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Studies on Seasonal Incidence of Gram Pod Borer, *Helicoverpa armigera* (Hubner) on Chickpea Crop

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Authors' contributions

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

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ABSTRACT

The present investigations entitled "Studies on seasonal incidence of gram pod borer, Helicoverpa armigera (Hubner) on chickpea crop" were carried out at the Student's Instructional Farm, Nawabganj of C. S. Azad University of Agriculture and Technology, Kanpur during *Rabi* season 2021-22 and 2022-23. The highest mean larval populations 4.53 larvae per plant in 2021-22 were observed during 6th std. week and in 2022-23 it was 4.10 larvae per plant were observed during 7th std. week. However, lowest mean larval population 0.10 larvae per plant in 2021-22 was observed during 46th std. week and in 2022-23 it was 0.07 per plant during 47th std. week. The correlation co-

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efficient with the population of *H. armigera* was positively correlated with minimum (0.733 during 2021-22 and 0.893 during 2022-23) and negatively correlated with maximum (-0.779 during 2021-22 and -0.330 during 2022-23) temperatures, respectively. However, it was negatively correlated (-0.812) in 2021-22 and (-0.609) in 2022-23 with relative humidity. While, rainfall had a positively correlated (0.569) in 2021-22 and (0.003) in 2022-23.

Keywords: Chickpea; seasonal incidence; Helicoverpa armigera; abiotic factors.

1. INTRODUCTION

The chickpea (*Cicer arietinum* L.), sometimes called gram or Bengal gram, is a significant pulse crop grown all over the world. It's pertaining to the subfamily Papilionaceae and family Leguminosae. Considering that the majority of Indians are vegetarians, this self-pollinated crop is a vital part of their diet and is rich in carbohydrates, proteins, and lipids [1,2]. As a significant source of protein, it is crucial to the vegetarian diet. It is eaten as a green vegetable, in dal, chhole, as a germinated breakfast snack, as a powder to make sweets, and in a variety of other mouthwatering cuisines.

Chickpeas are sometimes referred to as "poor man's meat" since they are an essential part of vegetarians' protein-rich diets. It is also rich in minerals, fibre, and unsaturated fatty acids in its lipid component [3]. To benefit from the malic acid, citric acid, mineral content, and fibre in the leaves all of which have therapeutic value**-**they are eaten both raw and cooked. Its grain is a good supply of vitamins, minerals (calcium, phosphorus, iron), fat (4–10%), protein (18–22%), and carbs (52–70%). The crop is commonly farmed in Bangladesh, Australia, India, Turkey, Pakistan, Iran, Mexico, and Turkey [4,5].

The total area cultivated under legumes in the world (registered in 2021) was 95.76 million hectares, of which 17.19 million tons were chickpea. Thus, of the total production of legumes, chickpea represented 18.63%. Of the total production of pulses worldwide, India contributes from 27.53% to 59.67% [6,7,8]. India is the largest chickpea-producing country in the world (followed by Australia and Turkey), with a share of about 66.19%, and contributes 86.03% of the total chickpea production in Asia. Other main chickpea-producing countries are the United States, Canada, Mexico, Iran, Ethiopia, Pakistan, Turkey, Australia and Myanmar [9,10].

In India, is compiled production has increased from 97.67 lakh tonnes in 2020-21 to 103.46 lakh tonnes in 2022-23.The area planted with chickpeas (9.99 million ha) increased significantly in 2020–21, reaching its greatest level in the previous ten years. Similarly, with a productivity of 11.92 q/ha, chickpea production (11.91 million tonnes) outperformed the previous 50-year record. From 6.45 million ha to 9.99 million ha were planted with chickpeas in 2020-21. Pulses are cultivated across the country with the maximum share coming from M.P. (24%), U.P. (16%), MH (14%), A.P. (10%), Karnataka (7%), and Rajasthan (6%). These states are contributing near about 77% of the total pulses production, while remaining 23% is contributed by Gujarat, Chhattisgarh, Bihar, Orissa and other state.

