International Journal of Entomology Research
www.entomologyjournals.com
ISSN: 2455-4758
Received: 02-05-2026, Accepted: 02-06-2026, Published: 17-06-2026
Volume 11, Issue 2, 2026, Page No. 483-485

Seasonal incidence of early shoot borer, *Chilo infuscatellus* Snellen on sugarcane in relation to weather parameters

Gangurde S M*, Nalawade S V, Ubale S S, Bhilare R L
Central Sugarcane Research Station, Padegaon, Tal. Phaltan, Maharastra, India
Corresponding author: Gangurde S M
DOI: https://doi.org/10.66856/ijer.2026.11.2.11205

Abstract
The studies on population dynamics of early shoot borer, *Chilo infuscatellus* Snellen on sugarcane variety Co 86032 was conducted during the year 2021-22 at Central Sugarcane Research Station, Padegaon, Dist. Satara, in Maharashtra state. It was revealed from the studies that the incidence of early shoot borer was first noticed in 11th MW. The incidence of early shoot borer was observed from 11th to 26th MW in the range of 0.88 to 10.08 per cent. The highest incidence of early shoot borer 10.08 per cent was recorded during 15th MW. Correlation of early shoot borer population with different weather parameters showed that there was a significant positive correlation with maximum temperature and had a non-significant negative correlation with minimum temperature and rainfall whereas it has significant and negative correlation with morning and evening relative humidity. The effect of bright sunshine hours with per cent damage by early shoot borer showed a non-significant positive correlation.

Keywords: *Chilo infuscatellus* Snellen, weather parameters, population dynamics, early shoot borer, sugarcane, correlation

Introduction

Sugarcane, *Saccharum officinarum* L., is one of the important long duration cash crops of Maharashtra. Sugar and jaggery are produced from sugarcane. Besides sugar and jaggery production, sugarcane produces number of important products like, alcohol used for pharmaceutical industry, press mud used as an organic matter in soil and ethanol as a fuel and it is also used for beverage purpose. In India, sugarcane cultivation and sugar industry play an important role in socio-economic development by creating rural resources and getting higher income and employment opportunities. About 45 million sugarcane farmers and their dependents including agricultural labourer are involved in Indian sugar industry (Dhanraj and Dharne, 2013) [6]. Sugar industry is second largest agro-based industry which comprises of more than 500 sugar mills, next to textiles (Takale, 2013) [17].

Sugarcane crop is attacked by several insect-pests at different stages of growth. Borers are the most important pests to cause damage to the cane from planting to harvest and affect the sustainability of cane production. Early shoot borer, *Chilo infuscatellus* is a wide spread pest in all sugarcane growing areas of the country. This pest attacks the crop at early periods of growth with its peak activity during May-June in places like Punjab, Haryana and Uttar Pradesh (Butani, 1969) [4]. The larva of shoot borer starts damage by boring on the lateral side of the plant to make a way to the base of the stalk through a bored entry hole and inside the plant it bores downwards or upwards killing the growing point. This would sever the central leaf spindle which dries up to form dead heart symptom that can be pulled out effortlessly (Srikanth, 2012) [15]. Early shoot borer, *Chilo infuscatellus* Snellen is a cosmopolitan pest distributed throughout India but in central Uttar Pradesh it has now become a major pest (Singh *et al*., 1998) [13]. In terms of cane yield it is equivalent to 0.6- 38.78 tonnes/ha and 0.4-4.2 units of sugar recovery (Chaudhary, 2008) [5]. The early shoot borer, *C. infuscatellus* is more active during hot periods of the year both in tropical (Murthy, 1953; Sulaiman, 1954; Jagannatha Rao and Jagannatha Rao, 1960; Varadharajan *et al.,* 1972) [9, 11, 16, 19] and subtropical India (Khan and Singh, 1942; Agarwala and Huque, 1955; Gupta, 1959; Bains and Dev Roy, 1981) [1, 3, 7, 10].

Hence the present study was under taken to analyze the effect of weather factors on the incidence of early shoot borer in sugarcane crops.

Materials and Methods

The field trial was conducted at Central Sugarcane Research Station, Padegaon, Dist. Satara, in Maharashtra state during the year 2021-22 in Suru crop season. The sugarcane variety Co 86032 was selected for the study which was planted on 04th February, 2021 at 150 cm row to row spacing. All the recommended agronomic practices were carried out except insecticidal application. The incidence of early shoot borer was recorded at weekly intervals starting from 11th MW to 25th MW. The observations on dead heart counts were recorded weekly and per cent incidence was calculated on dead heart basis by following formula-

$$\text{Per cent incidence} = \frac{\text{No. of infested shoots}}{\text{Total no. of shoots}} x\ 100$$

The data on weather parameters such as maximum temperature (ºC), minimum temperature (ºC), relative humidity (%), sunshine hours (hrs /day) and rainfall (mm) was obtained from the meteorological observatory of Central Sugarcane Research Station, Padegaon. Thus, the data on per cent incidence of early shoot borer was correlated with the weather parameters *viz*., maximum temperature (ºC), minimum temperature (ºC), morning relative humidity (%), evening relative humidity (%), bright sunshine hours (hours) and rainfall (mm).

