Original Research Article

Seasonal incidence of rice gundhi bug, *Leptocorisa oratorius* in three different rice growing seasons of Assam

ABSTRACT

Study on seasonal incidence of rice gundhi bug was carried out in the three different rice growing seasons of Assam, *viz*., *sali* (var. *Ranjit*), *boro* (var. *Joymoti*) and *ahu* (var. *Disang*) during 2020-21 at Regional Agricultural Research Station, AAU, Titabor. In *sali* rice, the lowest population (0.05 gundhi bug hill^{-1}) was observed on 40th Standard Meteorological Week (SMW) and the highest (0.9 gundhi bug hill^{-1}) was recorded on 46th SMW during 2020. In *boro* rice, the lowest population (0.3 gundhi bug hill^{-1}) was recorded on 14th SMW and the highest of 3.75 gundhi bug hill^{-1} was recorded on 20th SMW during 2021. During *ahu* season, the lowest population (0.25 gundhi bug hill^{-1}) was also recorded on 14th SMW and the highest (1.2 gundhi bug hill^{-1}) was on 19th SMW during 2021. On an average, the highest population of gundhi bug was observed in *boro* rice followed by *ahu* and *sali*. During *sali* season, population build-up of gundhi bug showed significant positive correlation with morning relative humidity (r=0.734) and bright sunshine hour (r= 0.661). While, during *boro* and *ahu* rice the gundhi bug showed significant positive correlation with minimum temperature (*boro*, r = 0.600; *ahu,* r =0.649), evening relative humidity (*boro*, r= 0.643; *ahu*, r= 0.614) and number of rainy days (*boro*, r = 0.742; *ahu*, r= 710).

Key words: *Leptocorisa oratorius, Ahu, Boro, Sali, Seasonal incidence*

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1. Introduction

Rice gundhi bug, *Leptocorisa oratorius* is a major pest of rice in Assam. They attack during reproductive stage of the crop, which appears just ahead of the flowering stage and continues till panicle ripening. In Asia, mainly four species of the genus *Leptocorisa* are reported to infest the rice crop *viz., L. acuta, L. varicornis*, *L. oratorius* and *L. chinensis* (1). Both the nymphs and adults suck the sap of grains during the milky stage, also from peduncle, leaves and stem causing shrivelled and chaffy grains and the feeding site favour the development of sooty mould, which cause considerable loss in the yield. In case of severe infestation, the entire panicle turns white coloured and empty (2) and sometimes reduce yield by as much as 30% (3) and in Eastern part of the country, 70% damage of the crop has been reported (4). A serious infestation can result in 80% (Maharashtra) or total (Malaysia) loss of the crop (5). Available literature suggests that abundant studies have been conducted in India as well as abroad, but there is a lack of

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information on the population abundance of *Leptocorisa oratorius*. in rice ecosystem of Assam. Moreover, in Assam, rice is grown in three different seasons of the year, viz., Sali (June/July- Nov/Dec), Boro (Nov/Dec- May/June) and Ahu (Feb/March- June/July). But information on incidence of rice gundhi bug in all the three rice growing seasons in lacking in the region. Information on the insect pests in relation to the weather parameters is a prerequisite before formulating a location-specific management strategy. Therefore, the present experiment was conducted to detect the seasonal incidence of rice gundhi bug in different rice growing seasons of Assam. Approach was also made to correlate them with weather parameters.

2. Materials and Methods

The study was carried out in all the three rice growing seasons of Assam, *viz., sali* (var. *Ranjit*), *boro* (var. *Joymoti*) and *ahu* (var. *Disang*) during 2020-2021 at Regional Agricultural Research Station, Titabor, Assam. Crop was grown by following standard package of practices recommended for Assam except application of pest control measures. To study of seasonal incidence of rice gundhi bug, an area of 400 sq. m. was selected. The sowing of rice during *sali, boro* and *ahu* was done on 27th June, 2020; 21st December, 2020 and 2nd February, 2021, respectively which were transplanted on 27th July, 2020; 17th February, 2021 and 2nd March, 2021, respectively.