Helicoverpa armigera (Hubner), an important insect species which severely harms this crop's economy (Lepidoptera: Noctuidae), is known as the pod borer. It is a highly polyphagous pest that targets over 182 plant species, including cotton, maize, tobacco, pigeonpea, chickpea, and tomato crops that are both widely farmed and commercially significant [11]. According to reports, the chickpea yield loss caused by the pod borer ranged from 10 to 60% under average weather circumstances to 50 to 100% under favourable weather conditions, especially in places where frequent rain and overcast weather are the norms during the crop season. In normal weather, the reduction in yield in chickpeas caused by the pod borer was reported to be between 30 and 80 percent. Before maturing, a single *Helicoverpa armigera* caterpillar may consume 30–40 pods [12,13,14].

2. MATERIALS AND METHODS

The experiments was laid out the studies on seasonal incidence of gram pod borer were carried out during 2021-22 and 2022-23 at Student's Instructional Farm, Nawabganj of C. S. Azad University of Agriculture & Technology, Kanpur. To determine the population fluctuations pod borer, *Helicoverpa armigera* in chickpea, the larval population was recorded on randomly selected 10 plants of chickpea (RVG-203) at

three random places at weekly intervals in each plot. The larval population was recorded at weekly intervals, starting a fortnight after germination and continued till crop maturity before the harvest of crop in both the years. These larval populations were correlated with abiotic factors. Larvae, for every observation were shaken down on a big paper sheet from the selected plants.

3. RESULTS AND DISCUSSION

The data on larval population of *H. armigera* during *Rabi* 2021-22 and 2022-23 have been presented in Tables 1&2 and Figs. 1&2, respectively. It is evident from the Tables 1&2, that the larval activity continued throughout the crop season. The highest mean larval populations 4.53 larvae per plant in 2021-22 were observed during 6th std. week and in 2022-23 it was 4.10 larvae per plant were observed during 7th std. week. However, lowest mean larval population 0.10 larvae per plant in 2021-22 was observed during 46th std. week and in 2022-23 it was 0.07 per plant during 47th std. week.

Two peaks in larval population of *H. armigera* were recorded during entire crop season, first started from 16th November to 28th December (46th to 52nd standard weeks) and second from 25th January to 5th April (4th to 14th std. week) in year 2021-22 and during 2022-23 first from 21st November to 2nd January (47th to 01st std. week) and second from 6th February to 8th April (6th to 14th std. week). Abiotic parameters played a key role in build-up of larval population. Similarly, Singh and Ali [15] Singh et al. [16] Yadav et al. [17] have also recorded two peaks in the larval population of *H. armigera* throughout the crop season, first from 46th to 49th and second from 5th to 13th standard weeks. Shinde et al. [18] Pal et al. [14] Meena et al. [19] recorded relative abundance of *H. armigera* in chickpea peaked twice: the first was during the 47th to 50th standard weeks and the second from the 10th to the 14th standard weeks in both years.

The larval population showed a positive correlation of 0.733 and 0.893 for minimum and negative correlation -0.779 and -0.330 for maximum temperatures during 2021-22 and 2022-23, respectively, however showed negative correlation of -0.812 and -0.609 for relative humidity and positive correlation 0.569 and 0.003 for rain fall during 2021-22 and 2022-23, respectively similarly Spoorthi et al. [2], Dharavath et al. [20], Meena et al. [19] have found same correlation result in their research experiment (Table 3).

Table 1. Seasonal incidence of *H. armigera* (Hub.) in chickpea during *Rabi* 2021-22

