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Population dynamics of gram pod borer (*Helicoverpa armigera* Hübner) on chickpeas

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Abstract
The present investigation was carried out at research farm of Tirhut College of Agriculture, Dholi, Muzaffarpur, Bihar during *Rabi* 2017-18. The larval population was initially recorded in 7th standard week (third week of February) (2.33 larva/plant) with a peak in 13th standard week (2nd week of April) (5.33 larva/plant). Mean larval population of *Helicoverpa armigera* on chickpea variety KPG-59 was found positively correlated with maximum temperature (0.495), whereas minimum temperature and relative humidity (7 Hrs and 14 Hrs) shows negative and non-significant correlation (-0.055), (-0.553), respectively. Correlation between rainfall and larval population was found negative and significant (-0.666). However, all the weather parameters together contributed 80.7 percent towards *Helicoverpa armigera* larval population.

Keywords: Population dynamics, gram pod borer, *Helicoverpa armigera*, chickpea

Introduction
Chickpea (*Cicer arietinum*) is considered as "King of Pulses" and commonly known as "Bengal gram or Chana", belongs to family Fabaceae. It is an important winter season soil fertility restorative legume crop and is grown globally as food source. It is known to be originated from India, Afghanistan and Persia. The most important chickpea growing states in the India are Maharashtra, Gujarat and Madhya Pradesh. In India chickpea, is grown on 8.95 million hectares area with production 7.06 million tonnes and productivity 801 kg per ha. The production of chickpea in Bihar is 0.066 million tonnes with productivity 1098 kg per ha which covered nearly 0.06 million hectares of area (Anonymous, 2016) [1].

Even though India is the largest producer of chickpea, it still imports chickpea from other countries. Keeping in view, the ever-increasing demand for this legume crop; it is essential to increase the production and area under cultivation, at the same time minimizing the stress on this crop plant.

It is damaged by over 50 insect species in different parts of the world, of which the gram pod borer, *Helicoverpa armigera* (Hübner) (Noctuidae: Lepidoptera) is the most important biotic constraint. 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) [10]. *Helicoverpa armigera* is known to be the key pest and most important limiting factor in the successful cultivation of chickpea (Lateef, 1985 and Reed *et al*., 1987) [7, 12] due to high reproduction rates, wide genetic diversity and an ability to withstand, metabolize and avoid toxic chemicals. A single larva can consume 30-40 pods in its life time (Taggar and Singh, 2012) [14]. Yield losses due to gram pod borer in chickpea may range from 70 to 95 percent (Prakash *et al*., 2007) [11]. Hence, an attempt has been made to investigate the incidence of pod borer infesting chickpea to the different meteorological parameters.

Materials and Methods
In order to study the population dynamics of *Helicoverpa armigera* on chickpea varietys, fixed plot survey was conducted at the research farm of Tirhut College of Agriculture, Dholi, Muzaffarpur, Bihar during *Rabi* 2017-18. The crop was sown on 5th December, 2017. All the agronomic practices were followed except insecticidal application. The larval population was recorded on five randomly selected plants from each quadrate at weekly interval on standard week basis. The data recorded on larval population and meteorological parameters were analysed statistically according to the method as described by Panse & Sukhatme (1967) [9]. Data on weather factor viz., atmospheric temperature (maximum and minimum), relative humidity (maximum and minimum) and total rainfall were obtained from Meteorological Department, T. C. A, Dholi.

Results and Discussion

The data summarized in Table 1 and depicted in fig 1 indicated that the pest population of pod borer on KPG-59 ranged from 1.00 to 5.33 larvae per plant during the season. The larval population occurred on gram throughout the growth phase, being low at vegetative stage and high at pod development stage. The maximum and minimum larval population was recorded in 13th (5.33 larva/plant) (2nd week of April) and 16th (1.00 larva/plant) (1st week of May) standard week, respectively. The larval population increases continuously from 7th (third week of February) to 13th (2nd week of April) standard week and decreases gradually from 14th (3rd week of April) standard week till harvesting. The variation in larval population might be due to fluctuating temperature, relative humidity and unexpected rainfall. The present results were in close approximation with the findings of Dubey *et al*., 1995 [3]; Gautam *et al*., 2018 [4]; Lomash and Bisht, 2013 [8] and Singh and Ali, 2006 [13]. They reported that the incidence of *Helicoverpa armigera* was found from December to April. The results of present studies are not in conformity with the findings of Chatar *et al*. (2010) [2] who revealed that pest activity was started from 2nd week of December and attend a peak during 2nd week of January.

The correlation studies between mean larval population of gram pod borer, *Helicoverpa armigera* and weather parameters has been presented in Table 2 and illustrated in fig 2. Maximum temperature shows positive correlation (0.495), whereas minimum temperature and relative humidity (7 Hrs and 14 Hrs) shows negative correlation (-0.055), (-0.553), respectively with mean larval population. The correlation between mean larval population and rainfall indicate negative and significant correlation (-0.666). Yadav and Lal, (1988) [18]; Verma *et al*, (1994) [17]; Krishna *et al*. (2007) [6] and Yadav and Jat, (2009) [19] have also reported a positive correlation with maximum temperature which gives strong support to the present investigation. The results of present investigation are in conformity with the finding of Yadav and Jat (2009) [19] who reported negative correlation between larval population and relative humidity whereas, findings of Upadhyay *et al*. (1989) [16]; Tripathy *et al*. (1999) [15] and Joshi *et al*. (2010) [5] are not in accordance with the present findings.

Table 3 indicated that, the cumulative effect of temperature, relative humidity and rainfall on mean larval population of *Helicoverpa armigera* was 80.7%. The results are in close approximation with the result of Yadav and Jat (2009) [19] who revealed that the weather factor might be responsible for population build up and outbreak of this pest.

