To study the seasonal incidence of Rice Earhead bug (*Leptocorisaoratorius*, Thunberg) in Balaghat district of Madhya Pradesh

Comment [MF1]: It is preferable to mention the family and order of the insect

Abstract

This study investigates the relationship between climatic factors and the population dynamics of the rice earhead bug (*Leptocorisaoratorius*) in Balaghat district of Madhya Pradesh. Through correlational analysis, we examined the associations between rainfall, rainy days, morning relative humidity (RH), evening RH, evening vapour pressure, wind velocity, maximum temperature, morning vapour pressure, evaporation, sunshine, and the prevalence of rice earhead bugs. Results indicate a negative correlation between rice earhead bug population and both rainfall and rainy days, suggesting a potential suppression effect of increased precipitation on bug abundance. Morning RH, evening RH, evening vapour pressure, and wind velocity showed non-significant negative correlations with bug population, indicating that these factors may have limited influence on bug dynamics in our study area. Conversely, a positive non-significant correlation was observed between rice earhead bug population and maximum temperature, morning vapour pressure, evaporation, and sunshine. This implies that higher temperatures and increased solar radiation may have a subtle positive effect on bug abundance, although further investigation is warranted to elucidate the underlying mechanisms. Overall, our findings shed light on the complex interplay between climatic factors and rice earhead bug dynamics, highlighting the importance of considering multiple variables in pest management strategies forrice cultivation.

INTRODUCTION

Rice, *Oryzasativa* L. (Family: Poaceae) is the most important food crop for more than two-thirds population of India and more than fifty percent of the world population. Almost 90% of rice is produced and consumed in Asian countries like China, India, Japan, Korea Republic, Srilanka, Pakistan, Bangladesh, *etc.*, (Nadaf*et al.* 2016). India is the second-largest producer of rice in the world. It is the seed of the grass species *Oryzasativa* (Asian rice) or *Oryzaglaberrima* (African rice). As a cereal grain, it is the most widely consumed staple food for a large part of the world's human population, especially in Asia and Africa. It is the agricultural commodity with the third-highest worldwide production after sugarcane and maize. Since the onset of the green revolution in the country, there has been a constant increase in productivity but there is also an increase in the number of insect pests and also a concomitant shift in their pest status intensity, diversity, and spread in rice.

The United States Department of Agriculture estimates that the World Rice Production 2020-21 will be 503.17 million metric tons, around 1.97 million tons more than the previous month's projection. Rice Production last year was 496.40 million tons. This year's 503.17 estimated million tons could represent an increase of 6.77 million tons or 1.36% in rice production around the globe (World Agricultural Production.com). India's rice production is estimated at a record 102.36 million tonnes in the Kharif season of 2020-21 crop year on the back of good monsoon rains and acreage, according to government data (Bloomberg | Quint).

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More than 100 species of insects have been recorded as a pest of rice, of which about a dozen are of significance in India. Major insect pests of rice *viz.*, *Scirpophagaincertulas* (Walker), *Nilaparvatalugens* (Stal), *Sogatellafurcifera* (Horváth), *Cnaphalocrocismedinalis* (Guenée), *Nymphuladepunctalis* (Guenée) *Orseoliaoryzae* (Wood-Mason), *Leptocorisaacuta*(Thunberg).

Among these major insect pests, the rice earhead bug, *Leptocorsiaacuta* (Thunberg) also known as “gundhi bug” is one of the serious sap-sucking pests of paddy (Hashmi*et al*. 1983). Both the nymphs and adults suck the sap from developing grains during the milking growth stage and thus make them fragmentary or entirely chaffy. The panicle is completely shattered and becomes white-colored under grievous infestation at the growing stage (Israel and Rao 1961). They feed on developing (milk stage) grains reducing crop quality and sometimes yield. Their feeding activity can result in partially filled or empty grains. Eggs are circular, brownish seed-like laid in clusters in two rows along the midrib on the upper surface of the leaf blade. Nymphs are pale green and adults are greenish-yellow, long and slender, above ½ inch in length with a characteristic buggy odour. Both adults and nymphs do the damage.

