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WEATHER IMPACT ON INCIDENCE OF SHOOT AND FRUIT BORER *Earias vittella* (FAB.) INFESTING OKRA DURING KHARIF SEASON

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ABSTRACT

An investigation entitled “Weather Impact on the Incidence of Shoot and Fruit Borer, *Earias vittella* (Fab.) Infesting Okra during the Kharif Season” was conducted at the Instructional Farm, Department of Agronomy, College of Agriculture, Junagadh Agricultural University, Junagadh, Gujarat, India, during the Kharif season of 2025 to investigate the seasonal incidence of *Earias vittella* and its relationship with prevailing weather parameters. The larval population of *E. vittella* was first observed during the 33rd Standard Meteorological Week (SMW), corresponding to the second week of August, with an initial population of 0.13 larva per plant. The population increased progressively and attained its maximum (3.40 larvae per plant) during the 39th SMW (third week of September; 10th week after sowing), followed by a gradual decline towards crop maturity. Correlation analysis indicated that maximum temperature ($r = 0.530^*$) and bright sunshine hours ($r = 0.793^{**}$) exerted significant positive effects on larval abundance. Shoot infestation commenced during the 33rd SMW with 0.90 per cent damage and reached a maximum of 28.30 per cent during the 39th SMW. Shoot infestation exhibited a significant positive correlation with maximum temperature ($r = 0.518^*$) and a highly significant positive correlation with bright sunshine hours ($r = 0.755^{**}$), whereas evening relative humidity ($r = -0.551^*$) and wind velocity ($r = -0.572^*$) showed significant negative correlations. Fruit infestation was first recorded during the 35th SMW (fourth week of August) with 5.00 per cent damage and increased steadily to a peak of 36.56 per cent during the 40th SMW (fourth week of September; 11th week after sowing). Fruit infestation showed a highly significant positive correlation with bright sunshine hours ($r = 0.866^{**}$) and a significant positive correlation with maximum temperature ($r = 0.620^*$), while evening relative humidity ($r = -0.695^{**}$) and wind velocity ($r = -0.642^{**}$) were significantly negatively correlated with fruit damage. The findings indicate that maximum temperature and bright sunshine hours favour the population build-up of *E. vittella*, whereas higher evening relative humidity and wind velocity suppress its incidence under the agro-climatic conditions of South Saurashtra.

Key words : *Abelmoschus esculentus*, *Earias vittella* (Fab.), Population dynamics, Seasonal incidence, Weather parameters, Correlation analysis.

Introduction

Okra [*Abelmoschus esculentus* (L.) Moench], classified under the family Malvaceae, it is most widely cultivated vegetable as crop in tropical and subtropical different regions across the world. The crop is believed to have originated in tropical Africa (Yawalkar, 1973). In India, it is commonly known as “bhindi” or “lady’s finger”

and has a significant position among vegetable crops resulting from its adaptability, grow quickly and high economic returns.

Okra is particularly favoured by small and marginal farmers because of its ease of cultivation, stable yield potential and adaptability to varied agro-climatic conditions (Latha *et al.*, 2019). Okra plays a crucial role in the

livelihood of farmers, yet its growth and yield face major challenges from insect pests are considered as damaging to okra (Mandal *et al.*, 2007).

Globally, okra is cultivated in several countries including India, Iran, Bangladesh, Pakistan, Turkey, Myanmar, Ghana, Malaysia, Ethiopia, Brazil and the southern United States (Swamy, 2023).

India ranks as the leading producer of okra globally, contributing a major share to global production. During 2023-24, okra was cultivated over approximately 5.57 lakh hectares in India, producing about 7.31 million tonnes with an average productivity of 13.12 tonnes per hectare (Anonymous, 2024). The main states in India that produce okra during 2023-24 are Gujarat, Madhya Pradesh, West Bengal, Bihar and Andhra Pradesh. Gujarat is one of the leading okra-producing states, contributing nearly 15 per cent of the country's total production. The crop is extensively cultivated in districts such as Surat, Navsari, Tapi, Vadodara, Ahmedabad, Gandhinagar, Anand, Bhavnagar, Junagadh, Mehsana, Patan and Banaskantha (Anonymous, 2019).

