*Plant Archives* Vol. 25, No. 2, 2025 pp. 1672-1678 e-ISSN:2581-6063 (online), ISSN:0972-5210

# Plant Archives

Journal homepage: http://www.plantarchives.org
DOI Url : https://doi.org/10.51470/PLANTARCHIVES.2025.v25.no.2.242

# SEASONAL INCIDENCE AND EFFECT OF WEATHER PARAMETERS ON POPULATION DYNAMICS OF BRINJAL SHOOT AND FRUIT BORER, *LEUCINODES ORBONALIS* (GUENEE) IN BRINJAL CROP

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(Date of Receiving : 01-08-2025; Date of Acceptance : 09-10-2025)

**ABSTRACT**

The experiment was carried out in a randomized complete block design with three replications during the *Kharif* season, 2024 at the Crop Research Centre of Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut. The shoot infestation was commenced at 20 days after transplanting and infestation was recorded in 36th standard week as 3.22 percent and reached to a peak level (24.68 percent shoot infestation) on 42th standard week. At peak level of shoot infestation, the minimum and maximum temperature were 18.9°C and 34.2°C, evening and morning relative humidity 63.3°C and 77.3°C percent, respectively and rainfall of 0.0 mm. The shoot infestation started declined (18.30 percent) during 43th standard week when the maximum and minimum temperature, relative humidity at morning and evening and rainfall were 33.5°C and 18.8°C, 82.3 percent and 67.9 percent and 0.0 mm, respectively. The fruit infestation was commenced at 50 days after transplanting and infestation was recorded in 40th standard week as 8.22 percent and reached to a peak level (29.60 percent fruit infestation) on 44th standard week. At peak level of fruit infestation, the minimum and maximum temperature were 18.0°C and 33.0°C, evening and morning relative humidity 68.7°C and 83.9°C percent, respectively and rainfall of 0.0 mm. The fruit infestation started declined (24.80 percent) during 45th standard week when the maximum, minimum temperature, relative humidity at morning and evening and rainfall were 30.8°C, 16.8°C, 94.1 percent, 75.6 percent and 0.0 mm, respectively. Correlation studies revealed that the shoot infestation by brinjal shoot & fruit borer, *L. orbonalis* showed positive non-significant correlation with maximum temperature (r = 0.334) and minimum temperature (r = 0.052) whereas, non-significant negative correlation was recorded with morning relative humidity (r = -0.072), evening relative humidity (r = -0.146) and rainfall (r = -0.356). The fruit infestation by brinjal shoot & fruit borer, *L. orbonalis* showed positive non-significant correlation with morning relative humidity (r = -0.063) whereas, negative significant correlation was recorded with minimum temperature (r = -0.732*) and (Byx = -1.255) and rainfall (r = -0.581*) and negative non-significant correlation with maximum temperature (r = -0.474) and evening relative humidity (r = -0.262).

***Keywords*:** Brinjal, Seasonal incidence, *L. orbonalis*, Shoot infestation, Fruit infestation, Weather parameters, Correlation.

## Introduction

The crop known as brinjal (*Solanum melongena* Linn.) is member of genus Solanum and family Solanaceae. It is widely referred to as the “King of vegetables”, and is believed to have originated in the Indian sub-continent (Gleddie *et al.*, 1986). It is also called aubergine (French word) in Europe, guinea squash (English) in Southern America. It is annual hermaphrodite crop that often self- fertilizes. The world cultivated area for brinjal (eggplant) was approximately 19.24 lakh hectare (FAO, 2023). It is