The pest appears on rice just before the flowering stage and continues until panicles ripen. Both nymphs and adults suck the juice from grains in the milky stage, also from peduncle, leaves, and stem causing shrivelled and chaffy grains, and the feeding site favors the development of sooty mould which cause considerable loss in the yield which is

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sometimes rich up to 30% (Tiwari*et al.,* 2014). Heavy infestation can result in 80% (Maharashtra) or total (Malaysia) loss of the crop (Schaefer and Panizzi, 2000). It is estimated that *L. oratorious* may damage 6.4 to 7.7 rice grains/day/adult when released in caged rice plants with the panicle at the flowering stage (Schaefer and Panizzi, 2000). Interestingly wild rice is served as an alternate host for earhead bugs. Environmental factors like relative humidity, temperature, rainfall, etc., have a direct effect on insect pest population development and their reproduction. Rainfall is not only important for survival but also disposal of the insect population (Sharma et al. 2018). Keeping given the above, the present study was undertaken to evaluate the effect of environmental factors against rice earhead bug on rice.

MATERIAL AND METHODS

The research entitled "To study the seasonal incidence of Rice Earhead bug *(Leptocorisaacuta* (Thunberg) in Balaghat district". at College of Agriculture, Murjhad Farm, Waraseoni, Balaghat Madhya Pradesh. For Seasonal incidence of rice earhead bug population counts in terms of nymph and adult were taken in the rice variety MTU-1010, at randomly selected 10 plants in the field. The observations were recorded at weekly intervals by sweeping insect collecting net five times across the crop from randomly selected 20 spots of one square meter from the selected field and the number of nymph and adults of rice earhead bugs will be counted. It will initiate after panicle initiation and will be taken up to the maturity of the crop.

Comment [MF4]: In work methods, remember the season in which the study was conducted (the beginning of planting the crop).

Comment [MF5]:

Comment [MF6]: What is the area of the farm under study?

Comment [MF7]: What time the samples were collected?

Table 1. Weekly meteorological data during the experimentation period i.e. (June 2020 to November 2020) at Balaghat District

Week No.	Dates	Max. Temp. (°C)	Min. Temp. (°C)	Rain-fall (mm)	Rainy days (No.)	Relative Humidity (%)		Vapour Pressure (mm)		Wind Velocity (Kmph)	Evaporation (mm)	Sun shine (hours)
						Morn.	Eve.	Morn.	Eve.			
31	**30-05 July**	33.3	26	23.6	2	89	69	23.9	24.8	5.9	26.7	3.3
32	**06-12Aug**	30.5	25.5	81.6	3	92	77	23.3	24.3	7.1	22.9	1.5
33	**13-19 Aug**	28.4	25.1	71.2	4	93	86	22.8	23.8	10.4	13.9	0.5
34	**20-26 Aug**	31	25.5	29.8	3	89	74	23	23.2	7.8	19.9	2
35	**27 Aug-02 Sept**	29.8	24.6	235.8	4	93	75	22.6	22.9	8.2	19.9	3.7
36	**03-09 Sept**	32.9	26	8	2	91	74	24.3	24.8	3	22.5	4.9
37	**10-16 Sept**	33.2	26	64	2	91	67	24.2	23.4	3.4	24.6	6
38	**17-23 Sept**	32.7	25.8	16.4	2	89	71	23.1	24.5	2.9	19.5	3.6
39	**24-30 Sept**	32.8	25.3	0	0	90	59	22.9	20.4	5.1	24.1	5.3
40	**01-07Oct**	31.8	25	12.8	1	90	63	22.3	21.6	2.6	20.5	4
41	**08-14 Oct**	32.5	25.3	0	0	90	66	23	22.6	4.4	22.4	5