The data on the incidence of gundhi bug was collected by following Plant Inspection Method (6). The pest population was recorded at 7 days interval starting from the initial pest occurrence to maturity of the crop. The incidence of *L. oratorius* was recorded on 20 randomly selected hills. The number of motile adult and nymphal stages of *L. oratorius* on all the randomly selected hills was recorded and total count was averaged and expressed in per hill basis. Data on weather parameters *viz.,* temperature (maximum and minimum), relative humidity (morning and evening), total rainfall, number of rainy days and bright sunshine hours (BSSH) were collected from meteorological observatory of RARS, Titabor preceding each sampling date for the three consecutive rice growing seasons. The average meteorological data for standard meteorological weeks were calculated and correlated to access their influence on population buildup of rice gundhi bug. Statistical analyses were done by using IBM SPSS statistics 22.

3. Results and Discussion

3.1 Seasonal incidence of rice *L. oratorius* during Sali season

Appearance of rice gundhi bug was started from 40th SMW *i.e*., October 1st week and continued till the maturity stage of the crop (49th SMW), population ranged from 0.05 to 0.9 bugs hill^{-1} (Table 1). The observation of the bug population indicated that its appearance almost coincided with the flowering phase and dough stage of the rice crop. The highest peak was recorded on 46th SMW. The present finding is in conformity with Singh *et al*. (7) who observed the appearance of gundhi bug population from 39th to 48th SMW. Girish *et al.* (8) also observed the appearance of gundhi bug population during reproductive phase of the crop. In present studies, the highest population of gundhi bug (0.9 no. of insects hill^{-1}) was

observed on 46th SMW (3rd week of November) when the crop was at hard dough stage. Mohanta *et al.* (9) from Varanasi, Uttar Pradesh also recorded peak population of rice gundhi bugs on 46th SMW. Kalita *et al*. (10) from Sikkim also reported that Gundhi bug started to appear from 42nd SMW onwards and reached peak during 45th SMW.

The correlation studies revealed that gundhi bug population had a significant negative correlation with maximum temperature (r = - 0.652), minimum temperature (r = -0.760), evening relative humidity (r = -0.765) whereas positive significant correlation was found with morning relative humidity (r = -0.734) and BSSH (r = 0.661) (Table 4). Similar findings were documented by Mohanta *et al.* (9) who reported a significant negative correlation of maximum temperature, minimum temperature, evening relative humidity and positive correlation with morning relative humidity with rice gundhi bug. Kalita *et al.* (11) also confirmed that the occurrence of gundhi bug revealed significant negative correlation with maximum temperature, minimum temperature, and rainfall while significant positive correlation with morning relative humidity. Gupta *et al.* (3) also reported significant positive correlation between rice gundhi bug incidence and BSSH.

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3.2 Seasonal incidence of rice *L. oratorius* during Boro season

During boro season, the incidence of rice gundhi bug started to appear from 14th SMW with a population level of 0.3 insects hill^{-1} during the maximum tillering stage of the crop and remained in the field till harvesting. Similar results were also reported by Sulagitti *et al.* (12) from Varanasi and opined that the pest was observed on the crop from tillering stage to harvesting of the crop. In the present investigation, two population peaks of gundhi bug were recorded at 16th SMW and 20th SMW. The highest population of gundhi bug was appeared on 20th SMW with a population level of 3.75 gundhi bugs hill^{-1}, which coincided with soft dough stage of the crop. Parwez *et al.* (13) also found less or more similar result in Pusa Samastipur, Bihar, who reported that during *boro* rice season, activity of gundhi bug started from 15 weeks age of the crop and remained intensified throughout the crop period.