mostly bushy plant with broad leaves, purple or white flowers and typical height of 2-4 feet. It is the most widely grown vegetable crop in India with the exception of higher elevations and it is grown in world throughout the year. The primary reason of brinjal crop is grown mainly for its delicate young fruits. Across the globe, they are primarily consumed as a cooked vegetable and used in preparing a variety of dishes in different regions. Popular worldwide recipes include baingan bharta, ratatouille, moussaka and baba ganoush. They are also utilized for making pickles and dehydrated products. Brinjal is a versatile and nutrient-rich vegetable used in various cuisines around the world. Brinjal is known for its glossy purple, green or white fruits which come in various shape and size. It is valued for its culinary versatility and nutritional content particularly its fiber, antioxidants and low-calorie profile. Nutritionally it is a better source of vitamins (especially Vitamin B) and antioxidants including phenolic acids, flavonoids and anthocyanins which is found in the purple skin. It helps to prevent arteriosclerosis by blocking cholesterol absorption, lowers body fat levels and contains polyphenols that aid in combating cancer (Daunay *et al.,* 2000). In the world during 2022-23, approximately 18.94 lakh hectares area were designated for brinjal cultivation yielding 593 lakh tonnes with a production rate of 31383 kg/ha. This positions of brinjal production are the fifth most economically significant production among the solanaceous crops. In India for the year 2022-23, the area reported to brinjal cultivation was 6. 79 lakh hectares producing 129. 33 lakh tonnes compared to the 127. 65 lakh tonnes produced from 6. 75 lakh hectares in 2021-22. Higher acreage was covered in West Bengal 1.69 lakh ha, Odisha 1.26 lakh ha, Gujarat 0.79 lakh ha, Madhya Pradesh 0.67 lakh ha, Bihar 0.58 lakh ha, Chhattisgarh 0.39 lakh ha, Andhra Pradesh 0.05 lakh ha and Telangana 0.03 lakh ha (Anonymous, 2023). In Uttar Pradesh it's cultivated area was 20,000 ha and productivity of 30.65 t/ha. Uttar Pradesh ranked 11th in terms of brinjal production that was 312.98 tonnes in 2021-22. Uttar Pradesh shared 2.45% in brinjal production of India. Among different districts of Eastern Uttar Pradesh Ayodhya was highest production of Brinjal in 2020-21 and that was 7.965 MT (Directorate of Economics & Statistics, Govt. of U.P. 2022). Brinjal crops are susceptible to infestation by various insect pests that can greatly reduce their yield and quality. Among these, the brinjal shoot and fruit borer, *Leucinodes orbonalis* (Guenee), is the most serious and destructive monophagous pest affecting brinjal. This pest remains active during the rainy and summer seasons and has a distinct feeding pattern. It is considered a serious threat capable of reducing crop yield by 60–70 percent.

## Materials and Methods

The field experiment for the present studies was conducted at Crop Research Centre (C.R.C.) of Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut. (U.P.). The University is situated at the distance of about 10 km from Meerut city on Delhi Dehradun National Highway (NH-58) and it lies between 29º 17' North latitude and 77º 42' East longitudes at an altitude of 237 meters above mean sea level. The total geographical area of Meerut district is 2564 $km^2$. Meerut is located in the North-east of Delhi in western plain zone of Uttar Pradesh and has Sub tropical climate. The climate of this region is characterized as semi-arid and sub-tropical. The summer is very hot and dry while winters are too cold. Moderate rainfall and wide temperature variation is the characteristic features of the semi-arid and sub-tropical climate. Generally, south-west monsoon sets in the third of fourth week of June, reaches its peaks in July and August and continues up to September, cyclonic weather leads to few winter rains. The area receives mean rainfall of 845 mm, of which 80-90 per cent is received from June to September. The mean minimum temperature reaches low as 3°C in winters, while during summer the mean maximum temperature varies from 43-45°C. Each treatment plot measured 4 x 3 $m^2$. Seeds of brinjal variety "Pusa Uttam" collected from Indian Agriculture Research Institute (IARI), New Delhi and nursery was raised at High-tech polyhouse of Horticulture Research Centre (H.R.C.) of SVPUA&T, Meerut. Ten trays were required for nursery preparation. After preparation of nursery plants, 30 days old seedlings of nursery were transplanted in a plot size 4×3 $m^2$. At the time of transplanting, the roots of the seedlings were dipped in a solution of Bavistin (2g/litre of water). Transplanting was done during evening hours at spacing 70× 60 cm and light watering was given after transplanting. 30 plants were transplanted in each plot replication wise. A total of 735 plants were transplanted in field.

