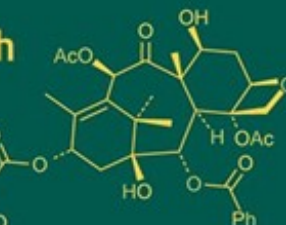
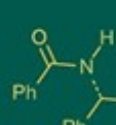


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## Influence of weather parameters on the borer pest complex of okra (*Abelmoschus esculentus* L. Moench)

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### ABSTRACT

Okra, the annual summer vegetable crop also known as “The Perfect Villager’s Vegetable” cultivated throughout the tropical and subtropical parts of the world and it is known for having high nutritional content. Many insect-pests were destructive for its growth and development of this crop and also climatic factors plays vital role in the activity of insect-pests. Among those, okra shoot and fruit borer and fruit borer were the most destructive pests in okra agroeco-system. In this present study, we investigated the effect of weather parameters on the target insect-pest complex of okra. This study revealed that activity of both okra shoot and fruit borer (OSFB) and Fruit borer (*Helicoverpa armigera*) reached the peak infestation level on 22nd standard meteorological week and correlation studies of weather parameters showed that okra shoot and fruit borer showing significant positive correlation with maximum temperature and wind velocity but showing non-significant negative correlation with relative humidity and rainfall. And fruit borer (*Helicoverpa armigera*) showing non-significant positive correlation with maximum temperature, wind velocity and minimum relative humidity but showing non-significant negative correlation with maximum relative humidity and rainfall.

**Keywords:** Okra, fruit borer, temperature, rainfall & humidity

### Introduction

The annual summer vegetable crop okra (*Abelmoschus esculentus* (L.) Moench) is commercially cultivated all throughout the tropical and subtropical parts of the world for immature fruit (Martin and Ruberte, 1978). According to Adamou *et al.* (2010) it is considered to be “The perfect villager's vegetable” and has a high nutritional content. Okra (*Abelmoschus esculentus* L. Moench) is a significant vegetable crop that contributes to a balanced diet by providing vitamins, carbohydrates, and minerals. Okra is grown in India during the rabi and kharif seasons and ranks first globally with 6,950 MT of the total bhendi production (Anon, 2017–18). In Rajasthan, the crop covers 3619 ha, producing 18152 MT for the state as a whole (Anon, 2018-19). It often known as ladies’ finger, is a significant tropical vegetable that is largely consumed in Ghana, India, Cameroon, Pakistan, and Nigeria. The fact that it is a good source of vitamin A and folic acid, in addition to phosphorus, carbohydrates, and magnesium, has led many people in Europe and North America to start loving this vegetable even though it is hardly ever grown in those regions.

India is the world's top producer of okra, accounting for 61.9% of the entire production, followed by Nigeria (22.2% of the total worldwide production), which is the world's second-largest producer of vegetables after China. During the 2017–2018 period, India produced almost 6073 thousand MT from 506 thousand ha of land (Rawat *et al.*, 2019). India's top producing state for okra is Andhra Pradesh. Its production is followed by West Bengal's (862.1 thousand tonnes) and Bihar's (788.3 thousand tonnes) in terms of volume (Rawat *et al.*, 2019). Okra productivity is low for a variety of reasons, but one of the biggest production barriers is insect pest attack. The most dangerous pests of okra are shoot and fruit borer, *Earias insulana* (Boisduval), and *E. vittella*, aphid (*Aphis gossypii*), and jassid, *A. biguttula biguttula*, which inflict 45.00 to 57.10% damage to fruits (Shrinivasan and Krishna Kumar, 1983; Nderitu *et al.*, 2008).

Temperature, precipitation, wind direction, and relative humidity are some of the climatic variables that affect the occurrence and spread of insect pests and their natural enemies. Data on the relationship between meteorological variables and insect development might be crucial for pest surveillance, forecasting, monitoring and management of the pest population through the timely use of control measures. In terms of form, colour, and habitat specialisation, insects are the most diverse category of animals, making them one of the most rewarding subsets of creatures. India is home to insects from 27 of the 29 identified insect orders that are known to exist worldwide (Anuradha Thakur, *et al.*, 2008). India's biological variety is extremely rich and diverse, and its diverse ecosystems serve as an example of this (Alfred, *et al.*, 2002).

In this present investigation, we are studying the effect of weather parameters on the target insect pests of okra agro-ecosystem in the farms of LPU, Phagwara, Punjab.

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## Materials and Methods

### To study the effect of abiotic factors on the growth of fruit borer and okra shoot and fruit borer

The current experiment was carried out in the summer of 2021 at Lovely Professional University in Phagwara, Punjab. Jeenu variety of the okra crop, which is indigenous to Punjab, was employed in the experiment. The experiment's randomised block design (RBD) plan included seven treatments that were replicated three times, total 21 plots. Standard agronomic methods were applied to each plot equally.

