, Department of Entomology, Dr. B.R. Ambedkar University of Social Science, Mhow, **Indore (M.P.) India**
Email : patel.satyendra04@gmail.com

Address of the Co-authors:
V. K. Garg, Department of Entomology, College of Agriculture, Ganjbasoda, **Vidisha (M.P.) India**

S. Balpande, Department of Entomology, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, **Gwalior (M.P.) India**

Chickpea or gram is one of the most important pulse crop of India. It is also known asthe king of pulses. It is the third most important pulse crop after peas and dry bean. This crop is grown on moderately heavy, black cotton and sandy loam soils. However, Fertile sandy loam to clay loam soils with good internal drainage are best suitable for its cultivation. Soils should not be heavy alkaline in nature. Ideal pH range of 5.5 to 7.0 is suitable for chickpea farming.

Helicoverpa armigera (Hubner) (Lepidoptera : Noctuidae) is a cosmopolitan, polyphagous and notorious pest that attacks numerous agricultural crops and is widely distributed in the tropics and sub-tropics. The low yield of chickpea is attributed to the regular outbreaks of pod borer *H. armigera,* which is considered one of the major pests of chickpea. Conventionally farmers are using various types of synthetic chemical insecticides to control gram pod borer. But due to the unconscious and unjustified use of synthetic pesticides, several problems have arisenin agro-ecosystem, such as direct toxicity to beneficial insects, aquatic animals, and humans.The repeated use of chemical insecticides alone has resulted in the development of resistance in the insect pest and disturbance to the agroecosystem by affecting the non-targets (Garg *et al.,* 2015). The increasing concerns of environmental awareness of pesticide hazards have evoked a worldwide interest in using pest control agents of bio and plant origin. These bio-control agents and botanical pesticides are safer to be used in pest control programs and may prevent several adverse effects caused by synthetic insecticidal applications (Rajasekaran and Kumarswamy, 1985). Biopesticides based on microbial and botanical products are efficacious and promising agents. Neem, *A. indica*. is known to affect larvae of various lepidopteran and coleopteran pests. *B. thuringiensis* (*Bt*) is a spore-forming, gram-positive bacteria – that produces proteinaceous crystal at the time of sporulation. These crystals have shown potential against lepidopteran, dipteran and coleopteran pests (Dhaliwal and Koul, 2007). In India, scientists have done extensive studies on evaluating the efficacy of Biopesticides against gram pod borer in chickpea. Keeping in view, the present study was undertaken as location-specific testing to evaluate the bioefficacy of specific bio pesticides against the pod borer in the chickpea ecosystem.

MATERIAL AND METHODS

The experiment was laid out in Randomized Block Design (RBD) with seven treatments *viz., Azadiractina* 1 % (1000ppm) *Neem* oil@1500ml, *Baeuveriabassiana* 1 % WP@3000gm, *Bacillus thuriengiensis* var *kurstaki* 5 %WP@3000gm, *Metarhiziumanisopliae*1.0%@ 3000gm, *Verticilliumlecanii* 1.15 % WP and HaNPV 250LE/ha including untreated control, using three replications. The plot size was 5.0 × 6.0 m^2, keeping row to row and plant plant distances are 30 cm and 10 cm, respectively, on evaluation of bio-pesticides against gram pod borer on chickpea during 2018-19 and 2019-20 at the experimental field of Department of Entomology, Rehti Farm of the school of agriculture Mhow, BRAUSS, (MP). The seeds of variety JG-14 were sown on November 12, 2018 and November 11, 2019. There were seven treatments, including control. All the six biopesticides treatments were applied as a foliar spray. The untreated (control) plot was also maintained for comparison with the water spray. The first spray was given on the economic threshold level of the pod borer, whereas the second spray was given after one fortnight afterthe first spray.

Observations were recorded before twenty-four hours of each spray as pretreatment and after 3, 7 and 10 days upto two sprayings. Larval counts and pod damage were recorded from five randomly selected and tagged plants per treatment. Pod damage was converted in percentage. Based on these observations, mean data was worked out and statistically analysedafter suitable transformation.

RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Larval population of *H. armigera* (H.) :

In both first application of bio-pesticides at 24 hr. before insecticide application, *H. armigera* (Gram Pod Borer) larval population was uniformly distributed among different treatments, the differences amongst them being non-significant but the second spray pooled data was found statistically significance due to long term effect of some first spray treatment effect and the pooled 24 hr. before treatment application data minimum larval population was recordedin *Azadiractina* 1% (1000ppm) *Neem* oil and *Baeuveriabassiana* 1% WP (2.20 and 2.20 larvae/plant).

All the first Bio pesticide treatments pooled data (table 1) proved significantly better than the untreated control in controlling the *Helicoverpaarmigera* (H.) infesting Chickpea crop during both *Rabi* crop seasons under investigations. At 3 days after spray (DAS), *Bacillus thuriengiensis* var *kurstaki* 5% WP resulted in significantly highest suppression of *H. armigera* population (1.30 larvae/plant) which was statistically superior (significantly) to all other treatments and untreated control (2.67 larvae/plant). However, at the pooled 7 DAS, the *H. armigera* population *Bacillus thuriengiensis*var*kurstaki* 5% WP, *Baeuveriabassiana* 1% WP and *Ha*NPV 250 LE was 0.73, 0.74 and 0.83 larvae/plant, respectively, the three being at par with each other but significantly superior to all other treatments and the untreated control (2.90 larvae/plant). After 10 DAS, minimum larval population was recorded in *Bacillus thuriengiensis*var*kurstaki* 5% WP (0.82 larvae/plant) but it was at par with *Ha* NPV 250 LE and *Baeuveriabassiana* 1% WP (1.03 and 1.13 larvae/plant, respectively) and maximum larval population was recorded in *Verticilliumlecanii*1.15%WP (1.43 larvae/plant) except untreated control (2.93 larvae/plant). The pooled mean data of the first spray revealed that the minimum larval population was recorded in *Bacillus thuriengiensis* var *kurstaki* 5% WP, *Baeuveria bassiana* 1% WP, *Ha*NPV 250 LE, *Metarhizium anisopliae* 1.0% WP and *Azadiractina* 1% (1000ppm). the five being at par with each other and significantly superior to *V. lecanii* 1.15% WP and UTC (1.75 and 2.71 larvae/plant).These findings were supported by earlier workers *i.e.,* Kumawat and Jheeba (1999), Cherry *et al.* (2000), Satpute and Mote (2002), Kumar *et al.* (2004), Ram and Agrawal (2007), Hossain (2007), Byrappa *et al.* (2009), Singh *et al.* (2009), Amrapali *et al.* (2011), Haris and Khan (2011), Mehlhorn *et al.* (2011), Bajya *et al.* (2010) and Kambrekar *et al.* (2018).

The second application of Biopesticide 3 DAS, the *B. thuriengiensis* var *kurstaki* 5% WP and *Ha* NPV 250 LE (1.63 and 1.83 larvae/plant, respectively) was at par and statistically significantly superior to all other

Table 1: Bio efficacy evaluation of bio-chemical insecticides against gram pod borer (*H armigera*) larval population

