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Seasonal incidence of yellow stem borer (*Scirpophaga incertulas* Walker) and its relationship with weather parameters in basmati rice

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Abstract

Rice (*Oryza sativa* L.) is a key staple food crop globally, but its productivity is severely limited by insect pests, particularly the yellow stem borer (*Scirpophaga incertulas* Walker). The present field study was conducted during Kharif 2022 at the Crop Research Centre, SVPUAT, Meerut, to recorded the incidence of yellow stem borer (*Scirpophaga incertulas* Walker). The incidence of yellow stem borer recorded as dead hearts and white ear heads ranged from 2.43 to 6.55 percent. The incidence of yellow stem borer (*Scirpophaga incertulas* Walker) was reached highest (6.55 percent dead hearts) during 37th standard week. The highest white ear heads infestation was 6 percent recorded during 42th standard week. The incidence of yellow stem borer (*Scirpophaga incertulas* Walker) was a non-significant positive correlation with maximum temperature ($r = 0.105$), evening relative humidity ($r = 0.411$) and non-significant negative correlation with minimum temperature ($r = -0.003$), morning relative humidity ($r = -0.242$) and rainfall ($r = -0.155$). These findings provide valuable information for forecasting yellow stem borer incidence and optimizing the timing of integrated pest management strategies in basmati rice.

Keywords: *Oryza sativa* L., yellow stem borer, *Scirpophaga incertulas* Walker, basmati rice

Introduction

Rice (*Oryza sativa* L.) is a staple food crop for over half of the world's population and is widely cultivated globally. Rice is grown under diverse conditions. India is the largest rice growing country and India has officially overtaken China as the world's top rice producer (Devi and Varma, 2022) [3]. India now produces around 150 million metric tons per year, whereas China's output is around 145 million metric tonnes (Anonymous 2026) [1]. Rice cultivation requires a warm and humid atmosphere, which also promotes insect survival and growth. In India, it accounts for 52% and 55% of total food grain and cereal production, respectively. It is produced in several ecosystems, including flooded, irrigated, rainfed lowland and upland areas (Jasrotia *et al.*, 2019) [6]. Over a hundred insect species are thought to have caused significant damage to rice crops. The majority of them are minor and intermittent, resulting in occasionally economic losses. Certain insects have a considerable impact on rice development and yield, making them a major pest. Rice stem borers, which belong to the Lepidoptera order, are extremely damaging pests. In India, 18 Pyralidae stem borer species and three Noctuidae species have been identified. The yellow stem borer (*Scirpophaga incertulas* Walker) is a highly damaging and widespread monophagous insect pest in the Indian subcontinent. YSB infests rice plants during the cropping season (Baskaran *et al.*, 2019) [2]. According to Sharma *et al.*, (2018) [2], yellow stem borer (*Scirpophaga incertulas* Walker) causes yield losses in rice ranging from 20 to 70%. This pest can be identified in fields by "dead heart" or "white ear" in vegetative hills and panicles during reproductive phases, caused by larval feeding and inter-nodal penetration. Abiotic conditions including temperature, humidity, and rainfall impact insect populations, either directly or indirectly (Jasrotia *et al.*, 2019) [6]. Climate change will impact insect behavior, distribution, and abundance, resulting in more annual generations, higher winter survival rates, and earlier appearance of most insects (Patel and Singh, 2017) [8]. Insect pest management involves studying insect incidence, population distribution on crops, and conducting regular field

surveys. Seasonal incidence studies improve insecticide application planning by identifying peak activity and insect-free periods during crop growth. Insect pest populations fluctuate based on both abiotic (rainfall, relative humidity, temperature) and biotic (natural enemies) components of a given area. This study aims to investigate how abiotic conditions influence the population build-up of yellow stem borer (*Scirpophaga incertulas* Walker) populations.

