

SHORT COMMUNICATION**Infestation levels of sugarcane shoot borer *Chilo infuscatellus* in Cauvery delta zone of Tamil Nadu, India**

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Abstract

Status of sugarcane shoot borer *Chilo infuscatellus* Snellen (Lepidoptera: Pyralidae) in the sugarcane command area of Pudukottai and Thanjavur districts lying in the Cauvery delta zone of Tamil Nadu, India, was assessed in May and October during 2013-2015. Infestation levels of the borer varied among eight divisions of the command area, two seasons and three years. In May, mean infestation rate was the highest in Vallathirakottai division (44.32%) and lowest in Andakulam division (37.86%). In October, the highest mean infestation rate was observed in Avanam (37.99%) and the lowest in Andakulam (25.49%). Repeated measures ANOVA analysis indicated that mean shoot borer infestation rate was significantly higher (40.84%) in May than in October (31.24%). Also, mean infestation rate was significantly lower in 2013 than in 2015. The possible factors responsible for the observed variation are discussed.

Keywords: Sugarcane; Shoot borer; *Chilo infuscatellus*; Cauvery delta zone; Pudukottai; Thanjavur

Sugarcane, *Saccharum officinarum* L., is one of the major commercial crops grown throughout the world in tropical and sub-tropical conditions. Worldwide, sugarcane occupies an area of 27.1 Mha with a total production of 1880.0 Mt at a productivity rate of 70.8 t/ha. (Shivashankara et al. 2018). In India, sugarcane is cultivated in over 4.73 Mha with a production of 376.91 Mt and productivity of 79.60 t/ha (Anonymous 2019). The second most important commercial crop in Indian agriculture after cotton, sugarcane also serves as raw material for alcohol production, power generation and biofertilizers.

Insect pests are a major constraint in sugarcane production resulting in estimated losses of about 20% in India (Avasthy 1983). Of the 200 species of insects and non-insects observed to infest the crop, a dozen are known to assume the status of major pests (David and Nandagopal 1986). Shoot borer *Chilo infuscatellus* Snellen (Lepidoptera: Pyralidae), a widespread pest in all sugarcane growing areas of the country (Srikanth 2019), attacks in the early stage. The larva enters laterally making a hole in the shoot and feeds on the meristem producing deadhearts (Fig. 1). Shoot borer is reported to destroy 26-65% mother shoots and 6.4, 27.1 and 75.0% primary, secondary and tertiary tillers, respectively (Krishnamurthy Rao

1954; Doss 1956). In severe cases of infestation, the damage due to the borer could be as much as 90% (Prasada Rao et al. 1991).



Figure 1. Deadhearts in young sugarcane crop caused by shoot borer

Estimation of damage status and pest populations is needed for decision making in pest management programs. Periodical surveys are vital to identify key or target pests and determine their relative abundance in different agro-climatic zones. Keeping this in view, the present study was carried out in the sugarcane command areas of Pudukottai and Thanjavur districts lying in the Cauvery delta zone of Tamil Nadu, India, to assess the infestation levels caused by sugarcane shoot borer.

A field study to assess shoot borer status in Pudukottai (10.38°N, 78.82°E) and Thanjavur (10.08°N, 79.16°E) districts, possessing almost similar soil and climatic conditions, was carried out during 2013-2015. Incidence levels of the borer were recorded in May and October of each study year on the popular sugarcane varieties Co 86032 and PI 1110 in eight divisions (Table 1) of M/s E.I.D. - Parry (India) Ltd. In each division, a 2 ac field with 45-90 d old crop was selected, 250 random clumps were marked, and the number of deadhearts and total number of plants were recorded from these clumps.

