

EVALUATION OF SOME RICE GENOTYPES FOR RESISTANCE TO BACTERIAL BLIGHT, *XANTHOMONAS ORYZAE* PV *ORYZAE*

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Rice germplasm comprising some Indian and exotic cultivars, donors for 'bacterial blight resistance' in the Indian rice breeding programme and some scented primitive rice cultivars, were evaluated for reaction to five genetically characterized isolates of *Xanthomonas oryzae* pv. *oryzae*. All these cultivars could be classified into 13 diverse groups on the basis of their reaction spectra. BR 285-5-6-6-2, IET 8320, IET 8326, IET 8584, IET 9691, IET 10745, IET 11005, IET 12188, IR 32720-139- 2-1-1-2, PERH 2 and PR 110 were resistant to all the five isolates. Out of the scented/basmati type landraces of rice, Xiang Geng Dao was resistant to all the five isolates; eight others namely Karnal Local, Basmati 1, Basmati 372, Basmati 376, Basmati 397 Basmati C-622, Basmati 5888 and Basmati Sufaid were resistant to only two weekly virulent isolates. Resistance to bacterial blight for the scented/basmati type rices should be sought in landraces or transferred from non-scented rices.

Key words : Rice, bacterial blight resistance, *Xanthomonas oryzae* pv *oryzae*, resistance

Resistance against bacterial blight caused by different pathotypes of *Xanthomonas oryzae* pv. *oryzae* Ishiyama sp. Nov. nom. rev. in rice (*Oryza sativa* L.) prevalent in India has been identified from time to time. Screening against single uncharacterized pathotypes/ isolates of the bacterium has a limited practical utility (Rao *et al.* 1971). Therefore, five single colony isolates of *oryzae* were characterized for their reaction to rice lines with known genes for resistance (*Xa* genes) to bacterial blight. Rice germplasm comprising some Indian and exotic rice cultivars, promising lines in the Indian rice breeding programme and some scented primitive rice cultivars were evaluated for resistance to these isolates.

MATERIAL AND METHODS

Five single colony isolates of *X. oryzae* pv. *oryzae* maintained in the Department of Genetics, Punjab Agricultural University, Ludhiana were char-

acterized in terms of their avirulence/ virulence formulae (effective/ineffective resistance genes) on differential lines carrying known genes (*Xa* genes) for resistance to bacterial blight. Eight rice lines in the background of IR 24 obtained from International Rice Research Institute, Manila, Philippines namely, IR-BB-3, IR-BB-4, IR-BB-5, IR-BB-7, IR-BB-8, IR-BB-10, and IR-BB-11 carrying *Xa3*, *Xa4*, *Xa5*, *Xa7*, *Xa8*, *Xa10* and *Xa11* genes, respectively, for resistance to bacterial blight and rice cv. *Tetep* carrying *Xa2+Xa16* were used as differentials while susceptible rice cv. Taichung Native 1 (TN. 1) was included as check.

For determining its avirulence/virulence formula, aqueous suspension (10^9 cfu/ml) of 48 hr old growth of a bacterial isolate multiplied on potato sugar peptone Agar (2:1:1:2) medium at 25°C was inoculated on 70 day old plants grown in pots in greenhouse following clipping technique of Kauffman *et al.* (1973). Twenty randomly selected leaves from five different plants were scored for their reaction to bacterial blight on 1-9 scale (IRRI, 1988 a,b), 14 days after inoculation. An isolate showing resistant (R) or moderately resistant (MR) reaction (mean score 1.0-5.4) on a particular differential line was designated as "avirulent" while that showing moderately susceptible (MS) to susceptible (S) reaction (mean score more than 5.4) was designated as "virulent".

The isolates of the bacterium thus characterized were inoculated, using the methods already described, on 70 day old plants (in maximum tillering to boot stage) of different rice lines raised in field during 1991. Rice germplasm evaluated here included 54 genotypes comprising Indian and exotic cultivars, donors for 'bacterial blight resistance' in the Indian rice breeding programme and some elite scented rice lines. Twenty randomly selected leaves from five different plants in each host genotype-pathogen isolate combination were scored for the disease reaction, 14 DAI both in 1991 and 1992. Rice lines with an overall mean leaf blight score upto 5.4 were classified as resistant (R) (IRRI, 1988 a,b) while those with higher scores (1-9 scale) as susceptible (S).

RESULTS AND DISCUSSION

The reaction of five isolates of *X. oryzae* pv. *oryzae* on eight differential rice lines with known sources of resistance (Table 1) revealed that isolate G-1 was avirulent on *Xa4*, *xa5* and *xa8* but virulent on *Xa2+Xa16*, *Xa3*, *Xa7*, *Xa10* and *Xa11*. Isolate G-2 was avirulent on all the *Xa* genes tested except *Xa2+Xa16*. Isolate G-3 showed avirulent reaction on all the *Xa* genes, however, G4 was avirulent only on *Xa4* and *xa8*. Isolate G-5 was avirulent on *Xa4*, *xa5*, *Xa7* and *xa8* but virulent on *Xa2+Xa16*, *Xa3*, *Xa10* and *Xa*. Thus all these isolates constituted five different pathotypes. On the basis of similarities and differences in the overall reaction spectrum of five isolates during the two years, the rice germplasm screened here could be classified into 13 diverse groups (Table 2).