The daily meteorological data pertaining to temperature, relative humidity and rain fall during experimental period were collected from meteorological observatory of Department of Soil Science, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut 250110 (U.P.). The incidence of brinjal shoot and fruit borer was recorded at weekly interval on randomly selected five plants from each spot starting from 7 days after transplanting to the late stage of the cropping season

from untreated control/check plot. Total number of healthy shoots and number of infested shoots of five randomly selected plants were observed for shoot infestation. There after its incidence was noticed by each fruit picking on randomly selected five plants. The numbers of healthy and damaged fruits of five randomly selected plants were counted at each picking. The seasonal fluctuation in the activity of brinjal shoot and fruit borer was observed by recording percentage of infested fruits at each picking. The population data of pest was subjected to statistical analysis to find out the simple correlation with abiotic factors using by the Karl Pearson formula for correlation coefficient.

$$r_{xy} = \frac{\sum x - \frac{\sum x \sum y}{n}}{\sqrt{[\sum x2 - \frac{\sum x2}{n}][\sum y2 - \frac{\sum y2}{n}]}}$$

Where,

$r_{xy}$ = Simple correlation coefficient

X = Variable i.e. abiotic component

Y = Variable i.e. mean number of insect pests

n = Number of Observation

## Results and Discussion

**Effect of weather parameters on brinjal shoot and fruit borer, *Leucinodes orbonalis* (Guenee) in relation to shoot infestation during *kharif*, 2024**

The results regarding the seasonal incidence and effect of weather parameters on brinjal shoot and fruit borer, *L. orbonalis* relation to shoot infestation was presented in table 1 and depicted in figure 1.0. During *kharif*, 2024. The shoot infestation by brinjal shoot and fruit borer ranged from 1.18 to 24.68 percent. The shoot infestation was commenced at 20 days after transplanting and infestation was recorded in 36$^{th}$ standard week (1$^{st}$ week of September) as 3.22 percent. After this, shoot infestation increased gradually and reached to a peak level (24.68 percent shoot infestation) on 42$^{th}$ standard week (second week of October to third week of October). At peak level of shoot infestation, the minimum and maximum temperature were 18.9°C and 34.2°C, evening and morning relative humidity 63.3°C and 77.3°C percent, respectively and rainfall of 0.0 mm. The shoot infestation started declined (18.30 percent) during fourth week of October (43th standard week) when the maximum and minimum temperature, relative humidity at morning and evening and rainfall were 33.5°C and 18.8°C, 82.3 percent and 67.9 percent and 0.0 mm, respectively. The minimum shoot infestation of *L. orbonalis* (1.18 percent per five plants) were recorded during 50$^{th}$ standard week (second week of December) when the maximum and minimum temperature, relative humidity at morning and evening and rainfall were 22.5°C and 7.3°C, 69.6 percent and 55.0 percent and 0.3 mm, respectively.

**Effect of weather parameters on brinjal shoot and fruit borer, *Leucinodes orbonalis* (Guenee) in relation to fruit infestation during *kharif*, 2024**

The results regarding the seasonal incidence and effect of weather parameters on brinjal shoot and fruit borer, *L. orbonalis* (Guenne) relation to fruit infestation was presented in table 2 and illustrated in figure 2.0. During *kharif*, 2024. The fruit infestation by brinjal shoot and fruit borer ranged from 8.22 to 29.60 percent. The fruit infestation was commenced at 50 days after transplanting and infestation was recorded in 40$^{th}$ standard week (4$^{th}$ week of September to 1$^{st}$ week of October) as 8.22 percent. After this, fruit infestation increased gradually and reached to a peak level (29.60 percent fruit infestation) on 44$^{th}$ standard week (4$^{th}$ week of October to 1$^{st}$ week of November). At peak level of fruit infestation, the minimum and maximum temperature were 18.0°C and 33.0°C, evening and morning relative humidity 68.7°C and 83.9°C percent, respectively and rainfall of 0.0 mm. The fruit infestation started declined (24.80 percent) during second week of November (45$^{th}$ standard week) when the maximum, minimum temperature, relative humidity at morning and evening and rainfall were 30.8°C, 16.8°C, 94.1 percent, 75.6 percent and 0.0 mm, respectively. The minimum fruit infestation of *L. orbonalis* (8.22 percent per five plants) were recorded during 40$^{th}$ standard week (4$^{th}$ week of September to 1$^{st}$ week of October) when the maximum and minimum temperature, relative humidity at morning and evening and rainfall were 35.0°C and 23.8°C, 80.6 percent and 67.7 percent and 0.3 mm, respectively.

The present findings are similar with Kumar *et al*. (2018) revealed that the initial incidence of the BSFB on shoot was occurred on the 40$^{th}$ standard week (First week of October) and reached the peak in the 43$^{th}$ standard week (Last week of October- 1$^{st}$ week of November); whereas initial incidence of the BSFB on fruit was occurred on the 42$^{nd}$ standard week (Third week of October) and reached the peak in the 45th standard week (2$^{nd}$ week of November). The present finding concord with the findings of Gangwar and Singh (2014) who also reported *L. orbonalis* infestation started from the last week of August and remained till last week of December *i.e.* this pest was found infesting the crop throughout the crop season.

