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Studies on the insect fauna and population dynamics of yellow stem borer and leaf folder in relation to abiotic factors in western Uttar Pradesh

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Abstract
This research was conducted at Crop Research Center of Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut (U.P.) during *Kharif*, 2018. The data revealed that first infestation of yellow stem borer was recorded on first week of August and reached its peak during first week of October when temperature, relative humidity and rainfall ranged from 20.70 to 35.90 ^{0}C, 58.90 to 96.10%, and 0.00 mm, respectively. The population of leaf folder was first recorded on first week of August and reached at maximum level during last week of September when mean temperature, relative humidity and rainfall ranged from 27.80 ^{0}C, 74.85% and 37.0 mm, respectively. The population of yellow stem borer and leaf folder showed negative correlation with minimum and maximum temperatures, evening relative humidity and rainfall while morning and mean relative humidity showed the positive correlation.

Keywords: Rice stem borer, leaf folder, temperature, R.H., rainfall

Introduction
The rice is the staple food of 65 per cent of the total population in India. Rice is the second large produced cereal in the world which have two cultivated and 22 wild *spp* [5]. It constitutes about 55 per cent of total cereal production. Rice is grown under various conditions such as irrigated, rainfed lowland, rainfed upland and flood-prone ecosystems. India is the largest rice growing country, while China is the largest producer of rice [3].

In India, West Bengal is the leading state in rice growing area (5.46 million hectare) as well as production (15.75 million tones) followed by Uttar Pradesh, which contribute 5.86 million ha area and 12.51 million tones production with productivity of 2.40 t/ha. [1]. Rice is excellent source of nutrition. Uncooked rice contains 6-9 per cent protein, 77-84 per cent carbohydrate and a good source of thiamine (vit b1), riboflavin (vit b2) and niocin including all eight of the essential amino acids [8]. Rice is generally grown by transplanting in puddled soils because, the conditions for higher productivity are more conducive in transplanted rice. But, there is need to increase rice production by about 3 per cent every year over the next decade to feed the increasing population of the country.

Warm and humid climate is essential for rice cultivation, is also conducive for the survival and proliferation of insects. More than 100 different species of insects are known as rice pests. Out of which about fifteen are major economic significance. These pests occur regularly and ravage the crop from seedling stage to maturity of the crop [10]. Among the various insect-pests damaging the rice crop, stem borer (*Scirpophaga incertulas* Walker) leaf folder (*Cnaphalocrocis medinalis* Guenee), brown plant hopper (*Nilaparvata lugens* Stal), and gall midge (*Orseolia oryzae* Wood Mason), are major insect-pests. The extents of losses due to ravages of these insect pests vary greatly from area to area and season to season [11].

The intensity of pest damage varies is different seasons, years and agro-climatic zones due to variability in weather parameters and biotic mortality factors. Understanding of pest population dynamics in relation to weather factors can help in better management of pest. Besides, knowledge of the seasonal abundance and pest build up trend is essential to ensure timely preparedness to tackle pest problems and prevent crop losses. So, the present study was conducted find out the dynamics of pest population in the correlation of abiotic factors. Keeping this in the view present study was conducted.

Materials and Methods

The present study was conducted at Crop Research Centre (CRC) of Sardar Vallabhbhai Patel University of Agriculture and Technology Modipuram, Meerut during the *Kharif* season of 2018. The observations recorded right from germination of crop in nursery till the harvest of the crop at weekly interval. Observations were taken randomly at five spots of each plot. The insects were collected and reared upto adult stage wherever necessary and identified. The nature and extent of damage caused by various insect pests was also recorded to assess the economic status of the pest. For the population dynamics the observations taken from the random sampling. Ten hills were tagged randomly from each plot of the untreated trial. These plants were observed regularly at weekly interval. Dead hearts/white ear heads and larval population of yellow stem borer and leaf folder, respectively, were recorded per hill starting from the transplanting till the harvest of the crop. The meteorological data were also recorded throughout the crop season.