The appearance of gundhi bug showed significant positive correlation with the minimum temperature (r= 0.600), evening relative humidity (r = 0.643) and number of rainy days (r = 0.742), (Table 4). Moreover, in the present investigation it was seen that population of rice gundhi bug had a non-significant positive correlation with morning relative humidity (r = 0.372), total rainfall (r = 0.526) while non-significant negative correlation with maximum temperature (r = -0.326) and BSSH (r = -0.459). Results of the present investigation are more or less similar to the results of Parwez *et al*. (13). They reported that maximum temperature showed a negative effect, whereas minimum temperature and evening relative humidity showed a positive influence on gundhi bug infestation in *boro* rice. Sulagitti *et al.* (12) also reported that morning relative humidity had a positive non-significant correlation with the population of rice gundhi bug.

3.3 Seasonal incidence of rice *L. oratorius* during Ahu season

During *ahu* season, the occurrence of rice gundhi bug started from 14th SMW (Table 3). Pest density in the first week of appearance was initially low *i.e.*, 0.25 no. of insect hill^{-1} which coincided with the tillering stage of the crop. Their abundance gradually increased reaching a peak level of 1.2 no. of insect hill^{-1} on 19th SMW which coincided with the soft dough stage of the crop. From 20th SMW onwards the population was observed to be declined and gradually population reached a level of 0.8 no. of insect hill^{-1} on 22nd SMW. These results are in concurrence with Saroja and Raju (14) who reported that the bug remained in field till the grain hardening and the successive generations migrated from early maturing varieties to late maturing varieties. The authors also mentioned that the rice gundhi bug becomes more active after milky stage of the crop. Ghule *et al*. (15) reported that during the summer season, incidence of gundhi bug started from 12th SMW, and thereafter the population gradually increased and reached peak during 17th SMW (9.65 bugs per five net sweeps). The variation in the incidence of rice gundhi bug and its peak incidence might be due to the difference in sowing time as well as weather conditions.

As per statistical data of 2012-13, Sali rice occupies 74.67 % of the rice growing area followed by boro (15.76 %) and ahu (9.57 %) (16). As a result of which, more gundhi bug population was observed in boro and ahu season as the crop is grown in a less area resulting in concentration of the pest. Though the flowering initiated almost at the same time during boro and ahu season, the highest seasonal abundance of rice gundhi bug during boro season might be due to the long growing season of the crop that favoured population build-up of the pest.

The correlation analysis of rice gundhi bug with weather parameters in *ahu* rice revealed that the incidence of rice gundhi bug had a significant positive correlation with minimum temperature (r = 0.649), evening relative humidity (r = 0.614) and number of rainy days (r = 0.71), while non-significant positive correlation was observed with morning relative humidity (r = 0.085) and total rainfall (r = 0.417) (Table 4).

4. Conclusion

In the present experiment, on an average, the incidence of gundhi bug was found maximum in *boro* season followed by *ahu* and *sali* seasons during 2020-2021. The population of gundhi bug was present from panicle emergence to the mature stage of the crop during *sali*, and from tillering to maturity of the crop during *boro* and *ahu*, 2020-21. However, the maximum population of gundhi bugs were recorded at the dough stage of the crop.

References:

