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Seasonal abundance of brown plant hopper, *Nilaparvata lugens* (Stal) in basmati rice and correlation of abiotic factors under Meerut region

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Abstract
The research was conducted at Crop Research Centre of Sardar Vallabhbhai Patel university of Agriculture and technology Meerut, During the *Kharif* season of 2018. The data revealed that Brown plant hopper (BPH) population was low from 31 to 35th SMW and ranged between 0.78 to 4.64 BPH per hill where as maximum population was recorded 15.87 BPH per hill in the 38th Standard Week with minimum temperature of 21.9 ^{0}C, Maximum temperature 35.1 ^{0}C, Min. R.H. 55.8%, Max. R.H. 93.2% and rainfall 13.0 mm. Mean population of BPH expressed positive correlation with minimum temperature (+0.019), maximum temperature (+0.117), minimum R.H. (+0.293), maximum R.H. (+0.165) and negatively correlate with rainfall (-0.245).

Keywords: BPH, rice, weather parameters

Introduction
Rice (*Oryza sativa* Linn.) belongs to the family-Graminae, is the second largest produced cereal in the world. It has two cultivated and 22 wild *spp*. It is only cultivated cereal plant adapted to growing in flooded and non- flooded soil. Rice is the major food crop which is providing about 80 percent of the calories to over 2 billion Asian's. Rice grown area is 44.50 M ha with production of 115.63 Mt in India (Anonymous, 2019) [2]. Rice is the major staple food for half of the world (Khush, 2004) [6]. It supplies 365 kcal energy, 0.12 g sugar, 7.12 g protein 1.3 g dietary fiber and traces of thiamine, riboflavin, zinc, calcium, iron, manganese (Anonymous, 2010) [1].

Various factors are responsible for the reduction of rice yield along with many of the diseases and insect pest. One of the main reasons for the low productivity of rice is insect-pests, diseases and weeds. Many most of the insect *spp*. has been reported to attack rice crop out of which aprrox. 20 *spp* have been found to be major including Brown plant hopper, White Backed Plant Hopper, Yellow stem borer and some other insect pests (Singh and Dhaliwal, 1996) [14].

The Brown plant hopper is the monophagus, small or tiny insect with 2.0 to 3.5 mm body length. It is a brownish color insect which feed on the phloem of plant. Adult and nymphs, both damage to the phloem of rice plant. Though this insect is known to occur in Asia since late forties, it was earlier only a minor pest of rice. Serious outbreaks of BPH were reported in various parts of India during early 70s**.** BPH damages plant directly by sucking to plant sap and indirectly by transmitting viral disease like grassy stunt and ragged stunt**.** BPH caused economic damage by sucking phloem sap which in turn leads to "hopper burn" and sever yield loss (Rao *et al.*, 2003) [11].

Both the nymphs and adults of these hoppers suck the sap from phloem and xylem resulting in drying up of the rice plant. At early infestation, round, yellow patches appear, which soon turn brownish due to the drying up of the plants (Ling, 1975) [8]. Agriculture consumes 52 per cent of the total insecticides in India, and intern rice crop alone accounts for 17 per cent of it. About 50 per cent of Indian rice farmers use insecticides ranging from one to six applications per crop season against Stem borers, Brown plant hopper, White backed plant hopper and Leaf folder (Lakshmi et al., 2010; Bharti et al., 2018) [7, 3].

The BPH, *Nilaparvata lugens* (Stal.) is one of most economic pest of rice causing up to 34.4 per cent losses in paddy crop in Chhattisgarh state (Prakash *et al.*, 2005) [10].

Keeping this in view the idea of agro ecosystem the research program was undertaken to investigate the effectiveness of different approaches against Brown Plant Hopper, *Nilaparvata lugens* (Stal.).

Materials and Methods

The present investigation was carried out during *Kharif*, 2018 in randomized block design with variety Pusa Basmati 1 replicated thrice and have a plot size of 5x 4 m^2. The seedlings transplanted in July 18th, 2018. Observations were taken by direct visual counting method. In this method, the random samplings of ten hills were carried out for the purpose of population fluctuation of the BPH in rice field. Hills were tagged out from the each plot of untreated control. These plants were observed regularly at weekly interval. The nymphal and adult population of BPH was recorded per hill starting from the transplanting till the harvest of the crop. The meteorological data was also recorded throughout the crop season.

