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Phenotyping of Rice varieties for Brown Plant Hopper and White backed plant Hopper Resistance in Net house

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ABSTRACT: Plant hoppers (BPH and WBPH) are very important pest of rice causing significant yield losses (30%) in Asian countries. Identification and Cultivation of resistant varieties is better and environmentally friendly approach. So one hundred three released rice varieties developed at National Rice Research Institute, Cuttack were evaluated for Brown Plant Hopper (BPH) and White Backed plant Hopper (WBPH) in net house of NRRI, Cuttack during Kharif 2019. TN-1 and PTB 33 are used as susceptible and resistant check in this experiment respectively. Two varieties namely Lunasampad and Gayatri showed moderately resistant reaction with SES Score 3 to BPH. Six varieties such as CRDhan 204, Tapaswini, Kalyani-2, Pradhandhan, Gayatri and Kshira showed moderately resistant reaction with SES Score 3 to WBPH. The variety Gayatri showed moderate resistant to BPH and WBPH. None of the variety are resistant to BPH and WBPH. These varieties can be popularised in hopper endemic areas and can be utilised in varietal development programme.

Keywords: Evaluation, rice varieties, BPH, WBPH.

INTRODUCTION

Rice is the major food crops of the world including Asian countries 90% of rice are grown in Asia. Rice crop is attacked by more than 100 insect species of which 20 species are most important (Norton and Way 1990). Plant hoppers (BPH and WBPH) are very important pest of rice causing significant yield losses in Asian countries (Dupo and Barrion 2009). Besides, they also act as vectors for virus like Turgo and rice dwarf virus (Hibbino, 1996; Abo *et al.*, 1997). During 1973-2000, these species are reported sporadically in Punjab, Andhra Pradesh, Bihar, Jharkhand, Tamilnadu, Odisha and West Bengal (Krishanaiah, 2014). From 2006, severe incidence of plant hoppers caused 30% yield loss in Asian countries every year (Catindig *et al.*, 2009; DRR, 2010). At that time, application of chemicals, insecticides are being used to control plant hoppers damage but it did not work effectively in some weather conditions and also kill the predators of hoppers which increase pest incidences due to changing of biotypes. Host plant resistance is an integrated approach to reduce yield losses caused by plant hoppers. Number of resistant varieties have been developed and over 70 plant hopper genes have been identified in rice. Both nymphs and adults of plant hoppers suck phloem sap from lower portion of rice plants causing severe plant mortality and complete damage of plant known as hopper burn (Liu *et al.*, 2008). Screening of rice varieties for resistance sources started at global level during 1970 and many varieties were developed for BPH and WBPH (Bentur *et al.*, 2011). The limitation of success is 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). To find out donors, it is important 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, DNA markers play a very significant role to identify the target gene which can be manipulated in popular rice varieties for durable resistance. One hundred three released varieties were evaluated in net house of National Rice Research Institute, Cuttack to find out resistant varieties for BPH and WBPH to popularise in endemic areas and utilise in varietal development programme.

MATERIALS AND METHODS

Materials: One hundred three released rice varieties of National Rice Research Institute, Cuttack of different ecology such as upland (17), irrigated (33), lowland (42), saline (5), aerobic (5) and boro (1) etc. were evaluated in this study for Brown hopper and White backed Plant Hopper in net house condition. The resistant and susceptible checks are PTB-33 and TN-1 respectively.

Table 1: List of rice varieties, ecology, reaction, % of damage against BPH and WBPH.