The data recorded during courses of investigation were subjected to statistical analysis using the formula given below. Correlations between the damage done by insects (%) and weather parameters *viz.* minimum and maximum temperatures, relative humidity and rainfall.

$$X_1 Y_1 = \frac{\sum XY - \frac{(\sum X_1)(\sum Y_1)}{N}}{\sqrt{[\sum X_1^2 - \frac{(\sum X_1)2}{n}]}\sqrt{[\sum Y_1^2 - \frac{(\sum Y_1)2}{n}]}}$$

Where,

X_1Y_1 = Simple Correlation coefficient,
X_1 = Number of larvae
Y_1 = Meteorological parameter
n = Number of observation

Results and Discussion

1. Insect fauna associated with basmati rice: During study period the insect species associated with rice crop along with their nature of damage, seasonal incidence and economic status have been studied and shown in Table 1. Thirteen insects were found attacking the rice crop at different crop growth stages at Modipuram, Meerut of Uttar Pradesh. These were yellow stem borer, *Scirpophaga incertulas* Walker (Pyralidae: Lepidoptera), leaf folder, *Cnaphalocrocis medinalis* Guenee (Pyralidae: Lepidoptera), swarming caterpillar, *Spodoptera mauritia* Boisduval (Noctuidae: Lepidoptera), rice case worm, *Nymphula depunctalis* Guenee (Pyralidae: Lepidoptera), green leaf hopper, *Nephotettix virescens* Distant (Cecadellidae: Homoptera), brown plant hopper, *Nilaparvata lugens* Stal (Delphacidae: Homoptera), white backed plant hopper, *Sogatella furcifera* Horvath (Delphacidae: Homoptera), rice gundhi bug, *Leptocorisa acuta* Thumb (Coreidae: Heteroptera), rice root weevil, *Echinocnemus oryzae* Marshall (Curculionidae: Coleoptera), white grub, *Holotrichia consanguinea* Blanch (Melolonthinae: Coleoptera), termite, *Odontotermes obesus* Romb (Termitidae: Isoptera), Kharif grasshopper, *Hieroglyphus banian* Fab. (Acrididae: Orthoptera), and grasshopper, *Oxya fuscovittata* Marschall (Acrididae: Orthoptera). The infestation started from July 15, 2018 at the stage of 20 days crop stage.

2. Population dynamics of *Scirpophaga incertulus*: The data showed that the infestation of yellow stem borer appeared first on 31st standard week and continued till 44th standard week (Table 2 and Figure 1). The infestation of stem borer recorded as dead hearts/white ear heads ranged from 0.67 to 8.45 per cent during *Kharif*, 2018. The infestation increased from second week of August and reached its peak (8.45%) during 40th standard week. During this period the weather parameters like temperature, relative humidity and rainfall ranged from 20.70 to 35.90 ^{0}C, 58.90 to 96.10 per cent and 0.00 mm with an average of 28.30 ^{0}C and 77.50 per cent, respectively. The stem borer infestation decreased after 42nd standard week and this might to be due to the no emergence of new leaves. These observations are in agreement with the earlier finding of [4, 9] who reported the peak activity of stem borer in the month of September - October during *Kharif* season. While [2] reported the maximum number of eggs and pupae in the first week of October, indicating that population of borers builds up late in season.

3. Population dynamics of *Cnaphalocrocis medinalis*: The data showed that the infestation of leaf folder appeared first on 31st standard week and continued till harvest of the crop and ranged from 1.47 to 9.40 per cent (Table 2 and Figure 1). The infestation increased from 32nd standard week and reached at maximum (9.40 %) during 39th standard week (last week of September), when mean temperature and relative humidity was 27.80 ^{0}C and 74.85 per cent, respectively. Thereafter the infestation declined. [6] reported that the maximum infestation of *C. medinalis* occurred at 41st standard weak.

