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POPULATION DYNAMICS OF MAJOR INSECT PESTS OF OKRA IN RELATION TO WEATHER PARAMETERS

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ABSTRACT

Population dynamics of the insect is one of the important phenomena, which is continuously influenced by surrounding crops. The study of population insects can help to understand the interaction of the insect population and crops about extraneous weather factors. The present investigation is based on the population dynamics of major insect pests i.e. shoot and fruit borer, whitefly and jassids in the okra ecosystem and their correlation with various weather parameters. Okra is susceptible to several insect pests, leading to significant yield losses. This study revealed notable patterns in pest infestations during the crop's growth cycle. Shoot borer infestation began at 30th Standard Week (SW) and reached its peak at 33rd SW, with a maximum infestation of 17.6%. This infestation exhibited a significant positive correlation with minimum temperature, while maximum temperature and sunshine hours showed non-significant positive correlations. Fruit borer infestation commenced at 34th SW, peaking at 21.8%, with minimum infestation (2.8%) observed at 40th SW. Non-significant negative correlations were found between fruit borer infestation and maximum temperature, minimum temperature, and average relative humidity. Jassid infestation began at 30th SW, reaching a maximum in 36th SW and a minimum in 40th SW. Significant positive correlations were observed with maximum temperature and sunshine hours, while minimum temperature showed a non-significant positive correlation. Whitefly infestation was first observed at 31st SW and peaked at 35th SW. The study found non-significant positive correlations with minimum temperature, maximum temperature, and sunshine hours, while non-significant negative correlations were identified with relative humidity and rainfall. Overall, this study contributes to understanding the interactions between insect pests and weather parameters in the okra ecosystem, facilitating more targeted and sustainable pest management.

Key words : Okra, insect pests, population dynamics, weather parameters, shoot borer, fruit borer, jassid, whitefly.

Introduction

The okra (*Abelmoschus esculentus*), also referred to as lady finger, is a widely grown vegetable crop belonging to the family Malvaceae and their cultivation in throughout of India, in addition to India, it is cultivated in numerous regions globally, particularly in tropical and subtropical areas. It is an abundant source of vitamins, iodine, phosphorus, calcium, potassium and other minerals. Generally cultivated for its tender and nutritive value which is consumed as vegetables and also thickens soups and gravies due to its elevated level of mucilage content. Additionally, their root and stems are employed for the clarification of sugarcane juice (Gamede *et al.,* 2015). India holds the position of the largest global producer, contributing to over 72% of worldwide production and cultivation across an area of 0.5 million hectares. Gujarat, Bihar, and West Bengal are the leading states that produce the most okra in India (FAOSTAT, 2022).

Okra is damaged by various insect-pests, resulting in a great reduction in its yield (Kumar *et al.*, 2002). In India, okra has been reported to be affected by 72 different species of insect pests (Pal *et al*., 2013). Several insect pests damaged started from sowing to harvesting including fruit and shoot borer, whiteflies, aphid, jassid, thrips and mites. The most typical pests are aphids, whiteflies and jassids (Pal *et al*., 2013; Das *et al.*, 2021). The infestation by jassid results in the necrosis of leaves and causes them to curl upward at the tips and edges. Whitefly is the most important insect pest of the okra crop that sucks the plant sap directly and transmits a large number of viral diseases indirectly especially under high temperature (Noopur *et al.,* 2022). The success or failure of a crop is greatly influenced by weather parameters, as they have a substantial impact on the physiological expression of the genetic potential of the crops it is widely recognized that the yield of any crop or variety is contingent upon the presence of specific optimal conditions, including temperature, solar radiation soil moisture, relative humidity, etc. at various stages of crop growth (Burade *et al.*, 2019). Hence, examining the timing and peak periods of insect pest infestation in okra ecosystem in relation to weather parameters is crucial. Given these considerations, the current study was initiated to acquire information regarding the succession of major pests in the okra ecosystem

