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Population dynamics of brown plant hopper of paddy and its correlation with weather parameters

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Abstract
An experiment was conducted in Research Farm, Orissa University of Agriculture and Technology Bhubaneswar, Odisha, India during 2017-2018, to study the effect of weather parameters on population dynamics of Brown Plant Hopper under with 12 dates of planting from 16th July 2017 to 1st January 2018 at 15 days interval with three aromatic varieties Geetanjali, Poorna Bhog and Pusa Sugandh –II. The incidence of BPH in the beginning was very low and the population increased along with the growth of the crop. The population was more during the vegetative growth stage of crop. BPH occurrence was more in 1st August and 16th November planting dates, which was positively correlated with rainfall (0.55-0.78) and relative humidity. The range of weather parameters such as maximum temperature of 32-34 °C, minimum temperature 25-27^{0}C, morning relative humidity 91-95% and evening relative humidity 75-80% were found favorable for peak population of BPH. The infestation was aggravated with the weekly cumulative rainfall up to 165 mm. However, the highest population was found at a weekly cumulative rainfall of 80 to 110 mm.

Keywords: BPH, relative humidity, rainfall, temperature & rice

Introduction
Globally rice is one of the most important cereal crop. With growing demand for aromatic rice in the local and international market in recent years, many of them found to be susceptible to insect pests therefore discarded by the farmers. Climatic factors e.g., rainfall, temperature and humidity are the key factors for development of any rice insect pest. Paddy crop in the field is attacked by numerous guilds of insect pests, but few causes significant losses. Losses caused by the insect pests are the main constraint in achieving high yield of rice. The BPH (*N. lugens*) cause direct damage to rice plant by sucking the plant sap. In addition to the feeding damage, it also transmit grassy stunt and wilted stunt virus diseases of rice. Heavy damage caused by brown plant hopper can be identified by the development of circular patches in the field, which is termed as hopper burn. Brown plant hopper (BPH) is the most important sucking pest of rice growing tracts of India. The caterpillar pests of rice such as case worm and leaf folder are of minor importance but sometimes cause considerable losses to rice.

Materials and Methods
The geographic situation of Odisha situated at an elevation of 25.9 m above mean sea level at 20^0 15' N latitude and 85^0 52 ' E longitude and East & South East Coastal Plain of Odisha. The general climatic condition of Bhubaneswar is hot and humid. The annual mean maximum temperature of 2017 is 35.3 °C and annual mean minimum temperature is 22.6 °C. Summer season (March to June) is hot and humid, with temperatures ranging 26.4-35.7 °C. Winter season (December and January) is cold and dry with temperature ranging 15–28 °C. May is the hottest month, when daily temperatures range from 32–42 °C. January, the coolest month, has temperatures varying from 15–28 °C. The present study was carried out during kharif 2017 and *rabi* 2017-2018 at Research farm of College of Agriculture, Orissa University of Agriculture and Technology, Bhubaneswar, and the data were recorded to BPH *Nilaparvata lugens* of aromatic rice, under prevailing weather conditions. Present investigation was carried out to study the effect of weather parameters on infestation of Brown Plant Hopper under staggered planting with 12 dates starting from 16th July 2017 to 1st January 2018 at 15 days interval and three varieties such as Geetanjali, PoornaBhog and Pusasugandh-II, and the normal agronomic practices were follow in the crop grown under the prevailing condition at

Research farm of College of Agriculture, Orissa University of Agriculture and Technology, Bhubaneswar and approximately same agricultural practices farmers were also adopted. The Observations were made at weekly intervals throughout the crop season, number of brown plant hopper per 5 hills were recorded, to study about population built up of Brown plant hopper in aromatic rice under staggered planting. To know the peak period of BPH incidence during aromatic rice growth period. During the course of investigation the weather parameters viz., maximum and minimum temperatures, rainfall, relative humidity and bright sunshine hours were recorded and the population of BPH was correlated with the abiotic factors.