Results and Discussion

The population of BPH, *Nilaparvata lugens* (Stal.) in the rice crop along with meteorological during *Kharif*-2018 has been presented in Table-1 and Figure - 1. The data showed that infestation of Brown plant hopper appeared during the first week of August (31st Standard week) and remained in the field till harvest of crop (46th Standard week). The abundance of the BPH was low from the 31st week of the year and ranged between 0.78 to 4.64 BPH per hill. Some favorable climatic condition increased to the abundance of rice brown plant hopper in the field from the first week of September (36th Standard week) and reached its peak 15.87 BPH per hill in the 38th standard week of year. During this period abiotic factors like mean temperature, relative humidity and rainfall ranged from 20.8 to 33.9 ^{0}C, 68.3 to 84.9 per cent and 1.4 to 370.0 mm, respectively. The rice Brown plant hopper infestation gradually decreased after the middle of September i.e. 38th and 39th standard week. This is caused due to the starting of maturity of rice crop.

The observations were in agreement with the earlier finding of Shivamurthappa (1993) [13] who revealed that maximum population of BPH occurred from September to October during *Kharif* crop season. The pest population was low during July to August. However, Jeyarani (2004) [5] also reported that the occurrence of BPH population was at pest peaked during September. Win *et al*., (2011) [15] also revealed that BPH population was high in mid September, association with heavy rainfall, high temperature and high humidity.

Table 1: Seasonal abundance of BPH in relation to abiotic factors during Kharif, 2018

Standard Week No.	Month	Date	No. of BPH/hill	Temp ºC		RH (%)		Rainfall (mm)
				Max.	Min.	Max.	Min.	
29	July	16-22	0	37.4	28.3	87.3	50.6	16.0
30		23-29	0	33.4	26.6	93.3	68.0	370.0
31		30-5 (Aug.)	0.78	37.9	27.9	88.9	49.1	0.0
32	August	6-12	3.01	37.0	27.3	93.6	47.9	56.3
33		13-19	3.56	38.7	27.6	92.1	50.4	23.0
34		20-26	4.39	36.4	24.9	91.4	52.6	22.0
35		27-2(Sept.)	4.64	35.4	20.5	88.3	48.7	198.1
36	September	3-9	11.92	37.6	21.7	91.4	51.6	82.8
37		10-16	13.98	34.9	24.7	92.8	53.7	9.7
38		17-23	15.87	35.1	21.9	93.2	55.8	13.0
39		24-30	13.30	35.9	25.3	94.0	75.7	37.0
40	October	1-7	9.64	32.6	22.6	96.1	58.9	0.0
41		8-14	9.52	34.1	18.7	87.0	55.0	3.4
42		15-21	9.7	34.4	15.0	90.0	51.0	1.4
43		22-28	5.34	32.7	13.4	90.6	49.1	0.0
44		29-4 (Nov.)	3.21	31.7	12.0	91.1	45.4	0.0
45	November	5-7	2.63	30.9	11.1	93.4	47.9	0.0
46		8-14	0.29	29.6	12.0	95.3	57.6	0.0

Correlation of *Nilaparvata lugens* (Stal.) with weather parameters

The correlation studies between infestations of Brown plant hopper, *Nilaparvata lugens* (Stal.) with abiotic factor are given in Table 2. On the basis of correlation table, it seems that there was a significant positive correlation was found between number of BPH and abiotic parameters like, T_{max}., T_{min} and R.H $_{min.,}$ R.H.$_{max}$ i.e. r = 0.117, r = 0.019 and r = 0.165 and r = 0.293, respectively. The correlation matrix indicates that there is negative correlation with rainfall i.e. r = -0.245, respectively.

The present findings are similar to the finding of Chaudhary *et al.*, (2014) [4] who also investigated that population of BPH was positively correlated to temperature and relative humidity where as a negative correlation was found to rainfall. Zainab and Singh (2015) [16] also showed positive correlation of temperature with population of BPH. Mean relative humidity also had significant positive correlation with population of BPH. Nirala *et al.*, (2014) [9] also recorded negative correlation with minimum temperature and non-significant positive correlation with morning relative. The findings of Sharma *et al.*, (2018) [15] also showed that BPH population has significantly positive correlation with morning R.H., evening R.H. and average R.H. which is similar to the present findings.