Materials and Methods

The present research was conducted at S.I.F, ANDUA&T, Ayodhya (U.P.) during *Kharif* 2022. The location of the experiment at 26.47^o N latitude, 82.12^o E longitude and an altitude of 113 meters from mean sea level. The soil type of the area is sandy to loam textured with flat, well-drained and moderately fertile. The normal pH of soils ranges from 7.2-8.4. The present experiment was laid down in a C.R.B. Design. Okra cultivar *Kaveri* was sown within a plot size of 8×8m with a border of 1 m, line-to-line spacing kept at 60cm and plant-to-plant spacing kept at 30cm. Two seeds per hill were dibbled at a depth of 4-5cm. All standard cultural practices were performed at the proper time. The estimation of seasonal occurrence of insect pests on *Kharif* Okra was recorded by selecting 5 plants randomly at weekly intervals starting 20 days after sowing (DAS) till harvesting, in terms of number/damage per cent of insect/leaf/plant. Shoot infestation data was taken by counting infested and un-infested shoots expressed by using the following formula.

$$\text{Percents root infestion} = \frac{\text{No.of infested shoots}}{\text{Total no. of shoots}} \times 100$$

Data about fruit infestation was collected by enumerating both damaged and undamaged fruits from five plants chosen at random. The percentage of fruit infestation was determined through the application of the following formula.

$$\text{Percents fruiting infestion} = \frac{\text{No.of damaged fruits}}{\text{Total no. of fruits}} \times 100$$

The data on meteorological parameters *viz*. minimum and maximum temperature (^{o}C), relative humidity (%), and rainfall (mm) of the study period were collected from the Department of Agrometeorology, A.N.D.U.A.&T., Kumarganj, Ayodhya and its correlation with insect Pests population was calculated.

Results and Discussion

The findings of this study are presented in Table 1 and Fig. 1, which illustrate the incidence of major insect pests on okra and their relationship with abiotic factors. Table 2 presents the correlation coefficients. Based on the data from these tables, the infestation levels of the major insect pests during the *Kharif* season of 2022 were as follows:

Shoot borer infestation : The shoot borer population (6.3%) was first noticed at 30th SW on the terminal shoot at the vegetative stage, with flower buds, flowers and young fruits in the fruit formation stages. After that shoot infestation increased gradually and reached a peak in 33rd SW with maximum shoot borer infestation (17.6%). The minimum infestation by insects of 2.6 per cent damaged shoots was observed in 40th SW. The correlation observed between the per cent shoot infestation of Okra shoot and fruit borerand abiotic parameters showed a significant positive correlation with minimum temperature (r = 0.775). However, maximum temperature (r = 0.402) and sunshine had (r = 0.523) non-significant positive correlation while average relative humidity (r = -0.031) and rainfall (r = -0.510) had a non-significant and negative correlation.

Fruit borer infestation : It was started from 34th SW with a mean infestation of 2.8%. Infestations, with a gradual increase observed with a maximum level of 21.8%. Minimum fruit infestation (2.8%) was recorded in the 40th SW. Correlation between the per cent fruit infestation of Okra shoot and fruit borerand abiotic parameters had a non-significant negative correlation with maximum (r = -0.164) and minimum temperature (r-0.588) and average relative humidity (r=-0.037). Rainfall

Table 1 : Incidence of major insect pests on Okra and abiotic factors during *Kharif*, 2022.

Standard Week (SW)	Shoot and fruit borer		Number of jassid/3 leaves	Number of whitefly/3 leaves	Temperature (°C)		Av. relative humidity(R.H %)	Rainfall	Sunshine hrs.
	Mean shoot infestation (%)	Mean fruit infestation (%)			Maximum	Minimum			
30	6.3	0.0	2.0	0.0	32.2	25.1	83.6	83.6	1.4
31	10.4	0.0	2.4	0.9	32.8	25.7	83.0	21.2	2.5
32	15.7	0.0	2.8	1.8	33.6	26.2	81.5	8.0	7.5
33	17.6	0.0	3.0	2.5	32.5	25.4	84.4	31.8	5.7
34	14.2	2.8	3.2	4.9	32.5	25.5	83.0	65.2	7.6
35	8.6	11.4	3.2	6.2	33.7	25.5	78.4	18.8	4.0
36	9.5	13.3	4.0	5.1	34.8	24.7	74.1	11.4	7.9
37	8.3	21.8	3.4	3.4	31.5	24.4	85.4	98.6	5.0
38	4.2	18.5	2.6	3.6	31.9	24.7	83.4	70.8	4.4
39	3.8	19.0	2.4	2.7	32.5	23.9	84.2	21.2	5.0
40	2.6	8.7	1.4	1.1	31.2	23.0	82.2	163.0	3.9

(r=0.402) and sunshine hours showed a non-significant positive correlation.