Okra is attacked by numerous insect pests throughout its growth period. Around 13 important pest species, including both insect and non-insect types, infest the crop at different growth stages (Dhamdhare *et al.*, 1984). More than 72 insect pest species have been reported to be associated with okra, causing significant reductions in yield and marketable fruit quality (Pal *et al.*, 2013). Among these, the shoot and fruit borer, *Earias vittella* (Fabricius) (Lepidoptera: Nolidae), is considered one of the most destructive pests, causing severe damage by boring into tender shoots and fruits, thereby reducing both yield and market value.

The incidence and population build-up of *E. vittella* are strongly influenced by climatic elements such as temperature, rainfall and relative humidity. Understanding the seasonal abundance and population dynamics of this pest with respect to climatic factors, is essential for predicting outbreaks and implementing timely management strategies.

Materials and Methods

The experiment was conducted during the *Kharif*-2025 season at the Instructional Farm, Department of Agronomy, College of Agriculture, Junagadh Agricultural University, Junagadh, Gujarat, India, to study the influence of weather parameters on the incidence of the shoot and fruit borer, *Earias vittella* (Fabricius), infesting okra. The okra variety GO-6 (Gujarat Okra-6) was sown during the third week of July 2025 in a 20 × 20 m experimental plot, maintaining a spacing of 60 × 30 cm between rows

and plants. All recommended agronomic practices were followed throughout the crop season, except that no insecticidal treatment was applied to allow the natural development of the pest population.

The experimental plot was divided into 30 quadrats, each measuring 1.20 × 1.80 m. Five plants were selected randomly from each quadrat for recording observations. The absolute larval population of *E. vittella*, along with per cent shoot damage and per cent fruit damage, was recorded at weekly intervals from 15 days after sowing (DAS) until the final harvest. Thus, the data obtained were analysed in relation to various weather parameters to ascertain the population fluctuation of the pest concerning various environmental factors. Weekly observations on pest incidence were correlated with the corresponding meteorological parameters, viz., including maximum temperature (Max. T), minimum temperature (Min. T), bright sunshine hours (BSS), morning relative humidity (RH₁), evening relative humidity (RH₂), wind speed (WS), morning vapour pressure (VP₁), evening vapour pressure (VP₂) and rainfall (R) recorded across various standard weeks. The meteorological data were obtained from the Agro-Meteorological Observatory located at the Instructional Farm, College of Agriculture, Junagadh Agricultural University, Junagadh. Simple correlation analysis was performed to determine the relationship between the incidence of *E. vittella* and the prevailing weather parameters.

Results and Discussion

Our research study titled “Weather impact on incidence of shoot and fruit borer, *Earias vittella* (Fab.) infesting okra during *Kharif* season of 2025 under field conditions at the Instructional Farm, Department of Agronomy, College of Agriculture, Junagadh Agricultural University, Junagadh. Our findings reported are outlined here and examined in context with previous research studies conducted elsewhere, as well as in both direct and indirect relation to the current investigations.

The data summarized in Table 1 and depicted in Fig. 1 on larval population of shoot and fruit borer demonstrated that the incidence of larvae first appeared during 33rd SMW (2nd week of August) with an initial population of 0.13 larva per plant and persisted until crop maturity. The abundance of larva varied from 0.13 to 3.40 per plant during 33th to 44th SMW. The population increased steadily, reached a high of 3.40 larvae per plant on the 39th SMW (third week of September), corresponding to the 10th week after sowing.

The results were supported by Rawat *et al.* (2020), who reported that the larval population of *Earias vittella*

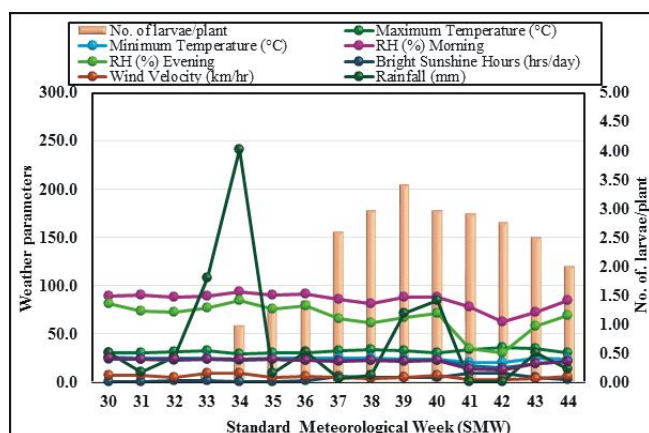


Fig. 1 : Effect of weather parameters on larval population of okra shoot and fruit borer.

