POPULATION DYNAMICS OF *HELICOVERPA ARMIGERA*IN CHICKPEA,(*Cicer arietinum* L.)

ABSTRACT

The present studies on population dynamics of gram pod borer insect pest were carried out at Students' Instructional Farm (SIF) of Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya (UP), India during *Rabi* 2022-23 and 2023-24. The present study revealed that gram pod borer, *Helicoverpa armigera* was commenced from the first fortnight of November and touched the highest at 8th SMW (2.98 pod borer larvae per plant) and 7th SMW (3.54 pod borer larvae per plant) in both the year, respectively. The population of *H. armigera* had a non-significant positive correlation with rainfall (r= 0.101) in *Rabi* 2022-23. The population of *H. armigera* had a significant positive correlation with wind speed (r= 0.495*) in *Rabi* 2023-24.

***Keyword*:** population dynamics, *Rabi* chickpea, gram pod borer

Introduction - Chickpea (*Cicer arietinum* L.) is a legume crop of the Fabaceae family. It is also known as gram or Bengal gram, and it is commonly known as "King of Pulses". Pulses, the food legumes, have been grown by farmers since millennia providing nutritionally balanced food to the people of India and many other countries in the world. In India, pulses have been described as a "poor man's meat and rich man's vegetable". The importance of vegetables protein has been well recognized during the world (Bahadur *et al.,* 2018). Among them the *Helicoverpa armigera* Hubner (Noctuidae: Lepidoptera) has attained status of the most serious pest in current years in terms of economic damage caused to different agricultural crops throughout India including chickpea (Ojha *et al.,* 2017).

Chickpea (*Cicer arietinum*) is the main significant pulse crop growing in India under irrigated and dryland situation. India positions first in the production chickpea in the world.In India, pulses are grown in an area of 23.47 million ha with overall production of 18.45 with productivity of 786 kg/ha (Galav *et al.,* 2021). It is grown in six major states, Maharashtra, Madhya Pradesh, Rajasthan, Gujarat, Uttar Pradesh, Andhra Pradesh, Karnataka and Chhattisgarh altogether contribute 97.15 per cent of the production and 96.95 per cent of the area (Singh *et al.,* 2023).In U.P. chickpea is grown an area of 0.57 million hectare with production of 0.73 million tonnes and productivity 1272 kg/ha (Raj *et al.,* 2022). A single larva of *Helicoverpa armigera* can damage 25-30 pods of gram in its life time. It feeds on

tender shoots and young pods. It makes holes in pods and insert its semi body inside the pod to eat the developing seeds (Gautam *et al.,* 2018). Chickpea seed contains 18-22 per cent protein, 61-62 percent carbohydrates, 47 per cent starch, 5 per cent fat, 6 per cent crude fibre, 6 per cent soluble sugar and 3 per cent ash. (Sharma *et al.,* 2020). It is a major supplement of protein (19g), calories 364 g), carbohydrate (61g), iron (34%), magnesium (28%) Vitamin B6 (25%), vitamin C (6%) and contain various amino acids and medicinal properties (Alok *et al.,* 2022). Chickpea has great nutritional value and plays vital role in human diet but as per study per capita availability of chickpea declines from 24g/day to 16 g/day due to reduction in productivity of chickpea. The productivity of chickpea reductions due to abiotic factors, weeds and most important insects and pest. Total Eight to Eleven insect pests recorded on chickpea crop like cutworms (*Agrotis ipsilon* Hufnagel), semilooper (*Autographa nigrisigna*) and termite (*Odontotermes obesus*) but most destructive major pest is Gram pod borer (*Helicoverpa armigera* Hubner)(Basugade *et al.,* 2023). Keeping in view, all the facts the current research was conducted on the population dynamics of *H. armigera* insect pest of chickpea and their correlation with abiotic factors *viz*. minimum temperature (°C), maximum temperature (°C), Average Relative Humidity (%), rainfall (mm), sunshine (hrs), and wind speed (km/hr).

MATERIALS AND METHODS

The experiment for current research was conducted under field conditions at Students' Instructional Farm (SIF) of Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya, Uttar Pradesh, India during *Rabi*, 2022-23 and 2023-24 of chickpea variety PUSA- 362. A bulk plot of 100 m^2 was sown with 30 cm row to row and 10 cm plant to plant spacing by following recommended agronomic practices and fertilizer application to study the population build up of gram pod borer insect pest associated with chickpea. The pest' population was recorded in this unprotected plot at 7 days interval from the 20 days after sowing and continued up to maturity. gram pod borer population was recorded on randomly selected 10 plants. The meteorological data of the corresponding weeks was also recorded from Department of Agrometeorology of the University. The insect population was correlated with the meteorological data using a suitable method of analysis.