42	**5-21 Oct**	31.9	24.4	7	1	90	60	22.4	20.4	5	23.3	6.5
43	**22-28 Oct**	32.6	20.1	0	0	87	35	16.8	12.7	2.1	24.1	8
44	**29-04 Oct**	31.8	17.4	0	0	82	30	14	10.3	2.2	24.9	7.6
AVG		**32.4**	**20.7**			**84**	**49**	**17.5**	**16.5**	**4.5**		**5.9**

Result & Discussion:-

Species of Rice Earhead bug (*Leptocorisaacuta*, Thunberg) was recorded on the crop 18 days after transplanting and remained active until 1 November 2020. During the study period, relatively good earhead bug populations were observed. The data presented in Table 2 showed that the highest incidence of earhead bug occurred in 41st week 16.50 was followed by 39th week 11.00 and 40th week 9.50 showing the highest incidence of gundhi bug in rice crop. A declining trend was observed in the incidence of gundhi bug after peak incidence and reached its lowest population in 44th week. Minimum incidence of gundhi bug was in 34th week 0.25.

Table 2 :-Seasonal Incidence of Earhead Bug on Rice at Murjhad Farm, COA, Balaghat

Standard Week	Period	Crop age (days)	Crop stage	Mean Earhead bug / hill
31	26 July – 2 Aug.	35	Tillering	0.00
32	3 Aug. – 9 Aug.	45	Tillering	0.00
33	10 Aug. – 16 Aug.	52	Tillering	0.00
34	17 Aug. – 23 Aug.	60	Panicle initiation	0.25
35	24 Aug. – 30 Aug.	65	Panicle initiation	0.50
36	31 Aug. – 6 Sept.	72	Panicle formation	1.50
37	7 Sept. – 13 Sept.	79	Flowering	4.00
38	14 Sept. – 20 Sept.	86	Flowering	5.75
39	21 Sept. – 27 Sept.	92	Flowering	11.00
40	28 Sept. – 4 Oct.	97	Milking	9.50
41	5 Oct. – 11 Oct.	105	Milking	16.50
42	12 Oct. – 18 Oct.	112	Milking	5.75
43	19 Oct. – 25 Oct.	120	Dough	3.50
44	26 Oct. – 1 Nov.	125	Dough	2.75

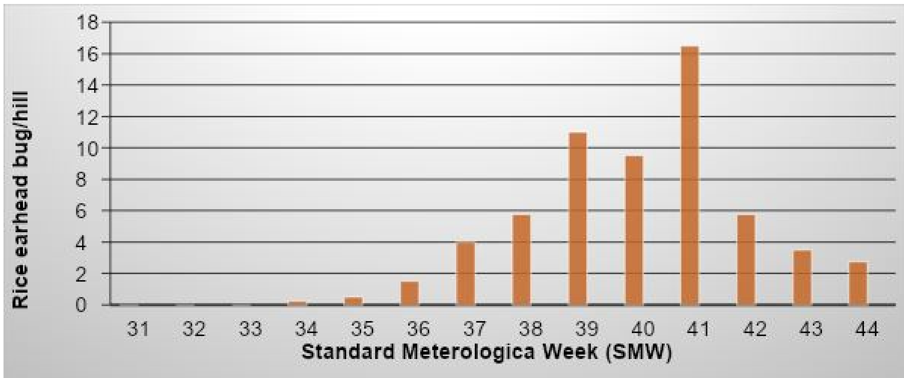

Fig 1. Seasonal Incidence of Earhead bug on Rice at Murjhad Farm, COA, Balaghat

Table 3. Correlation coefficient of Rice Earhead Bug population and weather parameters

