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Seasonal incidence of rice gundhi bug *Leptocorisa oratorius* Fab. (Hemiptera: Alydidae) and effect of various abiotic factors on their incidence in Dhubri district of Assam

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Abstract
A survey was conducted in different farmers field to study the seasonal incidence of gundhi bug, *Leptocorisa oratorius* Fab. (Hemiptera: Alydidae) in relation to the meteorological parameters and their damage potential in rice ecosystem in Dhubri district of Assam during *Sali* 2019 & 2020. The incidence of gundhi bug infestation commenced during second week of October and attained its peak population during first week of November *i.e* the 44th standard meteorological week (SMW). The correlation studies between incidences of *L. oratorius* with meteorological parameters revealed that only rainfall (r= - 0.606) showed significant negative correlation whereas, other parameters showed non-significant correlation during 2019. However during 2020, the incidence of *L. oratorius* showed significant positive relationship with bright sunshine hour (r = 0.704) and significant negative correlation with morning relative humidity (r = -0.817) whereas, other parameters showed non-significant correlation. During the survey period, the percent grain infestation due to gundhi bug was recorded as 25.95 and 26.77 during 2019 & 2020, respectively.

Keywords: Seasonal incidence, rice, Gundhi bug, correlation

Introduction
Rice is the second most important cereal grown in the world. It is the staple food for over half of the world's population. In India, rice is grown in an area of 43.79 million ha with a production of 116.42 million tonnes and productivity of 2659 kg/ha, stands second next to China (Anonymous, 2019) [2]. The major rice producing states of India are West Bengal, Uttar Pradesh, Andhra Pradesh, Punjab, Tamil Nadu, Bihar, Orissa, Assam, Karnataka and Haryana. In Assam, rice is grown in an area of 2.46 million ha with production of 5.14 million tonnes and its productivity is 2086 kg/ha (Anonymous, 2019) [2] and stands ninth position in production among all the rice growing states. The major constraints of rice production is both biotic (Pest, disease etc.) and abiotic (floods, drought, temperature, humidity etc.) stresses. Among the biotic stresses, insect pests are the major threat to rice production. In India insect pest cause 25 percent loss in rice (Mondal *et al*., 2017) [9]. About 300 species of insect pests attack the rice crop at various stages of crop growth and among them 23 species causes remarkable damage (Pasalu and Katti, 2006) [10]. Rice gundhi bug, *Leptocorisa* spp. Fab. (Hemiptera: Alydidae) is one of the most serious/important pest of rice, which causes about 15-30% yield reduction (Baharally and Simon, 2014; Tiwari *et al.*, 2014) [3, 14]. Both the nymphs and adults causes damage by sucking the sap from the grains during milky stage and thus make them chaffy. The incidence of gundhi bug populations are influenced by several biotic factors such as nearby woodlands, extensive weedy areas near rice fields, wild grasses near canals, and staggered rice planting and abiotic factors mainly temperature, relative humidity, heavy rainfall, and frequent drizzles etc. Occurrence of rice gundhi bug is common in rainfed and upland rice and they mostly prefer the flowering to milky stages of the rice crop. In the present investigation an attempt was made to know the effect of abiotic factors on the pest population of rice gundhi bug in Dhubri districts of Assam during *Sali*, 2019 and 2020.

Materials and Methods
The survey was conducted or carried out in different farmer's field of Dhubri district, Assam during *Sali*, 2019 and 2020 to study the incidence of rice gundhi bug in rice ecosystem.

During survey, the variety 'Ranjit' was taken under supervision.The rice variety Ranjit was transplanted on 13th and 11st March during 2019 and 2020, respectively with spacing row to row 20 cm and plant to plant 10 cm with two plants per hill at depth of 5 cm. The incidence of *L. oratorius* was recorded at weekly intervals from 10 randomly selected hills per plot starting from panicle initiation till harvesting and correlated the data with meteorological parameters.