4. Correlation of Yellow stem borer and Leaf folder with abiotic factors: The correlation studies between infestation of yellow stem borer with weather parameters are given in Table 2. The correlation matrix indicated that there is positive correlation with morning relative humidity (0.22) and a negative correlation with maximum and minimum temperature, evening relative humidity and rainfall, with the dead hearts and white ear heads caused by yellow stem borer [2] reported that the maximum temperature, minimum temperature and evening relative humidity exhibited a negative relationship with total number of larvae. The infestation of leaf folder showed negative correlation with maximum and minimum temperature, evening relative humidity and rainfall but morning relative humidity showed the positive correlation. The present findings are similar to the finding of [12] who reported that temperature, relative humidity and rainfall were negatively correlated with the infestation of *C. medinalis* [7] also reported minimum temperature, average temperature, morning relative humidity, evening relative humidity and rainfall had non-significant negative correlation with the rice leaf folder population.

Table 1: Insect fauna recorded on basmati rice during *Kharif*, 2018

Order	Family	Common Name	Scientific Name	Damaging stage of the insect	Economic status
Lepidoptera	Pyralidae	Yellow stem borer	*Scirpophaga incertulas* Walker	Larvae	Severe
	Pyralidae	Leaf folder	*Cnaphalocrosis medinalis* Guenee	Larvae	Severe
	Noctuidae	Army worm	*Spodoptera mauritia* Boisduval	Larvae	Low
	Pyralidae	Rice case worm	*Nymphula depunctalis* Guenee	Larvae	Low
Homoptera	Cecadellidae	Green leaf hopper	*Nephotettix virescens* Distant	Nymphs and adults	Low
	Delphacidae	Brown plant hopper	*Nilaparvata lugens* Stal	Nymphs and adults	Moderate
	Delphacidae	White backed plant hopper	*Sogatella furcifera* Horvath	Nymphs and adults	Low
Hetroptera	Coreidae	Rice gundhi bug	*Leptocorisa acuta* Thumb	Nymphs and adults	Moderate
Coleoptera	Curculionidae	Rice root weevil	*Echinocnemus oryzae* Marshall	Grubs and adults	Low
	Curculionidae	White grub	*Holotrichia consanguinea* Blanch	Grubs and adults	Low
Isoptera	Termitidae	Termite	*Odontotermes obesus* Romb	Workers	Low
Orthoptera	Acrididae	Kharif grass hopper	*Hieroglyphus banian* Fab	Nymphs and adults	Low
	Acrididae	Grass hopper	*Oxya fuscovittata* Marshall	Nymphs and adults	Low

Table 2: Population dynamics of rice stem borer and leaf folder in relation to abiotic factors

