Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

J E Z S Journal of Entomology and Zoology Studies

E-ISSN: 2320-7078
P-ISSN: 2349-6800
JEZS 2018; 6(1): 1405-1407

Received: 11-11-2017
Accepted: 12-12-2017

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Population dynamics of insect-pests of paddy and its correlation with weather parameters

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Abstract
This paper discusses the population dynamics of paddy and its correlation with weather parameters in Faizabad district of U.P. Occurrence and abundance of insect-pests of paddy on rice crop was monitored on rice variety Sarju-52 at Main Experimental Station of Narendra Deva University of Agriculture and Technology Kumarganj Faizabad (U.P.) during the season *kharif*, 2013. This investigation revealed that pest activity commenced from 35th Standard meteorological week (SMW) and continued to 49th SMW. Highest dead hearts (8%) of Yellow Stem Borer, *Scirpophaga incertulas* was found in the 38th SMW, the maximum population (2.40%) of Rice Hispa was recorded in the 36th SMW, the peak population of whorl maggot (2.50%) was estimated in the 42nd SMW. The highest population of the rice leaf folder and gundhi bug with 3.70% and 21.90% was found in the 40th and 43rd SMW, respectively. Yellow stem borer was positively correlated with sunshine hours and rice hispa with maximum temperature was found positively significant. The rice whorl maggot was positively non-significant with the maximum temperature, there were no negative correlations of rice leaf folder and rice gundhi bug was positively correlated with relative humidity.

Keywords: Rice leaf folder, *Scirpophaga incertulas*, minimum, maximum, temperature, correlation, pest, paddy, dead hearts, and population

1. Introduction
Rice, is the main staple food in India. Rice is mostly grown on the low-lying deltas of the Brahmaputra and Barak rivers. But its yield is greatly affected every year by various insect pests [3, 7]. Among the various insect pests of paddy, Rice hispa, *Dicladispa armigera* (Olivier) Yellow Stem Borer *Scirpophaga incertulas* (Walker), leaf folder, *Cnaphalocrosis mendinalis* (Guen), whorl maggot and rice gundhi bug *Leptocorisa accuta*. In the development of pest management strategies a detailed knowledge of the influence of abiotic factors on the pest insects is essential. Weather and climatic conditions are known to significantly affect the population dynamics of insect pests [9]. Knowledge of abiotic conditions, such as temperature, day length, rainfall and relative humidity can be used as important components in forecasting and predicting the severity of insect pest population [11]. Knowledge of insect-pests population dynamics is essential for developing sustainable crop protection strategies and for interpreting and forecasting the response of taxonomic groups to weathers patterns varying on a daily basis, seasonally, or as a long-term consequence of global climate change [6]. Information on population dynamics of insect-pests complex in relation to weather parameters under Faizabad conditions is lacking. Hence, considering the importance of insect-pests of rice an attempt has been made to study the population dynamics and its correlation with weather parameters.

2. Materials and Methods
For recording the population of insect-pests, the study was conducted at Main Experimental Station of Narendra Deva University of Agriculture and Technology Kumarganj, Faizabad-224229 (U.P.) during *kharif*, 2013. Total experimental plot size measured 10x10m. The seedlings were transplanted in the experimental plot with spacing 10 cm between plant to plant and 15 cm row to row. 21 days old seedlings of Sarju-52 rice variety were transplanted in IInd fortnight of July from the nursery sown 21 days ago, in experimental year. The normal cultural practices were performed throughout the growing season of the crop.
Method of Data Collection: Data collection was started after fifteen days of transplanting and subsequent at weekly intervals, using also sweeping method as per need. For insect-pests population, visuals counts of the numbers of insects/10 hills in plot were taken.

Observations on incidence of insects were taken on hill basis. Ten plants (hill) were randomly selected from plot planted with Sarju-52 for recording incidence of insects. The observations continued till harvest of the crop. The observations were recorded at morning hours.

3. Results and Discussion

3.1 To study the population dynamics of insect-pests of rice crop

The results indicated that the percentage of dead hearts were found initially low (5 per cent) during 37 std. meteorological week (SMW), which gradually increased during successive standard weeks and reached at the maximum level (8 per cent) during 38 SMW and thereafter dead hearts declined to 6.00 and 5.80 percent during 39 and 40 std. weeks, respectively (Table No. 1). The white earheads varied from 3.80 to 6.8 in field based on observations recorded from 43 to 49 std. weeks at weekly interval during *Kharif* 2013. The maximum (6.80 per cent) earheads was observed during 43 std. week, which reached to the lowest level (3.8 per cent) during 49th std. week (Table No.1). Similar observations were also recorded by [13].

