Environment and Ecology 40 (2C) : 913—916, April—June 2022
ISSN 0970-0420

Net House Evaluation of Rice Land Races against Brown Plant Hopper and White Backed Plant Hopper

P.C. Rath, J. Meher, L.K. Bose, S.K. Dash, Parmeswaran C., G.P. Pandi G, Basana Gowda G., Totan Adak, N.K.B. Patil, Annamalai M., M.K. Bag, Prabhukarthikeyan S.R., Raghu S., M.S. Baite, Prasanthi G., H.N. Subudhi

Received 21 October 2021, Accepted 23 December 2021, Published on 7 June 2022

ABSTRACT

Sixty one rice land races were evaluated for Brown Plant Hopper (BPH) and White Backed Plant Hopper (WBPH) in net house of NRRI, Cuttack during *kharif* 2020. TN-1 and PTB 33 are used as susceptible and resistant check in this experiment respectively. None of the land races showed resistant and moderate resistant with SES Score 1, 3 in both BPH and WBPH. Six varieties namely Kalachampa, Kalisaru, Kalajeera, Dubraj, Baikani, Govind showed moderate susceptible reaction to BPH with Score 5. Similarly eleven varieties namely Velari, Mahulkuchii, Seulpani, TikiMahsuri, Kalama, Lajkulibad, Dubraj, Bansapatri Jatia, Magura, Surjakanta. showed moderate susceptible reaction to WBPH. Other varieties showed susceptible and highly susceptible reaction to both BPH and WBPH. Only the genotype Dubraj showed moderately susceptible to BPH and WBPH.

Keywords Net house evaluation, Rice land races, Brown Plant Hopper, White backed plant hopper, Genotype Dubraj.

INTRODUCTION

Rice is the major food crops of India and is grown in all ecologies like upland, irrigated and lowland and saline. In India, rice is grown in 44.6 Mha. Rice crop is attacked by 20 important species of insect (Norton and Way 1990). Of which, Brown Plant hoppers (BPH) and White backed Plant Hopper (WBPH) are very important pest of rice causing significant yield losses in Asian countries (Dupo and Barrion 2009). First these species are reported sporadically in Punjab, Andhra Pradesh, Bihar, Jharkhand Tamilnadu, Odisha and West Bengal (Krishanaiah 2014). Severe incidence of plant hoppers caused 30% yield loss in Asian countries every year (Catindig *et al* (2009) and DRR 2010). Application of chemicals, insecticides are did not work effectively to control the spread in some weather conditions. Host plant resistance is the only integrated approach to reduce yield losses caused by plant hoppers. In recent times, Number of resistant varieties have been developed and over 70 plant hopper resistant genes have been identified in rice. Both nymphs and adults of plant hoppers suck phloem sap from lower portion of rice plants causing

P.C. Rath, J.Meher, L.K. Bose, S.K. Dash, Parmeswaran C, GP Pandi G, Basana Gowda G, Totan Adak, NKB Patil, Annamalai M, MK Bag, Prabhukarthikeyan SR, Raghu S, MS Baite, Prasanthi G, H.N. Subudhi*
National Rice Research Institute, Cuttack 753006, India

Email : dr_hatanath_subudhi@yahoo.co.in
*Corresponding author

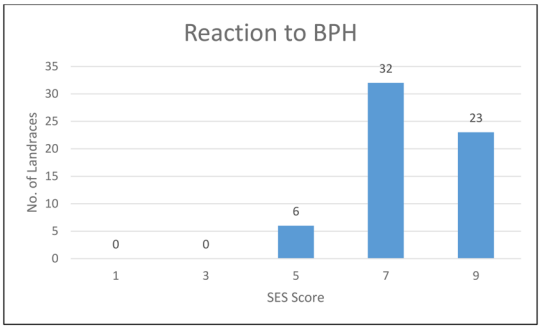

Fig. 1. Reaction to BPH.