		BPH			WBPH		
Cultivars	**Ecology**	**%Damage**	**SES Score**	**Reaction**	**SES Score**	**%Damage**	**Reaction**
Lunasampad	S	13	3	MR	9	89	HS
Gayatri	L	14	3	MR	3	18	MR
Neela	U	43	5	MS	5	47	MS
CRDhan 300	I	42	5	MS	5	45	MS
CRDhan 408	L	46	5	MS	9	84	HS
CRDhan 310	I	48	5	MS	5	48	MS
Reeta	L	44	5	MS	7	64	S
Udaya	I	42	5	MS	9	86	HS
Khitish	I	41	5	MS	9	81	HS
Sarala	L	47	5	MS	7	69	S
Chandrama	I	46	5	MS	7	68	S
Saktiman	I	49	5	MS	7	62	S
CRDhan 501	L	50	5	MS	9	84	HS
Sarasa	I	46	5	MS	9	82	HS
Vanaprava	U	43	5	MS	7	63	S
Vandana	U	41	5	MS	5	48	MS
Ratna	I	48	5	MS	5	42	MS
CRDhan 506	L	65	7	S	7	65	S
CRDhan 204	AO	67	7	S	3	15	MR
Savitri	L	62	7	S	5	42	MS
Tapaswini	I	63	7	S	3	12	MR
Poornbhog	L	69	7	S	5	45	MS
CRDhan 200	AO	61	7	S	7	69	S
Hazaridhan	U	67	7	S	7	64	S
CRDhan 601	BO	62	7	S	7	68	S
CRDhan 407	L	63	7	S	5	46	MS
Jalamani	L	68	7	S	7	64	S
CRDhan 202	AO	64	7	S	7	63	S
CRDhan 508	L	67	7	S	7	67	S
Swarn Sub 1	L	71	7	S	7	62	S
Improved Lalat	I	62	7	S	5	43	MS
CR Dhan 304	I	67	7	S	5	49	MS
Anjali	U	69	7	S	7	67	S
CR Sugandhadhan 910	L	65	7	S	7	63	S
CRDhan 300	I	67	7	S	7	45	S
Kalyani 2	U	69	7	S	3	14	MR
Maudamani	I	64	7	S	5	48	MS
Samalei	L	61	7	S	7	68	S
Dhalaheera	U	62	7	S	7	64	S
Jayanti dhan	L	65	7	S	5	47	MS
Lunabarial	S	63	7	S	7	62	S
Rajalaxmi	I	67	7	S	5	49	MS
Kalashree	L	69	7	S	5	46	MS
CRDhan 802	L	65	7	S	5	42	MS
Abhisek	U	64	7	S	7	67	S
CRDdhan 305	I	62	7	HS	7	61	MS
Tulsi	L	63	7	HS	5	47	S
Satyakrishna	I	67	7	HS	7	68	S
Swarn MAS	L	64	7	HS	7	64	S
CRDhan 206	AO	62	7	HS	7	69	S
Moti	L	68	7	HS	7	61	MS
Phalguni	I	64	7	HS	5	41	S
CRDhan 203	AO	63	7	HS	7	66	S
CRDhan 507	L	64	7	HS	7	63	HS
Dharitri	L	68	7	HS	9	83	S
CRDhan 306	I	69	7	HS	7	65	S
Radhi	I	67	7	HS	7	69	HS
Varshadhan	L	62	7	HS	9	86	S
Padmini	L	63	7	HS	7	67	HS
CRDhan 901	L	68	7	HS	9	84	S
CRDhan 500	L	64	7	HS	7	65	S
CRDhan 403	S	67	7	HS	7	63	S
Kshira	I	63	7	HS	3	14	MR
CRDhan 510	L	68	7	HS	7	67	S
Durga	L	62	7	HS	7	69	MS
Geetanjali	I	88	9	HS	5	47	S
Kaling 1	I	82	9	HS	7	61	S
CRDhan 301	I	84	9	HS	7	62	HS
Sneha	U	83	9	HS	9	85	S
Lunasanki	S	87	9	HS	7	69	MS

Kaling 3	U	81	9	HS	5	41	MS
CR Suganha 908	L	85	9	HS	5	42	S
Satabdi	I	87	9	HS	7	61	S
Sahabhagidhan	U	85	9	HS	7	65	S
CRDhan 701	L	82	9	HS	7	67	S
Pooja	L	87	9	HS	7	61	S
CRDhan 907	L	89	9	HS	7	64	S
CRDhan 800	L	84	9	HS	7	62	S
Tapaswini	I	86	9	HS	7	65	MS
Saket 4	I	89	9	HS	5	41	S
CRDhan 311	I	82	9	HS	7	68	MS
Nuadhusara	L	81	9	HS	5	43	S
Sadabahar	U	83	9	HS	7	64	MS
Panidhan	L	87	9	HS	5	47	MS
Supriya	I	85	9	HS	5	41	S
Nuachinikamini	L	86	9	HS	7	66	HS
Kamesh	U	82	9	HS	9	83	S
UtkalPrava	L	87	9	HS	7	62	S
Ketekijoha	L	83	9	HS	7	67	MS
Annada	U	85	9	HS	5	44	HS
Tara	I	86	9	HS	9	90	S
Sonamani	S	83	9	HS	7	63	S
Ramakrishna	I	87	9	HS	7	63	S
CR1014	L	89	9	HS	7	62	S
CRDhan 505	L	9	90	HS	5	44	MS
Nuakalajeera	L	9	89	HS	9	85	HS
Indira	I	9	84	HS	9	87	HS
Sattari	U	9	86	HS	9	89	HS
Ajay	I	9	82	HS	5	47	MS
Pradhan Dhan	L	9	87	HS	3	13	MR
Virendra	U	9	83	HS	7	65	S
CRDhan 101	U	9	85	HS	7	61	S
Naveen	I	9	84	HS	5	43	MS
TN 1	I	9	100	HS	9	100	HS