The incidence of rice hispa was observed from 35 to 38th std. week during *Kharif* 2013.The rice hispa damaged leaves (RHDL) ranged from 0.30 to 2.40 per cent. Weather conditions prevailed during crop season showed that the incidence of rice hispa was not favoured much by the prevailing weather conditions. The incidence confined to one month 35th to 38th std. Weeks (Table No.1). [13] where as also recorded incidence of rice hispa.

Data presented on the incidence of whorl maggot revealed that the pest incidence was highest at 42th SMW with 2.50 per cent damaged leaves followed by 40 SMW with 2.40 per cent in *Kharif*, 2013, the incidence of leaf folder revealed that the per cent damaged leaves and population were highest at 39th SMW with 3.90 per cent followed by 38th SMW with 3.70 damaged leaves and the lowest population was recorded at 45 SMW with 1.80 per cent during *Kharif*, 2013 and the gundhi bug was recorded from 39th -48th std. weeks during *Kharif* 2013. The population of gundhi bug ranged from 5.00 to 21.90 per 5 sweeps. The maximum population of gundhi bug was recorded in the 43th SMW with 21.90 per m row followed by 42th SMW with 18.60 per 5 sweeps and the minimum population of gundhi bug was observed at 48 SMW with 5 per 5 sweeps (Table No.1). Similar results were also observed By whom [5, 10, 12] which support present findings.

3.2 Correlation coefficient values between weather parameters and rice insect-pests

The Correlation coefficient determined between the incidence of yellow stem borer and abiotic factors revealed that the incidence of yellow stem borer was negatively correlated with maximum temperature, minimum temperature, relative humidity and rainfall, while sunshine hours had a positive impact on the incidence of YSB. However, none of the correlation coefficient was found significant (Table No. 2). The result also partially supported by the findings of whom [5].

The incidence of rice hispa on crop was positively correlated with maximum temperature, relative humidity and rainfall and negatively related with sunshine hours. The correlation of rice hispa with maximum temperature was found positively significant (Table No. 2).

The incidence of whorl maggot on rice crop was non-significantly negatively correlated with sunshine hours and incidence of rice whorl maggot on crop was significantly positively correlated with minimum and maximum temperature, relative humidity and rainfall. The correlation of rice whorl maggot with minimum temperature and relative humidity was found positively significant.

Results of correlation studies made on leaf folder population revealed that there were no negative correlations with minimum and maximum temperature, relative humidity rainfall and sunshine hours(0.48107, 0.32252, 0.41557, 0.09237 and 0.04648) respectively. However, all correlations were observed non-significant (Table No. 2). The results obtained By whom [8] support the present investigation.

The damage was non-significantly negatively correlated with minimum temperature, maximum temperature, relative humidity rainfall and sunshine hours (-0.0844, -0.3636, -0.2149 and -0.2438 respectively) and non-significantly positively correlated with relative humidity (0.24518) (Table No. 1). The result of whom [4] also partially supports the present research. This information can be utilized in formulating appropriate management strategies for the major insect-pests of rice crop through location specific IPM strategy.