Treatments	Form/ ha. (Kg/L)	Pooled mean larval population/ plant										% pod damage	Grain yield (q/ ha.)
		First spray					Second spray						
		DBS	3 DAS	7 DAS	10 DAS	MEAN	DBS	3 DAS	7 DAS	10 DAS	MEAN		
Azadiractina 1%	1.5 L	2.37	2.07	1.10	1.17	1.68	2.20	2.03	1.02	1.57	1.71	2.62	13.65
(1000ppm) *Neem* oil		(1.69)	(1.60)	(1.26)	(1.29)	(1.48)	(1.64)	(1.59)	(1.23)	(1.44)	(1.48)	(9.32)	
Baeuveriabassiana	3 Kg	2.37	2.33	0.74	1.13	1.58	2.20	2.07	0.93	0.97	1.50	2.36	15.68
1% WP		(1.69)	(1.68)	(1.12)	(1.28)	(1.43)	(1.64)	(1.60)	(1.20)	(1.21)	(1.41)	(8.84)	
Bacillus thuriengiensis/	3 Kg	2.30	1.30	0.73	0.82	1.51	2.40	1.63	0.86	0.80	1.48	2.03	16.91
varkurstaki 5% WP		(1.67)	(1.34)	(1.11)	(1.15)	(1.42)	(1.7)	(1.46)	(1.17)	(1.14)	(1.40)	(8.19)	
Metarhiziumanisopliae	3 Kg	2.30	2.20	1.00	1.17	1.63	2.27	2.07	1.03	1.57	1.73	2.54	14.25
1.0% WP		(1.67)	(1.64)	(1.22)	(1.29)	(1.46)	(1.66)	(1.60)	(1.24)	(1.44)	(1.49)	(9.16)	
Verticilliumlecanii	2.5 Kg	2.50	2.27	1.00	1.43	1.75	2.30	2.30	1.17	1.50	1.82	3.04	13.03
1.15% WP		(1.73)	(1.66)	(1.22)	(1.39)	(1.50)	(1.67)	(1.67)	(1.29)	(1.41)	(1.52)	(10.04)	
HaNPV	250 LE	2.37	2.17	0.83	1.03	1.59	2.27	1.83	0.92	1.07	1.53	2.48	15.06
		(1.69)	(1.63)	(1.15)	(1.24)	(1.44)	(1.66)	(1.53)	(1.19)	(1.25)	(1.42)	(9.06)	
UTC (water)		2.33	2.67	2.90	2.93	2.71	2.97	3.07	3.23	3.03	3.08	8.94	9.76
		(1.68)	(1.78)	(1.84)	(1.85)	(1.79)	(1.86)	(1.89)	(1.93)	(1.88)	(1.89)	(17.40)	
S.E.±		0.03	0.03	0.04	0.05	0.02	0.04	0.02	0.02	0.03	0.02	0.09	0.59
C.D.(P=0.05)		NS	0.09	0.12	0.14	0.06	0.12	0.07	0.08	0.09	0.05	0.30	1.21

() Figures in parenthesis are square-root transformed value, DBS= day before spraying, DAS= days after Spraying. NS=Non-Significant

Table 2 : Pooled data of bio insecticide expenditure and cost of cultivation (Rs. /ha)

Treatments	The total cost of cultivation (Rs. ha^{-1})	Grain yield (q/ ha.)	Gross returns (Rs. ha^{-1})	Net income (Rs. ha^{-1})	B:C Ratio
Azadiractina 1%(1000ppm) Neem oil	27024	13.65	64798.36	37774.36	1:2.40
Baeuveriabassiana 1% WP	26824	15.68	74460.29	47636.29	1:2.78
*Bacillus thuriengiensis*varkurstaki 5% WP	26624	16.91	80319.86	53695.86	1:3.02
*Metarhiziumanisopliae*1.0% WP	27874	14.25	67659.6	39785.6	1:2.43
Verticilliumlecanii 1.15% WP	26924	13.03	61872.68	34948.68	1:2.30
HaNPV	26864	15.06	71534.68	44670.68	1:2.66
UTC [water]	25424	9.76	46359.68	20935.68	1:1.82

treatments and untreated control (3.07 larvae/plant). However, at the pooled 7 DAS, the *H. armigera* population *B. thuriengiensis* var *kurstaki* 5% WP, *Ha* NPV 250 LE, *B. bassiana* 1% WP and *Azadiractina* 1% (1000ppm) *Neem* oil and *M. anisopliae* 1.0% WP was 0.86, 0.92, 0.93, 1.02 and 1.03 larvae/plant, respectively, the five being at par with each other and significantly superior to *V. lecanii* 1.15% WP and UTC (1.17 and 3.23 larvae/plant). After 10 DAS, minimum larval population was recorded in *B.s thuriengiensis* var *kurstaki* 5% WP (0.80 larvae/plant) but it was at par with *B.a bassiana* 1% WP (0.97 larvae/plant) followed by *Ha* NPV 250 LE (1.07 larvae/plant) and maximum larval population was recorded in *Metarhizium anisopliae* 1.0% WP (1.57 larvae/plant) except untreated control (3.03 larvae/plant). The pooled mean first spray data revealed that the minimum larval population was recorded in *B. thuriengiensis* var *kurstaki* 5% WP and *B.bassiana* 1% WP (1.48 and 1.50 larvae/plant, respectively), the two being at par with each other and significantly superior to remain all treatments except UTC (3.08 larvae/plant). The above findings are supported by findings of the scientists Bhatt and Patel (2002), Dhingra *et al.* (2002), Gowda and Yelshetty (2005), Gupta (2007), Bharti *et al.* (2009), Bhushan *et al.* (2011), Devi *et al.* (2011) and Kumar *et al*. (2018).

