

GENETICS OF BACTERIAL BLIGHT RESISTANCE IN INDIGENOUS GERMPLASM OF M.P. (India)

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ABSTRACT

Twenty resistant indigenous rice cultivars from M.P. (India), were found resistant to race groups 1 and 4 of the Philippine bacterial blight. These were studied for the genetics of resistance to the bacterial blight at IRRI. The resistance was found to be monogenic dominant and allelic to Xa-4 gene in all the cultivars studied.

The bacterial blight of rice (*Oryza sativa* L.) incited by *Xanthomonas campestris* pv. *oryzae* (Ishiyama) Dye, appeared as epi-phytotic in Maharashtra, Bihar and Punjab. Severe incidence of bacterial blight are being reported every year in one part or the other in India or abroad. Major yield losses (6 percent to 94 percent) have been reported due to this disease (Srivastava, 1967; Srinivasan, 1982). Chemical control is not effective so the host-plant resistance is logic approach in stabilizing yield. Therefore, incorporation of resistant genes became the major objective in national breeding programmes. The 20 resistant indigenous rice cultivars from Madhya Pradesh (India) germplasm were studied for inheritance of resistance to bacterial blight and the allelic relationships.

MATERIALS AND METHODS

Twenty indigenous rice cultivars from M.P. germplasm collection

(Table 1) were screened against four bacterial blight races of Philippines and were found to be resistance against race groups 1 and 4 only. For inheritance and allelic test, these 20 varieties were crossed with susceptible TN 1 and resistant IR 22. TN 1 has no known gene for resistance and IR 22 is homozygous resistant to Xa-4 gene.

The F₁ and F₂ were raised under optimum management condition with fertility level 100-20-20 NPK kg/ha and 30 cm X 20 cm plant spacing. PXO 61 (race group 1) of *X. c.* pv. *oryzae* was used for inoculation in genetical studies. Bacteria was cultured in modified Wakimoto medium (Wakimoto, 1954) and incubated for 3 days at 30°C. Inoculum was prepared by suspending bacterial culture in sterile distilled water and adjusted to the inoculum concentration to about 10⁹ cells per milliliter. The plants were inoculated at maximum tillering stage (50 days after seeding) by using clip inoculation technique

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TABLE 1 : Indigenous rice cultivars of M.P. studied for the inheritance of bacterial blight resistance.

Cultivar	M.P. Acc. No.	Disease reaction*				
		At Raipur	At IRRI			
			race 1	race 2	race 3	race 4
Anjania	A 88-2	R	R	S	S	MR
Agiyasal	A 330	R	R	MS	MS	MR
Aodiyasela	A 509	R	R	S	S	MR
Baigan	B 970	R	R	S	S	MR
Baidahuda	B 2221	R	MR	S	S	MS
Bhatagunda	B 2835	R	R	S	S	MR
Dudga	D 116	R	R	S	S	MR
Dudhsar	D 350	R	R	S	S	MR
Dhaniyaphool	D 514	R	R	S	S	MR
Dhoulimatia	D 800	R	R	S	S	MR
Gonda	G 600	R	R	S	S	MR
Garang	G 705	R	R	S	S	MR
Gangprasad	G 760	R	R	S	S	MR
Kondi	K 1655	R	R	S	S	MS
Kalchi	K 2096	R	R	S	S	MR
Kanthbhulau	K 2579	R	R	S	S	MR
Lalianjan	L 1206	R	R	S	S	MR
Munagi	M 1172	R	R	S	S	MR
No 19	N 658	R	R	S	S	MR
Sarpin	S 1436	R	R	S	S	MR

* R - Resistant ; MR - Moderately resistant; (Kauffman *et. al* 1973). Disease assessment was done by following Standard Evaluation System (IRRI, 1980). Resistant and moderate resistant plants were considered to be resistant (R) and moderate susceptible, susceptible and highly susceptible plants were grouped in to susceptible (S) for disease scoring.

MS - Moderately susceptible; S - Susceptible

RESULTS AND DISCUSSION

Inheritance studies

All the 20 cultivars were resistant to race 1 and moderate resistant to race 4. The F₁ progenies from the crosses of TN 1 with resistant cultivars were all resistant, thus showing the dominant nature of resistant gene. The F₂ population (Table 2) segregated in a good fit

ratio 3 R : 1 S, thus showing monogenic dominant gene control for the resistance in these cultivars.