**Correlation between brinjal shoot & fruit borer, *Leucinodes orbonalis* (Guenee) and weather parameters during *kharif*, 2024**

After analyzed the data of correlation (r) between brinjal shoot & fruit borer population and weather parameters, the result revealed that the shoot infestation by brinjal shoot & fruit borer, *L. orbonalis* showed positive non-significant correlation with maximum temperature (r = 0.334) and minimum temperature (r = 0.052) whereas, non-significant negative correlation was recorded with morning relative humidity (r = -0.072), evening relative humidity (r = -0.146) and rainfall (r = -0.356) during *kharif*, 2024 (Table 3). The correlation (r) between brinjal shoot & fruit borer population and weather parameters, the result revealed that the fruit infestation by brinjal shoot & fruit borer, *L. orbonalis* showed positive non-significant correlation with morning relative humidity (r = -0.063) whereas, negative significant correlation was recorded with minimum temperature (r = -0.732*) and (Byx = -1.255) and rainfall (r = -0.581*) and negative non-significant correlation with maximum temperature (r = -0.474) and evening relative humidity (r = -0.262) (Table 4).

The current findings are in agreement with findings of Baldev Ram *et al*. (2018), who revealed that the shoot damage showed a non-significant correlation with minimum temperature (r = 0.37) and rainfall (r = -0.28). Regarding fruit infestation, there was a significant negative correlation with maximum temperature (r = -0.77 based on number and r = -0.80 based on weight), minimum temperature (r = -0.86 based on number and r = -0.87 based on weight), and rainfall (r = -0.59 based on number and r = -0.56 based on weight). The present findings are in agreement with those of Gupta *et al.* (2023), who observed that shoot damage caused by *L. orbonalis* showed a positive and significant correlation with minimum temperature (r = 0.509). Furthermore, the percent fruit damage by *L. orbonalis* was significant negative correlations with minimum temperature (r = -0.831*), rainfall (r = -0.534*), evening relative humidity (r = -0.923*) and Maximum temperature showed a negative but non-significant correlation (r = -0.225) with fruit damage.

**Table 1:** Seasonal incidence and effect of weather parameters on population dynamics of brinjal shoot and fruit borer, *Leucinodes orbonalis* (Guenee) relation to shoot infestation during *kharif*, 2024

| SW | Month & Date | Temperature (℃) | | Relative humidity (%) | | Rainfall (mm) | Shoot infestation (%) |
|---|---|---|---|---|---|---|---|
| | | Max (℃) | Min (℃) | Morning (%) | Evening (%) | | |
| 33th | 12 Aug. - 18 Aug. | 33.7 | 25.3 | 86.7 | 73.3 | 40.7 | 0.00 |
| 34th | 19 Aug.- 25 Aug. | 35.0 | 24.9 | 87.7 | 77.3 | 10.6 | 0.00 |
| 35th | 26 Aug. – 1 Sep. | 34.7 | 23.9 | 81.3 | 67.1 | 45.2 | 0.00 |
| 36th | 2 Sep. – 8 Sep. | 33.7 | 24.7 | 89.1 | 75.3 | 59.8 | 3.22 |
| 37th | 9 Sep. – 15 Sep. | 31.7 | 24.6 | 90.6 | 78.6 | 165.4 | 5.78 |
| 38th | 16 Sep. – 22 Sep. | 31.1 | 23.7 | 87.6 | 77.6 | 42.0 | 8.22 |
| 39th | 23 Sep. – 29 Sep. | 34.7 | 25.5 | 81.4 | 75.4 | 0.0 | 13.22 |
| 40th | 30 Sep. – 6 Oct. | 35.0 | 23.8 | 80.6 | 67.7 | 0.0 | 16.62 |
| 41th | 7 Oct. – 13 Oct. | 34.6 | 21.4 | 77.4 | 57.9 | 0.0 | 20.22 |
| 42th | 14 Oct. – 20 Oct. | 34.2 | 18.9 | 77.3 | 63.3 | 0.0 | 24.68 |
| 43th | 21 Oct. – 27 Oct. | 33.5 | 18.8 | 82.3 | 67.9 | 0.0 | 18.30 |
| 44th | 28 Oct. - 3 Nov. | 33.0 | 18.0 | 83.9 | 68.7 | 0.0 | 16.11 |
| 45th | 4 Nov. – 10 Nov. | 30.8 | 16.8 | 94.1 | 75.6 | 0.0 | 13.20 |
| 46th | 11 Nov. – 17 Nov. | 29.3 | 16.4 | 94.0 | 75.1 | 0.0 | 14.18 |
| 47th | 18 Nov. – 24 Nov. | 25.8 | 11.3 | 93.4 | 75.1 | 0.0 | 7.68 |
| 48th | 25 Nov. – 1 Dec. | 26.5 | 10.2 | 89.3 | 71.0 | 0.0 | 6.00 |
| 49th | 2 Dec. – 8 Dec. | 25.9 | 9.6 | 73.1 | 56.4 | 0.0 | 2.02 |
| 50th | 9 Dec. – 15 Dec. | 22.5 | 7.3 | 69.6 | 55.0 | 0.3 | 1.18 |

