Monitoring of Gram Pod Borer, *Helicoverpa armigera* through Pheromone Trap in Chickpea, *Cicer arietinum* L Crop and their Influence with Abiotic Parameters

Ajeet Kumar Singh[1]; Devendra Kumar Yadav[2]; Akhileshwar Vishwakarma[3*]; Buts Kumar Gourav[4]; Pratiksha Dwivedi[5]

[1,2,5]Department of Entomology, Baba Raghav Das Post Graduate College, Deoria-274001, Uttar Pradesh
[3]ICAR-National Research Centre for Makhana, Darbhanga-846005, Bihar
[4]Sai Nath University, Ranchi-835219, Jharkhand
*Corresponding Author, ORCID ID: 0009-0000-5841-8272

Received:- 12 September 2025/ Revised:- 19 September 2025/ Accepted:- 24 September 2025/ Published: 30-09-2025

Abstract— *The present research experiments were carried out during Rabi season of the year 2022-23 at the Agricultural Research Farm of Baba Raghav Das Post Graduate College, Deoria (UP) to monitor the population of Helicoverpa armigera by using pheromone traps in chickpea (variety-'Pusa-261'). The male moth catches of H. armigera was recorded from 4th SMW (1.5 moths/trap/week) and the moths catches increased in subsequent weeks and reached at peak during 6th, 7th and 8th SMW with 4 moths/trap/week, 3.5 moths/trap/week and 4 moths/trap/week, respectively, between 2nd week of February to 4th week of February, at vegetative to reproductive stage of crop. Abiotic factors such as rainfall, maximum and minimum temperatures showed a non-significant negative correlation with male moth catches of Helicoverpa armigera, while maximum and minimum relative humidity exhibited a positive correlation. However, all the weathers parameters together influenced the H. armigera male moth's catches in the chickpea up to extent of 75.93%.*

Keywords— Pheromone trap, H. armigera, correlation, regression and abiotic factors.

I. INTRODUCTION

Chickpea *(Cicer arietinum* L.) commonly known as gram or Bengal gram is the most important pulse crop. Globally, India ranked first in area and production [1]. India produces 11.74 million tons of chickpea from 10.01 million ha with an average production of 1164 kg/ ha [2]. However, chickpea production is not fully achieved a mid-different biotic and abiotic stresses [3]. Among biotic factors, diseases, insect pests, nematodes, birds and vertebrates harm the crop but damage due to insects is more striking than others. Nearly 60 insect species are known to feed on chickpea [4,5]. In eastern Uttar Pradesh the major insect pests which attack on chickpea crop are mainly *H. armigera* (Hubn.), *Spodoptera litura* (F.), *Agrotis ipsilon* (Hubn.), *Plusia orichalsia* (F) *and Bemisia tabaci* (Genn). Among these, *H. armigera* is the most destructive and very notorious insect pests, bear polyphagous nature. Weather factors play a crucial role in the regulation of population of insects [6]. The yield losses vary from 6.88% to 50% in the chickpea due to pod borer infestation [7] and 50-100% in favourable weather conditions particularly when there are frequent rains and cloudy weather during the cropping seasons [8]. In India the population of *H. armigera* flourished during second half of February and outbreak situation were found throughout March. Pheromone traps play a crucial role in monitoring the population of *H. armigera* within integrated pest management (IPM) programs [9]. The incidence of this pest has been observed almost throughout the crop growing season. Therefore, an attempt has been made to develop an environmentally sound pest management strategy for this pest [10]. Keeping these points in view, the present investigation was carried out to monitor the population of *H. armigera* and its relationship with abiotic factors like; temperature (maximum and minimum), relative humidity (maximum and minimum) and rainfalls.