Jassid : It was started from the 30th SW onwards and the maximum incidence of jassid was recorded as 4.0 jassids /3 leaves in the 36th SW, while the minimum incidence was recorded as 1.4 jassids/3 leaves in the 40th SW. Correlation recorded between the jassids population and abiotic parameters showed a significant positive correlation with maximum temperature (r = 0.638) and sunshine hours(r =0.656), while minimum temperature had non-significant positive (r = 0.410). There was a non-significant and negative correlation with average relative humidity (r = -0.480) and rainfall (r = -0.560).

Whitefly : It was the first time it appeared during 31th SW (0.9 whitefly/3 leaves). The Maximum incidence of whiteflies was recorded 6.2 whitefly/3 leaves in the 35th SW, while; the minimum incidence was recorded as 0.9 whitefly/3 leaves per plant in 31th SW. The incidence of abiotic factors on the whitefly population showed a non-significant positive correlation with minimum (r = 0.656) and maximum temperature (r = 0.656) and sunshine hours (r = 0.656). At the same time, relative humidity (-0.519) and rainfall (-0.327) had a non-significant negative correlation.

These findings were by Kumar *et al.* (2021), who reported that shoot borer invasion started during the 29th SW. Fruit damage began to appear in the 31st SW Fruit deterioration started in the 31st SW and reached its peak in the 34th SW. They also found that fruit damage was shown to be positively correlated with maximum and minimum temperature and relative humidity at 7 hours. Saroj *et al.* (2017) stated that the 32nd SW and 37th SW, lowest and highest jassid populations were recorded. The jassid population in okra showed an insignificantly positive correlation with minimum and maximum temperature, and relative humidity and an insignificantly negative correlation with rainfall. Dhandge *et al.* (2018) observed the highest jassid population at maximum temperature. They also noted a weakly positive link between the pest population and the lowest temperature, the morning relative humidity, and the number of hours of strong sunshine. Only at night was there a negative correlation in relative humidity. Akhila *et al*. (2019) found that the jassid population exhibited a non-significant negative association with sunlight but a non-significant positive correlation with rainfall and a non-significant negative correlation with maximum and lowest temperature and relative humidity. Pandey (2018) revealed that relative humidity and rainfall exhibited a non-significant negative correlation with the