Standard Week	Larval population/plant	Abiotic factors			
		Temperature (^{0}C)		R.H. (%)	Rainfall (mm)
	Mean	Min.	Max.		
46th	0.10	14.8	27.8	61	0.0
47th	0.23	11.6	26.4	53	0.0
48th	1.27	15.6	26.8	60	0.0
49th	1.33	10.6	24.2	39	0.0
50th	1.47	13.0	22.0	68	0.0
51st	1.73	4.00	22.2	53	0.0
52nd	2.00	13.6	18.0	80	8.6
1st	2.27	13.4	19.0	86	21.0
2nd	2.53	4.40	18.4	67	0.0
3rd	3.67	4.00	20.6	51	0.0
4th	3.93	7.20	20.0	40	0.0
5th	4.40	4.60	23.8	36	0.0
6th	4.53	6.60	24.5	55	0.0
7th	2.13	9.40	25.8	38	0.0
8th	1.87	12.6	25.8	45	0.0
9th	1.67	12.4	29.0	54	0.0
10th	1.20	16.6	33.6	37	0.0
11th	0.87	18.2	37.5	21	0.0
12th	0.53	15.6	38.4	19	0.0
13th	0.00	17.6	40.6	15	0.0
14th	0.00	20.4	40.4	18	0.0
Average	**1.80**	**11.72**	**26.9**	**47.42**	**1.40**

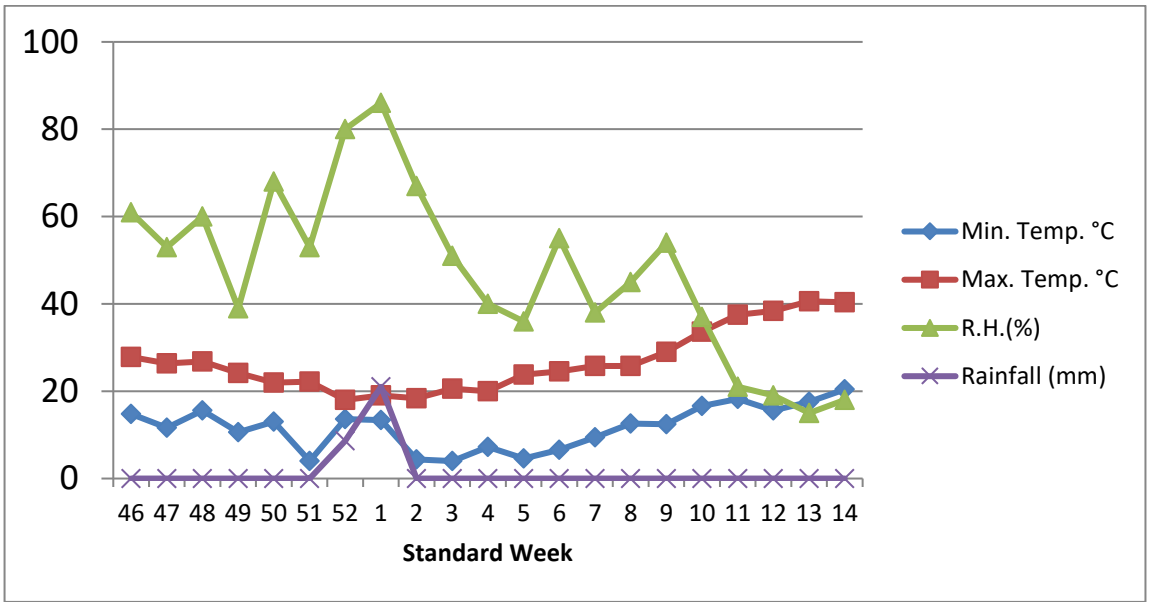

Fig. 1. Seasonal Incidence of *Helicoverpa armigera* (Hub.) in Chickpea

Table 2. Seasonal incidence of *H. armigera* (Hub.) in chickpea during *Rabi* 2022-23

Standard week	Larval population/plant	Abiotic factors			
		Temperature (^{0}C)		R.H. (%)	Rainfall (mm)
	Mean	Min.	Max.		
47th	0.07	9.9	27.0	62.0	0.0
48th	0.13	10.3	26.8	68.5	0.0
49th	0.73	9.7	24.7	69.0	0.0
50th	1.00	8.81	25.3	64.5	0.0
51th	1.53	7.5	23.3	75.0	0.0
52th	1.67	7.5	20.9	74.5	0.0
1st	2.10	5.4	13.9	82.0	0.0
2nd	2.33	6.3	17.8	81.5	0.0
3rd	2.63	4.4	20.4	69.5	0.0
4th	3.00	10.8	22.3	81.5	18.2
5th	3.30	9.7	22.7	75.0	1.0
6th	3.87	10.9	28.1	70.5	0.0
7th	4.10	11.1	26.7	66.5	0.0
8th	2.67	11.8	31.0	69.5	0.0
9th	2.30	14.4	31.2	72.5	0.0
10th	1.50	15.11	30.42	70.5	0.0
11th	1.33	15.8	30.3	75.0	6.4
12th	0.60	15.7	29.1	80.0	11.6
13th	0.33	16.7	32.2	62.5	39.2
14th	0.00	16.8	33.7	46.5	0.0
Average	**1.76**	**10.93**	**25.9**	**70.82**	**3.82**