Results and Discussion

Population built up of Brown Plant Hopper

The record of BPH population during present investigation indicated that abiotic factors (i.e. rainfall, temperature, relative humidity) play important role to oscillating the BPH population in rice ecosystem during cropping season. In the present study, The BPH infestation was found in most of the planting date starting from 1st date (16th July) to 9th date of planting (16th November). The number of pest per hill varied from 0.1 to 0.9 (Table.1). However, the infestation of BPH was first found from 1st week of August (SMW 32) and was continued up to last week of December (SMW 52), BPH population was not found in December and January planting dates. The highest occurrence of BPH found at 2nd week of August and 2nd week of November i.e. WK4 and WK5 after planting (0.9 BPH/hill) in 16th July and 16th August dates of planting. Mainly BPH infestation was occurred in vegetative stage of rice i.e. between WK3 to WK9 week after planting and BPH population was decreased as the crop reached the harvesting stage. Similar findings have been reported by Sachan *et al*., (2006) [15].

Table 1: Weekly BPH Population Per Hill

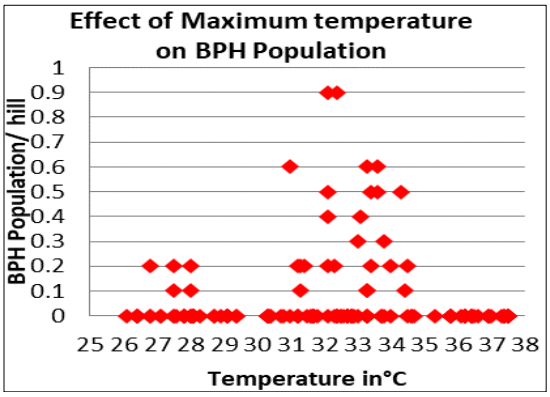
Week after planting	16-Jul	1-Aug	16-Aug	1-Sep	16-Sep	1-Nov	16-Nov	1-Dec	16-Dec	1-Jan
WK1	0	0.2	0.3	0	0	0	0	0	0	0
WK2	0	0.5	0	0	0	0	0	0	0	0
WK3	0.3	0.4	0.1	0	0	0	0.2	0	0	0
WK4	0.4	0.6	**0.9**	0	0	0	0	0	0	0
WK5	**0.9**	0.2	0.1	0	0.2	0	0.1	0	0	0
WK6	0.6	0.2	0	0	0	0	0.1	0	0	0
WK7	0.5	0.5	0	0.1	0.2	0.2	0	0	0	0
WK8	0.5	0	0.2	0	0.6	0.2	0	0	0	0
WK9	0.1	0	0.2	0	0	0	0	0	0	0
WK10	0	0	0.2	0	0	0	0	0	0	0
WK11	0	0	0	0	0	0	0	0	0	0
WK12	0	0	0	0	0	0	0	0	0	0
WK13	0	0	0	0	0	0	0	0	0	0
WK14	0	0	0	0	0	0	0	0	0	0

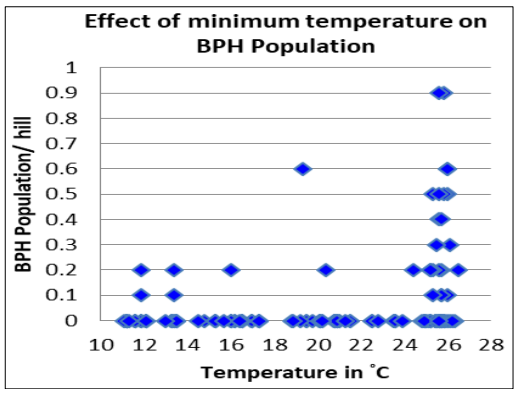
Favourable weather parameters for BPH Population built up

The BPH infestation was found at a maximum temperature ranging from 26 to 37°C but the peak was at a temperature of 32 to 34 °C. The BPH infestation was found at a minimum temperature ranging from 11 to 26°C but the peak was at a temperature of 25-27^{0}C. The infestation was aggravated with the weekly cumulative rainfall up to 165 mm. However, the highest population was found at a weekly cumulative rainfall of 80 to 110 mm, the occurrence was seen from 82 to 96% and the peak at high morning relative humidity 91-95% and evening relative humidity 75-80% (Fig 1). It was partially supported by the findings of Ali *et al*., (2014) [1].

