International Journal of Environment and Climate Change

Volume 13, Issue 11, Page 3401-3405, 2023; Article no.IJECC.108755
ISSN: 2581-8627
(Past name: British Journal of Environment & Climate Change, Past ISSN: 2231–4784)

Population Fluctuation with Climatic Condition of Gram Pod Borer *Helicoverpa armigera* (Hub.) on Chickpea Crops in Sultanpur Region of Eastern U.P.

Bal Mukund Pandey [a*], Rahul Kumar [a], Vijay Lakshmi [b] and Awaneesh Chandra [c]

[a] Department of Entomology, Faculty of Agriculture, Kamla Nehru Institute of Physical and Social Sciences, Sultanpur-228118 (U.P.), India.
[b] TDPG, College, Jaunpur (U.P.) India.
[c] Government Degree College, Jakhini, Varanasi (U.P.), India.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/IJECC/2023/v13i113513

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/108755

Original Research Article

Received: 04/09/2023
Accepted: 10/11/2023
Published: 20/11/2023

ABSTRACT

Gram pod borer *Helicoverpa armigera* is most serious insect pest of chickpea crop in Rabi season in eastern U.P., including Sultanpur district. The studies have been done on population fluctuation of gram pod borer, *Helicoverpa armigera on* one local desi variety of chickpea with meteorological data take on ANDUAT, Kumarganj, Ayodhya, (U.P.). The incidence of pod borer *Helicoverpa armigera* in chickpea/ commenced from 1st standard week of January with 0.10 mean larval

**Corresponding author: E-mail: bmpandey12479@gmail.com;*

population per plant**.** The larval population started increase per decrease and reached the maximum with 15**.**30 mean larval population per plant during 12th standard week of 2022**.** The population of larvae showed positive correlation with maximum temperature (0.70) and minimum temperature **(**0**.**82**)** and rainfall (0.25), while negative correlation was obtained with relative humidity (-0.72).

Keywords: Population; fluctuation; pod borer; Helicoverpa armigera (*Hub*.)*.*

1. INTRODUCTION

"Chickpea, *Cicer arietinum* L, is an important Rabi crop season legume crop in India". "Chickpea production in India has peaked to all time high at 11.23 million tons during 2017-18 [1] and it was sustained to 10.32 million tons [1] which has ushered self-sufficiency for this main pulse crop in India. It is cultivated in an area during 2021-22 (fourth estimate), chickpea production of India was 13.75 million tonnes from an acreage of 10.91 million ha with a productivity of 12.6 q./ha (DES 2023, MOAF&W, GoI). All India Rabi pulse acreage and production has been recorded 150 Lha and 151 Lt. Madhya Pradesh with 26% of area and 30% of total Rabi pulse production in the country outshined at first rank followed by Maharashtra (14% and 13%), Rajasthan (13% and 14%). Uttar Pradesh area lakh hectare 14.85 with production lakh tonns 17.39 and productivity with kg/ha. 1171" [2]. U.P. contributing the 11.4 lac million tons of production out of 13.24 lac hectare area rank first in India. The highest productivity (1394 kg/ha) has been reported from Mirzapur district of U.P. [3]. Chickpea solely contributes nearly 50% of the Indian pulse production. Among them, different insect pests play an important role in reducing production of chickpea crop. It has a rich source of nutritional values in the diet of Indian people because of containing 21.5% protein, 64.5% carbohydrates and 4.5% fat which is comparatively deficient in the cereals and oilseeds.