Results and Discussion

The data presented in table 1 showed that the incidence of early shoot borer was found in the range of 1.25 to 10.08 per cent. Initial incidence was recorded during 11th MW week (1.25 %). Thereafter, the incidence showed increasing trend and recorded peak incidence on 15th MW with 10.08 per cent. After that the incidence showed decreasing trend.

It is revealed from the Table 2 that the correlation of early shoot borer population with different weather parameters showed that there was a significant positive correlation with maximum temperature and had a non-significant negative correlation with minimum temperature and rainfall whereas it has significant and negative correlation with morning and evening relative humidity. The effect of bright sunshine hours with per cent damage by early shoot borer showed a non-significant positive correlation.

The present findings agreed with the findings of Tanwar and Bajpai (1993) [18], who reported that there was significant positive correlation between maximum temperature with early shoot borer incidence. In the earlier studies of Hapse *et al.*, (1979) and Avasthy and Tiwari (1986) [2], the role of maximum temperature was also noticed. Rao and Babu (2004) [12] reported that the studies on light trap catches of early shoot borer moths were found significant positive correlation between moth catches and maximum, minimum temperatures. Sithanantham *et al.* (1975) [14] observed that less rainfall was most favourable for the multiplication of early shoot borer.

Conclusion

The incidence of early shoot borer was found in the range of 1.25 to 10.08 per cent. and the peak incidence was recorded on 15th MW with 10.08 per cent. The correlation of early shoot borer population with different weather parameters showed that there was a significant positive correlation with maximum temperature, a non-significant negative correlation with minimum temperature and rainfall whereas it has significant and negative correlation with morning and evening relative humidity. There was non-significant positive correlation was observed with bright sunshine hours and per cent damage by early shoot borer.

Table 1: Population dynamics of early shoot borer on sugarcane in relation to weather parameters

Sr. No.	MW	Date of observation	Early Shoot Borer (% incidence)	Temperature		Relative Humidity		Bright Sunshine Hours (h)	Rainfall (mm)
				Max. (^{0}C)	Min. (^{0}C)	Mor. (%)	Eve. (%)		
1	9	27.2.21	0.00	30.2	14.3	98.0	89.1	8.1	0.0
2	10	08.3.21	0.00	29.1	14.3	98.0	70.1	6.9	0.0
3	11	15.3.21	1.25	30.1	16.1	96.3	71.7	7.1	0.0
4	12	22.3.21	3.69	28.2	17.5	93.7	80.3	4.7	0.0
5	13	30.3.21	8.52	33.2	17.0	82.1	63.4	8.0	0.0
6	14	6.4.21	9.85	35.6	18.0	82.1	68.6	8.0	0.0
7	15	13.4.21	10.08	34.8	20.6	86.7	64.3	4.1	3.3
8	16	20.4.21	7.75	37.4	20.9	91.9	54.6	9.4	0.0
9	17	27.4.21	4.12	37.6	20.3	93.6	59.1	8.3	0.0
10	18	5.5.21	5.90	37.0	20.9	91.1	77.3	6.9	1.1
11	19	12.5.21	3.68	37.9	22.4	94.3	67.7	7.2	0.8
12	20	17.5.21	3.02	33.1	22.5	95.0	79.6	3.8	0.5
13	21	25.5.21	3.10	36.4	22.6	96.4	80.7	7.9	0.0
14	22	2.6.21	3.37	34.9	22.8	96.9	85.3	7.4	5.7
15	23	09.6.21	2.03	33.1	21.6	97.4	86.9	6.4	15.0
16	24	15.6.21	1.36	31.5	22.8	97.6	85.0	5.0	1.3
17	25	24.6.21	0.88	30.2	21.8	97.7	88.3	5.4	5.1
18	26	1.7.21	0.00	30.1	22.9	97.7	87.0	4.4	0.7
19	27	8.7.21	0.00	33.3	22.6	98.0	90.0	7.6	0.8
20	28	15.7.21	0.00	29.3	21.9	98.0	91.3	2.1	5.5

Table 2: Correlation between weather parameters and early shoot borer on sugarcane

Sr. No.	Weather parameters	Correlation coefficient (r values) Per cent incidence of Early shoot borer
1	Maximum temperature (ºC)	0.560*
2	Minimum temperature (ºC)	-0.123
3	Morning relative humidity (%)	-0.920**
4	Evening relative humidity (%)	-0.638**
5	Rainfall (mm)	-0.175
6	Bright Sunshine hours (Hrs/day)	0.306

* Significant at 5% ** Significant at 1%

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