1. Khare VK, Prakash R. Effect of abiotic factors on the population dynamics of paddy earhead bug, *Leptocorisa oratorius* F. Journal of Entomology and Zoology Studies. 2020; 8 (6), 157-160.
2. Venkatesh H, Pradeep S, Sridhara S, Naik MI. Incidence of rice earhead bug, *Leptocorisa oratorius* (F.) (Hemiptera: Alydidae) in Bhadra command area and effect of its feeding on grain damage. Environment and Ecology. 2009; 27 (2), 708-712.
3. Gupta K, Kumar A, Patel GP, Navneet. Seasonal incidence of Gundhi bug on rice under agro-climatic condition of Allahabad. International Journal of Chemical Studies. 2018; 6 (3), 1516-1518.
4. Sharma KR, Raju SVS, Roshan DR. Effects of environmental factors on population dynamics of rice ear head bug and their management with newer insecticide combinations and sole insecticide. Bangladesh Journal of Botany. 2019; 48 (4), 973-979.
5. Schaefer CW and Panizzi AR. Heteroptera of Economic Importance. CRC Press LLC, N.W. Corporate Blvd., Boca Raton, Florida. 2000.
6. Saikia R, Saikia DK, Islam AN, Devee A. Seasonal population build-up of leaf folder (*Cnaphalocrocis medinalis* Guenee) in paddy in response to meteorological parameters. Journal of Agrometeorology. 2019; 21 (2), 230-232.
7. Singh D, Gupta PK, Chandra U, Vikrant. Population dynamics of insects pests of paddy and its correlation with weather parameters. Journal of Entomology and Zoology Studies. 2018; 6 (1), 1405-1407.
8. Girish VP, Mahabaleshwar H, Hanamaratti NG, Balikai RA. Population dynamics of leafhopper, grasshopper, horned caterpillar and ear head bugs under different planting methods of rice ecosystem. Journal of Experimental Zoology. 2012; 15 (2), 451-454.
9. Mohanta PK, Raju SVS, Giri GS. Influence of environmental factors on seasonal incidence of sucking pests of rice. Journal of Pharmacognosy and Phytochemistry. 2020; 9 (3), 822-825.
10. Kalita H, Avasthe RK, Ramesh K. Effect of weather parameters on population Buildup of different insect pests of rice and their Natural enemies. Indian Journal of Hill Farming. 2015; 28 (1), 69-72.

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11. Kalita S, Hazarika LK, Deka RL. Gayon J. Effect of weather parameters and varieties on occurrence of insect pests and natural enemies of rice. Journal of Pharmacognosy and Phytochemistry. 2020; 9 (5), 2429-2438.
12. Sulagitti A, Raghuraman M, Reddy MSS, Sathua SK. Seasonal variation in major insect pests incidence on rice and impact of various abiotic factors on their incidence under Varanasi conditions. Journal of Entomology and Zoology Studies. 2017; 5 (3), 1060-1063.
13. Parwez A, Singh SK, Shankar T, Singh PK, Singh SS. *Leptocorisa vericornis* –weather relationship studies in boro rice. Journal of Interacademia. 2012; 16 (2), 274-277.
14. Saroja R, and Raju N. Effect of planting time on rice panicle bug incidence. International Rice Research Newsletter. 1985; 10 (2), 17.
15. Ghule SD, Patel KG, Pandya HV. Seasonal incidence of Rice ear head bug (*Leptocorisa acuta* Thun.) of paddy in south Gujarat. Insect Environment. 2008; 14 (1), 7-8.
16. Goswami PK, Dutta RK, Das S, Medhi D et al. State / district wise area, production, price and value of ten major crops in Assam from 2003-04 to 2012-13. Directorate of Economics and Statistics, Assam Government of Assam, Guwahati-28. 2015.

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Table 1. Seasonal incidence of *L. oratorius* during Sali season, 2020

SMW	Crop stage	Population of gundhi bug /hill	Temperature (°C)		Relative humidity (%)		No. of rainy days	Total rainfall (mm)	Bright sunshine hours
			Max.	Min.	Mor.	Eve.			
38	Panicle initiation	0	33.8	23.8	95.4	78.7	3	63.3	4.2
39		0	31.4	23	96.7	82.7	6	53	2.6
40	Flowering	**0.05**	33.9	23.8	96	80.5	0	0	4.1
41	Milky	0.25	34.3	22.9	96	73.8	1	24	5.3
42		0.40	34.4	22.5	95.3	71.3	1	42.4	5.8
43	Soft dough	0.53	29.9	20.9	96.2	83.4	3	68	3.2
44		**0.80**	31.7	21.2	95.7	67.5	1	9.4	4.8
45	Hard dough	0.80	30.2	17	94.5	68.7	1	1.8	6
46		**0.90**	30	13.2	94	60	0	0	8.2
47	Maturity	0.70	26.5	13.8	94.3	67.1	1	17.2	4.3
48		0.80	27.4	10.6	93.7	56.1	0	0	7.6
49		0.60	27.2	11.5	94.7	57.5	0	0	6.4
Mean population of gundhi bug /hill = 0.5									

