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EVALUATION OF HOST PLANT RESISTANCE OF BACTERIAL LEAF BLIGHT DISEASE OF RICE IN BIHAR

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ABSTRACT

Rice is known to suffer from number of diseases caused by fungal, bacterial and viral origins. Among them, bacterial leaf blight (BLB) caused by *Xanthomonas oryzae pv. oryzae* (Ishiyama) is one of the most destructive disease of rice in Bihar. Identification of resistant genotypes is an essential continuous process either to recommend for cultivation in endemic area or to use as donors of the resistant genes. In view of these, the present investigation of evaluation of 213 rice varieties/genotypes against bacterial blight of rice. Out of 213 genotypes, 4, 87 and 31 showed the immune, resistant, moderately resistant reaction against the bacterial blight of rice pathogen. Four entries *viz.* IET Nos. 20601, 20881, 21200 and 21219 have found no lesions and therefore showed immune reaction. The resistant germplasms could be utilized in breeding programmes for the sustainable management of bacterial blight of rice.

Key words : *Evaluation, host plant resistance, bacterial leaf blight, rice.*

Rice (*Oryza sativa* L.) is an important cereal crop belonging to the family Poaceae. Rice is the most important staple food crop and grown in India providing of 43 per cent of calorie requirement for 70 per cent of the Indian population. India is the largest rice growing country accounting for about one third of the world acreage under the crop. Rice suffers from many biotic and abiotic factors which result in the lower productivity. The rice crop is susceptible to a number of diseases among which bacterial leaf blight (BLB) caused by *Xanthomonas oryzae* pv. *oryzae* (Ishiyama) is one of the most destructive disease of rice throughout the world and widespread in Asia and it is the most serious disease of rice in South East Asia, particularly in Japan, Philippines, Indonesia and India (Ou, 1985; Srivastava, 1967; Ahmed & Singh, 1975; Singh *et al*., 1977; Rangasawami, 1975; Swings *et al*.,1990). In India, during 1951, a very devastating and widespread disease of rice was found in different areas of Maharashtra state which was first reported caused due to bacterial leaf blight by Srinivasan *et al.* (1959). The disease was initially recorded in Maharashtra state but occurrence of epidemic in the Shahabad district of Bihar in 1963 established the destructiveness of the disease all over India (Srivastava, 1967).Bacterial leaf blight of rice disease is widespread and destructive in several countries in tropical rice-growing areas of Asia, Australia, United States, Latin America and Africa (Mew,1987, 1989; Mew et al., 1993; Sere *et al*., 2005). BLB was observed to occur in fields with high incidence of 70 to 80% in several West African countries (Sere *et al*., 2005). Yield losses due to BLB ranging from 50 to 90% have been reported (Ou, 1985; Sere *et al*., 2005). According to Mew 1987 the extent of yield loss depends on locality, season, weather, cultivar and application of high amount nitrogen fertilizer that tends to yield loss about 60%. The infection with *Xanthomonas oryzae* pv. *oryzae* is favored by high relative humidity (>70%) and temperatures between 28-34°C (Mew *et al.* 1993). Heavy dose of nitrogenous fertilizer, rainfed, deep water rice and close plant spacing are responsible for the increased severity of bacterial leaf blight disease of rice. The cultural, physical, biological and chemical controls have been used to manage Bacterial leaf blight disease of rice. The only feasible and economical way of controlling diseases is the use of resistant rice cultivars. In view of the importance of genetic resistance for disease control, studies were undertaken to evaluate the rice genotypes against BLB disease.

MATERIALS AND METHODS

Plant Material : 213 germplasms/entries/varieties obtained from All India Co-ordinated Rice Improvement Project, Directorate of Rice Research, Hyderabad under National Screening Nursery 1 (NSN 1). Field experiment was conducted of research farm of Agricultural Research Institute, Patna during kharif-2009. The trials were laid in an augmented design having spacing of 15x15 cm was adopted.

Isolation and purification of pathogens : Infected leaves were cut into small pieces (5mm infected tissue and 5mm of adjacent healthy tissue) and placed in 70%

ethanol for 10 seconds, washed twice with sterilized distilled water and dipped in 300ul sterilized distilled water for 15 minutes in micro-centrifuge tubes. The leaf bits were then placed on a sterilized groove glass slide with 2-3 drops of sterilized water and examined under the microscope for bacterial ooze. Bacterium was streaked and spreaded with the bacterial ooze on the petri plates containing nutrient agar medium. The test tubes were 5 ml contained nutrient broth inoculated with 2 drops of bacterial suspension (10^8cell/ml). These inoculated test tubes and plates were incubated in BOD at 27±2°C. Pathogenicity test was done to check the virulence of the pathogen.

Artificial Inoculation : 5 ml distilled water was mixed in *Xanthomonas oryzae* pv. *oryzae* two days old culture of petri plate and scratched the bacterial growth colony and mixed gently with the help of "L" shape spreader. 5 ml bacterial suspension was mixed with 50 ml distilled water. Fifteen petri plates were scratched and volume was adjusted so that 2 x10^8 bacterial cell in ml of bacterial suspension visualised under heamato-cytometer. The scissors were dipped in the inoculum and one-fourth of top 3- 4 leaves were cut with the help of the scissors. Data were collected after three weeks of inoculation under the following scale (Anonymous, 1996).