Materials and Methods

The field experiment on rice (Pusa Basmati-1509) was conducted during *Kharif*, 2022 at the Crop Research Centre, Chirori, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut (U.P.) in randomized block design (RBD) with three replications. The standard weekly average data on temperature, relative humidity, rainfall, rainy days and sunshine hours during growing season were recorded at meteorological observatory located at the Crop Research Centre of Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut (U.P.) for the year, 2022. The rice crop was grown in *Kharif*, 2022 and average weekly weather observations were recorded during July to October of the year. The plot size for seasonal incidence of yellow stem borer (*Scirpophaga incertulas* Walker) was 6 x 4.5 m². Observations were recorded on dead hearts and white ear heads of yellow stem borer, *Scirpophaga incertulas* (Walker). Five hills per plot were selected randomly from separated plot grown for seasonal incidence of yellow stem borer (*Scirpophaga incertulas* Walker). The selected hills were observed regularly after transplanting till the harvesting of the crop at weekly interval and meteorological data was recorded simultaneously from the meteorological observatory. Maximum dead heart percent infestation was observed during the vegetative phase and maximum white ear head percent infestation was highest during the reproductive phase of the crop growth period. The infected tillers of the hills were removed each time after the observation was taken. The data collected on the pest population was correlated with the maximum temperature, minimum temperature, morning relative humidity, evening relative humidity and rainfall to study the effect of these variables on seasonal incidence of yellow stem borer (*Scirpophaga incertulas* Walker). Calculation of the percentage infestation of yellow stem borer (*Scirpophaga incertulas* Walker) were done by using the following formula.

$$\text{Percent dead hearts} = \frac{\text{Number of dead hearts}}{\text{Total number of tillers/hill}} \times 100$$

$$\text{Percent white ear heads} = \frac{\text{Number of white ear heads}}{\text{Total number of panicles/hill}} \times 100$$

The data recorded during the course of investigation were also analysed with the help of computer software “OPSTAT” developed by O.P. Sheoran, CCS HAU, Hisar.

Results and Discussion

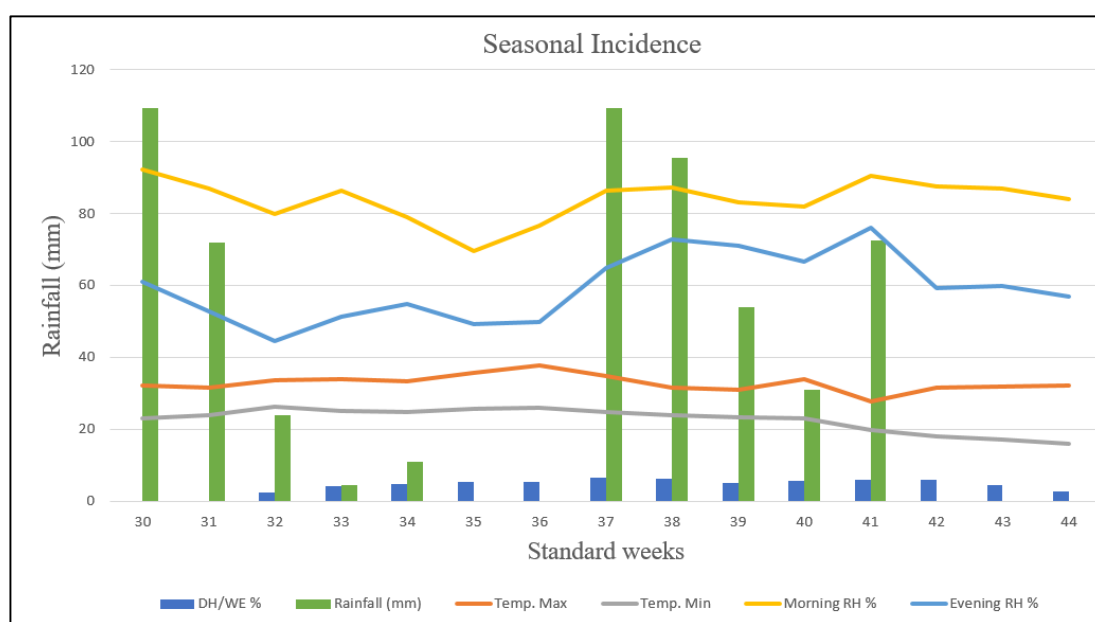
Data showed that the incidence of yellow stem borer (*Scirpophaga incertulas* Walker) appeared firstly in 32th standard week and continued till the 44th standard week (Table 1). The incidence of yellow stem borer (*Scirpophaga incertulas* Walker) recorded as dead heart and white ear heads ranged from 2.43 to 6.55 percent during *Kharif*, 2022. The incidence of yellow stem borer (*Scirpophaga incertulas* Walker) was increased gradually in last week of August and reached its peak (6.55 percent dead heart) during 37th standard week the weather parameters like temperature, relative humidity and rainfall ranged from 24.7 to 34.7°C, 64.9 to 86.3%, 109.5 mm, respectively. The highest white ear heads infestation was 6 percent recorded during 42th standard week. The yellow stem borer incidence suddenly decreased after last week of week of October i.e., 43th and 44th standard week this might due to no emergence of new leaves.