Standerd Week	Date	Dead heart / white ear head (%)	leaf damage (%)	Temperature ºC			Relative humidity (%)			Rainfall (mm)
				Max.	Min.	Mean	Morning	Evening	Mean	
26	25-1 (June)	0.00	0.00	39.4	28.0	33.7	85.3	52.4	68.85	9.0
27	2-8 (July)	0.00	0.00	40.0	26.1	33.05	89.0	48.4	68.7	49.0
28	9-15	0.00	0.00	35.4	27.6	31.50	89.1	72.4	80.75	70.0
29	16-22	0.00	0.00	37.4	28.3	32.85	87.3	50.6	68.95	16.0
30	23-29	0.00	0.00	33.4	26.6	30.00	93.3	68	80.65	370.0
31	30-5 (August)	0.67	1.47	37.9	27.9	32.90	90.1	49.1	69.6	0.0
32	6-12	0.90	2.20	37.0	27.3	32.15	93.6	47.9	70.75	56.3
33	13-19	1.46	3.26	38.7	27.6	22.10	92.1	50.4	71.25	23.0
34	20-26	2.73	4.18	36.4	24.9	30.65	91.4	52.6	72.0	22.0
35	27-2 (Sept.)	3.25	5.10	35.4	23.6	29.50	88.3	38.7	63.5	198.1
36	3-9	4.90	5.85	37.6	21.7	29.65	91.4	41.6	76.5	82.8
37	10-16	5.80	6.90	34.9	22.3	28.60	86.7	43.7	65.2	9.7
38	17-23	6.20	7.00	35.1	21.9	28.50	87.8	55.8	71.8	13.0
39	24-30	6.85	9.40	32.6	23.0	27.80	94.0	55.7	74.85	37.0
40	1-7 (October)	8.45	7.40	35.9	20.7	28.30	96.1	58.9	77.5	0.0
41	8-14	5.65	5.20	34.1	18.7	26.40	87.0	55	71.0	3.4
42	15-21	3.75	3.90	34.4	15.0	24.70	90.0	51	70.5	1.4
43	22-28	2.20	3.10	32.7	13.4	23.05	90.6	39.1	64.85	0.0
44	29-4 (Nov.)	1.70	2.60	31.7	12.0	21.85	91.1	45.4	68.25	0.0
Correlation coefficient with per cent dead heart/ white ear head (Rice stem borer)				-0.37	-0.43	-0.32	0.22	-0.08	0.25	-0.25
Correlation coefficient with per cent leaf damage (Rice leaf folder)				-0.38	-0.39	-0.37	0.26	-0.20	0.25	-0.23

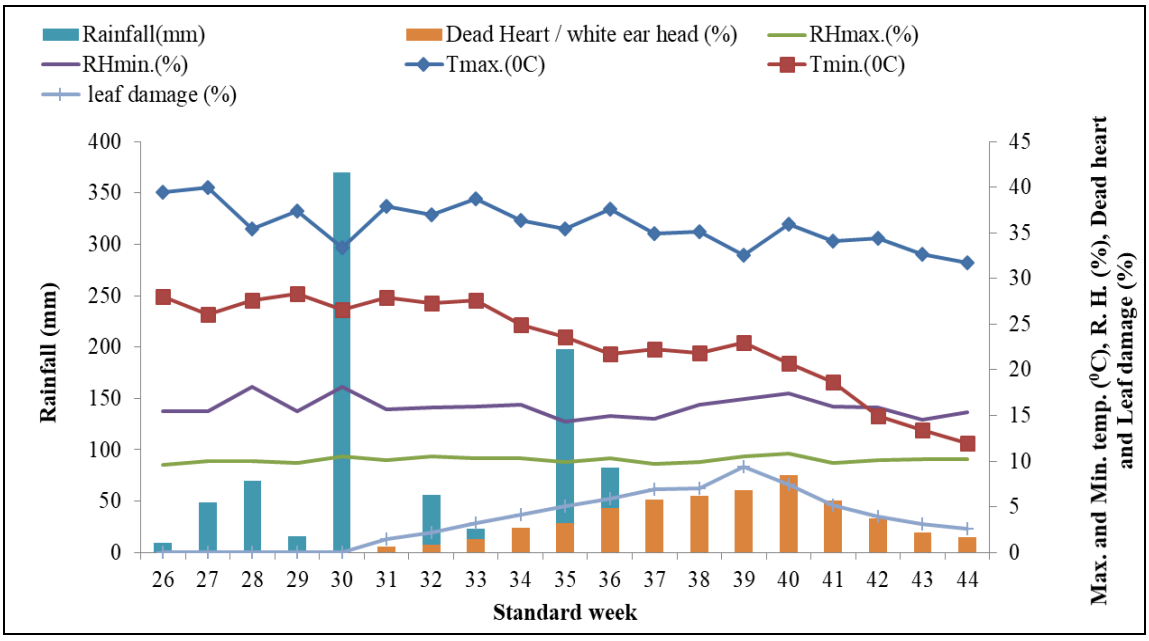

Fig 1: Population dynamics of rice stem borer and leaf folder in relation to abiotic factors

Conclusion

It is found that 13 insect species were found to attack basmati rice at various crop growth stages. Among them yellow stem bore, *Scirpophaga incertulas* (Walker) and leaf folder, *Cnaphalocrocis medinalis* (Guenee) were recorded as major pests. The brown plant hopper, *Nilaparvata lugens* (Stal) and gundhi bug, *Leptocorisa acuta* (Thumb) were found moderately damaging the crop. The other insect pests recorded on the crop were of less importance and amount of their damage was found without much economic loss.