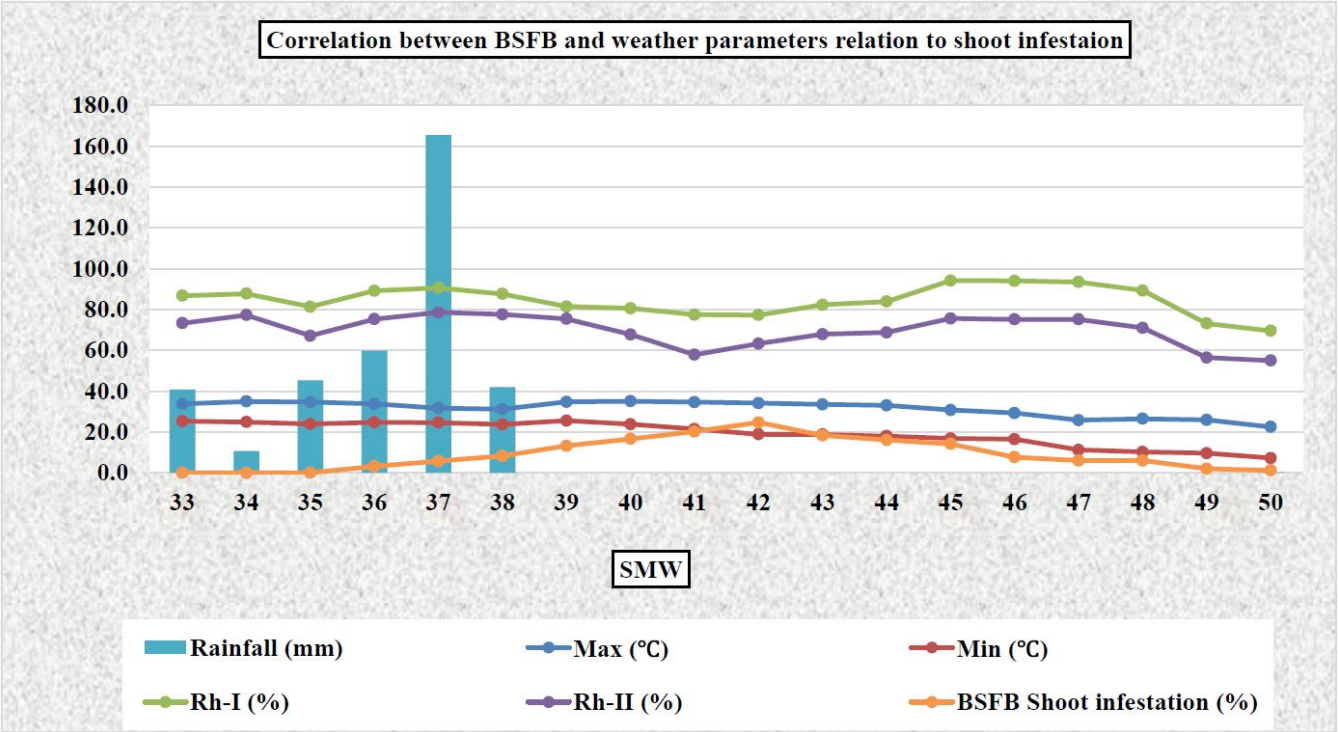


**Fig. 1 :** Seasonal incidence and effect of weather parameters on population dynamics of brinjal shoot and fruit borer, *Leucinodes orbonalis* (Guenee) relation to shoot infestation during *kharif*, 2024.