Table 1: Mean larval population of gram pod borer, *H. armigera* on chickpea variety KPG 59 during *Rabi* 2017-2018.

SW	Mean larval population	Weather Data (Weekly)				
		Temperature (°C)		Relative Humidity (%)		Rain fall (mm)
		Max.	Min.	7 Hrs	14 Hrs	
7	2.33	24.9	10.5	88.4	63.4	0.0
8	3.33	24.1	10.9	90.4	67.8	0.0
9	2.33	27.7	12.6	91.0	63.4	0.0
10	3.00	28.8	16.1	89.4	63.8	0.0
11	3.33	30.5	14.8	79.7	54.5	0.0
12	4.00	31.4	16.6	83.5	58.4	0.0
13	5.33	33.7	14.4	77.0	48.4	0.0
14	4.00	34.2	18.0	74.8	55.8	0.0
15	4.00	31.8	19.2	77.5	60.4	0.0
16	1.00	30.8	20.8	83.0	61.0	15.4

Table 2: Correlation matrix between weather parameter and larval population of *H. armigera* infesting chickpea.

Dependent Parameter	No. of observations	Weather parameters				
		Temperature (ºC)		Relative humidity (%)		Rainfall (mm)
		Max.	Min.	7.00 hr	14.00 hr	
Larval population	10	0.495	-0.055	-0.553	-0.620	-0.666*

*Correlation is significant at the 0.05 level (2 tailed).

Table 3: Regression equation between larval population of *H. armigera* on chickpea and weather parameters.

Dependent Variable	Regression equation	R^2
Larval population	$Y=6.345+0.127\ X_1-0.024\ X_2-0.149\ X_3-0.051\ X_4-0.059\ X_5$	0.807

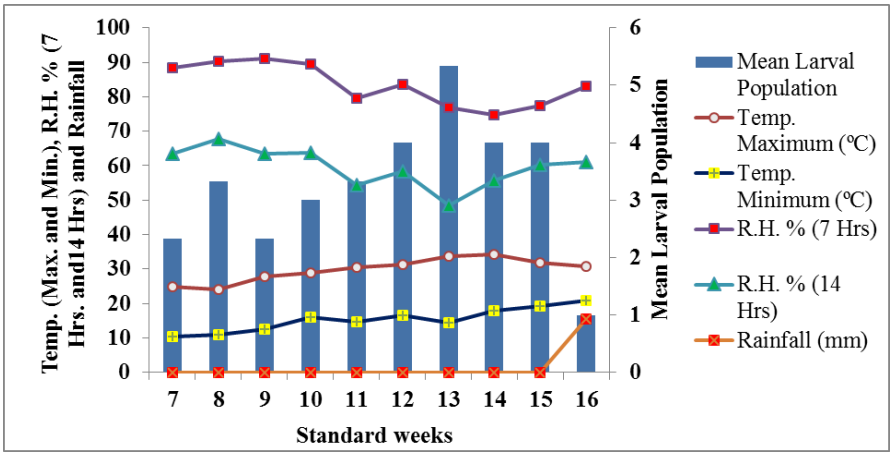

Fig 1: Mean larval population of gram pod borer, *Helicoverpa armigera* with weather parameters

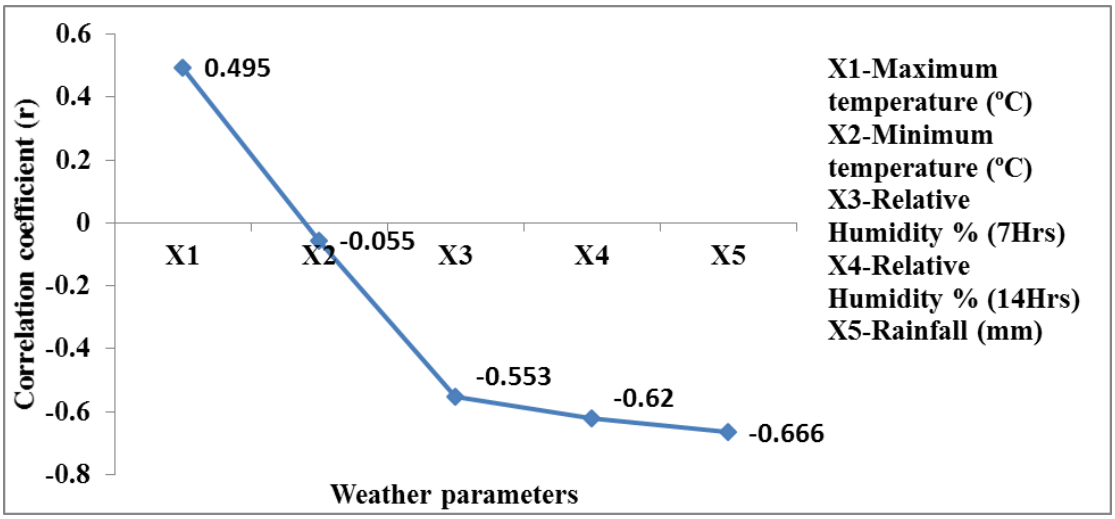

Fig 2: Correlation coefficient and regression equation between weather parameters (X) and larval population (Y_1)

Conclusion

The larval population was initially recorded on 7th standard week (third week of February) (2.33 larva/plant) with a peak on 13th standard week (2nd week of April) (5.33 larva/plant). Mean larval population of *Helicoverpa armigera* was found positively correlated with maximum temperature (0.495), whereas minimum temperature and relative humidity (7 Hrs and 14 Hrs) shows negative and non-significant correlation (-0.055), (-0.553), respectively. However, all the weather parameters together contributed 80.7 percent towards *Helicoverpa armigera* larval population.

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