RESULTS AND DISCUSSION

The observations were made at regular intervals to monitor the appearance of gram pod borer pest in *Rabi* 2022-23 and 2023-24. Data were collected on the severity of the insect pest complex, which includes Gram pod borer (*H. armigera*). These data were evaluated in conjunction with the present environmental situations. The results demonstrated the insect pests were active throughout different phases of crop growing.

Incidence of gram pod borer

The data presented in (Table 1a) revealed that during *Rabi* 2022-23, the gram pod borer population started in 46th Standard Meteorological Week (SMW) (0.18 gram pod borer larvae per plant) and continued up to 10th SMW. With two major peak during 8th SMW (21th to 27th February) (2.98 pod borer larvae per plant) and 7th SMW (14th to 20th February) (2.63 pod borer larvae per plant) the overall population of the gram pod borer ranged from 0.18 to 2.98 pod borer larvae per plant. The Maximum population of 2.98 pod borer larvae per plant were recorded throughout the 8th SMW when the minimum and maximum temperature was 11.3°C and 29.6°C, whereas, the relative humidity, rainfall, sunshine and wind speed were 75.5 per cent, 0.00 mm, 7.7 hrs and 2.0 km per hrs, respectively. the minimum population of gram pod borer (0.18 pod borer larvae per plant) was noted in 46th SMW (Fig. 1). Correlation studies revealed that the population of gram pod borer showed a non-significant positive correlation (r= 0.101) with rainfall. Further, the gram pod borer population showed a non-significant negative correlation with minimum and maximum temperature and sunshine hours (r= -0.464, -0.340 and -0.127 respectively) while they showed a significant and non-significant positive correlation with relative humidity and wind speed (r= 0.522* and 0.357) Table 1b).

During *Rabi* 2023-24, the occurrence of gram pod borer was recorded first time during 45th SMW (0.32 pod borer larvae per plant) and continued up to 10th SMW. gram pod borer larvae population ranged from 0.32 to 3.54 individuals per plant. Maximum count of gram pod borer was recorded in 7th SMW (14th to 20th February) (3.54 pod borer larvae/plant) at the minimum and maximum temperature of 10.8°C and 24.7°C, respectively with two major heights at 6th SMW (3.24 pod borer larvae/plant) and 5th SMW (2.92 pod borer larvae/plant) (Table 2a & Fig. 2). correlation studies revealed that none of the weather parameters showed any significant correlation with the gram pod borer population. Further, the gram pod borer population showed a non-significant negative and positive correlation with maximum temperature (r= -0.453) and relative humidity (r= 0.291), respectively while they showed a non-significant and significant positive correlation with rainfall, sunshine hours and wind speed (r= 0.196, 0.094 and 0.495*, respectively) (Table 2b).

These findings are in partially agreement with the findings of Sharma *et al.,* (2020) who reported the first appearance of gram pod borer population 0.39/plant in the 45th SMW. The population followed gradually increased and attain a peak population of 3.16/plant during 9th SMW at10.0^{0}C to 22.9^{0}C temperature and R.H 72.7 %. Similar finding were also reported by Mishra *et al.,* (2021) who found that appearance of larvae gram pod borer on chickpea was first time during 48th SMW. The gram pod borer population was ranged from 0.10 - 3.60 larvae/plant throughout the cropping period. Similar finding were also reported by Kumar and Mishra (2022) who found that appearance of larvae gram pod borer on chickpea was first time during 45th SMW. The gram pod borer population was ranged from 0.06 - 1.73 larvae/plant during the cropping season. Present finding are also supported by Kumar and Singh (2015) who found that relative humidity was to be the major factor affecting the population of gram pod borer larvae as non-significant and nagetive correlation was reported between the two (r= -0.569). Present finding are also supported by Akok *et al.,* (2022) who found that wind speed was to be the major factor affecting the population of gram pod borer larvae as non-significant and positive correlation was reported between the two (r= 0.115).

