Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

**E-ISSN:** 2278-4136
**P-ISSN:** 2349-8234
JPP 2019; 8(5): 740-742
Received: 19-07-2019
Accepted: 21-08-2019

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# Seasonal incidence of rice yellow stem borer, *Scirpophaga incertulas* (Walk.) and its correlation with weather parameters and natural enemies

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**Abstract**
A field experiment was conducted during *kharif* season of 2018 at Agriculture Research Station, Sakoli, Dist. Bhandara (MS) under Dr. Panjabrao Krishi Vidyapeeth, Akola to study the seasonal incidence of major insect pests in an experimental plot of 500 $m^2$ and incidence of major insect pests were correlate with natural enemies and abiotic factors. The results revealed that, Incidence of rice stem borer was initiated from 32$^{nd}$ MW and continued to 47$^{th}$ MW and its peak incidence during 36$^{th}$ MW (6.45% DH) and 42$^{nd}$ MW (11.23% DH). Similarly 5.9 per cent white earheads was recorded before harvesting during 47$^{th}$ MW. The peak population of spiders was observed at 47$^{th}$ MW (0.67 nos./hill) and the correlation analysis results revealed that, minimum temperature (r= -0.501) had significant negative correlation with incidence of rice stem borer.

**Keywords:** Rice yellow stem borer, weather parameters and natural enemies

## Introduction
Rice (*Oryza sativa* L.) belonging to the family Gramineae is the staple food for one third world's population and occupies almost one fifth of the total land area covered under cereals. Most of the world's rice is cultivated and consumed in Asia, which constitutes more than half of the global population. Approximately 11 per cent of the world's arable land is planted annually to rice. India is the world's second largest rice producer and consumer next to china. Rice has unique position in Indian economy. In 2017 rice cultivated on area 43.57 million hectares with an annual production 104.32 million tonnes and productivity about 2.98 tonnes/ha (Anonymous, 2017) [1]. Total Indian output of rice at an all-time high of 166.5 MT (111.0 MT, milled basis). This level would stand 1.2 per cent above the final estimate for the 2016 season and some 2.3 million tonnes above previous FAO expectations, (Anonymous, 2018) [2]. Rice is the most important food all over world. Rice is a high energy or high calories food and of high biological value of the proteins. These days, several types of rice and their products are used in different nations of the world *viz.*, USA. China, Indonesia, Japan, Sri lanka, Africa and India etc.

Yellow stem borer is one of the widely distributed, dominant and monophagous pest of paddy in the Indian subcontinent and forms dead hearts in younger plant at the vegetative stages result in destruction of growing point and white ears head bearing panicles at the panicle bearing stage in older plant.The yield losses caused by insect pest in rice have been reported to the tune of 25 per cent (Dhaliwal *et al.* 2010) [3]. The average yield loss in rice have been accounted for 30% loss in stem borers, (Krishnaiah and Varma, 2015) [4].

Change in a region's climate due to changes in temperature, humidity, rainfall could induce changes in the occurrence pattern of insect pests. Climate change, especially temperature increase will affect insect physiology, behaviour and development as well as species distribution and abundance, evidenced by changes in the number of generations a year, increasing survival rates in winter and the earlier appearance of some insects. Studies of the seasonal abundance and population build up trend is essential to ensure timely preparedness to tackle impending pest problems and prevent crop losses (Patel and Singh, 2017) [5, 10].

## Material and method
The experiment on study the seasonal incidence leaf folder of paddy was carried at Agriculture Research Station, Sakoli, Dist. Bhandara (MS) under Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, during *kharif* 2018.PKV HMT, a popular variety of rice was used for the experiment. The soil was puddle before planting. Experiment plot was filled with water for one to two days to allow the water to sink properly into the soil and to make the soil soft for

easy puddling. The puddling was done by tractor. Before transplanting, the layout was made in the field in accordance with experimental design by using of measuring tape, nylon string and wooden pegs. 2-3 seedling of PKV HMT were transplanted per hill at the spacing of 20 x 15 cm in puddled soil. The recommended fertilizers dose for paddy crop were applied @ 100:50:50 kg NPK/ha. Half dose of N (50 kg) and full dose of $P_2O_5$ (50 kg) and $K_2O$ (50 kg) was applied before transplanting and half dose of N (50 kg) was applied at 30 days after transplanting.