**Table 2 :** Seasonal incidence and effect of weather parameters on population dynamics of brinjal shoot and fruit borer, *Leucinodes orbonalis* (Guenee) relation to fruit infestation during *kharif*, 2024.

| SW | Month & Date | Temperature (℃) | | Relative humidity (%) | | Rainfall (mm) | Fruit infestation (%) |
|---|---|---|---|---|---|---|---|
| | | Max (℃) | Min (℃) | Morning (%) | Evening (%) | | |
| 33th | 12 Aug. - 18 Aug. | 33.7 | 25.3 | 86.7 | 73.3 | 40.7 | 0.00 |
| 34th | 19 Aug.- 25 Aug. | 35.0 | 24.9 | 87.7 | 77.3 | 10.6 | 0.00 |
| 35th | 26 Aug. – 1 Sep. | 34.7 | 23.9 | 81.3 | 67.1 | 45.2 | 0.00 |
| 36th | 2 Sep. – 8 Sep. | 33.7 | 24.7 | 89.1 | 75.3 | 59.8 | 0.00 |
| 37th | 9 Sep. – 15 Sep. | 31.7 | 24.6 | 90.6 | 78.6 | 165.4 | 0.00 |
| 38th | 16 Sep. – 22 Sep. | 31.1 | 23.7 | 87.6 | 77.6 | 42.0 | 0.00 |
| 39th | 23 Sep. – 29 Sep. | 34.7 | 25.5 | 81.4 | 75.4 | 0.0 | 0.00 |
| 40th | 30 Sep. – 6 Oct. | 35.0 | 23.8 | 80.6 | 67.7 | 0.0 | 8.22 |
| 41th | 7 Oct. – 13 Oct. | 34.6 | 21.4 | 77.4 | 57.9 | 0.0 | 12.18 |
| 42th | 14 Oct. – 20 Oct. | 34.2 | 18.9 | 77.3 | 63.3 | 0.0 | 13.60 |
| 43th | 21 Oct. – 27 Oct. | 33.5 | 18.8 | 82.3 | 67.9 | 0.0 | 20.60 |
| 44th | 28 Oct. - 3 Nov. | 33.0 | 18.0 | 83.9 | 68.7 | 0.0 | 29.60 |
| 45th | 4 Nov. – 10 Nov. | 30.8 | 16.8 | 94.1 | 75.6 | 0.0 | 24.80 |
| 46th | 11 Nov. – 17 Nov. | 29.3 | 16.4 | 94.0 | 75.1 | 0.0 | 22.76 |
| 47th | 18 Nov. – 24 Nov. | 25.8 | 11.3 | 93.4 | 75.1 | 0.0 | 19.44 |
| 48th | 25 Nov. – 1 Dec. | 26.5 | 10.2 | 89.3 | 71.0 | 0.0 | 20.22 |
| 49th | 2 Dec. – 8 Dec. | 25.9 | 9.6 | 73.1 | 56.4 | 0.0 | 16.86 |
| 50th | 9 Dec. – 15 Dec. | 22.5 | 7.3 | 69.6 | 55.0 | 0.3 | 15.03 |