Disease Scoring: Disease resistance screening trials are conducted with a specific set of entries that are evaluated by adopting a uniform screening method. For observation of disease in the field the percentage of tissue area infected out of total leaf area was examined. 0 to 9 disease rating scale was taken, where 0 rating scale is observed as healthy leaves, 1 rating scale was observed as 1-5% leaf lesion area infected, 3 rating scale was observed as 6-12% leaf lesion area infected, 5 rating scale was observed as 13-25% leaf lesion area infected, 7 rating scale was observed as 26-50% leaf lesion area infected and 9 rating scale was observed as 51-100% leaf lesion area infected (Table-1 and Fig-1).

RESULTS AND DISCUSSION

In order to identify the resistant sources, 213 rice genotypes/entries/varieties were screened by using 0-9 scale against bacterial leaf blight of rice caused by *Xanthomonas oryzae* pv. *oryzae* under artificial epiphytotic condition at Agricultural Research Institute, Patna.

Table-1 : Disease severity scale for evaluation of Bacterial leaf blight disease of rice in field condition. (IRRI (1996) SES for rice, IRRI, Fourth edition, Philippines).

Disease Score	Disease Reaction	Description
0	Immune	No disease
1	Highly Resistant	1-5% leaf lesion area
3	Resistant	6-12% leaf lesion area
5	Moderately Resistant	13-25% leaf lesion area
7	Susceptible	26-50% leaf lesion area
9	Highly Susceptible	51-100% leaf lesion area

Fig.-1 : Standard Evaluation System (SES) for accessing Bacterial Blight reaction. (IRRI (1996) SES for rice, IRRI, Fourth edition, Philippines)

Table-2 : Disease scoring and reaction of bacterial blight disease of rice in field trials under artificial condition.

Disease Score	Disease Reaction	Description
0	Immune	20601, 20881,21200, 21219,
1	Highly Resistant	20923, 20934, 20935, 21121, 20214, 20706, 21107, 20827, 19086, 20760, Jalmagna, Dinesh, Pooja, Salivahana,Tarori Basmati, IRBB60
3	Resistant	20619,20523,20544,20887,20891,20892,20893,20897,20898,20901,20900,20911,20913,20915,20924,20925,20926,20937,20945,20949,20735,20370,20375,21164,21176,20220,20697,21180,21202,21203,21204,21120,21212,Benibhog 3,Swarnadhan, Improved Sambha Mahsuri, 20006, 20233, 20235, 20261, 20278, 20852, 21065, 20841, 20842, 20847, 20861, 20617, 20761, 20765, 20768, 20774, 20776, 20782, 20784, 20786, 20800, 21129, 20886, 21076,Triguna,Sabita,Purnendu, Savitri, Pusa Basmati, Benibhog, Nidhi
5	Moderately Resistant	20114,20894,20902,20914,20918,20930,20931,20932,20942,20944,20952,20743,20744,20734,21148,21151,20082,20226,20716,21201,21215,TN1, Nidhi, 20230,20262,20267,20773,21299, Swarna, HR 12, Vikramarya
7	Susceptible	20904,20912,20524,20556,20419,20427,21000,20727,20625,21181,21199,21206,21210,21214,IR67,HR12,21066,21300,20311,20857,20859,20862,20868,20871,20872,20874,21075,Jaya,PA6201,TN1,Ajaya,
9	Highly Susceptible	20906,21247,21248,20997,20999,20723,20626,20628,20634,20661,21182,21184,21185,21186,21188,21189,21190,21191,21193,21194,21195,20649,20653,21208,21213,21216,21218,IR50,21069,20853,20854,20863,20876,20878,20879,20405,21073,21077,21078,21083,21088,21089,21109,21096,21098, 21100,21105,21106,21113,21114,21119,20708,20710,NDR359,PR113,Lalat, Sasyasree,MTU1010, Tapaswnini ,Anjali,PSD 3, Rasi,IR 64, IR 50,

The genotypes were grouped into six classes based on degree of reaction and the number of genotypes falling in particular group and results are presented in Table-1 and Figure-1 respectively. Out of 213 genotypes, 87 showed the resistant reaction, 31 showed moderately resistant against the bacterial blight of rice pathogen. It was found that 31 genotypes showed moderately reaction while 64 showed the highly susceptible reaction (Table-2). Four entries *viz.* IET Nos. 20601, 20881, 21200 and 21219 have found no lesions and therefore showed immune reaction. The genotypes ie IET Nos. 20619, 20523, 20544, 20887, 20891, 20892, 20893, 20897, 20898,. 20901, 20900, 20911, 20913, 20915, 20924, 20925, 20926, 20937, 20945, 20949, 20735, 20370, 20375, 21164, 21176, 20220, 20697, 21180, 21202, 21203, 21204, 21120, 21212, Benibhog 3, Swarnadhan, Improved Sambha Mahsuri, 20006, 20233, 20235, 20261, 20278, 20852, 21065, 20841, 20842, 20847, 20861, 20617, 20761, 20765, 20768, 20774, 20776, 20782, 20784, 20786, 20800, 21129, 20886, 21076,Triguna, Sabita, Purnendu, Savitri, Pusa Basmati, Benibhog and Nidhi showed highly resistant reaction(Table-2).

The same entries were used in the trials conducted at various other location of All India Coordinated Rice Improvement Programme during the year 2009. The results showed across the different locations were found similar (Annonymous, 2010). The immune and highly resistant germplasms could be used in breeding programmes for sustainable and eco-friendly management of bacterial blight disease of rice in Bihar.

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