To calculate the percent grain infestation, the whole experimental area was divided into three plots and from each plot five hills were selected and from each hill three numbers of panicle were taken. Each plot served as a replication. The grain infestation percentage was recorded by counting the total (infested and uninfested) number of grain and the number of infested grain per panicle. Percentage of infested grain was counted by using following formula (Aktar *et al*., 2020) [1].

$$\%\,\text{grain infestation} = \frac{\text{Total no. of infested grain}}{\text{Total no. of grain (Infested + uninfested)}} \times 100$$

Results and Discussion

The occurrence of rice gundhi bug *Leptocorisa acuta* (Thun.) was first recorded on 2nd week of October *i.e.* 41st standard meteorological week (SMW) with an average of 0.36 and 0.30 adult per hill during 2019 and 2020, respectively. The population was gradually increased with a peak of 1.40 and 1.63 adult per hill on 44th SMW (1st week of November), respectively. The present findings are in close conformity with Kulagod (2009) [8] who found that during *Kharif*, the peak period of earhead bug was the first fortnight of November. Girish *et al*. (2012) [5] reported that the gundhi bug population was found to be appeared during reproductive phase of the crop and Shitiri *et al*. (2014) [11] observed the incidence of earhead bug from 60 days after transplanting till harvest which supported the present findings.

Table 1: Incidence of rice gundhi bug (*Leptocorisa oratorius*) during Sali (*Kharif*), 2019

SMW	Date of observation	Mean (number of adult/hill)	Max. Temp. (ºC)	Min. Temp. (ºC)	RH (%)		Bright sunshine hour (BSSH)	Rainfall (mm.)
					Max.	Min.		
38	17 Sep-23 Sep	0.00	32.9	24.3	92.1	71.6	4.6	8.0
39	24 Sep - 30 Sep	0.00	28.5	22.1	98	86	1.5	38.5
40	1 Oct - 7 Oct	0.00	30.1	22.8	95	74	3.4	11.2
41	8 Oct - 14 Oct	0.36	30.7	21.4	95	71	4.8	15
42	15 Oct - 21 Oct	0.86	32.9	21.0	88	62	8.2	0
43	22 Oct - 28 Oct	1.20	27.6	19.8	92	74	1.7	1.5
44	29 Oct - 4 Nov	1.40	31.3	18.2	89	54	8.9	0
45	5 Nov - 11 Nov	1.16	29.9	18.3	91	63	6.6	0.2
46	12 Nov - 18 Nov	0.90	30.7	18.4	88	61	7.7	0
47	19 Nov - 25 Nov	0.66	28.6	15.8	95	60	4.8	0
48	26 Nov - 2 Dec	0.63	28.5	14.3	94	56	6.6	0
49	3 Dec - 9 Dec	0.20	27.1	9.4	86	44	8.4	0

Replication: 3
No. of hill per replication: 10
Max.: Maximum
Min.: Minimum
Temp.: Temperature
RH: Relative humidity.