Thirty hills from seasonal incidence plot were taken for recording observations of seasonal incidence of yellow stem borer. A separate plot of 500 $m^2$ area was sown and observations were recorded from nursery at weekly interval till the harvest of crop.

$$\% \text{ dead heart} = \frac{\text{No. of dead hearts in 10 hills}}{\text{Total no. of tiller in 10 hills}} \times 100$$

$$\% \text{ white ear heads} = \frac{\text{No. of white earheads in 10 hills}}{\text{Total no. of productive tillers in 10 hills}} \text{ x } 100$$

## Results and discussion

The data presented in table revealed that the incidence of dead hearts (DH) due to yellow stem borer were recorded from a week after sowing at weekly interval according to standard weeks and white earheads (WE) before harvesting. The data presented in Table revealed that the incidence of stem borer was initiated from 32nd meteorological week (MW) *i.e.* second week of August with 0.78 per cent dead hearts and gradually attained peak infestation at 36th MW (6.45% DH) *i.e.* first week of September. Furthermore, the fluctuations in the incidence of stem borer were evident, which again reached second peak at 42nd MW during third week of October with maximum dead hearts (11.23% DH). Then incidence of yellow stem borer was again fluctuated and decreased. Thereafter, incidence of yellow stem borer was continued till harvesting upto 47th MW (6.28% DH). Similarly, 5.9 per cent white earheads was recorded in seasonal incidence plot before harvesting during 47th MW.

## Correlation of stem borer with weather parameters and natural enemies

The correlation co-efficient analysis data of stem borer (dead heart) incidence showed that rainfall (r= -0.081), rainy days (r= -0.162) and spider population (r= -0.109) had non-significant negative correlation while, maximum temperature (r= 0.410) and relative humidity (r= 0.096) had non-significant positive correlation with stem borer. However, minimum temperature (r= -0.501) showed significantly negative correlation with stem borer at 5% significant level.

The present study is in accordance with Naganagoud *et al.* (1999), who reported that the peak incidence of rice stem borer occurred during October-November. Kharat (2006) [9] recorded the increased incidence of stem borer from 32nd MW (August) and it started declining from 42nd MW (October). Adiroubane and Raja (2006) [6] found that high incidence of yellow stem borer during the months October-November. Gole (2012) [7] also showed that incidence of *S. incertulas* was startedfrom second week of August (32nd MW) and continued up to the harvest of the crop. Kakde and Patel (2014) [8] recorded peak incidence of yellow stem borer was observed during first week of September and Patel and Singh (2017) [5, 10] reported that dead heart started from 32nd metrological week. Sulagatti *et al.* (2017) [11] stated that, incidence of yellow stem borer started from last week of July and its peak incidence observed during second week of October. These earlier reports strongly support the result of present investigation.

The result of the present study are in agreement with Bhatnagar and Saxena (1999) [12], they reported that the yellow stem borer number showed significant negative correlation with minimum temperature, evening relative humidity and rainfall. Hugar and Hosamani (2009) [13] stated the non-significant infestation of yellow stem borer and negative correlation with rainfall Sulagatti *et al.* (2017) [11] found that incidence of yellow stem borer showed a positive significant correlation with evening and average humidity and positive non-significant correlation with morning humidity and rainfall.

The data presented in Table revealed that the population of spiders was observed from second week of August *i.e.* 32nd MW (0.30 nos./hill) and continued up to the harvest of the crop *i.e.* 47th MW (0.67 nos./hill). The peak population of spiders was also observed at 47th MW. In the present findings of natural enemies population occurrence, similar type findings were reported by Barrion and Litsinger (1980) [14] and Pantua and Litsinger (1980) [14], they reported that spiders are large part of the predatory arthropod fauna of rice ecosystem and prey upon rice stem borer. Khan and Mishra (2003) [15] and Vijaykumar and Patil (2004) [19] found that the spider population was directly related to growth stages of the rice plants. Kharat (2006) [9] revealed that the population of spiders increased from 32nd standard week. Khan (2006) [16] stated that abundance of natural enemies are very reliable to suppress pest population. Mondal and Chakraborty (2017) [17] reported that incidence of yellow stem borer had negative correlation with natural enemies. These reports support the correlation result obtained in present finding.