Per cent pod damage :

The pooled data of pod damaging per cent data presented in Table 2, data revealed the minimum pod damage per cent was recorded in *B thuriengiensis* var *kurstaki* 5 % WP (2.03 %) in reducing the per cent pod damage from the rest of the treatments. The *B. bassiana* 1 % WP (2.36 %) was found second best, and it was at par with *Ha* NPV @ 250 LE/ha (2.45 %). The maximum per cent pod damage was recorded in *V. lecanii* 1.15 % WP (3.04 %) except untreated control (water) (8.94 %).These results agree with those of previously scientific findings *viz.*, Singh *et al.* (1999), Bhatt and Patel (2002), Kumar and Malik (1997), Mandal *et al.,* (2003) Gowda and Yelshetty (2005), Hossain (2007) and Ram and Agrawal (2007).

Economic of biochemical insecticides:

The pooled data on bio-chemical treatments economics-related presented in Table 3. The findings are revealed the maximum cost of cultivation was recorded in *M. anisopliae* 1.0% WP (27874 Rs. /ha.) and the minimum cost of cultivation was recorded in *B. thuriengiensis* var *kurstaki* 5% WP (26624 Rs./ha.) except untreated control. The maximum grain yield (q/ ha.), gross returns (Rs. /ha), net income (Rs./ha) and B:C ratio was recorded in *B. thuriengiensis* var kurstaki 5% WP (16.91 q/ ha., 80319.86 Rs./ha., 53695.86 Rs./ ha. and 1:3.02, respectively) and the minimum cost of cultivation was recorded in *B. thuriengiensis* var kurstaki 5% WP (26624 Rs./ha.). The minimum grain yield (q/ ha.), gross returns (Rs./ha), net income (Rs./ ha) and B:C ratio were recorded in *V. lecanii* 1.15% WP (13.03 q/ha., 61872.68 Rs./ha., 34948.68 Rs./ha. and 1:20.30, respectively) except untreated control earlier workers Mandal *et al.* (2003) and Singh and Yadav (2006) agreed with present results.

REFERENCES

Amrapali, T., Ramteke and Sarwshri, V. Gangurde (2011). Evaluation of fresh and stored Ha NPV formulations on *Helicover paarmigera* (Hubner) larval population and production of *Cajanas cajan* (L. Mill) *J. Biopesticides*, **4** (1) : 49–52.

Bajya, D. R., Ranjith, M. and Raza, S.K. (2010). Evaluation of *Beauveria bassiana* against chickpea pod borer, *Helicoverpa armigera* (Hubner) and its safety to natural enemies. *Indian J. Agric. Sci.,* **85** (3): 378–381.

Bharti, P., Singh, S.P.N. and Kumar, N.(2009). Efficacy of some insecticides, bio-products and their phytotonic effect against gram pod borer (*Helicoverpaarmigera* Hubner) in chickpea. *Current Biotica.,* **9** : 247–255.

Bhatt, N. and Patel R. K. (2002). Bio-efficacy of various insecticides against *Helicoverpaarmigera* (Hubner) on chickpea. *Indian J. Entomol.*, **64** : 27-34.

Bhushan, S., Singh, R.P. and Shanker, R. (2011). Bioefficacy of neem and Bt against pod borer, *Helicoverpa armigera* (Hubner) in chickpea. *J. Biopest.,* (1) : 87-89.

Byrappa, A., Kumar, N.G. and Divya, M. (2009). Impact of biopesticides application on pod borer complex in organically grown field bean ecosystem, **5**:148-160.

Cherry, A.J., Rabindra, R.J., Parnell, M.A., Geetha, N., Kennedy, J.S. and Grzywacz, D. (2000). Field evaluation of *Helicoverpa armigera* (Hubner) nucleopolyhedro virus formulations for control of the chickpea podborer, *H. armigera* (Hubn.), on chickpea (*Cicer arietinum* var. Shoba) in southern India. *Crop Protection*, **19** : 51–60.

Devi, A.B., Surekha, V., Sharma, H.C., Arjuna, A. and Rao, B.

A. (2011). Interaction between host plant resistance and biological activity of *Bacillus thuringiensis* in managing the pod borer *Helicoverpaarmigera* (Hubner) in chickpea, *Andhra Crop Protect.,***30**:962-969.

Dhaliwal, G.S. and Koul, O. (2007). Botanical pesticides. In: *Biopesticides in pest management– conventional and biotechnological approaches.* Kalyani Publishers, New Delhi, pp. 72-122.