Table 3. Correlation co-efficient of mean larval population with Abiotic factors

Abiotic factors Mean Larval population	Temperature ^{0}C		Relative humidity (%)	Rain fall (mm)
	Min.	Max.		
2021-22	0.733**	-0.779**	-0.812**	0.569**
2022-23	0.893**	-0.330**	-0.609**	0.003

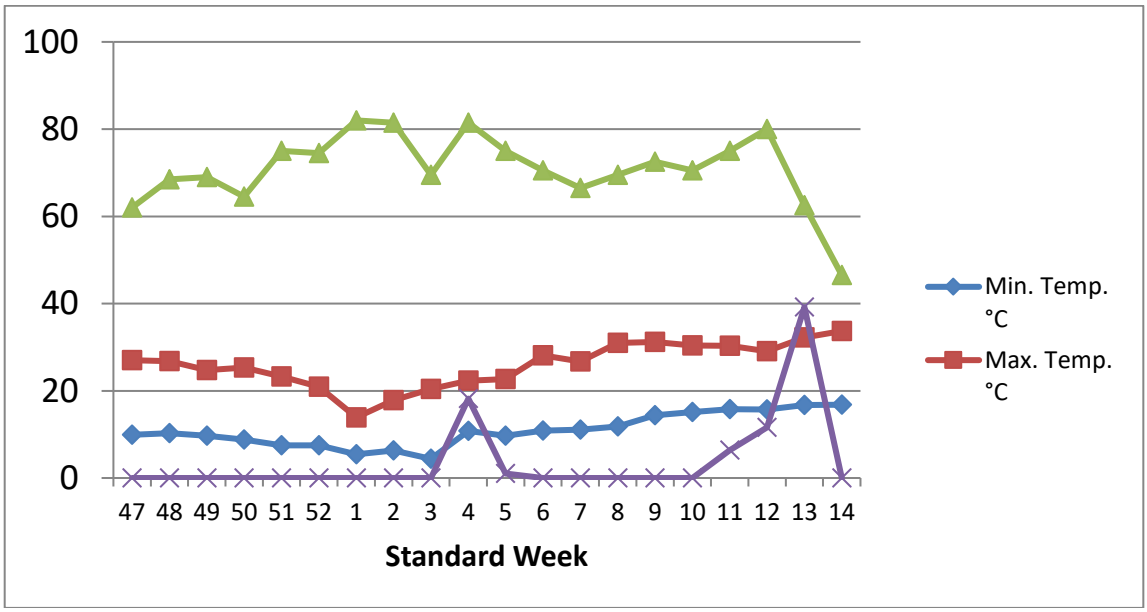

Fig. 2. Seasonal Incidence of *Helicoverpa armigera* (Hub.) in Chickpea during 2022-23

4. CONCLUSION

The occurrence of gram pod borer, was started from 3rd week of November (46th SW) with 0.10 larvae/plant and continued to harvesting stage of crop 3rd week of March (12th SW) in first year and second year it was started from 3th week of November (47th SW) with 0.07 larvae/plant and continued to harvesting stage of crop 4th week of March (13th SW). It was most serious in the first week of February (6th SW) when pod borer intensity 4.53 larvae/plant during first year and during second year, It was peak in the second week of February (7th SW) when pod borer intensity 4.10 larvae/plant. It was positively correlated minimum and negatively correlated maximum temperatures, while relative humidity negatively correlated and rainfall positively correlated with population built-up during both the years.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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