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Multiple Resistance in Indigenous Rice (*Oryza sativa* var *indica*) Germplasm

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Some indigenous landrace diversity of rice collected from diverse agro-ecological habitats and microniches with predominant tribal and ethnic population were screened against bacterial leaf blight (Xanthomonas campestris *pv.* oryzae *Dye* et al), *brown plant hopper* (Nilaparyata lugens *Stal*) *and white backed plant hopper* (Sogatella furcifera *Horvath*) *prevalent in the field. The local landraces adapted to this region, namely*, Agiyasal, Agyasar, *Akkapm,* Badshahbhog, Jhili *and* Karrigurmatia *were resistant to all the above mentioned pathogens and pests. The study on inheritance showed that genic control was under single gene pair (monogenic).*

Rice (*Oryza sativa* var. *indica*) is considered to be the host of over 60 diseases and about 100 insects/pests. Some of these are of major international importance. The most prominent and devastating among these are the bacterial blight, brown plant hopper and white backed plant hopper. It has been observed that chemical control is expensive and in some cases futile. Therefore, in rcent years, major thrust has been focused for incorporating genes for disease and insect/pest resistance in most of the national/international programmes. Germplasm collection, screening and conservation, thus became one of the most essential component of rice improvement programme. The screening of germplasm for identification of resistant donors has now been assigned high priority to pave the way for further utilization, both by conventional methods as well as by new biotechnological techniques. Raipur Agricultural University, located at Raipur, Madhya Pradesh, has built a very comprehensive collection of well over 18,000 rice accessions. The present study was undertaken to screen some of the indigenous rice cultivars/landraces against bacterial leaf blight (BLB), brown plant hopper (BPH) and white backed plant hopper (WBPH). Nature of resistance was also studied in some of the cultivars.

MATERIALS AND METHODS

Among the rice germplasm maintained in field gene bank (*ex-situ*) at Raipur, Madhya Pradesh, 200 accessions were found tolerant to BLB in preliminary field

*Part of the screening carried out by the author at International Rice Research Institute, Manila, Philippines.

evaluation during the year 1982. These were screened further at International Rice Research Institute, Manila, Philippines, for bacterial leaf blight as per the technique described by Kaufman *et al.* (1973) and against BPH and WBPH as per technique suggested by Athwal *et al* (1971). Standard evaluation system of IRRI (1980) was used for assessment of damage, only six cultivars (Table 1) which were found resistant to all the three biotic stresses (BLB, BPH and WBPH) were further utilized for genetic study. These were crossed with cv. Taichung Native-1 and their F_1 and F_2 generations were screened along with parents. 10 F_1's and more than 500 F_2 seedlings per cross were utilized for screening and study.

TABLE 1. RICE CULTIVARS SHOWING MULTIPLE RESISTANCE

Name of the cultivar	M.P. Acc. No.	Disease score SES 0-9 scale		
		*1 Bacterial leaf blight	*2 Brown plant hopper	*3 White backed plant hopper
Agiyasal	A 330	1	1	1
Agyasar	A 518	1	1	1
Akkapm	A 551	1	3	1
Badshahbhog	B 2486	1	3	1
Jhili	J 273	1	3	1
Karrigumatia	K 1393	1	1	1

*1 Philippine pathotype group I
*2 Philippine biotype I
*3 Philippine biotype

RESULTS AND DISCUSSION

The studies on the inheritance of bacterial leaf blight (BLB) showed that all the six cultivars under study indicated monogenic pattern of genetic control (Table 2). Monogenic dominant nature of gene has been reported by several earlier workers (Devdath, 1970; Murthy and Khush, 1972; Singh *et al.*, 1983). Allelic test earlier conducted on these cultivars possess *xa-4* dominant gene for resistance (Sidhu *et al.*, 1978). These cultivars were also resistance at Raipur centre, when screened under field conditions. This suggested that perhaps *xa-4* gene predominantly occurs in the landraces being cultivated in Madhya Pradesh region of India. However, it needs to be fully established through more comprehensive studies. The present virulent race of bacterial leaf blight can be checked through the introduction of improved varieties possessing *xa-4* gene for resistance. The cultivars identified for resistance gene *xa-4* at Philippine and India also exhibited resistance at Japan. In view of the above fact, these cultivars/landraces have assumed international importance for overcoming the problem of bacterial leaf blight epidemics.