### Observation of target pest complex in okra crop

Throughout the crop's growth season, periodic assessments on the okra crop were done for the population dynamics of insect pests. It started when crop seedlings appeared and continued until the crop was finally harvested. The total number of sound and damaged fruits from five randomly chosen plants were observed. To count the shoot and fruit borer larvae, the fruits were cut open. On selected plants, fruit borers were immediately counted, and the proportion of damage was computed.

### Data analysis

Weekly pest population data collected from the experimental field using a randomised block design pattern were examined using ANOVA. By counting both the damaged and total quantity of fruits, the percent damage caused by *Helicoverpa armigera* and *Earias sp.* was determined. Beginning 30 days after seeding and continuing until the crop reached maturity, observations were made at weekly intervals.

### Data collection of weather parameters

To investigate the instantaneous effect of weather parameters on pest population fluctuation, data from physical environmental factors such as bright sunshine (BSS), rainfall (RF), wind speed (WS), maximum (MaxT) and minimum (MinT) temperature, morning (RH1) and evening (RH2) relative humidity were correlated. The meteorological data was collected from the Meteorological Observatory, Department of Agricultural Meteorology, LPU, Punjab.

## Results and Discussion

### Effect of abiotic factors on the target pest of okra

#### *Helicoverpa armigera*

The average *Helicoverpa armigera* population began at 6.66 larva/5 plants on the 16th standard meteorological week (SMW), and it reached a maximum of 9.66 larva/5 plants on the 22nd SMW. According to Kharia *et al.* (2018), the gram pod borer first appeared in the 11th standard week and peaked in the 16th standard week.

### Correlation of weather parameters

The population of *Helicoverpa armigera* had a nonsignificant positive correlation with maximum temperature (0.486NS), a nonsignificant negative correlation with maximum relative humidity (-0.720NS), a nonsignificant positive correlation with minimum relative humidity (0.534NS), and a nonsignificant positive correlation with wind velocity (0.586 NS) and non-significant negative correlation with rainfall (-0.095 NS). Ojha *et al.*, (2017) also noticed the larval population of *Helicoverpa armigera* showed positive correlation with maximum temperature and minimum temperature, evaporation and wind speed but negative correlation with rainfall and morning and evening relative humidity. Rathore *et al.*, (2017) also noticed that the *Helicoverpa armigera* larval population showed positive correlation with temperature but non-significant negative correlation with relative humidity.

#### *Earias sps.*

When *Earias sp.* initially emerged in the 16th SMW, its population averaged 1.66 larva/5 plants, and it reached its peak on the 22nd SMW at 7.66 larva/5 plants. Pathan & Bharpoda (2016) looked into the fact that *E. vittella* infestation in okra fruits began in the third week of the 16th SMW (19.65%) and continued up until the okra crop was harvested, which was in the fourth week of May (21st SMW, 12th WAG with a mean 16.94 2.29%).

### Correlation of weather parameters

The population of *Earias sp.* exhibited a significant positive association with maximum temperature (0.810) but not with lowest temperature (0.750 NS), non-significant negative association with maximum relative humidity (-0.659 NS), non-significant negative connection with minimum relative humidity (-0.039 NS), extremely significant positive correlation with wind velocity (0.917), and non-significant negative correlation with rainfall (-0.033 NS). Rawat *et al.*, (2019) revealed that peak incidence of okra shoot and fruit borer population was observed 5.9 larvae/ plant in 37th standard meteorological week. Correlation of Okra shoot and fruit borer (*Earias vittella*) population with weather parameters revealed that there was non-significant negative correlation with Minimum temperature ( $r = -0.162$ ), evening relative humidity ( $r = -0.545$ ) and sunshine hour ( $r = -0.572$ ) while significant negative correlation with rainfall ( $r = -0.610^*$ ). While maximum temperature ( $r = 0.513$ ), morning relative humidity ( $r = -0.201$ ) and wind velocity ( $r = -0.411$ ) showed nonsignificant positive correlation. The linear regression analysis using weather parameters as independent variables and Okra shoot and fruit borer as dependent variables could explain the variability up to 78% ( $R^2 = 0.76$ ), respectively.