"*Helicoverpa armigera* (Hub) is a most polyphagous in nature and belonging to the family Noctuidae and order Lepidoptera**.** It is also known as cotton bollworm, corn ear worm, tomato fruit borer and bud worm**.** In chickpea and pigeon pea alone the annual loss caused by *Helicoverpa armigera* in India has been estimated to exceed 600 million US dollars" (ICRISAT.1992).Pod damage even up to extent of 80**%** has been reported in India [4]. In U**.**P**.** alone15**.**3**%** of the chickpea crop worth Rs**.** 462**.**50 million is lost annually due to this pest [5]. It has been reported to destroy 90**%** of chickpea production (Knight et al., 1980). Single larvae of *Helicoverpa armigera* can damage 25**-**30 pods during its larval life [6]. "It is a polyphagous, multi**-**voltine and cosmopolitan pest and is reported to feed and breed on 182 species of host plants belonging to 47 families in India" [7]. **"**A single larva can consume 30**-**40 pods in its life time [8]. Yield losses due to gram pod borer in chickpea may range from 70 to 95 percent" [9]. The knowledge on the population fluctuation with climatic condition of gram pod borer will certainly be helpful in formulating the insect pest management strategies for *Helicoverpa armigera* at Sultanpur district of Uttar Pradesh.

2. MATERIALS AND METHODS

The present study was carried out at the experimental Agricultural farm Faridipur campus of K**.**N**.**I**.**P**.**S**.**S**.** Sultanpur, U.P. during Rabi season 2021**-**2022**.** Chickpea was raised by all the recommended agronomical practices except plant protection measures which is the build up of insect pest in pesticide free environment**.** Weekly (7 days interval) observation on the appearance and population build up of larvae was recorded by 1 m row length (MRL) under area randomly selected plant method are taken**.** The chickpea (local desi variety) was sown on 4th week of October during Rabi season**.** The observation was recorded at 7 days interval from the time of planting to harvesting**.** The data of minimum and maximum temperature, relative humidity, sunshine hours, and rainfall were collected from the unit of meteorological observatory, ANDUAT Kumarganj, Ayodhya (U.P.) located close to the experimental site**.** The data of population of pods borer and correlation between pod borer and weather parameters**/**climatic fluctuation are presented in the Table.

3. RESULTS AND DISCUSSION

The larval population started commencing from the 1st week of January with 0**.**10 mean larval

population per plant. The larval population started increasing and reached its maximum of the 11.30 mean larval population / plant during 4th week of March 2022 and then the population decline with the maturation of chickpea crop. The population has increased gradually from 0.10 to 11.30 with an increase of temperature (Both minimum and maximum) and decreased sharply with further increase in temperature. There was significant positive correlation in both minimum and maximum temperature and pest observed correlation coefficient was 0.70 and 0.82, respectively.

The population steadily increased in general and particular there was steep rise in the level of population from a maximum temperature of 32 °C-35.5 °C and there after the population had reduced with further increase in the temperature up to pod maturation. At this junction maturity of pods seems to be responsible for the decline in the larval population. Prabhakar Rao et. al [10] reported that "the temperature range between 12-21 °C was an important factor for the population builds up of gram pod borer. In the present investigation the population incidence started at minimum temperature 7.30 °C which is

Table 1. Population fluctuation of *Helicoverpa armigera*, larvae in chickpea crop (2021-22)

Std. Week	Average No. of Larvae/plant	Temperature (ºC)		Relative Humidify (%)		Rainfall (mm)	Sunshine
		Max.	Min.	Max.	Min.		
1st	0.10	21.0	7.0	90	29	0.0	8.0
2nd	0.21	25.5	7.3	91	32	0.0	8.7
3rd	0.25	26.0	8.0	92	30	0.0	8.2
4th	0.33	25.5	7.5	86	36	0.82	7.0
5th	0.28	27.0	9.5	85	32	0	7.5
6th	0.32	29.5	11.0	72	28	0.71	8.5
7th	0.40	33.0	12.0	75	26	0.0	9.2
8th	2.70	31.0	12.5	78	25	0.0	8.5
9th	3.00	32.0	13.0	82	39	6.0	5.5
10th	8.55	30.0	14.0	91	40	0.0	7.4
11th	10.5	35.5	15.5	68	20	0.0	9.8
12th	11.3	36.0	16.0	61	18	7.5	7.5
13th	11.0	39.0	18.0	55	15	0.0	9.5
14th	5.25	40.0	20.0	62	13	0.15	8.6
15th	1.55	39.0	20.0	60	14	0.0	8.1
SE(d)	**r-**	**0.70**	**0.82**	**-0.72**	**-0.55**	**0.25**	**0.29**
CDP(0.05)	**t-**	**3.50**	**3.85**	**-2.50**	**-1.70**	**1.06**	**0.85**