The incidence of *S. incertulas* maintained fluctuating trend with crop season by influence of weather parameters. The infestation of *S. incertulas* was recorded first on 31th standard week and accelerated till 44th standard week. The infestation was high in the absence of rains. The correlation between incidence of *S. incertulas* and weather parameters revealed that all the weather parameters like maximum and minimum temperature, relative humidity and rainfall showed negative correlation with per cent infestation.

The incidence of *C. medinalis* also maintained fluctuating trends with crop season by the influence of weather parameters. The incidence of *C. medinalis* was first recorded on 31th standard week and reached at a maximum level during 39th standard week. The leaf folder population showed negative correlation with various weather parameters like maximum and minimum temperature, relative humidity and rainfall.

References

1. DAC& FW. Directorate of Economics and Statistics, www.dac&ew.gov.in.com, 2017.
2. Joshi G, Ram L, Singh R. Population dynamics of paddy stem borers in relation to biotic and abiotic factors. Annual Biodiversity. 2009; 25(1): 47-51.
3. Kakde AM, Patel KG. Seasonal incidence of rice yellow stem borer (*Scirpophaga incertulas* Walkar) in relation to conventional and sri methods of planting and its correlation with weather parameters. IOSR Journal of Agriculture and Veterinary Science. 2014; 7(6):05-10.
4. Kumar AD, Sudhakar TR. Incidence of the yellow stem borer, *Scirpophaga incertulas* (Walker), on rice in relation to weather parameters. Pest Management and Economic Zoology. 2001; 9(2):161-164.
5. Kumar S, Singh H, Yadav A, Kumar A, Shanker R. Seasonal abundance of brown plant hopper, *Nilaparvata lugen* (Stal) in basmati rice and correlation of abiotic factors under Meerut region. Journal of Entomology and Zoology Studies. 2019; 7(6):882-885.
6. Nigam VD. Effect of abiotic factors on the population fluctuation of rice leaf folder, *Cnaphalocrocis medinalis* (Guenee) in eastern Uttar Pradesh. Agricultural and Biological Research. 2009; 25(2):128-134.
7. Patel HN, Kadu RV, Landge SA. Study on seasonal incidence of rice leaf folders (*Cnaphalocrocis medinalis* Guen. and *Pelopidas mathias* Fab.) of paddy and its correlation with weather parameters. International journal of Plant Protection. 2011; 4(1):175-180.
8. Prakash A, Rao J, Singh ON, Singh JP, Rath PC. Rice the queen of cereal. *AZRA Publication* CRRI. 2007, 1-40.
9. Pujari D, Bora DK, Sharma S. Seasonal incidence of rice stem borer in Assam. Insect Environment. 2007; 13(3):99-101.
10. Rana R, Singh G, Kumar A, Tanwar, Kumar R. Effect of weather parameters on the infestation of yellow stem borer, *Scirpophaga incertulas* (Walker) in basmati rice. Journal of Entomology and Zoology Studies. 2017; 5(3):24-27.
11. Singh BB, Singh R. Major Rice Insect Pests in North-eastern U P. International Journal of life Science Biotechnology and Pharma Research. 2014; 3(1):124-143.
12. Singh D, Gupta PK, Chandra U, Vikrant, Akshay K. Population dynamics of insect-pests of paddy and its correlation with weather parameters. Journal of Entomology and Zoology Studies. 2018; 6(1):1405-1407