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POPULATION FLUCTUATION OF BROWN PLANTHOPPER (*Nilaparvata lugens* Stål.) IN RICE AGRO-ECOSYSTEM IN VARANASI REGION

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Abstract: *The present investigation was conducted on basmati rice variety HUBR 2-1 to study the seasonal abundance of brown planthopper (Nilaparvata lugens Stål) during kharif season, 2010, at agricultural Research Farm, B.H.U. Varanasi. The population of BPH appeared on crop 25-30 days after transplanting in last week of August. However, maximum infestation was observed from last week of September to mid October (in 39th standard week 10.33 BPH/hill and in 42nd standard week was 11.38 BPH/hill) whereas the highest population was recorded in 41st standard week (12.31 BPH/hill). The population fluctuation was correlated with abiotic factors which showed temperature and sunshine hours were positively correlated where as rainfall and relative humidity were negatively correlated with population of BPH.*
Key words- *Abundance, Abiotic factor, Brown plant hopper, Varanasi.*

Introduction: Rice is the most important cereal crop in the developing world and is the staple food of over half of the world's population [1]. In India, rice is the predominant crop both in terms of land use and dietary importance. India having the largest acreage under rice in the world with an area of about 44.5 Mha largely depended upon monsoon rain. It appears that the negative impact of vagaries of monsoon is such that due to which in 2009-10 the rice production came down to 89.1 million tonnes from a record 99.2 million tonnes of the previous year (Directorate of Economics and Statistics, Department of Agriculture and Co-operation, 2010). The area under cultivation is 35.46 million ha during *kharif* 2013. The rice production in India is 107 million tonnes in 2013 [2].

Rice fields, together with their contiguous aquatic habitats and dry land comprise a rich mosaic of rapidly changing ecotones, harboring a rich biological diversity, maintained by rapid colonization as well as by rapid reproduction and growth of organisms [3]. The variety of organisms inhabiting rice field ecosystems includes a rich composition of fauna and flora. These organisms colonize rice fields by resting stages in soil, by air and via irrigation water [4]. The fauna are dominated by micro, meso and macro invertebrates (especially arthropods) inhabiting the vegetation, water and soil sub-habitats of the rice fields, while vertebrates are also associated with rice fields. The aquatic phase of rice fields generally harbors a varied group of aquatic animals. Those that inhabit the vegetation are mainly the arthropod insects and spiders. In addition, many species of amphibians, reptiles, birds and mammals visit the rice fields for feeding, from surrounding areas, and are generally considered as temporary or ephemeral inhabitants [5]. In relation to the rice crop, the fauna and flora in rice fields include pests, their natural enemies (predators and parasitoids) and neutral forms.

The rice plant is subject to attack by more than 100 species of insects; 20 of them can cause economic damage. Together they infest all parts of the plant at all growth stages, and a few transmit viral diseases [6]. Planthoppers constitute a large group of phytophagous insects in the order hemiptera. Distributed worldwide, all members of this group are plant-feeders and some species are considered pests. In Asia, two planthoppers of economic importance are the brown planthopper (BPH), *Nilaparvata lugens* (Stål), and the whitebacked planthopper (WBPH), *Sogatella furcifera* (Horvath) of the

Family Delphacidae. They damage plants directly by sucking the plant sap and by ovipositing in plant tissues, causing plant wilting or hopper burn [7]. The brown planthopper, *Nilaparvata lugens* (BPH), is one of the major pests of rice. Damage to the rice crop is caused directly by feeding on the phloem [8] and indirectly by transmitting plant viral diseases like grassy stunt and wilted stunt viruses [9].

Nilaparvata lugens had caused serious outbreaks in rice growing countries. In India also, the serious outbreak of this pest has been reported from Madhya Pradesh, Orissa, West Bengal, Haryana, Punjab, Uttar Pradesh, Tamil Nadu and Andhra Pradesh, In Eastern Uttar Pradesh, the insects like brown planthopper, green leafhopper, white backed planthopper, leaffolder, grasshopper and gundhibug are a permanent threat to rice cultivation [10].