Table 1 : Population dynamics of shoot and fruit borer of okra in relation to weather parameters during *Kharif*-2025.

WAS	SMW	Month	Number of larva/plant	Shoot damage (%)	Fruit damage (%)
1 st	30 th	July	0.00	0.00	0.00
2 nd	31 st		0.00	0.00	0.00
3 rd	32 nd		0.00	0.00	0.00
4 th	33 rd	August	0.13	0.90	0.00
5 th	34 th		0.98	2.30	0.00
6 th	35 th		1.25	7.30	5.00
7 th	36 th		1.40	12.21	14.37
8 th	37 th	September	2.58	18.60	22.60
9 th	38 th		2.95	26.80	30.99
10 th	39 th		3.40	28.30	33.80
11 th	40 th		2.95	23.00	36.56
12 th	41 st	October	2.90	21.90	34.72
13 th	42 nd		2.75	19.90	32.30
14 th	43 rd		2.50	9.70	29.00
15 th	44 th		2.00	2.00	13.91

SMW = Standard Meteorological Week

WAS = Week After Sowing

first appeared during 2.10 larvae per plant (32th SMW), reached its peak during the 37th SMW and subsequently declined by the 39th SMW. Similarly, Sonawane *et al.* (2021) noted that the infestation of okra shoot and fruit borer larvae began in 33rd SMW with an initial population of 0.40 larva per plant. The 41st Standard Meteorological Week (SMW) had the highest larval incidence of 5.20 larvae per plant, whereas the 44th SMW, which was the last picking, saw the lowest larval incidence of 3.90 larvae

per plant. Likewise, Yadav *et al.* (2024) reported that the incidence of *E. vittella* started during the 34th SMW (fourth week of August) with an initial population of 0.83 larva per plant and persisted until the final picking of the crop. The larval population increased gradually and attained a peak of 5.92 larvae per plant during the 37th SMW (second week of September). Therefore, the present findings are in close conformity with the reports of earlier workers, although slight variations in the timing and magnitude of peak infestation may be attributed to differences in agro-climatic conditions, crop season, varietal response and prevailing weather parameters.

Shoot damage (%)

The data presented in Table 1 and illustrated in Fig. 2 revealed that the shoot damage caused by *Earias vittella* first appeared during the 33rd Standard Meteorological Week (SMW) (second week of August) with an incidence of 0.90%. The shoot damage gradually increased throughout the cropping period and reached its maximum of 28.30% during the 39th SMW (third week of September), corresponding to the 10th week after sowing. Thereafter, the infestation declined gradually towards crop maturity.

The results were supported by Choudhary and Sharma (2020) observed that shoot and fruit borer activity continued during the okra crop period. Shoot damage first appeared during the second week of August (2.10%) and increased progressively, reaching its maximum (15.15%) during the last week of September. Similarly, Chaudhary *et al.* (2024) observed that shoot and fruit borer infestation commenced during the fourth week of August with an initial shoot damage of 2.10%, increased gradually and attained a peak of 13.32% during the 39th Standard Meteorological Week (SMW), corresponding to the last week of September. Likewise, Sharma *et al.* (2025) reported that shoot infestation began during the 31st SMW (3.20%) and reached its highest level (29.07%) during the 36th SMW. The infestation persisted until the final harvest of the okra crop. Therefore, the present findings are in close conformity with the reports of earlier workers.

Fruit damage (%)

The data presented in Table 1 and illustrated in Fig. 3 revealed that fruit infestation caused by the shoot and fruit borer, *Earias vittella* (Fabricius), first appeared during the 35th Standard Meteorological Week (SMW) (fourth week of August) with an incidence of 5.00%. The per cent fruit damage increased gradually throughout the cropping period and reached its maximum of 36.56% during the 40th SMW (fourth week of September), corresponding to the 11th week after sowing.

Table 2 : Correlation co-efficient ('r') of weather parameters with mean population of *E. vittella* infesting okra during *Kharif*-2025.