Table 1a: Population dynamics of *Helicoverpa armigera* on chickpea in weather parameters during *Rabi* 2022-23

SMW	Date	Mean no. of pod borer larvae/Plant	Temperature (˚C)		Average RH (%)	Rainfall (mm)	Sunshine (hrs.)	Wind Speed (km/hr.)
			Min.	Max.				
45	05 - 11 Nov.	0.00	16.3	29.5	74.3	0.0	4.7	1.2
46	12 - 18 Nov.	0.18	11.3	28.1	71.6	0.0	7.1	2.8
47	19 - 25 Nov.	0.31	9.7	26.7	66.7	0.0	8.0	1.8
48	26 Nov. - 02 Dec.	0.73	12.4	29.2	65.6	0.0	6.1	1.0
49	03 - 09 Dec.	1.31	8.2	25.4	71.2	0.0	6.4	1.6
50	10 - 16 Dec.	1.09	8.3	25.8	66.0	0.0	8.0	3.2
51	17 - 23 Dec.	1.47	7.0	23.5	69.7	0.0	5.2	2.2
52	24 - 31 Dec.	1.72	7.1	19.2	74.3	0.0	3.8	2.3
1	01 - 07 Jan.	1.95	6.2	13.7	84.2	0.0	0.7	3.5
2	08 - 14 Jan.	2.31	6.2	14.0	78.6	0.0	1.5	2.3
3	15 - 21 Jan.	2.17	5.0	19.9	76.5	0.0	5.3	3.0
4	22 - 28 Jan.	1.87	11.3	23.1	75.4	0.4	4.0	3.3
5	28 Jan. - 04 Feb.	1.55	7.4	22.5	75.5	0.0	6.3	4.2
6	05 - 11 Feb.	2.15	9.2	26.9	73.5	0.0	8.5	2.8
7	12 - 18 Feb.	2.63	8.4	26.1	73.4	0.0	7.5	3.2
8	19 - 25 Feb.	2.98	11.3	29.6	75.5	0.0	7.7	2.0
9	26 Feb. - 04 Mar.	1.96	12.6	31.5	72	0.0	8.5	2.7
10	05 - 11 Mar.	1.17	14.7	30.8	72.3	0.0	8.0	3.5

SMW=Standard Meteorological Week

Table 1b: Relationship between *Helicoverpa armigera*of chickpea with weather parameter during *Rabi* 2022-23

Insect pests	weather parameters					
	Temperature (˚C)		Relative Humidity (%)	Rainfall (mm)	Sunshine (hrs.)	Wind Speed (km/hr.)
	Min.	Mix.				
Pod borer larvae/Plant	-0.464	-0.340	0.522*	0.101	-0.127	0.357

NS-Non significant *Significant at 5%

Table 2a: Population dynamics of *Helicoverpa armigera*on chickpea in weather parameters during *Rabi* 2023-24

SMW	Date	Mean no. of pod borer larvae/Plant	Temperature (˚C)		Average RH (%)	Rainfall (mm)	Sunshine (hrs.)	Wind Speed (km/hr.)
			Min.	Max.				
45	05 - 11 Nov.	0.32	15.5	29.6	71.8	0.0	5.6	1.4
46	12 - 18 Nov.	0.82	14.1	28.7	70.4	0.0	6.5	1.0
47	19 - 25 Nov.	1.13	12.6	27.1	70.5	0.0	6.5	1.5
48	26 Nov. - 02 Dec.	0.73	12.6	26.3	71.8	2.4	3.8	1.1
49	03 - 09 Dec.	0.62	14.2	25.9	71.8	2.0	3.6	1.9
50	10 - 16 Dec.	1.37	7.0	23.9	69.7	0.0	7.9	2.8
51	17 - 23 Dec.	1.82	6.0	23.2	71.3	0.0	7.0	1.8
52	24 - 31 Dec.	1.86	9.6	20.7	75.8	0.0	3.9	1.8
1	01 - 07 Jan.	2.09	9.7	18.2	79.5	5.0	1.9	1.6
2	08 - 14 Jan.	2.12	7.5	16.7	77.1	0.0	3.7	2.8
3	15 - 21 Jan.	2.05	6.5	13.2	79.3	0.0	0.8	2.3
4	22 - 28 Jan.	2.37	5.3	15.2	74.5	0.0	3.7	2.1
5	28 Jan. - 04 Feb.	2.92	8.0	22.0	73.9	0.0	5.8	3.0
6	05 - 11 Feb.	3.24	7.4	20.5	74.0	0.0	5.4	3.9
7	12 - 18 Feb.	3.54	10.8	24.7	72.9	2.4	7.1	1.8
8	19 - 25 Feb.	2.88	10.7	26.2	70.0	3.8	7.8	2.7
9	26 Feb. - 04 Mar.	2.28	11.7	25.7	70.0	7.8	7.8	3.0
10	05 - 11 Mar.	1.48	9.6	30.3	69.5	0.0	8.1	4.1