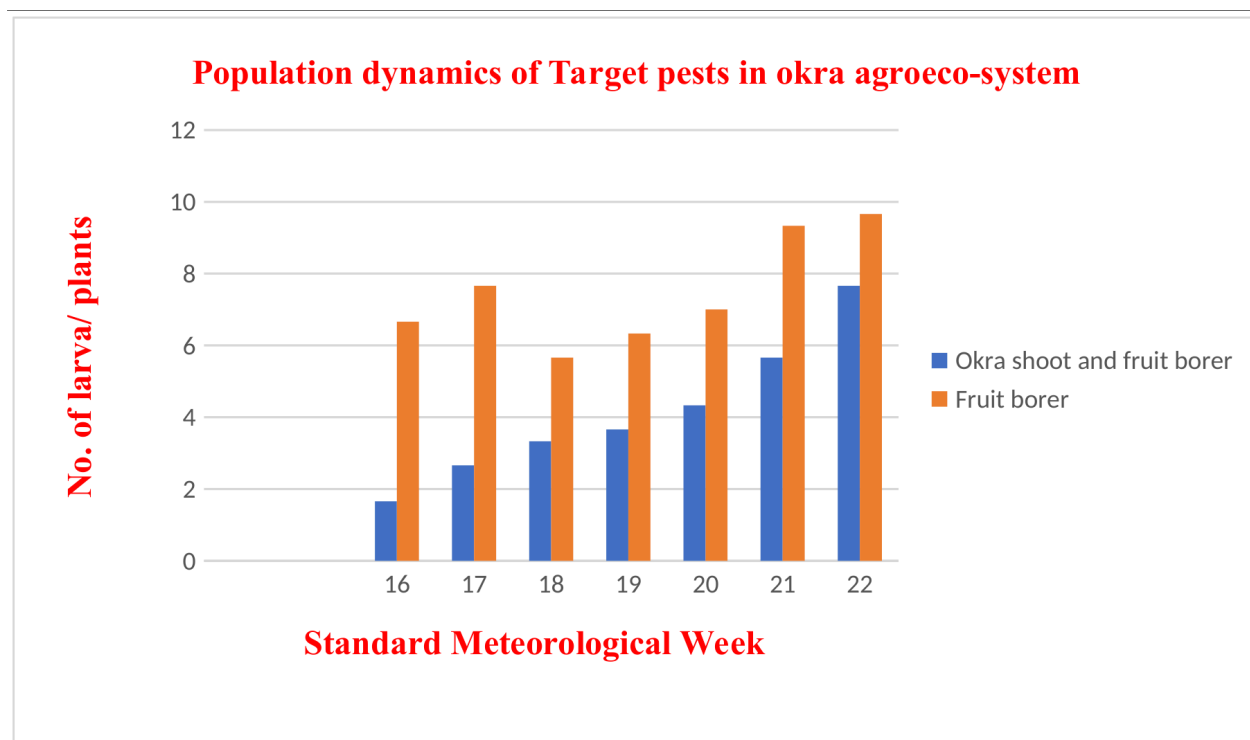
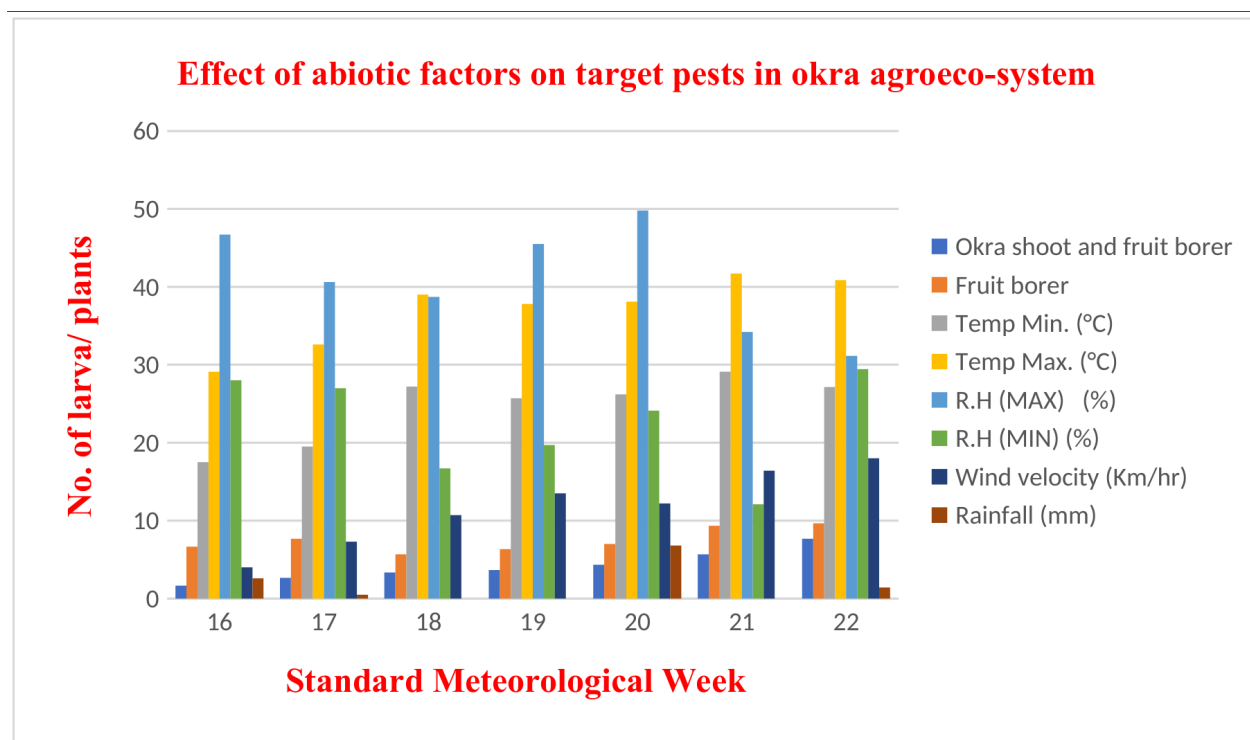
**Table 1.** Seasonal incidence of target pests in okra crop.