However, the present study on the abiotic factors help for the management and futuristic point of view which give the effective idea about the population growth pattern which help to escape the crop from pest through the alteration in sowing time and farm inputs, and also provide the relationship among the weather variables with the brown planthopper (*Nilaparvata lugens* (**Stål**) habitat in which pest is perpetuated.

Materials and Methods

To study the seasonal incidence of brown planthopper (BPH), *Nilaparvata lugens* (Stål) a field study was made at the Agricultural Research Farm, B.H.U., Varanasi under prevailing weather conditions. Rice variety HUBR 2-1 was transplanted on July 28 in 2010 for field trail. Crop was raised according to recommended agronomic practices. The field was properly ploughed and kept exposed to sun for several days to destroy the underground insects & weeds and then puddle thoroughly with the help of a tractor. In the present experiment, fertilizers were applied as per the agronomic practices recommended for the region. The plant geometry was 20 X 15 cm, three replications follow the RBD design and plot size was 4 x 5 cm^2. Observations were made at weekly intervals throughout the crop season on number of Brown planthopper/hill. The experiment was conducted on a sandy soil having almost neutral pH and medium fertile land, which was well levelled and provided with assured irrigation facilities and adequate drainage so that water could be properly managed throughout the cropping season. The weekly meteorological data were collected from Agro-meteorological Observatory, Department of Agronomy, Institute of Agricultural Sciences, BHU for *Kharif* season 2010-11.

Results and Discussion

Brown planthopper population commonly reaches extreme high in density during vegetative stage of the rice crop and continues till the harvest of the crop. If proper control measures are not applied the yield of the crop is significantly reduced causing economical loss to grower. The population of BPH vary greatly depending upon prevailing weather factors such as rainfall, temperature, relative humidity, sunshine hours. It is evident from the Table-1 that BPH appeared on the crop after 25-30 days after transplanting i.e. around last week of August (34th standard week and the population of BPH was 3.26/hill), So the incidence of BPH in the beginning was very low in correspondence to the abiotic factors as rainfall and relative humidity was more in comparision to initiation of the BPH population in the field and the growth stage of the plant was also initiate and in log phage manner, the population of the BPH increases as the rainfall was very less or negligible and relative humidity was also less.

Table.1. Seasonal abundance of BPH population in relation to abiotic factors during *kharif* season in 2010, in Varanasi region.

Standard week	Month & Date	BPH population per hill	RainFall (mm)	Average Temperature(°C)	Average RH (%)	Sunshine (hrs)
34	20-26	3.26	84.40	28.75	81.75	2.7
35	**SEP** 27-02	6.32	24.40	30.35	80.8	5.1
36	03-09	6.58	50.20	30.15	77.75	7.7
37	10-16	4.78	150.20	28.65	84.85	3.9
38	17-23	7.65	31.80	28.7	81.1	3.8
39	24-30	10.33	0.0	28.35	68.9	8.8
40	**OCT** 01-07	11.64	0.0	28.55	68.95	8.4
41	08-14	12.31	0.0	27.45	65.1	8.8
42	15-21	11.38	17.20	27.7	78.25	4.5
43	22-28	9.02	0.0	25.35	62.05	7.7
44	**NOV** 29-04	5.35	0.0	22.45	64.9	11.5
45	05-11	3.65	0.0	24.85	64.8	7.6