severe plant mortality and complete damage of plant known as hopper burn (Liu *et al*. 2008). During 1970, Rice varieties were screened at global level to find out resistance sources (Bentur 2011). At ICAR-National Rice Research Institute, Cuttack, Odisha, India rice varieties/germplasm/landraces were screened against plant hoppers particularly brown plant hopper and white backed plant hopper in control condition to find out resistance sources in rice (Rath *et al.* 2005, 2008, Rath 2008, Rath and Marndi 2010 Rath and Subudhi 2011, Rath 2018, Meher *et al.* 2020 and Rath *et al.* 2021). The success rate is low due to emergence of new biotypes of insect and break down of resistance (Glass 1975). Identification and Cultivation of resistant varieties is better and environmentally friendly approach. Such varieties reduce pesticide application and help in conservation of natural enemy (Panda and Khush 1995). It is very essential to evaluate large number of genotypes including land races / wild species and find out genes from intra specific and inter sub specific, which are reservoir of many valuable genes. In recent times, target gene can be manipulated in popular rice varieties for durable resistance identified by DNA markers. Sixty one rice landraces were evaluated in net house of National Rice Research Institute, Cuttack during *kharif* 2020 to find out resistant varieties for BPH and WBPH to popularise in endemic areas and utilise in varietal development program.

MATERIALS AND METHODS

In this study, sixty one rice landraces were evaluated

Table 1. Name of genotypes with SES score for BPH..

Sl. No.	SES score	No. genotypes	Name of genotypes
1	0	0	-
2	1	0	-
3	3	0	-
4	5	6	Kalachampa, Kalisaru, Kalajeera, Dubraj, Baikani, Govind
5	7	32	Velari, Nalibhutia, Kadalichampa, Kakudia, Tikimahsuri, Kalakrushna, Kalama, Kapurkanti, Kalikati, Salphool, Kabir, Lajkulibad, Kosakani, Basumati, Tulsibas, Ghanti, Local Basmati, Pimpudibas, Geleiguti, Ajana, Badanali, Badapatnei, Banspatri, GediDhan, Gelei, Jatia, Jhili, Kalachampa, Kalanamak, Nadiaphoola, Raktasiuli, Sapuri
6	9	23	Mahulkunchi, Desibasmati, Baimunda, Seulpani, Kasiphool, Kadalipendi, Chinamali, Chudi, Jaigundi, Botradhan, Badsabhog, Bansapatri, Dhusura, Gedibasumati, Jangali Jata, Karpurakeli, Kalabhat, Kamalsapuri, Khandagiri, Magura, Saruchinamali, Sanala madhi, Surjakanta, TN1

Table 2. Name of genotypes with SES score for WBPH.

Sl. No.	SES score	No. genotypes	Name of genotypes
1	0	0	-
2	1	0	-
3	3	0	-
4	5	11	Velari, Mahulkuchii, Seulpani, TikiMahsuri, Kalama, Lajkulibad, Dubraj, Bansapatri, Jatia, Magura, Surjakanta
5	7	22	Nalibhutia, Baimunda, Saruchinamali, Kajalphool, Punshi, Kapurkeli, Kadalichampa, Kadalipendi, Kosakani, Chinamali, Geleiguti, Local basmati, Botradhan, Dhusura, Govind, Jangalijata, Jhili, Kolabhat, Kalanamak, Khandagiri, Nadiaphool, Sanala Madhi
	9	28	Basumati, Desibasmati, Sitabhog, Pimpudibasa, Kakudia, Kalakrushna, Kalisaru, Kalikati, Salphool, Kabir, Kalajeera, Tulsibas, Chudi, Ghanti, Jaigundi, Anjana, Badnali, Bansapatri, Badsabhog, Badapatnei, Gedidhan, Gedibasumati, Gelei, Kalachampa, Karpurukeli, Kamala, Raktasial, Sapuri, TN1

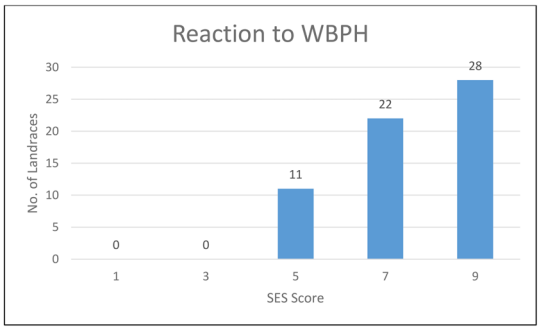

Fig. 2. Reaction to WBPH.