TABLE 2. F_1 AND F_2 REACTION TO RACE I OF BACTERIRL LEAF BLIGHT FROM THE CROSSES OF TAICHUNG NATIVE 1/RESISTANT CULTIVARS

Cross	F_1	F_2		X^2 3 : 2
		Resistant	Susceptible	
T.N.1/Agiyasal	Resistant	710	218	1.23
T.N.1/Agyasar	Resistant	734	369	1.77
T.N.2/Akkapm	Resistant	663	243	2.03
T.N.1/Badshahbhog	Resistant	787	242	2.68
T.N.1/Jhill	Resistant	643	242	2.60
T.N.2/Karrigumatia	Resistant	637	209	9.030

BHP reaction indicated that *Agiyasal*, *Agyasar*, *Akkapm*, *Badshahbhog* and *Karrigurmatia* possess single dominant gene for resistance (Table 3). The single dominant gene conferring resistance to this pest has also been reported by earlier workers (Athwal *et al*, 1971; Chen and Chang, 1971; Choi *et al*, 1979; Krishna and Seshu 1984,; Lakshminarayan and Khush 1977; Martines and Khush, 1974).

TABLE 3. F_1 AND F_2 REACTION TO BIOTYPE I OF BROWN PLANT HOPPER FROM THE CROSSES OF TAICHUNG NATIVE 1/RESISTANT CULTIVARS

Cross	F_1	F_2		X^2 3 : 1
		Resistant	Susceptible	
T.N.1/Agiyasal	Resistant	804	256	0.40
T.N.1/Agyasar	Resistant	760	251	0.026
T.N.1/Akkapm	Resistunt	773	263	0.082
T.N.1/Badshahbhog	Resistant	682	222	0.06
T.N.1/Jhili	Susceptible	208	533	3.75
T.N.1/Karrigurmatia	Resistant	682	223	0.06

TABLE 4. F_1 AND F_2 REACTION OF WHITE BACKED PLANT HOPPER FROM THE CROSSES OF TAICHUNG NATIVE 1/RESISTANT CULTIVARS

Cross	F_1	F_2		X^2 3 : 1
		Resistant	Susceptible	
T.N.1/Agiyasal	Resistant	487	224	2.51
T.N.1/Agyasar	Resistant	433	142	0.014
T.N.1/Akkapm	Resistant	655	229	0.34
T.N.1/Badshahbhog	Resistant	630	231	1.44
T.N.1/Jhili	Resistant	587	221	2.26
T.N.1/Karrigurmatia	Resistant	352	144	3.44

Nature of resistance to WBPH indicated that a single dominant gene conferred resistance in all the cultivars under study (Table 4). Several workers earlier reported monogenic nature of gene control for WBPH (Angeles *et al.*, 1981; Hernandes and Khush, 1981; Khush and Virmani, 1985 and Krishna, *et al.*, 1984).

The present study suuggested that many indigenous landraces collected from Madhya Pradesh possess multiple resistance and the resistance is monogenically inherited. Further study on allelic test for BPH and WBPH will suggest whether the genes observed in the present study are same or different from earlier reported genes. After allelic test, the desired resistant genes can be utilized in further breeding programme. Among 200 landraces screened, six landraces with multiple resistant could be identified. This clearly emphasizes the need and urgency for very comprehensive evaluation and screening of indigenous diversity in *Oryza* species for identifying resistant genetic resources to diseases and pests. The incorporation of the resistance derived from such well adapted landraces will be of considerable significance in rice crop improvement. The present study is an attempt to investigate the genetics of resistance to BLB, BPH and WBPH in a small number of landraces from Central India. Further, studies would be required to screen entire germplasm against other pests and diseases.

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