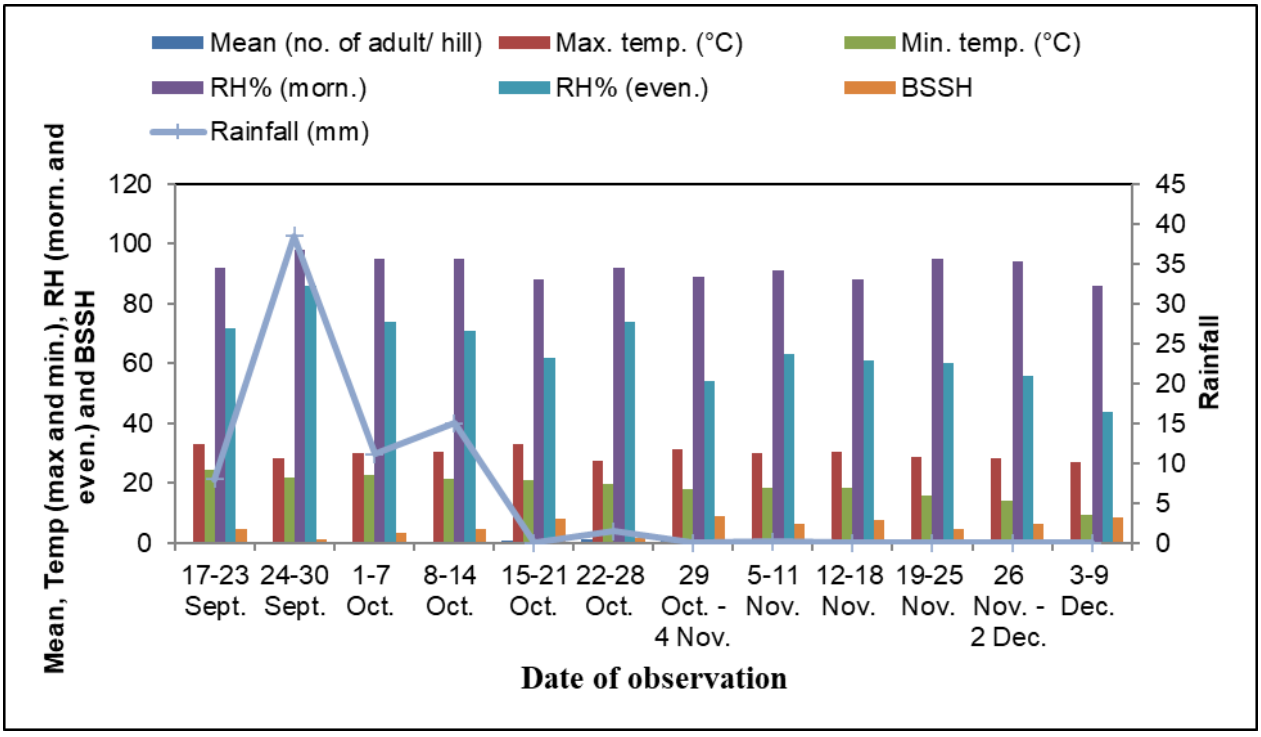

Fig 1: Incidence of rice gundhi bug (*Leptocorisa oratorius*) during *Sali* (*Kharif*), 2019

Table 2: Incidence of rice gundhi bug (*Leptocorisa oratorius*) during *Sali* (*Kharif*), 2019

SMW	Date of observation	Mean (number of adult/hill)	Max. Temp. (ºC)	Min. Temp. (ºC)	RH (%)		Bright sunshine hour (BSSH)	Rainfall (mm.)
					Max.	Min.		
38	17 Sep - 23 Sep	0.00	31.4	24.4	94	83	3.6	41.5
39	24 Sep - 30 Sep	0.00	29.1	23.6	96	85	2.5	44.6
40	1 Oct - 7 Oct	0.00	32.8	24.7	96	78	4.1	8.9
41	8 Oct - 14 Oct	0.30	34.1	23.5	91	64	7.4	0.1
42	15 Oct - 21 Oct	0.80	34.3	22.1	87	59	8.9	0
43	22 Oct - 28 Oct	1.10	30.0	21.1	91	75	5.2	16.6
44	29 Oct - 4 Nov	1.63	32.4	19.2	83	60	8.3	0.1
45	5 Nov - 11 Nov	1.23	29.8	13.9	79	54	8.1	0
46	12 Nov - 18 Nov	0.86	31.1	13.5	83	46	8.9	0
47	19 Nov - 25 Nov	0.53	27.0	13.5	92	55	5.8	0
48	26 Nov - 2 Dec	0.56	27.4	11.7	83	52	7.4	0
49	3 Dec - 9 Dec	0.26	26.9	13.2	94	56	6.6	0
50	10 Dec -16 Dec	0.16	24.9	13.9	97	67	3.4	0

Replication: 3
No. of hill per replication: 10
Max.: Maximum
Min.: Minimum
Temp.: Temperature
RH: Relative humidity

