

Original Research Article

<https://doi.org/10.20546/ijcmas.2021.1002.382>

Effect of Abiotic Factors on Occurrence of Leaf Folder, *Cnaphalocrocis medinalis* Guenee in Basmati Rice in Western Plain Zone of Uttar Pradesh

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ABSTRACT

Keywords

Basmati rice, *Cnaphalocrocis medinalis*, Leaf damage, Correlation

Article Info

Accepted:
24 January 2021
Available Online:
10 February 2021

The present investigation was conducted to study the effect of abiotic factors on occurrence of leaf folder, *Cnaphalocrocis medinalis* Guenee in basmati rice in western plain zone of Uttar Pradesh during Kharif 2017 and 2018. Observations of *C. medinalis* infestation were recorded at weekly interval, 15 days after transplanting till harvesting. The peak period of pooled maximum leaf damage (13.40%) of both cropping seasons was recorded in 39th standard week. Thereafter, infestation declined gradually. The correlation matrix between infestation of leaf folder with weather parameters indicated that there was a positive correlation with maximum temperature ($r=0.38$), minimum temperature ($r=0.50$), morning relative humidity ($r=0.01$), evening relative humidity ($r=0.70$) and rainfall ($r=0.13$) with the leaf damage caused by leaf folder.

Introduction

Rice an important staple food crop of India support more than two-third of its population⁽⁷⁾. In the World, rice is grown about in 167.24 million ha with an annual production of 769.65 million tonnes and 46.02 q/ha of productivity. In India, rice crop occupies an area of about 43.78 million ha with a total production of 168.50 million tones and the productivity of 38.50 q/ha⁽²⁾. Insect pests are responsible for considerable yield reduction of various crops in tropical Asian countries⁽⁹⁾. About 128 species of insects have been reported to ravage the rice field. Out of this

only 15 to 20 insects are regarded as economically obnoxious species⁽⁴⁾. Rice leaf folder, *Cnaphalocrocis medinalis* (Guenee) was considered to be a minor pest earlier but after 1980's it has become a major pest and reported to have more than one species of leaf folder in rice ecosystem. Excessive application of nitrogenous fertilizers and misuse of insecticides are the factors for this minor pest gaining major pest status⁽¹⁾. The leaf folder larva fastens edges of leaves together, fold them longitudinally and feed on green matter from inside the folded leaf. Damaged leaf produces white streaks, become membranous and ultimately reduces

photosynthetic activity of the plant⁽⁸⁾. Each insect pest requires certain set of weather conditions for their survival and multiplication.

Therefore, it is necessary to gain a thorough knowledge on relation of weather parameters to insects (Entomo-climatology) which will be very useful to farmers in all areas where major insect pests are appearing year after year and causing serious damage to crops.

Keeping in view, the severity of damage by leaf folder in rice growing area of western Uttar Pradesh and the influence of weather factors on their growth, multiplication and distribution. For developing any pest management programme, specific agro-ecosystem information on abundance and distribution of pest in relation to weather parameters is a basic requirement.

Materials and Methods

The field experiments were carried out during June to October 2017 and 2018 at Crop Research Centre, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut Uttar Pradesh. The experiment was conducted in Randomized Block Design (RBD) with rice cv. Pusa basmati 1. The spacing adopted was 20 × 20 cm and all the cultural operations except plant protection were followed as per the recommendations. The observations of *C. medinalis* infestation were recorded at weekly interval, 15 days after transplanting till harvesting. Observation on leaf folder infestation, number of damaged leaf were counted per five hills. To the study instantaneous effect of major abiotic factors viz., maximum temperature, minimum temperature, average temperature, morning relative humidity, evening relative humidity, average relative humidity, rainfall on the population of *C. medinalis*, correlation coefficient was worked out. Finally data so

obtained were worked out and converted into percentage of leaf damage (Per cent leaf damage = Total number of leaf damage X 100) / Total number of leaf). The weekly meteorological data recorded at ICAR-Indian Institute of Farming System Research, Modipuram (Meerut) during the *kharif* 2017 and 2018 from July to October period were utilized for this purpose.

Statistical analysis

The influence of weather parameters on damage done by *C. medinalis* (leaf damage) was analyzed by correlation analysis for a period of two years. The data was analyzed by using statistical software SPSS 16.0.

Results and Discussion

The impact of major abiotic factors on the incidence of per cent leaf damage at weekly interval during *Kharif* 2017 and 2018 according to standard weeks.

During Kharif season 2017

The data are depicted in Fig 1 revealed that the infestation of *C. medinalis* appeared first on 32th standard week and continued till the 44th standard week. The infestation of leaf folder recorded as leaf damage ranged from 2.48 to 14.23 percent during *Kharif*, 2017. The infestation increased from 39th standard week (last week of September). During this period the weather parameters like temperature, relative humidity and rainfall ranged from 21.00 to 33.40 °C, 58.90 to 98.70 percent and 0.00 mm, respectively. Thereafter infestation declined.