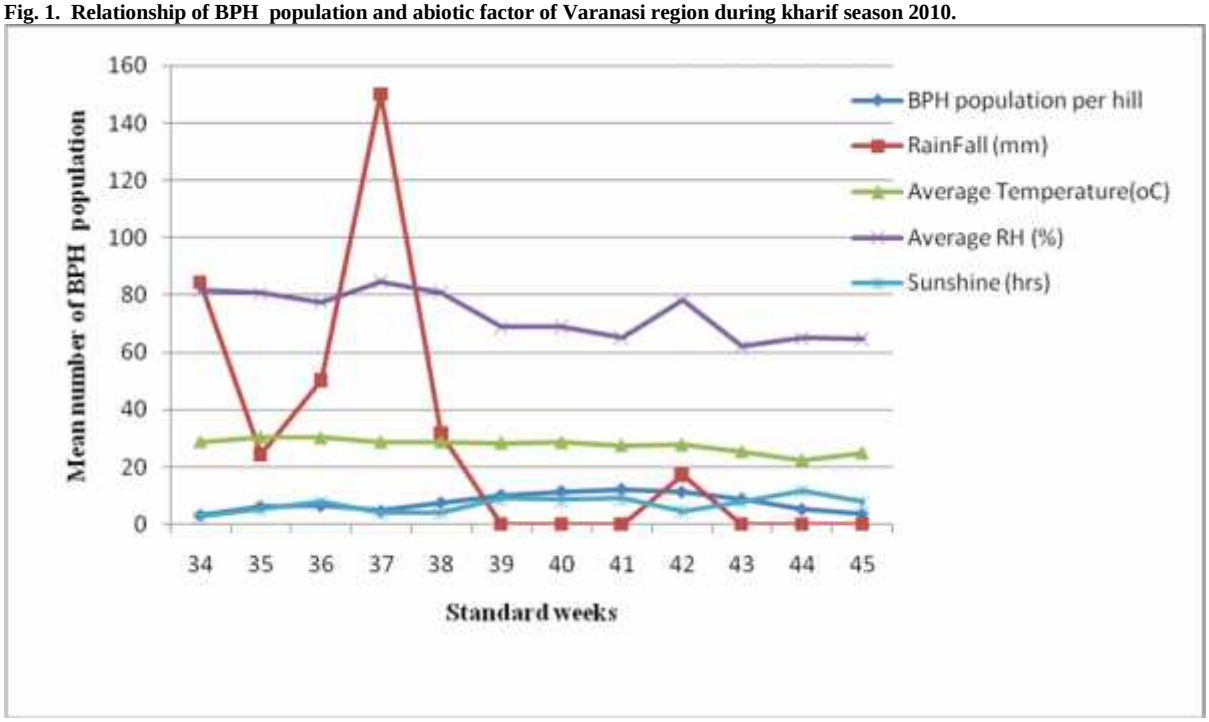
As soon as the rain stopped in last week of September then the population increased with the vegetative stage of the crop and reached highest (12.31 BPH population/hill in 41 standard week) in second week of October. The incidence of the pest was severe in last September to mid October. The incidence was severe from last week of September to third week of October (i.e. standard week no. 39 to 42). Later on the population slowly declined. The population of BPH decreased as the crop reached the harvesting stage around first week of November. Similar findings have been reported [11].

The population of BPH was positively correlated to temperature and Sunshine hours where as a negative correlation was found to rainfall and relative humidity was found in the present investigation are shown in the Table-2. The result are supported [12] who reported that the positive correlation with temperature. Present findings are also on line [13] who reported that the occurrence of the pest peaked during September, October and there is a negative correlation between the incidence of the pest and rainfall which is similar to our findings. The present findings showed that the correlation of different weather parameters had a non-significant relation with BPH population. Similar relation of BPH population with abiotic factors was found [14]. Sunshine hours and temperature were positively correlated with the abundance of hopper densities in lowland rice where as relative humidity showed negative impact on population build-up in upland rice. Showed a similar relation with these parameters [15]. From the Fig. 1 shown that the population growth trends in relation to abiotic factors. That shown the initiation of the population from 34th standard week (3.26 BPH/hill) and the corresponding of rainfall was high but rainfall was in decreases and the population of BPH was increases on next weeks, but when the rainfall was more the population of BPH decreases the highest population of BPH was recorded from the 41st standard week (12.31 BPH/hill).

Table 2: Correlation coefficient of abiotic factor on BPH population during *Kharif* 2010, in Varanasi region.

