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Study the impact of seasonal incidence of *Helicoverpa armigera* on chickpea

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Abstract
To study the impact of seasonal incidence of *Helicoverpa armigera* on chickpea, a study was carried out in the agriculture research farm of Career Point University, Kota during rabi season 2019-20. The whole experiment was laid out in four plots, measuring 3.0m x 3.0m with row to row and plant to plant spacing of 30 cm and 10 cm. Randomized block design with 3 replications with variety GNG-1958 was used. Pest population of (*Helicoverpa armigera*) was recorded at each meteorological weak, from germination to harvest of crop, and observation was taken weekly on ten plants randomly by counting the number of larvae on each plot plants in early morning hours without any insecticidal treatment. It was concluded that the first appearance of gram pod borer (*Helicoverpa armigera*) was noticed in the second week of January. The crop received a peak population of pod borers during the third week of February. The positive association with the population of gram pod borer was determined with minimum temperature and bright sunshine while maximum temperature and morning relative humidity negatively showed non-significant correlation respectively. Though the influence of evening relative humidity was also non-significant on the H. armigera population, it was positive. Further, rainfall showed a non-significant and negative correlation with the pest activity.

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

Introduction
Chickpea (*Cicer arietinum* L.), also known as Bengal gram, gram, or *chana* is an important *rabi* pulse crop of India and has been considered as 'King of Pulses' (Bhatt and Patel, 2001); consumed as a major nutrient supplement of protein. Globally chickpea is grown in over 45 countries and India produces around 10 to 11 million tonnes and contributes around 70 percent of the total world production. In India, about 10.56 Mha area coverage was reported under Bengal gram during rabi 2018-19. The current productivity level in India is 1063 kg/ha (Anonymous, 2019). In Rajasthan chickpea is cultivated in an area of 24.63 lakh hectares with a production of 26.60 lakh tons and productivity of 1080 kg/ha (Anonymous, 2019-20). Chickpea productivity has not witnessed any significant jump as compared to cereals because of several biotic and abiotic constraints. Chickpea faces the attack of more than 60 insect pests right from germination to maturity and also in storage (Shrivastava, 2003) [8]. In chickpea on average, about 30-40% of pods were found to be damaged by the pod borer resulting in the yield loss of 400 Kg/ha (Rahman, 1990) [5] under favourable weather conditions the damage to pods could increase upto 90-95%. *Helicoverpa armigera* (Hubner) generally known as legume pod borer, is one of the most important constraint to crop production globally. It si polyphagous and attacks more than 182 plant species. Among the various pulses, chickpea is one of the important leguminous crop. In India, pulses are grown in an area of 23.47 mha with total production of 18.45 with productivity of 786 kg/ha.

Materials and Methods
To study the impact seasonal incidence of *Helicoverpa armigera* on chickpea, a study was carried out in the agriculture research farm of Career Point University, Kota during rabi season 2019-20 The seeds of variety GNG-1958 were sown in last week of October during both the years. The whole experiment was laid out in four plots each measuring 3.0m x 3.0m with row to row and plant to plant spacing of 30 cm and 10 cm. During the entire period of the experiment, the crop was left for natural infestation and all recommended agronomical practices were followed as per the package of practices except insecticidal sprays. In each plot, ten plants were selected randomly and tagged and the larval population of pod borer was

recorded throughout the experimental period. The larvae of pod borer were recorded by visual count during morning hours at weekly intervals right from germination to harvesting of the crop. The record of the pest was maintained with a view to find out first appearance of pod borer and its peak incidence in chickpea crop.

The meteorological data on temperature, relative humidity, and rainfall were recorded at weekly intervals. To interpret the results of the seasonal incidence of pod borer, *H. armigera* in chickpea, the simple correlation was computed between pest population and abiotic factors, *i.e.,* minimum and maximum temperature, morning and evening relative humidity, and rainfall using the following formula.

$$r_{xy} = \frac{\sum xy - \frac{\sum x \sum y}{n}}{\sqrt{\left[\sum (x)^2 - \frac{(\sum x)^2}{n}\right]\left[\sum (y)^2 - \frac{(\sum y)^2}{n}\right]}}$$

Where,

r_{xy}= Simple correlation coefficient.

x = Variable i.e., abiotic component.

y = Variable i.e., Mean number of pod borer.

n = Number of observations.