for BPH and WBPH in net house condition at NRRI. The resistant and susceptible checks are PTB-33 and TN-1. The varieties were screened at seedling stage following modified standard seed box method (MSST). The test entries along with checks were soaked in water for 24 hours. Then the pre-germinated seeds were shown 3 cm apart in plastic seed box filled with 5–10 cm depth soil. In each seed box, 20 entries are shown along with checks in each row. Each row consists of 20 plants with both checks. The entries were screened separately for BPH and WBPH. After 7 days of sowing, the seedlings were infested with 2nd and 3rd instar nymphs, 8-10 nymphs are put in each plant. Observations were recorded when 90% of seedling were wilted in susceptible plant. Scoring was done following SES score (IRRI 1996). Collection of insect population were done from unsprayed field following IRRI protocol (Heinrich *et al.* 1985). BPH and WBPH population were maintained separately in susceptible plant TN-1 at NRRI net house.

RESULTS AND DISCUSSION

From the result, it is revealed that none of the varieties showed resistant reaction to BPH and WBPH. Six genotypes viz., Kalachampa, Kalisaru, Kalajeera, Dubraj, Baikani, Govind are moderately susceptible to BPH with SES score 5 (Table 1). Similarly eleven varieties showed moderately susceptible to WBPH with score 5, the varieties are Velari, Mahulkuchii, Seulpani, Tiki Mahsuri, Kalama, Lajkulibad, Dubraj, Bansapatri Jatia, Magura, Surjakanta (Table 2). Other genotypes showed susceptible and highly susceptible reaction to BPH and WBPH (Figs. 1–2).

The aromatic land races such as Kapurkanti, Kalikati, Lajkulibad, Kosakani, Basumati, Tulsibas, Local Basmati, Pimpudibas, Kalanamak, Nadiaphool, Karpurakeli, Kalakrushna and Banspatri showed susceptible reaction to BPH. Whereas Lajkulibad, Dubraj, Bansapatri and Badsabhog are moderately susceptible to WBPH. Ali *et al.* (2012) screened 1767 genotypes for BPH and found none to be resistant. Chandrasekhar *et al.* (2017) evaluated Nivara accessions and found resistant for both BPH and WBPH. Venkatesh *et al.* (2019) studied landraces of rice and released varieties and found that resistant genes are more in landraces than varieties. Subudhi *et al. (*2020) evaluated 94 elite rice genotypes and found 11 varieties having moderate resistant reaction. Meher *et al.* (2020) evaluated 94 varieties for WBPH and found 4 varieties namely Pathara, Pratap, Tejswaini and Santpheal to be moderate resistant. Rath *et al.* (2009) reported that Naveen was resistant with score 1 for WBPH.

CONCLUSION

For BPH, Kalachampa and Dubraj can be popularised as it high yielder with BPH resistant character. Dubraj can be popularized and can be used as donor in hybridization program. For WBPH, Dubraj, Kalama, Tikimahsuri are used as donor and WBPH endemic area.

REFERENCES

Ali MP, Salem M, Alghamdi MA, Begum ABM, Anwar Uddin, Alam MZ, Huang D (2012) Screening of rice genotypes for resistance to the Brown Plant Hopper. (*Nilaparvata lugen* Stal). *Cereal Res Commun* 40 (4) : 502—508.

Bentur JS, Padmakumari AP, Lakshmi VJ, Padmavati CH, Khondala, Amudhan YR, Pasalu IC (2011) Insect resistance in rice : Technical bulletin Directorate of Rice Research, Hyderabad, India, pp 51.

Catindig JLA, Arida GS, Baehaki SE, Bentur JS, Cuong LQ, Norowi M, Heong KL (2009) Situation of plant hoppers : New threats to the sustainability of intensive rice production systems in Asia, pp 191—220.

Chandrasekhar K, Suresh S, Soundararajan RP, Boopathi T (2017) Evaluation of some registance in some rice genotypes against Whitebacked plant hoppers (WBPH) *Sogatella furcifera* Horvath. *J Entom Zool Stud* 5 (4) : 1575—1577.