Dhingra, Singh, R.P. and Devakumar, C. (2002). Activity of *Neem* (*Azadirachta indica*) seed kernel extracts against the mustard Aphid, *Lipaphiserysimi*. *Phytoparasitica*, **16**: 225–230.

Garg,V. K., Patel, Yogesh and Sharma,S.K.(2015). Adoption of integrated pest management technology by chickpea growers. *Indian J. Tropical Biodiversity,* **23**(1): 78-81.

Gowda, D.K.S. and Yelshetty, S. (2005). Performance of different microbial agents sprayers against gram pod borer, *Helicoverpa armigera* (Hubner)on chickpea. *Karnataka J. Agric. Sci.*, **17** (2) : 217-224.

Gupta, M.P. (2007). Management of gram pod borer, *Helicoverpa armigera* (Hubner) in chickpea with biorationals *J. Entomology & Zoology Studies,***6** : 391-397.

Haris, S.M. and Khan, A. M. (2011). Efficacy of leaf extracts of *Azadirachta indica* on larval stages of gram pod borer *Helicoverpa armigera* (Hubner) *India. J. article:Bionotes,***13** (1): 31-32.

Hossain, M.A. (2007). Efficacy of some synthetic and biopesticides against pod borer, *Helicoverpa armigera* (Hubner) in chickpea. *Tropical Agricultural Research & Extention,* **10** : 74-78.

Kambrekar D.N. and Aruna, J. (2018). Screening for endophytic *Beauveria Bassiana* from different plants and its pathogenecity against chickpea pod borer, *Helicoverpa armigera* (Hubner) *J. Exp. Zool. India*, **21** (2) : 727-731.

Kumar, H. and Malik, S. (2005). Production scenario of (1997) chickpea in India: Growth and decomposition analysis. *Indian J. Pulses Res*., **18** (2) :199-201.

Kumar, V., Chandra Shekar, K. and Sidhu, O.P. (2004). Efficacy of indigenous botanical insecticides against selected insect pests. *J. Entomol. Res.,* **30** : 103–108.

Kumar, V., Chandra shekar, K. and Sidhu, O.P. (2018). Efficacy of indigenous botanical insecticides against selected insect pests. *J. Entomol. Res.,* **30** : 103–108.

Kumawat, K.C. and Jheeba, S.S. (1999). Ecofriendly management of gram pod borer, *Helicoverpa armigera* (Hubner). *Ann. Plant Protec. Sci*., **7**: 212-214.

Mandal, Uttam, Kumar, Singh, Gurucharan, Victor, U.S. and Sharma, K.L. (2003). Green manuring its effect on soil properties and crop growth under rice-wheat cropping system. *European J. Agron*., 225-237.

Mehlhorn, H.K., Al-Rasheid, A.S. and Abdel-Ghaffar, F. (2011). The *Neem* tree story: Extracts that really work. *Parasitol. Res.,* **1** : 77-108.

Rajasekaran, B. and Kumaraswamy, T. (1985). Antifeedant properties of certain plant products against *Spodopteralitura* Fabr. In: Reghupathy A, Jayaraj S, eds., Behavioural and physiological approaches in pest management. Coimbatore, India, T.N.A.U., Coimbatore Publication, pp. 25–28.

Ram and Agrawal (2007). To Develop a biorational approach against *H. armigera. Indian J. Entomol.,* **43**(1) : 121-122.

Satpute, B.B. and Mote, U.N. (2002). Efficacy of cypermethrin, Npv and nimbitor alone and in combination with each other aginst gram pod borer, *Helicoverpa armigera* (Hubner) and the yield on chickpea. *Plant Protection Bulletin,* **54** (1/2) : 21-24.

Singh, S.S. and Yadav, S.K. (2006). Efficacy and economics of some modern insecticides, bio-insecticides and *Neem*-based formulations against pod borer, *Helicoverpa armigera* (Hubner), in pigeonpea. *In. J. Ent*., **68** (2) : 139-143.

Singh, V., Siag, R.K. and Vijay P. (2009). Seasonal occurrence of larval population of *Helicoverpa armigera* (Hubner) on chickpea in North West Rajasthan. *Indian J. Pulse Res*., **18** : 92-93.

18th Year
★★★★★ of Excellence ★★★★★