Meteorological Parameters		Correlation coefficient
Max. Temp. (°C)		0.40 NS
Min. Temp. (°C)		0.07 NS
Rainfall (mm)		-0.42*
Rainy days		-0.68**
Relative Humidity (%)	Morning	-0.07 NS
	Evening	-0.21 NS
Vapour Pressure (mm)	Morning	0.04 NS
	Evening	-0.08 NS
Wind Velocity (km/h)		-0.41 NS
Evaporation (mm)		0.13 NS
Sunshine (hours)		0.34 NS

* = significant at 5% level of significance

** = significant at 1% level of significance

NS= Non-Significant

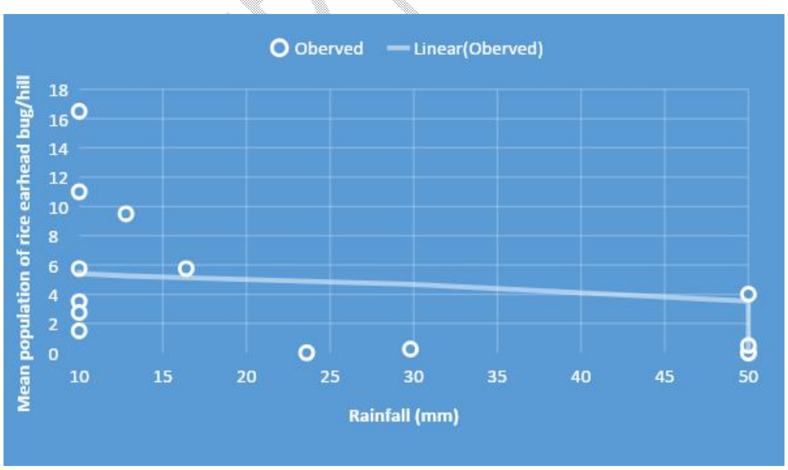

Fig 2. Regression of rainfall (mm) on rice earhead bug infesting rice

Fig 3. Regression of rainy days on rice earhead bug infesting rice

During the July to November months, the earhead bug population ranged from 0.00 to 16.50 with three leaves per plant. The initial occurrence of earhead bug with a mean population of 0.25, was observed on 17 August. The population then gradually increased and on the 2nd week of October reached its peak of 16.50 earhead bugs/hill. Thereafter the decline trend was observed in the earhead bug population and reached its lowest level during November 2.75 earhead bugs/hill. This study is in conformity with earlier findings made by Girish*et al.* (2012), that the pest appeared during reproductive stage of crop, but on the other hand Parwez*et al.* (2012) reported that the activity of pest started from 15th week of age of crop and remained infested throughout the crop period. Kalita*et al.* (2015) reported that in the first week of November the crop attained milking grains, then the pest population reached its peak. Bhattacharjee and Ray (2009) who reported maximum population levels and heavy infestation of gundhi bug in September-October in rice in Barak valley of Assam. Similar results were found with Girish et al. (2012) observed gundhi bug population appeared during reproductive phase of the crop. Shitiri et al. (2014) reported the incidence of ear head bug was observed from 60 days after transplanting till harvest. Sulagitti et al. (2017) reported gundhi bug was first observed during 2nd week of September and its activity gained peak during the third week of September and reached highest level during 4th week of October. Similar pattern of incidence was observed by Kalita et al. (2015) and Pathak (1977) had observed gundhi bug population was found maximum when the crop attained the milky stage.

The rice earhead bug showed negative correlation with rainfall and rainy days and a non-significant negative correlation with morning RH, evening RH, Evening vapour pressure and Wind velocity. Further, a positive non-significant correlation was observed with maximum temperature, maximum temperature, morning vapour pressure, Evaporation and sunshine. These results were in close conformity with the results obtaineed by Roshan and Raju (2017) who reported a negative correlation of weather factors with pest population. Whereas Kalita*et al.* (2015) reported a positive non-significant correlation with maximum temperature.

Comment [MF8]: Note to the researcher
Is there a scientific explanation for the researcher about the relationship between weather conditions of the environment and insect density?

CONCLUSION

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