DRR (2010) Directorate of Rice Research. Annual report pp 254.

Dupo ALB, Barrion AT (2009) Taxonomy and general biology of delphacid plant hoppers in rice agro ecosystems plant hoppers: New threats to the sustainability of intensive rice production systems in Asia, pp 3—155.

Glass EH (1975) Integrated pest management rationale, potential, needs and important ESA special publication 75 (2) : 141.

Heinrich EA, Medrano FG, Rapusas HR (1985) Genetic evaluation for insect resistance in rice International Rice Research Institute, Los Banos, Philippines pp 1—356.

IRRI (1996) Standard Evaluation System for rice (4th edition) International Rice Research Institute, Los Banos, Philippines.

Krishanaiah NV (2014) A global perspective of rice brown plant hoppers management-1, crop climatic requirement. *Int J Mol Zool* 4 (2) : 9—18.

Liu JL, Wu JF, Yin JC, Gu HN (2008) Physiological responses to *Nilaparvata lugens* in susceptible and resistance rice varieties allocation of assimilates between shoots and roots. *J Econ Entomol* 101 (2) : 384—390.

Meher J, Dash SK, Bose LK, Rath PC, Subudhi HN (2020) Screening of rice varieties against White backed plant hoppers (*Sogatella furcifera* Horvath) in net house condition. *J Entomol Zool Stud* 8 (2) 1044—1046.

Norton GA, Way MJ (1990) Rice pest management system, past and future : In pest management in rice pp 1—14. Springer Dordreht.

Panda N, Khush GS (1995) Factors affecting expression of resistance. In : Panda N, Khush GS (eds). Host Plant Resistance to Insects, pp 207—228. CAB International, Wallingford, UK.

Rath PC, Rao AP, Subudhi HN (2005) Screening of rice varieties against white backed plant hopper (WBPH) *Sogatella furcifera* Horvath in net house condition. *J Appl Zool Res* 16 (1) : 21—22.

Rath PC, Subudhi HN, Nandagopal V, Prakash A (2008) Categorization of rice varieties for resistance against white backed plant hopper (WBPH) at Cuttack. *J Pl Prot Environ* 5 (1) : 74—75

Rath PC (2008) Evaluation of rice genotypes against white backed plant hopper (*Sogatella furcifera* Horvath). *Oryza* 45 (4) : 331—332.

Rath PC, Prakash A, Nandagopal V, Subudhi HN (2009) Comparative studies of some rice genotypes against white backed plant hopper (WBPH) *Sogatella furcifera* Horvath. *J Appl Zool Res* 20 (2) : 125—126.

Rath PC, Marndi BC (2010) Evaluation of resistance in some rice germplasm against white backed planthopper, *Sogatella furcifera*. *Ind J Pl prot* 38 (2) : 197—199 (NAAS – 5.07).

Rath, PC, Subudhi HN (2011) Greenhouse evaluation of selected rice varieties against white backed plant hopper *Sogatella furcifera* (Horvath). *Oryza* 48 (2) : 188—189.

Rath PC, Bose LK, Jambhulkar NN, Subudhi HN, Kar MK (2021) Broadening Genetic Base of Rice and Identification of Pre-of Pre-Breeding Lines for Resistance to Brown Plant Hopper, *Nilaparvata lugens* (Stål.). *J Experim Agric Int* 43 (8) : 76—80.

Rath PC (2018) Net house evaluation of resistance in rice genotypes against white backed plant hopper, *Sogatella furcifera* (Horvath). *Oryza* 55 (1) : 234—236.

Subudhi HN, Meher J, Dash SK, Bose LK, Rath PC (2020) Screening of elite rice genotypes for Brown plant hoppers (*Nilaparvata lugens* Stal). *J Entomol Zool Stud* 8 (1) : 1307—1309.

Venkatesh K, Soundararajan RP, Muthukrishnan N, Jeyprakash P (2019) Evaluation of rice landraces for resistance to plant hoppers and leaf hoppers. *Elect J Pl Breeding* 10 (2) : 413—418.