Allelic relationships

Since the varieties showed the reaction pattern R S S MR for the four races respectively, the cultivars were therefore crossed with IR 22 for allelic

test. As was expected, all the F₁s were resistant and no segregation was observed in F₂ progenies, thus suggesting that all the M.P. cultivars studied have single dominant gene for resistance and are allelic to Xa-4 gene (Table 3)

Sakaguchi (1967) from Japan reported that the resistance in varieties

TABLE 2. Analysis of F₁ and F₂ progenies in crosses TN 1 with resistant cultivars

Cross	Disease reaction to PXO 61 (race 1)			
	F ₁	F ₂		
		R*	S*	$\chi^2 3 : 1$
TN 1 / Anjanika	R	266	98	0.62
TN 1 / Agiyasal	R	459	170	1.27
TN 1 / Aodisala	R	333	128	1.74
TN 1 / Baigan	R	319	103	0.05
TN 1 / Baidahuda	R	625	292	3.77
TN 1 / Bhatagunda	R	811	252	0.88
TN 1 / Dudga	R	282	113	2.55
TN 1 / Dudhsar	R	658	233	0.02
TN 1 / Dhaniyaphool	R	598	205	0.07
TN 1 / Dhoulimatiya	R	898	264	3.10
TN 1 / Gonda	R	684	206	1.53
TN 1 / Garang	R	432	143	0.01
TN 1 / Gangprasad	R	630	231	1.44
TN 1 / Kondi	R	370	164	2.33
TN 1 / Kalchi	R	376	144	1.88
TN 1 / Kanthbhulau	R	403	140	0.14
TN 1 / Lalianjan	R	328	120	0.64
TN 1 / Munagi	R	522	180	0.12
TN 1 / No 19	R	436	140	0.11
TN 1 / Sarpin	R	597	226	2.53

* R - Resistant, S - Susceptible

of Kogyoku group against bacterial strain 1 was found to be controlled by dominant gene. Shukla (1983) in India also reported dominant nature of gene control. Earlier studies at IRRI have also shown that many varieties, specially from gene center II and III (Khush, 1977) have single dominant gene for resistance against race group 1 of Philippines (Petpisit *et. al.* 1977, Olufowote *et. al.* 1977, Sidhu *et. al.* 1978 and Singh *et. al.* 1983) The

present set of cultivars studied, are all from M.P., i.e. gene center II. These cultivars were resistant at M.P., India as well as at IRRI, Philippines. But it is well known that the cultivars carrying Xa-4 gene are susceptible to all Indian isolates including the one from Raipur. The resistance in the varieties, to Raipur isolate might be due to gene/genes other than Xa-4. This needs further investigation through the allelic tests to Rainpur

TABLE 3. Analysis of F₁ and F₂ progenies from crosses of IR 2 with the resistant cultivars

Cross	Disease reaction to PXO 61 (race 1)		
	F ₁	F ₂	
		R*	S*
IR 22 / Anjania	R	464	0
IR 22 / Agiyasal	R	464	0
IR 22 / Aodisala	R	600	0
IR 22 / Baigan	R	640	0
IR 22 / Baidahuda	R	624	0
IR 22 / Bhatagunda	R	614	0
IR 22 / Dudga	R	836	0
IR 22 / Dudhsar	R	960	0
IR 22 / Dhaniyaphool	R	605	0
IR 22 / Dhoulimatiya	R	680	0
IR 22 / Gonda	R	706	0
IR 22 / Garang	R	640	0
IR 22 / Gangprasad	R	678	0
IR 22 / Kondi	R	580	0
IR 22 / Kalchi	R	720	0
IR 22 / Kanthbhulau	R	640	0
IR 22 / Lalianjan	R	520	0
IR 22 / Munagi	R	464	0
IR 22 / No 19	R	324	0
IR 22 / Sarpin	R	720	0

* R - Resistant, S - Susceptible

isolate for the identification of the source of resistance. The occurrence of bacterial blight race 1 has been reduced tremendously in the Philippines through the introduction of resistant IRRI varieties possessing Xa-4 gene. Similar way, the

incorporation of resistant gene in M.P. based breeding lines will be promising.

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