II. MATERIALS AND METHODS

The study was conducted during *Rabi* 2022-23 at the Agricultural Research Farm of Baba Raghav Das Post Graduate College, Deoria (UP), the variety 'Pusa-261' sown with spacing of 30x10 cm in 7x2 m^2 plot size. All the normal and recommended

agronomical practices for the region were applied, followed throughout the crop season for raising the crop, except the application of any plant protection measure. For monitoring of *H. armigera* two Pheromone traps were installed during 4th SMW (22nd January 2023) in the field with the help of bamboo sticks at 1 meter above the crop canopy. The pheromone traps used in this study were obtained from SK AGROTECH Pune, India. The pheromone traps were monitored regularly in morning and calculated moth population trap at weekly interval. The population of *H. armigera* obtained were correlated with the weather parameters and subjected to one way ANOVA by using IBM SPSS 16.0 software version.

III. RESULTS AND DISCUSSION

The perusal of Fig 1 revealed that the moth activity was initially recorded as 1.5 moths/trap/week during fourth week of January (4th SMW). Catches steadily increased, peaking between the second and fourth weeks of February (6th, 7th, and 8th SMW) with 3.5 to 4 moths/trap/week, coinciding with the crop's vegetative to reproductive stage. Following this peak, moth numbers gradually declined throughout March, reaching 1 moth/trap/week by the end of the month (12th SMW). A slight increase to 2 moths/trap/week was noted in the last week of March (13th SMW) just before harvest. Almost similar kind of observations were recorded by Bajia *et al.* [11] who reported that the male moth catches of *H. armigera* was recorded in 2nd SMW and reached its peak during 6th to 7th SMW. Bhagat *et al.* [12] noticed the activity of male moths of *H. armigera* during 51st SMW with 0.49 moths/trap/week which increased gradually and reached its peak (43.45 moths/trap/week) during 6th SMW followed by decreasing in 7th SMW and reached to a minimum 1.73 moths/trap/week in 11th SMW. Ramesh Babu *et al.* [13] observed that the moth populations were active from February to mid-April and decreased sharply in the late April.

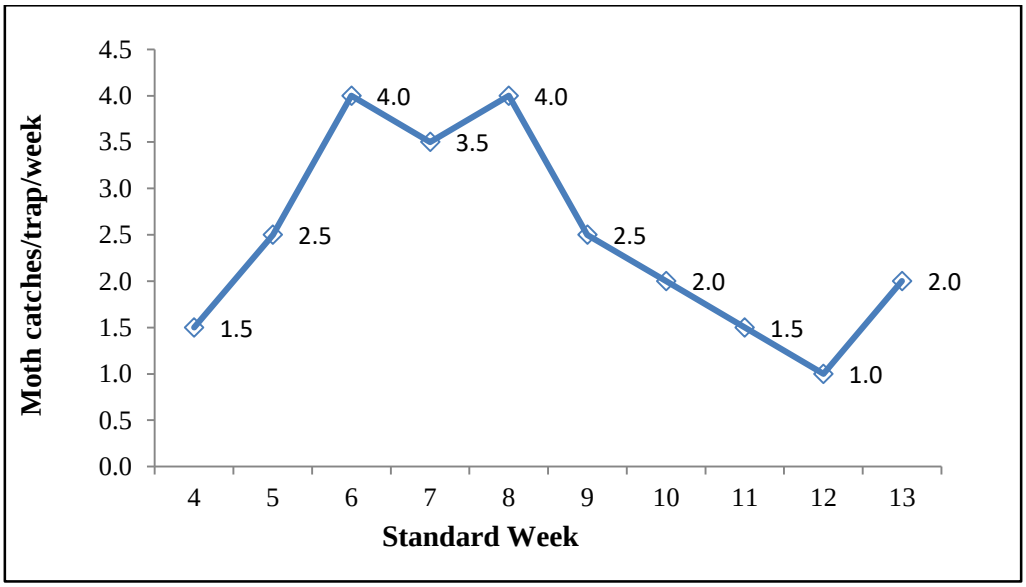

FIGURE 1: Average number male moths/trap/week of *H. armigera* catches on chickpea during *Rabi,* 2022-23