| SW | OSFB | Fruit borer | Temp<br>Min.<br>(°C) | Temp<br>Max.<br>(°C) | R.H<br>(MAX)<br>(%) | R.H<br>(MIN)<br>(%) | Wind velocity<br>(Km/hr) | Rainfall<br>(mm) |
|----|------|-------------|----------------------|----------------------|---------------------|---------------------|--------------------------|------------------|
| 16 | 1.66 | 6.66        | 17.5                 | 29.1                 | 46.7                | 28                  | 4                        | 2.6              |
| 17 | 2.66 | 7.66        | 19.5                 | 32.6                 | 40.6                | 27                  | 7.3                      | 0.5              |
| 18 | 3.33 | 5.66        | 27.2                 | 39                   | 38.7                | 16.7                | 10.7                     | 0                |
| 19 | 3.66 | 6.33        | 25.7                 | 37.8                 | 45.5                | 19.7                | 13.5                     | 0                |
| 20 | 4.33 | 7           | 26.2                 | 38.1                 | 49.8                | 24.1                | 12.2                     | 6.8              |
| 21 | 5.66 | 9.33        | 29.1                 | 41.7                 | 34.2                | 12.1                | 16.4                     | 0                |
| 22 | 7.66 | 9.66        | 27.14                | 40.85                | 31.14               | 29.42               | 18                       | 1.42             |

(continued on next page)

**Table 2.** Correlation of weather parameters on target pests in okra Agroecosystem.

| Abiotic factors                                                      | <i>Earias</i> sps    | <i>H. armigera</i>   |
|----------------------------------------------------------------------|----------------------|----------------------|
| Coefficient of correlation for population and max. temperature       | 0.750 <sup>NS</sup>  | 0.367 <sup>NS</sup>  |
| Coefficient of correlation for population and min. temperature       | 0.810 <sup>*</sup>   | 0.486 <sup>NS</sup>  |
| Coefficient of correlation for population and max. relative humidity | -0.659 <sup>NS</sup> | -0.720 <sup>NS</sup> |
| Coefficient of correlation for population and min. relative humidity | -0.039 <sup>NS</sup> | 0.053 <sup>NS</sup>  |
| Coefficient of correlation for population and wind velocity          | 0.917 <sup>**</sup>  | 0.586 <sup>NS</sup>  |
| Coefficient of correlation for population and total rainfall         | -0.033 <sup>NS</sup> | -0.095 <sup>NS</sup> |

**Figure 1.** Population dynamics of Target pests in okra agroeco-system**Figure 2.** Seasonal incidence of Target pests in okra Agroecosystem.

## Future aspects

Analysis of the link between pest and environment is useful. Additionally, to anticipate the occurrence of pests and warn farmers of insect attacks based on environmental factors.

## Conclusion

One of the most significant vegetables in the Malvaceae family is okra (*Abelmoschus esculentus* (L) Moench). Although it's typically eaten as a fresh vegetable, it can also be found canned, dehydrated, or frozen. 60% of fresh vegetables are for potential exports (Sharman and Arora, 1993). Insect infestations are a significant barrier to okra production. From seedling through maturity, the crop was attacked by a number of insect pests. In this present study, we investigated the effect of weather parameters on the target insect-pest complex of okra. This study revealed that activity of both okra shoot and fruit borer (OSFB) and Fruit borer (*Helicoverpa armigera*) reached the peak infestation level on 22<sup>nd</sup> standard meteorological week and correlation studies of weather parameters showed that okra shoot and fruit borer showing significant positive correlation with maximum temperature and wind velocity but showing non-significant negative correlation with relative humidity and rainfall. And Fruit borer (*Helicoverpa armigera*) showing non-significant positive correlation with maximum temperature, wind velocity and minimum relative humidity but showing non-significant negative correlation with maximum relative humidity and rainfall.

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