Table 2: Correlation between population of BPH and weather parameters

Season	Weather Parameters	Correlation coefficient (r)
Kharif-2018	Max. Temperature (^{0}C)	+0.117
	Min. Temperature (^{0}C)	+0.019
	Max. Relative humidity (%)	+0.165
	Min. Relative humidity (%)	+0.293
	Rainfall (mm)	-0.2451

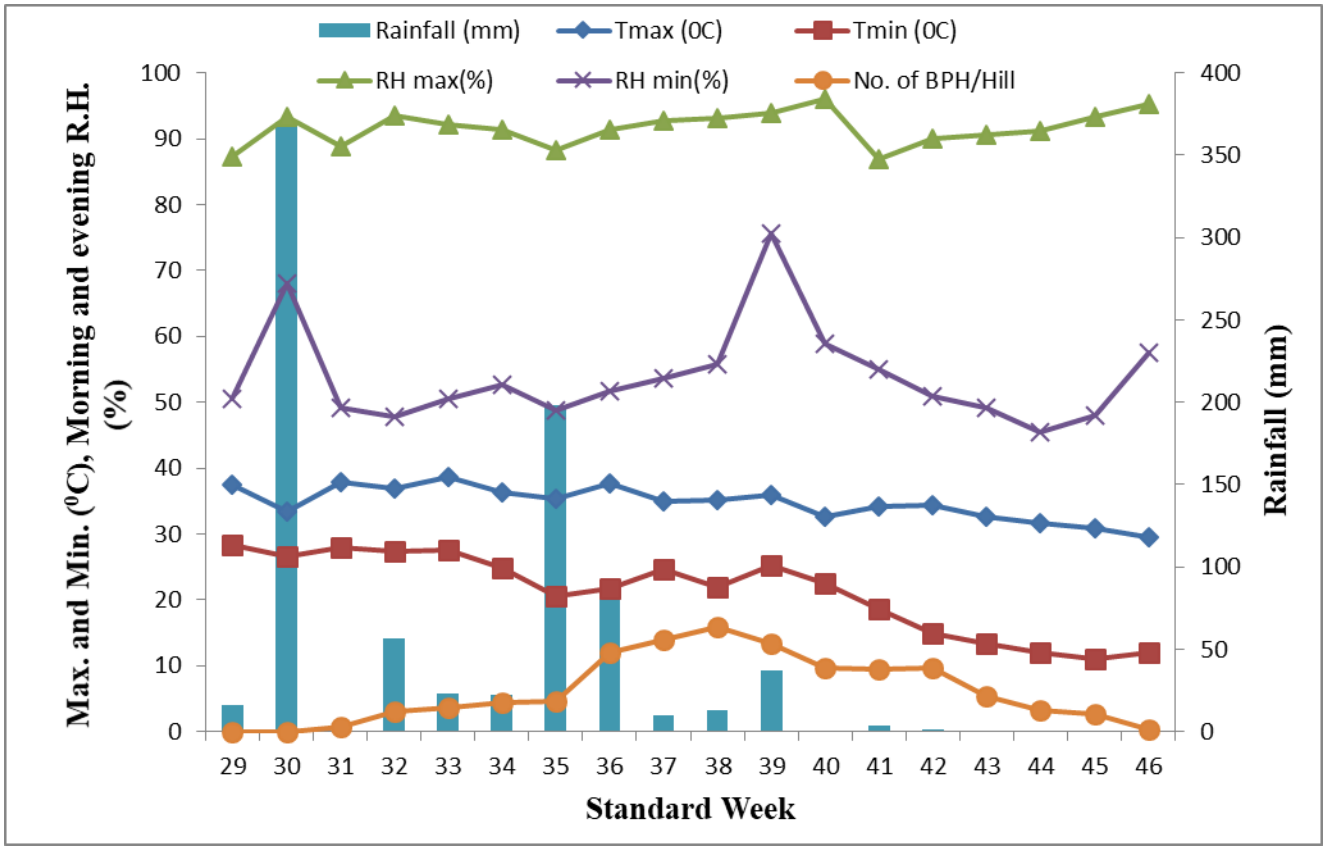

Fig 1: Abundance of Brown plant hopper in relation to abiotic factor during the crop season, 2018

Conclusion

In the light of results summarized above, it may be concluded that BPH population was low from the 31st to 35th standard week and it was higher in the 38th Standard Week of year when the observed maximum and minimum temperature, maximum and minimum R. H. and rainfall was 35.1^0, 21.9 ^{0}C, 93.2%, 55.8% and 13.0 mm, respectively. Positive correlation found between population of BPH and weather parameters *viz.* temperature, R.H. and negative correlation was there between rainfall and BPH population.

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