Factor	Correlation coefficient	Regression coefficient	't' value	SIG/NON-SIG. At 5 %
Population × Rainfall	-0.517	-0.029	-0.933	Non Sig.
Population × Average Temp	0.133	0.889	1.537	Non Sig.
Population × Average RH	-0.333	-0.178	-0.626	Non Sig.
Population × Sunshine Hrs.	0.294	0.012	0.020	Non Sig.

Fig. 1. Relationship of BPH population and abiotic factor of Varanasi region during kharif season 2010.



References

1. Juliano, B. O. (1993). Rice in human nutrition. FAO and IRRI, Philippines, 162pp.
2. Anonymous. (2013). State of Indian Agriculture 2012-13 Ministry of Agriculture, Department of Agriculture and Cooperation, Directorate of Economics and Statistics, New Delhi.
3. Fernando, C. H. (1995). Rice field are aquatic, semi-aquatic, terrestrial and agricultural: A complex and questionable limnology. *Tropical limnology*, 1: 121-148.

4. Fernando, C. H. (1993). A bibliography of references to rice field aquatic fauna, their ecology and rice fish culture. University of waterloo, 110 pp.
5. Bambaradeniya, C. N. B., Fonseka, K. T. and Ambagahawatte, C. L. (1998). A preliminary study of fauna and flora of a rice field in Kandy, Sri Lanka. Celon, *Journal of Science* (*Biological Sciences*), 25:1-22.
6. Pathak, M. D., and Khan, Z. R. (1994). Insect pests of rice. IRRI, Philippines. 89pp.
7. Turner, R. W., Song, Y. H. and Uhm, K. B. (1999). Numerical simulation of rice planthopper (*Nilaparvata lugens* and *Sogatella furcifera* Homoptera: Delphacidae) migration as a component in an internet surveillance system. *Bulletin of entomological research*, 89(6): 557-569.
8. Sogawa, K. (1982). The rice brown planthoper: feeding physiology and host plant interactions. *Annual Review of Entomology*, 27: 49-73.
9. Powell, K. S., Gatehouse, A. M. R., Hilder, V. A. and Gatehouse, J. A. (1995). Antifeedent effects of lectins and an enzyme on the adult stage of the rice brown planthopper, Brown plant hopper, *Nilaparvata lugens*. *Entomollogia experimentalis et Applicata*, 75: 51-59.
10. Khan, A. A. and Mishra, D. S. (2003). Abundance of spider fauna in relation to biotic and abiotic factors in lowland rice ecosystem of Eastern Uttar Pradesh. *Plant protection Bulletin* (Faridabad). **55**(1/2): 14-15.
11. Sachan, S. K., Singh, D. V. and Chaudhary, A. S. (2006). Seasonal abundance of insect pests associated with basmati rice. *Annals of plant protection sciences*, 14(1): 247-248.
12. Krishnaiah, N. V., Prasad, A. S. R., Rao, C. R., Pasalu, I.C., Zaheruddeen, S. M., Varma, N. R. G., Lakshmi, V. J. and Lakshminarayanamma, V. (2006). Population dynamics of rice plant hopper, *Nilaparvata lugens* in Godavari Delta of Andhra Pradesh state. *Indian journal of plant protection*, 34(2): 158-164.
13. Jeyarani, S. (2004). Population dynamics of brown plant hopper, *Nilaparvata lugens* and its relationships with weather factors and light trap catches. *Journal of Ecobiology*, 16(6): 475-477.
14. Kumar, V. and Patil, B.V. (2004). Activity of brown plant hopper, *Nilaparvata lugens.*(Homoptera: Delphacidae) and its natural enemies in Tungabhadra Project area of Karnataka. *Karnataka Journal of Agricultural Sciences*, 17(4): 717-720.
15. Khan, A. A. and Mishra, D. S. (2003). Abundance of spider fauna in relation to biotic and abiotic factors in upland rice ecosystem of Eastern Uttar Pradesh. *Plant protection Bulletin* (Faridabad). 55(3/4): 23-29.