Weather parameters	Correlation co-efficient ('r')		
	Mean no. of insects		
	Number of larva/plant	Shoot damage(%)	Fruit damage (%)
Maximum Temperature (°C)	0.530*	0.518*	0.620*
Minimum Temperature (°C)	-0.452	-0.429	-0.514
Morning Relative Humidity (%)	-0.510	-0.391	-0.605*
Evening Relative Humidity (%)	-0.609*	-0.551*	-0.695**
Wind Velocity (km/hr)	-0.622*	-0.572*	-0.642**
Bright Sunshine Hours (hrs/day)	0.793**	0.755**	0.866**
Rainfall (mm)	-0.196	-0.219	-0.292
Morning Vapour Pressure, mm in Hg (VP ₁)	-0.524*	-0.380	-0.596*
Evening Vapour Pressure, mm in Hg (VP ₂)	-0.550*	-0.457	-0.630*

The results were supported by Shivani *et al.* (2023) revealed that fruit damage started from 35th SMW (5.50%) and the peak fruit damage was 38th SMW (20.25%). Similarly, Sharma *et al.* (2025) studied that the fruit borer and shoot incidence begin in the 35th SMW (3.20%) and continued till the 43rd SMW (31.36%). The fruit damage increased gradually, attaining a peak of 36.42% fruit damage during the 39th SMW (4th week of September). Likewise, Rathore *et al.* (2021) recorded that the shoot and fruit borer incidence commenced from the 37th SMW (4.98%). The fruit damage increased steadily and reached its maximum of 40.12% during the 42nd SMW, after which it declined to 8.57% during the 46th SMW. Therefore, the present findings are in close conformity with the reports of earlier workers, although slight variations in the onset and peak infestation may be attributed to differences in agro-climatic conditions, crop season, varietal response and prevailing weather parameters.

Correlation studies

The larval population shown in Table 2 had a highly significant positive association with bright sunshine hours ($r = 0.793^{**}$), whereas maximum temperature ($r = 0.530^{*}$) had a significant positive correlation, according to a correlation coefficient analysis (Table 2 and Fig. 1). There is a significant negative association with wind speed ($r = -0.622^{*}$), evening relative humidity ($r = -0.609^{*}$) and morning and evening vapor pressure ($r = -0.524^{*}$, -0.550^{*} , respectively). However, there is a negative, non-significant association with total rainfall ($r = -0.196$), morning relative humidity ($r = -0.510$) and minimum temperature ($r = -0.452$).

The present findings are in conformity with earlier reports indicating the significant influence of weather parameters on larval population. Raju *et al.* (2017) found that there was a positive correlation between the shoot and fruit borer larvae population and sunlight, but a non-significantly negative correlation with minimum temperature, morning relative humidity and rainfall. According to Rawat *et al.* (2019), there was a non-significant negative correlation with lowest temperature ($r = -0.162$) and a positive correlation with larval population with maximum temperature ($r = 0.513$). Sonawane *et al.* (2021) found that larval population showed a negative non-significant correlation with morning relative humidity ($r = -0.065$) and rainfall ($r = -0.052$).

According to the correlation coefficient analysis data shown in Table 2 and Fig. 2 revealed that shoot damage showed a significant positive correlation with maximum temperature ($r = 0.518^{*}$), while bright sunshine hours ($r = 0.755^{**}$) had a highly positive significant correlation and a significant negative correlation with evening humidity ($r = -0.551^{*}$) and wind velocity ($r = -0.572^{*}$). The minimum temperature ($r = -0.429$), morning relative humidity ($r = -0.391$), morning vapor pressure ($r = -0.380$), evening vapor pressure ($r = -0.457$) and total rainfall ($r = -0.219$) all showed negative, non-significant correlations.

The results were supported by Choudhary and Sharma (2020) revealed that there was a significant positive correlation between the percentage of shoot damage and weather parameters and the highest temperature ($r = 0.650$), however there was a negative correlation between relative humidity and rainfall. Chaudhary *et al.* (2024) found that shoot damage had a

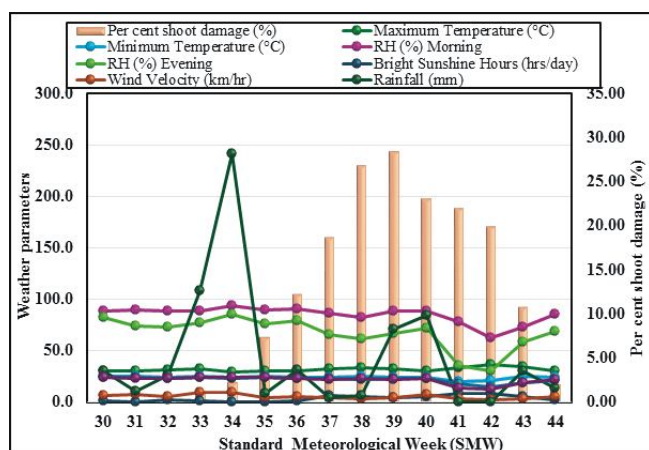


Fig. 2 : Effect of weather parameters on per cent shoot damage in okra.

