# Population fluctuation with climatic condition of Gram pod borer *Helicoverpa armigera* (Hub.) on Chickpea crops in Sultanpur region of Eastern U.P., India


## 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 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.)


## Introduction

"Chickpea, *Cicer arietinum* L, is an important Rabi crop season legume crop in India". [17] "Chickpea production in India has peaked to all time high at 11.23 million tons during 2017-18 (Mo AF&W, 2019) and it was sustained to 10.32 million tons (MoAF&W, 2019) 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"(**Anonymous 2021**). 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. (**Ali and Mishra 2000**). 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 (**Ahmad *et al.*, 1990**). In U.P. alone15.3% of the chickpea crop worth Rs. 462.50 million is lost annually due to this pest (**Lal *et al.*, 1985**). 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 (**Rai and Nath, 1996**). "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" (**Pawar, 1998**). **"**A single larva can consume 30-40 pods in its life time (Taggar and Singh, 2012). Yield losses due to gram pod borer in chickpea may range from 70 to 95 percent" (**Prakash *et al.*, 2007**). 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.

## 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 4$^{th}$ 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.

## Results and discussion

The larval population started commencing from the 1$^{st}$ 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 4$^{th}$ 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.

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

| Std. Week | Average No. of Larvae/plant | Temperature ($^{o}$C) | | Relative Humidify (%) | | Rainfall(mm) | Sunshine |
|---|---|---|---|---|---|---|---|
| | | Max. | Min. | Max. | Min. | | |
| 1$^{st}$ | 0.10 | 21.0 | 7.0 | 90 | 29 | 0.0 | 8.0 |
| 2$^{nd}$ | 0.21 | 25.5 | 7.3 | 91 | 32 | 0.0 | 8.7 |
| 3$^{rd}$ | 0.25 | 26.0 | 8.0 | 92 | 30 | 0.0 | 8.2 |
| 4$^{th}$ | 0.33 | 25.5 | 7.5 | 86 | 36 | 0.82 | 7.0 |
| 5$^{th}$ | 0.28 | 27.0 | 9.5 | 85 | 32 | 0 | 7.5 |
| 6$^{th}$ | 0.32 | 29.5 | 11.0 | 72 | 28 | 0.71 | 8.5 |
| 7$^{th}$ | 0.40 | 33.0 | 12.0 | 75 | 26 | 0.0 | 9.2 |
| 8$^{th}$ | 2.70 | 31.0 | 12.5 | 78 | 25 | 0.0 | 8.5 |
| 9$^{th}$ | 3.00 | 32.0 | 13.0 | 82 | 39 | 6.0 | 5.5 |
| 10$^{th}$ | 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** |
| **CD P(0.05)** | **t-** | **3.50** | **3.85** | **-2.50** | **-1.70** | **1.06** | **0.85** |

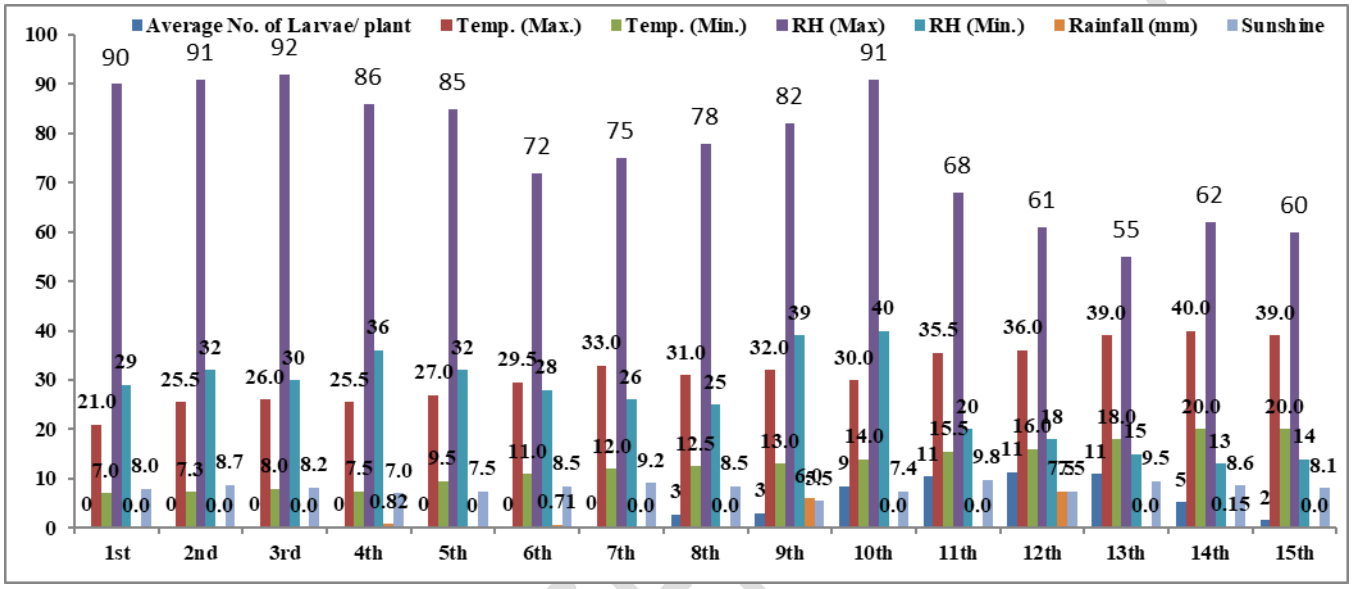


**Fig 1. Population fluctuation of *Helicoverpa armigera,* larvae in chickpea crop (2021-22)**

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* (2001)** 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 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 (2001)** 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" (**MP Gautam *et.,al.***)

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, (1988). Verma *et al,* (1994). Krishna *et al*. (2007)** and **Yadav and Jat, (2009)** 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 (1980),** "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".

**Conclusion**

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. Form the data it was evident that sunshine hours gradually increased throughout the crop period. The correlation coefficient (0.29) indicated that the sunshine hours and the incidence of the larvae were non-significant positively correlated with each other.

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