The correlation between infestation of leaf folder with weather parameters are given in Table 1. The leaf folder infestation showed positive correlation with maximum temperature (r= .53), minimum temperature

($r= 0.52$), morning relative humidity ($r= 0.12$), evening relative humidity ($r=0.28$) and rainfall ($r=0.11$).

During Kharif season 2018

The data depicted in Fig. 2 revealed that the infestation of leaf folder appeared first on 32th standard week and continued till the 44th standard week. The infestation of leaf folder recorded as leaf damage ranged from 1.05 to 12.5 percent during Kharif, 2018. The infestation increased from 33th standard week and reached at maximum during 39th standard

week (last week of September). During this period the weather parameters like temperature, relative humidity and rainfall ranged from 23.00 to 32.60 °C, 75.70 to 94.00 percent and 37.00 mm, respectively. Thereafter the infestation declined.

The leaf folder infestation showed positive correlation with maximum temperature ($r= 0.13$), minimum temperature ($r= 0.47$), evening relative humidity ($r= 0.70$) and rainfall ($r= 0.13$) and negative correlation with morning relative humidity (Table 1).

Table.1 Correlation between seasonal incidence of *Cnaphalocrocis medinalis* in relation to abiotic factors

Weather Parameters	Correlation coefficient (r)		
	Percent leaf damage		
	2017	2018	Pooled
Maximum Temp. (°C)	0.532	0.132	0.387
Minimum Temp. (°C)	0.528	0.470	0.505
Average	0.602	0.390	0.500
Morning RH (%)	0.123	-0.121	0.012
Evening RH (%)	0.283	0.701	0.700
Average	0.386	0.562	0.690
Rainfall (mm)	0.119	0.136	0.132

Fig.1 Seasonal incidence of rice leaf folder, *C. medinalis* in relation to abiotic factors during Kharif, 2017

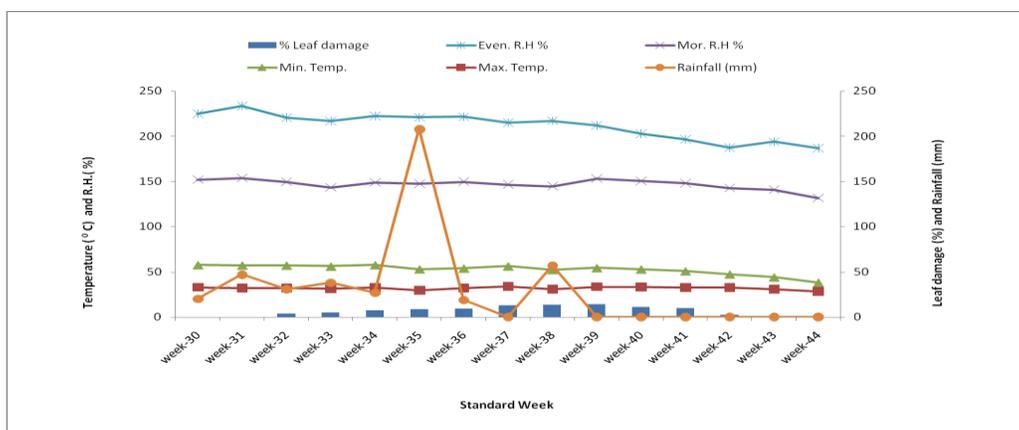


Fig.2 Seasonal incidence of rice leaf folder, *C. medinalis* in relation to abiotic factors during *Kharif*, 2018

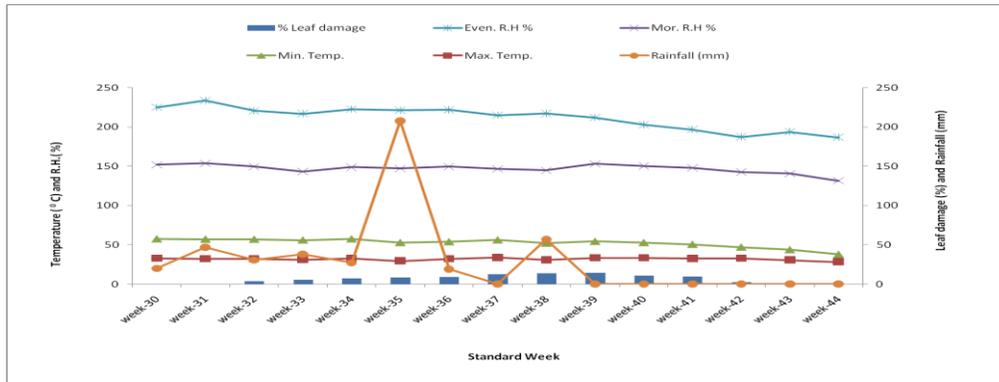
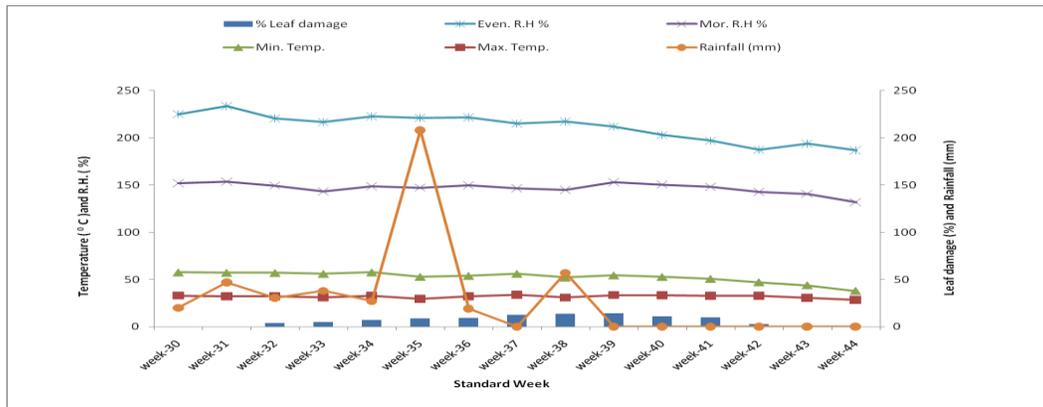