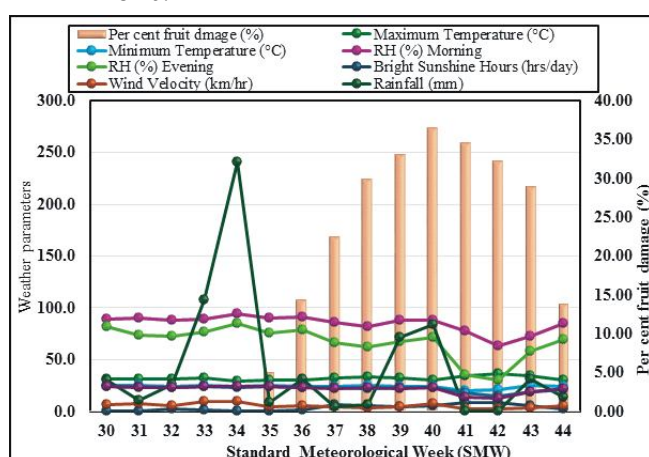


Fig. 3 : Effect of weather parameters on per cent fruit damage in okra.

positive correlation with maximum temperature ($r = 0.194$) and a negative correlation with rainfall ($r = -0.362$). Sharma. *et al.* (2025) found that morning relative humidity ($r = -0.091$) and rainfall ($r = -0.559$) had a negative correlation with shoot infection, while maximum temperature ($r = 0.319$) and wind speed ($r = 0.213$) had a positive correlation with shoot infestation.

The correlation coefficient analysis (Table 2 and Fig. 3) revealed that per cent fruit damage indicated significant highly positive correlation with bright sunshine hours ($r = 0.866^{**}$), while maximum temperature ($r = 0.620^{*}$) showed significant positive correlation and negatively with evening humidity ($r = -0.695^{**}$), wind velocity ($r = -0.642^{**}$). Significant negative correlation with morning relative humidity ($r = -0.605^{*}$). While negative non-significant correlation with minimum temperature ($r = -0.514$) and total rainfall ($r = -0.292$).

Rathore *et al.* (2021) noted that the population of shoot and fruit borer (*E. vittella*) decreased as temperatures dropped. In contrast, higher maximum temperatures were associated with an increase in pest

infestation levels. Shivani *et al.* (2023) reported that non-significant negative correlation between shoot and fruit borer infestation and rainfall ($r = -0.11$). Aman *et al.* (2025) reported that the fruit damage exhibited a non-significant negative correlation with minimum temperature ($r = -0.013$), relative humidity ($r = -0.083$) while non-significant positive relationship with maximum temperature ($r = 0.216$). Sharma. *et al.* (2025) reported that there was a negative correlation between fruit infestation and minimum temperature ($r = -0.674$), morning relative humidity ($r = -0.513$), evening relative humidity ($r = -0.532$) and rainfall ($r = -0.611$).

Conclusion

The present study revealed that the peak larval population and maximum shoot damage caused by *Earias vittella* were recorded during the 39th Standard Meteorological Week (SMW) (third week of September), corresponding to the 10th week after sowing. The larval population and shoot damage exhibited significant positive correlations with maximum temperature and bright sunshine hours, whereas significant negative correlations were observed with wind speed, evening relative humidity and vapour pressure. However, minimum temperature, morning relative humidity and rainfall showed non-significant negative correlations with pest incidence. The highest fruit damage was recorded during the 40th SMW (fourth week of September), corresponding to the 11th week after sowing. Fruit infestation also showed significant positive correlations with maximum temperature and bright sunshine hours, while wind speed, relative humidity and vapour pressure were significantly and negatively correlated. In contrast, minimum temperature and rainfall exhibited non-significant negative correlations. These findings indicate that weather parameters play a crucial role in regulating the seasonal incidence of *E. vittella* and can be effectively utilized for forecasting pest outbreaks and planning timely pest management strategies in okra.

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Author contribution

Mamta J.: She is main researcher for the said research findings. Gadhiya V.C.: He has served as major advisor of the research findings.

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