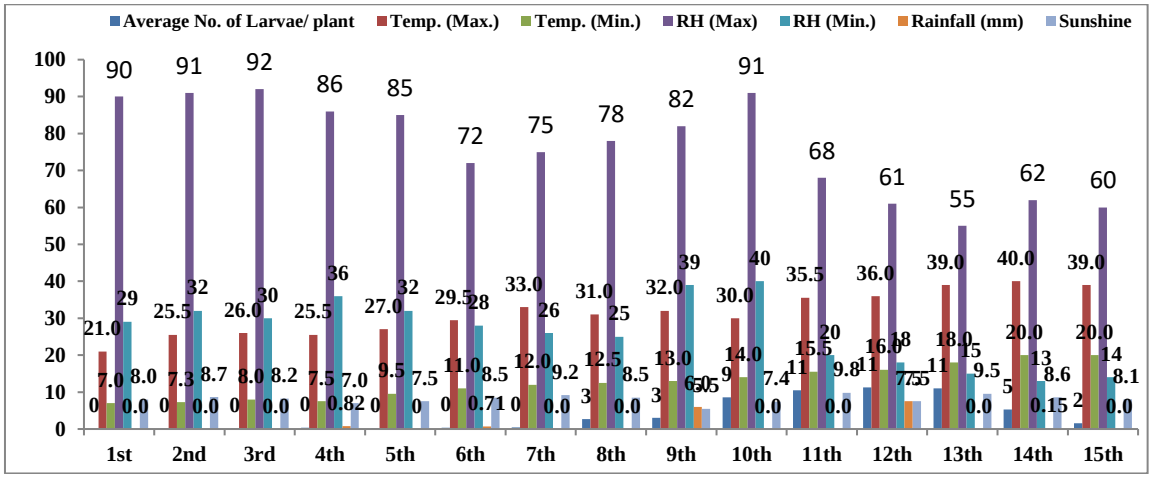

Fig. 1. Population fluctuation of *Helicoverpa armigera,* larvae in chickpea crop (2021-22)

in agreement with the above report. Relative humidity was the other most important factor closely related to the activity of the insect pest. The correlation coefficient of both morning and afternoon relative humidity was -0.61. Morning relative humidity of 81-68% and afternoon relative humidity 39-20% were recorded during the crop period the data could be observed that highest and lowest relative humidity was not conductive for incidence of the larvae". The relative humidity recorded during the 3rd and 4th week of March may be optimal for the larval development and in this period the higher in incidence of larvae was observed. Prabhakar Rao et. al [10] indicated "below 70% maximum relative humidity was conductive for the incidence and population build up of gram pod borer larvae. *Helicoverpa armigera* population were noticed for the first time during 46th SW of 2016 and respective mean population were 0.33 larvae/plant". "The lowest mean population *H. armigera* is 0.33 larvae/plant was recorded during 46th and 47th SW at the minimum temperature of 11.8 °C, maximum temperature of 29 °C, relative humidity 67.4 and there were no rainfall. Whereas maximum mean population of *Helicoverpa armigera* population of 5.67 larvae/plant was recorded during 08 SW of 2018" [11].

Rainfall was considered as most important factor regulating the insect population. During the investigation period a total rainfall 15.18 mm was received which was more or less equally distributed in March. The correlation between mean larval population and rainfall indicate negative and significant correlation (-0.666). Yadav and Lal, [12]. Verma et al [13]. Krishna et al. [14] and Yadav and Jat, [15] have also reported "a positive correlation with maximum temperature which gives strong support to the present investigation".

The correlation coefficient (0.25) indicated positive relationship between the larval population and rainfall but it was non-significant. According to Vaishampayan and Veda [16], "early good rain in September or October favoured the build up of first generation larval population of gram pod borer. A total of 15.18 mm precipitation was received fairly distributed in three months. The distribution range was a non-significant positive correlation was established between rainfall and population dynamic of gram pod borer larvae. Sunshine (hrs/day) beings on important metrological indicator in closely related the temperature".