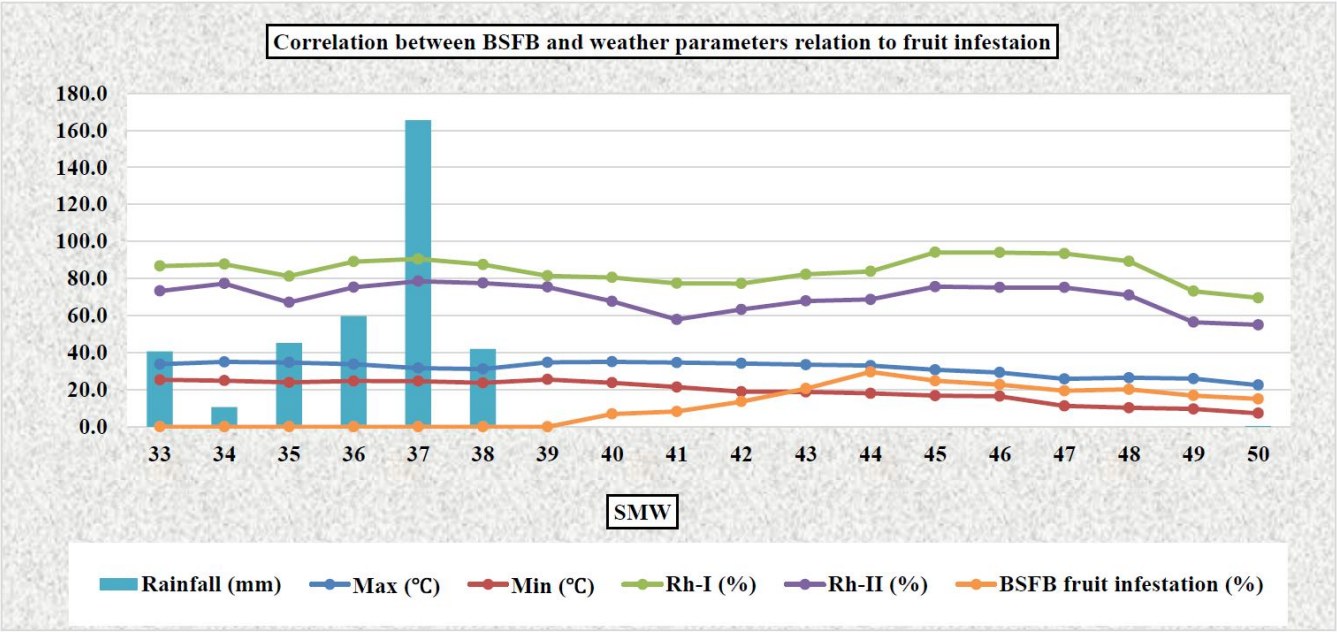


**Fig. 2 :** Seasonal incidence and effect of weather parameters on population dynamics of brinjal shoot and fruit borer, *Leucinodes orbonalis* (Guenee) relation to fruit infestation during *kharif*, 2024

**Table 3 :** Correlation between brinjal shoot & fruit borer and weather parameters relation to shoot infestation during *kharif*, 2024

| Season | Weather parameters | Correlation coefficient (r) | 'Byx' |
|---|---|---|---|
| ***Kharif*, 2024** | **Max. Temp (°C)** | $0.334^{NS}$ | - |
| | **Min. Temp. (°C)** | $0.052^{NS}$ | - |
| | **Relative humidity Morning (%)** | $-0.072^{NS}$ | - |
| | **Relative humidity Evening (%)** | $-0.146^{NS}$ | - |
| | **Rainfall (mm)** | $-0.356^{NS}$ | - |

*Significance at 5% level (P = 0.05) NS – Non-significant

**Table 4 :** Correlation between brinjal shoot & fruit borer and weather parameters relation to fruit infestation during *kharif*, 2024

| Season | Weather parameters | Correlation coefficient (r) | 'Byx' |
|---|---|---|---|
| ***Kharif*, 2024** | **Max. Temp (°C)** | $-0.474^{NS}$ | - |
| | **Min. Temp. (°C)** | -0.732* | -1.255 |
| | **Relative humidity Morning (%)** | $0.063^{NS}$ | - |
| | **Relative humidity Evening (%)** | $-0.262^{NS}$ | - |
| | **Rainfall (mm)** | -0.581* | -0.122 |

*Significance at 5% level (P = 0.05) NS- Non-significant

## Conclusions

The correlation between brinjal shoot and fruit borer and weather parameters relation to shoot infestation was found positive non-significant correlation with maximum temperature and minimum temperature whereas, non-significant negative correlation was recorded with morning relative humidity, evening relative humidity and rainfall during *kharif*, 2024. The fruit infestation by brinjal shoot & fruit borer, *L. orbonalis* showed positive non-significant correlation with morning relative humidity whereas, negative significant correlation was recorded with minimum temperature & rainfall and negative non-significant correlation with maximum temperature and evening relative humidity.

**Acknowledgments**

The authors gratefully acknowledge Dr. K.K. Singh, Hon'ble Vice-Chancellor, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut (U.P.), India, for extending financial assistance and necessary facilities that made this research

possible. Special thankful to Dr. Gaje Singh, Professor, Department of Entomology for his constant guidance, valuable suggestions and support during the entire course of the investigation.

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