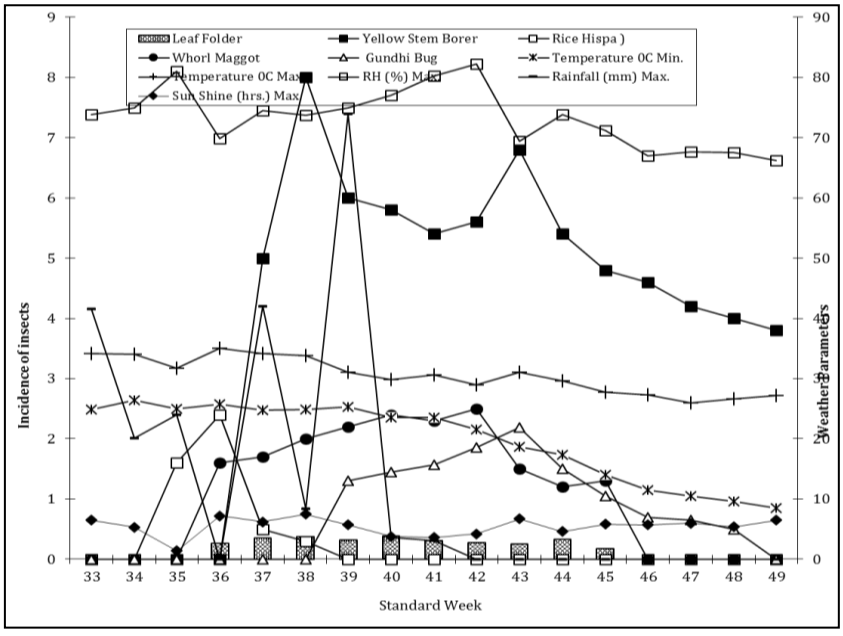

Fig 1: Seasonal incidence of insect pest on Sarju-52 along with weather parameters

Table 1: Seasonal Incidance of insect-pests on rice crop along with weather parameter during *kharif*, 2013.

a. Insect-pests						b. Weather parameter				
Standard Week	Yellow Stem Borer DH (%)	Rice Hispa Damaged Leaf (%)	Whorl Maggot Damaged Leaf (%)	Leaf Folder Damaged leaf (%)	Rice Gundhi Bug	Temperature ^{0}C		RH (%)	Rainfall (mm)	Sun Shine (hrs.)
						Min.	Max.			
33	0	0	0	0	0	24.9	34.2	73.9	41.6	6.5
34	0	0	0	0	0	26.4	34	75	20.1	5.3
35	0	1.6	0	0	0	25	31.7	81	24	1.4
36	0	2.4	1.6	2.6	0	25.7	35	69.9	0	7.2
37	5	0.5	1.7	3.5	0	24.8	34.1	74.5	42	6.2
38	8	0.3	2.0	3.7	0	24.9	33.8	73.7	8.4	7.5
39	6	0	2.2	3.2	13	25.3	31.1	75	74	5.7
40	5.8	0	2.4	3.9	14.5	23.5	29.8	77	3.6	3.8
41	5.4	0	2.3	3.1	15.7	23.5	30.6	80.3	3.1	3.6
42	5.6	0	2.5	2.8	18.6	21.6	28.9	82.3	0	4.2
WE (%)										
43	6.8	0	1.5	2.5	21.9	18.7	31.1	69.4	0	6.7
44	5.4	0	1.2	3.3	15	17.3	29.6	73.9	0	4.6
45	4.8	0	1.3	1.8	10.5	14	27.7	71.2	0	5.8
46	4.6	0	0	0	6.9	11.5	27.3	67	0	5.7
47	4.2	0	0	0	6.5	10.5	26	67.7	0	6
48	4	0	0	0	5	9.6	26.6	67.5	0	5.4
49	3.8	0	0	0	0	8.5	27.2	66.2	0	6.5

Table 2: Correlation between insect-pests and weather parameters during *Kharif* -2013.

Insects	Weather Parameters				
	Temperature ^{0}C		R.H. (%)	Rainfall (mm)	Sunshine (Hours)
	Min.	Max.			
Yellow Stem Borer	-0.2117	-0.3423	-0.0224	-0.1454	0.16444
Rice Hispa	0.38216	0.48238*	0.09489	0.00306	-0.069
Whorl Maggot	0.27463	0.06603	0.43778	0.1525	-0.1283
Leaf Folder	0.48107	0.32252	0.41557	0.09237	0.04648
Rice Gundhi Bug	-0.0844	-0.3636	0.24518	-0.2149	-0.2438

4. Conclusion

For recorded the population of insect-pests, the study was conducted at Main Experimental Station of Narendra Deva University of Agriculture and Technology Kumarganj, Faizabad. It can be concluded that all 5 insects (rice hispa, leaf folder, gundhi bug, whorl maggot and Yellow stem borer) which have been discussed in this Experiment. But, out of 5 insects, Yellow Stem Borer and Leaf Folder were recorded as major insect-pests in paddy crop.

5. Acknowledge

The author thanks the Head, Department of Entomology and the Director Research, to provide a piece of land for conducting an experiment in Main Experimental Station of Narendra Deva University of Agriculture and Technology Kumarganj Faizabad (U.P.) and for the necessary facilities that were made available to carry out the research work.

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