The infestation rate of the borer was calculated using the following formula:

$$\text{Infestation rate} = \frac{\text{Number of deadhearts}}{\text{Total number of shoots}} \times 100$$

Table 1. Shoot borer infestation rates in different factory divisions of Pudukottai and Thanjavur districts

Division	Infestation rate (%)					
	May			October		
	2013	2014	2015	2013	2014	2015
Andakulam	35.98	39.46	38.15	18.97	26.29	31.21
Pudukottai	45.68	35.57	37.23	22.46	23.89	36.56
Vallathirakottai	47.35	45.87	39.75	20.73	32.33	36.32
Aranthangi	42.11	46.33	38.63	29.12	38.15	35.22
Alangudi	35.02	39.08	40.14	22.05	33.94	28.65
Vettanviduthy	42.45	43.74	39.94	26.04	35.26	35.28
Avanam	45.65	38.40	45.84	36.45	38.30	39.21
Pattukottai	43.97	31.93	41.74	35.15	29.06	39.03

Table 2. Comparison of shoot borer infestation rates in different factory divisions of Pudukottai and Thanjavur districts

Month	Infestation rate (%)			Mean [#]
	2013	2014	2015	
May	42.28	40.05	40.18	40.84 a
October	26.37	32.15	35.19	31.24 b
Mean [#]	34.32 a	36.10 ab	37.68 b	

[#] Means separated by the same letter in the column/row are not significantly different ($P > 0.05$) by repeated measures ANOVA on arcsin transformed data

Repeated measures ANOVA was applied to the data of shoot borer with May and October observations as the levels of between-group factor, three years of study (2013-15) as the levels of within-subject repeated measure factor and the eight divisions as replications after arcsin transformation, as in our earlier study with sugarcane pyrilla (Mahesh et al. 2019). Box plots were used for graphical depiction of means; the analyses were performed using StatSoft Inc. (2004).

In the survey conducted in May, infestation rate of shoot borer for the period 2013-15 in different divisions showed minimum variation (Table 1). The highest mean infestation rate was observed in Vallathirakottai division (44.32%) followed by Avanam (43.30%), Aranthangi (42.36%), Vettanviduthy (42.04%), Pudukottai (39.49), Pattukottai (39.21) and Alangudi (38.08%). The lowest infestation was recorded in Andakulam division (37.86%).

In October, infestation rate of shoot borer (2013-15) in different divisions showed moderate variation (Table 1). The highest mean infestation rate was observed in Avanam (37.99%) followed by Pattukottai (34.41%), Aranthangi (34.16%), Vettanviduthy (32.19%), Vallathirakottai (29.79%), Alangudi (28.21%) and Pudukottai (27.64%). Andakulam division was found to have the lowest deadheart damage (25.49%).

Repeated measures ANOVA of arcsin transformed data from the three years and two seasons (Fig. 2)

showed significance for seasons ($F_{1,14} = 30.26$; $P < 0.001$) but not for years ($F_{2,28} = 3.08$; $P = 0.062$); however, the interaction between seasons and years was significant ($F_{2,28} = 7.94$; $P < 0.01$). Post-hoc analysis showed that shoot borer incidence was significantly lower in 2013 than in 2015; it was significantly higher in May than in October (Table 2).

Mean shoot borer infestation rates over the three study years showed minimum variation among different divisions in May which is the general peak period of its activity. The favorable climatic conditions and homogeneity of crop system, i.e. availability of crop of suitable age may have encouraged such uniform distribution of the borer among the divisions. On the other hand, borer incidence in October showed moderate variation among the divisions and this could be due to differential activity of natural enemies which is known to vary at the micro-geographical level (Srikanth et al. 2001).

Analysis of the yearly infestation data showed overlapping differences among the three years with the lowest in 2013 and highest in 2015. This indicated a gradual rise in the borer abundance over the three years, primarily contributed by its increase in October and partly by the higher incidence in May in all the three years. In long term studies, shoot borer displayed such year-to-year variation in abundance in habitats with