SMW= Standard Meteorological Week

Table 2b: Relationship between *Helicoverpa armigera*of chickpea with weather parameter during *Rabi* 2023-24

Insect pests	weather parameters					
	Temperature (˚C)		Relative Humidity (%)	Rainfall (mm)	Sunshine (hrs.)	Wind Speed (km/hr.)
	Min.	Mix.				
Pod borer larvae/Plant	-0.574*	-0.453	0.291	0.196	0.094	0.495*

NS-Non significant *Significant at 5%

Figure 1: Population dynamics of *Helicoverpa armigera*on chickpea in relation to weather parameters during *Rabi,* 2022-23

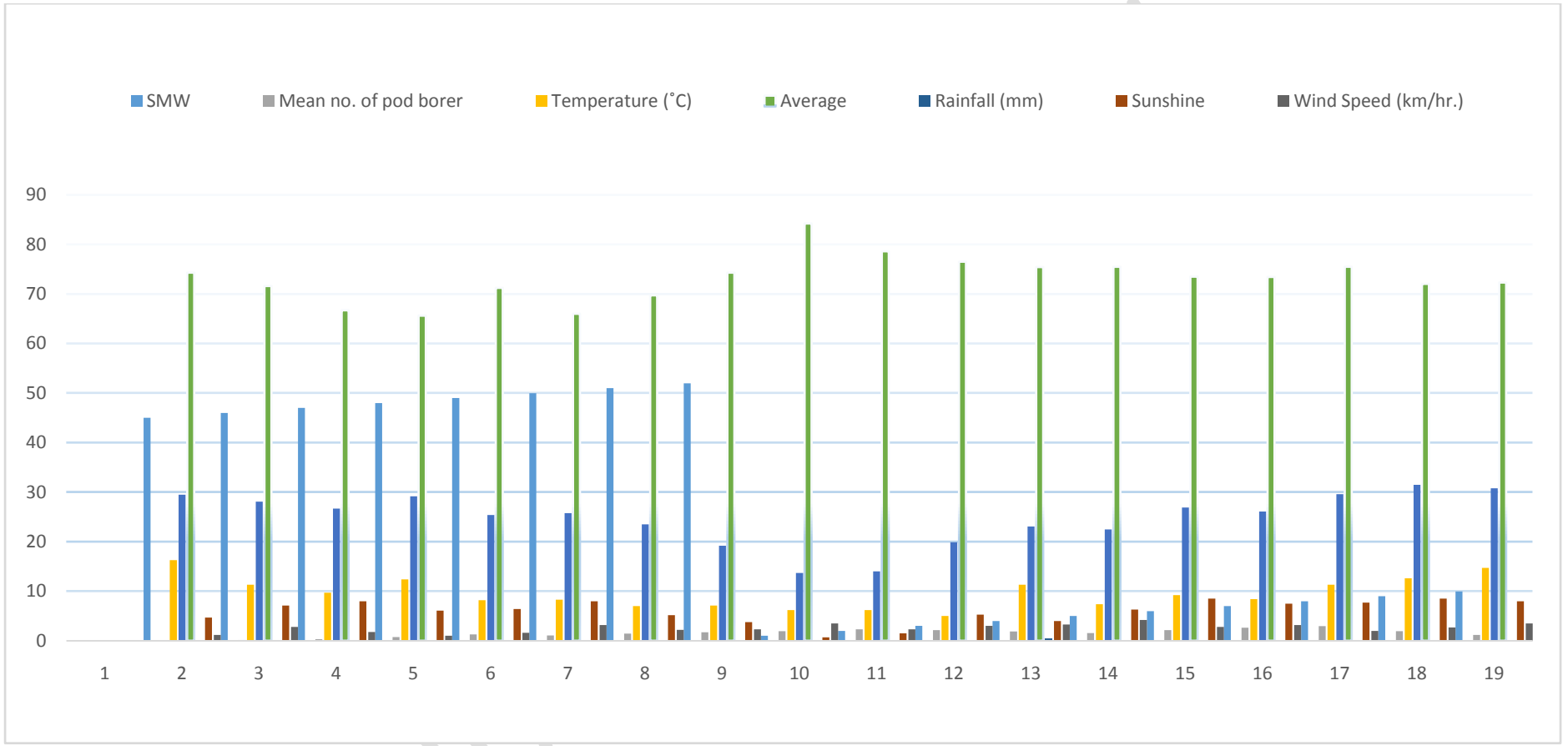
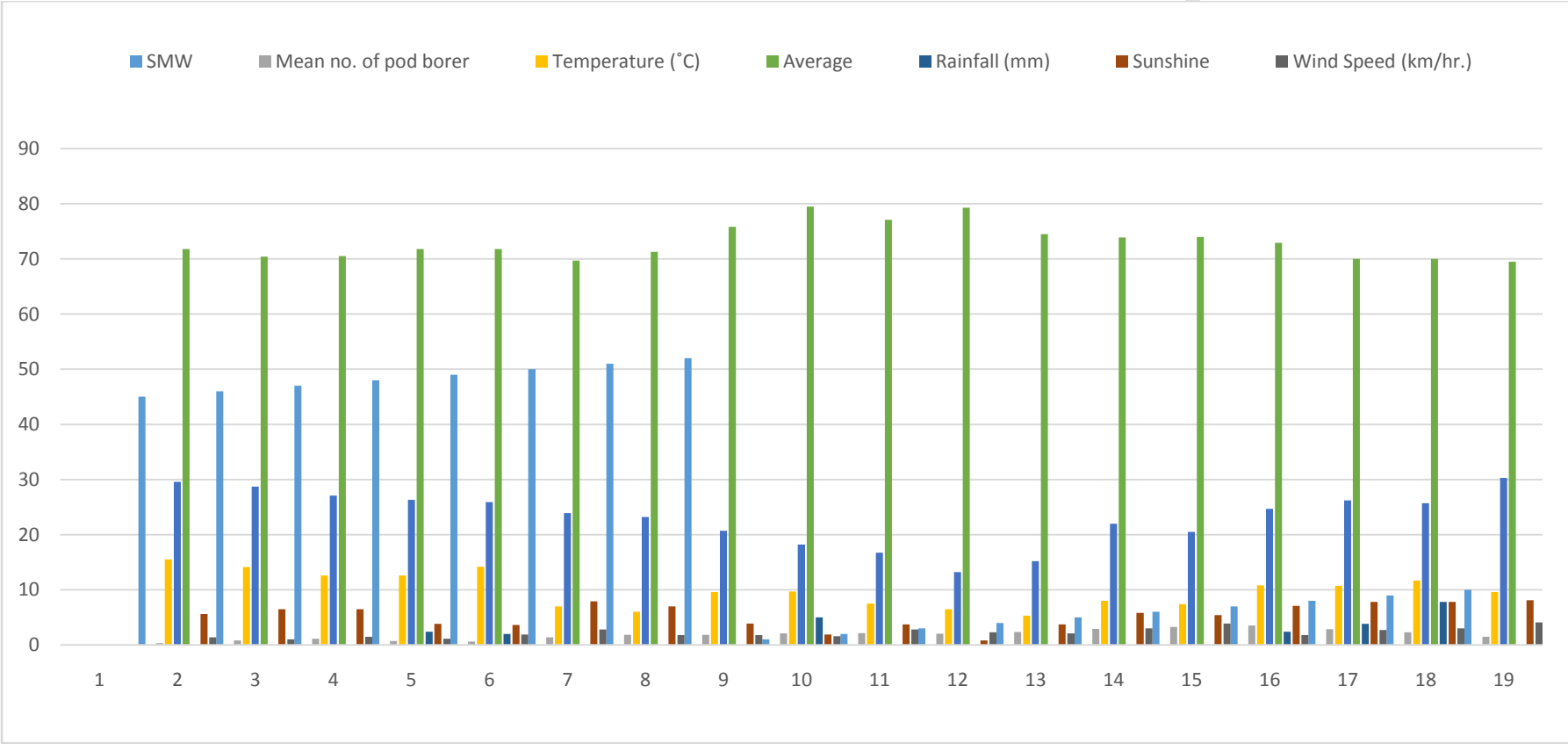


Figure 2: Population dynamics of *Helicoverpa armigera*on chickpea in relation to weather parameters during *Rabi,* 2023-24