Fig.3 Pooled data for incidence of rice leaf folder, *C. medinalis* in relation to abiotic factors (*Kharif*, 2017 and 2018)



Pooled data during *Kharif* season 2017 and 2018

Perusal of pooled data showed that the *C. medinalis* infestation with 3.20 percent leaf damage was appeared from 32nd SW and recorded its peak with 13.40 percent leaf damage during 39th SW. (last week of September). During this period the weather parameters like temperature, relative humidity and rainfall ranged from 22.00 to 33.00 °C, 67.30 to 96.40 percent and 18.50 mm, respectively. Thereafter, infestation declined gradually. Further, this infestation turn down and observed up to the harvest with minimum infestation of 1.80 % leaf damage at 42nd SW (Figure 3).

The correlation matrix between infestation of leaf folder with weather parameters indicated that there was a positive correlation with minimum temperature ($r= 0.50$), maximum temperature ($r= 0.38$), morning relative humidity ($r= 0.01$), evening relative humidity ($r= 0.70$) and rainfall ($r= 0.13$) with the leaf damage caused *C. medinalis* (Table 1). The observations recorded present investigation are similar to the finding of earlier workers like ⁽⁵⁾ who reported the maximum infestation of leaf folder during second fortnight of September. ⁽⁶⁾ reported maximum infestation of *C. medinalis* during 41st standard week. ⁽³⁾ reported that the leaf folder population was found maximum in the last week of August and first week of September (14.50-16.75

damaged leaves/10 hills). The leaf folder showed positive correlation with maximum temperature ($r= 0.26$) and ($r= 0.23$) whereas, minimum temperature ($r= 0.74$) and ($r= 0.075$), morning relative humidity ($r= 0.72$) and ($r= 0.79$), evening relative humidity ($r= 0.65$) and ($r= 0.74$), rainfall ($r= 0.65$) and ($r= 0.68$), respectively during 2017 and 2018, reported. Similar observation were made by ⁽¹⁰⁾ who observed that the larval population of leaf folder increased gradually till 38th week with 10 larvae/ 10 hills. The correlation analysis revealed a positive correlation with evening ($r =0.580$) and average relative humidity ($r =0.565$). However a positive correlation was obtained with temperature ($r =0.366$), rainfall ($r =0.236$) and morning relative humidity ($r =0.182$).

In conclusion the peak period of *C. medinalis* was recorded in last week of September (39th standard week) during *Kharif*, 2017 and 2018. The seasonal incidence of *C. medinalis* delineated the leaf folder population build up and interaction with weather parameters, which can be utilized for decision making. The correlation analysis between infestation of leaf folder with environmental factors indicated that there was a positive correlation with maximum temperature, minimum temperature, morning relative humidity, evening relative humidity and rainfall with the leaf damage caused by leaf folder.

Acknowledgements

Authors are highly thankful to Head, Department of Entomology, and the Director Research, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut, for the necessary facilities and encouragement during course of present investigation and also thankful to ICAR-Indian Institute of Farming System Research, Modipuram (Meerut) for providing weather data.

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How to cite this article:

Rajat Deshwal, S. K. Sachan, Visvash Vaibhav, Nitin Kumar and Ankit Kumar. 2021. Effect of Abiotic Factors on Occurrence of Leaf Folder, *Cnaphalocrocis medinalis* Guenee in Basmati Rice in Western Plain Zone of Uttar Pradesh. *Int.J.Curr.Microbiol.App.Sci*. 10(02): 3462-3467. doi: <https://doi.org/10.20546/ijcmas.2021.1002.382>