Results and Discussion

The first appearance of the population was recorded to be 3.80 larvae/ten plants. An increasing trend was observed in the population buildup of *H. armigera* larvae and at peak, the maximum number of larvae (19.20/ten plants) was observed during the third week of February (8th Standard Meteorological Week). Thereafter, the population started declining and at the time of harvest, 4.20 larvae/ten plants were recorded on chickpea crop (10th Standard Meteorological Week). The data on the correlation coefficient between *H. armigera* larvae and abiotic factors for 2020 presented in Table 1 clearly indicated that minimum temperature (r= 0.599) and bright sunshine hours (r= 0.644) showed a significant positive association with the *H. armigera* larval population build-up. While, maximum temperature showed non-significant correlation (r= 0.422). The influence of morning relative humidity (r= -0.223) was also found non-significant on the larval population but it was negative in manner. Though, the influence of evening relative humidity (r= 0.078) was also non-significant on *H. armigera* population but it was positive. Further, rainfall showed non-significant and negative correlation with the pest activity (r= -0.309). The present findings is in full agreement with Tripathy *et al.* (1998), have also reported that the pest appear in December. The peak period of larval population recorded in the 12th standard week (3rd week of March). Ravi and Verma (1997) have also reported that seasonal incidence of *H. armigera* in chickpea by first week of January which reached its peak in middle of March. Singh *et al.* (2008) [10] reported that the appearance of H. armigera larvae observed from last week of December to first week of January. Reddy *et al.* (2009) [7] found that the incidence of gram pod borer *Helicoverpa armigera* in chickpea commenced from second week of February i.e. in the early part of 1st fortnight of February with 0. 05 mean larval population/plant. The larval population started increasing and reached its maximum of 12.97 mean larval population/plant during 4th week of March. Likewise, Ramteke *et al.* (2014) [6] from Allahabad where initial larval population of H. armigera was observed during 4th standard week i.e. fourth week of January and the peak population was reported on 10th standard week. Findings of Durga Bahadur *et al.* (2018) corroborate the present findings, who also reported first appearance of *H. armigera* during the 2nd standard week with a population of 1.21 larvae per plant and persisted up to 11th SW with 3.67 larvae per plants. Similarly, during 2017-18, *H. armigera* started appearance during 3rd standard week population is 0.94 larval per plant and persisted up to 12th SW with 1.54 larval per plants. However, some workers have also studied the seasonal incidence of gram pod borer who's finding slightly differ with present finding. Tahhan and Hariri (1982) have reported its peak periods in the month of April.

Table 1: Seasonal incidence of pod borer, *Helicoverpa armigera* (Hubner) in chickpea and their correlation with abiotic factors during 2019-20

Month/Week	SMW	Abiotic Factors						Larval population of *H. armigera*
		Temperature (ºC)		Relative Humidity (%)		Rainfall (mm)	BSS (hrs)	
		Max	Min	Max	Min			
29.10.2019 to 04.11.2019	44	32.36	18.86	73.86	84.29	0.00	8.24	0.00
05.11.2019 to 11.11.2019	45	31.57	17.29	84.57	88.86	0.00	7.91	0.00
12.11.2019 to 18.11.2019	46	31.36	17.43	86.29	89.57	0.00	7.23	0.00
19.11.2019 to 25.11.2019	47	30.14	16.50	84.43	84.43	0.00	7.76	0.00
26.11.2019 to 02.12.2019	48	30.00	17.36	91.43	81.71	0.00	4.86	0.00
03.12.2019 to 09.12.2019	49	26.79	14.71	85.43	79.43	0.00	5.36	0.00
10.12.2019 to 16.12.2019	50	26.36	14.29	83.14	70.14	0.00	6.43	0.00
17.12.2019 to 23.12.2019	51	24.14	9.79	83.71	67.71	0.00	7.46	0.00
24.12.2019 to 31.12.2019	52	21.63	6.94	84.13	73.75	0.00	7.14	0.00
01.01.2020 to 07.01.2020	01	22.71	6.71	86.29	77.14	0.00	5.46	0.00
08.01.2020 to 14.01.2020	02	24.21	8.50	84.71	69.29	0.00	6.44	3.80
15.01.2020 to 21.01.2020	03	21.29	7.93	85.00	71.14	3.90	2.90	5.20
22.01.2020 to 28.01.2020	04	22.86	9.21	84.29	73.00	0.00	8.26	7.60
29.01.2020 to 04.02.2020	05	23.64	9.57	84.86	73.71	0.00	8.37	11.30
05.02.2020 to 11.02.2020	06	24.07	9.86	85.71	58.43	0.00	8.49	13.00
12.02.2020 to 18.02.2020	07	25.71	12.43	82.71	71.86	0.00	9.31	16.50
19.02.2020 to 25.02.2020	08	26.93	15.14	87.14	73.71	0.00	9.30	19.80
26.02.2020 to 04.03.2020	09	27.88	15.75	83.88	77.63	0.00	7.99	12.70
05.03.2020 to 11.03.2020	10	28.40	15.00	87.86	58.29	1.00	8.07	4.20

Temperature (^{0}C) Maximum	0.422
Temperature (^{0}C) Minimum	0.599*
Relative Humidity (%) Morning	-0.223
Relative Humidity (%) Evening	0.078
Rainfall (mm)	-0.309
Bright sunshine hours	0.644*

*Significant at 5.0% level

Conclusion

Results showed that the infestation of *H. armigera* in chickpea crop was started from second week of January (2nd Standard Meteorological Week) on during 2019-20 (3.80 larvae/ ten plants). The pest attained peak activity in third week of February (8th Standard Meteorological Week) (19.20 larvae/ ten plants). Thereafter, the population started declining and at the time of harvest, 4.20 larvae/ten plants were recorded on chickpea crop (10th Standard Meteorological Week). The data on correlation coefficient between *H. armigera* larvae and abiotic factors indicated that minimum temperature (r= 0.599) and bright sunshine hours (r= 0.644) showed significant positive association with the *H. armigera* larval population build up during the season. Rest of the abiotic factors under study showed non-significant influence of the larval population of *H. armigera.*

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