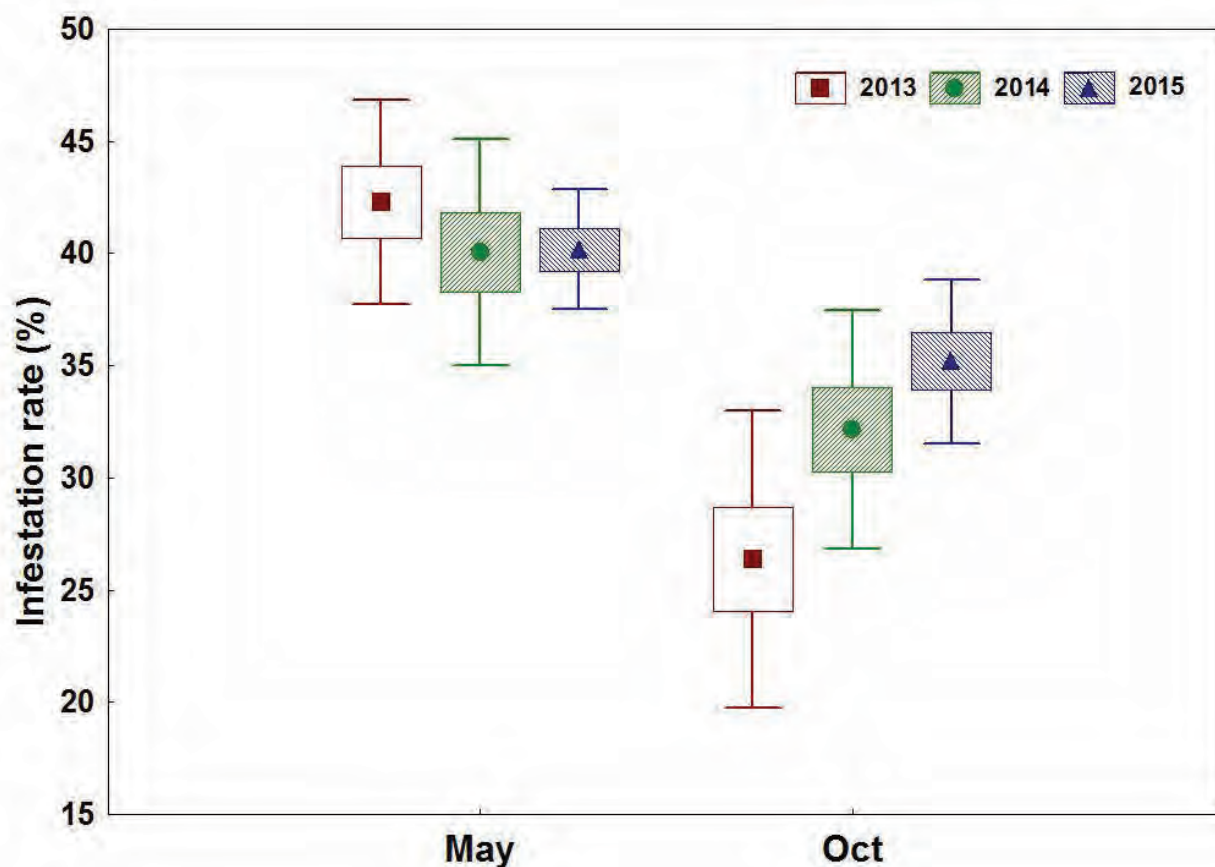


Figure 2. Mean infestation rates of shoot borer in different seasons and years

moderate climatological conditions (Srikanth et al. 2002, 2009). Surveys conducted two years later in Pudukottai and Thanjavur districts revealed similar infestation rates (N. Geetha and M. Punithavalli, personal communication with authors, June 6, 2020). Which indicated that the borer is maintaining its status in these areas, probably due to no major climatological and crop habitat changes.

The significantly higher borer infestation rates in May than in October during the study period is consistent with the known preference of shoot borer for summer. Avasthy and Tiwari (1986) observed heavy borer infestation under high temperature and low to moderate humidity conditions. Similarly, it was more active during

hot periods of the year both in tropical and sub-tropical parts of the country (Mali 1990; Mahla and Chaudhary 1992; Sabale et al. 2005). Two population peaks, one in May and the other in October, observed in Maharashtra (Mali 1990) are identical with the present findings. This indicated that the borer is capable of displaying similar population patterns in different geographical locations and climatological conditions. Considerable variations in the levels of shoot borer incidence were observed in different months of planting (David and Sithanatham 1980). Its occurrence throughout the year with peaks during July-August in high incidence years was attributed to the moderate climatological conditions in the habitat (Srikanth et al. 2002, 2009).

Notwithstanding the variations among the divisions, seasons and years, shoot borer infestation rates in the present study area were above the economic threshold levels (ETL) determined for the borer (David and Sithanatham 1986). Such high incidence in both seasons warrants examination of local conditions contributing to it which will enable adoption of suitable control measures for the borer.

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