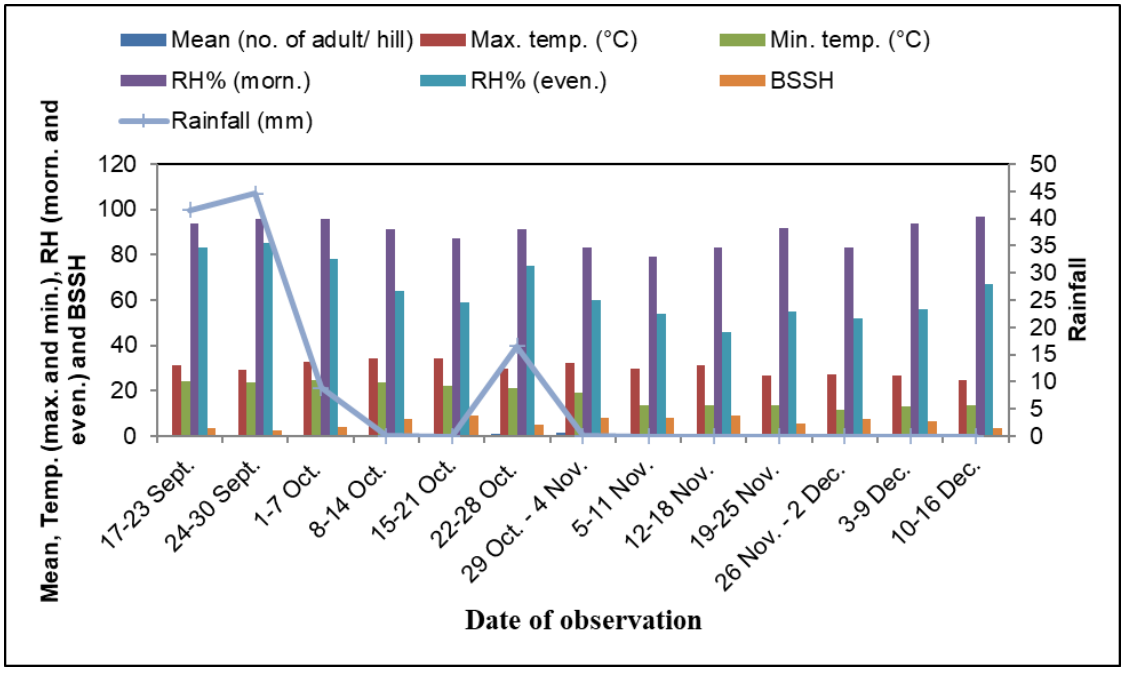

Fig 2: Incidence of rice gundhi bug (*Leptocorisa oratorius*) during *Sali* (*Kharif*), 2019

The correlation studies between incidence of *L. oratorius* with meteorological parameters revealed that during 2019, the incidence of *L. oratorius* showed significant negative correlation with rainfall (r= - 0.606) whereas, non-significant positive correlation with maximum temperature (r = 0.047) and bright sunshine hour (r = 0.399) and non-significant negative correlation was found with minimum temperature (-0.200), morning relative humidity (r=-0.433) and evening relative humidity (r= -0.354). In accordance with the present findings, Bhatnagar and Saxena (1999) [4] also found a positive correlation of *L. acuta* with maximum temperature while, Kalita *et al*. (2015) [7] recorded a non-significant positive correlation between bright sunshine hour (r= 0.353) and gundhi bug population whereas, non-significant negative correlation with maximum relative humidity (r= -0.381) and minimum relative humidity (r= -0.348) during 2007. During 2008, they have also reported a non-significant negative correlation with minimum relative humidity (r= -0.115). Similarly, Sulagitti *et al*. (2017) [12] also reported that gundhi bug population showed a negative non-significant correlation with evening relative humidity (r= -0.133). Tigga *et al*. (2018) [13] reported that the percent infestation of gundhi bug was positively correlated with the maximum temperature.

However, during 2020 the incidence of *L. oratorius* showed significant positive relationship with bright sunshine hour (r = 0.704) whereas, *L. oratorius* incidence showed significant negative correlation with morning relative humidity (r = -0.817); non-significant positive correlation with maximum temperature (r = 0.208) and non-significant negative correlation with minimum temperature (r = -0.283), evening relative humidity (r = -0.523) and rainfall (r= - 0.452). Similarly, Kalita *et al*. (2015) [7] also found a non-significant negative correlation with total rainfall (r= -0.018) during 2007. During 2008, they have also reported a non-significant negative correlation with minimum relative humidity (r= -0.115) and total rainfall (r= -0.308). Sulagitti *et al*. (2017) [12]

reported that gundhi bug population showed a negative non-significant correlation with evening relative humidity (r= -0.133) as well as rainfall (r= -0.087). Gupta *et al*. (2018) revealed that gundhi bug population showed a significant positive correlation only with sunshine (r = 0.556); non-significant positive correlation with maximum temperature (r = 0.223) and non-significant negative correlation with minimum temperature (r = -0.008), evening relative humidity (r = - 0.171) and rainfall (r = -0.356) at 5 per cent significant level.

Table 3: Correlation of *Leptocorisa oratorius* incidence with meteorological parameters during *Sali*, 2019 & 2020

Year	Temp (ºC)		RH (%)		Bright sunshine hour (BSSH)	Rainfall (mm.)
	Max.	Min.	Mor.	Eve.		
2019	0.047	-0.200	-0.433	-0.354	0.399	-0.606*
2020	0.208	-0.283	-0.817*	-0.523	0.704*	-0.452

*=Significant at 5%
Max.: Maximum
Min.: Minimum
Temp.: Temperature
RH: Relative humidity

The grain infestation percentage was slightly higher during 2020 which was found to be 26.77 while, 25.95 was recorded during 2019.

Conclusion

From the present investigation it can be concluded that incidence of rice gundhi bug, was highest during reproductive phase of the crop. The population fluctuation is mainly depends on the meteorological parameters. The incidence of gundhi bug infestation commenced during second week of October and attained its peak population during first week of November *i.e* the 44th SMW. These findings could be helpful for proper and timely management of the gundhi bug in rice crop.

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