The correlation between infestation of yellow stem borer with weather parameters are presented in table 1 and figure 1. The correlation matrix indicated that there was a non-significant positive correlation with maximum temperature ($r = 0.105$), evening relative humidity ($r = 0.411$) and non-significant negative correlation with minimum temperature ($r = -0.003$), morning relative humidity ($r = -0.242$) and rainfall ($r = -0.155$). Morshed *et al.* (2020) [7] reported that the non-significant positive correlation with maximum temperature and non-significant negative correlation with minimum temperature. Guru-Pirasanna-Pandi *et al.* (2021) [4] had reported the negative correlation with minimum temperature and rainfall. Jastoria *et al.* (2019) had also reported the non-significant positive correlation with maximum temperature and non-significant negative correlation with minimum temperature. Hatwar *et al.* (2021) [5] found that the infestation by yellow stem borer showed non-significant positive correlation with maximum temperature and non-significant negative correlation with minimum temperature, morning relative humidity and rainfall. Rana *et al.* (2017) [9] who had also reported that the positive correlation with evening relative humidity. Shilpa *et al.* (2018) [10] reported negative correlation with rainfall.

Table 1: Incidence of yellow stem borer on basmati rice and abiotic factors during *Kharif*, 2022

Standard weeks	Mean yellow stem borer population (DH/WE%)	Temp. Max.	Temp. Min.	Morning RH%	Evening RH%	Rainfall (mm)
30	0	32.3	22.9	92.3	60.9	109.3
31	0	31.7	23.9	87.1	52.9	72
32	2.43	33.7	26.3	80	44.6	24
33	4.25	33.8	25.1	86.4	51.3	4.5
34	4.65	33.3	24.9	79.1	54.9	11
35	5.35	35.7	25.7	69.6	49.4	0
36	5.45	37.8	26	76.7	49.7	0
37	6.55	34.7	24.7	86.3	64.9	109.5
38	6.25	31.7	23.8	87.4	72.7	95.5
39	5.12	31.1	23.3	83	71.1	54
40	5.55	34	23	82	66.7	31
41	5.88	27.7	19.9	90.6	76	72.4
42	6	31.6	17.9	87.7	59.3	0
43	4.34	32	17.1	86.9	60	0
44	2.77	32.2	16.1	83.9	57	0
Simple correlation coefficient with DH/WE%		0.105	-0.003	-0.242	0.411	-0.155

Note: White ear heads were appeared after 38th standard week.

**Fig 1:** Incidence of yellow stem borer on basmati rice and abiotic factors during *Kharif*, 2022

Conclusion

The present study revealed that the yellow stem borer (*Scirpophaga incertulas* Walker) remained active from the 32nd to the 44th standard week during *Kharif* 2022, with peak dead hearts (6.55%) and white ear heads (6.0%) infestations occurring during the 37th and 42nd standard weeks, respectively. Pest incidence showed non-significant positive correlations with maximum temperature and evening relative humidity, and negative correlations with minimum temperature, morning relative humidity, and rainfall. These findings provide valuable information for timely monitoring and effective pest management in basmati rice.

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