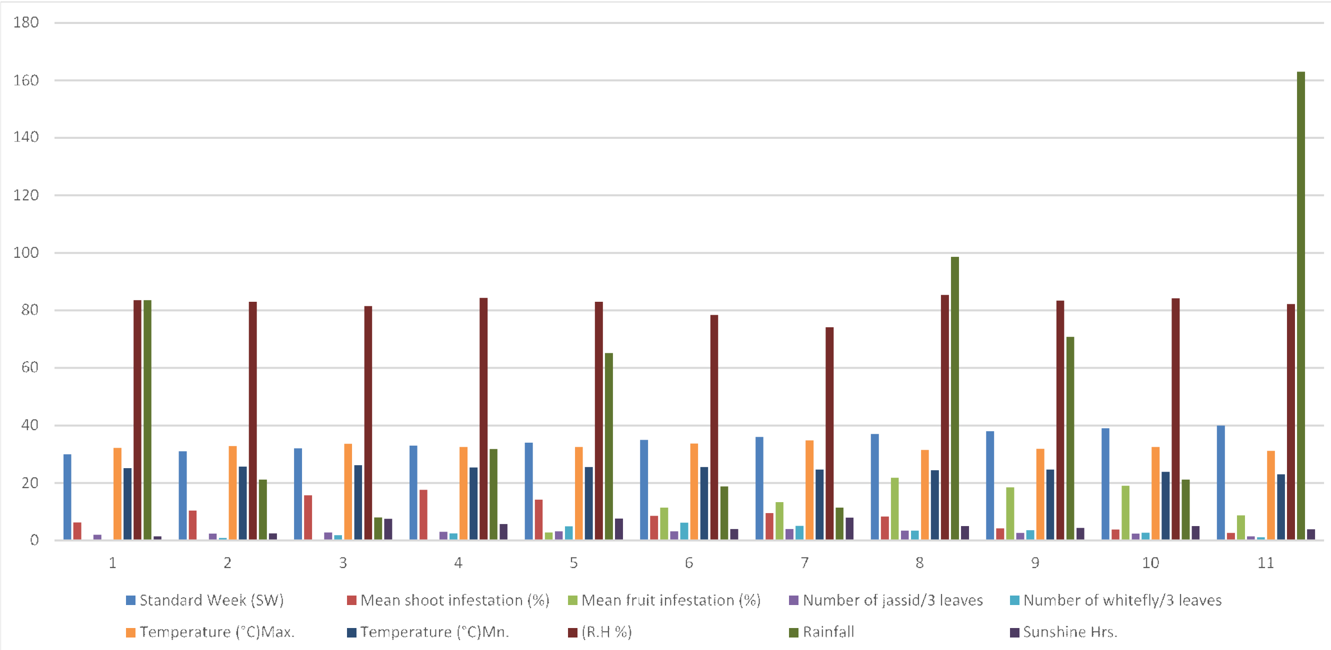

Fig. 1 : Incidence of major insect pests on Okra and abiotic factors during *Kharif*, 2022.

Table 2 : Correlation coefficient between major insect pests of Okra and abiotic factors during *Kharif*, 2022.

Insect pests		**Temperature (°C)**		**Av. relative humidity (%)**	**Rainfall (mm)**	**Sunshine hrs.**
		Maximum	**Minimum**			
Okra shoot and fruit borer	**%shoot infestation**	NS (0.402)	0.775*	NS(-0.031)	NS(-0.510)	NS(0.523)
	% fruit infestation	NS(-0.164)	NS(-0.588)	NS(-0.037)	NS(0.164)	NS(0.081)
Jassid	0.638*	NS(0.410)	NS(-0.480)	NS(-0.560)	0.656*	
White fly	NS(0.467)	NS(0.122)	NS(-0.519)	NS(-0.327)	NS(0.550)	

jassid population in okra. Similar studies were reported by Mishra *et al.* (2018) in which the aphid and whitefly populations were at the peak at 35th SW and 27th SW, and the population of both insects increased with maximum temperature and bright sunshine hours. Shanthi *et al.* (2020) observed that the summer-sown okra was more susceptible to sucking pests with more population of natural enemies than the *rabi* crop.

Conclusion

This research sheds light on the intricate relationship between weather parameters and the population dynamics of major insect pests in the okra ecosystem. The study's findings provide valuable in sights into the timing and severity of infestations by key pests namely shoot borer, fruit borer, jassid and whitefly. The population dynamics of shoot borer and fruit borer revealed distinct patterns, with peak infestations occurring during specific weeks of the growing season. Notably, shoot borer infestation exhibited a significant positive correlation with minimum temperature, suggesting its sensitivity to thermal conditions. Conversely, fruit borer infestation showed non-significant negative correlations with maximum and minimum temperatures, indicating a less direct temperature influence on this pest. Jassid populations were influenced by maximum temperature and sunshine hours, demonstrating a preference for warmer and sunnier conditions. In contrast, whitefly populations showed non-significant positive correlations with both maximum and minimum temperatures, reflecting their adaptability to a broader range of temperature conditions. These findings highlight the importance of considering weather parameters in pest management strategies for okra cultivation. By understanding the seasonal dynamics of these pests and their responses to temperature and humidity variations, farmers and researchers can develop more precise and effective pest control measures, potentially reducing yield losses and minimizing the environmental impact of pest management practices. In its entirety, this research contributes to an enhanced and thorough comprehension of the interaction between insect pests and weather parameters in the okra ecosystem, facilitating more targeted and sustainable pest management approaches in agricultural systems.

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Conflict of interest : None

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