Conclusion

During the both year of calculatedperiod, one insect species were experimental infesting chickpea crop at various phases of crop growing. Pod feeders such as gram pod borer (*Helicoverpa armigera,* Hubner) was found throughout the *Rabi* 2022-23 and 2023-24. The present study revealed that gram pod borer was commenced from the first fortnight of November during the vegetative stage and persisted until crop maturity, *i.e.,* the 10^{th} SMW. The *H. armigera* population gradually rose and touched the highest at 8^{th} (2.98 pod borer larvae per plant) and 7^{th} (3.54 pod borer larvae per plant) in both the year, respectively. The population of *H. armigera* had a non-signififant positive correlation with rainfall (r= 0.101) in *Rabi* 2022-23. However, other weather parameters had a non-significant positive or negative effect on pod borer population in both years. With the purpose of creating effective pest management strategies against insect pests of the chickpea crop for increased production efficiency, profit, and enviromental safety, the information generated in this study will be useful in understanding the establishment of insect pest population in contrast to weather factors.

References

- Alok, N. K., Singh, S. K. and Chandra, U. (2022). population dynamics of gram pod borer, *Helicoverpa armigera* (Hubner) in relation to abiotic factors on chickpea, *J. Exp. Zool. India*, Vol. 25, No. 1, pp. 553-556.
- Bahadur, GM. D., Keval, R., Verma, S. and Bisht, K. (2018). Seasonal occurrence of gram pod borer *Helicoverpa armigera* (Hubner)] on chickpea in Varanasi, *Journal of Entomology and Zoology Studies*, 6(6): 786-790.
- Basugade, R. P., Bondre, C. M., Gawali, K. A. and Jeur, V. S. (2023). Population fluctuations of *Helicoverpa armigera* (Hubner) on chickpea in relation with weather parameters, *International Journal of Statistics and Applied Mathematics*, SP-8(5): 192-195.
- Gautam, MP., Chandra, U., Yadav, SK., Jaiswal, R., Giri, SK., and Singh, S. N. (2018). Studies on population dynamics of garm pod borer *Helicoverpa armigera* (Hubner) on chickpea (Cicer arietinum L.), *Journal of Entomology and Zoology Studies*, 6(1): 904-906.

- Galav, A., Sharma, P., Dadhich, D. K. and Gautam, V. (2021). Study the impact of population dynamics of *Helicoverpa armigera* on chickpea, *The Pharma Innovation Journal*, SP-10(11): 2719-2721.
- Kumar, P., Mishra, DN., Singh, DV., Singh, R., and Mishra, P. (2022) Population fluctuation of pod borer, *Helicoverpa armigera* (Hubner) in relation with abiotic factors, *The Pharma Innovation Journal*; SP-11(6): 1471-1474.
- Kumar, S., Singh, G., Singh, D. V., Rahul, S. N., and Kumar, S. (2015) Population dynamics of larval population of gram pod borer (*Helicoverpa armigera* Hubner) on chickpea in meerut, *Society for Recent Development in Agriculture* Prog. Agric. 15 (2) : 259-262.
- Mishra, R., Kumar, P., Kumar, D. and Kumar, P. (2021). Population dynamics of major Lepidopteran insect pests on chickpea (*Cicer arietinum* Linn.), *The Pharma Innovation Journal*, 10 (11): 1187-1189.
- Ojha, P. K., Kumari, R., and Chaudhary, R. S. (2017). Impact of abiotic and biotic factors on population dynamics of *Helicoverpa armigera* Hubner (Noctuidae: Lepidoptera) in chickpea, *Journal of Entomology and Zoology Studies*, 5 (1): 636-642.
- Raj, A., Shanker, K., Shakya, A., Kumar, S. and Singh, S. P. (2022). Population dynamics of gram pod borer, *Helicoverpa armigera* Hubner in relation to abiotic factors in chickpea, *Cicer arietinum* L., *The Pharma Innovation Journal*; 11(4): 1965-1968.
- Singh, B., Singh, H., Singh, G., Singh, D. V. and Singh, R. (2023). Effect of Abiotic Factors on Population Fluctuation of Gram Pod Borer, *Helicoverpa armigera* (Hubner) in Chickpea, *Int. J. Environ. Clim. Change*, vol. 13, no. 10, pp. 2123-2131; Article no.IJECC.105009.
- Sharma, S., Chandra, U., Veer, R., Kumar, S., Yadav, S. K. and Kumar, A. (2020). Study on population dynamics of *Helicoverpa armigera* (Hübner) in chickpea, *Journal of Entomology and Zoology Studies*; 8(5): 629-632.