U: Upland, I: Irrigated, L: Lowland, S: Saline, AO: Aerobic, BO: Boro

Methods: 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 pregerminated seeds were shown 3 cm apart in plastic seed box filled with 5-10cm 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 in star nymphs, 8-10 nymphs are put in each plants. Observations were recorded when 90% of seedling were wilted in susceptible plant. Scoring was done following SES score (IRRI, 2002). Collection of insect population were done from unsprayed field following IRRI protocol (Heinrich *et al.,* 1985) and BPH and WBPH population were maintained separately in susceptible plant TN-1 at NRRI net house.

RESULTS AND DISCUSSION

From the observation, it is found that in BPH screening only two varieties namely Lunasampd and Gayatri showed moderate resistance reaction with SES score 3. None of the genotypes showed resistant reaction. Fifteen varieties showed moderate susceptible reaction, the varieties are CRDhan 310, Sarala, Khitish and Ratna etc. Fifty three varieties showed susceptible reaction, among these, popular varieties are Savitri, Tapaswini, Swarn sub-1, Dharitri, Padmini, Swarn MAS and Durga. Forty varieties are highly susceptible to BPH, the popular varieties are Kaling-3, Satabdi, Sahabhagidhan, Pooja, Annada, Saket-4, CR1014, and Naveen.

Six varieties namely CRDhan 204, Tapaswini, Kalyani-2, Pradhandhan, Gayatri, and Kshira showed moderate resistant to WBPH with SES Score 3. None of the varieties are resistant to WBPH. Thirty one varieties showed moderate susceptible. The popular varieties are Savitri, Kaling-3, Imp Lalat, Rajalaxmi, Ajay, Annada, Vandana, Ratna etc. Fifty six varieties showed susceptible reaction. The varieties are Swarn sub-1, Satabdi, Anjali, Sahabhagidhan, Pooja, Tapaswini, Swarn MAS, Durga etc. and seventeen varieties are highly susceptible to WBPH. The varieties are Dharitri, Varshadhan, Khitish, Uday, Kamesh, etc. It is interesting to note that the variety Gayatri is moderate resistant to both BPH and WBPH. Rath (2018) reported that the varieties like Satabdi, Radhi, Kaling-1, and Hazaridhan showed resistant reaction with score-1. But in present study, these varieties showed susceptible reaction which may be due to change of biotype. Rath (2009) reported that Naveen was resistant with score-1, but in the present study it showed susceptible reaction. Ali (2012) screened 1767 genotypes for BPH and found none to be resistant. Chandrasekhar *et al.* (2017) evaluated Njavara accessions and found resistant for both BPH and WBPH. Venkatesh (2019), studied landraces and released varieties of rice and found that resistant genes are more in land races than released varieties. Subudhi *et al.* (2020) evaluated 94 released varieties for BPH and found 11 varieties to be moderate resistant. Similarly Meher *et al.* (2020) evaluated 94 varieties for WBPH and found 4 varieties

namely Pathara, Pratap, Tejswaini and Santpheal to be moderate resistant.

CONCLUSION

The varieties *viz*., Lunasampad and Gayatri can be popularised in BPH endemic areas and utilised in varietal development programme. Similarly the varieties such as CRDhan 204, Tapaswini, Kalyani-2, Pradhandhan, Gayatri and Kshira can be grown in WBPH endemic areas and used as donors in hybridisation programme.

FUTURE SCOPE

The resistant varieties will be popularised among the farmers and will be used as donor in hybridisation programme to develop plant hopper resistant varieties.

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Conflict of Interest. None.

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