TABLE 1
CORRELATION STUDIES BETWEEN WEATHER PARAMETERS AND MALE MOTH CATCHES OF *H. ARMIGERA* ON CHICKPEA DURING *RABI,* 2022-23

Weather parameters	Populations of adult male moth catches of *H. armigera*
Maximum temperature (°C)	-0.361
Minimum temperature (°C)	-0.569
Maximum relative humidity (%)	0.236
Minimum relative humidity (%)	0.236
Rainfall (mm)	-0.548

TABLE 2
MULTIPLE REGRESSION MODEL OF MALE MOTH CATCHES OF *H. ARMIGERA* POPULATIONS WITH ABIOTIC FACTORS DURING *RABI*, 2022-23

Multiple regression equation	R^2
$Y=6.640+0.207X_1-0.558X_2+0.028X_3-0.078X_4-0.170X_5$	0.7593
Where, Y = *H. armigera* male moths catches, X_1 = maximum temperature, X_2= minimum temperature, X_3= maximum relative humidity, X_4= minimum relative humidity and X_5 = rainfall.	

The perusal of Table 1 revealed that male moth catches in pheromone traps showed non-significant negative correlation with the maximum, minimum temperature and rainfalls with r-value of -0.361,-0.569 and -0.548, respectively. However, it showed a positive and non-significant correlation with maximum and minimum relative humidity with r-value of 0.236 and 0.057, respectively. The findings are contrary to that of Varshney [14] who reported that the temperature was positively correlated with moth catches while relative humidity negatively correlated. Pathania *et al.* [15] and Khadse *et al.* [16] reported negative and non-significant correlation between maximum and minimum temperature with male moth catches which is agreement with present findings, whereas findings of Sagar *et al*. [17] and Rawat *et al.* [18] are not in accordance with the present findings. The multiple linear regression model (2022-23) was $Y=6.640+0.207X_1-0.558X_2+0.028X_3-0.078X_4-0.170X_5$. Where, Y = *H. armigera* male moths catches, X_1 = maximum temperature, X_2= minimum temperature, X_3= maximum relative humidity, X_4= minimum relative humidity and X_5 = rainfall. The present findings are in accordance with Pal *et al.* [19] who reported that weather factors together influenced 62.88 % to 69.13% on pheromone trap catches of adult moths in chickpea. Similarly, Ramesh Babu *et al.* [13] also reported that the various weather parameters influence the population adult moths *H. armigera* by trap catches is up to 88% in chickpea.

IV. CONCLUSION

These investigations therefore indicate that pheromone traps are important tools for monitoring of *H. armigera* population. The period of high moth catches suggests the potential for significant larval damage, emphasizing the need for timely intervention. Therefore, immediate control measures using Integrated Pest Management (IPM), rather than relying solely on widespread insecticide use, are essential to address this potential infestation.

ACKNOWLEDGEMENT

This research was supported by Department of Entomology, Baba Raghav Das Post Graduate College Deoria, UP. Dr Rajnish Kumar, Dr Amrendra Pratap Singh, Dr Shushil Kumar Dr Sania Tyagi are also acknowledged to assist the research, Sh Suraj Rajbhar (lab assistant) also helped us in managing our field experimentation.

CONFLICT OF INTEREST

There is not any conflict of interest among the authors.

REFERENCES

[1] FAO (Food and Agriculture Organization). (2022). FAOSTAT Database faostat.fao.org/.

[2] DES, Ministry of Agri. & FW (DA&FW), GoI. (2022). Normal Area & Prod. (2017-18 to 2021-22).

[3] Chaturvedi, S.K., Jha, S.K., Singh, N.P., Gaur, P.M. and Varshney, R.K. (2018). Technological and policy intervention for increasing chickpea production in India. *Pulse India* **8**, 7-12.

[4] Sharma, H.C. (2008). *Biotechnological Approaches for Pest Management and Ecological Sustainability*. CRC Press.

[5] Nair, R.M. and Götz, M. (2016). Chickpea: Breeding for Insect Resistance. In *Chickpea: Crop Wild Relatives for Enhancing Genetic Gains* (pp. 149-176). Academic Press.