4. CONCLUSION

The maximum pod borer Helicoverpa armigera in chickpea recorded 15.30 mean larval population per plant during 12th standard week of 2022. The population of larvae showed positive correlation with maximum temperature (0.70) and minimum temperature (0.82) and rainfall (0.25), while negative correlation was obtained with relative humidity (-0.72).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Annual Report of IIPR. Chickpea production in India has peaked to all time high at 11.23 million tons during 2017-18 (MoAF&W, 2019); 2019.
2. Anonymous. Uttar Pradesh area lakh hectare 14.85 with production lakh tonns 1739 and productivity with kg/ha. 2021; 1171.
3. Ali M, Mishra JP. Technology for production of winter pulses, IIPR. Kanpur. 2000:2-4.
4. Ahmed K. Lal SS, Morris H, Khalique F. Malik BA. Insect pest problem and recent approaches to solving them on chickpea in south Asia Chickpea in the nineties; proc. II-Int. Workshop on chickpea improvement ICRISAT, Pantancheru, India, 4-8 Dec. 1990:165-168.
5. Lal SS, Yadav CP, Dias CAR. Assessment of crop losses in chickpea caused by H.armigera FAO Plant Prot. Bull. 1985;33: 27-35.
6. Rai R, Nath P. Evaluation of some insecticides for the management of the pod borer H.armigera infesting Gram. Ann.Pl.Protec. Sci. 1996;4(2):154-159
7. Pawar VM. Microbial control of Helicoverpa armigera sp. on pulses crops In: IPM System in Agriculture (Upadhyaya R.K., Mukarji K.G. and Rajak RL Eds.) New Delhi, India, Aditya books Private Ltd, P. 1998:55-78.
8. Taggar GK, Singh R. Integrated management of insect pests of rabi pulses. In: Arora R, Singh B and Dhawan AK (ed.) Theory and practice of Integrated pest management. Scientific Publishers, India. 2012;454-72.
9. Prakash MR, Ram U, Tariq A. Evaluation of chickpea (*Cicer arietinum* L.) germplasm

for the resistance to gram pod borer, *Helicoverpa armigera* Hubner (Lepidoptera: Noctuidae). Journal of Entomology Research. 2007;31:215-218

10. Rao Prabhakar, K Sudhakar, K Radha krishnaiah. Seasonal Incidence and Host preference of *Helicoverpa armigera* (Hubner) Indian J. Plant Protection. 2001; 29(1-2):152-153.
11. Gautam MP, Chandra Umesh, Yadav SK, Jaiswal. Ramesh, Giri SK, Singh Shesh Narayan. Studies on population dynamics of garm pod borer *Helicoverpa armigera* (Hubner) on chickpea (*Cicer arietinum* L.) Journal of Entomology and Zoology Studies 2018;6(1):904-906.
12. Yadav CP, Lal SS. Relationship between certain abiotic and biotic factors and occurrence of gram pod borer, *Heliothis armigera* (Hub.) on chickpea. Entomon: 1988;13(3-4):269-73.
13. Verma KS, Kakar KL, Verma AK. Incidence, biology and population fluctuations of *Heliothis armigera* (Hb.) in mid hill region of Himachal Pradesh. Pest Management and Eco. Zoo. 1994;2(1):41-44
14. Krishna Kant, Kanaujia KR, Kanaujia S. Role of plant density and abiotic factors on population dynamics of *Helicoverpa armigera* (Hubner) in chick pea. Annals of Plant Protection Sciences. 2007;15(2): 303-306.
15. Yadav SR, Jat BL. Season incidence of *Helicoverpa armigera* (Hub.) on Chickpea. Journal of Insect Science. 2009;22(3):325-328.
16. Vaishampayan SM, Veda OP. Population dynamics of gram pod borer *H. armigera* (Hub.) and its outbreak situation on gram *Cicer arietinum* L. at Jabalpur.Indian J. Entomol. 1980;42(3): 353-359.

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