Correlation studies of Brown Plant Hopper with weather parameters

The correlation between BPH Population and different weather parameters revealed significant correlation only in two dates of planting viz., 1st August and 16th November out of 12 planting dates (Table 4.2). The BPH infestation was found positively correlated with rainfall (0.55) in 1st August and (0.78) in 16th November planting dates. In 16th September BPH population was negatively correlated with morning relative humidity (-0.69). It was also found positively correlated with afternoon relative humidity (0.58) in 16th November planting dates. Similar findings were reported by Nair *et al*., 1980, who found that the plant hopper population was significantly influenced by climatic factors especially rainfall in association with high relative humidity and high temperatures, and it was partially supported by the findings of Chaudhary *et al.* (2014) [4].





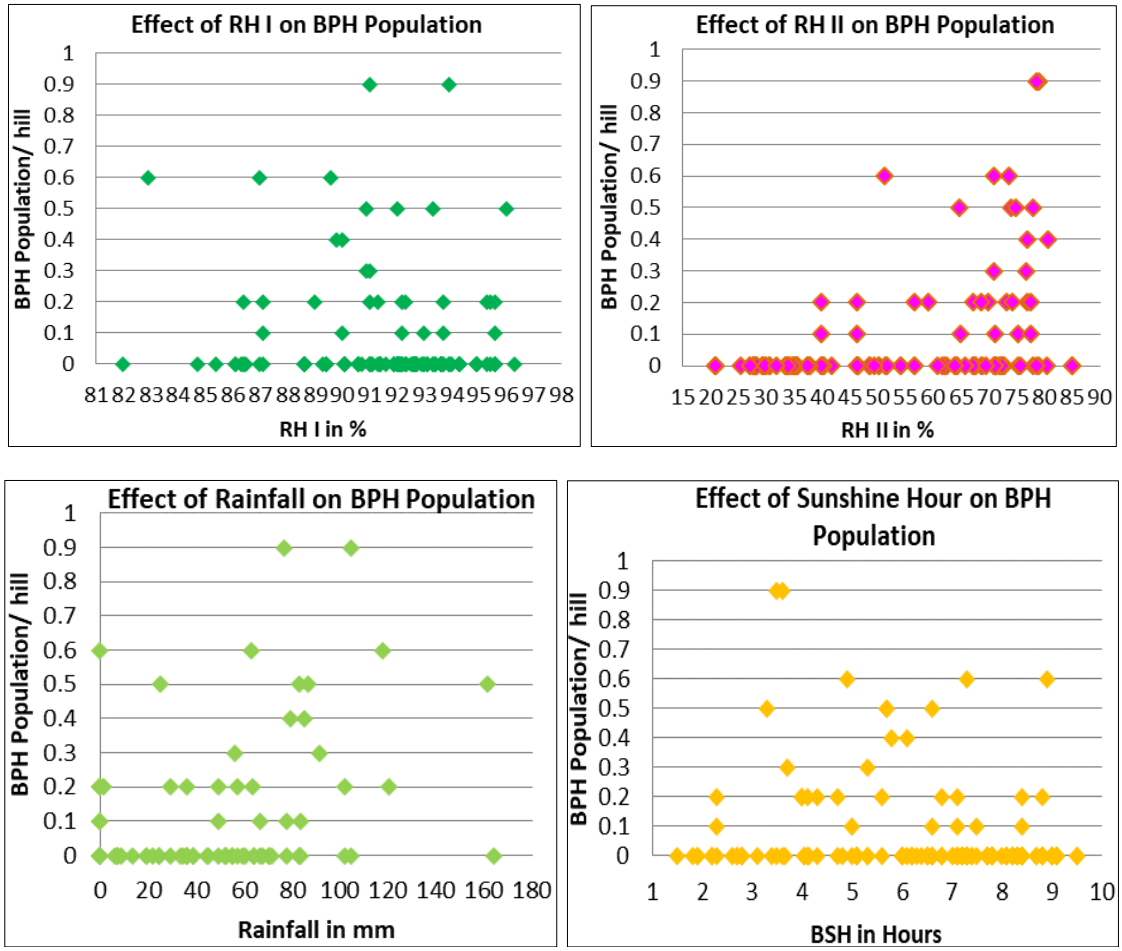


Fig 1: Favourable weather parameters for BPH population

Correlation studies of Brown Plant Hopper with weather parameters

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Table 2: Correlation studies of BPH population density with weather parameters in different planting dates

WP	16th Jul	1st Aug	16th Aug	1st Sep	16th Sep	1st Nov	16th Nov	16thDec
Maximum Temp	0.23197	0.40878	-0.1234	-0.1205	0.11943	-0.2902	-0.4391	-0.3958
	0.4249	0.1467	0.6741	0.6815	0.6716	0.228	0.0599	0.1442
TN	0.2256	0.40843	0.28114	0.16464	0.06006	-0.3081	-0.1712	-0.281
	0.438	0.1471	0.3302	0.5738	0.8316	0.1993	0.4832	0.3102
RH1	-0.3538	-0.4253	0.30468	0.24425	-0.6961	0.27723	-0.2156	-0.0921
	0.2146	0.1295	0.2895	0.4	0.0039	0.2505	0.3752	0.7439
RH2	0.21151	-0.0491	0.41402	0.41258	-0.0337	0.11586	0.58519	0.12039