Table 2. Seasonal incidence of *L. oratorius* during Boro, 2020-21

SMW	Crop stage	Population of gundhi bug /hill	Temperature (°C)		Relative humidity (%)		No. of rainy days	Total rainfall (mm)	Bright sunshine hours
			Max.	Min.	Mor.	Eve.			
12	Tillering	0	33.0	16.0	92.3	39.3	0	0.0	5.6
13		0	30.6	17.6	92.8	55.4	3	24.4	4.4
14 2 aprl		**0.30**	32.2	15.45	91.3	43.57	0	0.0	6.07
15		0.35	31.8	16.9	87.1	47.9	2	1.4	5.6
16	Panicle initiation	0.80	30.3	17.6	90.8	56.8	2	18.2	4.7
17		0.53	35.6	18.0	82.4	36.3	0	0.0	8.7
18	Flowering	0.75	33.2	19.4	89.3	54.0	4	19.2	3.3
19	Milky	2.10	29.8	18.6	94.4	66.8	5	25.0	3.6
20	Soft dough	**3.75**	27	19.4	95.3	83.6	7	73.8	1.3
21	Hard dough	3.50	33.8	23	91.8	66.8	4	16.2	4.9
22	Maturity	1.60	32.8	22.7	90.3	80.6	5	102.4	3.8
23 04 Jun		0.75	29.3	21.8	95.4	84	4	13.2	1.8
Mean population of gundhi bug /hill = 1.2									

26 dec (171days)

Table 3. Seasonal incidence of *L. oratorius* during Ahu, 2021

SMW	Crop stage	Population of gundhi bug /hill	Temperature (°C)		Relative humidity (%)		No. of rainy days	Total rainfall (mm)	Bright sunshine hours
			Max.	Min.	Mor.	Eve.			
12	Tillering	0.0	33.0	16.0	92.3	39.3	0	0.0	5.6
13		0.0	30.6	17.6	92.8	55.4	3	24.4	4.4
14		**0.25**	32.2	15.4	91.3	43.6	0	0.0	6.1
15	Panicle initiation	0.45	31.8	16.9	87.1	47.9	2	1.4	5.6
16		0.53	30.3	17.6	90.8	56.8	2	18.2	4.7
17	Flowering	0.75	35.6	18.0	82.4	36.3	0	0.0	8.7
18	Milky	1.00	33.2	19.4	89.3	54.0	4	19.2	3.3
19	Soft dough	**1.20**	29.8	18.6	94.4	66.8	5	25.0	3.6
20	Hard dough	1.13	27.0	19.4	95.3	83.6	7	73.8	1.3
21	Maturity	1.00	33.8	23.0	91.8	66.8	4	16.2	4.9
22		0.80	32.8	22.7	90.3	80.6	5	102.4	3.8
Mean population of gundhi bug /hill = 0.64									

Table 4. Correlation of rice *L. oratorius* population with different weather parameters in *Sali*, *boro* and *ahu* seasons during 2020-2021

Weather parameters	Correlation coefficient (r)		
	Sali	***Boro***	***Ahu***
Maximum temperature (°C)	**-0.652***	-0.326	-0.161
Minimum temperature (°C)	**-0.760****	**0.600***	**0.649***
Morning relative humidity (%)	**0.734****	0.372	0.085
Evening relative humidity (%)	**-0.765****	**0.643***	**0.614***
No. of rainy days	-.562	**0.742****	**0.710 ***
Total rainfall (mm)	-0.566	0.526	0.417
BSSH	**0.661***	-0.459	-0.432

*Significant at P = 0.05

**Significant at P = 0.01