[6] Hameed, A., Sohail, M., Ahmad, S.S. and Karar, H. (2015). Forecasting and modelling of *Helicoverpa armigera* (Hub.) in relation to weather parameter in Multan, Punjab Pakistan. *Pak. J. Zool.* **47(1)**, 15-20.

[7] Singh, C.B., Srivastav, A.K. and Rai, M.K. (2008). Survey and assessment of status of *Helicoverpa armigera* in district Jhansi on chickpea. *Indian J. Entomol.* **70**, 113-117.

[8] Saminathan, V.K., Mahadevan, N.R. and Muthukrishnan, N. (2003). Population ecology of *Helicoverpa armigera* under different rainfed cotton cropping systems in southern districts of Tamil Nadu. *Indian J. Entomol.* **65(3)**, 82-85.

[9] Ahmed, K. and Khalique, F. (2002). Forecasting adult population of *Helicoverpa armigera* on chickpea using pheromone trap. *Pak. J. Sci. Inf.* **5(8)**, 830-834.

[10] Kumar, R., Mondal, P. and Chakravarty, M.K. (2014). Evaluation of IPM modules against *Helicoverpa armigera* (Hübner). *Ann. Plant Prot. Sci.* **22(2)**, 244-248.

[11] Bajia, R.; Srivastava, C.P. and Keval, R. (2016). Monitoring of gram pod borer, *Helicoverpa armigera* (Hübner) through pheromone traps in chickpea, *Cicer arietinum* L. crop and influence of some abiotic factors on its population. *Journal of Experimental Zoology India*, **19**(2): 751-755.

[12] Bhagat, J.K.; Soni, V.K. and Chandrakar, H.K. (2020). Monitoring of pod borer, *Helicoverpa armigera* (Hubner) on chickpea crop through pheromone traps at Kawardha, Chhattisgarh. *International Journal of Chemical Studies*, **8**(5): 170-172.

[13] Ramesh Babu, S., Rupawat, K.S. and Jambhulkar, P.P. (2009). Monitoring of adult populations of *Helicoverpa armigera* (Hubner) on chickpea using pheromone trap in Southern Humid Zone of Rajasthan. *Indian J. Appl. Entomol.* **23(2)**, 85-89.

[14] Varshney, K. (2012). Study of seasonal population fluctuation of gram pod borer *Helicoverpa armigera* (Hubner) in chickpea using pheromone technology. *Int. J. Agric. Food Sci. Technol.* **3(2)**, 115-121.

[15] Pathania, S.S., Verma, A.K. and Gupta, P.R. (2009). Pheromone monitoring of *Helicoverpa armigera* (Hub.) and relationship with abiotic factors and infestation on tomato. *Indian J. Entomol.* **71**, 312-316.

[16] Khadse, S.R., Khandwe, N., Sinha, S. and Tomar, S.P.S. (2018). Studies on correlation of gram pod borer, *Helicoverpa armigera* with abiotic factors by pheromone traps. *Int. J. Stud.* **6(2)**, 872-875.

[17] Sagar, D., Nebapure, S.M. and Chandra, S. (2017). Development and validation of weather based prediction model for *Helicoverpa armigera* in chickpea. *J. Agrometeorol.* **19(4)**, 328-333.

[18] Rawat, R.K., Keval, R., Chakravaarty, S. and Ganguly, S. (2017). Monitoring of gram pod borer, *Helicoverpa armigera* (Hub.) through pheromone traps on long duration pigeonpea. *J. Entomol. Zool. Stud.* **5(5)**, 665-669.

[19] Pal, S., Chatterjee, H. and Senapati, S.K. (2015). Influence of abiotic factors on pheromone trap catches and field infestation of *Helicoverpa armigera* on carnation (*Dianthus caryophyllus*) in Hilly Region of West Bengal, India. *Int. J. Bio-resour. Stress Manag.* **6(6)**, 695-699.