	0.4679	0.8676	0.1411	0.1426	0.905	0.6367	0.0085	0.6691
RF	0.09671	0.55895	0.50996	0.01369	-0.0214	-0.1149	0.78444	-0.0714
	0.7422	0.0377	0.0625	0.963	0.9396	0.6394	<.0001	0.8003
SS	0.2649	0.70355	-0.3867	-0.4544	0.30782	0.09422	-0.4488	-0.3145
	0.36	0.005	0.1719	0.1026	0.2644	0.7012	0.0539	0.2535

Table 3: Response of variety towards population built up of Brown Plant Hopper per Hill

Date of Transplanting	Geetanjali	Poornabhog	Pusa sugandh II
16th Jul. 2017	0.16	0.11	0.15
1st Aug. 2017	0.10	0.11	0.04
16th Aug. 2017	0.10	0.04	0.04
1st Sep. 2017	0.0	0.01	0.0
16th Sep. 2017	0.02	0.04	0.02

1st Nov. 2017	0.01	0.04	0.0
16th Nov. 2017	0.0	0.05	0.01
1st Dec.2017	0.0	0.0	0.0
16th Dec. 2017	0.0	0.0	0.0
1st Jan. 2018	0.0	0.0	0.0
Mean	0.39	0.40	0.26

I was t revealed that Poornabgoh variety is most susceptible to plant hoppers as compared to poornabhog, and Pusa sugandh-II (Table 3). Occurrence of BPH was seen highest in 16th July date of planting in all three varieties. In 1st September date of planting only in Poornabhog variety BPH infestation was there but other two varieties are free from this pest infestation.

Summary and Conclusion

BPH population was found in most of the planting dates but the highest occurrence of BPH was found at 2nd week of August (32 SMW) and 2nd week of November (45 SMW). The highest population was found at a weekly cumulative rainfall of 80 to 110 mm, at a maximum temperature range of 32-34^{0}c, minimum temperature 25-27^{0}c.With high relative humidity of 91-95%. It was found positively correlated with rainfall and afternoon humidity. Basmati rice cv. Pusa Sugandh-II was resistance to insect pests and also a high yielding variety among three cultivars. Poornabhog was most susceptible variety to BPH.

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