Table 1. Reaction of different isolates of *Xanthomonas oryzae* pv. *oryzae* on rice lines with known sources of resistance (differentials) to bacterial blight and their avirulence/virulence formulae

Isolate	Reaction to rice lines*								**Avirulence/virulence	
	Tetep	IRBB -3	IRBB -4	IRBB -5	IRBB -7	IRBB -8	IRBB -10	IRBB -11		TN1
G-1	S	S	MR	MR	S	R	S	S	S	<i>Xa4, xa5, xa8, Xa2 + Xa16, Xa3, Xa7, Xa10, Sa11</i>
G-2	S	R	R	R	R	R	MR	MR	S	<i>Xa3, Xa4, xa5, Xa7, xa8, Xa10, Xa11/Xa2+ Xa16</i>
G-3	R	R	R	R	R	R	R	R	S	<i>Xa2 + Xa16, Xa3, Xa4, xa5, Xa7, xa8, Xa10, Xa11</i>
G-4	S	S	MR	MS	S	MR	S	S	S	<i>Xa4, xa8, Xa2 + Xa16, Xa3, xa5, Xa7, Xa10, Xa11</i>
G-5	S	S	R	R	R	R	S	S	S	<i>Xa4, xa5, Xa7, xa8, /Xa2 + Xa16, Xa3, Xa10, Sa11</i>

*Reaction score (on 1-9 scale of S.E.S. of rice, Anon. 1988) R = Score 1-3.4, MR = 3.5-5.4, MS = 5.5-6.4, S = 6.5-9

**Avirulence = MR/R reaction, Virulence = MS/S reaction

Thirteen genotypes namely BR 285-5-6-6-2, IET 8320, IET 8326, IET 8584, IET 9691, IET 10745, IET 11005, IET 12188, IR 32720-139-2-1-1- 2, PERH-2, PR 109, PR 110 and a scented rice land race, Xiang Geng Dao were resistant to all the five isolates of *X. oryzae* pv. *oryzae* tested. Likewise, BR 51-50-3-4, IET 10844, IET 11047, IET 11130, IET 11394, IET 11394, IET 12174, IET 12869, IR 58, IR 64, IR 29341-85-3-1-3, IR33355-39-1-1-3, IR58028-3-3-13, PERH-1 and PERH-1 and PERH-3 had resistant reaction to four isolates. Commercial rice cultivars like HKR 120, Jaya, PR106 and Pusa 44-33 were resistant to three isolates. BR 285-5-6-6-2 and IET 8584 (RP 2151-173-1-8) are known to be resistant to bacterial blight at 33 locations across Asia and also have a good phenotypic acceptability (IRRI, 1988a). Similarly, IET 10844, IET 11047, IET 12188 and IET 12869 were reported to be resistant to the leaf blight phase and IET 11130 and IET 12174 to both leaf blight and *kresek* phase of this disease at more than 10 locations in India (AICRIP, 1990, 1991).

Table 2. Classification of different rice genotypes on the basis of their spectrum of resistance to five isolates of *Xanthomonas oryzae* pv. *oryzae*

Group	Reaction* to isolate					Cultivars / lines
	G-1	G-2	G-3	G-4	G-5	
1	R	R	R	R	R	ER 285-5-6-62, IET 8320, IET 8326, IET 8584, IET 9691, IET 10745, IET 11005, IET 12188, IR 32720-138-2-1-1-2, PERH 2, PR109, PR110, Xiand Geng Dao
2	S	R	R	R	R	IET 12174, IET 12869, IR 5828-3-B, PERH 1 and PERH 3.
3	R	S	R	R	R	IET 11394
4	R	R	R	S	R	IET 11130
5	R	R	R	R	S	BR 51-50-3, IET 10844, IET 11047, IR 29341-85-3-1-3, IP 33355-39-1-1-3, IR 58, IR 64
6	R	R	R	S	S	IR 34, IR 36, IR 46
7	R	R	S	R	S	C 731067
8	S	R	R	R	S	HKR 120
9	S	R	R	S	R	BR 319-1-HR-28, Jaya, Pusa 44-43, PR 106
10	S	S	R	R	R	IET 12175
11	S	R	R	S	S	IR8, IR54, IR56, PAU1126, PR108, Karnal Local, Basmati 1, Basmati 372, Basmati 376, Basmati 397, Basmati C-622, Basmati 5888, Basmati Surfaid 100
12	S	S	R	S	S	Sakthi
13	S	S	S	S	S	Pak Basmati 385, Pusa Basmati 1, TN1

*R = Resistant, S = Susceptible

It is significant that scented/basmati type rice lines, Karnal Local, Basmati 1, Basmati 372, Basmati 376, Basmati 397, Basmati C622, Basmati 5888 and Basmati sufaïd were resistant (Table 2) to only two isolates whereas commercial scented cultivars Pak Basmati 385 and Pusa Basmati 1 were susceptible to all the isolates of *X. oryzae* pv. *oryzae* tested here. Since scented/basmati type rice has a vast potential for export, resistance to bacterial blight for this type of rice should either be sought in more of its landraces or transferred from non-scented rice. The grouping of different rice lines as done here can serve as a basis for postulating probable genotypes of the members of each group for reaction to bacterial blight. The rice lines in diverse groups can be crossed for upgrading level of resistance to this disease for use in rice improvement programme.

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