**Table 1:** Seasonal incidence of stem borer and population of natural enemies of paddy in fixed plot survey during*kharif*2018.

| Date | MW | Stem borer (% Dead heart) | Natural enemies (No./hill) | Rainfall (mm) | Rainy days | Temperature | | Relative morning humidity (%) |
|---|---|---|---|---|---|---|---|---|
| | | | Spider | | | Max ($^O$C) | Min ($^O$C) | |
| | 26 | | | 132.2 | 2 | 32 | 24 | 83.71 |
| 6.7.2018 | 27 | 0.00 | 0.00 | 106.6 | 5 | 31 | 23 | 97.14 |
| 12.7.2018 | 28 | 0.00 | 0.00 | 92.2 | 6 | 29 | 24 | 89.00 |
| 19.7.2018 | 29 | 0.00 | 0.00 | 123.6 | 4 | 29 | 24 | 79.14 |
| 25.7.2018 | 30 | 0.00 | 0.00 | 49.6 | 2 | 29 | 23 | 81.28 |
| 3.8.2018 | 31 | 0.00 | 0.00 | 0.0 | 0 | 33 | 23 | 74.57 |
| 8.8.2018 | 32 | 0.78 | 0.30 | 42.4 | 3 | 32 | 24 | 70.85 |
| 17.8.2018 | 33 | 1.04 | 0.30 | 134.0 | 4 | 31 | 24 | 91.28 |
| 23.8.2018 | 34 | 2.60 | 0.70 | 102.4 | 2 | 30 | 23 | 87.28 |
| 29.8.2018 | 35 | 5.70 | 0.00 | 68.8 | 3 | 28 | 23 | 90.14 |
| 3.9.2018 | 36 | 6.45 | 0.17 | 25.4 | 2 | 29 | 22 | 94.57 |
| 12.9.2018 | 37 | 5.21 | 0.33 | 0.0 | 0 | 34 | 21 | 94.28 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 18.9.2018 | 38 | 2.25 | 0.17 | 47.0 | 2 | 32 | 23 | 90.28 |
| 24.9.2018 | 39 | 3.16 | 0.60 | 0.0 | 0 | 34 | 22 | 64.00 |
| 1.10.2018 | 40 | 4.94 | 0.50 | 0.0 | 0 | 35 | 21 | 94.71 |
| 8.10.2018 | 41 | 3.70 | 0.33 | 0.0 | 0 | 34 | 19 | 78.71 |
| 15.10.2018 | 42 | 11.23 | 0.30 | 0.0 | 0 | 35 | 19 | 84.00 |
| 22.10.2018 | 43 | 4.24 | 0.16 | 0.0 | 0 | 35 | 17 | 73.57 |
| 31.10.2018 | 44 | 5.47 | 0.16 | 0.0 | 0 | 32 | 17 | 80.71 |
| 5.11.2018 | 45 | 1.79 | 0.30 | 0.0 | 0 | 32 | 15 | 91.42 |
| 13.11.2018 | 46 | 5.03 | 0.20 | 0.0 | 0 | 33 | 13 | 89.28 |
| 19.11.2018 | 47 | 6.28 | 0.67 | 0.0 | 0 | 32 | 15 | 77.42 |
| | | White earhead | | | | | | |
| 22.11.2018 | 47 | 5.96 | | | | 32 | 15 | 77.42 |

**Table 2:** Correlation of Stem borer of paddy with weather parameters and natural enemies.

| Pest | Weather Parameters | | | | | Natural enemies (No./hill) |
|---|---|---|---|---|---|---|
| | Rainfall (mm) | Rainy days | Temperature | | RH Mor. (%) | Spider |
| | | | Max ($^{O}$C) | Min ($^{O}$C) | | |
| Stem borer (% Dead heart) | -0.081 | -0.162 | 0.410 | -0.501* | 0.096 | -0.109 |

Table 'r' value at 1% significance level: 0.623
Table 'r' value at 5% significance level: 0.497
**Significant Correlation at 1% significance level *Significant Correlation at 5% significance level

## Conclusion

On the basis of present investigation, it was concluded that peak activity of stem borer was observed at 36th MW (6.45% DH) *i.e.* first week of September. Furthermore, the fluctuations in the incidence were recorded, which again reached second peak during third week of October. Then damage of stem borer was gradually declined and continued uptomaturity of crop. Incidence of stem borer had significant negative correlation with minimum temperature.

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